Spatial Policies and Heterogeneous Employment Responses*

Fabian Bald† Marcel Henkel‡

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Abstract

This paper shows that place-based policies influence not only where people work, but also whether they work by reducing local barriers to labour supply. We propose a quantitative spatial model where public services, financed by local taxation or interregional transfers, act as a crucial substitute for home production, influencing the decision to enter the labour force. We provide causal evidence from Germany, where quasi-experimental fiscal shocks increased labour force participation, particularly for women in regions with limited public childcare. This endogenous labour supply margin creates an externality with countervailing effects: market entry boosts local output and tax revenues, but simultaneously congests the public services that alter participation incentives for others. Implementing optimal spatial policies increases aggregate welfare by 2.7% and real GDP by 2.2%, primarily by reallocating female labour from home to market work in the most productive urban centres.

JEL Codes: H41, H73, J16, J22, J61, R23, R58

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†European University Viadrina Frankfurt (Oder), Berlin School of Economics & CRED. Email: Bald@europa-uni.de

‡University Bern, CRED. Email: marcel.henkel@unibe.ch

1 Introduction

Place-based policies that redistribute resources across regions are a primary tool for addressing spatial inequality. The established view in spatial economics is that these policies influence the spatial distribution of firms and workers (Ehrlich and Overman, 2020; Kline and Moretti, 2014; Neumark and Simpson, 2015). This focus on spatial sorting, however, overlooks a critical margin of adjustment: local labour force participation (LFP). This paper argues that place-based policies also generate heterogeneous employment responses by altering the trade-off between market work and home production. By funding public services such as childcare and transportation–goods often under-provided by the private market due to positive externalities or credit constraints–these policies lower the opportunity cost of market work. We show that incorporating this LFP margin fundamentally changes the design of optimal spatial policy.

To explore this channel, we develop a quantitative spatial model of worker allocation. In the model, individuals are heterogenous along different dimensions: they belong to different demographic groups, possess idiosyncratic location preferences, and vary in their home-production productivity. This rich heterogeneity governs how workers are allocated not only between regions, but also within them–specifically, into market work or a productive home sector. Local public finance is central to this allocation. Public services can substitute for privately produced home goods, making market work more attractive. However, these services are funded by local taxes and inter-regional transfers, and their quality is subject to local congestion.

Introducing an endogenous LFP margin has first-order implications for policy design. In contrast to full-employment models where the aggregate supply of market labour is fixed, our framework recognizes it is an outcome of individual choices. Standard models of optimal spatial policy therefore focus on a single objective: correcting the inefficient sorting of a fixed number of workers across locations (Fajgelbaum and Gaubert, 2020, 2024; Henkel et al., 2021). Our framework expands this objective to a dual mandate: efficiently sorting workers across regions and efficiently allocating them between the market and home sectors within each region. This second margin is crucial because the social returns to market work and the employment responses to policy vary systematically across space and demographic groups.

These spatial heterogeneities give rise to a novel labour supply fiscal externality. Individual participation decisions generate fiscal and technological externalities that private agents do not internalize. A worker entering the market, for example, contributes to agglomeration economies and expands the local tax base–creating positive spillovers. Simultaneously, this worker increases congestion of the very public services that facilitate market entry for others–creating a negative spillover. The net effect of these spillovers, operating through a feedback loop where one person's choice alters the participation incentives for all other residents, must be managed by the social planner. We show that using place-based policies to correct for this externality, by aligning the private and social returns to labour force participation across locations, is fundamental to maximizing aggregate welfare.

The empirical relevance of this mechanism is underscored by persistent spatial patterns in labour markets across the developed world. A significant "urban participation gap" for women, where female LFP does not rise with wages in the same way as male LFP, has been documented in various contexts, such as the United States (Moreno-Maldonado, 2023). These gaps suggest that female labour is not always allocated to its most productive use, motivating a deeper look into the barriers preventing market entry. Identifying policies that can mobilize underutilized labour is a key priority for many developed economies facing demographic pressures. Our framework demonstrates that place-based policy can be a powerful lever for this, with potentially large aggregate gains.

The German economy, with its pronounced regional disparities and extensive system of fiscal transfers, provides a particularly compelling setting to study these barriers in detail. We document two key stylized facts for Germany that highlight the importance of our proposed channel: first, a stark urban participation gap for women, and second, a fiscal system that directs substantial transfers not only to low-wage regions but also to regions with lower labour force participation.

To establish a causal link between public policy and LFP, we exploit quasi-experimental variation from Germany's 2011 Census. Following the approach of Serrato and Wingender (2016) and Helm and Stuhler (2024), we use unexpected population revisions as an exogenous shock to local fiscal transfers. Our difference-in-differences estimates show that positive fiscal shocks significantly increased market participation, with the strongest effects for women and in areas with limited public infrastructure, such as childcare. This evidence supports the hypothesis that public spending can substitute for home production, thereby influencing the LFP margin (Baker et al., 2008; Bick, 2016).

We formalize this mechanism within a quantitative spatial model where heterogeneous workers make two choices to maximize expected utility. First, they sort across locations based on idiosyncratic preferences and local economic conditions. Second, within their chosen location, they select into either market work or the productive home sector. This participation decision follows a Roy-style model of comparative advantage (Roy, 1951; Hsieh et al., 2019): individuals join the labour force only if their utility from market production exceeds the value they derive from home production.

This core participation margin is directly influenced by local public policy. Public services, such as subsidized childcare or transport infrastructure, act as a substitute for goods produced in the home sector, thereby lowering the opportunity cost of market employment. The strength of this substitution is a key elasticity we estimate from German public finance data. However, these services are rivalrous: their effectiveness diminishes with congestion as more residents use them, linking individual participation decisions to the welfare of others.[1]

The model is embedded in a general equilibrium framework. Local governments fund public goods through a combination of local income taxes and a system of interregional fiscal transfers (Henkel et al., 2021; Fajgelbaum et al., 2019). Non-employed workers receive compensation financed by taxes on immobile production factor rents. On the production side, competitive firms combine mobile labour with immobile factors to produce traded and non-traded goods (Caliendo et al., 2018), with output serving both private consumption and public services. This structure ensures that wages, prices, and the allocation of workers are all determined endogenously.

The presence of this endogenous labour supply margin fundamentally alters the social planner's problem. In standard spatial models with externalities such as agglomeration economies and congestion costs, optimal policy corrects for misallocation by aligning private incentives with social returns (Fajgelbaum and Gaubert, 2020, 2024, 2025; Rossi-Hansberg et al., 2025). This involves directing resources to balance the benefits of high local productivity against the social value derived from consumption in high-marginal-utility (often low-wage) areas, all while accounting for congestion costs.

Our framework introduces a new dimension to this calculus. The labour supply elasticities, which vary by location and demographic group, govern the magnitude of a novel labour supply fiscal externality. An additional resident, by increasing demand for public goods, raises their effective cost for all others. This heightened congestion increases the opportunity cost of market work, inducing a marginal shift of other workers from the market to the home sector. This reallocation generates countervailing welfare effects: a social cost from lost market output and tax revenue, and a social benefit from the increased value of home production.

[1]For instance, public childcare enables parents to work in the market sector while ensuring daytime care for children, and public transportation reduces commuting time. However, as more workers rely on these services, their quality may decline due to factors like infrastructure congestion or reduced staff-to-user ratios.

The sign and magnitude of this net externality are location-specific and policy-dependent. We show, for example, that it is more likely to act as a congestion force in high-wage locations (where lost market output is most costly) or in areas with an already large home sector (where the marginal social value of home production is lower). Consequently, optimal policy is no longer a simple function of local wages. It must instead resolve the interactions between local productivity, participation rates, and the varying social value of market versus home production. The planner's solution involves targeting a combination of locations to manage the full set of spatial externalities–agglomeration, congestion, and our novel labour supply fiscal externality–to maximize aggregate welfare.

Our counterfactual analysis, which quantifies the model for German commuting zones, yields two main findings. First, the optimal policy deviates significantly from both the current German system and the prescriptions of full-employment models. It involves less broad-based redistribution and more targeted tax incentives to encourage sectoral reallocation from home to market work, particularly for women in the most productive locations. Second, the aggregate gains are substantial: real GDP increases by 2.2% and welfare by 2.7%. These gains are significantly larger than those in a benchmark model without home production, highlighting the first-order importance of accounting for heterogeneous employment responses.

This paper contributes to three literatures. First, we advance the literature on public finance in quantitative spatial economics. While foundational models focused on how endogenous amenities and productivity explain location choice (Allen and Arkolakis, 2014; Roback, 1982; Redding and Rossi-Hansberg, 2017), recent work has turned to characterizing the role of place-based policies, particularly in the presence of spatial frictions and externalities (Donald et al., 2024; Blouri and Ehrlich, 2020; Fajgelbaum et al., 2019; Fajgelbaum and Gaubert, 2020; Henkel et al., 2021; Rossi-Hansberg et al., 2025). These models typically assume full employment, focusing on how fiscal transfers should correct for the inefficient spatial sorting of workers. Our primary contribution is to relax the full-employment assumption and introduce an endogenous labour supply margin. In doing so, we identify a novel labour supply fiscal externality that fundamentally alters the optimal policy calculus, forcing the planner to consider not only the spatial allocation of workers but also their sectoral allocation between market and home production. Second, we bridge the literature on spatial economics with the macro-labour literature on home production. Seminal work in macroeconomics establishes the importance of the home sector in explaining aggregate labour market dynamics and gender gaps (Becker, 1965; Benhabib et al., 1991; Doepke and Tertilt, 2016). Our framework spatializes this concept, showing how local frictions, such as the availability of childcare (Goldin, 2014; Kleven et al., 2019) or commuting constraints (Le Barbanchon et al., 2021), create regional variation in the opportunity cost of market work. This generates spatially heterogeneous gender gaps and a misallocation of talent that place-based policy can directly address, extending insights on aggregate misallocation (Albanesi and Olivetti, 2016; Hsieh et al., 2019) to a regional context. Finally, our work complements research on frictional labour markets (Bilal, 2023; Jung et al., 2023; Kline and Moretti, 2013; Kuhn et al., 2021; Schmutz and Sidibé, 2019) and the empirical evaluation of place-based policies (Kline and Moretti, 2014) by identifying a specific, empirically-grounded channel–the substitutability of public goods for home production–through which policy can address barriers to LFP.

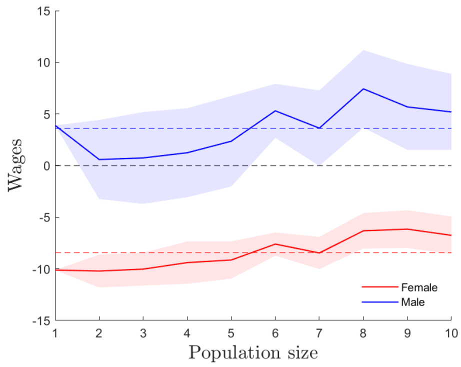
2 Stylized Facts

Before developing our framework, we document key patterns in Germany's regional landscape that motivate our quantitative model with migration and local labour force participation choices of heterogeneous workers. We focus on two empirical features: the relationship between urban wage premia and gender-specific labour market engagement, as well as the structure of Germany's fiscal redistribution system.

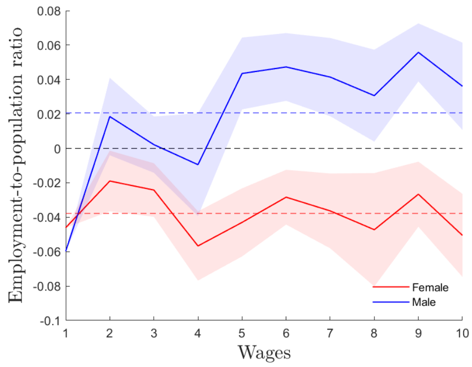
Our study focuses on German commuting zones (CZs) for the years 2008 to 2018, which are defined as local labour markets where most residents live and work. This allows us to concentrate on our central mechanism of labour force participation within locations, while abstracting from commuting across them. We measure market engagement using the employment-to-population ratio or labour force participation (LFP). Correspondingly, "non-employment" refers to those not in market work.[2] Crucially, in our theoretical framework, we explicitly model this non-employed group as being engaged in a productive home sector. In Figure 1, we split commuting zones into deciles according to their population size or wages to compare average compensation and LFP across space for heterogeneous workers.

Figure 1 reveals a stark gender divergence in response to urban wage premia. Panel (a) shows that larger cities exhibit higher wages, consistent with the well-documented urban wage premium (Dauth et al., 2022; Glaeser and Maré, 2001). Panel (b) indicates that men's market participation is highest in urban centres, where their compensation and productivity are highest. Yet, female labour force

[2]Non-employed workers encompass all working-age individuals not currently employed, including those seeking work, in job training, on leave, or searching without official unemployment registration.



(a) Urban wage premium w/o Controls



(b) LFP vs Wages w/o Controls

Figure 1: Urban Premia and Gender Gaps

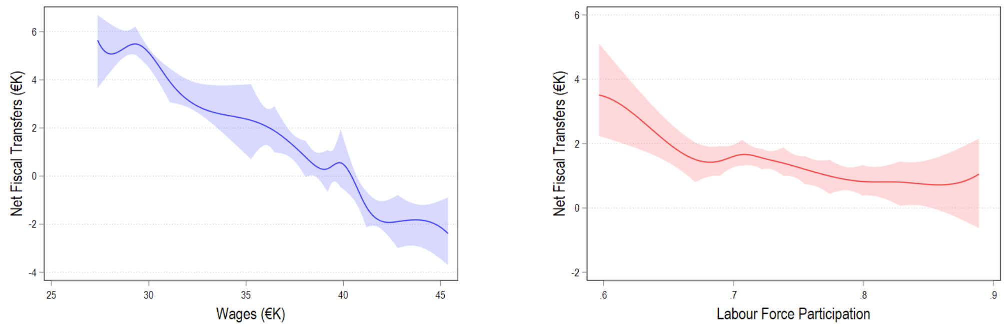
Notes: This figure plots binned scatter plots of demeaned data for German commuting zones (CZs), 2008–2018. LFP is local employment relative to the working-age population. Solid lines are cross-sectionally demeaned averages within each bin for men and women. The dotted lines represent the mean across all commuting zones (CZs). Shaded areas are 95% confidence intervals. Wage measures are constructed using SIAB data; see Section 5 for details.

participation does not increase with their average wages in the market sector, such that gender gaps in employment are highest in the largest cities.

Figure 1 thus suggests that (female) labour is not necessarily employed in those places where their productivity in the market is highest. Similar "urban participation gaps" for women have also been documented in other developed economies. For example, Moreno-Maldonado (2023) documents that childcare access and commuting infrastructure are key in explaining these spatial differences in labour force participation for young mothers in the USA. Taken together, this suggests a role for well-targeted spatial redistributive policy that helps allocate (female) labour to its most productive use both within and between locations.

Germany's existing fiscal redistribution scheme transfers nearly 10 % of nominal GDP between different government layers and regions. This system follows a formula-based approach where transfers depend on a region's fiscal capacity (determined by local tax bases and revenue) and its assessed fiscal needs, primarily driven by population size – a fact we will later use to estimate labour supply reactions to fiscal spending.

Figure 2 presents two key correlations of this redistribution scheme. We hereby define net fiscal transfers as the change in consumption possibilities from redistribution. Panel (a) confirms a finding consistent with the system's design (Henkel et al., 2021): transfers flow from high-wage to low-wage regions. Panel (b), however, reveals a second, distinct pattern: transfers also flow systematically to regions with lower LFP, indicating the fiscal system supports areas where a larger share of the population is engaged in the home sector. These place-based policies affect where people live and work. Redistributed funds support public amenities that increase local attractiveness (Tiebout, 1956) and help workers, especially women, join the labour force.



(a) Net Transfers vs Wages w/ Controls

(b) Net Transfers vs LFP w/ Controls

Figure 2: Stylised Facts about the German Fiscal Redistribution Scheme

Notes: The figure shows nonlinear binned scatter plots (10 bins) for German CZs, 2008–2018. The analysis controls for working-age population, year fixed effects, and the other labour market characteristics (i.e., Panel (a) controls for LFP, Panel (b) controls for wages). Standard errors are clustered by CZ. Shaded areas are 95% confidence intervals.

3 Theoretical Framework

To rationalize the stylized facts, this section develops a spatial model where individuals inside each location allocate time between two productive sectors: the market and the home market sector. The model builds on a quantitative spatial economics framework with frictional migration across heterogeneous locations but incorporates a detailed home production technology. The choice to participate in the market depends on a worker's relative productivity in either sector.

We then integrate a public finance structure where local public goods, funded by taxes and transfers, can act as a substitute for home production, thereby influencing this participation margin differently across space and worker groups. The following subsections lay out the model's components in full: preferences, production technologies, public finance, and the spatial equilibrium.

3.1 Environment

The economy comprises $i \in J$ regions connected by trade and is populated by L heterogeneous individuals belonging to different demographic groups $g \in G$ (e.g., men and women). Workers select locations based on individual preference draws, local market conditions, and public goods availability, while individual productivity draws determine whether workers join the market ($s = m$) or the home market sector ($s = h$).

3.2 Preferences

Each worker ω of group g in location i and sector $s \in \{h, m\}$ derives utility from four components: individual amenity valuation, consumption of market goods, work disutility, and benefits from home production as a function of public goods access. The utility function is:

$$U^g_{s|i}(\omega) = a^g_i(\omega)\left(C^g_{s|i}\right)^{1-\alpha} \cdot (\Lambda^g_s)^{-1} \cdot b^g_{s|i}(\omega), \tag{1}$$

where $a^g_i(\omega)$ represents individual location-specific preferences, $C^g_{s|i}$ denotes consumption from private goods with preference parameter $0 < 1 - \alpha < 1$, $(\Lambda^g_s)^{-1}$ represents the disutility of working in $s \in m, h$ (and taken to be equal across groups or sectors in the following), and $b^g_{s|i}(\omega)$ captures the benefits from home production and public goods access.

Individual location preferences $a^g_i(\omega)$ follow a Fréchet distribution with shape parameter $\theta > 1$: $F^g_i(a) = \exp(-A^g_i \cdot a^{-\theta})$, and scale parameter $A^g_i = \bar{A}^g_i L_i^{-\eta}$, where $\bar{A}^g_i$ is an exogenous fundamental amenity term shifted endogenously by local population $L_i = \sum_{g \in G} L^g_i$ with constant elasticity $-\eta < 0$ (Allen and Arkolakis, 2014; Diamond, 2016).

3.3 Home Production Technology

Following the household production literature (Becker, 1965; Benhabib et al., 1991), each worker allocates one unit of time to either market work or home production.[3] We model home production as a utility-generating activity whose efficiency varies across people and places. Utility from home production depends on individual abil-

[3]We focus on the extensive labour supply margin assuming indivisible labour, i.e., single workers cannot split their time endowment between the two uses (Doepke and Tertilt, 2016).

ity, regional characteristics, and local public goods R_i:

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

Workers in both the market and the home sector benefit from public goods, but with different intensities governed by $1-\rho^g$. When $\rho^g \geq 0$, public goods are substitutes for home production (for example, public childcare reduces the need for private childcare). Higher local population reduces effective public goods via congestion. The congestion parameter $\chi \in [0,1]$ captures rivalry in public goods: $\chi = 0$ implies pure public goods, $\chi = 1$ full rivalry. Public goods are endogenously financed through local taxation; see Section 3.5 for details. For market workers, public goods perfectly substitute for private home production activities, lowering the opportunity cost of market work.

For workers in the home sector, utility depends on two additional components that drive the core trade-off. First, $\varphi(\omega)$ is an idiosyncratic productivity draw for home tasks, following a Pareto distribution $Q^g(\varphi) = 1 - \varphi^{-\epsilon^g}$ with shape parameter $\epsilon^g > 1$. This idiosyncratic term naturally only enters the production function for workers who actually allocate time to home production and is normalized relative to market sector productivity. Second, $\exp\left[B^g_{h|i}\right]$ captures exogenous, systematic differences in the efficiency of home production across locations. This key parameter creates spatial heterogeneity in the market-versus-home trade-off. As a structural residual recovered from LFP data, controlling for public goods provision and average wages, it reflects local characteristics that alter the relative return to market work, such as skill mismatches, search costs, or the availability of flexible work arrangements in the local labour market.[4]

3.4 Market Production and Trade

Production. The production structure of intermediate goods features regional specialisation and trade following Caliendo et al. (2018). Firms combine labour l_i and immobile factors h_i (land and structures) under perfect competition, with production function

$$y_i(z_i) = z_i h_i^{\kappa_i} l_i^{1-\kappa_i}, \tag{3}$$

[4]Alternatively, $\exp\left[B^g_{h|i}\right]$ may reflect spatial variation in preferences or cultural norms regarding market work (Boelmann et al., 2025; Jessen et al., 2023). In this instance, the spatial component of labour disutility will also be captured in the structural residual. Section 5.1 extends the model to multiple market sectors to account for sectoral composition.

where z_i represents firm-specific productivity for each variety drawn from a Fréchet distribution, and $1-\kappa_i$ the labour share in production. The cumulative distribution function is given by $\phi_i(z) = \exp\{-z^{-\nu}\}$, where the shape parameter $\nu > 1$ governs the variance of efficiency draws. Labour input combines different worker types with substitution elasticity $\sigma^g > 1$:

$$l_i = \left[\sum_{g\in G}\left(Z_i^g(1-\xi_{h|i}^g)L_i^g\right)^{\frac{\sigma^g-1}{\sigma^g}}\right]^{\frac{\sigma^g}{\sigma^g-1}}, \tag{4}$$

where $\xi_{h|j}^g \equiv L_{h|i}^g/L_i^g$ represents the local non-employment share. Similarly, $\xi_{m|i}^g \equiv L_{m|i}^g/L_i^g = 1 - L_{h|i}^g/L_i^g$. Average labour productivity $Z_i^g = \bar{Z}_i^g\left(\sum_{g\in G}(1-\xi_{h|i}^g)L_i^g\right)^{\zeta^g}$ includes both an exogenous component and agglomeration economies that increase with local employment under constant group-specific elasticity $\zeta^g > 0$ (Combes and Gobillon, 2015; Rosenthal and Strange, 2004).

The cost of inputs $\lambda_i(z_i)$ is determined as

$$\lambda_i(z_i) = \frac{D_i}{z_i}\left(r_i^{\kappa_i}\left[\sum_{g\in G}\left(\frac{Z_i^g}{w_i^g}\right)^{\sigma^g-1}\right]^{\frac{1-\kappa_i}{1-\sigma^g}}\right), \tag{5}$$

where $D_i \equiv \kappa_i^{-\kappa_i}(1-\kappa_i)^{-(1-\kappa_i)}$ and λ_i is the unit cost index as a function of wages w_i^g and rents r_i.

Trade. Trade flows between regions follow an Eaton-Kortum structure (Eaton and Kortum, 2002) with iceberg costs τ_{ij}. The share of total expenditures in region i on intermediate goods from region j is

$$\pi_{ij} = \frac{X_{ij}}{X_i} = \frac{(\lambda_j\tau_{ij})^{-\nu}}{\sum_{n\in J}(\lambda_n\tau_{in})^{-\nu}}, \tag{6}$$

where X_{ij} are bilateral expenditures, and X_i is gross output in i. Final goods producers source intermediate goods from locations offering the lowest acquisition cost and combine them using a CES technology with a substitution elasticity $\sigma > 1$. This leads to regional price indices:

$$P_i = \Gamma\left(\frac{\nu+1-\sigma}{\nu}\right)^{\frac{1}{1-\sigma}}\left[\sum_{j\in J}(\lambda_j\tau_{ij})^{-\nu}\right]^{-\frac{1}{\nu}}, \tag{7}$$

where $\Gamma(.)$ denotes the Gamma function.

Final goods are not traded across regions, and assembly has no extra costs. The resulting final goods are used for both private consumption and public provision. Total expenditure on final goods, $X_i \equiv P_i Y_i = P_i C_i + P_i^R R_i$, comprises private consumption $P_i C_i \equiv P_i \sum_{s\in h,m} \sum_{g\in G} \xi_{s|i}^g C_{s|i}^g$, and government spending $P_i^R R_i \equiv E_i$, where $P_i^R = P_i$ denotes the price level of local governments.[5]

3.5 Public Finance Structure

The model captures core features of fiscal federalism–income taxation, intergovernmental transfers, and local public goods provision–in a form generalizable beyond Germany.

Income and Transfers. Workers receive after-tax income combining market wages, taxes, and lump-sum transfers from the federal government:

$$I_{s|i}^g = (1 - t_{s|i}) w_i^g + x_{s|i}^g, \tag{8}$$

where $t_{s|i}$ may vary by employment status and location, and $x_{s|i}^g$ denotes wage subsidies from a national redistribution system.

Total income of non-employed workers comes from two sources: (1) a fraction of after-tax labour income, implying that workers in the home market sector h pay higher taxes $t_{h|i} > t_{m|i}$, and (2) equal per-capita dividends from a national portfolio of immobile factor rents:

$$\mathcal{K} = \sum_{j\in J} \left(r_j h_j - (1 - t_{h|j}) \sum_{g\in G} \xi_{h|j}^g w_j^g L_j^g \right)$$

where $r_i h_i$ denotes local rents from immobile factors in region i and we assume $x_{s|i}^g = x = \mathcal{K}/L$ for all groups, locations, and workers of all employment statuses. This setup minimises distortions from local ownership of fixed factors and ensures uniform redistribution.[6]

[5] In an economy with multiple market sectors (see Section 5.1), the price level faced by the government may differ from the one faced by workers, provided that the share of each market sector in total consumption varies between the two uses.

[6] We assume a national portfolio of rents to abstract from inefficiencies arising from local ownership of fixed factors, which can create its own distinct distortions (see Fajgelbaum and Gaubert (2024) for a detailed discussion). In our quantification of the model for Germany, we match local public spending to local tax revenues. Since most social benefits and transfer payments to private households (e.g., non-employment payments, child-care benefits, pensions) are federally funded, we introduce a second, national portfolio. For realistic parametrisations, rent payments suffice to finance all non-employed compensation.

Local Public Goods. Local governments fund public services via local taxation of (employed) workers and transfers from other parts of the economy (Fajgelbaum et al., 2019; Henkel et al., 2021):

$$E_i = (t_{m|i} + \iota_i) \sum_{g \in G} (1 - \xi^g_{h|i}) w^g_i L^g_i, \tag{9}$$

where ι_i is the transfer rate. This flexible structure accommodates additional funds in recipient regions ($\iota_i > 0$) that have to be completely funded by donor locations ($\iota_i < 0$) in the aggregate. We treat $t_{s|i}$, ι_i, and $x^g_{s|i}$ as exogenous policy instruments, without modelling the political economy of their determination (Agrawal et al., 2025; Chevalier et al., 2024), allowing us to: (1) match observed fiscal data (see Section 5), and (2) conduct clean counterfactuals without modelling endogenous policy responses. Workers respond to regional variation in taxes, transfers, and public goods through migration and participation decisions. Public goods are taken as given when making location decisions–an assumption appropriate for short-to-medium analysis.

3.6 Labour Force Participation and Spatial Sorting

Participation Decision. After choosing a location, each worker decides whether to join the market sector by comparing the utility from market work against the utility from home production. This decision hinges on their individual home productivity draw, $\varphi(\omega)$, and local economic conditions. A worker will choose home production if its utility exceeds that from market work. The properties of the Pareto distribution then yield the aggregate share of non-employed workers:

$$L^g_{h|i} = \xi^g_{h|i} L^g_i = \left[\underbrace{\left(\exp\left[B^g_{h|i}\right]\right)^{-1}}_{\text{Home Market Efficiency}} \underbrace{\left(\frac{I^g_{m|i}}{I^g_{h|i}}\right)^{1-\alpha} \left(\left[\frac{R_i}{L^X_i}\right]^{\rho^g}\right)^{\alpha}}_{\text{Spatial Policies}} \right]^{-\epsilon^g} L^g_i. \tag{10}$$

Local labour force participation thus increases with the income from market work relative to home market compensation and is shaped by public policy via its effect on both incomes and the provision of local public goods. The elasticity of non-employment with respect to public goods is $\gamma^g \equiv \alpha \epsilon^g \rho^g$, and we estimate it in the approach outlined in Section 5. These participation decisions, in turn, generate agglomeration and congestion spillovers: when workers enter employment, they increase local productivity, expand the tax base, reduce transfer obligations of the federal government, but also increase public goods congestion and decrease home production in the economy. Individuals do not internalize the impact of their participation decisions on other workers, which motivates well-designed spatial policy to correct these inefficiencies. [7]

Spatial Sorting. Workers choose locations to maximise expected utility, accounting for spatial variation in public goods, real incomes, home production efficiency, and amenities. In spatial equilibrium, it holds that

$$L_i^g = \frac{(\bar{V}_i^g)^\theta}{\sum_{i \in J} (\bar{V}_i^g)^\theta} L^g, \tag{11}$$

where $\bar{V}_i^g = A_i^g \Lambda \left[\left(I_{m|i}^g / P_i \right)^{1-\alpha} \cdot (R_i / L_i^\chi)^\alpha \right] \left(1 + \xi_{h|i}^g / (\epsilon^g - 1) \right)$ is the expected indirect utility, incorporating the weighted utility of becoming employed or non-employed.[8]

3.7 Equilibrium Definition

Given exogenous characteristics $\{\bar{A}_i^g, B_{h|i}^g, H_i, \bar{Z}_i^g, \Lambda\}$, the total number of workers of each type L^g, a set of spatial policies $\{t_{s|i}, x_{s|i}^g, \iota_i\}$, and structural parameters $\{\alpha, \epsilon^g, \zeta^g, \theta, \kappa_i, \nu, \rho^g, \sigma, \sigma^g, \tau_{ij}, \chi\}$, a competitive equilibrium for this economy is defined by the set of endogenous objects $\{E_i, h_i, I_{s|i}^g, L_i^g, L_{s|i}^g, P_i, r_i, w_i^g, X_i, \lambda_i, \pi_{ij}\}$ such that:

1. Workers optimise location and employment choices given regional wages, amenities, public services, and home market production

2. Firms maximise profits given production costs and trade opportunities

3. Local governments maintain balanced budgets while providing public services

4. All goods and factor markets clear in each region

[7] Equation (10) can also be derived as the steady state of a dynamic, regional search-and-matching model (Kline and Moretti, 2013) as outlined in Online Appendix A.3, which provides an alternative micro-foundation for spatially-varying labour supply elasticities.

[8] Combining equations (1) and (10) and using the Pareto distribution properties, we derive the expected indirect utility of workers as

$$\bar{V}_i^g(\omega) = a_i^g(\omega) \sum_{s \in h,m} V_{s|i}^g \xi_{s|i}^g = a_i^g(\omega) \bar{V}_{m|i}^g \left(1 + \xi_{h|i}^g / (\epsilon^g - 1) \right) \equiv a_i^g(\omega) \bar{V}_i^g,$$

with $\bar{V}_{m|i}^g$ the utility when being employed in the market sector. See Online Appendix A.1 for detailed derivations.

Our Online Appendix A.2 provides detailed derivations of market clearing conditions and equilibrium properties. In what follows, we examine how a benevolent social planner would design spatial policies in this environment, highlighting key trade-offs that allow for maximising efficiency in the presence of spatial externalities and variation in labour force participation rates.

4 Optimal Spatial Policy

The competitive spatial equilibrium in this framework is inefficient in the presence of spatial externalities. This section characterizes the allocation chosen by a utilitarian social planner who corrects these inefficiencies and describes the optimal policy instruments required to implement this first-best outcome. The planner's objective is to maximise a social welfare function, $\mathcal{W}$, subject to the economy's resource and technological constraints.[9]

In the presence of a productive home sector, the planner must correct inefficiencies on two margins simultaneously: the sorting of workers across locations and the allocation of labour between the market and home sectors within each location. The competitive equilibrium fails to do so, since individuals do not internalize the full social costs and benefits of their choices.

4.1 Efficiency Conditions

To highlight the contribution of the labour force participation channel, we first present the efficiency condition in a benchmark model without a home production sector and then show how it is modified in our two-sector framework.

4.1.1 Benchmark: Full Employment

In a standard spatial model with full employment ($\xi^g_{h|i} \to 0$), the efficient allocation equalizes the social marginal return of a worker across all locations:

$$\underbrace{W_i^g}_{\text{opportunity cost}} + \underbrace{P_i C_i^g}_{\text{consumption cost}} = \underbrace{w_i^g}_{\text{marginal product of labour}} + \underbrace{Ex_i^{\text{AGG}} + Ex_i^{\text{CON}}}_{\text{net externalities}} \tag{12}$$

The left-hand side captures the marginal cost of placing a worker in location i (local consumption costs plus the opportunity cost of not placing the worker in another

[9]The social welfare function is given by $\mathcal{W} = \sum_{g \in G} \mu^g \mathcal{U}(\bar{V}^g_{agg})$, where μ^g are group-specific welfare weights, $\mathcal{U}$ is an increasing and concave function and $\bar{V}^g_{agg}$ is the expected utility for group g, which is equalised across space due worker mobility. See Appendix A for the full social planner problem setup.

location); the right-hand side represents the marginal benefit (the employed worker's marginal product of labour plus any productivity spillovers net of congestion costs). The planner's objective is to allocate workers to locations where their marginal product, adjusted for net externalities, is highest.

4.1.2 Market and Home Production Sectors

When workers endogenously choose between the market sector ($s = m$) and the home production sector ($s = h$), the planner must find an allocation that is efficient on both the spatial and sectoral margins. Efficiency along the sectoral margin requires that the social value of a worker in both home and market sectors is equalized.

Proposition 1 (Efficiency Condition with a Home Production Sector)**.** *The efficient allocation satisfies two conditions:*

(a) The efficiency condition for ***spatial sorting*** *requires:*

$$\underbrace{W_i^g}_{\text{opportunity cost}} + \underbrace{P_i \sum_{s\in h,m} \xi_{s|i}^g C_{s|i}^g}_{\text{consumption cost}} = \underbrace{\left(1-\xi_{h|i}^g\right) w_i^g}_{\text{marginal product of labour}} + \underbrace{Ex_i^{NET}}_{\text{net externalities}} \tag{13}$$

(b) The efficiency condition for ***sectoral allocation*** *requires:*

$$w_i^g = \tilde{W}_{m|i}^g \tag{14}$$

where $\tilde{W}_{m|i}^g$ is the social marginal value of allocating an additional worker to the market sector in location i, given the participation equation, Eq. (10).

The net externalities in condition (a) are composed of three distinct channels:

$$Ex_i^{NET} \equiv \underbrace{Ex_i^{AGG}}_{\text{productivity spillovers}} + \underbrace{Ex_i^{CON}}_{\text{congestion spillovers}} + \underbrace{Ex_i^{LFP\text{-}Fiscal}}_{\text{labour supply fiscal externality}}$$

with the components defined as:

$$Ex_i^{AGG} \equiv \zeta^g(1-\xi_{h|i}^g)w_i^g \tag{15}$$

$$Ex_i^{CON} \equiv -(\alpha\chi+\eta)\cdot\frac{\bar{\mathcal{C}}}{1-\alpha} \tag{16}$$

$$Ex_i^{LFP\text{-}Fiscal} \equiv -\chi\gamma^g\xi_{h|i}^g \cdot \left(w_i^g - \frac{\bar{\mathcal{C}}}{(1-\alpha)(\epsilon^g-(1-\xi_{h|i}^g))}\right) \tag{17}$$

with elasticity $\gamma^g \equiv \alpha\epsilon^g\rho^g$, *and* $\bar{\mathcal{C}} = \sum_{i\in J} P_i \sum_{s\in h,m} \sum_{g\in G} \xi^g_{s|i} C^g_{s|i} L^g_i / L$ *the average private goods expenditure.*

Proof. See Appendix A for the full derivation of both the spatial and sectoral first-order conditions.

Proposition 1 characterizes the two key margins of the planner's problem. Condition (b) ensures the efficient allocation of labour between the market and home sectors within each location. This condition allows us to express the value of market output in the spatial sorting condition in terms of the observable market wage, w^g_i. The structure of spatial externalities in condition (a) is fundamentally richer than the benchmark. In addition to standard agglomeration (Ex^{AGG}_i) and congestion (Ex^{CON}_i) spillovers, our framework identifies a novel labour supply fiscal externality ($Ex^{\text{LFP-Fiscal}}_i$).[10] This term captures the net effect of a distortion to the local participation margin: an additional resident in location i increases public goods congestion, which makes the home sector relatively more attractive for all other residents. This distortion has two opposing welfare effects–a negative effect from reduced market output and tax revenue, and a positive effect from the increased consumption-equivalent value of the time spent in the now relatively more productive home sector. Its net sign is therefore ambiguous depending on the relative strength of these two forces. The size of this externality is scaled by the elasticity γ^g, the size of public rivalry χ and the initial level of non-employment.

The labour supply fiscal externality has a crucial property: it varies across space and is endogenously determined by worker selection. Because its sign and magnitude are functions of local wages and the local participation rate ($\xi^g_{h|i}$), it differs from one location to another, depending on exogenous home market efficiency and local fiscal policy. This heterogeneity contrasts with standard frameworks where externalities are often assumed to be constant, and it provides a new theoretical rationale for why optimal policies must be place-based. A formal analysis of the labour supply externality and its properties is provided in Appendix B.

4.2 Optimal Policy Instruments

To implement the efficient allocation defined by Proposition 1, the planner chooses a system of fiscal instruments that are designed to correct for the spatial externalities and align private incentives with social returns while taking all general equilibrium

[10] In our framework, the productivity spillovers are governed by the agglomeration economies ζ^g, while additional workers congest both local amenities (via η) and public goods (via χ).

effects into account. The planner first allocates different levels of private goods consumption by optimising over tax rates and wage subsidies:[11]

$$P_i\tilde{C}_{s|i} = \left(1 - \tilde{t}_{s|i}\right) w_i + \tilde{x}_{s|i} \tag{18}$$

Public goods are funded by local tax revenue and well-designed inter-regional transfers:

$$\tilde{E}_i = \left(\tilde{t}_i^R + \tilde{\iota}_i\right)(1 - \xi_{h|i}) w_i L_i \tag{19}$$

The following proposition characterizes the optimal form of these instruments.

Proposition 2. *Assuming a single worker group and market sector, the first-best allocation is implemented by the following system of taxes, subsidies, and transfers.*

Proof. See Appendix A.1.2 and Online Appendix B for detailed derivations.

Optimal Labour Income Tax. A location-status-specific tax, $\tilde{t}_{s|i}$, targets participation margins:

$$1 - \tilde{t}_{s|i} = \begin{cases} \frac{(1-\alpha)\theta}{1+(1-\alpha)\theta} + (1-\alpha)\epsilon\xi_{h|i}\left(\frac{1}{1-\xi_{h|i}} - \frac{\theta}{(1+(1-\alpha)\theta)\left(\epsilon-(1-\xi_{h|i})\right)}\right) & \text{if } s = m, \\ \frac{1-\xi_{h|i}}{\xi_{h|i}}\left(\frac{(1-\alpha)\theta}{1+(1-\alpha)\theta} - (1-\tilde{t}_{m|i})\right) & \text{otherwise} \end{cases} \tag{Tax}$$

Optimal Lump-Sum Subsidy. A location-status-specific subsidy, $\tilde{x}_{s|i}$, corrects for local externality deviations via the dEx_i^{NET} term:

$$\tilde{x}_{s|i} = \begin{cases} \frac{\epsilon-1}{\epsilon-(1-\xi_{h|i})}\left[\sum_j \left(\frac{(1-\xi_{h|j})w_j L_j}{1+(1-\alpha)\theta} + r_j h_j - \tilde{E}_j\right)/L + \frac{(1-\alpha)\theta L}{1+(1-\alpha)\theta}\cdot dEx_i^{NET}\right] & \text{if } s = m, \\ \frac{\epsilon}{\epsilon-1}\cdot \tilde{x}_{m|i} & \text{otherwise} \end{cases} \tag{Subsidy}$$

Optimal Fiscal Transfers. Let $\Upsilon_i^g \equiv \frac{\gamma^g \xi_{h|i}^g}{\epsilon^g - (1-\xi_{h|i}^g)}$. An inter-regional system of taxes and transfers, defined by rates $\{\tilde{t}_i^R, \tilde{\iota}_i\}$, then corrects for participation spillovers:

$$\tilde{t}_i^R = \frac{(\alpha - \Upsilon_i)\,\theta}{1 + \xi_{h|i}(1-\alpha)\theta} \sum_{s\in h,m} \xi_{s|i}\tilde{t}_{s|i} \tag{Local Tax Rate}$$

[11] For didactic purposes, we first provide equations for policy tools under the special case with one worker group and market sector ($G = M = 1$). Online Appendix B provides calculations for the most general case with $G, M > 1$.

and

$$\tilde{\iota}_i = \frac{\gamma \xi_{h|i}}{1-\xi_{h|i}} + \frac{(\alpha - \Upsilon_i)}{1-\alpha} \frac{\epsilon - (1-\xi_{h|i})}{\epsilon - 1} \frac{\tilde{x}_{m|i}}{(1-\xi_{h|i})w_i} \qquad \text{(Transfer)}$$

4.3 Policy Implications and Intuition

The presence of a productive home sector transforms the planner's task from solving one problem (the inefficient sorting of workers across locations) to solving two (the inefficient allocation of labour between the market and home sectors within each location). In the language of the welfare decomposition literature (e.g., Donald et al. (2024)), the optimal policy is one that perfectly balances the gains from reducing the spatial dispersion of marginal consumption utility against the costs or benefits from inducing changes in technological and fiscal externalities.

The policy rule that mechanistically resolves this trade-off is to direct resources to locations where the deviation of total net externalities from the national average, dEx_i^{NET}, is positive:

$$dEx_i^{NET} \equiv Ex_i^{NET} - \frac{1}{L^g} \sum_{j \in J} Ex_j^{NET} L_j^g > 0$$

The following subsections illustrate how this general principle, driven by the competing pressures of the three externalities we identified, shapes the optimal design of specific policy instruments, namely taxes and fiscal transfers.

4.3.1 Optimal Taxation

In a single-sector (full-employment) model, uniform taxes are optimal to avoid distorting migration incentives where they are unrelated to productivity differences.[12] When a productive home sector exists with endogenous LFP ($\epsilon < \infty$ and $\xi_{h|i} > 0$), this is no longer the case. The planner sets location-specific tax rates to target spatial variation in the labour supply elasticity – a principle that aligns with the broader public finance literature on optimal taxation.[13]

To illustrate the logic of optimal taxation, we simulate the tax rates from Proposition 2 for different equilibrium levels of non-employment, using our calibration for

[12] Under full-employment ($\epsilon \to \infty$ and $\xi_{h|i} = 0$), the planner typically sets a uniform tax rate $t_{m|i} = t_i = [1 + (1-\alpha)\theta]^{-1}$ (Fajgelbaum and Gaubert, 2024; Helpman and Pines, 1980; Wildasin, 1987). The optimal rate declines with worker mobility and private goods preferences, consistent with the principle of preferably taxing inelastic bases (Keen and Konrad, 2013).

[13] See, for example, Saez (2002) for foundational work and Blundell and Shephard (2012) or Kleven (2014) for applications with different labour market frictions.

Germany. We compare optimal tax rates across otherwise similar regions that differ solely in the magnitude of exogenously determined home market efficiency or market frictions. As shown in Panel (a) of Figure 3, the optimal tax rate on market workers ($\tilde{t}_m$) is U-shaped in the share of the local labour force in the home sector ($\xi_{h|i}$).

This U-shape reflects a trade-off between two competing tax principles. In locations with a large market sector (low ξ_h), the sectoral allocation margin is relatively inelastic. Here, the planner can set higher taxes on market work to raise local tax revenue for public goods without causing a large distortion along the sectoral margin (the tax base), following the standard public finance principle of taxing inelastic bases.[14]

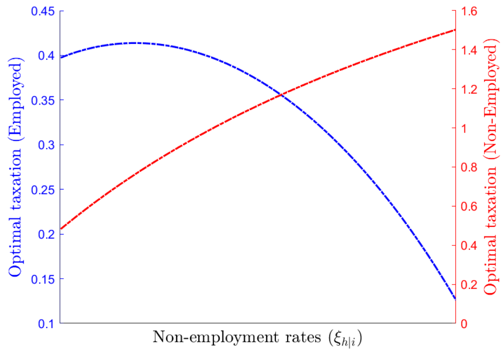
Conversely, in locations with a large home market sector (high ξ_h), the sectoral allocation margin is highly elastic. A large pool of relatively productive individuals is close to the margin of switching between sectors. Here, tax cuts become a highly effective instrument to incentivise a sectoral reallocation of labour from home to market. This 'selection effect', where tax cuts draw relatively productive individuals into the market, boosts output and the tax base more than it decreases the social value of private home market work, making the lower rate optimal. Simultaneously, taxes on individuals in the home sector rise in these locations to strengthen the incentive for market entry.

4.3.2 Optimal Redistribution

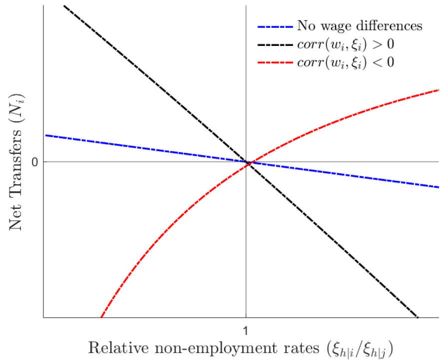
In a single-sector (full-employment) model, redistribution is driven by a trade-off determined by the sign of net externalities and dispersion of marginal utilities. The planner must resolve the tension between: a baseline preference to transfer resources to low-wage, high-non-employment locations where the marginal utility of consumption is highest. An additional efficiency motive is driven by the balance between the agglomeration spillover (Ex_i^{AGG}), which favours transfers *towards* productive, high-participation areas, and the congestion spillover (Ex_i^{CON}), which favours transfers *away* from them.

The novel labour supply fiscal externality ($Ex_i^{\text{LFP-Fiscal}}$) adds another layer: it either reinforces or dampens the motive for transfers to low-wage areas depending on the correlation between local wages, w_i^g, and the local home production share, $\xi_{h|i}^g$. Because its sign and magnitude vary with local conditions, it amplifies or counteracts the effect of traditional agglomeration and congestion spillovers differently across

[14] Note that the demand for fiscally funded public goods as a substitute for private home work is also higher in places with high labour market attachment - providing another rationale for locally increasing tax revenues.



(a) Taxation



(b) Redistribution

Figure 3: Optimal Spatial Policies

Notes: These figures plot the optimal tax rates and net transfers against different levels of non-employment rates for two locations i, j, using equation (C.17) and parameter values used in the quantification for Germany ($\alpha = 0.24; \epsilon = 1.57$; $\theta = 2$; $1 - \gamma = 0.62$; $\kappa = 0.34$; $\zeta = 0.02$; $\rho_h = 0.012$; $\chi = 1$. Panel (a) displays optimal tax rates for workers of different employment statuses as a function of non-employment rates, $\xi_{h|i}$. Panel (b) plots net transfers against relative non-employment rates, $\xi_{h|i}/\xi_{h|j}$, between places, under three scenarios: (a) equal wages across locations, $w_i = w_j$, (b) positive correlation between wages and non-employment, $corr(w_i, \xi_{h|i} > 0)$, where low-wage locations have high labour force participation; and (c) negative correlation, $corr(w_i, \xi_{h|i} < 0)$, where high-wage locations have high labour force participation.

places. The labour supply externality is more likely to be negative and smaller in productive places with high wages (making changes along the participation margin more costly), or locations with a large existing home market sector (decreasing the social benefit of additional home market work). In these places, the labour supply externality acts as an additional congestion force, increasing redistribution towards low-wage places or those with high labour participation. See Appendix B for an in-depth discussion about the impact of the novel externality and heterogeneity in labour supply elasticities for spatial redistribution.

To analyse how the planner resolves the now more complex set of competing motives, we simulate the net fiscal transfer (N_i), between two synthetic locations $\{i, j\}$– the total change in resources (both private and public goods consumption) available to the average resident in i relative to a scenario without spatial redistribution.[15] Panel (b) of Figure 3 illustrates the outcome, which depends critically on the correlation between local wages, w_i^g, and the allocation between sectors, $\xi_{h|i}^g$. We use the calibration for Germany and vary local fundamentals to generate the mapped differences in non-employment rates, $\xi_{h|i}/\xi_{h|j}$.

[15] A positive N_i indicates a net recipient; a negative value means it is a net contributor. The formal derivation is in Appendix C. There, we also discuss how fiscal transfers can be calculated solely from structural parameters as well as observable wages, population and participation rates.

Start with the case of equal market wages across all locations (blue line). The simulation shows that transfers then flow to regions that allocate more labour to the market sector (i.e., have higher participation) under realistic parametrization. In these places, agglomeration spillovers (Ex_i^{AGG}) are stronger and the labour supply externality is more likely to be positive. Moreover, labour supply is more inelastic, such that distortions along the sectoral margin are smaller, and the marginal switcher between sectors is relatively less productive in the market sector (the selection effect).

Next, we reintroduce wage differences to see how the spatial dispersion of marginal consumption utility interacts with these spatial externalities. When high market wages are in locations with a large home sector (black line), the motive to transfer to low-wage areas and the new efficiency motive (transfer to high-participation areas) align. This alignment amplifies the scale of redistribution to these low-wage, high-market-share regions.

Conversely, when high market wages are in locations with a small home sector (red line), as is empirically relevant for German men, the motives conflict. The spatial dispersion of marginal utility and congestion externality push for transfers away from these locations, while the agglomeration and labour supply motives push for transfers towards them. The figure shows that, depending on the size of wage and participation differences, the latter motive can dominate, such that net transfers would flow towards high-wage locations because their large allocation of labour to the market sector makes them extremely productive from a social perspective. Intuitively, their high allocation of labour to the market sector maximizes agglomeration gains, but minimizes the social cost of distortions along the sectoral allocation. These findings show that explicitly modelling the home production sector can change not only the magnitude but even the direction of optimal redistribution.

5 Quantification

To take our theoretical framework to the data, we quantify its key parameters for Germany, focusing on commuting zones (CZs) for the baseline year 2014. Our primary goal is to measure the economic forces that govern the allocation of labour between different locations and between the market and home production sectors. This requires two steps: first, constructing a comprehensive dataset of regional economic conditions, including gender-specific wages and employment rates, and second, using quasi-experimental methods to causally identify how policy affects the market-versus-home trade-off.

5.1 A Multi-Sector Framework for Quantification

While our core theoretical insights come from the market-versus-home margin, for a realistic quantification that accounts for Germany's industrial structure, we extend the framework to include multiple market sectors ($u \in M \subset S$). This allows us to capture the fact that men and women are concentrated in different industries (e.g., manufacturing vs. services), which are distributed unevenly across space.

In this extended model, workers make choices over location i and market sector specialization u. After these choices, idiosyncratic productivity shocks determine their final allocation to either their chosen market sector or the home production sector. We denote the share of labour allocated to the home sector as $\xi^g_{h|i,u} \equiv L^g_{h|i,u}/L^g_{i,u}$, where $L^g_{i,u} \leq L^g_i$ represents the number of local workers in region i who would be employed in sector u if they were to join the labour force. Workers derive utility from consuming a bundle of tradeable goods and non-tradeable services, connected as a Cobb-Douglas aggregate with elasticities β_u. Workers' location choices depend on region-sector-specific wages, preferences for local public goods and amenities, as well as sector-specific participation costs $\exp\left[-\mu^g_{m|i,u}\right] \leq 1$ for joining market sector u in location i. These structural residuals could capture occupation-specific disutility of labour, while the efficiency of home production, $\exp\left[\bar{B}^g_{h|i,u}\right] \varphi(\omega)$, now conditions on these prior choices, creating a rich heterogeneity in the market-versus-home tradeoff. On the production side, we incorporate input-output linkages between market sectors, following Caliendo et al. (2018).[16]

5.2 Data

Our quantification combines several data sources. The core labour market data comes from the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) and the Federal Employment Agency, providing detailed information on the working-age population, labour force participation, and unemployment rates by gender at the county level. We use these data to construct measures of "non-employment" as our empirical proxy for the share of the population engaged in the home production sector.

To capture sectoral composition and construct region-sector-specific wages by gender, we use the Sample of Integrated Labour Market Biographies (SIAB) from

[16] Firms combine labour, land and structures, and materials from all market sectors. The production technology incorporates input-output linkages, where $M_{i,uu'}$ represents material inputs from sector u' used by firms in region i and sector u. The parameter $\delta_{i,uu'}$ captures the share of materials from sector u' in sector u's production, while $\delta_{i,u}$ denotes the share of value added in gross output. Under constant returns to scale, these shares sum to unity: $\sum_{u' \in S} \delta_{i,uu'} = 1 - \delta_{i,u}$.

the Institute for Employment Research (IAB) to allocate total employment across different market sectors.[17] We apply an AKM earnings model (Abowd et al., 1999) to individual wages, addressing wage censoring issues using the imputation method proposed by Card et al. (2013). We then combine estimated fixed effects for each gender, region, and sector with national account data from the EU KLEMS Database to ensure consistency with aggregate wage measures.

Fiscal data on tax revenues and inter-regional transfers originate from German Statistical Offices (Statistisches Bundesamt, Destatis), and we construct a (novel) panel data set of local tax and inter-regional transfers following the methodology of Henkel et al. (2021). We allocate federal, state, and municipal tax revenues to the commuting zone level and calculate corresponding fiscal transfers within and between Federal states. We use regional price indices for non-tradable goods and real estate from Ahlfeldt et al. (2020) and Weinand and Auer (2020).[18]

For production structure and trade patterns, we combine several data sources. Gross output and value-added data come from EU KLEMS and regional economic accounts provided by the Statistical Office of the European Union (Eurostat). Input-output linkages are derived from World Input-Output Tables (WIOD). We measure trade flows using data from the Clearing House of Transport Data at the Institute of Transport Research of the German Aerospace Center (Schubert et al., 2014), which provides information on interregional trade between German districts. These flows are aggregated to match our commuting zone and sector-specific gross output data.

5.3 Parametrisation

We determine the model's parameters through a combination of calibration from existing literature, our own causal estimates, and model inversion.

Baseline Parameters. We calibrate our model to match key observations from the German economy. The non-employment compensation is set to 62% of after-tax

[17]"Weakly anonymous Version of the Sample of Integrated Labour Market Biographies (SIAB) - Version 7521 v1". Research Data Centre of the Federal Employment Agency (BA) at the Institute for Employment Research (IAB). DOI: 10.5164/IAB.SIAB7521.de.en.v1. The data access was provided via on-site use at the Research Data Centre (FDZ) of the German Federal Employment Agency (BA) at the Institute for Employment Research (IAB) and subsequently remote data access. Our sample includes individuals aged 15-65 who are either employed or non-employed, excluding marginally employed, deceased or emigrated workers. See Table C.1 in the Online Appendix for categorising six 'market sectors' based on the ISIC 4 classification of economic activities.

[18]To capture local cost-of-living differences for the non-tradable sectors, we use regional price indices for real estate (serving as a proxy for construction sector prices) and non-tradable service prices. The real estate price indices follow the methodology of Combes et al. (2019), using micro-data from the Immobilien Scout 24 platform as documented in Boelmann and Schaffner (2019).

wages, reflecting Germany's first-tier unemployment benefit ('Arbeitslosengeld I'). Production parameters are calibrated to match observed data: the labour share in production $(1 - \kappa_{i,u})$ corresponds to labour payments relative to value-added, while value-added shares $\delta_{i,u}$ match their data counterparts, using output data from EU KLEMS and value-added data from the regional economic accounts of Eurostat. For the share of sector u goods used in sector u' and region i, $\delta_{i,u'u}$, we rely on national input-output shares $\delta_{u'u}$ from WIOD, noting that $\delta_{i,u'u} = (1 - \delta_{i,u'})\delta_{u'u}$.

For agglomeration economies in production, we use gender-specific productivity spillover estimates for Germany from Ahlfeldt et al. (2020): $\zeta^M = 0.018$ for males and $\zeta^F = 0.032$ for females, which fall well within the range of 0.01 to 0.06 documented in the literature (Rosenthal and Strange, 2004). We set amenity spillovers to $\eta = 0.3$ for both genders, matching the average across skill groups in Diamond (2016). The elasticity of substitution between male and female workers in production is set to $\sigma^g = 2.5$, consistent with estimates in Olivetti and Petrongolo (2014).[19]

Trade parameters follow standard values from the gravity literature (Head and Mayer, 2014). We set the elasticity of substitution across regions at $\sigma = 5$ and model trade costs for tradable sectors as $\tau_{ij,u} = dist_{ij}^{\zeta_u}$ with $\nu_u = 5$. Using equation (6) and our bilateral trade flow data, we estimate trade cost parameters $-\nu_u\zeta_u$ ranging from -1.43 to -2.14.

For public goods, we assume perfect rivalry ($\chi = 1$) and set the preference weight for local public services ($\alpha = 0.24$) and the Fréchet shape parameter ($\theta = 2$) following Fajgelbaum et al. (2019) – values that are also supported by local public finance data for Germany.[20] Lastly, we calibrate the expenditure shares across sectors to ensure that model-consistent expenditures across all regions result in aggregate goods market clearing. A detailed summary of all parameter choices is provided in Table C.2 of Online Appendix C.

Elasticity of Allocation between Market and Home Sectors. A key parameter in our model is ϵ^g, which governs how readily individuals substitute between the market and home sectors in response to changes in relative income or tax policy. From equation (10), the elasticity of local labour supply to wage or income tax

[19] This parameter varies by occupation, with estimates ranging from 1.2 to 2.7 in Mexico (Bhalotra and Fernández, 2018) and around 3 in the US (Acemoglu et al., 2004).

[20] Given Cobb-Douglas preferences, α represents the public goods expenditure share, which should equal the share of aggregate public expenditure to total value added. Local public finance data for Germany also suggests a similar value, which justifies our chosen value.

changes is captured by the following elasticity:

$$\frac{\partial L^g_{m|i,u}}{\partial (I^g_{m|i,u}/I^g_{h|i,u})} \frac{(I^g_{m|i,u}/I^g_{h|i,u})}{L^g_{m|i,u}} \equiv \varepsilon^g_{i,u} = \left[(1-\alpha)\,\epsilon^g \xi^g_{h|i,u}\right] \left(1-\xi^g_{h|i,u}\right)^{-1}.$$

We calibrate the implied average elasticities of labour force participation to match meta-analyses for European countries and the US (Mui and Schoefer, 2025), setting $\varepsilon^M = 0.310$ for men and $\varepsilon^F = 0.465 = 1.5 * \varepsilon^M$ for women – such that female elasticities are 50% higher and very close to the mean for married women across studies in Bargain and Peichl (2016). This reflects the well-documented finding that women's allocation of time is more responsive to changes in financial incentives.[21] Combined with our public goods preference parameter ($\alpha = 0.24$) and observed average non-employment rates by gender across labour markets, these elasticities imply Pareto shape parameters of $\{\epsilon^M = 1.58; \epsilon^F = 1.56\}$.

The Effect of Public Goods on the Market-vs-Home Choice. We estimate the crucial parameter ρ^g, which governs how public spending alters the relative attractiveness of the home production sector (that is, whether public goods are substitutes or complements for home production). To do this, we exploit a quasi-natural experiment arising from Germany's 2011 Census, which led to unexpected and permanent shocks to local fiscal transfers.

Our identification strategy exploits unexpected revisions to local population counts that determine fiscal transfer allocations (Helm and Stuhler, 2024; Serrato and Wingender, 2016). These Census-induced population adjustments, ranging from -7.65% to $+3.43\%$ across regions, generated permanent changes in local public resources from the fiscal redistribution scheme for reasons unrelated to economic or fiscal conditions.

We analyse district-level data for the pre-COVID period $2008-2018$, controlling for state-specific trends in the redistribution system and compare regions experiencing above-mean Census revisions (treated) to those below the mean (control) in an event study. To account for systematic differences in pre-treatment characteristics between affected regions (see Appendix Table C.3), we employ a difference-in-differences design with augmented inverse probability weighting (Sant'Anna and Zhao, 2020). This approach accounts for observed differences in regional characteristics and pre-treatment dynamics by including four annual lags of our outcome variables. Online Appendix C.2 provides institutional details of the Census shock

[21] Comparing 17 EU countries and the USA, Bargain et al. (2014) document estimates for married women ranging narrowly between 0.2 and 0.6, with our preferred parametrization positioned centrally within this interval.

and its implications, as well as further information on the estimation strategy.

The event study estimates confirm parallel pre-trends in our outcome variables (Appendix Figure C.2). After the Census shock, treated areas experienced a 167 Euros per capita increase in fiscal revenues from increased transfers (2.43%). These positive fiscal shocks caused a statistically significant decrease in non-employment/home production, particularly for women (Table 1): -1.31% for women and -0.94% for men. This effect was strongest in regions with limited pre-existing public childcare or worse commuting infrastructure.[22] This causal evidence allows us to identify the structural elasticity ρ^g. Using our model framework, we translate these reduced-form effects into structural parameters, finding that for both genders, public goods act as a substitute for home production (e.g., public childcare replaces private provision), thus lowering the opportunity cost of market work. For women, this substitutability is stronger. The compound spillover parameter $\gamma^g = \alpha\epsilon^g\rho^g$, combined with our calibrated values for α and ϵ^g, yields estimates of $\rho^F = (0.013/(1.56 * 2.43))/0.24 = 0.014$ for women and $\rho^M = 0.010$ for men.

Recovering Unobserved Fundamentals. We use the full model structure to recover the region- and gender-specific fundamentals that rationalize the observed data: home production efficiencies ($B^g_{s|i}$), market productivity levels, ($\bar{Z}^g_i$), and amenities, ($\bar{A}^g_i$). This inversion allows us to understand the underlying drivers of the stylized facts from Section 2. For instance, we find that the gender participation gap in large cities is explained by a combination of high market productivity for men and relatively high home production efficiency or market frictions for women in those same locations (see Appendix Figure C.3). A full description of the inversion strategy and results is in Online Appendix C.3.

6 Counterfactual Policy Analysis

This section uses the quantified model to analyse how optimal spatial policies, designed to correct the externalities identified in our framework, would reshape labour market outcomes in Germany. We investigate the effects on the allocation of labour

[22] Appendix Table C.4 shows that fiscal transfer shocks following the 2011 Census had the strongest impact in regions with limited childcare availability, where non-employment rates decreased by around 1.91%. In areas with above-median childcare access, both groups' effects are substantially smaller and statistically insignificant. The pattern is similar for transport infrastructure: regions with poor transport connectivity show a modest decrease in female non-employment (-0.6%), while effects on male non-employment and in well-connected areas are insignificant. This aligns with findings from Helm and Stuhler (2024), who show that local governments in Germany respond to unforeseen lump-sum budget increases primarily through increased investment spending rather than debt restructuring, tax adjustments, or public employment changes.

Table 1: EFFECTS OF FISCAL TRANSFER SHOCKS ON EMPLOYMENT

Outcome Variable	**ATT Estimate**
First Stage:	
Fiscal Transfers per Capita (in euros)	167.34**
	(84.80)
Reduced Form:	
Log Non-Employment Rate, Female	-0.013**
	(0.006)
Log Non-Employment Rate, Male	-0.009
	(0.013)
Observations	4,400
Controls	Yes
State × Year FE	Yes
Pre-treatment Dynamics	Yes

Notes: The table reports the Average Treatment Effect on the Treated (ATT) from a difference-in-differences design with augmented inverse probability weighting. The first row shows the first-stage effect of the Census-induced shock on fiscal transfers. The subsequent rows show the reduced-form effects on gender-specific non-employment rates. Controls include log net wages and four annual lags of outcome variables. Standard errors, clustered at the commuting zone level, are in parentheses. * $p < 0.10$, ** $p < 0.05$.

between the market and home sectors across different regions and demographic groups, quantify the aggregate welfare and output implications, and highlight the importance of the endogenous labour supply margin.

6.1 Implementation Strategy

We compute the counterfactual equilibrium that maximizes social welfare using an iterative algorithm.[23] Starting from the 2014 baseline, we calculate the optimal policy adjustments–taxes, subsidies, and transfers–prescribed by Proposition 2. These policies alter the relative returns to market versus home work, inducing changes in labour allocation and location choices. These individual decisions, in turn, shift regional wages, prices, and externalities, requiring a new set of optimal policies. We iterate this process until the economy reaches a new spatial equilibrium where all

[23]Given the structural parameters, exogenous fundamentals, endogenous variables $\{E_i, h_{i,u}, I^g_{s|i,u}, L^g_{i,u}, L^g_{s|i,u}, P_{i,u}, r_i, w^g_{u|i,u}, X_{i,u}, \lambda_{i,u}, \pi_{ij,u}\}$, and a set of spatial policies, we simulate how changes in spatial policies affect employment decisions differently across local labour markets.

markets clear and no further welfare gains are possible.[24] To isolate the contribution of the LFP channel, we solve the spatial model under two scenarios: first, in our most general framework with endogenous non-employment and second, in a special scenario where all workers are assumed to be in the labour force.

6.2 Key Policy Changes under the Optimal Regime

The counterfactual analysis reveals two key differences between the optimal policy and Germany's current system in two key dimensions: taxation and redistribution.

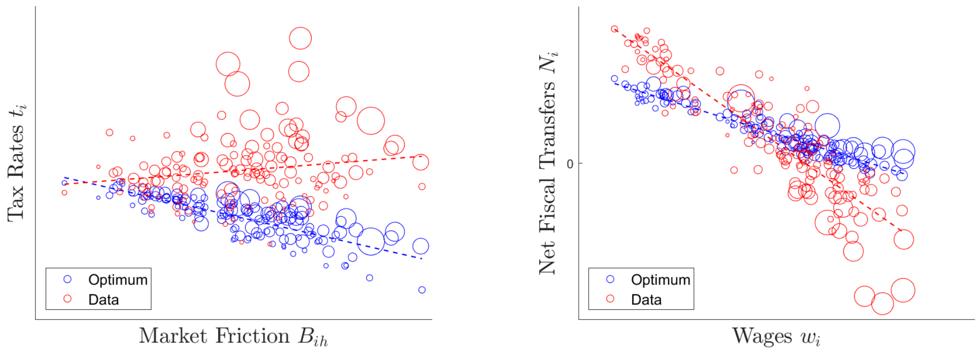
Taxation. The optimal policy features lower taxes on market work in locations that currently have high non-employment (i.e., a large home production sector). As Panel (a) of Figure 4 shows, this reverses the existing pattern. The model's logic is that in these locations, where the labour supply is more elastic, tax cuts are a highly effective instrument for productive workers to move from home to market production. This effect is particularly strong for women. Conversely, tax rates are higher in areas with high market attachment, as this allows for revenue generation with minimal distortion to the local participation margin.

Redistribution. While optimal net fiscal transfers (in blue) continue to flow from high-wage to low-wage locations, the magnitude of this redistribution is smaller and less correlated with local wages compared to the current system (Figure 4 Panel b).

Note that this holds true even in the full employment version of the model. Yet, accounting for the LFP channel in our counterfactual simulations, we find that the planner reduces levels of redistribution from high-wage to low-wage regions even more than in the full employment version. This is because, consistent with our theoretical findings, efficiency gains in high-participation areas (i.e., higher agglomeration plus labour supply externalities) partially offset the traditional goal of supporting high marginal utility of consumption areas (i.e., low-wage areas). This is a result of the empirical observation that wages and labour force participation correlate positively in the data, especially for male workers. See Online Appendix D.3 and Figures D.4 for further details and discussions. Consequently, we would

[24] To ensure we find a global, rather than local, welfare maximum, we use a Monte Carlo approach with numerous initial starting values. Equilibria are unique based on structural parameters, fundamentals, and an initial set of fiscal policies. Our approach identifies N localised maxima by inverting fundamentals and parameters while varying the initial sets of spatial policies. These maxima result from implementing the optimal policies of Proposition 2 and remain consistent with a spatial equilibrium. See Online Appendix D.1 for details.

overestimate the optimal level of redistribution when not accounting for the labour force participation channel.



(a) Taxation (b) Redistribution

Figure 4: Optimal fiscal policies: Key Policy Changes

Notes: This figure highlights spatial fiscal policy for two different scenarios: (i) optimized policy instruments ("Optimum") according to Proposition 2 and (ii) observed German public finance system in 2014 ("Data"). Panel (a) plots tax rates against inverted market frictions, while Panel (b) displays net fiscal transfers (see Definition 1) against local wages. The size of the marker is proportional to local labour market size.

6.3 Local and Aggregate Effects

The optimal policy regime reallocates labour along two margins: spatially, through migration, and sectorally through movements from home to market work. The most significant changes occur in high-wage urban areas that currently feature large gender participation gaps. These locations experience an influx of workers and a notable increase in the share of labour allocated to the market sector, particularly among women.[25]

Table 2 (Column 1) quantifies the aggregate effects. Under the optimal policy, the aggregate market labour force increases by approximately $400,000$ workers, a shift driven primarily by women. This expansion of the labour force, combined with more efficient spatial sorting, leads to substantial increases in real GDP (2.18%), fiscal capacities (6.56%), and aggregate welfare (2.74%). As Figure D.2 shows, these policies significantly reduce the "urban participation gap" by creating stronger incentives for market work in high-wage cities, where the social value of market

[25] Online Appendix Figure D.1 illustrates these local adjustment patterns in detail, demonstrating that high-wage urban areas experience the largest increases in consumption possibilities, leading to both in-migration and higher labour force participation.

production is highest.[26]

Table 2: Optimal Policies: Aggregate Effects

	(1) Full model	(2) $\epsilon^g \to \infty$	(3) $\zeta^g = 0$	(4) $\eta = 0$	(5) $\theta^g = 3$
Labour Force	402,394	-	402,740	403,929	442,541
Fiscal capacities (per capita)	6.56	3.86	6.49	6.86	7.88
Nominal GDP	2.82	-0.09	2.75	3.08	4.34
Real GDP	2.18	-0.62	2.15	2.38	3.37
Welfare	2.74	0.39	2.69	2.96	3.82

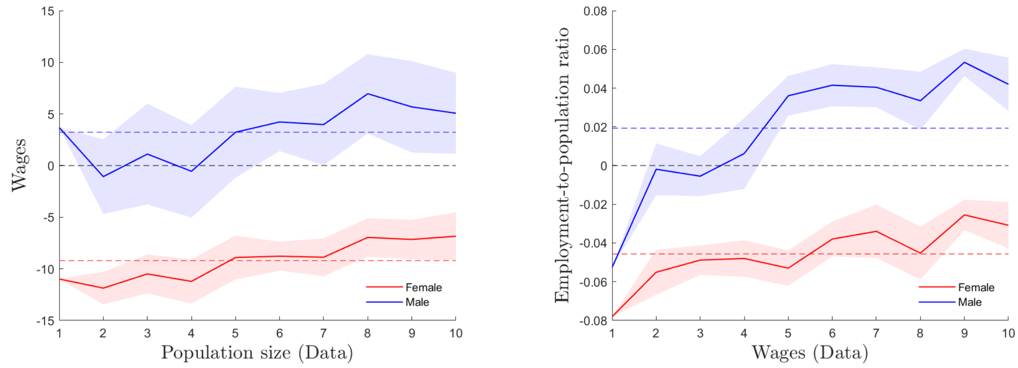
Notes: This table presents the nominal changes in the size of the labour force and percentage changes in aggregate outcomes–fiscal capacities (per capita), nominal and real GDP, and welfare. These variations result from counterfactual changes in spatial policies that implement optimal policies. We simulate counterfactual changes in 5 different scenarios: our preferred parametrization ("full model"), and four alternative specifications where we vary the main structural parameters of the model: $\{\epsilon^g, \zeta^g, \eta, \theta^g\}$

A key finding emerges when comparing the results to a benchmark full-employment model where adjustment can only occur through migration (Table 2, Column 2). The welfare gains in our two-sector model are significantly larger. This is because the planner can exploit a less costly adjustment margin: shifting existing residents from home to market work generates smaller increases in congestion (e.g., in housing markets) than attracting new migrants from other regions. The ability to activate this local labour supply channel, which is absent in standard frameworks, is therefore of first-order importance for realizing the full potential gains from place-based policy.

6.4 Sensitivity Analysis

Our main findings are robust to a wide range of alternative parameter specifications. As shown in Table 2 (columns 3-5), the results are qualitatively stable when varying standard spatial parameters such as worker mobility (θ) and amenity congestion (η). We also test the sensitivity to parameters governing the home production sector. As detailed in Online Appendix D.3, the welfare gains are larger when the labour supply elasticity (ϵ^g) or the public goods substitutability parameter (ρ^g) is higher, as this makes the LFP margin more responsive to policy. Crucially, assuming uniform labour supply responses across genders would substantially reduce the aggregate

[26]The optimized policies lead to a notable compression in the regional variation of gender gaps in employment. While LFP rises in productive urban centers, it can decrease slightly in areas where the social value of market work is lower. See Online Appendix Figure D.2 for the full spatial distributions.



(a) Urban wage premium w/o Controls (b) LFP vs Wages w/o Controls

Figure 5: Urban Premia and Gender Gaps under Optimal Policy

Notes: This figure shows the relationship between wages (Panel a) and LFP rates (Panel b) simulated by the model against labour market size and wage deciles for males and females in Germany. LFP rates are defined as local labour supply relative to the working-age population. The dotted lines represent the mean across all commuting zones (CZs). Two solid lines are plotted, one for each gender, representing the demeaned average of each variable within each bin. The shaded areas around each line represent the 95% confidence interval.

welfare gains, confirming that the heterogeneous nature of the home-versus-market trade-off is a key driver of our results.

Across all specifications, the central conclusion persists: the optimal policy involves less spatial redistribution than the current system but uses targeted fiscal instruments to incentivise labour allocation towards the market sector in the most populous places with the largest gender employment gaps.

7 Conclusion

This paper shows that fiscal transfers affect where people work but also whether they work, fundamentally altering the logic of optimal spatial policy. We introduce selection into a productive home sector in a quantitative spatial model to re-examine the design and consequences of place-based policies.

Our analysis yields two main contributions. First, on the theoretical side, we show that the social planner's problem expands from solely correcting the inefficient sorting of workers across locations to also managing the inefficient allocation of labour between the market and home sectors within each location. This dual mandate arises from a novel labour supply fiscal externality, which varies across regions and demographic groups. The optimal policy regime must therefore use targeted tax incentives and a nuanced redistribution scheme to account for heterogeneous labour supply elasticities.

Second, our contribution is quantitative. We apply the model to Germany, providing causal evidence that public spending on services like childcare directly influences the labour participation margin, particularly for women. Our counterfactual simulations show that a policy regime optimized for this two-sector economy generates substantial aggregate gains, increasing real GDP by 2.2% and welfare by 2.7%. These gains are driven by reallocating labour–especially female labour–from the home to the market sector in the high-productivity urban centers where it is most valuable.

The central insight from our analysis is that the home production sector is not a peripheral detail but a first-order determinant of optimal spatial policy. In developed economies facing demographic pressures and skills shortages, mobilising underutilised labour is a key policy objective. Our framework demonstrates that place-based policies, when designed to account for the trade-offs between market and home production, can yield welfare gains that are overlooked by conventional full-employment models.

While our framework identifies substantial welfare gains, we acknowledge that implementing the fully optimal policy would face practical challenges, including political resistance from regional winners and losers and the data-intensive nature of calibrating local elasticities. Nevertheless, our analysis provides a clear direction for policy reform. Even incremental moves toward the optimal design–such as directing public investment toward specific barriers to market entry–could realize a significant portion of the potential gains. Future research could extend our analysis to dynamic settings or explore the interaction of these mechanisms with family structure and dual-earner households (Calvo et al., 2024).

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APPENDIX

A The Social Planner's Problem: General Model and Derivations

This appendix provides the formal derivation of the optimal policy results presented in Section 4. While the main text focuses on a simplified single-sector model for clarity, the derivations here are for the general multi-sector model used in our quantification (Section 5), where $G, M > 1$. We first lay out the full planner's problem and its constraints, then derive the key first-order conditions that lead to the efficiency conditions and optimal policy instruments discussed in the main paper.

A.1 The Social Planner's Problem

A utilitarian social planner chooses the allocation of worker of different groups $\{L^g_{i,u}\}$ across locations i and market sectors u to maximize a social welfare function, $\mathcal{W}$, subject to a set of resource and technological constraints. The social welfare function is given as:

$$\mathcal{W} = \sum_{g\in G} \mu^g \mathcal{U}\left[\left(\sum_{u\in M}\sum_{i\in J}\left[A^g_i \exp\left[-\mu^g_{m|i,u}\right]\left(C^g_{m|i,u}\right)^{1-\alpha}\left(\frac{R^g_{m|i,u}}{\left(\sum_{g\in G}\sum_{u\in M} L^g_{i,u}\right)^{\chi}}\right)^{\alpha}\right.\right.\right.$$
$$\left.\left.\left.\left(1+\frac{\left[\left(\frac{1}{\mathcal{B}^g_{s|i,u}}\right)\left(C^g_{m|i,u}/C^g_{h|i,u}\right)^{1-\alpha}\left(\left[\frac{R^g_{m|i,u}}{\left(\sum_{g\in G}\sum_{u\in M} L^g_{i,u}\right)^{\chi}}\right]^{\rho^g}\right)^{\alpha}\right]^{-\epsilon^g}}{\epsilon^g - 1}\right)\right]^{\theta}\right)^{\frac{1}{\theta}} \Gamma\left(\frac{\theta-1}{\theta}\right) L^g\right]$$

The social planner maximises the social welfare function, subject to non-negativity constraints for consumption and production choices, resource constraints, supply of productive inputs, workers' preferences, and mobility. The following equations detail these constraints:

- Preferences:

$$\prod_{u'=1}^{M}\left(C^g_{s,u'|i,u}\right)^{\beta^C_{u'}} = C^g_{s|i,u} \quad \text{and} \quad \prod_{u'=1}^{M}\left(R^g_{m,u'|i,u}\right)^{\beta^R_{u'}} = R^g_{m|i,u}.$$

- Final goods resource constraints:

$$Y_{i,u'} = \sum_{s\in h,m}\sum_{u\in M}\sum_{g\in G}\xi^g_{s|i,u}C^g_{s,u'|i,u}L^g_{i,u}+\sum_{u\in M}\sum_{g\in G}\left(\frac{L^g_{i,u}}{L_i}\right)R^g_{m,u'|i,u}+\sum_{u\in M}\int M_{i,uu'}\left(\mathbf{z_{u'}}\right)d\phi\left(\mathbf{z_{u'}}\right)$$

where we let $Y_{i,u'} \equiv \left(\int\left(\sum_{j\in J}\tilde{y}_{ij,u'}\left(\mathbf{z_{u'}}\right)\right)^{\frac{\sigma-1}{\sigma}}d\phi\left(\mathbf{z_{u'}}\right)\right)^{\frac{\sigma}{\sigma-1}}$ denote the quantity produced of final goods in region-sector pair $\{i,u'\}$. Final goods produced in a given sector are used for private and public consumption or as material inputs in other sectors. $\tilde{y}_{ij,u'}\left(\mathbf{z_{u'}}\right)$ is the input of intermediate goods produced in region j and sector u', but consumed in i.

- Intermediate goods resource constraints:

$$\left[\left(h_{i,u'}\left(z_{i,u'}\right)\right)^{\kappa_{i,u'}}\left(\left[\sum_{g\in G}\left(Z^g_{i,u'}L^g_{m|i,u'}\left(z_{i,u'}\right)\right)^{\frac{\sigma^g-1}{\sigma^g}}\right]^{\frac{\sigma^g}{\sigma^g-1}}\right)^{1-\kappa_{i,u'}}\right]^{\delta_{j,u'}}\prod_{u\in M}\left[M_{i,u'u}\left(z_{i,u'}\right)\right]^{\delta_{i,u'u}}$$
$$= \sum_{j\in J}\tau_{ji,u'}\tilde{y}_{ji,u'}\left(\mathbf{z_{u'}}\right)$$

- Supply of production inputs:

$$H_i = \sum_{u\in M}\int h_{i,u}\left(z_{i,u}\right)d\phi_i\left(z_{i,u}\right) \quad \text{and} \quad L^g_{m|i,u} = \int L_{m|i,u}\left(z_{i,u}\right)d\phi_i\left(z_{i,u}\right)$$

- Worker Sorting:

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

- Local labour supply:

$$\left(1-\left[\left(\frac{1}{\mathcal{B}^g_{s|i,u}}\right)\left(C^g_{m|i,u}/C^g_{h|i,u}\right)^{1-\alpha}\left(\left[\frac{R^g_{m|i,u}}{\left(\sum_{g\in G}\sum_{u\in M}L^g_{i,u}\right)^\chi}\right]^{\rho^g}\right)^\alpha\right]^{-\epsilon^g}\right)L^g_{i,u} = L^g_{m|i,u}$$

A.1.1 Characterising Optimal Spatial Policies

In this section, we show how the set-up of the social planner problem allows us to characterise the socially optimal choices of consumption, production, population and employment.

1. Consumption of goods in different sectors:

$$\frac{\partial \mathcal{W}}{\partial C^g_{s,u'|i,u}}: \quad L^g_{s|i,u} P_{i,u'} = \beta^C_{u'} \frac{C^g_{s|i,u}}{C^g_{s,u'|i,u}} P^g_{s|i,u}, \tag{A.1}$$

where $P_{i,u'}$ denotes the Lagrange multiplier corresponding to the final goods resource constraint. $P^g_{s|i,u}$ is the multiplier on private consumption aggregation. This condition implies an ideal price index $P_i \equiv \frac{P^g_{s|i,u}}{L^g_{s|i,u}} = \prod_{u'=1}^M \left(P_{i,u'}/\beta^C_{u'}\right)^{\beta^C_{u'}}$.

$$\frac{\partial \mathcal{W}}{\partial R^g_{s,u'|i,u}}: \quad P_{i,u'} \frac{L^g_{i,u}}{L_i} = \beta^R_{u'} \frac{R^g_{s|i,u}}{R^g_{s,u'|i,u}} \tilde{P}_{s|i,u}, \tag{A.2}$$

where $\tilde{P}_{s|i,u}$ is the Lagrange multiplier for the public good consumption aggregation, and we get an ideal price index for public goods: $P^R_i \equiv \tilde{P}_{s|i,u}\left(L_i/L^g_{i,u}\right) = \prod_{u'=1}^M \left(P_{i,u'}/\beta^R_{u'}\right)^{\beta^R_{u'}}$.

2. Local consumption of private and public goods:

$$\frac{\partial \mathcal{W}}{\partial C^g_{m|i,u}}: \quad \underbrace{\frac{(1-\alpha)\,\mu^g \mathcal{U}'\left(\mathcal{V}^g\right)\mathcal{V}^g}{C^g_{m|i,u}} \left[\frac{\epsilon^g - 1}{\epsilon^g - 1 + \xi^g_{h|i,u}}\right]}_{\text{marginal utility of consumption (per capita)}} \tag{A.3}$$

$$= P_i - \underbrace{\sum_{j\in J}\sum_{u'\in M} W^g_{j,u'}\Psi^g_{j,u'}/\left(1-\xi^g_{h|i,u}\right)}_{\text{sorting across region-sectors}} - \underbrace{\frac{\tilde{W}^g_{m|i,u}\left[(1-\alpha)\,\epsilon^g\right]\xi^g_{h|i,u}}{\left(1-\xi^g_{h|i,u}\right)C^g_{m|i,u}}}_{\text{selection along extensive margin}},$$

where $W^g_{j,u}$ and $\tilde{W}^g_{m|i,u}$ are the Lagrange multipliers on the regional and extensive labour supply constraints, respectively, $\mathcal{V}^g$ is the equalised indirect utility for each worker group, and the $\Psi^g_{j,u'}$ are given as:

$$\Psi^g_{j,u'} = \begin{cases} -\left(L^g_{j,u'}/L^g\right)\left(\frac{(1-\alpha)\theta}{C^g_{m|i,u}}\right)\left[\frac{(\epsilon^g-1)(1-\xi^g_{h|i,u})}{\epsilon^g-1+\xi^g_{h|i,u}}\right] & \text{if } \{i,u\} \neq \{j,u'\} \\ \left(1-\frac{L^g_{i,u}}{L^g}\right)\left(\frac{(1-\alpha)\theta}{C^g_{m|i,u}}\right)\left[\frac{(\epsilon^g-1)(1-\xi^g_{h|i,u})}{\epsilon^g-1+\xi^g_{h|i,u}}\right] & \text{if } \{i,u\} = \{j,u'\}. \end{cases}$$

$$\frac{\partial \mathcal{W}}{\partial C^g_{h|i,u}} : \quad \underbrace{\frac{(1-\alpha)\,\mu^g \mathcal{U}'(\mathcal{V}^g)\,\mathcal{V}^g}{C^g_{h|i,u}}\left[\frac{\epsilon^g}{\epsilon^g - 1 + \xi^g_{h|i,u}}\right]}_{\text{marginal utility of consumption (p.c.)}} \tag{A.4}$$

$$= P_i - \underbrace{\sum_{j\in J}\sum_{u'\in M} W^g_{j,u'}\Psi^g_{j,u',h}/\xi^g_{h|i,u}}_{\text{sorting across region-sectors}} + \underbrace{\frac{\tilde{W}^g_{m|i,u}\left[(1-\alpha)\,\epsilon^g\right]\xi^g_{h|i,u}}{\xi^g_{h|i,u}C^g_{h|i,u}}}_{\text{selection along extensive margin}},$$

where we denote as $\Psi^g_{j,u',h}$ the following components:

$$\Psi^g_{j,u',h} = \begin{cases} -\left(L^g_{j,u'}/L^g\right)\left(\frac{(1-\alpha)\theta}{C^g_{h|i,u}}\right)\left[\frac{\epsilon^g\xi^g_{h|i,u}}{\epsilon^g-1+\xi^g_{h|i,u}}\right] & \text{if } \{i,u\}\neq\{j,u'\} \\ \left(1-\frac{L^g_{i,u}}{L^g}\right)\left(\frac{(1-\alpha)\theta}{C^g_{h|i,u}}\right)\left[\frac{\epsilon^g\xi^g_{h|i,u}}{\epsilon^g-1+\xi^g_{h|i,u}}\right] & \text{if } \{i,u\}=\{j,u'\}. \end{cases}$$

$$\frac{\partial \mathcal{W}}{\partial R^g_{m|i,u}} : \quad \underbrace{\mu^g \mathcal{U}'(\mathcal{V}^g)\,\mathcal{V}^g/R^g_{m|i,u}\left[\alpha - \Upsilon^g_{i,u}\right]}_{\text{marginal utility of consumption}} \tag{A.5}$$

$$= \frac{P^R_i}{L_i} - \underbrace{\sum_{j\in J}\sum_{u'\in M} W^g_{j,u}\Psi^{g,R}_{j,u'}}_{\text{sorting across region-sectors}} - \underbrace{\tilde{W}^g_{m|i,u}\left[\alpha\epsilon^g\rho^g\right]\xi^g_{h|i,u}/R^g_{m|i,u}}_{\text{selection along extensive margin}},$$

$$\Psi^{g,R}_{j,u'} = \begin{cases} -\left(L^g_{j,u'}/L^g\right)\left(\frac{\theta}{R^g_{m|i,u}}\right)\left[\alpha-\Upsilon^g_{i,u}\right] & \text{if } \{i,u\}\neq\{j,u'\} \\ \left(1-\frac{L^g_{i,u}}{L^g}\right)\left(\frac{\theta}{R^g_{m|i,u}}\right)\left[\alpha-\Upsilon^g_{i,u}\right] & \text{if } \{i,u\}=\{j,u'\}. \end{cases}$$

with $\Upsilon^g_{i,u} \equiv \frac{\gamma^g\xi^g_{h|i,u}}{\epsilon-(1-\xi^g_{h|i,u})}$ and $\gamma^g = \alpha\rho^g\epsilon^g$ is the spillover from public expenditure to local non-employment.

3. Production inputs:

$$\frac{\partial \mathcal{W}}{\partial L^g_{m|i,u}(z_{i,u})} : \quad \tilde{\lambda}_{i,u}(z_{i,u})\,\delta_{i,u}(1-\kappa_{i,u})\frac{\left(\frac{Z^g_{i,u}}{w^g_{i,u}}\right)^{\sigma^g-1}}{\sum_{g\in G}\left(\frac{Z^g_{i,u}}{w^g_{i,u}}\right)^{\sigma^g-1}}\frac{\sum_{j\in J}\tau_{ji,u}\tilde{y}_{ji,u}(z_{i,u})}{L^g_{m|i,u}(z_{i,u})}$$

$$= w^g_{i,u}d\phi(z_{i,u}) \tag{A.6}$$

where $\tilde{\lambda}_{i,u}(z_{i,u})$ and $w^g_{i,u}$ are the Lagrange multipliers on the intermediate goods constraint and resource constraint for local labour respectively. Also,

$$\frac{\partial \mathcal{W}}{\partial h_{i,u}(z_{i,u})}: \quad \tilde{\lambda}_{i,u}(z_{i,u})\,\delta_{i,u}\kappa_{i,u}\frac{\sum_{j\in J}\pi_{ji,u}\tilde{y}_{ji,u}(z_{i,u})}{h_{i,u}(z_{i,u})} = r_i d\phi(z_{i,u}), \tag{A.7}$$

where we denote as r_i the Lagrange multiplier on the resource constraint for land and structures. Similarly, the materials input is derived as follows:

$$\frac{\partial \mathcal{W}}{\partial M_{i,uu'}(z_{i,u})}: \quad \tilde{\lambda}_{i,u}(z_{i,u})\,\delta_{i,uu'}\frac{\sum_{j\in J}\pi_{ji,u}\tilde{y}_{ji,u}(z_{i,u})}{M_{i,uu'}(z_{i,u})} = P_{i,u'}d\phi(z_{i,u}). \tag{A.8}$$

Using the first-order conditions (A.6) - (A.8) in the intermediate goods resource constraint, we derive the optimal region-sector-specific unit cost index:

$$\tilde{\lambda}_{i,u}(z_{i,u}) \equiv \frac{\lambda_{i,u}d\phi(z_{i,u})}{z_{i,u}} = \frac{D_{i,u}}{z_{i,u}}\left(r_i^{\kappa_{i,u}}\left[\sum_{g\in G}\left(\frac{Z_{i,u}^g}{w_{i,u}^g}\right)^{\sigma^g-1}\right]^{\frac{1-\kappa_{i,u}}{1-\sigma^g}}\right)^{\delta_{i,u}}\prod_{u'\in M}\left[P_{i,u'}\right]^{\delta_{i,uu'}} d\phi(z_{i,u}),$$

with $D_{i,u} \equiv \left(\delta_{i,u}(\kappa_{i,u})^{\kappa_{i,u}}(1-\kappa_{i,u})^{(1-\kappa_{i,u})}\right)^{-\delta_{i,u}}\prod_{u'\in M}(\delta_{i,uu'})^{-\delta_{i,uu'}}$ a region-sector-specific constant. The social planner similarly optimizes with respect to intermediate goods production and consumption in region-sector pair $\{i,u'\}$:

$$\frac{\partial \mathcal{W}}{\partial \tilde{y}_{ji,u'}(\mathbf{z_{u'}})}: \begin{cases} \tilde{y}_{ji,u'}(\mathbf{z_{u'}}) > 0 \text{ if } & \tilde{\lambda}_{j,u}(z_{j,u})\,\tau_{ij,u} = P_{i,u}\left(\frac{Y_{i,u}}{\tilde{y}_{ij,u'}(\mathbf{z_u})}\right)^{\frac{1}{\sigma}} d\phi(z_{j,u}) \\ \tilde{y}_{ji,u'}(\mathbf{z_{u'}}) = 0 \text{ if } & \tilde{\lambda}_{j,u}(z_{j,u})\,\tau_{ij,u} > P_{i,u}\left(\frac{Y_{i,u}}{\tilde{y}_{ij,u'}(\mathbf{z_u})}\right)^{\frac{1}{\sigma}} d\phi(z_{j,u}) \end{cases}$$

This first-order condition can be re-written as $\tilde{y}_{i,u}(\mathbf{z_u}) = (p_{i,u}(\mathbf{z_u}))^{-\sigma} P_{i,u}^{\sigma-1}(Y_{i,u}P_{i,u})$, using the fact that prices equal unit costs under perfect competition and with $\tilde{\lambda}_{i,u}(z_{i,u}) \equiv p_{i,u}(z_{i,u})d\phi(z_{i,u})$ if producers choose minimal unit costs. It is easily seen that this first-order condition implies the same trade shares and price levels as in the competitive equilibrium.

4. Local labour force:

$$\frac{\partial \mathcal{W}}{\partial L_{m|i,u}^g}: \quad w_{i,u}^g = \tilde{W}_{m|i,u}^g. \tag{A.9}$$

5. Worker Allocation across space:

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

It follows that:

$$\frac{\partial \mathcal{W}}{\partial L^g_{i,u}}: \underbrace{W^g_{i,u}}_{\text{opportunity cost}} + \underbrace{\sum_{u'\in M} P_{i,u'}\left[\xi^g_{h|i,u} C^g_{h,u'|i,u} + \left(1-\xi^g_{h|i,u}\right) C^g_{m,u'|i,u}\right]}_{\text{consumption cost}}$$

$$= \underbrace{\left(1-\xi^g_{h|i,u}\right)\tilde{W}^g_{m|i,u}}_{\text{marginal product of labour}} + \underbrace{Ex^{NET}_i}_{\text{net spatial externalities}}, \tag{A.10}$$

Productivity spillovers are given as

$$Ex^{AGG}_i \equiv \sum_{u\in M}\sum_{g\in G}\int \zeta^g \delta_{i,u}\left(1-\kappa_{i,u}\right)\frac{\left(\frac{Z^g_{i,u}}{w^g_{i,u}}\right)^{\sigma^g-1}}{\sum_{g\in G}\left(\frac{Z^g_{i,u}}{w^g_{i,u}}\right)^{\sigma^g-1}}\frac{\sum_{j\in J}\tau_{ji,u}\tilde{y}_{ji,u}\left(z_{i,u}\right)}{\sum_{u\in M}\sum_{g\in G}L^g_{i,u}} p_{i,u}(z_{i,u})d\phi\left(z_{i,u}\right).$$

Integration of equation (A.6) and combination with the definition of agglomeration economies yields

$$Ex^{AGG}_i = \sum_{u\in M}\sum_{g\in G}\zeta^g\left(1-\xi^g_{h|i,u}\right)w^g_{i,u}\left(\frac{L^g_{i,u}}{L_i}\right) \tag{A.11}$$

Using the first-order condition (A.9), labour force spillovers are derived as

$$Ex^{LFP}_i = \chi\sum_{u\in M}\sum_{g\in G}\gamma^g\xi^g_{h|i,u}w^g_{i,u}\left(\frac{L^g_{i,u}}{L_i}\right). \tag{A.12}$$

Congestion spillovers on amenity and public goods consumption are given by

$$Ex^{CON}_i = \frac{1}{\sum_{g\in G}\sum_{u\in M}L^g_{i,u}}\sum_{g\in G}\left(\mu^g\mathcal{U}'\left(\mathcal{V}^g\right)\mathcal{V}^g\sum_{u\in M}L^g_{i,u}\left(\chi\left(\alpha-\Upsilon^g_{i,u}\right)+\eta\right)\right).$$

In our Online Appendix, we show that expected utility can be further expressed as

$$\left(1-\alpha\right)\mu^g\mathcal{U}'\left(\mathcal{V}^g\right)\mathcal{V}^g = \frac{1}{L_g}\sum_{i\in J}\sum_{u\in M}L^g_{i,u}\left[P_i\sum_{s\in h,m}\xi^g_{s|i,u}C^g_{s|i,u}\right]$$

Using this equation in the definition of Ex_i^{CON} we finally get:

$$Ex_i^{CON} = \frac{1}{(1-\alpha)} \sum_{g \in G} \left[\frac{1}{L_g} \left(\sum_{i \in J} \sum_{u \in M} L_{i,u}^g \left[\sum_{s \in h,m} \xi_{s|i,u}^g \left(\left(1 - \tilde{t}_{s|i,u}^g \right) w_{i,u}^g + \tilde{s}_{s|i,u}^g \right) \right] \right) \right.$$
$$\left. \times \sum_{u \in M} \left(\frac{L_{i,u}^g}{L_i} \right) \left(\chi \left(\alpha - \Upsilon_{i,u}^g \right) + \eta \right) \right]. \tag{A.13}$$

Combining Equations (A.10), (A.11), (A.12) and (A.13), and applying it for the special case with $M = G = 1$, yields Equation (13) in the main paper and proves Proposition 1.

A.1.2 Optimal Spatial Policies - Proof of Proposition 2

This Appendix outlines the steps necessary to derive the optimal taxes and transfers that implement the socially optimal levels of private and public good consumption by combining the planner's first-order conditions.

1. Solve for the optimal private goods consumption of employed and non-employed workers in all regions, sectors and groups by combining (A.3), (A.4), (A.9) and the planner's first-order condition on local population (A.10).

2. Step 1 yields optimal private good consumption levels as a function of wages, employment rates and two policy instruments: region-specific tax rates, $\tilde{t}_{s|i,u}^g$ on local labour income as well as additive wage subsidies $\tilde{x}_{s|i,u}^g$.

3. Using the general equilibrium structure of the framework and again applying the planner's first-order condition on local population (A.10), all policy instruments can be expressed using solely information on observable variables at the regional level (e.g. wages, employment, rents and labour force participation rates), structural parameters and the optimal level of local public good provision.

4. Derive the optimal level of public good consumption, using equations (A.5), (A.9), the planner's first-order condition on local population (A.10) as well as the solutions for private good consumption from step 2.

5. Again, using the general equilibrium structure of the framework, local public good levels can be expressed solely as a function of economic variables at the regional level (wages, rents, population, labour force participation rates) as well as structural parameters of the model.

6. Determine private goods consumption expenditures using the previously solved levels of public goods expenditure.

The optimal consumption levels and socially optimal taxes and transfers as derived in Proposition 2 follow from applying these six steps. See Section B in our Online Appendix for detailed calculations.

B Analysis of the Labour Supply Externality

The main text identifies a novel labour supply externality, which is formally derived from the planner's first-order conditions in Appendix A. It arises because an additional resident increases public goods congestion, which makes the home sector relatively more attractive and thus distorts the labour supply decisions of all other residents. The externality is defined as the net effect of two opposing forces:

$$Ex_i^{\text{LFP-Fiscal}} \equiv -\chi\gamma^g \xi^g_{h|i} \cdot \Big(\underbrace{w_i^g}_{\substack{\text{Cost from lost}\\ \text{market output}}} - \underbrace{\frac{\bar{\mathcal{C}}}{(1-\alpha)(\epsilon^g - (1-\xi^g_{h|i}))}}_{\substack{\text{Benefit from increased}\\ \text{home market production}}} \Big) \tag{B.14}$$

B.1 Sign Condition and Economic Interpretation

This condition is most clearly understood by interpreting the left-hand side in relation to a national benchmark and the right-hand side as a local benefit in terms of home market production. The externality is negative if the cost to market production and fiscal budgets exceeds the benefit from increased home market production. The condition is:

$$\frac{\bar{\mathcal{C}}}{w_i^g} < (1-\alpha)(\epsilon^g - 1 + \xi^g_{h|i}) \tag{B.15}$$

The key insight is that the sign of this new externality depends on the interaction between a location's wage (w_i^g) and its participation rate (captured by $\xi^g_{h|i}$).

- A high local wage (w_i^g) increases the cost of lost market work, pushing the externality towards being negative.
- A high local home production share ($\xi^g_{h|i}$) increases the denominator, reducing the benefit of increased home production, pushing the externality towards being negative.

On the one hand, the social cost from reducing the labour force is particularly high in places where workers are highly productive and are compensated by higher market wages. On the other hand, the benefit of increase home market production is smaller in locations where many workers are already non-employed, since the marginal worker is (marginally) less productive in this sector ('selection effect').

C Derivation and Decomposition of Net Fiscal Transfers

The main text conceptually defines the net fiscal transfer, N_i, and uses it to interpret the redistribution simulations in Figure 3 (Panel b). This appendix provides the formal derivation of N_i.

To calculate N_i, we conduct a thought experiment comparing a "before" no-redistribution benchmark with the "after" state under the optimal policies from Proposition 2. We hold prices and wages fixed to isolate the direct impact of the fiscal instruments. We assume a simple initial allocation where there is no inter-regional redistribution. Local tax revenues fund local public goods: $E_i^{before} = t_{m|i}(1-\xi_{h|i})w_i L_i$, and any remaining rents are redistributed to local workers as lump-sum subsidies. Non-employed workers receive a fixed share $1-o$ of local after-tax wage income, $(1-t_{m|i})(1-o)w_i$, as compensation financed from locally-occurring rents.

The planner implements the optimal tax, subsidy, and transfer instruments ($\tilde{t}_{s|i}$, $\tilde{x}_{s|i}$, $\tilde{\iota}_i$) described in Proposition 2. These policies determine the new levels of private consumption ($\tilde{C}_{s|i}$) and public goods ($\tilde{E}_i$). We define the change in private consumption expenditures as $dP_iC_{s|i} \equiv (P_iC_{s|i})^{after} - (P_iC_{s|i})^{before}$, and the change in public goods expenditure as dE_i.

Definition 1. *The net fiscal transfer, N_i, measures the change in per capita consumption possibilities after the implementation of optimal policies:*

$$N_i = \sum_{s\in h,m} \xi_{s|i} dP_iC_{s|i} + d(E_i/L_i). \tag{C.16}$$

The following corollary provides the full analytical decomposition of N_i, linking it to local economic conditions. This decomposition forms the basis for the simulations in the main text.

Corollary 1. *The net fiscal transfer to location i is given by:*

$$N_i = \Theta_{i,1} \underbrace{\left(\sum_{j\in J} w_j L_j/L - w_i\right)}_{\text{relative market compensation}} + \Theta_{i,2} \underbrace{\left(\sum_{j\in J} \xi_{h|j} w_j L_j/L - \xi_{h|i} w_i\right)}_{\text{relative non-market compensation}} \tag{C.17}$$

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

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

where the weighting terms $\Theta_{i,1}, \Theta_{i,2}, \Theta_{i,3}$ are functions of the model's deep parameters:

$$\Theta_{i,1} \equiv \frac{1 - [\alpha(1-\Upsilon_i/\alpha) + \zeta(1-\Upsilon_i)]\,\theta}{1+(1-\alpha)\theta}$$

$$\Theta_{i,2} \equiv -\Theta_{i,1} - \gamma\left(1 - \frac{[1-\Upsilon_i]\,\theta\chi}{1+(1-\alpha)\theta}\right) + (1-o)(1-t_{m|i})$$

$$\Theta_{i,3} \equiv \frac{\chi\,[1-\Upsilon_i]\,\theta\cdot\bar{\mathcal{C}}}{[1+(1-\alpha)\theta](1-\alpha)} \quad \textit{with} \quad \Upsilon_i \equiv \frac{\gamma\xi_{h|i}}{\epsilon-(1-\xi_{h|i})}$$

Proof. Substituting the optimal policy expressions from Proposition 2 into the household and government budget constraints to find the "after" consumption levels, and then applying Definition C.16.

This decomposition provides the analytical basis for the simulations in Figure 3. The corollary translates the structural motives from the planner's problem into coefficients on observable local characteristics. For instance, the "relative market compensation" term, with its coefficient $\Theta_{i,1}$, captures the net effect of the planner's underlying preference the marginal utilities of consumption and the components of the spatial externalities (like $Ex_i^{\text{LFP-Fiscal}}$) that are systematically correlated with local wages. As long as $\Theta_{i,1} > 0$, the planner redistributes towards locations with below-average wages. Similarly, the other terms capture how differences in local participation rates ($\xi_{h|i}$) drive transfers, bundling the effects of the competing agglomeration and labour supply externalities. Finally, the Samuelson rule governs the optimal redistribution between the uses of funds for private goods or public services.

Online Appendix

A Theoretical Framework

A.1 Expected Utility

Given the definition of private home market efficiency, $\exp\left[B^g_{h|i,u}\right]\varphi(\omega)$, the expected amount of private home market production is determined as

$$\frac{1}{L^g_{h|i,u}}\int_1^\infty L^g_{h|i,u}\exp\left[B^g_{h|i,u}\right]\varphi\frac{\partial Q^g(\varphi)}{\partial\varphi}d\varphi=\exp\left[B^g_{h|i,u}\right]\int_1^\infty\varphi\frac{\partial Q^g(\varphi)}{\partial\varphi}d\varphi$$

where $Q^g(\varphi)$ is the cumulative distribution function of workers' individual efficiency draws. Only those workers whose individual draw is above a local cut-off $\tilde{\varphi}^g_{h|i,u}$ end up in the home market sector, such that the average level of private home market production can be re-written as

$$\bar{B}^g_{h|i,u}=\frac{\exp\left[B^g_{h|i,u}\right]}{1-Q^g\left(\tilde{\varphi}^g_{h|i,u}\right)}\int_{\tilde{\varphi}^g_{h|i,u}}^\infty\varphi dQ^g(\varphi),$$

with $L^g_{h|i,u}/L^g_{i,u}=1-Q^g\left(\tilde{\varphi}^g_{h|i,u}\right)$ the share of workers in the home market sector.

Assume now that the idiosyncratic component follows a Pareto distribution with the following group-specific cumulative distribution and density functions:

$$Q^g(\varphi)=1-\varphi^{-\epsilon^g}\quad\text{and}\quad\frac{\partial Q^g(\varphi)}{\partial\varphi}=\epsilon^g\varphi^{-\epsilon^g-1}$$

Substituting these functional forms into the expression above yields

$$\int_{\tilde{\varphi}^g_{h|i,u}}^\infty\varphi dQ^g(\varphi)=\int_{\tilde{\varphi}^g_{h|i,u}}^\infty\varphi\left(\frac{\partial Q^g(\varphi)}{\partial\varphi}\right)d\varphi=\epsilon^g\int_{\tilde{\varphi}^g_{h|i,u}}^\infty\varphi^{-\epsilon^g}d\varphi=\frac{\epsilon^g}{\epsilon^g-1}\left(\tilde{\varphi}^g_{h|i,u}\right)^{1-\epsilon^g}.$$

Comparing individual utility under either employment status yields the size of the local cutoff. Thus we get

$$\int_{\tilde{\varphi}^g_{h|i,u}}^\infty\varphi dQ^g(\varphi)=\frac{\epsilon^g}{\epsilon^g-1}\left(\left(\frac{1}{\mathcal{B}^g_{s|i,u}}\right)\left(\frac{I^g_{m|i,u}}{I^g_{h|i,u}}\right)^{1-\alpha}\left(\left[\frac{R_i}{L^\chi_i}\right]^{\rho^g}\right)^\alpha\right)^{1-\epsilon^g}.$$

Collecting terms, we arrive at

$$\begin{aligned}\bar{B}^g_{h|i,u} &= L^g_{i,u}/L^g_{h|i,u} \exp\left[B^g_{h|i,u}\right] \frac{\epsilon^g}{\epsilon^g-1} \left(\left(\frac{1}{\mathcal{B}^g_{s|i,u}}\right)\left(\frac{I^g_{m|i,u}}{I^g_{h|i,u}}\right)^{1-\alpha}\left(\left[\frac{R_i}{L^X_i}\right]^{\rho^g}\right)^{\alpha}\right)^{1-\epsilon^g} \\ &= \frac{\epsilon^g}{(\epsilon^g-1)}\left(\mathcal{B}^g_{s|i,u}\right)^{\epsilon^g} \exp\left[-\mu^g_{m|i,u}\right]\left[\left(\frac{I^g_{m|i,u}}{I^g_{h|i,u}}\right)^{1-\alpha}\left(\left[\frac{R_i}{L^X_i}\right]^{\rho^g}\right)^{\alpha}\right]^{(1-\epsilon^g)} \frac{1}{L^g_{h|i,u}/L^g_{i,u}},\end{aligned}$$

Using this expression in the expression for expected market efficiency, we calculate expected indirect utility in region i and market sector u as follows:

$$\begin{aligned}\bar{V}^g_{i,u}(\omega) &= a^g_{i,u}(\omega)\left(\left(1-\xi^g_{h|i,u}\right)V^g_{m|i,u} + \xi^g_{h|i,u}V^g_{h|i,u}\right) \\ &= a^g_{i,u}(\omega)\,A^g_i \exp\left[-\mu^g_{m|i,u}\right]\left(\frac{I^g_{m|i,u}}{P_i}\right)^{1-\alpha}\left(\frac{R_i}{L^X_i}\right)^{\alpha}\left(1+\xi^g_{h|i,u}\left[\frac{\epsilon^g}{\epsilon^g-1}-1\right]\right) \\ &= a^g_{i,u}(\omega)\,V^g_{m|i,u}\left(1+\xi^g_{h|i,u}\left[\frac{\epsilon^g}{\epsilon^g-1}-1\right]\right).\end{aligned}$$

For the special case where $M = 1$, we get the expression for indirect utilities in equation (11) of the main paper.

A.2 Equilibrium

In this Appendix, we detail the equilibrium of the quantitative framework. Given model primitives, a general equilibrium of the economy is referenced by a vector of endogenous objects $\mathbf{V} = \{E_i, h_{i,u}, I^g_{s|i,u}, L^g_{i,u}, L^g_{s|i,u}, P_i, r_i, w^g_{i,u}, X_{i,u}, \lambda_{i,u}, \pi_{ij,u}\}$. These endogenous objects are jointly determined such that:

1. Workers optimally choose bundles of final goods from all markets given region-specific price indices for all market sectors and after-tax income;

2. Workers optimally sort into locations and market sectors, given after-tax income, public expenditure, local amenities and regional price levels:

$$L^g_{i,u} = \frac{\left(A^g_i \exp\left[-\mu^g_{m|i,u}\right]\left(\frac{I^g_{m|i,u}}{P_i}\right)^{1-\alpha}\left(\frac{R_i}{L^X_i}\right)^{\alpha}\left(1+\xi^g_{h|i,u}\left[\frac{\epsilon^g}{\epsilon^g-1}-1\right]\right)\right)^{\theta}}{\sum_{i\in J}\sum_{u\in M}\left(A^g_i \exp\left[-\mu^g_{m|i,u}\right]\left(\frac{I^g_{m|i,u}}{P_i}\right)^{1-\alpha}\left(\frac{R_i}{L^X_i}\right)^{\alpha}\left(1+\xi^g_{h|i,u}\left[\frac{\epsilon^g}{\epsilon^g-1}-1\right]\right)\right)^{\theta}} L^g$$

3. Workers decide on their labour force participation after their workplace deci-

sion:

$$L^g_{h|i,u} = \left[\underbrace{\left(\exp\left[\mathcal{B}^g_{s|i,u}\right]\right)^{-1}}_{\text{Home Market Efficiency}} \underbrace{\left(\frac{I^g_{m|i}}{I^g_{h|i}}\right)^{1-\alpha} \left(\left[\frac{R_i}{L^\chi_i}\right]^{\rho^g}\right)^{\alpha}}_{\text{Spatial Policies}} \right]^{-\epsilon^g} L^g_i.$$

4. Intermediate good producers demand materials, labour, as well as land and structures under unit costs in a Cobb-Douglas production function. These productive inputs are used to produce idiosyncratic intermediate good varieties.

5. Final goods producers import intermediates from the least cost intermediate producers according to equation (6) in the main paper;

6. Trade costs and unit costs determine optimal price indices

7. Final goods market clearing implies

$$\begin{aligned} X_{i,u} =& \beta^R_u \left[\left(\sum_{u'\in M}\sum_{g\in G}\left(t^g_{m|i,u'} + \iota_i\right)(1-\xi^g_{h|i,u'})w^g_{i,u'}L^g_{i,u'}\right)\right] \\ &+ \beta^C_u \left[\frac{L_i}{L}\left(\sum_{j\in J}\sum_{u'\in M} r_j h_{j,u'} - \sum_{g\in G}(1-t^g_{h|i,u'})\xi^g_{h|j,u'}w^g_{j,u'}L^g_{j,u'}\right)\right. \\ &+ \left.\sum_{s\in h,m}\sum_{u'\in M}\sum_{g\in G}\left(1-t^g_{s|i,u'}\right)\xi^g_{s|i,u'}w^g_{i,u'}L^g_{s|i,u'}\right] + \sum_{u'\in M}\delta_{i,u'u}\sum_{j\in J}\pi_{ji,u'}X_{j,u'} \end{aligned}$$

8. Intermediate goods market clearing is given as

$$(1-\xi^g_{h|i,u})w^g_{i,u}L^g_{i,u} = \delta_{i,u}\left(1-\kappa_{i,u}\right)\frac{\left(\frac{Z^g_{i,u}}{w^g_{i,u}}\right)^{\sigma^g-1}}{\sum_{g\in G}\left(\frac{Z^g_{i,u}}{w^g_{i,u}}\right)^{\sigma^g-1}}\sum_{j\in J}\pi_{ji,u}X_{j,u},$$

where $\sum_{j\in J}\pi_{ji,u}X_{j,u}$ are expenditures in all locations j on goods produced in region i and sector u.

9. Market clearing for land and structures implies

$$h_{i,u} = \frac{\delta_{i,u}\kappa_{i,u}}{r_i}\sum_{j\in J}\pi_{ji,u}X_{j,u}.$$

Land and structures market clearing for all regions $i \in J$ and market sectors $u \in M$ ensures that demand for land and structures (9) equals the exogenous supply of land and structures $H_i = \sum_{u\in M} h_{i,u}$.

10. Demand for materials is given by

$$M_{i,uu'} = \frac{\delta_{i,uu'}}{P_{i,u'}} \sum_{j \in J} \pi_{ji,u} X_{j,u}.$$

11. The local governments' budget constraint reads

$$E_i = \sum_{u \in M} \sum_{g \in G} (t^g_{m|i,u} + \iota_i)(1 - \xi^g_{h|i,u}) w^g_{i,u} L^g_{i,u}$$

The system of equations is over-identified (by one equation in total), meaning there are more equations than unknowns. To solve this, we normalise the aggregate price level in the economy and treat it as the numéraire in the system, e.g.

$$\sum_{i \in J} P_i L_i / L \equiv \bar{P} = 1.$$

This equation also pins down aggregate welfare in the economy.

A.3 Alternative Micro-Foundation of Labour Force Participation

This Online Appendix Section provides an alternative micro-foundation of the labour supply equation (Eq. (10) in the main paper), based on dynamic search-and-matching models of unemployment. This micro-foundation draws inspiration from previous work in Kline and Moretti (2013) and allows to connect our results to existing research on spatial sorting and frictional unemployment (Bilal, 2023; Schmutz and Sidibé, 2019).

Model Setup. We consider a similar setup as in the spatial equilibrium framework of Section 3 of the main paper. For tractability, we assume, however, that workers and firms are homogeneous, exclude frictional trade and suppress the sub-scripts for heterogeneous worker groups.

The economy has L individuals who can move freely across $i \in J$ regions, work in the market sector $m \in S$ or join the home market sector h. Each worker demands one unit of a non-tradable final good, with prices equal to marginal production costs ($P_i = \lambda_i$). Workers and firms are matched according to a constant-returns-to-scale matching function, $\mathcal{M}_i(L_{h|i}, O_i)$, where $L_{h|i}$ denotes unemployed workers, and O_i represent the open vacancies in labour market i.

We assume a logarithmic utility function for all workers. Unemployed workers derive utility from local amenities A_i, private goods, public goods, and the flow utility of unemployment $\tilde{B}_i$, including non-employment benefits, private home market production and leisure value. The transition of workers to employment depends on the number of open vacancies and non-employed workers. Firms face costs related to posting job openings and hiring workers, including a sunk flow cost of k and a hiring cost of H_i. These costs and worker-firm match productivity (Z_i) influence job creation and posting dynamics. Immobile capitalists own firms. Workers and firms discount the future at a common rate r.

Value functions. In steady-state, the value of non-employment is

$$rJ_{h|i} = \ln(\tilde{B}_i) + \ln(A_i) - (1-\alpha)\ln(P_i) + \alpha\,(1-\tilde{\rho}_h)\ln(R_i/L_i^{\chi}) + \upsilon_i q_i(\upsilon_i)\left(J_{m|i} - J_{h|i}\right),$$

where $\upsilon_i = \frac{O_i}{L_{h|i}}$ represents market tightness, and $q_i(\upsilon_i) = \frac{\mathcal{M}_i}{O_i}$ denotes the job finding rate. The steady-state value of market employment $J_{m|i}$ relates to

$$rJ_{m|i} = (1-\alpha)\ln w_i + \ln A_i + \alpha\ln(R_i/L_i^{\chi}) - (1-\alpha)\ln(P_i) + o_i\left(J_{h|i} - J_{m|i}\right),$$

with w_i being workers' market wage and o_i representing an exogenous separation probability. Worker mobility ensures that the expected utility of being non-employed is equalised across the economy, resulting in $rJ_{h|i} = rJ_h = \mathcal{V}$ for all $i \in J$.[27]

In a steady state, firms and workers are matched with a certain probability, filling an open vacancy. The value of this filled vacancy $J_{F|i}$ satisfies

$$rJ_{F|i} = \ln(Z_i) - \ln(w_i) + o_i\left(J_{O|i} - J_{F|i}\right),$$

where $J_{O|i}$ is the steady-state value of opening a vacancy. Since firms incur costs of vacancy posting irrespective of obtaining a match, the value of opening vacancies is driven to zero by free firm entry and given by:

$$rJ_{O|i} = -k + q_i(\upsilon_i)\left(J_{F|i} - J_{O|i} - H_i\right).$$

In spatial equilibrium, worker reallocation across regions is determined by inflow

[27] Alternatively, one could assume that the expected utility of being non-employed or employed must be equalised across locations as in our generalised framework in the main paper. Introducing this assumption will, however, not impact the main predictions from this Appendix.

and outflow rates, resulting in the local non-employment rate:

$$\xi_{h|i} = \frac{L_{h|i}}{L_i} = \frac{o_i}{o_i + \upsilon_i q_i(\upsilon_i)}.$$

In less tight markets, we can approximate the non-employment rate as follows:

$$\ln \xi_{h|i} \approx -\upsilon_i q_i(\upsilon_i)/o_i.$$

Equilibrium. Workers and firms bargain over the surplus generated by the match:

$$J_{m|i} - J_{h|i} = \frac{b}{1-b}\left(J_{F|i} - J_{O|i} - H_i\right),$$

with b the workers' Nash bargaining share of the surplus. Substituting the values for employment and unemployment as well as the value of matching in the previous expression, we get an expression for regional wages:

$$\ln w_i = \frac{1}{1-\alpha(1-b)}\left[b\left(\ln Z_i - \left(r + o_i\right) H_i\right) + (1-b)\left((1-\alpha)\ln P_i + \mathcal{V} - \ln A_i - \alpha \ln(R_i/L_i^{\chi})\right)\right].$$

Combining the steady-state values for vacancy posting and matches, the job creation side of the model requires that:

$$q_i\left(\upsilon_i\right) = \frac{k\left(o_i + r\right)}{\ln Z_i - \ln w_i - \left(o_i + r\right) H_i}.$$

After integrating the values of employment and non-employment, incorporating the job-finding rate, applying the wage expression, and substituting the market tightness expression, we obtain the following through algebraic manipulation:

$$\mathcal{V} + (1-\alpha)\ln P_i - \ln A_i = k\upsilon_i \frac{b}{1-b} + \tilde{B}_i + \alpha\left(1 - \tilde{\rho}_h\right)\ln(R_i/L_i^{\chi}).$$

After substituting this equation into the wage expression, we arrive at the following expression:

$$\ln w_i = \frac{1}{1-\alpha(1-b)}\left[b\left(\ln Z_i - \left(r + o_i\right) H_i + k\upsilon_i\right) + (1-b)\left(\tilde{B}_i - \alpha\tilde{\rho}_h \ln(R_i/L_i^{\chi})\right)\right].$$

This equation illustrates how the wage is determined by the bargaining power (b), weighted average of match productivity (Z_i) net of hiring costs (H_i) and the necessary flow for workers to obtain the utility level $\mathcal{V}$. This utility level represents the flow utility of unemployment $\tilde{B}_i$ net of public goods provision (R_i/L_i^{χ}).

Leveraging the relationship between non-employment rates and labour market tightness, we derive an expression for the logarithm of non-employment rates as a function of the logarithm of wages, public goods, and exogenous components:

$$\ln \xi_{h|i} = -\left(\frac{q_i(\upsilon_i)}{ko_i}\right)\left(\frac{1-\alpha(1-b)}{b}\ln w_i - \ln Z_i - \frac{(1-b)\alpha\tilde{\rho}_h}{b}\ln(R_i/L_i^X)\right) + \frac{q_i(\upsilon_i)}{ko_i}\left(\frac{1-b}{b}\tilde{B}_i - (r+o_i)\,H_i\right).$$

This simplified framework of frictional labour markets provides a micro-foundation for the labour force participation equation (10). Specifically, the wage elasticity of labour supply, ϵ, and the elasticity of extensive labour supply to public goods provision ρ_h in the main framework of our paper are thus related as follows:

$$\epsilon = \left(\frac{q_i(\upsilon_i)}{ko_i}\right)\frac{1-\alpha(1-b)}{b(1-\alpha)}; \quad \rho_h = \frac{(1-\alpha)(1-b)}{1-\alpha(1-b)}\tilde{\rho}_h.$$

They are functions of the job finding rate, the sunk cost of vacancy posting, the separation rate, and the workers' Nash bargaining share. The elasticity of labour supply ϵ increases with the local job-finding rate but decreases with the sunk cost of vacancy posting, the exogenous separation rate and the workers' Nash bargaining share. Furthermore, the utility value of non-employment, represented by $B_{h|i}$, increases with non-employment benefits, the value of leisure/non-employment, $\tilde{B}_i$, and productivity of worker-firm matches, Z_i (as a proxy for the job finding rate under perfect firm entry) but decreases with match costs, $(r + o_i)H_i$:

$$B_{h|i} = \frac{b(1-\alpha)}{1-\alpha(1-b)}\left(\left(\frac{1-b}{b}\right)\tilde{B}_i - (r+o_i)H_i + \ln Z_i\right).$$

B Optimal Spatial Policy

This Appendix provides further details on how to derive the optimal policy. The first-order conditions we refer to here are all supplied in Appendix A.1.1 that accompanies the main paper. In this Appendix, we refer to their designation and numbering throughout.

B.1 Steps 1 & 2: Private Good Consumption

We first derive workers' optimal private good consumption levels from the planner's problem. By using the first-order condition on the local labour force, equation (A.9), we can re-write the first-order conditions on local consumption of both types of goods as follows:

$$(1-\alpha)\left[\frac{(\epsilon^g-1)\left(1-\xi^g_{h|i,u}\right)}{\epsilon^g-1+\xi^g_{h|i,u}}\right]\left(\mu^g\mathcal{U}'\left(\mathcal{V}^g\right)\mathcal{V}^g+\theta W^g_{i,u}-\theta\sum_{j\in J}\sum_{u'\in M}W^g_{j,u'}\left(\frac{L^g_{j,u'}}{L^g}\right)\right)$$
$$=\left(1-\xi^g_{h|i,u}\right)P_iC^g_{m|i,u}-w^g_{i,u}\left[(1-\alpha)\,\epsilon^g\right]\xi^g_{h|i,u}.$$

$$(1-\alpha)\left[\frac{\epsilon^g\xi^g_{h|i,u}}{\epsilon^g-1+\xi^g_{h|i,u}}\right]\left(\mu^g\mathcal{U}'\left(\mathcal{V}^g\right)\mathcal{V}^g+\theta W^g_{i,u}-\theta\sum_{j\in J}\sum_{u'\in M}W^g_{j,u'}\left(\frac{L^g_{j,u'}}{L^g}\right)\right)$$
$$=\xi^g_{h|i,u}P_iC^g_{h|i,u}+w^g_{i,u}\left[(1-\alpha)\,\epsilon^g\right]\xi^g_{h|i,u}.$$

Next, we substitute the first-order conditions on local population, Eq. (A.10) into these new equations. This yields a system of three equations, which can be uniquely solved for the optimal consumption levels of employed workers solely as a function of the market wage and policy instruments $\{\tilde{t}^g_{s|i,u},\,\tilde{x}^g_{s|i,u}\}$:

$$P_i\tilde{C}^g_{s|i,u}=\left(1-\tilde{t}^g_{s|i,u}\right)w^g_{i,u}+\tilde{x}^g_{s|i,u} \tag{B.1}$$

$$1-\tilde{t}^g_{s|i,u}=\begin{cases}\frac{(1-\alpha)\theta}{1+(1-\alpha)\theta}+(1-\alpha)\,\epsilon^g\xi^g_{h|i,u}\left(\frac{1}{1-\xi^g_{h|i,u}}-\frac{\theta}{[1+(1-\alpha)\theta]\left[\epsilon^g-\left(1-\xi^g_{h|i,u}\right)\right]}\right) & \text{if } s\in M,\\ \frac{1-\xi^g_{h|i,u}}{\xi^g_{h|i,u}}\left(\frac{(1-\alpha)\theta}{1+(1-\alpha)\theta}-(1-\tilde{t}^g_{m|i,u})\right) & \text{otherwise}\end{cases}$$

$$\tilde{x}^g_{s|i,u}=\begin{cases}\frac{(\epsilon^g-1)(1-\alpha)\left(\mu^g\mathcal{U}'(\mathcal{V}^g)\mathcal{V}^g-\theta\sum_{j\in J}\sum_{u'\in M}\frac{W^g_{j,u'}L^g_{j,u'}}{L^g}+\theta Ex_i^{NET}\right)}{[1+(1-\alpha)\theta]\left[\epsilon^g-\left(1-\xi^g_{h|i,u}\right)\right]} & \text{if } s\in M,\\ \frac{\epsilon^g}{\epsilon^g-1}\cdot\tilde{x}^g_{m|i,u} & \text{otherwise}\end{cases}$$

B.2 Step 3: Private Goods Consumption Levels as a Function of Observables

We substitute the opportunity cost term $W^g_{i,u}$ once again, using the first-order condition on local population in the additive wage subsidy equations.

Note further that the weighted average of aggregate private good consumption is given as follows:

$$\sum_{i\in J}\sum_{u\in M}P_iL^g_{i,u}\sum_{s\in h,m}\xi^g_{s|i,u}C^g_{s|i,u}=\sum_{i\in J}\sum_{u\in M}\left[L^g_{i,u}w^g_{i,u}\sum_{s\in h,m}\xi^g_{s|i,u}\left(1-\tilde{t}^g_{s|i,u}\right)+L^g_{i,u}\sum_{s\in h,m}\xi^g_{s|i,u}\tilde{x}^g_{s|i,u}\right]$$

Plugging in the expressions for weighted additive wage subsidies and taxes yields

$$(1-\alpha)\,\mu^g \mathcal{U}'(\mathcal{V}^g)\,\mathcal{V}^g = \frac{1}{L_g}\sum_{i\in J}\sum_{u\in M} L^g_{i,u}\left[P_i \sum_{s\in h,m} \xi^g_{s|i,u} C^g_{s|i,u}\right]$$

Note further that total consumption expenditures (on private and public goods) in the economy have to equal total incomes from working and land rents such that

$$\begin{aligned}&\sum_{g\in G}\sum_{j\in J}\sum_{u'\in M} L^g_{j,u'} P_j \sum_{s\in h,m} \xi^g_{s|j,u'} C^g_{s|j,u'} + \sum_{j\in J} P^R_j R_j \\ &= \sum_{g\in G}\sum_{j\in J}\sum_{u'\in M} L^g_{j,u'}\left(1-\xi^g_{h|j,u'}\right) w^g_{j,u'} + \sum_{j\in J}\sum_{u'\in M} h_{j,u'} r_j\end{aligned}$$

Substituting the expression for marginal utilities $(1-\alpha)\,\mu^g \mathcal{U}'(\mathcal{V}^g)\,\mathcal{V}^g$ into the expression for additive wage subsidies and using this last equation, finally yields:

$$\begin{aligned}\tilde{x}_{m|i,u} =& \frac{1}{\sum_{g\in G} L^g\left[\epsilon^g - \left(1-\xi^g_{h|i,u}\right)\right]/(\epsilon^g-1)} \times \\ &\left[\sum_{g\in G}\sum_{j\in J}\sum_{u'\in M} \frac{\left(1-\xi^g_{h|i,u}\right) L^g_{j,u'} w^g_{i,u'}}{1+(1-\alpha)\,\theta} + \left(h_{j,u'} r_j - P^R_j R_j\right)\right. \\ &\left. + \sum_{g\in G} \frac{(1-\alpha)\,\theta L^g}{1+(1-\alpha)\,\theta}\left(Ex^{NET}_i - \frac{1}{L^g}\sum_{j\in J}\sum_{u'\in M} L^g_{j,u'} Ex^{NET}_j\right)\right]\end{aligned} \tag{B.2}$$

as well as

$$\tilde{x}_{h|i,u} = \tilde{x}_{m|i,u} * \frac{\sum_{g\in G} L^g\left[\epsilon^g - \left(1-\xi^g_{h|i,u}\right)\right]/(\epsilon^g-1)}{\sum_{g\in G} L^g\left[\epsilon^g - \left(1-\xi^g_{h|i,u}\right)\right]/\epsilon^g} \tag{B.3}$$

where we assume that additive wage subsidies do not differ by worker group as in the framework in the main part of the paper, such that $\tilde{x}^g_{s|i,u} = \tilde{x}_{s|i,u} \quad \forall g \in G$.

Given that tax rates are solely a function of observable labour force participation rates (see equation (B.1)), optimal transfers to workers, $\tilde{x}_{s|i,u}$, are determined by a vector of variables at the regional level $\{h_{i,u}, L^g_{i,u}, r_i, w^g_{i,u}, \xi^g_{h|i,u}\}$, structural parameters $\{\alpha, \epsilon^g, \zeta^g, \theta, \rho^g, \chi\}$ and payments to local governments for public goods provision.

B.3 Step 4: Public Good Provision

Next, given the optimised private goods consumption possibilities for all worker groups and the tax system, we derive optimal public goods provision. In the first step, we re-write the first-order conditions on local public good consumption (equation (A.5)) as follows:

$$\left[\alpha - \Upsilon^g_{i,u}\right] \left(\mu^g \mathcal{U}'\left(\mathcal{V}^g\right) \mathcal{V}^g + \theta W^g_{i,u} - \theta \sum_{j\in J} \sum_{u'\in M} W^g_{j,u'} \left(\frac{L^g_{j,u'}}{L^g}\right)\right)$$
$$= P^R_i \tilde{R}_i / L_i - \alpha \epsilon^g \rho^g \xi^g_{h|i,u} w^g_{i,u}.$$

Substituting in the first-order conditions on local population $L^g_{i,u}$, equation Eq. (A.10), as well as the optimal consumption levels yields optimised public goods consumption as a function of private goods consumption. Substituting the expressions for the latter and again combining with the first-order condition on population, we derive optimised public goods consumption as follows:

$$\frac{P^R_i \tilde{R}_i}{L_i} = \left[\alpha - \Upsilon^g_{i,u}\right] \left(\frac{\mu^g \mathcal{U}'\left(\mathcal{V}^g\right) \mathcal{V}^g}{1 + (1-\alpha)\theta} + \frac{\theta E x^{NET}_i}{1 + (1-\alpha)\theta} - \theta \left(\frac{(1-\alpha)\theta\left(1 - \xi^g_{h|i,u}\right)}{1 + (1-\alpha)\theta}\right) w^g_{i,u}\right.$$
$$+ \frac{\frac{\theta}{L^g} \sum_{j\in J} \sum_{u'\in M} L^g_{j,u'} \left[P_j \sum_{s\in h,m} \xi^g_{s|j,u'} C^g_{s|j,u'} - \left(1 - \xi^g_{h|j,u'}\right) w^g_{j,u'} - E x^{NET}_i\right]}{1 + (1-\alpha)\theta}$$
$$\left. + \left(\theta\left(1 - \xi^g_{h|i,u}\right) + \epsilon^g \rho^g \xi^g_{h|i,u} \left[\frac{\epsilon^g - 1 + \xi^g_{h|i,u}}{\epsilon^g - 1 + \xi^g_{h|i,u}\left[1 - \epsilon^g \rho^g\right]}\right]\right) w^g_{i,u}\right)$$

B.4 Step 5: Public Good Provision as a Function of Observables

At this point, we again make use of the fact that

$$\mu^g \mathcal{U}'\left(\mathcal{V}^g\right) \mathcal{V}^g = \frac{1}{(1-\alpha) L^g} \sum_{i\in J} \sum_{u\in M} L^g_{i,u} \left[P_i \sum_{s\in h,m} \xi^g_{s|i,u} C^g_{s|i,u}\right]$$

Plugging in and combining with the solutions for private goods consumption, we derive the optimal levels of local public good provision $\tilde{R}_i$ solely as a function of observable variables at the region-gender-sector level (e.g. employment, wages, rents, labour force participation rates, price levels) as well as structural parameters and subsidies to workers:

$$\frac{P_i^R \tilde{R}_i}{L_i} \sum_{g \in G} \sum_{u \in M} \frac{\left(\epsilon^g - 1 + \xi^g_{h|i,u}\right) L^g}{\left(\epsilon^g - 1 + \xi^g_{h|i,u}\left[1 - \epsilon^g \rho^g_{h,R}\right]\right)} = \frac{\alpha}{1-\alpha}$$

$$\left(M \times \left[\sum_{g \in G} \frac{L^g \left[\epsilon^g - \left(1 - \xi^g_{h|i,u}\right)\right]}{\epsilon^g - 1} \cdot \tilde{x}_{m|i,u} \right] + \frac{(1-\alpha)\,\theta \sum_{g \in G} \sum_{u \in M} \left(1 - \xi^g_{h|i,u}\right) L^g w^g_{u|i,u}}{1 + (1-\alpha)\,\theta} \right.$$

$$\left. + \sum_{g \in G} \sum_{u \in M} L^g (1-\alpha)\, \epsilon^g \rho^g_{h,R} \xi^g_{h|i,u} w^g_{u|i,u} \left[\frac{\epsilon^g - 1 + \xi^g_{h|i,u}}{\epsilon^g - 1 + \xi^g_{h|i,u}\left[1 - \epsilon^g \rho^g_{h,R}\right]} \right] \right), \tag{B.4}$$

where we used the fact that aggregate expenditures on private and public goods consumption equals total labour and rent income in the economy and the definition of optimal subsidies to employed workers.

B.5 Step 6: Public and Private Goods Consumption

Given our results from steps 1-3 and the definition of local externalities, the vector of optimal policy instruments $\{\tilde{x}_{s|i,u}, P_i^R \tilde{R}_i\}$ is given by the unique solution to the system of equations (B.2) - (B.4), while optimal tax rates $\tilde{t}^g_{s|i,u}$ are determined by equation (B.1).

C Quantification

C.1 Data

Table C.1 maps the ISIC 4 sectors to the six "market sectors" we use to quantify our framework. The first four sectors are tradable, while the last two are non-tradable.

C.2 Parametrization

Table C.2 summarises our parametrization for German commuting zones. We either take parameter values from the literature, calibrate them to our data (see Online Appendix Section C.3 for details) or – where necessary– estimate them ourselves.

Arguably, the most important parameter relates to the substitutability of public with private home market production. The next appendix section then details our strategy for estimating the public expenditure elasticities of labour force participation and additional empirical results.

Table C.1: ISIC Revision 4 Sector Classification

Sector	ISIC Rev. 4	Description
1. Agriculture	A	Agriculture, Forestry and Fishing
2. Mining and Quarrying	B, D, E	Mining and Quarrying; Electricity, gas, steam and air conditioning supply; Water supply; sewerage, waste management and remediation activities
3. Manufacturing	C	Manufacturing
4. Wholesale/Retail Trade	G - J	Wholesale and retail trade; repair of motor vehicles and motorcycles; Transportation and Storage; Accommodation and food service activities; Information and communication
5. Construction	F	Construction
6. Non-tradable and Non-market Services	K - U	Financial and insurance activities; Real estate activities; Professional, scientific and technical activities; Administrative and support service activities; Public administration and defence; compulsory social security; Education; Human health and social work activities; Arts, entertainment and recreation; Other service activities; Activities of households as employers; Activities of extraterritorial organizations and bodies

Notes: This table displays the six sectors: Agriculture (A), Mining (B/D/E), Manufacturing (C), Wholesale/Retail Trade (G - J), Construction (F), and Non-tradable and Non-market Services (K - U). Sectors 1 - 4 are tradable sectors, while sectors 5 and 6 are non-tradable sectors.

Public Expenditure Elasticities of Labour Force Participation. Germany's fiscal redistribution scheme uses local population counts to determine transfer allocations across jurisdictions. In 2011, a nationwide Census revealed substantial deviations from official registry-based population projections previously used to calculate fiscal transfers. Figure C.1 displays the spatial distribution of Census revisions. These unexpected revisions, ranging from -7.65% to $+3.43\%$, led to permanent changes in local fiscal budgets unrelated to economic conditions.[28]

Following a similar strategy as Helm and Stuhler (2024) and Serrato and Wingender (2016), we compare regions experiencing above-mean Census revisions (treated) to those below (control). The potential correlation between census count revisions and pre-existing local economic trends remains an identification concern. Declining areas might show larger discrepancies between registry and Census counts, potentially confounding our estimates. We adjust the difference-in-differences (DID) regression approach to address this concern with augmented inverse probability weighting (AIPW). The AIPW approach constructs synthetic control groups by combining outcome regression and treatment models, requiring only one correctly specified model for consistent estimation (Sant'Anna and Zhao, 2020). Our estimations control for state-specific trends, pre-treatment characteristics, four annual lags of non-employment rates and transfers to account for pre-treatment dynamics.

[28] Helm and Stuhler (2024) show that such windfall increases to budgets translate into higher government expenditures, particularly in the short run.

Table C.2: Parameter Values

Description	Parameter	Value	Origin	Approach
Preferences				
Endogenous amenities	η	0.30	Diamond, 2016	Set
Public goods weight	α	0.24	Average public spending to GDP ratio (c.f. Fajgelbaum et al., 2019; Henkel et al., 2021)	Cal.
Degree of rivalry in public services	χ	1.0	Fajgelbaum et al. (2019); Henkel et al. (2021)	Set
Migration elasticity	θ	2.0	Fajgelbaum et al. (2019)	Set
Wage elasticity	ϵ^g	[1.58.1.56]	Bargain and Peichl (2016)	Set
LFP elasticity w.r.t. public expenditure	ρ^g	$[0.01, 0.014]$	DID of fiscal transfer shocks	Est.
Production				
Agglomeration elasticity	ζ^g	$[0.018, 0.03]$	Ahlfeldt et al. (2020)	Set
Elasticity of substitution between males and females	σ^g	2.5	Olivetti and Petrongolo (2014)	Set
Elasticity of substitution of varieties	σ	5.0	Head and Mayer (2014)	Set
Trade elasticity	ν_u	5.0	Head and Mayer (2014)	Set
Labour share in production	$1 - \kappa_{i,u}$	$[0.08, 0.95]$	Wage income to value added ratio	Cal.
Share of value added	$\delta_{i,u}$	$[0.15, 1]$	Value added to gross output ratio	Cal.
Share of material inputs	$\delta_{i,uu'}$	$[0, 0.54]$	Input-Output Tables	Cal.
Expenditure share	β_u	$[0.001, 0.53]$	Aggregate goods market clearing	Fitted
Government				
Regional tax rate	t_i	$[0.22, 0.45]$	Tax revenue to GDP ratio	Cal.
Transfer rate	ρ_i	$[-0.15, 0.23]$	Net transfer to GDP ratio	Cal.

Notes: "Cal." indicates that the parameter is calibrated based on observable data outlined under "data", while "Set" indicates that the parameter is assigned a value based on theoretical considerations or literature. "Fitted" parameters match the model-consistent equations outlined under "source/target", while we estimate parameters indicated by "Est." ourselves. We identify parameter values following the estimation steps outlined in Appendix C.3.

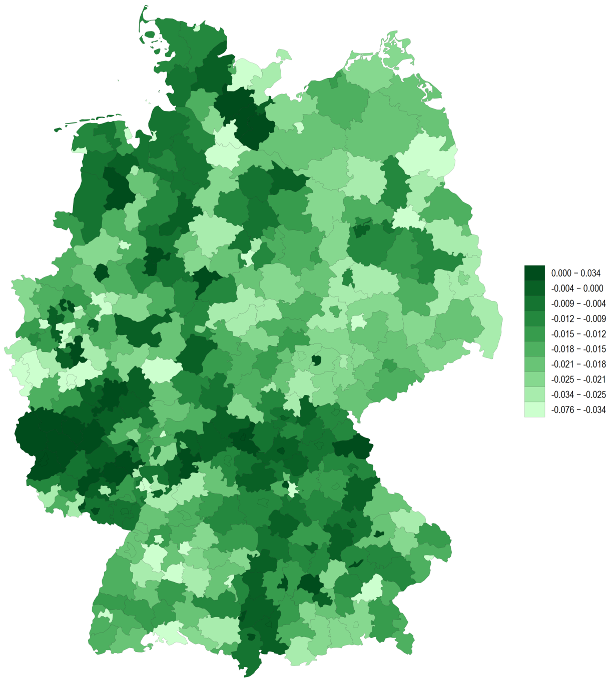


Figure C.1: Distribution of the 2011 Census shock

Note: The figure plots the spatial distribution of the 2011 Census Shock. The Census Shock is measured as the log difference between local population counts at the end of 2010 and the results of the 2011 Census in May 2011.

Additional Estimation Results. We compare pre-treatment characteristics between regions experiencing above-mean Census revisions (treated) and those below the mean (control). Table C.3 documents systematic differences between treated and control regions for several characteristics in our sample. Treated regions show higher wages but lower population and initial fiscal transfers. Moreover, the dynamics of these variables in the pre-treatment period differ between groups. These systematic differences in both levels and pre-treatment dynamics motivate our use of augmented inverse probability weighting (AIPW).

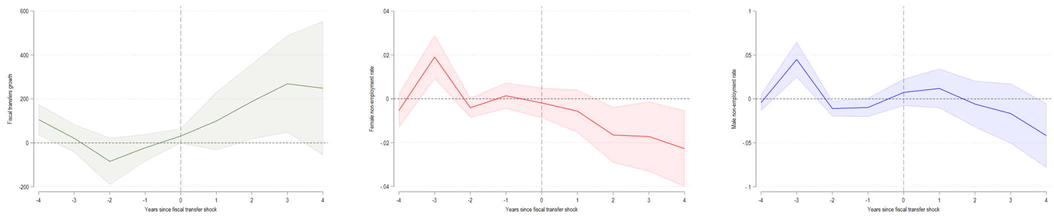
Despite these differences, Figure C.2 confirms the validity of our research design by demonstrating parallel pre-trends in both fiscal transfers and non-employment rates, with clear divergence only after treatment. Panel A shows that treated regions experienced higher fiscal transfers following the Census revision. Panels B and C demonstrate that these increased transfers coincided with sustained reductions in non-employment rates, with stronger effects for female workers.

Table C.4 explores treatment effect heterogeneity by local infrastructure access.

Table C.3: Balance on Pre-treatment Characteristics

	Control	Treated	Difference	SE
GDP per capita	47 138.53	45 146.75	1991.78**	808.80
Working-age population	158 874.39	111 822.88	47 051.51***	6323.59
Wages	34 305.82	35 884.64	−1578.82***	195.08
Net wages	26 960.65	27 834.84	−874.19***	148.61
Net wages, female	28 930.87	29 777.91	−847.04***	145.06
Net wages, male	39 680.77	41 991.38	−2310.61***	255.46
Employment rate	0.71	0.74	−0.03***	0.00
Employment rate, female	0.70	0.71	−0.01***	0.00
Employment rate, male	0.77	0.80	−0.03***	0.00
Non-employment rate, female	0.30	0.29	0.01***	0.00
Non-employment rate, male	0.23	0.20	0.03***	0.00
Fiscal transfers per capita	903.81	659.92	243.89**	121.78
Tax revenues per capita (before redistribution)	9717.25	9664.22	53.03	125.83
Tax revenues per capita (after redistribution)	10 621.05	10 324.14	296.92***	39.55
Gross expenditures per capita	3279.24	3185.93	93.31	72.36
Public debt per capita	2060.77	2378.80	−318.03***	74.87

Note: The table shows the balance of pre-treatment characteristics between control and treated groups. Means and standard errors (SE) are reported. Significant differences are indicated by ** (p ¡ 0.05) and *** (p ¡ 0.01).



(a) Transfers (b) Female Non-employment (c) Male Non-employment

Figure C.2: Event Study Estimates

Note: This figure presents event study estimates for fiscal transfers per capita and (log) non-employment rates by gender. Panel A shows the fiscal transfers per capita estimates, while Panels B and C display the estimates for female and male non-employment rates, respectively. The results confirm parallel pre-trends between treated and control regions.

We construct composite measures of public service availability using principal component analysis. For childcare access, we combine standardized measures of childcare rates for children below 3 years and between 3-5 years. For transport access, we combine standardized distance measures to public transportation and average travel times to the nearest motorway, airport, and train station. Data comes from the INKAR (2020) database. The results indicate that fiscal transfer shocks following the 2011 Census had the most significant employment effects in regions with limited pre-existing public services, especially in areas lacking adequate childcare infrastructure.

Table C.4: 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

Notes: This table reports estimates of heterogeneous effects of Census-induced fiscal transfer shocks on non-employment rates by initial public service access. Childcare access (columns 1-2) combines standardized principal components of childcare rates for children below 3 years and between 3-5 years. Transport access (columns 3-4) combines standardized principal components of distance to public transportation and average travel time to the nearest motorway, airport, and train station. Regions are classified as "Low" or "High" based on pre-treatment median splits of these composite measures. All specifications include controls for log net wages and four annual lags of outcome variables. Standard errors (in parentheses) are clustered at the regional labour market level. + $p < 0.15$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

C.3 Identifying Model Fundamentals

This appendix details our procedure for inverting model fundamentals from observed economic outcomes. The approach follows a sequential strategy that leverages the model's structure to recover unobserved productivity levels, amenity values, and home market efficiency that rationalize the observed spatial patterns in wages, employment, and migration across German labour markets:

1. **Derive model-consistent values $\delta_{i,u}$, $\delta_{i,uu'}$, $\kappa_{i,u}$** The parameters $\delta_{i,u}$ can be identified by the fraction of value added over gross regional output in each region-sector pair:

$$\delta_{i,u} = \frac{\sum_{g \in G}(1 - \xi_{h|i,u}) w_{i,u}^g L_{i,u}^g + r_i h_{i,u}}{\sum_{j \in J} \pi_{ji,u} X_{j,u}},$$

Summing the demand for materials over all regions yields

$$\delta_{uu'} = \frac{\sum_{i \in J} M_{i,uu'} P_{i,u'}}{\sum_{i \in J} X_{i,u}},$$

where we define as $\delta_{uu'}$ the share of economy-wide material inputs of goods from sector u' used in the production of goods from sector u. We observe material inputs in producing goods from each sector from the World Input-Output Tables (Timmer et al. (2015)). We assume then that in all regions, the value of materials $u' \in M$ used as inputs, relative to total material inputs, is constant:

$$\delta_{uu'} = \frac{\delta_{i,uu'}}{\sum_{u' \in M} \delta_{i,uu'}} \quad \forall i \in J \quad \text{and} \quad \delta_{i,uu'} = (1 - \delta_{i,u})\, \delta_{uu'}.$$

We calibrate the share of value added accruing to workers as

$$1 - \kappa_{i,u} = \frac{\sum_{g \in G} (1 - \xi_{h|i,u}) w^g_{i,u} L^g_{i,u}}{\delta_{i,u} \sum_{j \in J} \pi_{ji,u} X_{j,u}}.$$

2. **Derive expenditures on land and structures for all regions**

   Expenditures on land and structures are a fixed share of total wage expenditures:

$$r_i h_{i,u} = \frac{\kappa_{i,u}}{1 - \kappa_{i,u}} \sum_{g \in G} w^g_{i,u} L^g_{m|i,u}.$$

3. **Calculate model-consistent expenditure shares $\beta^C_{u'}$ and $\beta^R_{u'}$**

   Aggregate goods markets clear for all sectors, which implies that

$$\begin{aligned}
\sum_{i \in J} X_{i,u} =& \beta^R_u \left[\left(\sum_{i \in J} \sum_{g \in G} \sum_{u' \in M} \left(t^g_{m|i,u'} + \iota_i \right) (1 - \xi^g_{h|i,u'}) w^g_{i,u'} L^g_{i,u'} \right) \right] \\
&+ \beta^C_u \left[\sum_{i \in J} \frac{L_i}{L} \left(\sum_{j \in J} \sum_{u' \in M} r_j h_{j,u'} - \sum_{g \in G} (1 - t^g_{h|i,u'}) \xi^g_{h|j,u'} w^g_{j,u'} L^g_{j,u'} \right) \right. \\
&+ \left. \sum_{i \in J} \sum_{s \in h,m} \sum_{u' \in M} \sum_{g \in G} \left(1 - t^g_{s|i,u'} \right) \xi^g_{s|i,u'} w^g_{i,u'} L^g_{s|i,u'} \right] \\
&+ \sum_{i \in J} \sum_{u' \in M} \frac{\delta_{i,u'u}}{\delta_{i,u'} (1 - \kappa_{i,u'})} \sum_{g \in G} (1 - \xi^g_{h|i,u'}) w^g_{i,u'} L^g_{i,u'}.
\end{aligned}$$

   With wage and employment data, as well as parameter values for ι_i and regional tax rates t_i, as well as $\delta_{i,u}$,$\kappa_{i,u}$ and $\delta_{i,uu'}$ obtained from identification step 1, we solve for model-consistent expenditure shares $\{\beta^C_u, \beta^R_u\}$. [29]

[29] We assume local governments do not consume housing but distribute expenditures like workers across the remaining sectors. This assumption allows us to better fit private expenditure to observable housing expenditure shares in Germany.

4. **Calculate total expenditures**
Goods market clearing in all regions and sectors implies that,

$$
\begin{aligned}
X_{i,u} =& \beta_u^R \left[\left(\sum_{g \in G} \sum_{u' \in M} \left(t^g_{m|i,u'} + \iota_i \right) (1 - \xi^g_{h|i,u'}) w^g_{i,u'} L^g_{i,u'} \right) \right] \\
&+ \beta_u^C \left[\frac{L_i}{L} \left(\sum_{j \in J} \sum_{u' \in M} r_j h_{j,u'} - \sum_{g \in G} (1 - t^g_{h|i,u'}) \xi^g_{h|j,u'} w^g_{j,u'} L^g_{j,u'} \right) \right. \\
&+ \left. \sum_{s \in h,m} \sum_{u' \in M} \sum_{g \in G} \left(1 - t^g_{s|i,u'} \right) \xi^g_{s|i,u'} w^g_{i,u'} L^g_{s|i,u'} \right] \\
&+ \sum_{u' \in M} \frac{\delta_{i,u'u}}{\delta_{i,u'} \left(1 - \kappa_{i,u'} \right)} \sum_{g \in G} (1 - \xi^g_{h|i,u'}) w^g_{i,u'} L^g_{i,u'},
\end{aligned}
$$

which we solve for using the model-consistent expenditure shares $\{\beta_u^C, \beta_u^R\}$ from identification step 4.

5. **Calculate relative unit cost shares $\tilde{\lambda}_{i,u}$ for all tradable goods**
Substituting the model-consistent expressions for trade shares as well as the calculated values for total expenditure into the equations for value-added, we get

$$
\sum_{j \in J} X_{j,u} \frac{\left(\lambda_{i,u} \tau_{ji,u} \right)^{-\nu_u}}{\sum_{n \in J} \left(\lambda_{n,u} \tau_{jn,u} \right)^{-\nu_u}} = \frac{\sum_{g \in G} w^g_{i,u} L^g_{m|i,u}}{\delta_{i,u} \left(1 - \kappa_{i,u} \right)}.
$$

For all pairs $\{i, u\}$ we solve for the relative unit costs $\tilde{\lambda}_{i,u} \equiv \frac{(\lambda_{i,u})^{\nu_u}}{\sum_{n \in J} (\lambda_{n,u})^{\nu_u}}$ that are implied by the structure of trade flows.

6. **Compute sector-specific price levels for all tradable goods**
Substituting relative unit costs $\tilde{\lambda}_{j,u}$ we solve for the ideal cost indices $P_{i,u}$:

$$
P_{i,u} = \Gamma \left(\gamma_u \right)^{\frac{1}{1-\sigma}} \left[\sum_{j \in J} \left(\tilde{\lambda}_{j,u} \right)^{-1} \left(\tau_{ij,u} \right)^{-\nu_u} \right]^{-\frac{1}{\nu_u}} * \left(\sum_{n \in J} \left(\lambda_{n,u} \right)^{\nu_u} \right)^{\frac{1}{\nu_u}},
$$

where $\sum_{n \in J} \left(\lambda_{n,u} \right)^{\nu_u}$ are sector-specific constants to be determined by normalisation. We choose a model-consistent normalisation on aggregate sector-specific cost indices: $P_u \equiv \sum_{i \in J} P_{i,u} \pi_{i,u} = 1$, that is, we define sector-specific cost aggregates as a weighted average of region-sector-specific costs and normalise them to unity. The weights $\pi_{i,u} = \frac{X_{i,u}}{\sum_{n \in J} X_{n,u}}$ are the share of total spending in sector u, that accrues to region-i expenditures. Applying the normalisation, we solve for the sector-specific constants and subsequently calculate ideal cost indices:

$$P_{i,u} = \frac{\left[\sum_{j\in J}\left(\tilde{\lambda}_{j,u}\right)^{-1}\left(\tau_{ij,u}\right)^{-\nu_u}\right]^{-\frac{1}{\nu_u}}}{\sum_{i\in J}\pi_{i,u}\left[\sum_{j\in J}\left(\tilde{\lambda}_{j,u}\right)^{-1}\left(\tau_{ij,u}\right)^{-\nu_u}\right]^{-\frac{1}{\nu_u}}}.$$

Unit costs in levels are therefore determined as

$$\lambda_{i,u} = \frac{\left(\tilde{\lambda}_{i,u}\right)^{\frac{1}{\nu_u}}}{\Gamma\left(\gamma_u\right)^{\frac{1}{1-\sigma}}\sum_{i\in J}\pi_{i,u}\left[\sum_{j\in J}\left(\tilde{\lambda}_{j,u}\right)^{-1}\left(\tau_{ij,u}\right)^{-\nu_u}\right]^{-\frac{1}{\nu_u}}}.$$

7. **Compute price levels in all regions for all non-tradable goods**
The price levels of non-tradable services are defined as

$$P_{i,ntS} = \beta_{ntS}\left(\frac{P_{i,S}}{\left(P_{i,tS}/\beta_{tS}\right)^{\beta_{tS}}}\right)^{\frac{1}{\beta_{ntS}}},$$

where the price level of tradable services $P_{i,tS}$ and the consumption shares of tradable and non-tradable services $\{\beta_{tS}, \beta_{ntS}\}$ follow from the previous steps. In all non-tradable sectors it holds that $\tau_{ij,u} \to \infty$ for all regions $j \neq i$, such that price levels simplify to $P_{i,nt} = \Gamma\left(\gamma_{nt}\right)^{\frac{1}{1-\sigma}}\lambda_{i,nt}$. Finally, we normalise aggregate price levels and unit costs to the numéraire such that $\sum_i P_i \equiv \bar{P} = 1$.

8. **Compute productivity as compensating differential to unit costs**
This step leverages the relationship between unit costs and productivity in spatial equilibrium. In high-wage locations, higher production costs must be offset by greater productivity to maintain firms' competitiveness in trade. The recovered productivity values reveal systematic patterns across regions and gender groups that help explain observed spatial wage disparities. Group-specific labour demand can be re-written in terms of the aggregate wage sum:

$$\frac{w_{i,u}^{g}L_{m|i,u}^{g}}{\sum_{g\in G}w_{i,u}^{g}L_{m|i,u}^{g}} = \frac{\left(\frac{Z_{i,u}^{g}}{w_{i,u}^{g}}\right)^{\sigma^g-1}}{\sum_{g\in G}\left(\frac{Z_{i,u}^{g}}{w_{i,u}^{g}}\right)^{\sigma^g-1}}$$

Substituting relative productivity $\tilde{Z}_{i,u}^{g} \equiv \frac{Z_{i,u}^{g}}{\sum_{g\in G}Z_{i,u}^{g}}$ and applying the fact that relative productivity $\tilde{Z}_{i,u}^{g}$ sums to unity in all region-sector pairs allows identifying them solely in terms of observable average wages and market employment:

$$\tilde{Z}^g_{i,u} = \frac{\left(w^g_{i,u}\right)^{\frac{\sigma^g}{\sigma^g-1}} \left(L^g_{m|i,u}\right)^{\frac{1}{\sigma^g-1}}}{\sum_{g\in G} \left(w^g_{i,u}\right)^{\frac{\sigma^g}{\sigma^g-1}} \left(L^g_{m|i,u}\right)^{\frac{1}{\sigma^g-1}}}$$

Given unit cost estimates, higher local unit prices (e.g. wages, rent, intermediate goods prices) thus imply larger regional productivity in sector u:

$$Z^g_{i,u} = \tilde{Z}^g_{i,u} \left[\frac{D_{i,u}}{\lambda_{i,u}} \left(r_i^{\kappa_{i,u}} \left[\sum_{g\in G} \left(\frac{\tilde{Z}^g_{i,u}}{w^g_{i,u}} \right)^{\sigma^g-1} \right]^{\frac{1-\kappa_{i,u}}{1-\sigma^g}} \right)^{\delta_{i,u}} \prod_{u'\in M} \left[P_{i,u'}\right]^{\delta_{i,uu'}} \right]^{\frac{1}{\delta_{i,u}\left(1-\kappa_{i,u}\right)}}.$$

9. **Ensure goods market clearing in non-tradable sectors**
Identification step 5 ensures goods market clearing in all regions and tradable sectors since unit costs are identified from model-consistent trade flows. In contrast, we use data on observable price levels in non-tradable sectors for quantification, which may not ensure goods market clearing initially. We, therefore, gradually adjust the parameters $\delta_{i,u}, \delta_{i,uu'}$ across regions and non-tradable sectors such that they ensure goods market clearing also in non-tradable sectors. The loop works as follows:

   - Follow identification steps 1-8, given initial guesses for $\delta_{i,u}, \delta_{i,uu'}$ in all regions and sectors
   - Calculate trade flows implied by guesses of unit costs, $X_{i,u}$ and trade costs
   - Use guesses for unit costs and intermediate cost inputs to compute the total value of intermediate goods production
   - Evaluate whether local production equals total demand
   - Adjust the parameters $\delta_{i,u}, \delta_{i,uu'}$, re-do all the steps above until goods market clearing is ensured

10. **Compute preferences as compensating differentials to labour supply**
Given sector-specific unit cost levels as well as data on wages $w^g_{i,u}$, tax rates, public expenditure and employment rates, overall preference shifters $A^g_i \exp\left[-\mu^g_{m|i,u}\right]$

are recovered as the residual to observable labour supply: [30]

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

To split the two preference components, we regress the overall preference shifter on region-fixed effects for all worker groups to identify amenities and region-sector-specific participation costs separately. Thus $\bar{A}_i^g = A_i^g L_i^{-\zeta^g}$, with $A_1 = 1$ for both worker groups.

11. **Compute home market efficiency**
Finally, we use the structural parameter estimates $\{\epsilon^g, \rho^g, \alpha\}$ and non-employment rates to recover the aggregate level $\mathcal{B}_{s|i,u}^g$, such that

$$\mathcal{B}_{s|i,u}^g = \left(\xi_{h|i,u}^g\right)^{\frac{1}{\epsilon^g}} \left(\frac{I_{m|i,u}^g}{I_{h|i,u}^g}\right)^{1-\alpha} \left(\left[\frac{R_i}{L_i^\chi}\right]^{\rho^g}\right)^\alpha.$$

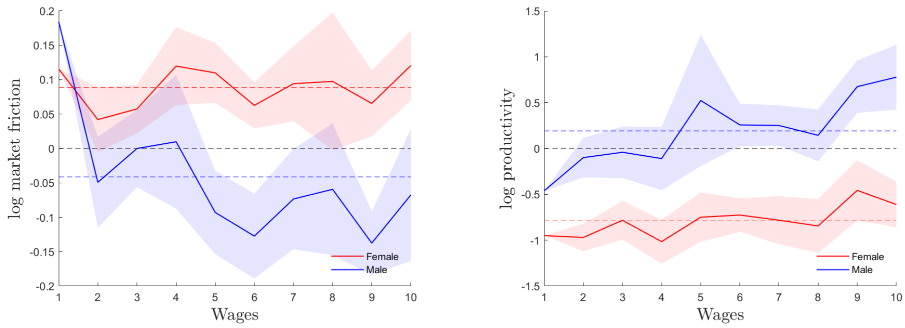
Finally, we split preference shifters into participation costs and home-market-efficiency, such that $\exp\left[B_{h|i,u}^g\right] = \mathcal{B}_{s|i,u}^g \exp\left[-\mu_{m|i,u}^g\right]$ and normalize all preference components.

Local Home Market Efficiency, Productivity, and Amenities. Panel (a) reveals systematic differences in home market efficiency across locations: male workers experience lower home market efficiency in high-wage cities, consistent with better labour market access and higher wages in urban areas. Female workers, by contrast, face relatively constant home market efficiency across the wage distribution, showing no systematic reduction in higher-wage areas. This pattern helps explain why female labour force participation does not necessarily increase with local wages despite potentially higher returns to market work.

Panel (b) documents a positive relationship between (log) productivity and wages for both gender groups, consistent with established evidence on urban productivity advantages (Rosenthal and Strange, 2004). However, the persistence of labour market barriers for women suggests that the productivity benefits of larger cities may not translate equally into improved labour market outcomes across demographic groups.

[30] Since preference shifters are identified only up to scale, we normalize the first cell (J=1,G=1,M=1) to unity such that the preference terms in all other regions, sectors and groups are identified relative to this cell.

The analysis demonstrates that spatial variation in home market efficiency plays a central role in determining labour market outcomes, with particularly strong effects on women. These patterns provide a structural interpretation of our reduced-form evidence on gender-specific responses to place-based policies.



(a) Home Market Efficiency (b) Productivity

Figure C.3: Stylised Facts about the Fundamentals

Notes: This figure shows the relationship between cross-sectionally demeaned log home market efficiency (Panel a) and log productivity (Panel b) against wage deciles for males and females. The dotted lines represent the mean across all commuting zones (CZs). Two solid lines are plotted, one for each gender, representing the demeaned average of each variable within each bin. The shaded areas around each line represent the 95% confidence interval.

D Counterfactual Analysis

This appendix provides technical details on our counterfactual implementation and additional results that complement Section 6 of the main paper. We explain our computational approach to finding welfare-maximizing spatial policies and document local effects that support our aggregate findings about the potential benefits of optimized redistribution.

D.1 Implementation Strategy

Monte Carlo Study. Conditional on the initial distribution of fiscal policies, counterfactual equilibria are unique as long as congestion forces outsize agglomeration forces. Yet, there may be a multiplicity of equilibria for different initial sets of policies. Since we are interested in the global maximum achievable for the German economy, we further explore this multiplicity of equilibria by varying the spatial distribution of initial policies and, consequently, the starting point for implementing social planner policies.

We randomly draw $N = 10,000$ different sets of policies, $\mathcal{V}_0^P = \{\tilde{t}^g_{s|i,u}, \tilde{x}^g_{s|i,u}, \tilde{E}_i\}$, and then solve for the values of all endogenous variables that are consistent with these policies in general equilibrium, given structural parameters and exogenous economy fundamentals.

Randomization strategy. A social planner chooses a vector of taxes, regional transfers and wage subsidies, $\mathcal{V}_0^P = \{\tilde{t}^g_{s|i,u}, \tilde{x}^g_{s|i,u}, \tilde{E}_i\}$ as a function of local wages, labour force participation, population and rents, such that they satisfy all general equilibrium conditions as detailed in the Appendix A.2 of the main paper. We randomised this vector for our Monte Carlo study, which allowed us to solve for $N = 10,000$different initial equilibria. In the following, we provide details on the randomization procedure.

1. Randomly draw tax rates for employed workers, $\tilde{t}^g_{m|i,u}$, from a uniform distribution in bounds $(0, 1)$ for all places, sectors and worker groups. We normalize simulated tax rates such that their average equals the mean in the data (at around $t = 0.4$). This ensures that the aggregate share of public goods, relative to private goods, is still comparable to the observed one for the year 2014.

2. Non-employed workers receive a fraction $o^g_{i,u}$ of after-tax wage income. We randomly draw this fraction from a uniform distribution in bounds $(0, 1)$ for all places, sectors and worker groups. Taxes on non-employed workers follow as $\tilde{t}^g_{h|i,u} = 1 - (1 - \tilde{t}^g_{m|i,u}) \cdot o^g_{i,u}$.

3. Calculate model-consistent rent income from all locations, net of non-employment payments:

$$\mathcal{K} = \sum_{i\in J}\sum_{u\in M}\sum_{g\in G}\left(\frac{\kappa_{i,u}}{1-\kappa_{i,u}}\left(1-\xi^g_{h|i,u}\right)w^g_{i,u}L^g_{i,u} - (1-\tilde{t}^g_{h|i,u})\xi^g_{h|i,u}w^g_{i,u}L^g_{i,u}\right)$$

4. Calculate aggregate government income that can be redistributed across local governments and workers:

$$E = \sum_{i\in J}\sum_{u\in M}\sum_{g\in G}\tilde{t}^g_{m|i,u}\left(1-\xi^g_{h|i,u}\right)w^g_{i,u}L^g_{i,u} + \mathcal{K}$$

5. Calculate total funds available for public goods expenditure: $\alpha \cdot E$.[31]

[31]Note: Under Cobb-Douglas preferences α is the preferred ratio of public to private goods.

6. Randomly allocate αE to different locations: $\tilde{E}_i = \frac{\text{share}_i^P}{\sum_{i \in J} \text{share}_i^P} \cdot \alpha E$, where [32]

$$\text{share}_i^P = \frac{\sum_{u \in M} \sum_{g \in G} L_{i,u}^g}{\sum_{i \in J} \sum_{u \in M} \sum_{g \in G} L_{i,u}^g} \cdot \tilde{\iota}_i; \quad \text{and} \quad \tilde{\iota}_i \sim U(0.1, 1.9)$$

7. Calculate total funds to be distributed as (additive) wage subsidies: $(1 - \alpha) \cdot E$

8. Randomly allocate wage subsidies across locations, sectors and worker types. First, we calculate the (random) shares of the total funds that accrue to all workers:

$$\text{share}_i^S = \frac{L_{i,u}^g}{\sum_{i \in J} \sum_{u \in M} \sum_{g \in G} L_{i,u}^g} \cdot \tilde{\iota}_{i,u,S}^g; \quad \text{and} \quad \tilde{\iota}_{i,u,S}^g \sim U(0.5, 1.5)$$

   Second, we determine the subsidies that accrue to all workers:

$$\tilde{x}_{u|i,u}^g = \frac{\text{share}_{i,u,S}^g}{\sum_{i \in J} \sum_{u \in M} \sum_{g \in G} \text{share}_{i,u,S}^g} \cdot (1 - \alpha) \cdot E / L_{i,u}^g$$

   Lastly, we normalize subsidies such the total amount of subsidies equals the funds used for private wage subsidies:

$$\tilde{x}_{u|i,u}^g = \frac{\tilde{x}_{i,u}^g}{\sum_{i \in J} \sum_{u \in M} \sum_{g \in G} \left(\tilde{x}_{i,u}^g L_{i,u}^g\right)} \cdot (1 - \alpha) \cdot E \quad \text{and} \quad \tilde{x}_{u|i,u}^g = \tilde{x}_{h|i,u}^g$$

This randomization strategy ensures we explore a broad range of potential equilibria, enabling us to identify policies that maximize global rather than merely local welfare. We can systematically compare welfare outcomes across alternative redistribution schemes by varying initial policy combinations while maintaining consistency with general equilibrium constraints.

D.2 Initial equilibria

When solving for the initial spatial equilibrium in each Monte Carlo iteration, we start from the observed equilibrium in 2014, implement the N sets of spatial policies and solve for the counterfactual values of all endogenous variables in general equilibrium. In each iteration, we solve for new levels of wages, employment and LFP rates and use them to adjust the (random) policies: we keep tax rates ($\tilde{t}_{s|i,u}^g$),

[32] Our choice of randomisation of government transfers and wage subsidies incorporates three objectives: (i) ensures that there is at least some public good provision/wage subsidies in all locations initially, (ii) ensures that all funds are spent on public or private goods in either of the J locations and (iii) highly-populous locations get more funds for consumption of both goods.

random transfer rates ($\tilde{\iota}_i$) and subsidy shares ($\tilde{\iota}^g_{i,u,S}$) constant, but update public/ private funds, government expenditures and wage subsidies with the new wages, local employment and labour force participation rates.

A spatial equilibrium is found when all markets clear, the random policies are implemented, and the aggregate resource constraint is satisfied. The outcomes are N different spatial equilibria determined by (random) fiscal policies, exogenous characteristics of the German economy in 2014 and the same set of structural parameters.

Details on Implementation. In the following, we provide further details how inverted model fundamentals $\{\bar{A}^g_i, B^g_{h|i,u}, H_i, \bar{Z}^g_{i,u}\}$ and model parameters $\{\alpha, \epsilon^g, \zeta^g, \eta^g, \theta, \kappa_{i,u}, \nu_u, \rho^g, \sigma, \tau_{ij,u}, \chi\}$ can be combined with a counterfactual set of spatial policies $\{t^g_{s|i,u}, x^g_{s|i,u}, \iota_i\}$ to solve for a counterfactual set of endogenous variables $\mathbf{V} = \{E_i, h_{i,u}, I^g_{s|i,u}, L^g_{i,u}, L^g_{s|i,u}, P_{i,u}, r_i, w^g_{i,u}, X_{i,u}, \lambda_{i,u}, \pi_{ij,u}\}$. For computational quickness, we split the loop into two components: An inner loop and an outer loop that updates labour force participation rates. In Algorithm 1, we use pseudo-code to highlight the workings of the inner loop.

We update labour force participation rates in the outer loop with the model-consistent endogenous variables determined in the inner loop. Particularly, we solve for non-employment rates (Eq. (10)) and use this to restart the inner loop with new inputs.

Local Maxima. In this counterfactual, we search for the fiscal policies that maximize overall welfare and evaluate their aggregate economic impact. We start from the initial equilibria determined by the random fiscal policy sets. Next, we derive and implement the policy instruments according to Proposition 2 in the main paper and solve for a counterfactual general equilibrium. Since the optimal policies are a function of endogenous variables, we re-adjust them in each iteration after having solved for new values of these variables in each iteration. Conditional on exogenous economy characteristics, structural parameters and initial policies, we thus find $N = 10,000$ local welfare maxima induced by implementing the optimal tax, transfer and subsidy rules.

Global Maximum. Out of the set of local maxima, we pick the one that leads to the largest increase in overall welfare relative to the *baseline* German economy in the year 2014 and with the empirically observable tax and transfer rates.

Algorithm 1: Numerical solution algorithm - Inner Loop

Given values for primitives $\{\bar{A}_i^g, B_{h|i,u}^g, H_i, \bar{Z}_{i,u}^g\}$, first guess for $\xi_{h|i,u}^g$ and model parameters $\{\alpha, \epsilon^g, \zeta^g, \eta^g, \theta^g, \kappa_{i,u}, \nu_u, \rho_h^g, \sigma, \tau_{ij,u}, \chi\}$, define a counterfactual set of spatial policies $\{t_{s|i,u}^g, x_{s|i,u}^g, \iota_i\}$ that solve for a set of endogenous variables $\mathbf{V} = \{E_i, h_{i,u}, I_{s|i,u}^g, L_{i,u}^g, L_{s|i,u}^g, P_{i,u}, r_i, w_{i,u}^g, X_{i,u}, \lambda_{i,u}, \pi_{ij,u}\}$

Set convergence parameter $\kappa \in (0, 1)$

Set precision rule to govern deviation between guesses and model solution.

Set maximum number of iterations to *maxiter* and *count* $= 1$

Guess values of $P_{i,u}$ $w_{i,u}^g$ and $L_{i,u}^g$

while *count* $<$ *maxiter* **do**

- Solve for aggregate expenditures, $\sum_{j \in J} \pi_{ji,u} X_{j,u}$, from labour demand condition.
- Use aggregate expenditures to solve for expenditures on materials, $M_{i,uu'}$, and rents, $\{r_i h_{i,u}, r_i\}$, from their respective market clearing conditions
- Solve for $X_{i,u}$ by using final goods market clearing.
- Solve for $\lambda_{i,u}$ from the definition of unit costs.
- Solve for new trade shares π_{ij}, using updated unit costs.
- Then compute new values of initial (or updated) guesses:
- Compute $P_{i,u}^{new}$ from updated unit costs. Normalise aggregate price level in the economy to $\sum_{i \in J} P_i^{new} L_i / L \equiv \bar{P} = 1$
- Compute $L_{i,u}^{g,new}$ from labour supply condition and using updated prices.
- Compute $w_{i,u}^{g,new}$ from labour demand condition and using updated levels of employment.
- Check deviation between guesses and model solution

$$target1 = round(abs(w_{i,u}^g - w_{i,u}^{g,new}), precision)$$
$$target2 = round(abs(L_{i,u}^g - L_{i,u}^{g,new}), precision)$$
$$target3 = round(abs(P_{i,u} - P_{i,u}^{new}), precision)$$

- **if** *target*1 $== 0$ & *target*2 $== 0$ & *target*3 $== 0$ **then**
  - break;
- **else**
  - Update initial guesses or updated values of $P_{i,u}$ $w_{i,u}^g$ and $L_{i,u}^g$:

$$w_{i,u}^{g,up} = \kappa w_{i,u}^g + (1 - \kappa) w_{i,u}^{g,new}$$
$$L_{i,u}^{g,up} = \kappa L_{i,u}^g + (1 - \kappa) L_{i,u}^{g,new}$$
$$P_{i,u}^{up} = \kappa P_{i,u} + (1 - \kappa) P_{i,u}^{new}$$

  - Use updated values and re-iterate

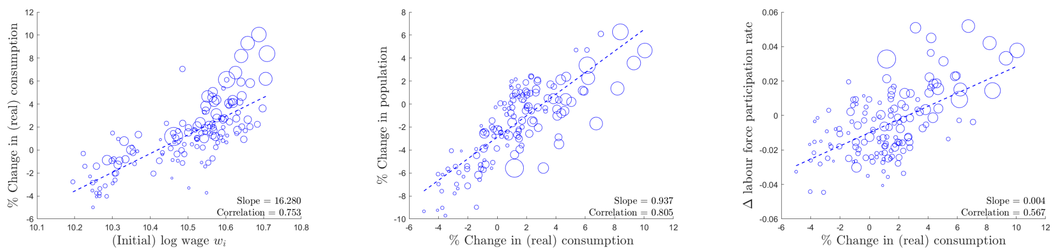
$$w_{i,u}^g = w_{i,u}^{g,up}, L_{i,u}^g = L_{i,u}^{g,up}, P_{i,u} = P_{i,u}^{up}$$

- Compute other endogenous variables (e.g. quantities) as needed.

Result: Equilibrium values of $\mathbf{V}$, given initial guess for $\xi_{h|i,u}^g$

D.3 Additional Results

Local Effects. Figure D.1 illustrates how optimized spatial policy affects different locations heterogeneously. Panel (a) reveals a positive relationship between local wages and increases in real consumption possibilities, with urban areas experiencing the largest gains. These consumption improvements generate two complementary effects: attracting workers from other regions (Panel b) and stimulating higher local labour force participation (Panel c). The latter effect operates through the mechanisms described in equation (10) in the main paper, where reduced tax rates and enhanced public goods provision lower opportunity cost of market employment. This participation response is particularly pronounced for female workers due to their higher labour supply elasticities, contributing significantly to the aggregate employment gains documented in the main text.



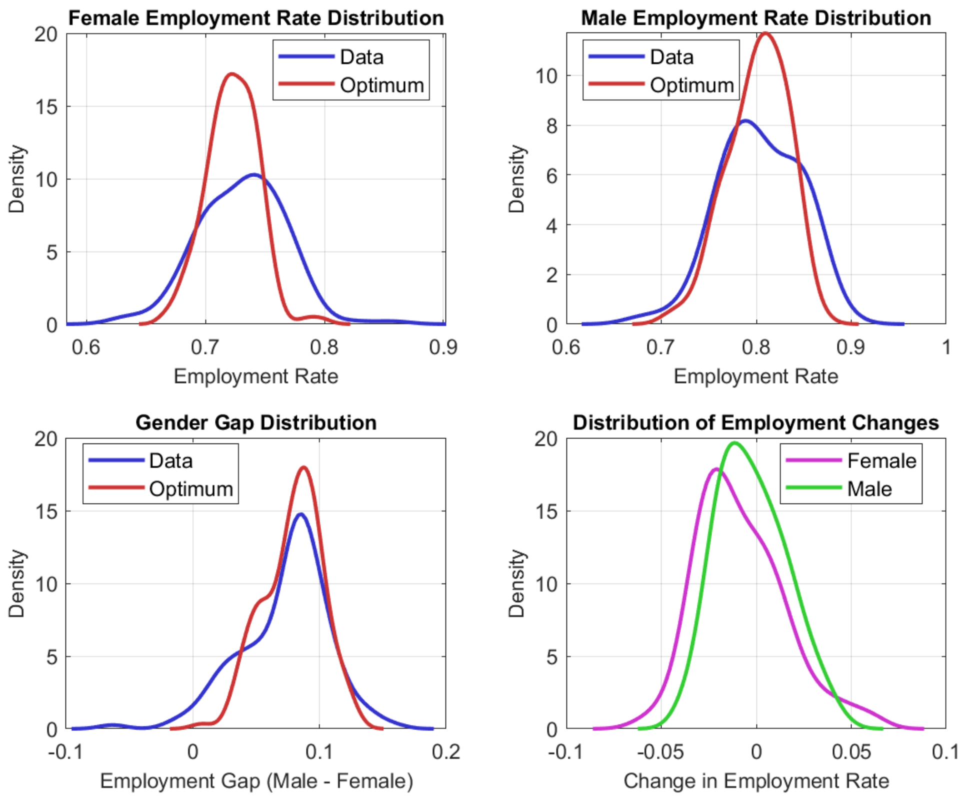
(a) Change in real consumption possibilities (b) Population changes (c) Changes in LFP rates

Figure D.1: Local Effects

Notes: This figure shows key local responses to optimized spatial policy. Panel (a) plots the change in real consumption possibilities (private + public goods) against local wages, demonstrating larger gains in high-wage locations. Panel (b) illustrates the resulting population changes, showing worker migration toward areas with improved consumption. Panel (c) displays changes in local labour force participation rates, which increase most in areas with the largest consumption improvements. Marker size is proportional to local labour market size in all panels. These patterns highlight the dual adjustment channels through which spatial policy affects local economies: worker reallocation across space and changes in employment rates within locations.

Changes in the Spatial Distribution of Labour Force Participation Figure D.2 illustrates how the optimal policy reshapes regional labour force participation patterns. Female LFP rates (Panel a) become more concentrated under the optimal policy, with reduced regional variation. Male LFP rates (Panel b) also become more uniform, though the effect is less pronounced than for women. Panel (c) shows that while gender gaps persist, the optimal policy substantially narrows their regional variation, creating more consistent labour market conditions across Germany. Finally, Panel (d) reveals gender-specific responses to the policy changes, with some regions experiencing particularly strong increases in female labour force participation. This is consistent with our empirical finding that women show stronger employment responses to fiscal transfers.

Figure D.2: Labour Force Participation Distribution: Baseline vs. Optimal Policy



Notes: This figure compares labour force participation (LFP) distributions under the baseline scenario and optimal spatial policy. Panel (a) shows kernel density estimates of female LFP rates across regions. Panel (b) presents the distribution of male LFP rates. Panel (c) displays the gender gap distribution (male minus female employment rates) under each scenario. Panel (d) illustrates the distribution of changes in LFP rates from baseline to optimal policy for both genders. All panels use kernel density estimation to visualize the full distribution of outcomes across labour markets in Germany.

Sectoral Dimension of Employment Effects. Our counterfactual analysis also reveals important sectoral dimensions within the market economy. Figure D.3 shows that under the optimal policy, female workers gain more employment in historically male-dominated sectors (e.g., Agriculture, Construction, Wholesale/Retail), while male employment grows most in female-dominated sectors (e.g., Services). This suggests that the optimal spatial policy, by altering local incentives, may also reduce occupational gender segregation.

Female employment shows stronger positive responses in industries where women are traditionally under-represented, such as Agriculture (+3.2%) and Wholesale/Retail (+2.8%), while declining in Manufacturing (-1.7%). Male employment, by contrast, shows its largest gains in heavily female-dominated Service sectors (+1.4%) and declines in traditionally male sectors like Mining (-1.3%) and Manufacturing (-1.0%). This pattern suggests that optimized spatial policy reduces occupational segregation by gender, facilitating female entry into previously male-dominated fields while encouraging male employment in service sectors.

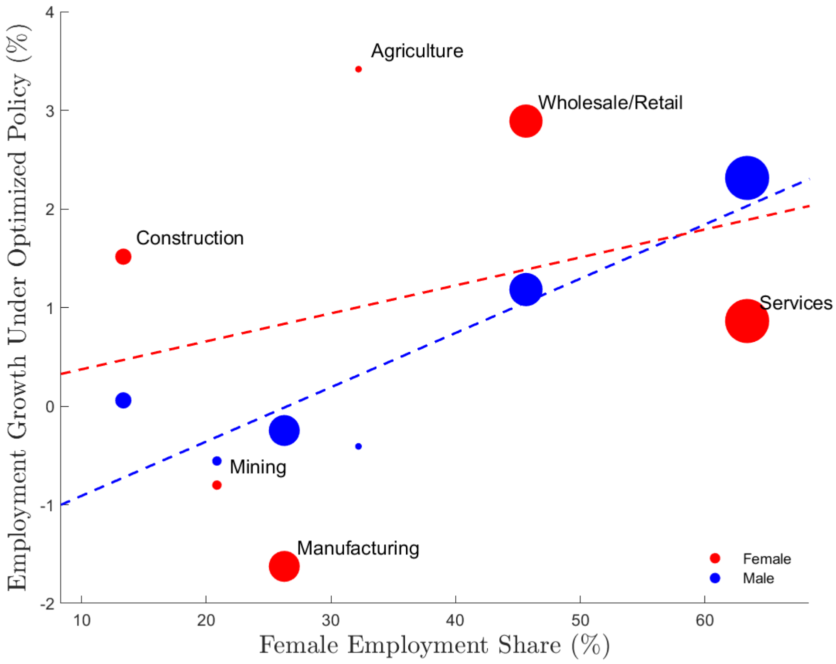


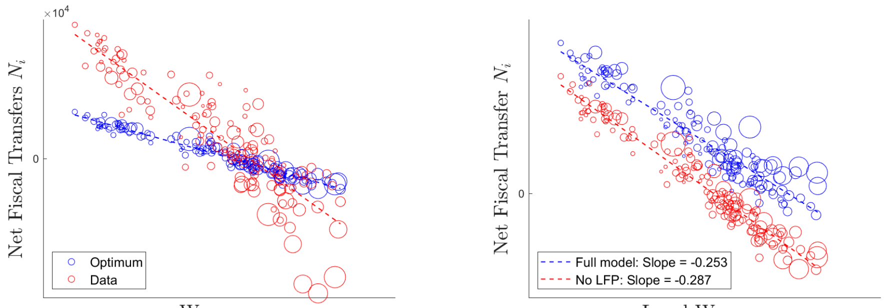
Figure D.3: Sectoral Employment Growth by Gender Under Optimized Policy

Notes: This figure shows the relationship between initial female employment share and employment growth under optimized spatial policy across economic sectors. Each point represents a sector, with point size proportional to total sector employment. Red points show female employment growth, while blue points show male employment growth. Dashed lines represent linear trends. The figure reveals that female employment gains are largest in sectors with lower initial female representation (Agriculture, Wholesale/Retail, Construction), while male employment grows most in female-dominated sectors (Services). This pattern suggests that optimal spatial policy reduces gender-based occupational segregation across sectors.

Optimal Transfers and Redistribution. In Figure D.4, we compare the optimized level of redistribution across different versions of our framework. Panel (a) underscores that even in a model with full employment ("No LFP", $\epsilon^g \to \infty$), a social planner would redistribute fewer funds into low-wage locations compared to the observed transfer system given current labour market conditions and size of net externalities.

Yet, the correlation of net fiscal transfers with wages is stronger in this full employment model version, compared to their relationship in our general framework (Panel b) and as seen in the larger slope coefficient. This relates to the fact that local differences in LFP impact the size and distribution of spatial externalities.

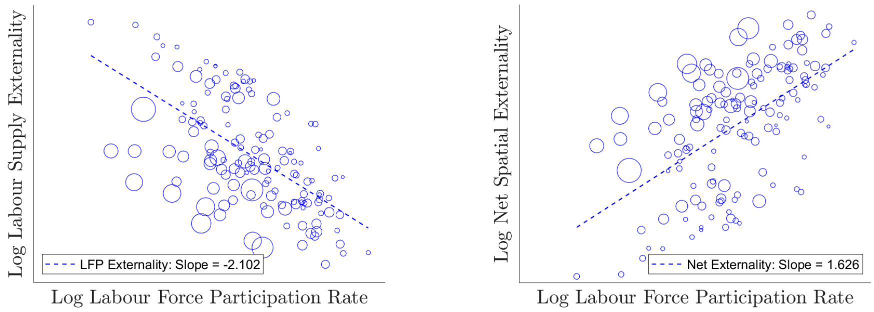
For the German parametrization we find that labour supply externalities are positive in all locations, but smaller in places with a large share of workers in the market sector (Panel (a) of Figure D.5), which is in line with our theoretical discussions in Appendix B. At the same time, agglomeration economies are also higher in these places, such that overall net spatial externalities are higher in places with higher labour force participation (see Figure D.5), making the efficiency channel of redistribution larger in places with high market attachment. Since wages and LFP rates are, furthermore, positively correlated across German labour markets, the planner redistributes even less funds once we account for the LFP channel. The main paper also discusses the relevant conditions behind this insight in the theory Section 4.2. Abstracting from the LFP channel, one would, therefore, overestimate the optimal level of redistribution in Germany.



(a) Redistribution ("No LFP") (b) LFP vs No LFP

Figure D.4: Optimized Redistribution - Impact of LFP channel

Notes: Panel (a) of this Figure displays net fiscal transfers (see Definition 1) against local wages for two different scenarios: (i) optimized policy instruments when abstracting from the LFP channel ($\epsilon^g \to \infty$) and (ii) observed German public finance system in 2014 ("Data"). Panel (b) plots optimized net fiscal transfers (i) in our full model and (ii) in the "No LFP" scenario. The size of the marker is proportional to local labour market size.



(a) Redistribution ("No LFP") (b) LFP vs No LFP

Figure D.5: IMPACT OF LFP ON NET EXTERNALITIES

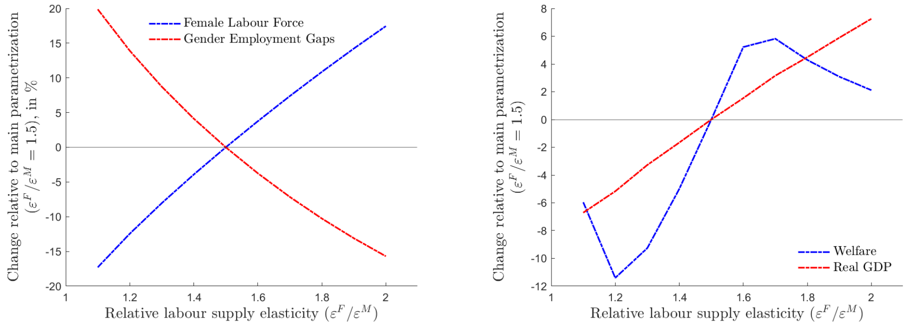
Notes: Panel (a) of this Figure displays labour supply externalities against local labour force participation rates, while Panel (b) plots the net spatial externalities (agglomeration externalities + labour supply externalities) against labour force participation rates. Note that congestion externalities do not directly depend on LFP rates. The size of the marker is proportional to local labour market size.

Sensitivity to Gender-specific Labour Supply Elasticities. We document sizeable effects of implementing optimized spatial policies. The size of these effects is governed by gender-specific responses to fiscal policy.

In Figure D.6, we explore the sensitivity of our counterfactual results to the gender-specific magnitude of labour supply elasticities. While the female elasticity is 50 % larger in our preferred parametrization (see Section 5), we also consider alternative values in this sensitivity analysis and highlight the aggregate implications. Starting from homogeneous labour supply elasticities across workers of different gender ($\varepsilon^F/\varepsilon^M = 1$), we incrementally increase the gender-specific heterogeneity in employment responses to fiscal policy. We calculate the impact of optimized spatial policy under the different specifications by plotting four aggregate variables (female labour force, gender employment gaps, real GDP and welfare) across these heterogeneous values for labour supply elasticities. We normalize results relative to their impact in our most preferred parametrization ($\varepsilon^F/\varepsilon^M = 1.5$) and plot their (percentage) deviations.

Female employment growth is larger, the bigger the labour supply elasticity , and thus, the heterogeneity in responses to spatial policy. This is also reflected in a greater decrease in the employment gap. Indeed, if female elasticities were almost twice the size of males, optimized spatial policies could close gaps in most places altogether. A large increase in the female labour force would also translate into higher growth in real GDP (Panel (b)). This also holds for changes in overall welfare, even though there are striking non-linearities with regard to the impact of

ϵ. While welfare increases in the size of the economy, higher female labour force participation also impacts congestion in the economy and selection into the home market sector. The latter two effects attenuate the impact of the former and give rise to the observable non-linearities.



(a) Female Labour Force and Gender Gaps

(b) Real GDP and Welfare

Figure D.6: OPTIMIZED REDISTRIBUTION - SENSITIVITY TO GENDER-SPECIFIC LABOUR SUPPLY ELASTICITIES

Notes: This Figure displays the differential impact of implementing optimized spatial policy for four variables (female labour force, gender employment gap, real GDP and welfare) and different values of the labour supply elasticity μ^g. All variable values are calculated as changes relative to our main parametrization, where $\mu^F/\mu^M = 1.5$ (see Section 5 in the main paper). The x-axis plots the relative difference in labour supply elasticities across workers of both genders. Panel (a) shows the changes in the (female) labour force (in %) and the shift in employment gaps in percentage points. Panel (b) plots percentage changes in real GDP and welfare.

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