Place-based Policy, Migration Barriers, and Spatial Inequality

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Abstract

What makes place-based incentives for firms succeed at reducing spatial inequality? The answer depends on where workers migrate and thus on how migration costs vary across destinations. I develop a dynamic spatial general equilibrium model with firm dynamics and endogenous public services. Vietnam's enterprise tax and household registration reforms provide variation in place-based incentives and migration costs. I exploit these variations to discipline key elasticities. I find that where migration costs fall matters more than how much they fall. When migration barriers fall toward secondary cities rather than metropolitan areas in Vietnam, the redistributive effect of place-based incentives increases fivefold.

1 Introduction

Governments worldwide spend heavily on place-based tax incentives to reduce spatial inequality, particularly in developing countries where poverty concentration is severe and persistent. Yet these policies generate widely varying results, often failing to achieve redistribution despite substantial fiscal costs. This paper shows how migration barriers modulate the success of place-based incentives for firms.

Standard spatial models predict that if place-based incentives succeed at attracting firms to disadvantaged regions, they raise local wages and employment. Migration complicates this logic. Workers flowing into targeted regions expand labor supply and compress wage gains, potentially dissipating the spatial targeting of tax incentives. Recent quantitative work confirms this intuition.

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Atalay et al. (2025) find that blocking migration would make Turkey's investment subsidies twice as effective at reducing regional inequality. This finding suggests migration undermines place-based incentives for firms.

Yet this conclusion rests on comparing two polar cases: one where migration exists and one where it does not. Policymakers face a different question. They may not eliminate migration, but they often can shape where migration costs fall. Infrastructure investments reduce costs toward certain destinations, while directly subsidizing migration toward urban places is another option (Lagakos et al., 2023). Whether such policies amplify or undermine place-based incentives likely depends on where those barriers fall. Examining this question requires not only large-scale variation in migration costs alongside place-based tax incentives, but also a general equilibrium framework that captures firm dynamics and spatial linkages.

This paper provides both. First, I exploit Vietnam's 2003 enterprise tax reform and 2005 household registration (Ho Khau) reform, which generate rare joint variation in place-based incentives and migration barriers. Second, I extend dynamic spatial models to incorporate entry and exit of entrepreneurs and local public services funded by profit taxes. While Kleinman et al. (2023) incorporate forward-looking capital accumulation, they abstract from firm entry and exit. Other models treat public goods as exogenous (Caliendo and Parro, 2020). Without firm dynamics, the model cannot capture how tax incentives affect entrepreneurial location and survival. Without endogenous public services, it misses the fiscal externality where tax cuts can reduce government revenue and force service declines that offset employment gains.

Vietnam provides the empirical setting to implement this framework. Spatial inequality was pronounced in the early 2000s: the regional income Gini coefficient was 0.4, three times that of the US. The 2003 enterprise tax reform aimed to address this inequality by replacing the previous flat 20-25% rate in disadvantaged districts with a new age-graded schedule that reduced taxes to 0% for young firms in the poorest locations, while also lowering the nationwide statutory rate from 32% to 28%. Two years later, the 2005 Ho Khau reform reduced internal migration barriers by relaxing household registration requirements. Critically, the reform was asymmetric. While barriers fell nationwide, the five metropolitan areas retained additional requirements, creating larger cost reductions for moves to secondary cities than to major urban centers. This asymmetric design generates variation in where migration costs fall, not just how much they fall.

I combine detailed micro data on firms and migration to estimate key structural elasticities. Using firm-level data covering all registered enterprises from 2000-2019, I estimate how firm survival responds to age-specific tax incentives through a triple-difference strategy exploiting variation across space, time, and firm age. Using population census data from 1999-2019, I identify changes in migration costs from the asymmetric Ho Khau reform by exploiting differential migration flows across origins, destinations, and time periods. Both strategies use model-consistent equations, ensuring the estimated elasticities directly discipline the quantitative model. I then perform counterfactual policy experiments using a dynamic hat algebra approach that extends

Caliendo et al. (2019). This method solves for counterfactual equilibria without requiring unobserved fundamentals, allowing me to isolate the effects of each policy reform by comparing actual outcomes with scenarios where one or both policies are removed. The quantitative analysis reveals how the spatial targeting of migration cost reductions shapes the redistributive effectiveness of place-based tax incentives.

The quantitative results confirm that where migration costs fall matters more than how much they fall. The 2003 tax reform alone generates modest convergence, raising aggregate welfare by 0.88% and reducing spatial inequality, measured by the Gini coefficient of welfare, by 0.12%. Adding the actual Ho Khau migration reform raises these effects substantially. Aggregate welfare rises to 1.36% and the Gini reduction increases nearly fivefold to 0.59%. However, counterfactual experiments reveal that the actual reform left substantial welfare and redistributive gains unrealized. Directing the same magnitude of barrier reductions exclusively toward secondary cities would have increased the Gini reduction to 1.12%—nearly double the actual policy's effect and ninefold larger than tax reform alone—while raising aggregate welfare to 1.43%. In contrast, reducing barriers exclusively toward the five metropolitan areas generates virtually no additional redistribution beyond the tax reform alone (Gini reduction remains at 0.12%), though aggregate welfare still rises to 1.10%. This asymmetry reveals a substantial leakage effect. Even modest reductions in barriers to the most prosperous locations divert workers and entrepreneurs away from disadvantaged regions, thereby decreasing the redistributive gains by half.

This paper contributes to understanding place-based policy effectiveness, especially in developing countries where migration barriers remain high. Place-based incentives generate heterogeneous effects from Tennessee Valley Authority's lasting employment gains (Kline and Moretti, 2014a) to California's enterprise zones showing no detectable impact (Neumark and Kolko, 2010), extending to developing economies where such policies are even more extensive.[1] The sources of this heterogeneity remain poorly understood (Neumark and Simpson, 2015), though Kline and Moretti (2014b) suggest that effective subsidies should limit mobility responses.[2] Recent work suggests migration may indeed undermine place-based redistribution (Atalay et al., 2025). I provide, to my knowledge, the first analysis of how the spatial pattern of changes in migration costs interacts with place-based tax policies. I find that the direction of migration barrier reductions matters more than their magnitude. Relative to reducing barriers exclusively toward secondary cities, reducing barriers also to metropolitan areas decreases spatial inequality reduction by half without generating additional aggregate welfare gains.

Second, this paper contributes to the literature using dynamic spatial general equilibrium

[1] Additional evidence includes Busso et al. (2013) on U.S. Empowerment Zones, Gobillon et al. (2012) on French zones, Chen et al. (2023) on Opportunity Zones, Incoronato and Lattanzio (2024) on Italy in the 1960s-70. Studies examining India (Chaurey, 2017), China (Lu et al., 2019), and Korea (Kim et al., 2021) document positive firm-level employment responses. However, these studies analyze place-based policies in isolation from changes in migration barriers.

[2] Theoretical work establishes normative benchmarks for spatial redistribution through optimal income taxation (Gaubert et al., 2025) or place-based policies given agglomeration spillovers (Fajgelbaum and Gaubert, 2020, 2025).

models to study policy interactions. Recent quantitative work demonstrates how trade and migration costs jointly shape aggregate and distributional outcomes. For instance, Caliendo et al. (2021) analyze the EU enlargement's trade and migration effects.[3] Kleinman et al. (2023) develop a tractable framework with forward-looking capital accumulation and migration to study their interactions. I extend Caliendo and Parro (2020) in two ways that prove important for the analysis of place-based policies. First, I model firm dynamics through occupational choice, allowing capital to move with entrepreneurs who enter and exit based on age-dependent tax incentives. Critically, I estimate the firm stay elasticity using a triple-difference strategy that exploits variation in age-dependent tax rates across space, time, and firm age. Counterfactual exercises show this margin is critical: without firm entry and exit, the same tax reform generates aggregate welfare losses rather than gains. Second, I incorporate endogenous public services funded by profit taxes, capturing the fiscal externality where tax cuts reduce government revenue and service provision—an effect that absorbs over one-third of gross welfare gains.

Third, the paper adds to the literature on internal migration. Existing work emphasizes aggregate productivity and welfare gains from reducing mobility barriers, with Lagakos et al. (2023) finding large gains from encouraging rural-urban migration, Bryan and Morten (2019) documenting similar effects for Indonesia, and Pellegrina and Sotelo (2025) showing how migration policy in Brazil shapes regional specialization and trade patterns.[4] This paper focuses on the distributional effects across space, examining how migration costs shape the effectiveness of place-based tax incentives. Vietnam's Ho Khau reform provides two advantages for such analysis. First, it changed migration costs through administrative policy, similar to the Hukou system in China, rather than infrastructure investment, avoiding the identification challenge that infrastructure simultaneously affects trade and migration costs.[5] Second, its asymmetric design generates variation across many origin-destination pairs rather than a single rural-urban corridor, allowing me to identify a leakage mechanism where even modest reductions in barriers to prosperous locations divert workers and entrepreneurs from disadvantaged regions.

The remainder of the paper proceeds as follows. Section 2 provides institutional background on Vietnam's place-based policies. Section 3 develops the dynamic spatial general equilibrium model. Section 4 discusses the estimation strategies of key structural parameters. Section 5 presents the quantitative impact of actual policies and counterfactual policy combinations. Section 6 concludes.

[3]See Parro and Desmet (2025) for a review. Using static models, Tombe and Zhu (2019) and Fan (2019) quantify the role of migration barriers in shaping the gains from trade in China.

[4]Related studies examining allocative and welfare effects of internal mobility include Imbert et al. (2022), Imbert and Papp (2020), and Morten and Oliveira (2024).

[5]Recent studies on the effects of Hukou include Wu and You (2025); An et al. (2024); Wang et al. (2021).

2 Vietnam's Place-Based Tax and Migration Reforms

Vietnam's simultaneous reforms in 2003 and 2005 provide rare variation to examine the role of migration policy on the success of place-based tax incentives for firms. The government first restructured corporate tax incentives to favor firms in disadvantaged districts, then asymmetrically liberalized internal migration by easing restrictions nationwide while maintaining higher requirements for the five major metro areas. This section describes both reforms and the fiscal redistribution policy that provides additional linkages between local and central governments.

2.1 The 2003 Tax Reform

Vietnam in 2000 confronted spatial inequality rivaling the world's most unequal countries. The Gini coefficient of provincial GDP per capita stood at 0.40—more than three times higher than the United States (0.12)—and would persist through 2003 before declining to 0.25 by 2019 (Figure A3). Table 1 illustrates the depth of these disparities across the district classifications that would form the basis for Vietnam's place-based tax policy. At the district level, poverty incidence (which captures not just income but also access to infrastructure estimated by Minot et al. (2003)) ranged from 19% in the most advantaged districts (A*) to 68% in areas facing special socio-economic difficulties (C districts). These disadvantaged districts were also geographically isolated, with population densities 40-100 times lower than advantaged areas (0.44-0.90 versus 42.26 people per acre), and economically dormant, averaging only 13-34 firms compared to 329 in A* districts. The ethnic minority share exceeded 70% in C districts, compared to just 3% in A* areas, reflecting the historical concentration of marginalized populations in remote, mountainous regions.

Table 1: Spatial Disparities by Tax Policy Classification, 2000

	Districts				Provinces				
	A*	A	B	C	A*	A	B	C	Overall
Poverty Incidence	0.19	0.31	0.47	0.68	0.20	0.35	0.41	0.57	0.41
Population per Acre	42.26	4.27	0.90	0.44	6.12	2.22	0.76	0.54	1.79
N Firms	328.9	96.9	34.4	12.6	4173.5	574.6	525.5	324.0	800.4
Minority Share	0.03	0.02	0.35	0.70	0.03	0.04	0.27	0.50	0.21
GRDP per Capita	–	–	–	–	16.30	11.90	7.40	6.33	9.82
N Obs.	66	200	113	118	5	26	14	15	60

Notes: All values are means. District-level statistics in columns 1-4; provincial statistics in columns 5-9. Firm counts from Annual Enterprise Surveys (2000-2003). GRDP data from Trinh (2019). Poverty incidence and socioeconomic indicators from Minot et al. (2003).

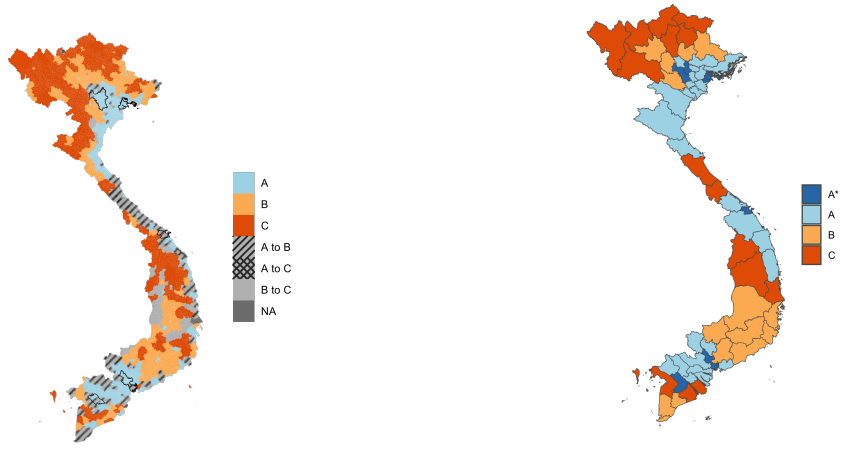
These district-level disparities aggregated into sharp provincial inequality. Provinces classified

as most disadvantaged (C), those with the highest population shares in C districts, had average GDP per capita of only 6.3 million VND in 2000, less than 40% of the 16.3 million VND in the most advantaged (A*) provinces comprising Vietnam's five major metro areas. While A* metro areas receive the same tax treatment as other A locations, their distinct role in the 2005 migration policy warrants separate designation for the spatial analysis below. The B provinces, with intermediate characteristics, exhibited GDP per capita of 7.4 million VND. These income gaps, combined with differential access to basic infrastructure embedded in poverty incidence measures, motivate the model's explicit incorporation of local public goods provision, a feature that proves important for understanding the welfare effects of spatial policies.

Figure 1 displays the spatial distribution of these classifications. Panel (a) shows the district-level designations, revealing that disadvantaged B and C districts concentrate in Vietnam's mountainous north and central highlands, precisely the areas with high poverty and ethnic minority populations documented in Table 1. Panel (b) aggregates these district classifications to the provincial level using 1999 population shares to align with available data on trade flows, migration, and local revenues.[6]

Figure 1: District and Provincial Tax Classifications

(a) Map of Tax Policy Labels (b) Map of Tax Policy Labels at Province level



Sources: Panel (a): District classifications from Decrees 164/2003/ND-CP and 88/2004/TT-BTC. Panel (b): Author's calculations based on district classifications aggregated to provincial level using 1999 population shares.
Notes: Panel (a) displays Vietnam's district-level tax policy classifications as of 2003. Panel (b) shows provincial-level aggregations where provinces are classified based on the population-weighted share of disadvantaged (B and C) districts within each province.

Vietnam's initial place-based tax policy was established through Decree No. 51/1999/ND-CP

[6]The aggregation procedure ranks remaining provinces (after designating the five centrally-administered metro areas as A*) by population-weighted share of C districts to assign C classification, then ranks among remaining provinces by population-weighted share of B districts to assign B classification. The rest are classified as A. This sequential assignment preserves district-level proportions at the provincial level while respecting the ordinal nature of disadvantage intensity. Appendix A.1 provides full details.

of July 8, 1999. This early framework created the foundational three-tier classification system, categorizing Vietnam's districts into advantaged areas (A), areas with socio-economic difficulties (B), and areas with special socio-economic difficulties (C). Under the 1999 policy, firms faced a standard tax rate of 32%, but those locating in B districts received a reduced rate of 25%, while C district firms paid only 20% (Figure 2, panel (a)).

The 2003 Enterprise Income Tax Law (No. 09/2003/QH11 and Decree No. 164/2003/ND-CP) fundamentally restructured these incentives while maintaining 82% of district classifications. Under the new regime, all firms faced a reduced base rate of 28%, but firms in disadvantaged areas received age-dependent tax holidays that varied by location (Figure 2, panel (b)). These incentives applied only to newly established firms after the reform, whose tax liability was determined by their years of operation. In particular, firms in B districts paid zero tax for two years, then 10% for years 3-8, 20% for years 9-10, and the standard 28% thereafter. C districts received even deeper incentives: zero tax for two years, 7% for years 3-8, 15% for years 9-10, and 28% subsequently. Incumbent firms established before 2003 did not receive age-graded holidays unless they qualified as new enterprises under the law's strict re-registration rules.

These age-graded incentives represent substantial location-specific subsidies. Enterprise income taxes comprised nearly 40% of Vietnamese government revenue in 2000, exceeding both value-added tax (22%) and personal income tax (2%) combined (Shukla et al., 2011). For a firm choosing between an A district and a C district, cumulative tax savings over ten years could reach 15-20 percent of total profits. This age-dependent structure, common in place-based policies worldwide but understudied, creates dynamic incentives for firm location persistence that prove crucial for identification of the dynamic spatial model detailed later.[7]

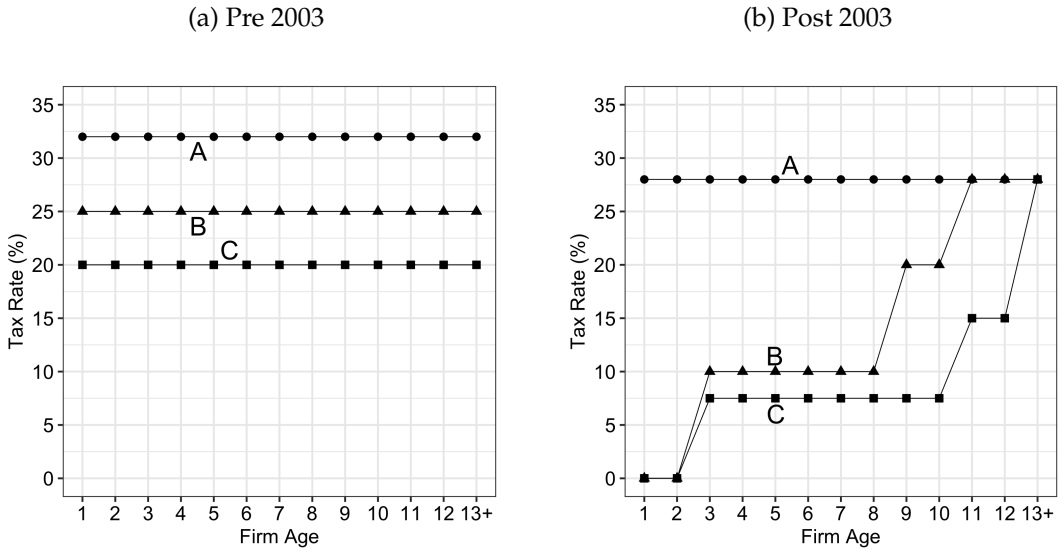
Several institutional features enhance the policy's credibility as a source of identifying variation. First, the stability of district classifications ensures that policy effects stem from the reform itself rather than endogenous relabeling. The main empirical analysis focuses on districts with stable classifications to ensure identification comes from the policy reforms rather than endogenous relabeling. Second, high closure and restart costs (requiring debt clearance certificates, asset liquidation records, and multi-agency approval) significantly limited firms' ability to exploit tax incentives through strategic dissolution and reentry. Furthermore, simply changing business names while maintaining ownership structure does not qualify for new firm benefits, as tax authorities track beneficial ownership across corporate restructuring.[8]

While the policy's treatment of multi-establishment firms adds complexity, it is unlikely to be a major concern in this context. In 2000, 99% of Vietnamese firms operated single establishments (Table A2), limiting multi-plant concerns. For the small fraction of multi-location firms, those

[7] Age-graded tax incentives are common in place-based policies worldwide. Examples include India's Industrially Backward Districts program (Hasan et al., 2021), France's Regional Assistance Zones (ZAFR), and U.S. state enterprise zones (Slattery and Zidar, 2020).

[8] See Section III Article 1 of Decree 128/2003/TT-BTC and Item 6.1.2 of Decree 88/2004/TT-BTC for specific regulatory provisions.

Figure 2: Enterprise Profit Tax Varies over Time, across Districts, and Firm Ages



Sources: Decrees No. 51/1999/ND-CP, 164/2003/ND-CP and 88/2004/TT-BTC. *Notes*: The 2003 reform maintained the three-tier district classification (A, B, C) while introducing age-dependent tax rates. Firms in disadvantaged areas (B and C districts) received progressively larger benefits in their early years of operation. The A* metro areas referenced in the analysis (five major cities) face the same tax treatment as other A districts but are distinguished for migration policy analysis.

operating across districts within a single province pay taxes at the provincial level, while firms spanning multiple provinces must file separate returns for establishments in tax-advantaged areas.[9] This treatment ensures location-specific incentives target actual production sites rather than nominal headquarters.

2.2 The 2005 Ho Khau Reform

The Ho Khau system is Vietnam's household registration framework that determines where individuals are officially recognized as residents and governs their access to essential public services. Under this system, every Vietnamese citizen maintains a registered address for administrative purposes, and this registration status determines access to public healthcare, education for children, social insurance, bank credit, and various government programs in their registered location. Similar to China's Hukou registration, Ho Khau historically restricted internal migration by linking public services to permanent residence status in one's registered location.[10] Prior to 2005, obtaining permanent residency in a province different from one's birth province required meeting complex bureaucratic requirements, including relocation certificates from origin provinces and property ownership documentation at the destination province that often created circular requirements for migrants (Liu and Meng, 2019).

[9] See Section III Article 1 of Decree 128/2003/TT-BTC and Article 11 of Decree 126/2020/ND-CP.

[10] The Ho Khau policy is less strict than the Hukou policy because, unlike the Hukou, it does not restrict individuals to the birth sector.

In 2005, Decree 108/2005/ND-CP fundamentally reformed this system by simplifying the path to permanent residency. The reform eliminated most bureaucratic prerequisites and introduced a path to permanent residency solely based on proof of residence. Migrants could obtain permanent status by demonstrating legal residence through property ownership, official confirmations from local authorities, or formal lease agreements.

Critically, the reform created differential migration cost reductions across Vietnam's provinces. While the policy reduced migration barriers nationwide, it maintained additional requirements for Vietnam's five centrally administered cities (Hanoi, Hai Phong, Da Nang, Ho Chi Minh City, and Can Tho).[11] Migrants to these major urban centers (designated A* provinces) must demonstrate continuous residence for at least one year, whereas no such requirement applies to other provinces.[12]

This institutional feature generates spatial and time variations in the magnitude of migration cost reductions. The reform substantially lowered migration costs to all provinces but created a smaller reduction for moves to the five major cities (A* provinces) compared to other destinations. This differential treatment (larger cost reductions for non-A* destinations) provides identifying variation for estimating the magnitude of Ho Khau-related migration costs in the structural model below.

2.3 Fiscal Redistribution System

While not the primary focus of this analysis, Vietnam's fiscal redistribution system creates additional equilibrium effects that interact with the tax and migration reforms. The central government operates an extensive redistribution system that transfers resources from economically advantaged to disadvantaged provinces, adjusting both revenue retention rates and direct transfers based on provincial development levels. These fiscal transfers partly offset the development disadvantages that the tax incentives aim to address while also affecting the relative attractiveness of different locations for both firms and workers.

Figure A4 illustrates the magnitude of these transfers across the provincial classifications (A*, A, B, C) described in Section 2.1, based on official Ministry of Finance records in 2003, 2006, and 2015.[13] Panel (a) shows retention rates: the most disadvantaged provinces (C) retain 100% of locally generated revenue, intermediate provinces (B) retain approximately 93-95%, while the most advantaged provinces (A*) retain only 65-75%. Panel (b) displays central transfers as a share of local revenue. C provinces receive transfers worth approximately 500% of their local revenue in 2003, declining to 100% by 2015. B provinces receive transfers worth roughly 200% of local revenue in 2003, falling to around 50% by 2015. In contrast, A* provinces receive minimal transfers (5-10% of local revenue) throughout the period.

[11] Ha Tay was merged into Hanoi in 2008 and is treated as part of Hanoi throughout this analysis.

[12] Decree 108/2005/ND-CP initially required three years of continuous residence, but the 2006 Residence Law (81/2006/QH11) reduced this to one year.

[13] Ministry of Finance, Decisions 757/2003/QD-BTC, 4526/QD-BTC, and 3137/QD-BTC.

The overlapping timing and general equilibrium nature of these three policy dimensions (tax incentives, migration costs, and fiscal redistribution) complicate credible reduced-form analysis of either reform in isolation. Tax policy changes firm incentives while simultaneously affecting local fiscal capacity through revenue effects. Migration reforms alter both labor supply and entrepreneurship patterns across space. Fiscal transfers create cross-regional spillovers that change the relative attractiveness of locations independent of the targeted reforms. Next, I develops a dynamic spatial model where these policies interact in equilibrium, treating fiscal transfers as observed policy parameters rather than choice variables. Section 4 then exploits the rich structure of both reforms (age-graded tax schedules and asymmetric migration cost reductions) to separately identify the key elasticities that determine policy effectiveness.

3 A Dynamic Spatial General Equilibrium Model

To understand how place-based tax incentives and migration policies interact, I develop a dynamic spatial general equilibrium model with three core elements necessary to capture the institutional setting: (i) age-dependent firm entry and exit responding to location-specific tax incentives, (ii) local public goods financed by tax revenues with cross-regional fiscal redistribution, and (iii) migration barriers that vary by policy regime. The framework builds on Caliendo and Parro (2020) by adding these three key features.

Time is discrete and indexed by t. The economy consists of N locations indexed by i or n, each with J sectors indexed by j. Each location has population $\mathcal{L}_{it} = L_{it} + E_{it}$, comprising L_{it} workers and E_{it} entrepreneurs. The local government provides public services G_{it} that enter agents' utility on a per-capita basis.[14]

3.1 Workers

Workers make two sequential decisions that determine spatial reallocation in response to economic conditions and idiosyncratic preferences. First, they choose whether to remain workers or become entrepreneurs in a specific sector, trading off current wages against future entrepreneurial profits. Second, those who remain workers decide where to locate, balancing higher wages and better amenities against migration costs. This two-stage structure is crucial for understanding policy effects, as tax incentives affect the entrepreneurship margin directly but influence migration indirectly through their impact on local wages and public services.

Preferences. Workers derive utility from consumption and face forward-looking occupational and location choices. Their indirect utility at the start of period t reflects both current consumption

[14] Following Fajgelbaum et al. (2018) and Caliendo et al. (2021), public goods enter utility as $G_{it}/\mathcal{L}_{it}$.

and the option value of future opportunities:

$$u_{it}^{w} = \log(C_{it}^{w}) + \max\left\{\Xi_{it} + \chi\varepsilon_{it}^{0}, \quad \max_{j=1,\ldots,J}\left\{\beta V_{it+1}^{j1} + \chi\varepsilon_{it}^{j}\right\}\right\} \tag{1}$$

where $\beta \in (0,1)$ is the discount factor. The first term captures current period utility from consumption. The second term reflects the value of future opportunities, where Ξ_{it} represents the option value of migration, V_{it+1}^{j1} denotes the expected lifetime value of becoming a new (age-1) entrepreneur in sector j, and the ε shocks capture idiosyncratic preferences across occupational choices that generate heterogeneity in worker decisions.

Worker consumption combines private goods (purchased with wages) and local public services. The Cobb-Douglas structure implies that workers value both dimensions:

$$C_{it}^{w} = \left(\frac{G_{it}}{\mathcal{L}_{it}}\right)^{\gamma}\left(\frac{w_{it}}{P_{it}}\right)^{1-\gamma} \tag{2}$$

where $\gamma \in (0,1)$ is the consumption share of public services. This formulation captures a key fiscal externality. When tax incentives reduce government revenue, the resulting decline in G_{it} directly reduces worker welfare even if wages rise.

Workers can switch sectors freely within their location. They exhibit nested CES preferences over varieties produced by entrepreneurs across locations. The aggregate price index in location i is

$$P_{it} = \prod_{j=1}^{J}\left(\frac{P_{it}^{j}}{\alpha^{j}}\right)^{\alpha^{j}}, \quad 0 < \alpha^{j} < 1 \text{ and } \sum_{j}\alpha^{j} = 1 \tag{3}$$

where α^{j} is the consumption share of sector j goods. Workers aggregate across varieties within each sector using CES preferences. The sector-specific price index reflects both the number of entrepreneurs producing varieties (E_{nt}^{j}) and their prices:

$$P_{it}^{j} = \left(\sum_{n=1}^{N} E_{nt}^{j}(p_{nit}^{j})^{1-\sigma}\right)^{1/(1-\sigma)} \tag{4}$$

where σ is the elasticity of substitution between varieties, E_{nt}^{j} is the measure of entrepreneurs (varieties) in location n and sector j, and p_{nit}^{j} is the price of goods produced in n and sold in i. This love-of-variety effect means that firm entry in a location reduces prices for all workers, creating positive spillovers beyond the direct employment effects of tax incentives.

Occupational Choice: Workers vs. Entrepreneurs. Having described worker preferences, I now turn to their occupational decisions. Workers differ in their entrepreneurial ability across sectors. After observing current wages and entrepreneurial profit opportunities, each worker draws occupation-specific preference shocks $\boldsymbol{\varepsilon}_t = \{\varepsilon_t^{j}\}_{j=0,\ldots,J}$ from a Type-I Extreme Value dis-

tribution with dispersion $\chi > 0$, where $j = 0$ denotes continued employment and $j > 0$ indicates a sector. These shocks capture idiosyncratic match quality between workers and different entrepreneurial opportunities. The dispersion parameter χ governs responsiveness to policy changes where higher χ means more heterogeneity in entrepreneurial ability, so fewer workers switch occupations in response to tax incentives.

The value V_{it+1}^{j1} represents the expected lifetime value of starting a new firm (age 1) in location i and sector j at time $t+1$. This forward-looking component is crucial because workers compare the option value as employees against the entire stream of future entrepreneurial profits, accounting for age-dependent tax rates. A worker becomes an entrepreneur only if the entrepreneurial value (plus their idiosyncratic shock) exceeds the worker option value Ξ_{it}.

Workers choose entrepreneurship in sector j with probability

$$\psi_{it}^{j} = \frac{\exp(V_{it+1}^{j1})^{\beta/\chi}}{\exp(\Xi_{it})^{1/\chi} + \sum_{k=1}^{J} \exp(V_{it+1}^{k1})^{\beta/\chi}}, \quad j > 0 \tag{5}$$

and remain workers with probability

$$\psi_{it}^{0} = \frac{\exp(\Xi_{it})^{1/\chi}}{\exp(\Xi_{it})^{1/\chi} + \sum_{k=1}^{J} \exp(V_{it+1}^{k1})^{\beta/\chi}}. \tag{6}$$

These probabilities show how workers respond to tax incentives. When tax cuts increase V_{it+1}^{j1} in disadvantaged regions, more workers may choose entrepreneurship there (higher ψ_{it}^{j}). The magnitude of this response depends on χ, a key parameter estimated in Section 4.

Migration. For workers who choose to remain employees rather than become entrepreneurs, the model features a second choice margin: where to locate. Workers draw location-specific preference shocks $\boldsymbol{\epsilon}_t = \{\epsilon_{nt}\}_{n=1}^{N}$ and choose their destination based on migration costs m_{int} and the expected value of being in destination n, denoted by $U_{nt+1} \equiv \mathbb{E}_{\epsilon}\left[u_{nt+1}\right]$.

Following Caliendo et al. (2021), the migration cost from origin i to destination n consists of a fixed component m_{in} (reflecting distance and cultural barriers) and a Ho Khau policy-related cost $mpol_{int}$:

$$m_{int} = m_{in} + mpol_{int}, \text{ with } m_{iit} = 0 \text{ and } m_{int} > 0 \text{ for } n \neq i. \tag{7}$$

The policy component $mpol_{int}$ varies by location and policy regime, capturing the differential migration barriers to A* provinces versus other locations under the Ho Khau system as well as the overall reduction in migration costs after the 2005 reform.

The value of migration opportunities, Ξ_{it}, aggregates the expected benefits across all possible destinations. It depends on the expected utility across all possible destinations, net of migration

costs:

$$\Xi_{it} \equiv \mathbb{E}\left[\max_{\{n=1,\ldots,N\}} \beta U_{nt+1} - m_{int} + \nu\epsilon_{nt}\right] = \nu \log\left[\sum_{n=1}^{N} \exp\left(\beta U_{nt+1} - m_{int}\right)^{1/\nu}\right], \tag{8}$$

where $\nu > 0$ governs the dispersion of location preferences. Crucially, this option value enters the occupational choice. That is, workers consider migration opportunities when deciding whether to become entrepreneurs, since entrepreneurship ties them to a specific location.

Workers migrate from origin i to destination n with probability

$$\mu_{int} = \frac{\exp\left(\beta U_{nt+1} - m_{int}\right)^{1/\nu}}{\sum_{n=1}^{N} \exp\left(\beta U_{nt+1} - m_{int}\right)^{1/\nu}}. \tag{9}$$

The migration share μ_{int} depends on both migration costs m_{int} (affected by Ho Khau policy through $mpol_{int}$) and destination utility U_{nt+1} (affected by tax policy through wages and public services). This interaction between policies is central to the paper's findings.

These occupational and migration decisions interact through general equilibrium effects. The lifetime utility of a worker in location i incorporates both dimensions:

$$U_{it} = \gamma \log\left(G_{it}/\mathcal{L}_{it}\right) + (1-\gamma)\log\left(w_{it}/P_{it}\right) + \chi \log\left[\exp(\Xi_{it})^{1/\chi} + \sum_{j=1}^{J} \exp(V_{it+1}^{j1})^{\beta/\chi}\right]. \tag{10}$$

The first two terms capture utility from public services and real wages. The third term reflects the option value of both migration and entrepreneurship, showing how these choices jointly determine worker welfare and spatial reallocation patterns.

3.2 Entrepreneurs

Entrepreneurs differ from workers in three key ways. First, they are tied to a specific sector and cannot switch freely. Second, they are immobile. Relocation requires exiting, migrating as a worker, and re-entering. Third, they face age-dependent profit tax rates τ_{it}^{a} that create dynamic incentives for location persistence. These features generate the firm dynamics central to understanding place-based tax policy effects.

The production side follows standard monopolistic competition with entrepreneurs producing differentiated varieties. Entrepreneurs are characterized by their age $a \in \{1, 2, \ldots, \mathcal{A}\}$, which determines their tax treatment.

Production. Each entrepreneur produces a unique variety using labor and land. The Cobb-Douglas production function is given by

$$q_{it}^{j} = A_{it}^{j}(L_{it}^{j})^{\xi^{j}}(H_{it}^{j})^{1-\xi^{j}} \tag{11}$$

where A_{it}^j is location-sector productivity, ξ^j is the labor share, and land supply $\bar{H}_i$ is fixed in each location.

Cost minimization under competitive input markets determines the unit cost bundle:

$$x_{it}^j = B^j \left(w_{it}\right)^{\xi^j} \left(r_{it}\right)^{1-\xi^j} \tag{12}$$

where w_{it} denotes the local wage, r_{it} the land price, and B^j is a constant, $B^j = \xi^{j-\xi^j}(1-\xi^j)^{-(1-\xi^j)}$. With fixed land supply, the land market clearing condition pins down rents:

$$r_{it} H_{it}^j = \frac{1-\xi^j}{\xi^j} w_{it} L_{it}^j. \tag{13}$$

This fixed supply of land creates a congestion force. As more firms enter a location, rising rents (r_{it}) increase costs, limiting agglomeration benefits from market size expansion.

Entrepreneurs set prices with a constant markup over delivered costs, where delivery includes iceberg trade costs d_{int}^j to destination n:

$$p_{int}^j = \frac{\sigma}{\sigma-1} \frac{d_{int}^j x_{it}^j}{A_{it}^j}. \tag{14}$$

Entrepreneurs sell their varieties across all locations. Pre-tax profits depend on three margins that respond to spatial policies:

$$\pi_{it}^j = \left(\frac{\sigma-1}{\sigma}\right)^{\sigma} \left(\frac{A_{it}^j}{x_{it}^j}\right)^{\sigma-1} \sum_{n=1}^{N} (d_{int}^j)^{1-\sigma} X_{nt}^j (P_{nt}^j)^{\sigma-1} \tag{15}$$

where X_{nt}^j represents expenditure on sector j in location n. Profits rise with productivity relative to costs (A_{it}^j / x_{it}^j), fall with trade costs to destinations, and increase with destination market size. Tax incentives affect profits directly through statutory rates τ_{it}^a but also indirectly by changing local costs (through factor prices) and destination demand (through income effects).

Exit Decisions. Having described how entrepreneurs produce and earn profits, I now turn to their dynamic decisions about continuation versus exit. Entrepreneurs consume after-tax profits and then decide whether to continue operations or exit to become workers. Each entrepreneur draws option-specific preference shocks $\varepsilon_t^{ja,0}$ and $\varepsilon_t^{ja,1}$ from independent Type-I Extreme Value distributions with dispersion χ, where the superscript 0 denotes continuation and 1 denotes exit. Geographic immobility means entrepreneurs remain in their current location unless they exit entirely.

Entrepreneur consumption has the same structure as worker consumption, combining public

services and private income:

$$C_{it}^{ja} = \left(\frac{G_{it}}{\mathcal{L}_{it}}\right)^{\gamma} \left((1-\tau_{it}^{a})\frac{\pi_{it}^{j}}{P_{it}}\right)^{1-\gamma} \tag{16}$$

The key difference is the income source. Entrepreneurs consume after-tax profits $(1-\tau_{it}^{a})\pi_{it}^{j}$ while workers consume wages w_{it}. This parallel structure means both groups experience the same fiscal externality when tax incentives reduce G_{it}.

The value function for entrepreneurs reflects current consumption and future continuation opportunities:

$$v_{it}^{ja} = \log(C_{it}^{ja}) + \max\left\{\beta V_{it+1}^{ja'} + \chi\varepsilon_{t}^{ja,0}, \beta U_{it+1} + \chi\varepsilon_{t}^{ja,1}\right\} \tag{17}$$

where $a' = \min\{a+1, \mathcal{A}\}$ and $V_{it+1}^{ja'}$ is the value of continuing with age a', while U_{it+1} is the value of exiting to become a worker. The idiosyncratic shocks $\{\varepsilon_{t}^{ja,0}, \varepsilon_{t}^{ja,1}\}$ generate heterogeneity in exit decisions across otherwise identical firms. The expected value function is

$$V_{it}^{ja} = \log(C_{it}^{ja}) + \chi \log\left[\exp\left(V_{it+1}^{ja'}\right)^{\beta/\chi} + \exp\left(U_{it+1}\right)^{\beta/\chi}\right], \tag{18}$$

and entrepreneurs continue operations with probability

$$\varsigma_{it}^{ja} = \frac{\exp(\beta V_{it+1}^{ja'}/\chi)}{\exp(\beta V_{it+1}^{ja'}/\chi) + \exp(\beta U_{it+1}/\chi)}. \tag{19}$$

This continuation probability is critical for understanding dynamic tax policy effects. Age-specific rates create incentives for firm persistence: entrepreneurs facing low current taxes but anticipating higher future rates are more likely to remain in place to retain preferential treatment.

Entrepreneurs in the same location-sector-age cell earn identical profits and differ only in their exit shocks.[15] These entry and exit decisions, combined with workers' occupational choices from the previous subsection, determine the equilibrium distribution of firms across locations in response to tax incentives and migration policies.

3.3 Local Government

Having described how workers and entrepreneurs make decisions, I now turn to the government sector that provides public services and redistributes resources across regions. In each location i, local governments fund public services G_{it} through central transfers, land rent, and profit taxes.

[15]The model abstracts from productivity heterogeneity within location-sector cells. All firms in the same (i, j) cell earn identical profits π_{it}^{j} and differ only in their idiosyncratic exit shocks ε_{t}^{ja} and age-specific tax. This simplification maintains computational tractability while replicating Vietnam's statutory age-dependent tax structure. Incorporating heterogeneous productivity types within each (i, j, a) cell would require tracking firm-type distributions across N locations, J sectors, and $\mathcal{A}$ age groups in each time period, substantially increasing the state space.

The budget constraint is

$$P_{it}G_{it} = \Omega_{it}\Lambda_t + \omega_{it}\underbrace{\left(r_{it}H_i + \sum_{j=1}^{J}\sum_{a=1}^{\mathcal{A}} E_{it}^{ja}\tau_{it}^{a}\pi_{it}^{j}\right)}_{\Gamma_{it}} \tag{20}$$

where ω_{it} is the local retention rate of revenue Γ_{it} from land and profit taxes, Ω_{it} is location i's share of central government budget, and Λ_t is total central government revenue given by

$$\Lambda_t = \sum_{i=1}^{N}(1-\omega_{it})\Gamma_{it}. \tag{21}$$

The budget constraint shows how place-based tax incentives create fiscal externalities. When tax rates τ_{it}^{a} decline in disadvantaged regions, local revenue Γ_{it} falls, reducing public services G_{it} unless offset by central transfers. The retention rate ω_{it} determines how much revenue leakage occurs: disadvantaged provinces retain more ($\omega_{it} \approx 1$) while developed areas send resources to the center ($\omega_{it} < 0.75$). The model assumes local governments spend all revenue on public services, consistent with Vietnam's institutional context where local governments derive substantial revenue from land and tax collection.[16]

3.4 Equilibrium

Equilibrium requires that goods markets clear through trade, labor markets clear through wage adjustments, and factor allocations satisfy optimization conditions. This subsection describes the static equilibrium conditions that must hold each period, then characterizes the dynamic evolution of the spatial distribution of economic activity.

Goods markets clear through trade. The bilateral trade share from location i to destination n in sector j depends on the number of producers and their relative prices:

$$\lambda_{int}^{j} = E_{it}^{j}\left(\frac{p_{int}^{j}}{P_{nt}^{j}}\right)^{1-\sigma} \tag{22}$$

This gravity-style relationship means that firm entry in location i increases its export share to all destinations, creating spatial spillovers from place-based policies.

Sectoral expenditure follows constant shares is given by

$$X_{it}^{j} = \alpha^{j}\Pi_{it} \tag{23}$$

where location income Π_{it} combines three sources: the value of public services (government bud-

[16] As detailed in Subsection 2.3, the retention rates ω_{it} and shares Ω_{it} reflect observed fiscal redistribution policies. Incorporating strategic public finance interactions between government tiers is beyond this paper's scope but would be an interesting extension.

get), labor earnings, and entrepreneurial income net of taxes:

$$\Pi_{it} = P_{it}G_{it} + \sum_{j=1}^{J}\left(w_{it}L_{it}^{j} + \pi_{it}^{j}\sum_{a=1}^{\mathcal{A}}E_{it}^{ja}(1-\tau_{it}^{a})\right). \tag{24}$$

This expression shows how tax policy affects local income both directly (through τ_{it}^{a} reducing entrepreneur income) and indirectly (through effects on wages and public services).

Labor market clearing pins down wages as a function of sectoral demand across all trading partners:

$$w_{it}L_{it}^{j} = \xi^{j}\frac{\sigma-1}{\sigma}\sum_{n=1}^{N}\lambda_{int}^{j}X_{nt}^{j}. \tag{25}$$

The term $\sum_{n=1}^{N}\lambda_{int}^{j}X_{nt}^{j}$ captures total demand for location i's output in sector j, showing how trade linkages transmit policy effects across space.

These static conditions determine equilibrium prices and allocations within each period. The spatial distribution of economic activity evolves through two dynamic margins: entrepreneur entry and exit, and worker migration and occupational choice.

Entrepreneur dynamics reflect occupational choice and survival. New entrepreneurs (age 1) enter from the worker population:

$$E_{it+1}^{j1} = \psi_{it}^{j}L_{it} \tag{26}$$

where ψ_{it}^{j} is the entry probability from equation (5). Existing entrepreneurs age and face exit risk:

$$E_{it}^{ja} = \varsigma_{i,t-1}^{j,a-1}E_{i,t-1}^{j,a-1} \qquad \text{for } a \in \{2,\ldots,\mathcal{A}-1\}, \tag{27}$$

$$E_{it}^{j\mathcal{A}} = \varsigma_{i,t-1}^{j,\mathcal{A}-1}E_{i,t-1}^{j,\mathcal{A}-1} + \varsigma_{i,t-1}^{j\mathcal{A}}E_{i,t-1}^{j\mathcal{A}} \tag{28}$$

where ς_{it}^{ja} is the age-specific continuation probability from equation (19). The total mass of entrepreneurs by location is:

$$E_{it+1} = \sum_{j=1}^{J}\sum_{a=1}^{\mathcal{A}}E_{it+1}^{ja}. \tag{29}$$

Worker dynamics combine migration flows and transitions from exiting entrepreneurs:

$$L_{it+1} = \sum_{n=1}^{N}\mu_{nit}\psi_{nt}^{0}L_{nt} + \sum_{j=1}^{J}\sum_{a=1}^{\mathcal{A}}(1-\varsigma_{it}^{ja})E_{it}^{ja}. \tag{30}$$

The first term captures workers migrating from other locations who remain workers (ψ_{nt}^{0} from equation (6)). The second term represents entrepreneurs who exit and become workers. These flows generate the spatial reallocation central to evaluating tax and migration policies.

I now formally define equilibrium in two stages. The static equilibrium describes within-period outcomes given the current distribution of workers and firms. The sequential equilibrium

traces the full dynamic path.

Each period's equilibrium depends on fundamentals (trade costs d_{int}^{j}, productivity A_{it}^{j}, migration costs m_{in}), policies (tax rates τ_{it}^{a}, Ho Khau barriers $mpol_{int}$, fiscal parameters ω_{it}, Ω_{it}), and state variables (distributions L_{it} and E_{it}^{ja}).

Definition 1. Each period t, given state variables $\{L_{it}, E_{it}^{ja}\}_{i,j,a}$, policies, and fundamentals, the *static equilibrium* is a set of factor prices $\{w_{it}, r_{it}\}_i$ that solve the price indices (3)-(4), firm optimization (14)-(15), and market clearing (22)-(25).

For ease of notation, let variables with only time subscripts denote matrices. For example, L_t is an $N \times 1$ matrix representing the cross-location distribution of labor at t.

Definition 2. Given initial allocations $\mathcal{S}_0 = \{L_{i0}, E_{i0}^{ja}\}_{i,j,a}$ and sequences of fundamentals and policies, a *sequential competitive equilibrium* consists of sequences $\{L_t, \mu_t, E_t, \varsigma_t, \psi_t, V_t, U_t, w_t, r_t, P_t\}_{t=0}^{\infty}$ that solve the worker and entrepreneur problems (10), (17), population dynamics (30), (26)-(28), government budget (20), and static equilibrium conditions at each t.

This definition makes clear that equilibrium requires consistency between agents' forward-looking decisions (embodied in V_t and U_t) and the resulting spatial distributions (L_t and E_t).

3.5 Solving the Model with Policy Changes

Evaluating counterfactual policies requires solving the model under alternative tax and migration regimes. A standard approach would require data on unobservable fundamentals like productivity A_{it}^{j} and migration costs m_{in} in levels. Following Caliendo et al. (2019), I use a "dynamic hat algebra" approach that solves for counterfactual outcomes using only observable changes in policies and outcomes, without estimating fundamental parameters. This method also accommodates Vietnam's rapid growth by allowing the economy to be in transition rather than requiring steady state.

The solution proceeds in three steps. First, construct the actual economy. Using observed data from 2000-2019, I solve for the sequential equilibrium under actual policies. From 2019 onward, I assume fundamentals and policies remain constant and solve to steady state. This provides the baseline economy incorporating all observed policy changes. Then, I solve for counterfactual changes. Given a counterfactual policy sequence $\widehat{\mathcal{P}}_t$ (expressed as changes relative to actual policies), Proposition 2 shows how to solve for the counterfactual equilibrium without knowing fundamental levels. Lastly, I calculate welfare effects. Using the difference between actual and counterfactual paths, I measure welfare changes via compensating variation.

I use the dot notation to indicate relative time changes for each variable y, denoted by $\dot{y}_{t+1} \equiv y_{t+1}/y_t$. The key insight is that relative changes over time depend only on observables:

Proposition 1. *Given allocation $(\mathcal{S}_t, \mu_{t-1}, \varsigma_{t-1}, \psi_{t-1}, \lambda_t)$ and constant sequences of policies and fundamentals following t, the sequential equilibrium in relative time change can be solved without knowing the levels of fundamentals and policies.*

This extends the approach of Caliendo et al. (2019) to incorporate entrepreneur heterogeneity by age and occupational choice margins. The proof appears in Appendix E. Comparing actual and counterfactual paths yields the second key result. For each variable x, define the hat notation $\widehat{x}_{t+1} = \frac{x'_{t+1}}{x_{t+1}}$ where x' is the value in the counterfactual economy:

Proposition 2 (Dynamic Hat Algebra)**.** *Given an economy* $\{\mathcal{S}_t, \mu_{t-1}, \varsigma_{t-1}, \psi_{t-1}, \lambda_t\}_{t=0}^{\infty}$ *and a sequence of policy changes relative to the actual economy* $\{\widehat{\mathcal{P}}_t\}_{t=1}^{\infty}$*, the counterfactual sequential equilibrium can be determined without requiring information on the level of the fundamentals.*

This proposition enables the central counterfactual exercise which is isolating the effect of specific policies (tax reform or Ho Khau liberalization) while holding other factors constant. I assume that households do not anticipate the counterfactual policy at time $t = 0$ but instead learn about the entirely new policy sequence starting from period $t = 1$. Consequently, this approach allows me to address the counterfactual question: How would the economy change if the only alteration were a policy while all other factors (such as changes in fundamentals and other policies) continued to evolve as observed in the data?

I measure welfare using consumption-equivalent variation for workers in each location[17]. The welfare change accounts for both direct utility from consumption and the option value of migration and entrepreneurship:

$$\widehat{W}_i = \sum_{t=1}^{\infty} \beta^t \log \frac{(\widehat{G}_{it}/\widehat{\mathcal{L}}_{it})^{\gamma}(\widehat{w}_{it}/\widehat{P}_{it})^{1-\gamma}}{(\widehat{\mu}_{iit})^{\nu}(\widehat{\psi}^0_{it})^{\chi}}. \tag{31}$$

The numerator captures changes in real consumption from wages, public services, and prices. The denominator adjusts for changes in the value of staying in location i (through $\widehat{\mu}_{iit}$) and remaining a worker (through $\widehat{\psi}^0_{it}$).

Applying this method requires two key inputs from estimation. First, the Ho Khau migration cost changes $\Delta mpol_{int}$, which I estimate using the reform's differential effects across destinations (Subsection 4.3). Second, the occupational choice parameter χ, which governs firm entry and stay elasticities and is identified from age-dependent tax variation (Subsection 4.2).

4 Data and Estimation

Quantifying the model requires two key elasticities. The first governs how firm survival responds to age-dependent tax incentives. The second captures how migration costs changed under the Ho Khau reform. Identifying these parameters is challenging because Vietnam implemented both reforms within two years, alongside concurrent changes in trade policy, infrastructure investment, and local government capacity.

[17] Appendix E shows the derivation.

I address these challenges using triple-difference strategies that exploit quasi-experimental variation in both policies. For tax incentives, I leverage variation across space, time, and firm age. For migration barriers, I exploit differential changes across origins, destinations, and reform timing. This approach differences away general equilibrium confounds while recovering model-consistent elasticities that discipline the quantitative analysis.

4.1 Data

The quantitive analysis combines multiple data sources to measure policy effects on firm locations, migration, and local public finance.

The primary firm-level analysis draws on annual enterprise surveys conducted by Vietnam's General Statistics Office (GSO) covering 2000 to 2019. This survey is mandatory for all registered firms, providing detailed information on firm location, employment, and industry classification. Following McCaig et al. (2022), I construct consistent firm identifiers and industry codes to track firms over time. Starting in 2004, single-location household businesses employing fewer than ten workers became exempt from registration requirements, allowing them to operate informally without survey reporting or tax obligations.

Despite this exemption, many small enterprises register voluntarily, as evidenced by the firm size distribution in Figure A5. The omission of the informal sector from our establishment data has minimal impact on measuring policy effects for several reasons. First, McCaig et al. (2022) and McCaig and Pavcnik (2021) document that most private firms begin as formal entities, with only 2% of informal firms transitioning to formality within two years. Second, while informal employment represents a substantial share of total employment, Cling et al. (2011) estimates that informal activities contribute only 20% of GDP. Third, the identification strategy in section 4 relies primarily on variation in firm behavior across ages and locations among already-registered firms, rather than relying on firm entry, which could be contaminated by informal-to-formal transitions.

To analyze migration responses to policy changes, I use the Population and Housing Census data from 1999, 2009, and 2019. These censuses provide representative migration flows for Vietnam's 60 provinces. Following the GSO definition, I classify individuals as migrants if their current province differs from their residence five years prior. While this definition may underestimate total mobility by excluding seasonal migration or return migration within five years, it provides a consistent measure of permanent migration decisions that align with the Ho Khau system's focus on permanent residence status.

Inter-provincial trade flows for 2000 come from JICA (2000). I supplement these with bilateral truck distances between all province pairs calculated using ArcGIS network analysis and 1999 IPUMS administrative boundary maps. These data calibrate trade cost parameters in the spatial model. Finally, provincial Gross Regional Domestic Product (GRDP) data come from Trinh (2019). Annual provincial population figures from 2000 to 2019 come from Vietnam's statistical yearbooks (General Statistics Office, 2016).

4.2 Identifying the Firm-Stay Elasticity

The model predicts that lower taxes increase firm survival by raising after-tax profits and continuation values. I exploit this relationship to estimate the firm-stay elasticity using the 2003 tax reform. The reform varied tax rates by district classification, year, and firm age, creating triple-difference variation that identifies how survival responds to tax changes.

The firm continuation probability (equation (19)) delivers a specific estimating equation linking survival odds to after-tax profits. Taking logs of the continuation-to-exit ratio and substituting the model's value functions yields[18]

$$\log\left(\frac{\varsigma_{it}^{ja}}{1-\varsigma_{it}^{ja}}(1-\varsigma_{it+1}^{ja+1})^{\beta}\right)=\frac{\beta(1-\gamma)}{\chi}\log\left[(1-\tau_{it+1}^{a+1})\frac{\pi_{it+1}^{j}}{P_{it+1}}\right]+\Phi_{it}, \tag{32}$$

where the left-hand side combines current survival odds $\varsigma_{it}^{ja}/(1-\varsigma_{it}^{ja})$—the ratio of firms that continue to those that exit—with the forward-looking term $(1-\varsigma_{it+1}^{ja+1})^{\beta}$ capturing next period's exit probability. The right-hand side shows that this composite measure responds to after-tax real profits, with the intercept Φ_{it} absorbing location-time effects.

I define the unlogged version of the outcome variable as the Local Age-Specific Turnover rate (LAST): $\text{LAST}_{it}^{ja} \equiv \frac{\varsigma_{it}^{ja}}{1-\varsigma_{it}^{ja}}\left(1-\varsigma_{it+1}^{ja+1}\right)^{\beta}$. It combines current survival odds, $\frac{\varsigma_{it}^{ja}}{1-\varsigma_{it}^{ja}}$, with the forward-looking continuation value, $\left(1-\varsigma_{it+1}^{ja+1}\right)^{\beta}$. The equation motivates the following regression specification

$$\log(\text{LAST}_{it}^{ja})=\theta\log(1-\tau_{it+1}^{a+1})+\Phi_{it}^{j}+\varphi_{i}^{a}+\eta_{t}^{a}+\varepsilon_{it}^{ja}, \tag{33}$$

where $\theta=\beta(1-\gamma)/\chi$ is the firm-stay elasticity. The parameter combines the discount factor, consumption share, and idiosyncratic shock dispersion. The specification includes district-sector-year fixed effects (Φ_{it}^{j}), district-age effects (φ_{i}^{a}), and age-year effects (η_{t}^{a}). Standard errors are clustered at the district-age level. I estimate equation (33) using Poisson pseudo-maximum likelihood (PPML) given the presence of many zeros at the firm-age-district level.

The main identification threat of θ is compositional sorting. If tax subsidies attract high-productivity entrepreneurs to disadvantaged districts, survival gains would partly reflect selection of stronger firms rather than pure tax effects. This mechanism would inflate the estimated elasticity. However, the triple-difference specification requires a specific sorting pattern to bias estimates. Selection must differ more for young firms in the most disadvantaged districts compared to both young firms in moderately poor districts and old firms in the same locations. Additional evidence, comparing firms and employment between B and C districts, in Appendix C shows the

[18] The derivation starts from equations (18) and (19). The continuation term incorporates next-period's exit probability: $(1-\varsigma_{it+1}^{ja+1}) = \exp(U_{it+2})^{\beta/\chi}/[\exp(V_{it+2}^{ja+2})^{\beta/\chi}+\exp(U_{it+2})^{\beta/\chi}]$. After substitution and rearrangement, terms common to all firms in a location-sector-age cell are absorbed into $\Phi_{it} = \frac{\beta}{\chi}\gamma\log(G_{it+1}/\mathcal{L}_{it+1})+\frac{\beta^2}{\chi}U_{it+2}-\frac{\beta}{\chi}U_{it+1}$, which captures public goods per capita and continuation values.

opposite pattern. Average firm size declined in treated districts after the reform, suggesting entry of smaller firms rather than selective location of productive entrepreneurs.

Table 2: Firm-Stay Elasticity Estimates

	Survival Odds		LAST	
	(1)	(2)	(3)	(4)
$\log(1-\tau)$	1.47***	1.23***	1.54***	0.89**
	(0.25)	(0.25)	(0.42)	(0.45)
Pseudo R^2	0.52	0.54	0.33	0.34
Observations	82,645	82,572	58,053	57,902
# District-Age	7,906	7,906	5,144	5,144
District-Age fixed effects	✓	✓	✓	✓
District-Sector-Year fixed effects	✓	✓	✓	✓
Age-Year fixed effects		✓		✓

Notes: This table estimates how firm survival responds to age-dependent tax cuts from the 2003 reform using Poisson pseudo-maximum likelihood (PPML). The dependent variable in columns (1)-(2) measures survival odds. Columns (3)-(4) use LAST, which incorporates forward-looking continuation values. Standard errors clustered at the district-age level. Sample covers 2000-2019 for firms in districts with stable A/B/C classifications.

Table 2 reports the estimates. Columns (1)-(2) show results using only current survival odds without continuation values. Columns (3)-(4) present the main results using LAST with different fixed effect structures.[19] Column (4), which includes the full set of fixed effects, delivers an estimate of $\widehat{\theta} = 0.89$, statistically significant at the 5 percent level. A ten-percentage-point cut in the statutory rate increases survival odds by approximately 10%.

Estimates of firm-stay elasticity are virtually absent from the literature. The closest comparison is Cevik and Miryugin (2022), who report a hazard coefficient on effective marginal tax rates in a cross-country panel. Converting their semi-elasticity to our metric yields an implied elasticity of approximately 0.85.[20]

The preferred estimate of 0.89 is remarkably close to the external benchmark of 0.85. This concordance is reassuring despite two important distinctions. First, effective marginal tax rates embed depreciation and financing provisions absent from Vietnam's age-graded statutory cuts. Second, the identification here relies on sharp within-district, within-age variation that strips out cross-country heterogeneity. This agreement reinforces confidence in both the reduced-form estimate and the calibrated shock dispersion parameter χ used in the counterfactual exercises.

[19] The LAST specification uses 70% of the sample because it requires observing the same cohort one year later.

[20] The calculation starts from their hazard semi-elasticity of 3.951 and converts through several steps accounting for the relationship between hazard rates, tax rates, and survival odds. The conversion ignores timing differences between their continuous-time hazard and our annual odds ratio but provides a useful benchmark.

4.3 Identifying Changes in Ho Khau-related Migration Cost

The 2005 Ho Khau reform reduced the policy component of bilateral migration costs nationwide, creating two sources of variation. First, the reform generated a temporal reduction common to all province pairs. Second, five centrally controlled cities (Hanoi, Ho Chi Minh City, Da Nang, Can Tho, and Hai Phong, collectively denoted A^*) received smaller cost reductions to limit excessive inflows into large urban centers. This differential treatment creates spatial variation across destination types.

I use migration flows from the Population and Housing Censuses conducted in 1999 (pre-reform) and 2009 (post-reform). The ten-year interval allows sufficient time for migration responses to manifest while avoiding confounds from subsequent policy changes.

Formally, decompose the change in the policy component of bilateral migration costs between the pre-reform and post-reform periods as

$$\Delta mpol_{in} \equiv mpol_{in,\text{post}} - mpol_{in,\text{pre}} = \Delta_T + \Delta_L \cdot \mathbf{1}(n \in A^*) + \omega_{in}, \tag{34}$$

where $\Delta_T < 0$ is the nationwide temporal reduction in policy barriers (common to all pairs), $\Delta_L > 0$ is the additional differential for regulated-city destinations (so that A* cities experience a smaller total reduction $\Delta_T + \Delta_L$ closer to zero), and ω_{in} captures residual bilateral variation that is not Ho Khau. Non-policy time-invariant migration costs from geography and culture remain unchanged during this period, so $\Delta m_{in} = \Delta mpol_{in}$. My goal is to identify (Δ_T, Δ_L) separately.

As equation (35) shows, observed flows depend on both current migration costs and future location values through option-value terms:

$$\log \frac{\mu_{int}}{\mu_{iit}} = -\frac{1}{\nu} m_{int} + \frac{\beta}{\nu} \left(U_{nt+1} - U_{it+1} \right). \tag{35}$$

Any policy shock to m_{int} affects future wages and amenities (including endogenous public services $G_{nt}/\mathcal{L}_{nt}$) in both locations, thereby contaminating $(U_{nt+1} - U_{it+1})$. To isolate pure cost changes, I take inspiration from Head and Ries (2001) and construct the bilateral Head-Ries (HR) index. Taking the difference of equation (35) for flows from i to n and the reverse flow from n to i, the option-value terms $(U_{nt+1} - U_{it+1})$ cancel exactly, yielding

$$\text{HR}_{int} \equiv \log \left(\frac{\mu_{int}}{\mu_{iit}} \frac{\mu_{nit}}{\mu_{nnt}} \right) = -\frac{1}{\nu} (m_{int} + m_{nit}),$$

which is symmetric in (i, n) and depends solely on bilateral costs. Therefore, the change

$$\Delta \text{HR}_{int} = \text{HR}_{in,\text{post}} - \text{HR}_{in,\text{pre}} = -\frac{1}{\nu} (\Delta m_{in} + \Delta m_{ni})$$

isolates policy-driven cost changes without general equilibrium contamination.

The identification strategy separately recovers the temporal and spatial components through a two-step procedure.

Step 1: Temporal Variation (Δ_T). I focus on province pairs where neither origin nor destination is a regulated city ($i, n \notin A^*$). For these pairs, equation (34) simplifies to $\Delta mpol_{in} = \Delta_T + \omega_{in}$. Under the identifying assumption

$$\mathbb{E}[\omega_{in} \mid i, n \notin A^*] = 0, \tag{36}$$

the mean change in the HR index for non-A* pairs identifies the temporal component:

$$\mathbb{E}[\Delta \text{HR}_{int} \mid i, n \notin A^*] = -\frac{2}{\nu}\Delta_T.$$

Assumption (36) requires that, among non-regulated province pairs, changes in migration costs between 1999 and 2009 are driven solely by the Ho Khau reform. Violations would arise if specific non-A* pairs experienced differential infrastructure improvements (e.g., new highways connecting particular provinces) or regional trade agreements that reduced bilateral frictions independently of the Ho Khau policy.[21]

Step 2: Spatial Variation (Δ_L). To recover the differential treatment of A* destinations, I estimate the following PPML specification on the full sample of province pairs:

$$\text{HR}_{int} = \gamma \mathbf{1}(i \in A^*,\, n \in A^*,\, t = 2009) + \varrho_{in} + \vartheta_{it} + \varphi_{nt} + \varepsilon_{int}, \tag{37}$$

where the triple interaction indicator equals one only when both origin and destination are regulated cities in the post-reform period (2009). Bilateral fixed effects ϱ_{in} absorb all time-invariant frictions (geography, culture), while origin-year fixed effects ϑ_{it} and destination-year fixed effects φ_{nt} control for all unilateral shocks (e.g., changes in origin-specific push factors or destination-specific pull factors). This structure ensures that γ identifies purely bilateral variation between A*-A* pairs, not unilateral trends in A* city attractiveness. Standard errors are clustered by origin-destination pair.

The coefficient γ identifies the spatial differential under the assumption

$$\mathbb{E}[\varepsilon_{int} \mid i \in A^*, n \in A^*, \varrho_{in}, \vartheta_{it}, \varphi_{nt}] = 0. \tag{38}$$

Assumption (38) requires that, conditional on pair, origin-year, and destination-year fixed effects, A*-to-A* pairs have no differential time-varying bilateral frictions relative to other pair types. Violations would occur if A* cities jointly invested in inter-city transportation networks (e.g., expressways connecting only large cities) or if agglomeration spillovers between A* pairs evolved differently during this period. The geographic distance between A* locations (see Figure 1b) and

[21] Similar to the literature on bilateral trade costs, one could argue that the bilateral non-policy components of migration costs are typically related to factors that are persistent over time, such as geographic distance, linguistic or cultural differences, and historical migration networks. If this is the case, time-varying deviations ω_{in} are plausibly small, and Assumption (36) is likely to hold.

the fact that major infrastructure improvements during 2005-2009 primarily connected A* cities to coastal areas rather than targeting specific city pairs among the A* (Balboni, 2025) support the plausibility of Assumption (38).

Table 3: Spatial Variation Estimates of 2005 Ho Khau Reform

	HRIndex
	(1)
$\mathbf{1}(i \in A^*, n \in A^*, t = 2009)$	-0.519**
	(0.244)
Observations	2,837
# O-D Pairs	1,493
Pseudo R^2	0.18
Mean HR Changes (non-A* pairs)	0.664
Origin-Destination fixed effects	✓
Origin-Year fixed effects	✓
Destination-Year fixed effects	✓

Notes: This table estimates the spatial differential in Ho Khau migration cost changes using the Head-Ries index $\text{HR}_{int} = \log[(\mu_{int}/\mu_{iit})(\mu_{nit}/\mu_{nnt})]$ as the dependent variable, which differences out general equilibrium effects to isolate bilateral cost changes. The coefficient $\widehat{\gamma}$ captures the additional cost reduction for A*-to-A* pairs (negative sign indicates these pairs received smaller reductions). Mean HR Changes (non-A* pairs) identifies the temporal component $-\frac{2}{\nu}\Delta_T$ among unregulated province pairs. Sample: 1999 and 2009 Population and Housing Censuses. Standard errors (in parentheses) clustered by origin-destination pair.

Table 3 reports the estimation results. The row labeled Mean HR Changes (non-A* pairs) shows that $\mathbb{E}[\Delta \log \text{HR}_{int} \mid i, n \notin A^*] = 0.664$. Under Assumption (36), this identifies $-\frac{2}{\nu}\Delta_T = 0.664$, implying $\Delta_T < 0$ and confirming a reduction in migration costs on average among non-A* pairs following the reform.

The estimated triple-interaction coefficient $\widehat{\gamma} = -0.519$ (s.e. 0.244, significant at 5%) captures the spatial differential. A*-to-A* pairs experienced a smaller reduction in bilateral costs relative to other pair types. Since $\widehat{\gamma} = -\frac{2}{\nu}\Delta_L$ and the coefficient is negative, this implies $\Delta_L > 0$. Regulated cities indeed received less relief from registration hurdles, consistent with the policy's stated objective of limiting excessive inflows into large urban centers.

The two-step identification strategy separately recovers the temporal (Δ_T) and spatial (Δ_L) components of the 2005 Ho Khau reform. Both estimates are scaled by the migration elasticity ν, which I calibrate below. Given (Δ_T, Δ_L) and ν, I construct the implied changes in bilateral migration costs $\Delta mpol_{in}$ using equation (34) and feed them into the quantitative spatial model for counterfactual analysis.

4.4 Internal Trade Flows

Trade flows are observed only for 2000, but the model requires annual flows from 1999-2019. I estimate sector-specific distance elasticities from the 2000 cross-section using a gravity approach, then construct time-varying flows using these elasticities combined with observed production and expenditure.

Following Monte et al. (2018), I assume iceberg trade costs take the power form $d_{in}^j = (\text{dist}_{in})^{\kappa^j}$, where κ^j is the sector-specific distance elasticity. Substituting into the trade share equation (22) and taking logs yields the gravity specification

$$\log \lambda_{in}^j \;=\; (1-\sigma)\,\kappa^j \,\log \text{dist}_{in} + \alpha_i^j + \delta_n^j + \varepsilon_{in}^j, \tag{39}$$

where λ_{in}^j is the share of province n's expenditure on sector-j goods sourced from province i, α_i^j is an origin fixed effect absorbing productivity $\log A_i^j$, and δ_n^j is a destination fixed effect absorbing the price index $\log P_n^j$.

I estimate equation (39) using trade data from JICA (2000), which reports inter-provincial flows across all sectors for 2000, matched to bilateral truck distances computed using an ArcGIS network-routing algorithm on the 1999 IPUMS province shapefile. I use PPML estimation with origin and destination fixed effects, clustering standard errors by province pair.

Figure A6 shows the estimated distance elasticities $(1-\sigma)\kappa^j$ across sectors with 95% confidence intervals. Estimates range from -0.8 to -1.8 and are all statistically significant. These magnitudes are similar to the benchmark of -1.29 for the United States (Monte et al., 2018).

Given the estimated elasticities $\{\widehat{\kappa}^j\}$ and time-invariant bilateral distances, I construct annual trade flows from 1999-2019 using observed sectoral production and expenditure. The trade share equation (22) allows recovering bilateral flows from these observables combined with equilibrium price indices. The detailed procedure iterates between trade shares, price indices, and market-clearing conditions, ensuring constructed flows remain consistent with the model's general equilibrium structure (Appendix B.2).

4.5 Model Implementation

Implementation choices. Integrating annual firm data with decennial census data requires three key implementation choices.

First, firms are observed annually while censuses report five-year migration rates every ten years. To have one model period correspond to a calendar year, I recover annual gross migration flows by combining population data and five-year migration flows with the model's migration equilibrium condition following Kleinman et al. (2023). Appendix B details the method.

Second, firm data are available at the district level while migration data are representative only at the provincial level. I conduct counterfactual simulations at the province level, aggregating district-level tax categories A, B, and C using 1999 population weights (Figure 1b). This aggrega-

tion also simplifies matching to province-level fiscal variables, as local income and redistribution shares are legislated at the provincial tier (Section 2.3).

Third, I collapse firm ages into three groups to reduce computational burden. Every establishment is assigned to Young if its age is less than 3 years, to Middle if the age lies between 3 and 8 years, and to Old once it reaches 9 years. These bins are used when forming province-level counts and survival rates. Finally, I also need annual series for provincial retention rates ω_{it} and central-transfer shares Ω_{it}. I use the Ministry of Finance schedules in the decree years 2003, 2006, and 2015. For all intervening years, I treat these parameters as piecewise constant between revisions. Accordingly, $\{\omega_{it}, \Omega_{it}\}$ for 2003–2005 follow the 2003 schedule, those for 2006–2014 follow the 2006 schedule, and post-2015 values follow the 2015 schedule.

Calibration. I set the discount factor to $\beta = 0.95$ and the elasticity of substitution to $\sigma = 6$, both standard values in the quantitative spatial literature. The labor share is fixed at $\xi^j = 0.7$ across all sectors.

The migration elasticity is $1/\nu = 0.63$, the estimate from Caliendo et al. (2021) that incorporates public goods consumption.[22] Government expenditure's share is $\gamma = 0.194$, the mean revenue-to-GDP ratio for 2000-2019 following Fajgelbaum et al. (2018).

The sectoral consumption weights $\{\alpha^j\}$ follow from the labor-market clearing condition (25) given observed provincial GRDP. The idiosyncratic shock dispersion is pinned down by the firm-stay elasticity from Section 4.2. With $\widehat{\theta} = 0.89$, I have $\chi = 0.86$.

5 Economic Effects of Place-Based Tax and Migration Policies

Place-based tax incentives and migration policies are typically designed in isolation, yet their interaction determines redistributive outcomes. This section quantifies that interaction by simulating Vietnam's 2003 tax reform and 2005 Ho Khau reform both jointly and separately. The results reveal substantial gains left on the table. While the actual reforms reduced spatial inequality, better policy coordination could have achieved twice that reduction, without compromising aggregate welfare.

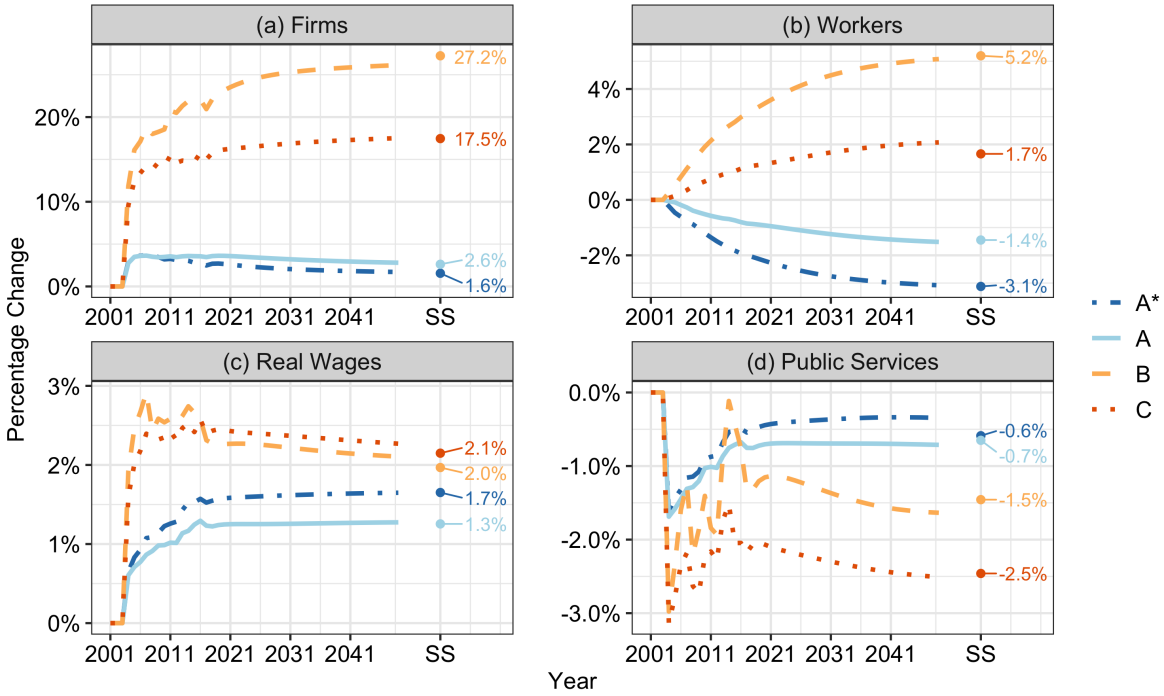
5.1 Firm and Worker Effects

I simulate a counterfactual economy in which neither the 2003 tax reform nor the 2005 Ho Khau reform was implemented, allowing all other fundamentals (productivity, trade costs, non-policy migration costs) to evolve as observed from 2001 to 2019. The dynamic hat algebra approach isolates the effects of both policies by comparing the no-policy counterfactual with the observed economy where both reforms occurred. The model solves for equilibrium outcomes across all 60 provinces,

[22] This annual elasticity corresponds to a five-year elasticity of approximately 3, consistent with estimates for Vietnam by Balboni (2025).

which I aggregate into four location types for presentation: A* (five major metro areas), A (developed), B (intermediate), and C (lagging). For each type, I sum firm counts and worker populations across constituent provinces, while real wages and public services are weighted means using year-2000 employment shares. Figure 3 traces the transition path from 2001 through steady state.

Figure 3: Dynamic Effects of Combined Place-based Tax and Migration Policies



Notes: Dynamic responses to combined 2003 tax and 2005 Ho Khau reforms relative to no-policy counterfactual. Model solves for 60 provinces, aggregated into four types: A* (five major metro areas), A (developed), B (intermediate), C (lagging). Firms and workers are summed across provinces within each type; real wages and public services are weighted means using year-2000 employment shares. SS = steady state. Panel (a) establishments, (b) workers, (c) real wages, (d) per-capita public services.

Tax incentives successfully redirect firm entry toward less developed regions (Panel a). B provinces see the largest response, reaching 27.2% more establishments at steady state, while C provinces gain 17.5%. Most adjustment occurs by 2010, suggesting rapid entrepreneurial response to tax differentials.

This ranking reveals how policy design shapes outcomes. Despite nominally deeper tax cuts in C districts during years 3-10, the age-dependent structure compressed the lifetime tax advantage in present value between them and the B locatoins. B provinces, with better market access and infrastructure, proved more attractive even with slightly higher lifetime taxes. Meanwhile, developed regions (A and A*) see modest gains (2.6% and 1.6%) from the across-the-board rate reduction from 32% to 28%.

Worker reallocation diverges from firm patterns as seen in Panel (b). B provinces attract 5.2% more workers, but A* metro areas lose 3.1%. This reflects the Ho Khau reform's asymmetric

design, which maintained barriers to major cities while easing access to secondary locations. The employment response also builds more gradually than firm entry. While establishments surge immediately into tax-favored locations, worker reallocation unfolds over decades as migration decisions respond to changing opportunities. By steady state, C provinces gain only 1.7% more workers despite 17.5% firm growth. This gap reflects two constraints. Workers still face higher migration costs to reach remote C provinces, and these locations offer lower wages and amenities that make them less attractive residentially even as business activity expands.

Wages rise across all locations, confirming that reforms increase labor demand more than supply (Panel c). B and C provinces see the largest gains (2.0% and 2.1%), reflecting substantial firm entry in disadvantaged regions. A* and A provinces also experience meaningful wage growth (1.7% and 1.3%) driven by their own firm entry. Panel (a) shows that even developed areas gain establishments (A* by 1.6%, A by 2.6%) due to the uniform statutory rate reduction from 32% to 28%, which stimulates entry everywhere despite smaller relative tax advantages in high-productivity locations. However, wage gains tell only part of the welfare story.

Public services decline in all location types, with C provinces suffering the steepest fall at 2.5% by steady state (Panel d). B provinces decline 1.5%, while even developed areas see reductions (A at 0.7%, A* at 0.6%). The temporal pattern shows substantial volatility, particularly in the first decade. These dynamics stem from the age-dependent tax schedule. Young firms pay 0% tax in their first two years, then gradually increasing rates, creating fluctuations in local government budgets as cohorts of firms age into higher tax brackets. The widespread declines at steady state reflect two forces. First, the uniform rate reduction from 32% to 28% lowers revenue everywhere. Second, spatial reallocation creates fiscal mismatches in disadvantaged regions that attract many new firms but collect minimal revenue from them during their tax-exempt early years. Even as firm populations stabilize, steady-state service levels remain depressed because the lower statutory rates and age-graded structure permanently reduce tax bases relative to the pre-reform regime.

Comparing combined reforms with tax-only counterfactuals reveals how migration policy shapes spatial equilibrium (Figure 4). The Ho Khau reform redirects firm location within developed areas. Under tax reform alone, A* metro areas gain 3.4% versus only 1.6% under combined reforms. Conversely, A provinces gain just 1.5% with tax alone but 2.6% with both policies. The mechanism operates through two channels. Some A* entrepreneurs, facing reduced barriers, choose to become workers in A* rather than start firms. Others choose to operate their businesses in A provinces where improved labor mobility makes expansion easier. Both channels reduce firms and workers in A*.

Migration reform reduces worker concentration in disadvantaged regions. Without Ho Khau, B provinces attract 7.2% more workers versus 5.2% with both policies. Similarly, C provinces gain 2.4% under tax alone versus 1.7% under both. A provinces lose fewer workers under combined reforms (1.4%) than tax-only (2.9%), while A* metro areas decline more (3.1% vs 2.4%). The asym-

Figure 4: Dynamic Effects of Only Changes to Tax Policy



Notes: Dynamic responses to 2003 tax reform only (no migration policy change). Variables and aggregation as in Figure 3.

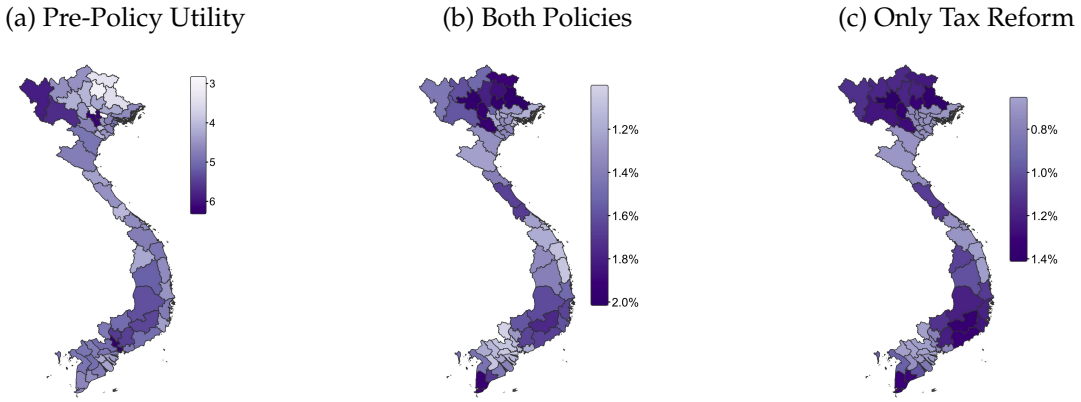
metric barrier reduction thus disperses workers more broadly. In particular, some leave B and C for better opportunities in A, while A* faces larger outflows. This spatial dispersion appears to dilute the concentration effects of place-based tax incentives in terms of workers and firms. However, allowing workers to access opportunities elsewhere is also part of the welfare gains for local residents which I will address in the welfare analysis below.

These allocation patterns reveal a trade-off between concentration and dispersion. Under the tax-only reform, B provinces attract more firms and more workers, with worker inflows rising by 7.2% (vs. 5.2% under the combined policy) and firm counts increasing by 33.1% (vs. 27.2%), generating fiscal benefits through higher revenues that limit service declines. The Ho Khau reform disperses this activity as workers spread more broadly toward A provinces, firms shift from A* to A, and public service provision becomes more strained in B due to lower worker concentration. The allocation effects suggest that migration barriers determine whether place-based tax incentives concentrate or disperse economic activity across space. The next subsection evaluates which allocation pattern generates higher welfare and greater inequality reduction.

5.2 Welfare Effects

The allocation effects documented above, rising wages alongside declining public services, make clear that welfare assessment requires accounting for both dimensions. This subsection quantifies the net welfare impact by measuring changes in lifetime expected utility, which aggregates private consumption gains, public service losses, and the value of expanded migration and entrepreneurship options.

Figure 5: Pre-Policy Expected Utility and Welfare Gains from Policies



Notes: Panel (a) shows pre-policy expected lifetime utility by province (darker shading = higher utility). Panel (b) shows welfare effects from combined reforms, measured as consumption-equivalent percentage changes relative to no-policy counterfactual. Panel (c) shows effects from tax reform only. Province boundaries as of 1999.

I measure welfare using consumption-equivalent changes in lifetime expected utility, comparing the policy scenario with a no-policy counterfactual. The welfare effect for each province captures the value to a representative year-2000 resident, including both those who stay and those who migrate to exploit new opportunities. Although the model features a separate value function for incumbent entrepreneur, the reported welfare results are based on the worker value function which evaluates each individual ex-ante before occupational and migration choices. This ensures that the option value of becoming or remaining an entrepreneur—together with all subsequent migration and location choices—is already embedded in U_{it} and thus incorporated in the welfare calculations.

Pre-policy expected utility varies substantially across provinces (Figure 5a, panel a). Major metro areas like Hanoi and Ho Chi Minh City show the highest values, while northwestern and central highland provinces show the lowest. This gradient captures not just current economic conditions but also forward-looking option values—the potential for future migration and entrepreneurship embedded in each location. As a validity check, this model-based measure correlates at -0.36 with 1999 poverty rates from Minot et al. (2003) (Appendix Figure A8), data never used in calibration. The model's welfare measure thus aligns with observed disadvantage while incorporating forward-looking considerations absent from static poverty measures.

The combined reforms generate positive welfare gains across all provinces, with magnitudes varying by initial conditions (Panel b). The largest improvements (1.8-2.0%) concentrate in initially disadvantaged northwestern and central coast provinces. Moderate gains (1.4-1.6%) appear in intermediate provinces, while developed areas see more modest improvements (1.0-1.2%).

Tax reform alone produces a similar spatial pattern but with uniformly smaller magnitudes (Panel c). The Ho Khau reform thus amplifies tax policy's effectiveness in two ways. It allows workers to move toward new employment opportunities created by firm entry. It also independently benefits provinces near major metro areas by easing access to high-opportunity locations, even where firms received no preferential tax treatment. Table 4 aggregates provincial welfare by location type, revealing the reforms' overall impact on welfare levels and spatial inequality.

Table 4: Welfare Effects of Place-based Tax and Migration Policies (Percent)

	Tax + Ho Khau Reforms (1)	Only Tax Reform (2)	Only Ho Khau Reform (3)
A*	1.14	0.75	0.39
A	1.24	0.71	0.57
B	1.77	1.27	0.48
C	1.53	1.07	0.46
Aggregate	1.36	0.88	0.50
Gini Reduction	0.59	0.12	0.57

Notes: Welfare measured as consumption-equivalent percentage change in lifetime expected utility for a representative pre-policy household at each location. Aggregate welfare uses initial population shares as weights. Gini reduction is the decrease in welfare inequality across provinces.

The combined reforms generate aggregate welfare gains of 1.36% and reduce the spatial Gini coefficient by 0.59% (Column 1). B provinces benefit most (1.77%), followed by C provinces (1.53%), achieving spatial convergence as less developed regions gain more. Even A* metro areas (1.14%) and A provinces (1.24%) see meaningful improvements.

Tax reform alone generates aggregate gains of 0.88% but reduces inequality by only 0.12% (Column 2). B provinces benefit most (1.27%), but modest inequality reduction reflects the uniform rate cut from 32% to 28%, which aids all regions. Near-parity between A* metro areas (0.75%) and A provinces (0.71%) limits convergence despite differential tax treatment.

The Ho Khau reform alone produces smaller aggregate gains (0.50%) but reduces inequality by 0.57%, nearly fivefold larger than tax reform's distributional impact (Column 3). A reversal emerges between A provinces and A* metro areas. Under tax reform alone, A provinces see the smallest gains (0.71%). Under migration reform alone, A provinces see the largest gains (0.57%), exceeding A* metro areas (0.39%) by 50%. This reflects the asymmetric reform design: maintaining

high barriers to A* metro areas while easing restrictions elsewhere channels newly mobile workers toward secondary cities in A provinces.

The combined reforms generate complex interactions between policies. Aggregate welfare (1.36%) and spatial inequality reduction (0.59%) fall slightly short of summing individual policies (1.38% and 0.69%, respectively), indicating modest subadditivity overall. However, this aggregate pattern masks important heterogeneity across locations. In B provinces, the interaction between the two policies is positive. Their welfare gain under combined reforms (1.77%) exceeds the sum of individual policy effects (1.27% from tax + 0.48% from Ho Khau = 1.75%), suggesting the two policies reinforce each other in intermediate regions. This effect reflects the allocation mechanism identified earlier where tax incentives attract firms to B provinces, while migration reform enables worker sorting that enhances productivity without excessive concentration. Despite this local amplification, the overall spatial inequality reduction falls short of additivity because the Ho Khau reform disperses workers away from the most disadvantaged C provinces where tax incentives concentrate firms, reducing the convergence gains that would occur if policies operated independently. The next subsection further explores the role of alternative migration designs in strengthening these effects while maintaining overall welfare gains.

The Role of Migration Barriers

Table 5 examines how migration policy design shapes tax incentive effectiveness. I compare tax reform under five migration regimes: no mobility (Column 1), benchmark costs (Column 2), and three alternative barrier reductions targeting different destinations (Columns 3-5).

Migration fundamentally determines whether tax incentives promote convergence or concentration. Without mobility (Column 1), tax reform generates 0.91% aggregate welfare and reduces inequality by 0.25%. Firms enter disadvantaged regions where taxes are lowest, bidding up local wages without worker mobility to dissipate gains. B and C provinces capture nearly all benefits (1.97% and 1.36%), while developed areas gain minimally. When migration is allowed at benchmark costs (Column 2), aggregate welfare falls slightly to 0.88% while inequality reduction drops by more than half to 0.12%. Two mechanisms drive this attenuation. First, workers migrate toward higher-wage locations, including developed areas that benefit from uniform rate cuts, dispersing employment gains across space. Second, in-migration to targeted regions increases local labor supply, compressing wage gains in these places. Together, these forces dilute the spatial concentration of welfare improvements.

Column (3) reduces barriers only for moves into A* metro areas, mimicking infrastructure projects that lower access costs to major cities or direct subsidies for migration towards these urban regions (Morten and Oliveira, 2024; Bryan et al., 2014). The results show minimal impact on reducing spatial inequality. Gini reduction remains at 0.12, identical to benchmark. A* metro areas capture disproportionate gains (0.90% versus 0.75%), while other locations see modest increases. Easing access to the richest locations does little to enhance the redistributive impact of place-

Table 5: Welfare Effects of Tax Reform Under Alternative Migration Policies

	Only Tax Reform		Tax Reform +		
	No Migration (1)	Benchmark Migration (2)	A* Access (3)	Non-A* Access (4)	2005 HK Reform (5)
A*	0.51	0.75	0.90	1.68	1.14
A	0.50	0.71	0.82	1.90	1.24
B	1.97	1.27	1.37	2.35	1.77
C	1.36	1.07	1.16	2.08	1.53
Aggregate	0.91	0.88	0.99	1.97	1.36
Gini Reduction	0.25	0.12	0.12	1.12	0.59

Notes: Column (1) shows tax reform effects with no migration allowed. Column (2) reproduces the tax-only results from Table 4 with benchmark migration costs in the data. Columns (3)-(5) combine tax reform with different migration barrier reductions: (3) reduces barriers by $\Delta_T + \Delta_L$ only for moves into A* metro areas, (4) reduces barriers by Δ_T only for moves into non-A* locations, (5) implements the actual 2005 Ho Khau reform affecting all destinations asymmetrically. Welfare measured as consumption-equivalent percentage change in lifetime expected utility.

based tax incentives. Workers and firms gravitate toward A* metro areas despite tax advantages elsewhere, concentrating activity in already-developed areas.

Excluding A* metro areas from barrier reductions produces the strongest redistribution (Column 4). Aggregate welfare nearly doubles to 1.97%, exceeding even the actual Ho Khau reform (1.36%). Yet, Gini reduction reaches 1.12%, nearly double the actual reform's 0.59 and almost ten times benchmark's 0.12. The mechanism operates through spatial foreclosure. Excluding A* from barrier reductions forces firms and workers to choose secondary cities. With A* access restricted, A and B provinces become viable alternatives that can compete for both entrepreneurs and migrants. Every location type benefits more than under actual reform: A provinces reach 1.90%, B provinces 2.35%, even A* metro areas gain 1.68% despite facing no barrier reductions. This A* gain reflects general equilibrium effects of congestion externaltiy as diverting workers to secondary cities reduces congestion in major metro areas, raising welfare for those who remain.

The actual Ho Khau reform (Column 5) achieves only half the redistribution potential by partially easing A* access. Even modest barrier reductions for major metro areas create sufficient gravitational pull to redirect activity from secondary cities. The foregone welfare is substantial. A provinces realize only 65% of their potential gains (1.24% versus 1.90%), B provinces 75% (1.77% versus 2.35%), and spatial inequality reduction falls to 53% of its potential (0.59% versus 1.12%). The policy lesson is that migration barrier design requires categorical restrictions on major metro access, not marginal adjustments. Partial liberalization toward major cities dissipates the spatial targeting that place-based tax incentives create.

These counterfactuals reveal a fundamental principle for coordinating place-based policies with migration reform. The spatial distribution of migration barrier reductions matters as much as their magnitude. Certain level of liberalization (benchmark) from no-migration world permits continued concentration in high-productivity metro areas, dissipating tax policy's spatial targeting. Asymmetric liberalization favoring megacities (Column 3) proves equally ineffective, as gravitational pull toward A* overwhelms tax incentives elsewhere. Only categorical restrictions on major metro access (Column 4) force genuine spatial rebalancing by making secondary cities the exclusive destinations for enhanced mobility. The actual reform's partial approach leaves substantial welfare gains unrealized—nearly 45% of potential inequality reduction—demonstrating that migration policy design is crucial in shaping the effects of place-based policy.

The Role of Firm Dynamics and Public Goods

Table 6 isolates three mechanisms underlying tax policy effectiveness: firm entry and exit, endogenous exit, and public goods provision. Columns (1)-(4) examine tax reform alone under alternative specifications. Columns (5)-(6) add the Ho Khau reform.

Firm mobility is necessary for tax incentives to address spatial inequality. When both entry and exit are disabled (Column 2), welfare turns negative everywhere: -0.29% to -0.30% in developed areas, -0.20% to -0.30% in disadvantaged regions. Aggregate welfare falls to -0.28%, with no inequality reduction. The same tax reform with firm dynamics enabled (Column 1) generates 0.88% aggregate welfare and 0.12% Gini reduction. Without entry or exit, the tax reform simply redistributes resources from government to existing entrepreneurs through lower rates. These windfall gains to incumbent firms generate no new employment or wage increases for workers, and no expansion of the local tax base. Meanwhile, government revenues fall immediately from rate cuts, forcing reductions in public service provision. The result is a pure fiscal loss. Workers experience declining public services without offsetting private income gains, while benefits accrue entirely to a small number of existing entrepreneurs. Workers benefit only when firm entry expands employment and raises wages enough to offset service declines.

Endogenous exit creates an efficiency-equity trade-off. Disabling exit (Column 3) raises aggregate welfare from 0.88% to 1.06%—a 20% gain—but reduces measured convergence (Gini decline falls from 0.12% to 0.06%). The welfare gains concentrate in disadvantaged regions: B provinces jump from 1.27% to 1.58%, C provinces from 1.07% to 1.34%. Although B and C provinces experience larger welfare gains in this scenario (rising from 1.27% to 1.58% and from 1.07% to 1.34%, respectively), the province-level Gini reflects the entire cross-section of 60 provinces, not just group averages. Without exit, some firms relocate toward richer locations, increasing within-group dispersion among advantaged provinces and muting overall convergence even as disadvantaged regions benefit on average.

Two mechanisms drive this trade-off. Without exit, firms stay active longer in disadvantaged regions, sustaining employment and wages. But anticipating this lock-in, some firms choose de-

Table 6: The Role of Firm Dynamics and Public Goods in Place-Based Policy Effectiveness

	Only Tax Reform				Tax + Ho Khau Reforms	
	Full Model	Without Firm Entry + Exit	Without Firm Exit	Without Public Goods	Full Model	Without Firm Entry + Exit
	(1)	(2)	(3)	(4)	(5)	(6)
A*	0.75	-0.29	0.89	1.19	1.14	0.22
A	0.71	-0.30	0.83	1.13	1.24	0.36
B	1.27	-0.20	1.58	1.86	1.77	0.40
C	1.07	-0.30	1.34	1.70	1.53	0.25
Aggregate	0.88	-0.28	1.06	1.37	1.36	0.32
Gini Reduction	0.12	0.00	0.06	0.14	0.59	0.47

Notes: Column (1): full model with endogenous entry, exit, and public goods ($\gamma > 0$). Column (2): no entry or exit. Column (3): entry but no exit. Column (4): no public goods ($\gamma = 0$). Columns (5)-(6) add Ho Khau reform: (5) full model, (6) no entry or exit.

veloped regions where fundamentals are stronger, reducing concentration in the most disadvantaged areas. The result leads to higher aggregate welfare through sustained employment, less spatial redistribution.

Public service declines impose substantial welfare costs. When agents do not value public goods (Column 4, $\gamma = 0$), aggregate welfare rises from 0.88% to 1.37%—a 56% increase. This 0.49 percentage point difference represents the welfare cost of service declines. Every location experiences substantially higher welfare when public services do not matter: B provinces would gain 1.86% instead of 1.27% (a difference of 0.59 points), C provinces 1.70% instead of 1.07% (0.63 points), A provinces 1.13% instead of 0.71% (0.42 points), and A* metro areas 1.19% instead of 0.75% (0.44 points). These differences reveal a critical fiscal externality. Gross welfare gains from employment and wages are substantial (1.37%), but more than one-third are offset by service declines. The fiscal cost hits disadvantaged regions hardest. For B provinces, the welfare gain would be 1.86% absent public-service considerations but falls to 1.27% in the benchmark, implying a 0.59 percentage-point loss. C provinces experience a similar magnitude, losing 0.64 points.

Migration and firm dynamics complement each other. Adding the Ho Khau reform to tax policy (Columns 1 vs 5) raises aggregate welfare from 0.88% to 1.36% and amplifies inequality reduction from 0.12% to 0.59%. As shown earlier, migration enables workers to access opportunities created by firm entry in disadvantaged regions as well as moving to high productivity places. Migration also provides a critical fallback when firm dynamics fail. Without firm entry or exit (Column 2), tax reform generates welfare losses everywhere as it becomes pure fiscal transfer to incumbent owners. Adding the Ho Khau reform (Column 6) rescues the policy, raising aggregate welfare to 0.32% and creating substantial convergence (0.47% inequality reduction). The mecha-

nism operates through worker reallocation toward existing firms in higher-productivity locations that benefit from uniform rate cuts.

These comparisons establish three findings. First, firm entry is essential. Without it, tax incentives reduce welfare by becoming transfers to incumbent owners, costing public services with little employment expansion. Second, migration policy partially substitutes for firm dynamics by enabling workers to access existing opportunities, preventing complete policy failure. Third, migration reform amplifies convergence (nearly fivefold, from 0.12% to 0.59%), reflecting its asymmetric design that specifically targets spatial inequality. The comparison reveals that both margins are necessary. Firm entry creates opportunities, while worker mobility ensures these opportunities translate into broad-based welfare gains and spatial convergence.

5.3 Sensitivity Analysis

The paper's core mechanism depends on firms responding to tax incentives by entering disadvantaged regions while workers move across locations based on mobility costs. The strength of these responses hinges critically on firm entry and exit elasticities, captured by parameter χ which was estimated using model-consistent design earlier. This parameter governs how readily firms relocate in response to profit differentials, reflecting real-world frictions like regulatory barriers, sunk capital investments, and relocation costs. Policymakers designing place-based interventions need confidence that strategic migration reform delivers equity gains across diverse contexts, not just under narrow calibration assumptions.

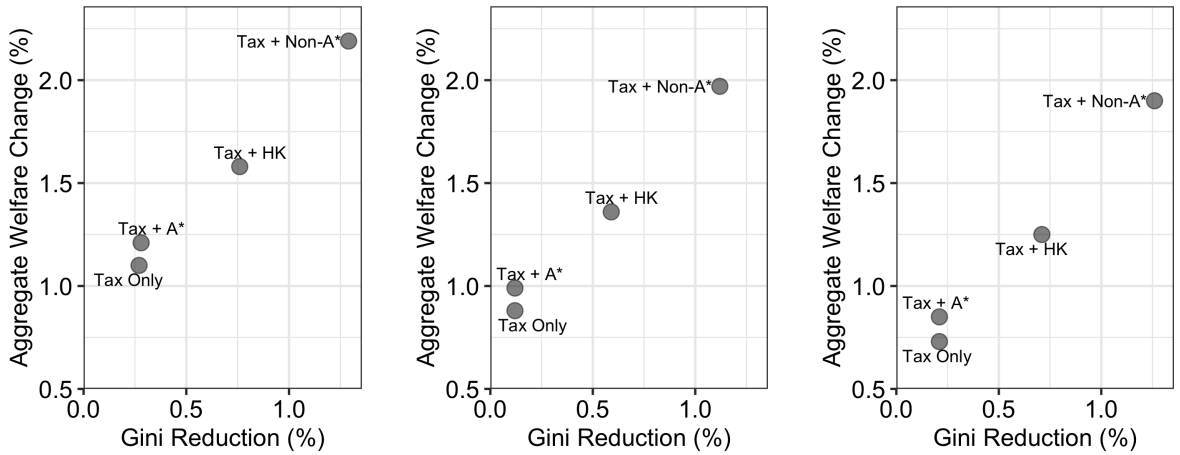
Figure 6 demonstrates the robustness of the paper's main findings across different assumptions about firm mobility. Each panel plots efficiency-equity tradeoffs for four policy combinations under alternative firm entry/exit cost parameter (χ): low costs in panel (a), benchmark calibration in panel (b), and high costs in panel (c). Points closer to the upper-right corner represent policies achieving both higher aggregate welfare and stronger spatial convergence. Whether firms face minimal or substantial entry costs, maintaining barriers to major metro areas while opening access to secondary cities consistently produces the largest equity improvements when combined with place-based tax incentives.

Three key patterns emerge consistently across all three panels, reinforcing the main findings from Table 5. First, tax reform alone (Tax Only) yields the smallest redistribution for all firm-mobility assumptions, with Gini reductions ranging from 0.12% (benchmark) to 0.27% (high mobility). This modest convergence reflects the tension documented earlier. Even though firms enter disadvantaged regions in response to tax incentives, the uniform statutory rate reduction as well as the costs to public services ensures that developed areas also benefit, preserving much of the existing spatial hierarchy. Second, combining tax reform with migration barriers that facilitate access to A* metro areas (Tax + A*) consistently produces outcomes barely distinguishable from tax reform alone—welfare gains of 0.85-1.21% and Gini reductions of 0.12-0.28% across specifications. This persistent weak performance confirms the critical insight that easing access to the richest lo-

cations does little to enhance the redistributive impact of place-based tax incentives, as workers and firms gravitate toward major cities despite tax advantages elsewhere.

Figure 6: Sensitivity Across Firm Entry/Exit Elasticities

(a) $\chi = 0.7$ (b) $\chi = 0.8$ (Benchmark) (c) $\chi = 2.8$



Notes: Vertical axis shows population-weighted aggregate welfare change (%) relative to no-policy baseline. Horizontal axis shows percentage reduction in spatial inequality measured by Gini coefficient of welfare across provinces. Each panel displays results for a different firm entry/exit cost parameter (χ), with the benchmark calibration ($\chi = 0.8$) shown in panel (b). Lower χ values indicate higher firm mobility (easier entry/exit), while higher values indicate greater entry/exit frictions. Policy labels indicate: "Tax Only" refers to the 2003 tax reform alone, "Tax + HK" combines the tax reform with 2005 Ho Khau relaxation, "Tax + A*" adds preferential access to A* cities, and "Tax + Non-A*" improves access to non-A* regions.

Most importantly, the Tax + Non-A* policy robustly dominates all alternatives across every specification, consistently appearing in the upper-right corner of efficiency-equity space. Under benchmark firm mobility ($\chi = 0.8$, panel b), this policy generates 1.97% aggregate welfare and 1.12% Gini reduction, substantially exceeding both the actual Ho Khau reform (1.36% welfare, 0.59% Gini) and any other alternative. This dominance persists under low firm mobility ($\chi = 2.8$, panel c), where Tax + Non-A* still achieves 1.90% welfare and 1.26% Gini reduction, and strengthens further under high mobility ($\chi = 0.7$, panel a), reaching 2.19% welfare and 1.29% Gini reduction. The consistent superiority validates the fundamental mechanism identified earlier. By maintaining strict barriers to A* metro areas while reducing costs elsewhere, this policy forces spatial rebalancing. Entrepreneurs locate where workers can move freely, and workers face clear incentives to consider employment in A and B provinces rather than waiting for opportunities in congested A* metro areas. This asymmetry creates viable alternative development poles that can compete effectively with major cities.

While firm mobility affects the overall magnitude of welfare gains—higher mobility amplifies impacts for all policies—the relative performance remains remarkably stable. The Tax + Non-A* policy delivers higher welfare than Tax + HK and much higher redistribution than Tax Only across

all three specifications. This robustness demonstrates that the paper's central policy recommendation does not depend on precise calibration of firm entry/exit elasticities. Whether firms face low, medium, or high relocation costs, strategically targeted migration reforms that exclude major metro areas while enhancing access to secondary cities consistently generate the largest efficiency and equity gains when combined with place-based tax incentives.

6 Conclusion

Place-based tax incentives struggle to reduce spatial inequality when implemented alone. The 2003 enterprise tax reform provided age-graded reductions to firms in disadvantaged regions while cutting the statutory rate nationwide, reducing the Gini coefficient of welfare by only 0.12%. This modest convergence reflects the uniform rate cut benefiting all regions and fiscal constraints limiting public service provision. Migration policy design determines whether tax incentives achieve redistributive goals. Vietnam's 2005 Ho Khau reform reduced barriers nationwide but maintained stricter requirements for major metro areas, creating larger cost reductions for moves to secondary cities. This asymmetry amplified inequality reduction nearly fivefold to 0.59%. The mechanism operates through spatial coordination. Tax incentives attract firms to disadvantaged regions, while migration reform enables workers from these regions to access expanding opportunities in secondary cities where firm entry is also profitable. By maintaining barriers to major metro areas, the policy creates viable alternative development poles rather than allowing concentration in the most productive locations.

When deploying place-based tax incentives, governments should focus on enabling workers from disadvantaged regions to access opportunities in secondary cities rather than facilitating moves to major metro areas. Counterfactual simulations show that reducing barriers to secondary cities only while maintaining existing metro restrictions yields substantially larger gains than the actual reform. Specifically, the Gini reduction nearly doubles, while aggregate welfare increases by roughly 45%. This approach works across diverse economic environments whether firm mobility is high or low. Implementation requires coordinating tax policy with migration reforms that reduce administrative barriers, improve education access for migrant children, and ease housing registration in target secondary cities. The coordination challenge is substantial, however. Fiscal spillovers further complicate implementation as more than one-third of gross welfare gains are offset by public service declines when local revenues fall and populations reallocate.

Three open questions emerge from the findings. First, within-firm heterogeneity matters for evaluating policy effectiveness. If tax subsidies attract primarily low-productivity entrants rather than easing constraints for high-potential firms, the welfare gains here may overstate the true effect of place-based incentives. Preliminary evidence of smaller entrants suggests that incorporating firm heterogeneity could strengthen the case for complementary migration policy, since adverse selection weakens the impact of tax incentives while leaving—if not increasing—the gains

from allowing workers to move toward more productive locations. Second, sorting responses to skill heterogeneity merit further study. High-skilled workers and productive firms cluster in major cities, and redirecting these flows may affect productivity and inequality in ways not captured in the current framework. Third, when regions compete using coordinated tax-migration strategies, strategic interactions may amplify or dampen the benefits identified here. These extensions would clarify when policy coordination can address persistent spatial inequality.

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A List of Provinces

A.1 Provincial Tax Classifications

This appendix details the procedure for aggregating district-level tax classifications to the provincial level. The provincial taxonomy serves two purposes: it aligns with the GDP per capita measures in Table 1, and more importantly, it matches the geographic level at which key data (particularly bilateral trade flows, migration flows, and local revenues) are available. The quantitative analysis uses this provincial aggregation for general equilibrium computations and welfare calculations, while the estimation of firm location elasticities exploits the finer district-level variation in tax treatment to identify structural parameters (Section 4.2).

Classification Procedure The aggregation follows a sequential assignment procedure that preserves the district-level proportions of each classification at the provincial level while respecting the ordinal nature of disadvantage intensity:

1. **A* provinces**: The five centrally-administered metro areas (Hanoi, Ho Chi Minh City, Hai Phong, Da Nang, and Can Tho) receive automatic A* designation based on their administrative status.

2. **C provinces**: Among the remaining provinces, we rank by population-weighted share of C districts using 1999 population data. Provinces with the highest shares of C districts are assigned C classification.

3. **B provinces**: Among provinces not yet classified, we rank by population-weighted share of B districts. The top-ranked provinces receive B classification.

4. **A provinces**: The remaining provinces are classified as A.

This sequential procedure ensures that provinces classified as C have the highest concentration of severely disadvantaged districts, while B provinces have the next highest concentration of moderately disadvantaged areas. The approach maintains the ordinal structure of disadvantage while enabling analysis at the provincial level where critical general equilibrium data are observed.

Population Weights The population weights used in aggregation come from the 1999 Population and Housing Census, predating both the 2003 tax reform and the 2005 Ho Khau reform. This timing ensures the aggregation weights are not endogenous to the policy changes under study.

For each province p, the population-weighted share of classification $k \in \{A, B, C\}$ districts is:

$$s_{pk} = \frac{\sum_{d \in D_{pk}} \text{Pop}_{d,1999}}{\sum_{d \in D_p} \text{Pop}_{d,1999}} \tag{A.1}$$

where D_{pk} denotes the set of districts in province p with classification k, and D_p denotes all districts in province p.

Validation Table 1 demonstrates that this aggregation procedure successfully captures provincial level disparities. The provincial GDP per capita measures show clear gradients across the A*, A, B, C classification, with C provinces averaging 6.3 million VND compared to 16.3 million VND in A* provinces. This validates that the population-weighted aggregation of district classifications meaningfully reflects provincial economic conditions.

To make the provincial aggregation concrete, Table A1 lists all Vietnamese provinces by their assigned tax classification (A*, A, B, C). The table provides the complete mapping implied by the sequential procedure described above, translating district-level treatment status into province-level categories used in the quantitative analysis.

Table A1: Provinces by Tax Classification

A*	A	B	C
Ha Noi	Vinh Phuc	Lang Son	Ha Giang
Hai Phong	Bac Ninh	Yen Bai	Cao Bang
Da Nang	Hai Duong	Thai Nguyen	Lao Cai
Ho Chi Minh City	Hung Yen	Phu Tho	Lai Chau
Can Tho	Ha Nam	Hoa Binh	Bac Kan
	Nam Dinh	Khanh Hoa	Tuyen Quang
	Thai Binh	Dak Lak	Dien Bien
	Ninh Binh	Lam Dong	Son La
	Bac Giang	Ninh Thuan	Quang Binh
	Quang Ninh	Binh Phuoc	Quang Tri
	Thanh Hoa	Dong Nai	Phu Yen
	Nghe An	Binh Thuan	Kon Tum
	Ha Tinh	Bac Lieu	Gia Lai
	Thua Thien Hue	Ca Mau	Kien Giang
	Quang Nam		Tra Vinh
	Quang Ngai		Soc Trang
	Binh Dinh		
	Tay Ninh		
	Binh Duong		
	Ba Ria–Vung Tau		
	Long An		
	Dong Thap		
	An Giang		
	Tien Giang		
	Vinh Long		
	Ben Tre		

B Annual Gross Migration and Trade Flows

B.1 Migration Flows

This subsection describes the procedure for getting annual gross migration flows across provinces when direct data are unavailable. My analysis requires annual migration data from 2000 to 2019, but population census sources only provide gross migration flows for three 5-year intervals: 1994–1999, 2004–2009, and 2014–2019. I adapt the approach in Kleinman et al. (2023) using a two-step procedure.

Step 1: Estimate bilateral migration costs. From each census, I estimate bilateral migration costs m_{int} using equation (9). I assume symmetric bilateral costs and normalize $m_{ii} = 0$, which implies:

$$\frac{\mu_{int}\mu_{nit}}{\mu_{iit}\mu_{nnt}} = \exp\left(\frac{-2}{\nu} m_{int}\right)$$

This yields three cross-sections of migration costs from census years 1999, 2009, and 2019 (capturing flows during 1994–1999, 2004–2009, and 2014–2019 respectively). The 2009 census thus reflects the post-2005 Ho Khau reform period. For intermediate model years 2000–2018, I linearly interpolate between consecutive census observations.

Step 2: Solve for annual migration flows. For each year $t \in \{2000, \ldots, 2018\}$, I solve for expected utility values U_{it+1} using the labor evolution equilibrium condition (30), which combines interpolated migration costs m_{int}, observed population and firms, and assumes perfect foresight. Given U_{it+1}, I compute annual migration flows μ_{int} from equation (9).

B.2 Trade Flows

This appendix outlines the algorithm for constructing annual bilateral trade flows $\{\lambda^j_{int}\}$ for all years $t \in \{2001, \ldots, 2019\}$, given that trade data are only observed for year 2000. The procedure jointly solves for trade shares, sectoral price indices, and location-sector TFPs by exploiting the model's equilibrium conditions.

Data. *Trade Data (Year 2000).* Bilateral shipments by sector from JICA (2000), aggregated into three tradable sectors (agriculture, light manufacturing, heavy manufacturing) and non-tradables.

Distance Matrix. Truck distances dist_{in} computed via ArcGIS network analysis on 1999 IPUMS province shapefile. Combined with estimated elasticities $\widehat{\kappa}^j$ from Section 4.4 to form bilateral iceberg costs: $d^j_{in} = (\text{dist}_{in})^{\widehat{\kappa}^j}$.

Algorithm. For each year t, the algorithm iterates between three objects until convergence:

1. *Productivity*: $(A^j_{it})^{\sigma-1}$ for tradable sectors, pinned down by goods-market clearing

2. *Trade shares*: λ_{int}^{j} from CES demand given bilateral prices and destination price indices
3. *Expenditures*: X_{nt}^{j} from local income, which depends on public goods, wage income, and profits

Outer Loop (Tradable Equilibrium). Starting from initial guess $(A_{it}^{j,(0)})^{\sigma-1}$:

1. Compute unit costs x_{it}^{j} and bilateral prices p_{int}^{j}
2. Compute destination price indices P_{nt}^{j}
3. Compute trade shares: λ_{int}^{j}
4. Solve non-tradable equilibrium to obtain wage bill $w_{it}L_{it}^{3}$
5. Compute total income Π_{it} and expenditures X_{nt}^{j}
6. Update productivity via market clearing condition
7. Check convergence

C Motivating Evidence on Firm and Migration Responses

This subsection presents descriptive evidence on how firm location and migration patterns evolved following Vietnam's spatial policy reforms. These patterns motivate the quantitative analysis but should not be interpreted as causal effects of either policy or both. The simultaneous implementation of both reforms, combined with other concurrent changes—including trade liberalization, infrastructure investment, and ongoing economic transition—precludes credible reduced-form identification. Instead, I use these patterns to establish that meaningful spatial reallocation occurred during the reform period, providing empirical support for the estimation in Section 4.

Firm location patterns following tax reform

I document changes in firm location and local employment using an event-study specification comparing districts with different tax treatment. The analysis focuses on districts with stable B and C classifications between 1999 and 2003, ensuring observed differences reflect the 2003 policy change rather than reclassification. I estimate:

$$y_{ist} = \sum_{j=2000, j\neq 2003}^{2019} \beta_j \cdot \mathbf{1}\{i \in C\} \cdot \mathbf{1}\{t = j\} + \alpha_i + \theta_{st} + \varepsilon_{ist}, \tag{C.1}$$

where y_{ist} measures either the number of firms or total employment in district i, sector s, and year t. The indicator $\mathbf{1}\{i \in C\}$ equals one for C districts and zero if $i \in B$. with 2003 serving

as the omitted base year to align with the policy implementation timing. I include district fixed effects (α_i) and sector-year fixed effects (θ_{st}) to control for time-invariant location characteristics and sector-specific trends. I estimate equation (C.1) using Poisson Pseudo Maximum Likelihood (PPML) to handle zeros in the dependent variable, clustering standard errors at the district level.

Figure A1 reveals suggestive evidence that the enhanced tax incentives for C districts attracted more firms and employment. Pre-2003 coefficients are close to zero and not statistically significant. Following the 2003 reform, firm counts and employment in C districts increased significantly relative to the pre-reform baseline, with effects building gradually and reaching approximately 25% for employment around the same magnitude for firm counts.

These patterns are consistent with tax incentives affecting firm location, but alternative explanations cannot be ruled out. Infrastructure improvements, trade policy changes, and differential local government capacity all evolved during this period and varied spatially in ways potentially correlated with tax classifications. The structural approach addresses these identification challenges by leveraging the age-graded structure of tax incentives for estimation and incorporating general equilibrium linkages across locations for welfare analysis.

Migration patterns following Ho Khau reform

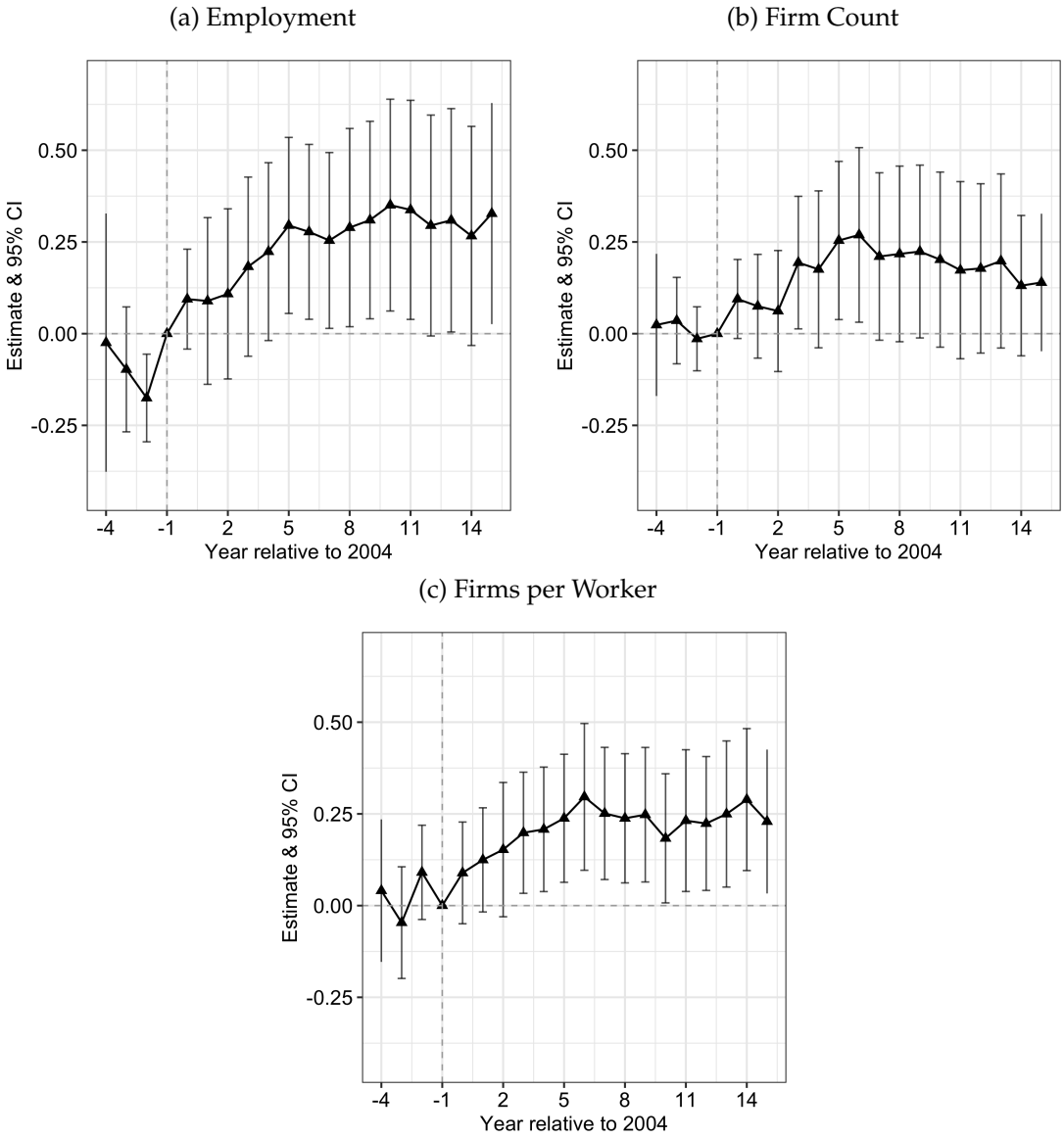
Figure A2 documents migration pattern changes using census data spanning the 1994-1999, 2004-2009, and 2014-2019 periods.

Panel (a) reveals substantial increases in migration rates between the pre-reform (1994-1999) and post-reform (2004-2009) periods. Out-migration from non-A* provinces increased from approximately 3.5% to 6.0%—a 70% increase—while migration from A* provinces rose more modestly from 2.8% to 3.1%. By 2014-2019, rates declined somewhat but remained above pre-reform levels.

Panel (b) shows heterogeneity in destination choices. Migrants from non-A* provinces dramatically shifted toward A* destinations, with the share choosing major cities rising from 39% to 49%. In contrast, migrants from A* provinces showed stable preferences, with approximately 35% consistently choosing A* destinations across all periods. This divergence is consistent with the asymmetric nature of the Ho Khau reform, which relaxed restrictions nationwide but maintained additional requirements for A* cities.

As with the firm location patterns, these migration changes coincide with multiple simultaneous reforms. Vietnam's rapid economic growth, urbanization, and integration into global markets all accelerated during this period. The structural model disentangles these forces by estimating migration cost changes that rationalize observed flows within the model's equilibrium framework, exploiting the differential timing and geography of the Ho Khau policy across destinations.

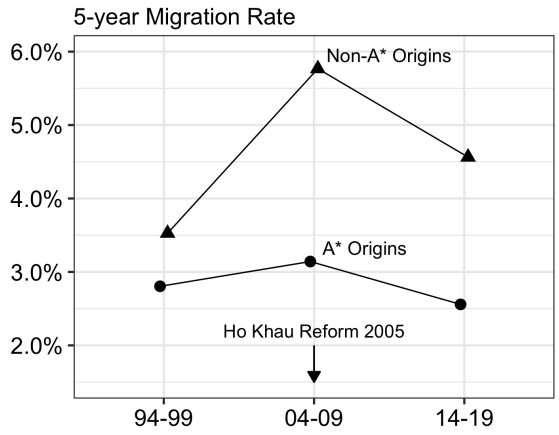
Figure A1: Event-Study Analysis of Firm Count and Employment



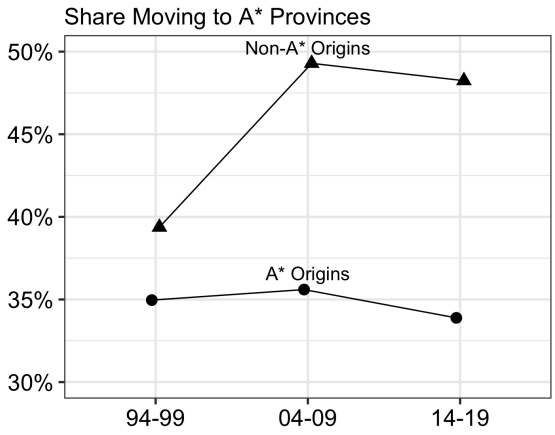
Source: Annual Enterprise Surveys (2000-2019).
Notes: Panel (a) shows employment growth; Panel (b) shows firm count growth. Panel (c) shows firms per worker. Each panel displays PPML estimates from equation (C.1) comparing C districts to B districts, with 95% confidence intervals clustered at the district level. The vertical dashed line indicates 2003, when the tax reform was announced.

Figure A2: Trends in Vietnamese Migration Patterns: 1999, 2009, 2019

(a) 5-year Migration Rate by Origin Type



(b) Share of Migrants Choosing A* Destinations



Sources: Population and Housing Census data from 1999, 2009, and 2019.
Notes: A^* designates five centrally administered provinces, while non-$A*$ refers to Vietnam's remaining provinces. Panel (a) shows the average percentage of people migrating from each origin type between years t and $t+5$. Panel (b) displays the proportion of migrants choosing A^*s destinations.

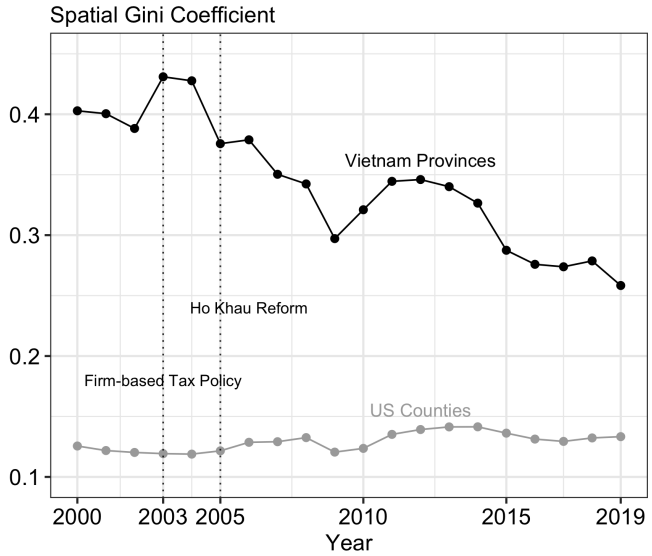
Discussion

The descriptive evidence establishes that firm location and migration patterns changed substantially during the reforms period in ways broadly consistent with the spatial policies' intended effects. However, three fundamental limitations prevent causal interpretation. First, the simultaneous implementation of tax and migration reforms, separated by only two years and accompanied by concurrent changes in trade policy, infrastructure, and economic institutions, makes it difficult to isolate each policy's overall general-equilibrium effect through reduced-form methods. Second, specifications comparing treated and control districts in isolation ignore general equilibrium effects: tax incentives may generate negative spillovers to untreated districts, while migration cost reductions simultaneously affect wages, firm entry, and public services across locations. Third, understanding welfare consequences requires quantifying specific mechanisms—firm entry/exit margins, migration elasticities, public goods provision, and their interactions—which necessitates explicit structural modeling.

The dynamic spatial model developed in Section 3 addresses these limitations by incorporating the institutional features of Vietnam's reforms—age-dependent tax schedules, asymmetric migration cost reductions, and fiscal redistribution—within a general equilibrium framework. The model's structure also enables identification of structural parameters by exploiting policy variation in a model-consistent way.

D Additional Figures and Tables

Figure A3: Gini Coefficients of Regional GDP per Capita in Vietnam and the United States



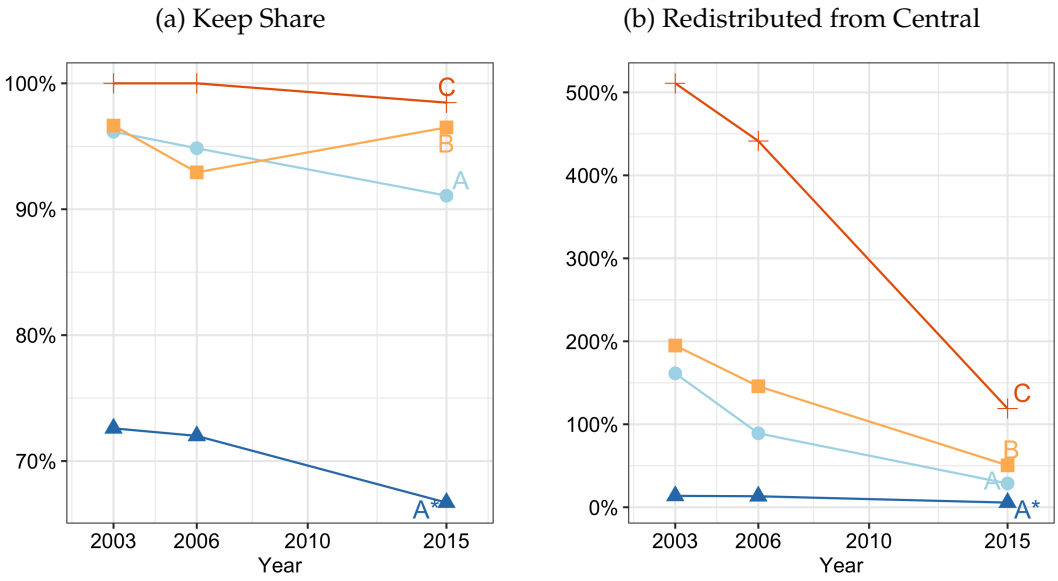
Sources: Vietnam data from Trinh (2019) based on General Statistics Office provincial GDP statistics. U.S. data from Bureau of Economic Analysis

Table A2: 2000 Multi-Plant Firm Shares

Shares of Multi-plant	Firms	Sales	Employment
All	0.011	0.078	0.077
SOE	0.068	0.136	0.119
Private	0.002	0.006	0.018
Foreign	0.006	0.006	0.013

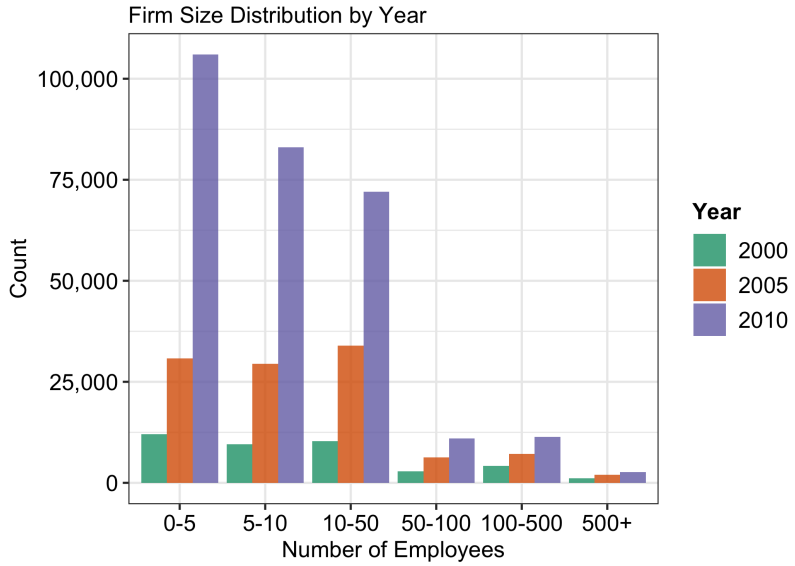
* *Source:* Annual Establishment Surveys, 2000

Figure A4: Fiscal Redistribution Policy



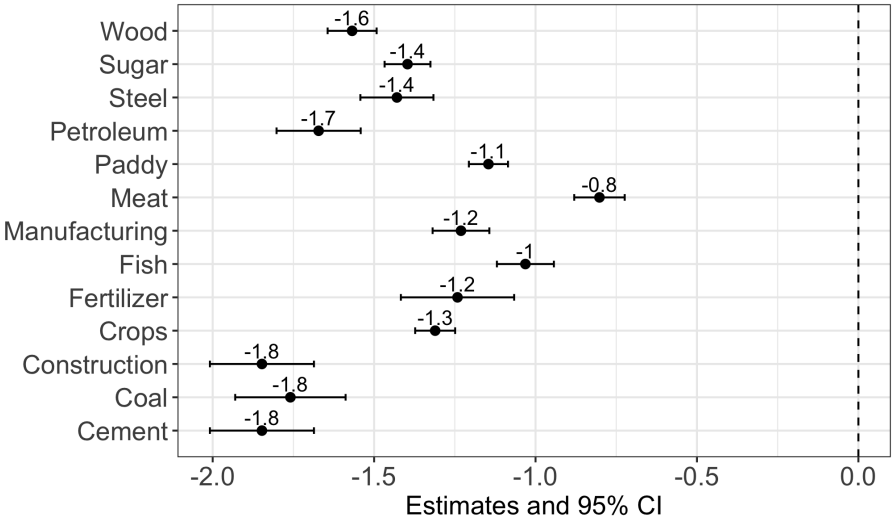
Sources: Ministry of Finance, Decisions 757/2003/QD-BTC, 4526/QD-BTC, and 3137/QD-BTC.
Notes: The A, B, and C labels are at the provincial levels, constructed using the 1999 population share in C and B districts within each province. See Figure 1b for a map of these provincial labels.

Figure A5: Firm Size Distribution 2000, 2005, and 2010



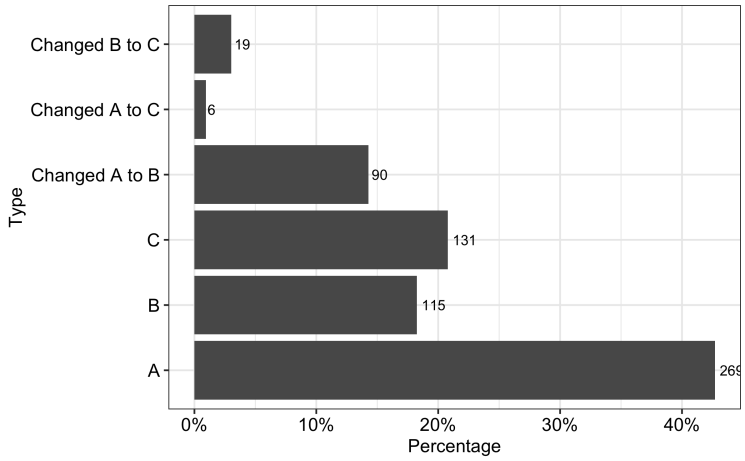
Source: Annual Establishment Surveys (2000, 2005, 2010)

Figure A6: Estimates of Distance Elasticities $(1-\sigma)\kappa^j$



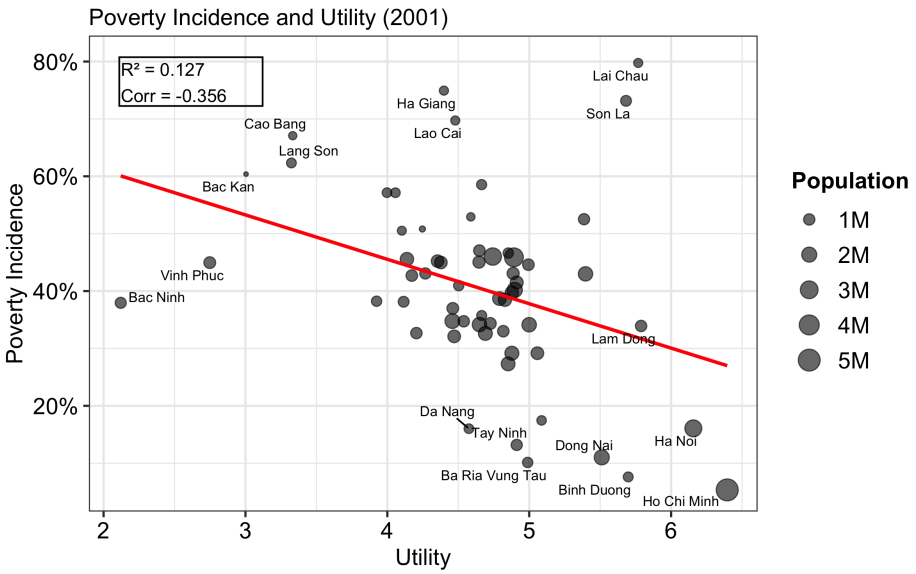
Notes: Data come from JICA (2000). Standard errors are clustered at the origin-destination level.

Figure A7: Distribution of Policy Labels



Sources: Decrees 164/2003/ND-CP and 88/2004/TT-BTC

Figure A8: Estimated Expected Utility 2001 and Poverty Incidence 1999



Notes: This figure shows the correlation between the poverty incidence in 1999 from Minot et al. (2003) and the expected utility averaging from 2001 to 2003 for each province.

E Model Appendix

This appendix derives the welfare measure and proves Propositions 1 and 2.

E.1 Derivation of the Welfare Measure

I derive equation (31). The probability of remaining a worker from equation (5) is

$$\psi_{it}^0 = \frac{\exp(\Xi_{it}/\chi)}{\exp(\Xi_{it}/\chi) + \sum_{k=1}^{J} \exp(\beta V_{it+1}^{k1}/\chi)}.$$

This equation implies the log-sum identity

$$\chi \log \left[\exp(\Xi_{it}/\chi) + \sum_{k=1}^{J} \exp(\beta V_{it+1}^{k1}/\chi) \right] = \Xi_{it} + \chi \log(1/\psi_{it}^0).$$

Hence, the worker's value is

$$U_{it} = \log C_{it}^w + \Xi_{it} + \chi \log(1/\psi_{it}^0), \tag{E.1}$$

where $C_{it}^w \equiv (G_{it}/\mathcal{L}_{it})^\gamma (w_{it}/P_{it})^{1-\gamma}$ is worker consumption. The migration option value satisfies

$$\Xi_{it} = \nu \log \sum_n \exp\left(\frac{\beta U_{nt+1} - m_{in,t}}{\nu} \right),$$

and the probability of staying in i is $\mu_{ii,t} = \exp[(\beta U_{it+1} - m_{ii,t})/\nu]/\sum_n \exp[(\beta U_{nt+1} - m_{in,t})/\nu]$. Using $m_{ii,t} = 0$, we obtain

$$\Xi_{it} = \beta U_{it+1} + \nu \log(1/\mu_{ii,t}). \tag{E.2}$$

Combining (E.1) and (E.2) gives

$$U_{it} = \log C_{it}^w + \beta U_{it+1} + \nu \log(1/\mu_{ii,t}) + \chi \log(1/\psi_{it}^0). \tag{E.3}$$

Iterating forward yields

$$U_{i0} = \sum_{t=0}^{\infty} \beta^t \left[\log C_{it}^w - \nu \log \mu_{ii,t} - \chi \log \psi_{it}^0\right]. \tag{E.4}$$

Define $\bar{c}_i$ as the constant consumption adjustment that equalizes lifetime utility between the counterfactual (prime) and baseline:

$$U'_{i0} - U_{i0} = \sum_{t=0}^{\infty} \beta^t \log \bar{c}_i = \frac{1}{1-\beta} \log \bar{c}_i.$$

Substituting (E.4) for both economies and differencing gives

$$\log \bar{c}_i = (1-\beta) \sum_{t=0}^{\infty} \beta^t \log \left(\frac{C^{w\prime}{}_{it}/C^{w}{}_{it}}{(\mu'_{ii,t}/\mu_{ii,t})^\nu (\psi_{it}^{0\prime}/\psi_{it}^0)^\chi} \right).$$

Define $A_t \equiv \frac{C'_{it}/C_{it}}{(\mu'_{ii,t}/\mu_{ii,t})^\nu (\psi_{it}^{0\prime}/\psi_{it}^0)^\chi}$, so that $\log \bar{c}_i = (1-\beta)\sum_{t=0}^{\infty} \beta^t \log A_t$. Using $(1-\beta)\sum_{t=0}^{\infty} \beta^t x_t = \sum_{t=0}^{\infty} \beta^t x_t - \sum_{t=0}^{\infty} \beta^{t+1} x_t$ yields

$$\log \bar{c}_i = \sum_{t=0}^{\infty} \beta^t \log A_t - \sum_{t=0}^{\infty} \beta^{t+1} \log A_t = \log A_0 + \sum_{t=1}^{\infty} \beta^t \log(A_t/A_{t-1}).$$

There is no policy change at $t = 0$, so $A_0 = 1$ and $\log A_0 = 0$. Hence $\log \bar{c}_i = \sum_{t=1}^{\infty} \beta^t \log(A_t/A_{t-1})$. Now note that

$$\frac{A_t}{A_{t-1}} = \frac{\widehat{C}_{it}^w}{(\widehat{\mu}_{ii,t})^\nu (\widehat{\psi}_{it}^0)^\chi},$$

where $\widehat{y}_t \equiv \dot{y}'_t/\dot{y}_t$ is the ratio of counterfactual-to-baseline time changes and $\dot{y}_t \equiv y_t/y_{t-1}$. Therefore,

$$\log \bar{c}_i = \sum_{t=1}^{\infty} \beta^t \log \left(\frac{\widehat{C}_{it}^w}{(\widehat{\mu}_{ii,t})^\nu (\widehat{\psi}_{it}^0)^\chi} \right), \tag{E.5}$$

which corresponds to equation (31) in the main text.

E.2 Proof of Proposition 1: Dot Algebra

I show that given allocation at period t, $(\mathcal{S}_t, \mu_{t-1}, \varsigma_{t-1}, \psi_{t-1}, \lambda_t)$ and constant sequences of policies and fundamentals thereafter, the sequential equilibrium in relative time change can be solved without knowing fundamental levels. Define dot notation $\dot{y}_{t+1} \equiv y_{t+1}/y_t$. The following equilibrium conditions use only dot variables:

Sequential equilibrium equations. I first derive the value function equations. Recall the level form of worker utility from the model:

$$U_{it} = \gamma \ln\left(\frac{G_{it}}{\mathcal{L}_{it}}\right) + (1-\gamma)\ln\left(\frac{w_{it}}{P_{it}}\right) + \chi \ln\left[\exp(\Xi_{it})^{1/\chi} + \sum_{j=1}^{J} \exp(V_{it+1}^{j1})^{\beta/\chi}\right].$$

Define $u_{it} \equiv \exp(U_{it})$, $v_{it}^{j1} \equiv \exp(V_{it+1}^{j1})$, and $\widetilde{\Xi}_{it} \equiv \exp(\Xi_{it})$. Then

$$u_{it} = \left(\frac{G_{it}}{\mathcal{L}_{it}}\right)^{\gamma} \left(\frac{w_{it}}{P_{it}}\right)^{1-\gamma} \left[(\widetilde{\Xi}_{it})^{1/\chi} + \sum_{j=1}^{J} (v_{it+1}^{j1})^{\beta/\chi}\right]^{\chi}.$$

Taking the ratio $\dot{u}_{it} \equiv u_{it}/u_{it-1}$ and factoring the bracketed term yields

$$\dot{u}_{it} = \left(\frac{\dot{G}_{it}}{\dot{\mathcal{L}}_{it}}\right)^{\gamma} \left(\frac{\dot{w}_{it}}{\dot{P}_{it}}\right)^{1-\gamma} \left[\frac{(\widetilde{\Xi}_{it})^{1/\chi} + \sum_{j=1}^{J} (v_{it+1}^{j1})^{\beta/\chi}}{(\widetilde{\Xi}_{it-1})^{1/\chi} + \sum_{j=1}^{J} (v_{it}^{j1})^{\beta/\chi}}\right]^{\chi}.$$

Recall the entry shares $\psi_{it-1}^{0} = (\widetilde{\Xi}_{it-1})^{1/\chi}/[(\widetilde{\Xi}_{it-1})^{1/\chi} + \sum_{j=1}^{J}(v_{it}^{j1})^{\beta/\chi}]$ and $\psi_{it-1}^{j} = (v_{it}^{j1})^{\beta/\chi}/[(\widetilde{\Xi}_{it-1})^{1/\chi} + \sum_{k=1}^{J}(v_{it}^{k1})^{\beta/\chi}]$. Factoring the numerator using $\dot{\Xi}_{it} \equiv \widetilde{\Xi}_{it}/\widetilde{\Xi}_{it-1}$ and $\dot{v}_{it+1}^{j1} \equiv v_{it+1}^{j1}/v_{it}^{j1}$, the bracketed ratio becomes $\psi_{it-1}^{0}(\dot{\Xi}_{it})^{1/\chi} + \sum_{j=1}^{J} \psi_{it-1}^{j}(\dot{v}_{it+1}^{j1})^{\beta/\chi}$. Hence,

$$\dot{u}_{it} = \left(\frac{\dot{G}_{it}}{\dot{\mathcal{L}}_{it}}\right)^{\gamma} \left(\frac{\dot{w}_{it}}{\dot{P}_{it}}\right)^{1-\gamma} \left[\psi_{it-1}^{0}(\dot{\Xi}_{it})^{1/\chi} + \sum_{j=1}^{J} \psi_{it-1}^{j}(\dot{v}_{it+1}^{j1})^{\beta/\chi}\right]^{\chi}. \tag{E.6}$$

For the firm value function, recall the level equation $V_{it}^{ja} = \ln(c_{it}^{ja}) + \chi \ln[\exp(V_{it+1}^{ja+1})^{\beta/\chi} + \exp(U_{it+1})^{\beta/\chi}]$. Define $v_{it}^{ja} \equiv \exp(V_{it}^{ja})$. Then $v_{it}^{ja} = c_{it}^{ja}[(v_{it+1}^{ja+1})^{\beta/\chi} + (u_{it+1})^{\beta/\chi}]^{\chi}$. Taking the ratio $\dot{v}_{it}^{ja} \equiv v_{it}^{ja}/v_{it-1}^{ja}$ and using the continuation probability $\varsigma_{it}^{ja} = (v_{it+1}^{ja+1})^{\beta/\chi}/[(v_{it+1}^{ja+1})^{\beta/\chi} + (u_{it+1})^{\beta/\chi}]$ yields

$$\dot{v}_{it}^{ja} = \dot{c}_{it}^{ja}\left[\varsigma_{it-1}^{ja}(\dot{v}_{it+1}^{ja+1})^{\beta/\chi} + (1-\varsigma_{it-1}^{ja})(\dot{u}_{it+1})^{\beta/\chi}\right]^{\chi}. \tag{E.7}$$

The migration option value follows analogously. The equilibrium system is:

Value functions and choice probabilities:

$$\begin{aligned}
\dot{v}_{it}^{ja} &= \dot{c}_{it}^{ja}\left[\varsigma_{i,t-1}^{ja}\left(\dot{v}_{it+1}^{ja+1}\right)^{\frac{\beta}{\chi}} + (1-\varsigma_{it-1}^{ja})\left(\dot{u}_{it+1}\right)^{\frac{\beta}{\chi}}\right]^{\chi} \\
\dot{\Xi}_{it} &= \left(\sum_{n=1}^{N}\mu_{in,t-1}(\dot{u}_{nt+1})^{\frac{\beta}{\nu}}(\dot{m}_{int})^{\frac{-1}{\nu}}\right)^{\nu} \\
\dot{u}_{it} &= \left(\frac{\dot{G}_{it}}{\dot{\mathcal{L}}_{it}}\right)^{\gamma}\left(\frac{\dot{w}_{it}}{\dot{P}_{it}}\right)^{1-\gamma}\left[\psi_{it-1}^{0}\left(\dot{\Xi}_{it}\right)^{\frac{1}{\chi}} + \sum_{j=1}^{J}\psi_{it-1}^{j}(\dot{v}_{it+1}^{j1})^{\frac{\beta}{\chi}}\right]^{\chi}.
\end{aligned} \tag{E.8}$$

Continuation and entry shares:

$$\varsigma_{it}^{ja} = \frac{\varsigma_{it-1}^{ja}\left(\dot{v}_{it+1}^{ja+1}\right)^{\frac{\beta}{\chi}}}{\varsigma_{it-1}^{ja}\left(\dot{v}_{it+1}^{ja+1}\right)^{\frac{\beta}{\chi}} + (1-\varsigma_{it-1}^{ja})\left(\dot{u}_{it+1}\right)^{\frac{\beta}{\chi}}} \tag{E.9}$$

$$\psi_{it}^{j} = \frac{\psi_{it-1}^{j}\left(\dot{v}_{it+1}^{j1}\right)^{\frac{\beta}{\chi}}}{\psi_{it-1}^{0}\dot{\Xi}_{it}^{\frac{1}{\chi}} + \sum_{j'=1}^{J}\psi_{it-1}^{j'}(\dot{v}_{it+1}^{j'1})^{\frac{\beta}{\chi}}}, \forall j > 0 \tag{E.10}$$

$$\psi_{it}^{0} = \frac{\psi_{it-1}^{0}\dot{\Xi}_{it}^{\frac{1}{\chi}}}{\psi_{it-1}^{0}\dot{\Xi}_{it}^{\frac{1}{\chi}} + \sum_{j'=1}^{J}\psi_{it-1}^{j'}(\dot{v}_{it+1}^{j'1})^{\frac{\beta}{\chi}}} \tag{E.11}$$

Migration shares:

$$\mu_{int} = \frac{\mu_{int-1}\left(\dot{u}_{nt+1}\right)^{\frac{\beta}{\nu}}\left(\dot{m}_{int}\right)^{\frac{-1}{\nu}}}{\sum_{c=1}^{N}\mu_{ict-1}(\dot{u}_{ct+1})^{\frac{\beta}{\nu}}(\dot{m}_{ict})^{\frac{-1}{\nu}}}. \tag{E.12}$$

Population dynamics:

$$L_{it+1} = \sum_{n=1}^{N}\mu_{nit}\psi_{nt}^{0}L_{nt} + \sum_{j=1}^{J}\sum_{a=1}^{\mathcal{A}}\left(1-\varsigma_{it}^{ja}\right)E_{it}^{ja}. \tag{E.13}$$

$$E_{it+1}^{ja} = \varsigma_{it}^{j,a-1}E_{it}^{j,a-1} \quad \text{for } a = 2,\ldots,\mathcal{A} \tag{E.14}$$

$$E_{it+1}^{j1} = \psi_{it}^{j}L_{it}. \tag{E.15}$$

Static equilibrium: prices given populations. Given $\{L_{it}, E_{it}^{ja}\}$, the static equilibrium determines $\{\dot{w}_{it}, \dot{P}_{it}, \dot{G}_{it}\}$. I derive each temporary equilibrium equation in dot notation.

To derive the sectoral price index, recall from equation (4):

$$P_{it}^{j} = \left(\sum_{n=1}^{N}E_{nt}^{j}(p_{nit}^{j})^{1-\sigma}\right)^{1/(1-\sigma)}.$$

Taking the ratio of next-period and current-period price indices yields

$$\dot{P}^j_{it+1} = \frac{P^j_{it+1}}{P^j_{it}} = \left(\frac{\sum_{n=1}^N E^j_{nt+1} (p^j_{nit+1})^{1-\sigma}}{\sum_{n=1}^N E^j_{nt} (p^j_{nit})^{1-\sigma}} \right)^{1/(1-\sigma)}.$$

I can rewrite the numerator as

$$\sum_{n=1}^N E^j_{nt+1} (p^j_{nit+1})^{1-\sigma} = \sum_{n=1}^N [E^j_{nt} (p^j_{nit})^{1-\sigma}] \dot{E}^j_{nt+1} (\dot{p}^j_{nit+1})^{1-\sigma}.$$

Recall the trade share $\lambda^j_{nit} = E^j_{nt} (p^j_{nit})^{1-\sigma} / \sum_{m=1}^N E^j_{m,t} (p^j_{mit})^{1-\sigma}$. Then,

$$\frac{\sum_n E^j_{nt+1} (p^j_{nit+1})^{1-\sigma}}{\sum_n E^j_{nt} (p^j_{nit})^{1-\sigma}} = \sum_{n=1}^N \lambda^j_{nit} \dot{E}^j_{nt+1} (\dot{p}^j_{nit+1})^{1-\sigma}.$$

Putting all pieces together yields

$$\dot{P}^j_{it+1} = \left(\sum_n \lambda^j_{nit} \dot{E}^j_{nt+1} (\dot{p}^j_{nit+1})^{1-\sigma} \right)^{1/(1-\sigma)}. \tag{E.16}$$

To get the location price index in dot form, recall the Cobb-Douglas aggregate over sectoral price indices:

$$P_{it} = \prod_{j=1}^J (P^j_{it} / \alpha^j)^{\alpha^j}.$$

Taking the ratio from t to $t+1$ yields

$$\dot{P}_{it+1} = \prod_{j=1}^J (\dot{P}^j_{it+1})^{\alpha^j}. \tag{E.17}$$

I now turn to the rental cost of land. Recall the land market clearing condition $r_{it} H^j_{it} = \frac{1-\xi^j}{\xi^j} w_{it} L^j_{it}$. Summing over all sectors j and using $\sum_j H^j_{it} = H_i$ (constant land endowment) yields

$$r_{it} = w_{it} \frac{\sum_j \frac{1-\xi^j}{\xi^j} L^j_{it}}{H_i}.$$

Taking ratios over time yields

$$\dot{r}_{it+1} = \dot{w}_{it+1} \frac{\sum_j \frac{1-\xi^j}{\xi^j} L^j_{it+1}}{\sum_j \frac{1-\xi^j}{\xi^j} L^j_{it}}. \tag{E.18}$$

For monopolistic pricing, recall that prices equal unit costs times markup: $p^j_{int} = (\sigma/(\sigma-1)) d^j_{in} x^j_{it} / A^j_{it}$, where $x^j_{it} = B^j (w_{it})^{\xi^j} (r_{it})^{1-\xi^j}$ is the unit cost. Because $\sigma/(\sigma-1)$, d^j_{in}, and A^j_{it} are

assumed constant from 2019 onwards,

$$\dot{p}^j_{int+1} = \dot{x}^j_{it+1} = (\dot{w}_{it+1})^{\xi^j}(\dot{r}_{it+1})^{1-\xi^j}. \tag{E.19}$$

For trade shares, recall the definition $\lambda^j_{int} = E^j_{it}(p^j_{int})^{1-\sigma} / \sum_{o=1}^N E^j_{ot}(p^j_{ont})^{1-\sigma}$. Then,

$$\dot{\lambda}^j_{int+1} = \frac{\lambda^j_{int+1}}{\lambda^j_{int}} = \frac{E^j_{it+1}(p^j_{int+1})^{1-\sigma} / \sum_o E^j_{ot+1}(p^j_{ont+1})^{1-\sigma}}{E^j_{it}(p^j_{int})^{1-\sigma} / \sum_o E^j_{ot}(p^j_{ont})^{1-\sigma}}.$$

Observe that $\sum_o E^j_{ot+1}(p^j_{ont+1})^{1-\sigma} = \sum_o [E^j_{ot}(p^j_{ont})^{1-\sigma}]\dot{E}^j_{ot+1}(\dot{p}^j_{ont+1})^{1-\sigma}$. Recall that $(\dot{P}^j_{nt+1})^{1-\sigma} = \sum_o \lambda^j_{ont}\dot{E}^j_{ot+1}(\dot{p}^j_{ont+1})^{1-\sigma}$ from (E.16). Substituting and simplifying yields

$$\dot{\lambda}^j_{int+1} = \dot{E}^j_{it+1}\left(\frac{\dot{p}^j_{int+1}}{\dot{P}^j_{nt+1}}\right)^{1-\sigma}. \tag{E.20}$$

For firm profits, recall the level definition of profits from selling location i to location n:

$$\pi^j_{int} = \frac{p^j_{int}y^j_{int}}{\sigma} = \frac{\lambda^j_{int}X^j_{nt}}{\sigma E^j_{it}}.$$

Total profits are $\pi^j_{it+1} = \sum_n \dot{\pi}^j_{int+1}\pi^j_{int}$ where

$$\dot{\pi}^j_{int+1} = \frac{\pi^j_{int+1}}{\pi^j_{int}} = \frac{(p^j_{int+1})^{1-\sigma}(P^j_{nt+1})^{\sigma-1}X^j_{nt+1}}{(p^j_{int})^{1-\sigma}(P^j_{nt})^{\sigma-1}X^j_{nt}} = (\dot{x}^j_{it+1})^{1-\sigma}(\dot{P}^j_{nt+1})^{\sigma-1}\dot{X}^j_{nt+1}.$$

Hence,

$$\pi^j_{it+1} = \frac{1}{\sigma}\sum_{n=1}^N (\dot{x}^j_{it+1})^{1-\sigma}(\dot{P}^j_{nt+1})^{\sigma-1}\frac{\lambda^j_{int}}{E^j_{it}}X^j_{nt+1}. \tag{E.21}$$

Finally, labor market clearing is

$$\dot{w}_{it+1}\dot{L}^j_{it+1}w_{it}L^j_{it} = \xi^j\frac{\sigma-1}{\sigma}\sum_{n=1}^N \dot{\lambda}^j_{int+1}\lambda^j_{int}\alpha^j\Pi_{nt+1}, \tag{E.22}$$

where Π_{nt+1} is total income in location n determined from government budgets, factor payments, and profits (E.21).

Equations (E.16)–(E.22) form a system in $\{\dot{w}_{it}, \dot{r}_{it}, \dot{P}^j_{it}, \dot{\lambda}^j_{int}\}$ that depends only on current population stocks and lagged trade shares. The system (E.7)–(E.22) can be solved recursively for all periods $t \geq 1$ given initial conditions at $t = 0$. ■

E.3 Proof of Proposition 2: Dynamic Hat Algebra

Define hat notation $\widehat{y}_{t+1} \equiv \dot{y}'_{t+1}/\dot{y}_{t+1}$ where primes denote counterfactual values and $\dot{y}'_{t+1} = y'_{t+1}/y'_t$, $\dot{y}_{t+1} = y_{t+1}/y_t$. I derive the equilibrium conditions in hat notation by taking ratios of counterfactual and baseline versions of the dot algebra equations from Proposition 1.

Equilibrium conditions for $t > 1$. To derive the value function in hat notation, write the counterfactual version of (E.7):

$$\dot{v}'^{ja}_{it} = \dot{c}'^{ja}_{it}[\varsigma'^{ja}_{it-1}(\dot{v}'^{ja+1}_{it+1})^{\beta/\chi} + (1-\varsigma'^{ja}_{it-1})(\dot{u}'_{it+1})^{\beta/\chi}]^{\chi}.$$

Taking the ratio $\widehat{v}^{ja}_{it} \equiv \dot{v}'^{ja}_{it}/\dot{v}^{ja}_{it}$ and dividing both sides by the baseline version yields

$$\widehat{v}^{ja}_{it} = \widehat{c}^{ja}_{it}\left[\varsigma^{ja}_{it}\left(\widehat{v}^{ja+1}_{it+1}\right)^{\frac{\beta}{\chi}} + (1-\varsigma^{ja}_{it})\left(\widehat{u}_{it+1}\right)^{\frac{\beta}{\chi}}\right]^{\chi}. \tag{E.23}$$

For the migration option value and worker utility, the same approach applies. Taking ratios of counterfactual and baseline versions of (E.8) and (E.6), and using $\widehat{\mu}_{int} \equiv \mu'_{int}/\mu_{int}$ and $\widehat{\psi}^{j}_{it} \equiv \psi'^{j}_{it}/\psi^{j}_{it}$, yields:

$$\widehat{\Xi}_{it} = \left(\sum_{n=1}^{N} \mu'_{int-1}\dot{\mu}_{int}(\widehat{u}_{nt+1})^{\frac{\beta}{\nu}}(\widehat{m}_{int})^{\frac{-1}{\nu}}\right)^{\nu} \tag{E.24}$$

$$\widehat{u}_{it} = \widehat{c}_{it}\left[\psi'^{0}_{it-1}\dot{\psi}^{0}_{it}(\widehat{\Xi}_{it})^{\frac{1}{\chi}} + \sum_{j'=1}^{J}\psi'^{j'}_{it-1}\dot{\psi}^{j'}_{it}(\widehat{v}^{j'1}_{it+1})^{\frac{\beta}{\chi}}\right]^{\chi}. \tag{E.25}$$

Choice probabilities follow from taking ratios of (E.9), (E.10), and (E.12):

$$\varsigma'^{ja}_{it} = \frac{\varsigma'^{ja}_{it-1}\dot{\varsigma}^{ja}_{it}(\widehat{v}^{ja+1}_{it+1})^{\frac{\beta}{\chi}}}{\varsigma'^{ja}_{it-1}\dot{\varsigma}^{ja}_{it}(\widehat{v}^{ja+1}_{it+1})^{\frac{\beta}{\chi}} + \frac{1-\varsigma'^{ja}_{it-1}}{1-\varsigma^{ja}_{it-1}}(1-\varsigma^{ja}_{it})(\widehat{u}_{it+1})^{\frac{\beta}{\chi}}} \tag{E.26}$$

$$\psi'^{j}_{it} = \frac{\psi'^{j}_{it-1}\dot{\psi}^{j}_{it}(\widehat{v}^{j1}_{it+1})^{\frac{\beta}{\chi}}}{\psi'^{0}_{it-1}\dot{\psi}^{0}_{it}(\widehat{\Xi}_{it})^{\frac{1}{\chi}} + \sum_{j'=1}^{J}\psi'^{j'}_{it-1}\dot{\psi}^{j'}_{it}(\widehat{v}^{j'1}_{it+1})^{\frac{\beta}{\chi}}} \tag{E.27}$$

and migration shares:

$$\mu'_{int} = \frac{\mu'_{int-1}\dot{\mu}_{int}(\widehat{u}_{nt+1})^{\frac{\beta}{\nu}}(\widehat{m}_{int})^{\frac{-1}{\nu}}}{\sum_{n'=1}^{N}\mu'_{in't-1}\dot{\mu}_{in't}(\widehat{u}_{n't+1})^{\frac{\beta}{\nu}}(\widehat{m}_{in't})^{\frac{-1}{\nu}}}. \tag{E.28}$$

Equilibrium conditions for $t = 1$. At $t = 1$, agents learn about policy sequences and form perfect-foresight expectations. This creates special initial conditions because agents at $t = 0$ did not anticipate the policy change.

To derive the $t = 1$ value function, note that at $t = 0$ (before policy change): $V_{i0}^{ja} = \ln c_{i0}^{ja} + \chi \ln[\exp(V_{i1}^{ja+1})^{\beta/\chi} + \exp(U_{i1})^{\beta/\chi}]$. After the policy change: $V_{i1}^{\prime ja} = \ln c_{i1}^{\prime ja} + \chi \ln[\exp(V_{i2}^{\prime,ja+1})^{\beta/\chi} + \exp(U_{i2}^{\prime})^{\beta/\chi}]$. Since $v_{i0}^{\prime ja} = v_{i0}^{ja}$ (no change at $t = 0$), we have $\widehat{v}_{i1}^{ja} = v_{i1}^{\prime ja}/v_{i1}^{ja}$. Taking exponentials and using the continuation probability, the value functions incorporate continuation values from both $t = 1$ and $t = 2$:

$$\widehat{v}_{i1}^{ja} = \widehat{c}_{i1}^{ja} \left[\varsigma_{i1}^{ja} \left(\widehat{v}_{i1}^{ja+1} \right)^{\frac{\beta}{\chi}} \left(\widehat{v}_{i2}^{ja+1} \right)^{\frac{\beta}{\chi}} + (1 - \varsigma_{i1}^{ja}) \left(\widehat{u}_{i1} \right)^{\frac{\beta}{\chi}} \left(\widehat{u}_{i2} \right)^{\frac{\beta}{\chi}} \right]^{\chi} \tag{E.29}$$

$$\widehat{\Xi}_{i1} = \left(\sum_{n=1}^{N} \mu_{in1} (\widehat{u}_{n1})^{\frac{\beta}{\nu}} (\widehat{u}_{n2})^{\frac{\beta}{\nu}} (\widehat{m}_{in1})^{\frac{-1}{\nu}} \right)^{\nu} \tag{E.30}$$

$$\widehat{u}_{i1} = \widehat{c}_{i1} \left[\psi_{i1}^{0} (\widehat{\Xi}_{i1})^{\frac{1}{\chi}} + \sum_{j'=1}^{J} \psi_{i1}^{j'} (\widehat{v}_{i1}^{j'1})^{\frac{\beta}{\chi}} (\widehat{v}_{i2}^{j'1})^{\frac{\beta}{\chi}} \right]^{\chi}. \tag{E.31}$$

Choice probabilities at $t = 1$ are:

$$\varsigma_{i1}^{ja} = \frac{\varsigma_{i1}^{ja} (\widehat{v}_{i1}^{ja+1})^{\frac{\beta}{\chi}} (\widehat{v}_{i2}^{ja+1})^{\frac{\beta}{\chi}}}{\varsigma_{i1}^{ja} (\widehat{v}_{i1}^{ja+1})^{\frac{\beta}{\chi}} (\widehat{v}_{i2}^{ja+1})^{\frac{\beta}{\chi}} + (1 - \varsigma_{i1}^{ja}) (\widehat{u}_{i1})^{\frac{\beta}{\chi}} (\widehat{u}_{i2})^{\frac{\beta}{\chi}}} \tag{E.32}$$

$$\psi^{\prime j}_{i1} = \frac{\psi_{i1}^{j} (\widehat{v}_{i1}^{j1})^{\frac{\beta}{\chi}} (\widehat{v}_{i2}^{j1})^{\frac{\beta}{\chi}}}{\psi_{i1}^{0} (\widehat{\Xi}_{i1})^{\frac{1}{\chi}} + \sum_{j'=1}^{J} \psi_{i1}^{j'} (\widehat{v}_{i1}^{j'1})^{\frac{\beta}{\chi}} (\widehat{v}_{i2}^{j'1})^{\frac{\beta}{\chi}}} \tag{E.33}$$

and migration shares:

$$\mu^{\prime}{}_{in1} = \frac{\mu_{in1} (\widehat{u}_{n1})^{\frac{\beta}{\nu}} (\widehat{u}_{n2})^{\frac{\beta}{\nu}} (\widehat{m}_{in1})^{\frac{-1}{\nu}}}{\sum_{n'=1}^{N} \mu_{in'1} (\widehat{u}_{n'1})^{\frac{\beta}{\nu}} (\widehat{u}_{n'2})^{\frac{\beta}{\nu}} (\widehat{m}_{in'1})^{\frac{-1}{\nu}}}. \tag{E.34}$$

Static equilibrium in hat form. To derive the price index in hat notation, write the counterfactual version of (E.16):

$$\dot{P}^{\prime j}_{it+1} = \left(\sum_{n} \lambda^{\prime j}_{nit} \dot{E}^{\prime j}_{nt+1} (\dot{p}^{\prime j}_{nit+1})^{1-\sigma} \right)^{1/(1-\sigma)}.$$

Using $\dot{\lambda}^{\prime j}_{int+1} (\dot{P}^{\prime j}_{nt+1})^{1-\sigma} = \dot{E}^{\prime j}_{it+1} (\dot{x}^{\prime j}_{it+1})^{1-\sigma}$ from the counterfactual version of (E.20), we can write $\dot{P}^{\prime j}_{it+1} = \dot{P}^{j}_{it+1} (\sum_n \lambda^{\prime j}_{nit} \dot{\lambda}^{j}_{nit+1} \widehat{E}^{j}_{nt+1} (\widehat{x}^{j}_{nt+1})^{1-\sigma})^{1/(1-\sigma)}$. Taking the ratio $\widehat{P}^{j}_{it} \equiv \dot{P}^{\prime j}_{it} / \dot{P}^{j}_{it}$ yields the price index. Other static equilibrium equations follow similarly. Price indices:

$$\widehat{P}^{j}_{it} = \left(\sum_{n} \lambda^{j\prime}_{nit-1} \dot{\lambda}^{j}_{nit} \widehat{E}^{j}_{nt} (\widehat{x}^{j}_{nt})^{1-\sigma} \right)^{1/(1-\sigma)} \tag{E.35}$$

$$\widehat{P}_{it+1} = \prod_{j=1}^{J} (\widehat{P}^{j}_{it+1})^{\alpha^j}. \tag{E.36}$$

Rental price and monopolistic pricing:

$$\widehat{r}_{it+1} = \widehat{w}_{it+1} \left(\frac{\sum_j \frac{1-\xi^j}{\xi^j} L'^j_{it+1}}{\sum_j \frac{1-\xi^j}{\xi^j} L'^j_{it}} \Big/ \frac{\sum_j \frac{1-\xi^j}{\xi^j} L^j_{it+1}}{\sum_j \frac{1-\xi^j}{\xi^j} L^j_{it}} \right) \tag{E.37}$$

$$\widehat{p}^j_{int+1} = \widehat{x}^j_{it+1} = (\widehat{w}_{it+1})^{\xi^j} (\widehat{r}_{it+1})^{1-\xi^j}. \tag{E.38}$$

Trade share evolution:

$$\lambda'^j_{int+1} = \lambda'^j_{int} \dot{\lambda}^j_{int+1} \widehat{E}^j_{it+1} (\widehat{x}^j_{it+1})^{1-\sigma} (\widehat{P}^j_{nt+1})^{\sigma-1}. \tag{E.39}$$

The system (E.23)–(E.39), together with $t = 1$ initial conditions (E.29)–(E.34), determines all counterfactual variables recursively given the baseline economy and policy sequence. ■

E.4 Solution Algorithms

The proofs are constructive and yield numerical algorithms. I describe the procedures with explicit steps.

Baseline algorithm (Proposition 1). Starting from observed data at $t = 0$ (year 2019), solve for equilibrium under constant policies and fundamentals. The algorithm iterates on value functions $\{\dot{v}^{ja}_{it}, \dot{u}_{it}\}$ for all future periods $t \geq 1$.

Initialization: Set $\dot{v}^{ja}_{it} = 1$ and $\dot{u}_{it} = 1$ for all i, j, a, t.

Iteration: For each iteration k, perform these steps for all periods $t = 1, 2, \ldots, T$:

1. Update choice probabilities (sequential equilibrium): Using current value guesses $\{\dot{v}^{ja,(k)}_{it}, \dot{u}^{(k)}_{it}\}$, compute continuation probabilities $\varsigma^{ja,(k+1)}_{it}$ from (E.9), entry shares $\psi^{j,(k+1)}_{it}$ from (E.10)–(E.11), and migration shares $\mu^{(k+1)}_{int}$ from (E.12).

2. Update population stocks (sequential equilibrium): Using choice probabilities from step 1, evolve population according to (E.13)–(E.15).

3. Solve static equilibrium: Given population stocks $\{L^{(k+1)}_{it}, E^{ja,(k+1)}_{it}\}$, solve equations (E.16)–(E.22) for prices $\{\dot{w}^{(k+1)}_{it+1}, \dot{r}^{(k+1)}_{it+1}, \dot{P}^{j,(k+1)}_{it+1}\}$.

4. Update value functions (sequential equilibrium): Using prices from step 3, compute consumption changes and update entrepreneur values $\dot{v}^{ja,(k+1)}_{it}$ from (E.7) and worker values $\dot{u}^{(k+1)}_{it}$ from (E.6).

Convergence: If $\max_{i,j,a,t} |\dot{v}^{ja,(k+1)}_{it} - \dot{v}^{ja,(k)}_{it}| < \epsilon$, stop. Otherwise set $k \leftarrow k + 1$ and repeat.

Counterfactual algorithm (Proposition 2). Given the solved baseline and counterfactual policy sequence $\{\widehat{\tau}_{it}^{a}, \widehat{m}_{int}\}_{t\geq 1}$, solve for hat variables $\{\widehat{v}_{it}^{ja}, \widehat{u}_{it}\}$ using the same structure with two modifications:

(a) At $t = 1$, use equations (E.29)–(E.34) to account for the unanticipated policy change.

(b) For $t > 1$, update counterfactual probabilities using (E.26)–(E.28), which includes ratio $(1 - \varsigma_{it-1}^{'ja})/(1 - \varsigma_{it-1}^{ja})$ to ensure exit probabilities scale consistently.

The algorithm produces $\{\widehat{L}_{it}, \widehat{E}_{it}^{ja}, \widehat{w}_{it}, \widehat{P}_{it}\}$ which, with welfare formula (31), quantify the welfare impact.