Urban-Biased Structural Change*

Natalie Chen† Dennis Novy‡ Carlo Perroni§ Horng Chern Wong¶

April 2026

Abstract

Using French micro-data, we document that between 1995 and 2018 the rise of tradable services disproportionately favored dense cities, especially through the expansion of large tradable-services firms and the relative decline of large manufacturing firms. These changes were accompanied by sharply rising urban house prices but no compensating increase in urban nominal wages. Using a quantitative spatial equilibrium model, we show that the interaction of firm sorting and endogenous local-service variety can explain these patterns. In the model, tradable-services growth reallocates activity toward dense cities, where large tradable-services firms are more strongly concentrated. The induced expansion of local-service variety then raises urban amenities and moderates nominal wage growth, allowing those firms to expand further despite rising housing costs. As a result, spatial welfare gaps widen even though conventional indicators based on wages and house prices substantially understate the change.

Keywords: Agglomeration, Cities, House Prices, Services, Sorting, Structural Change
JEL codes: R11, R12, R30

*Chen, Novy and Perroni acknowledge research support from the Economic and Social Research Council (ESRC grant ES/Z504701/1). Wong acknowledges financial support from the ERC TRADENET grant (714597) and Handelsbanken Program grant (P23-0309). For data access and assistance, we thank DGFiP, INSEE, and CASD. We are grateful for comments from various seminar and conference presentations, in particular by Ernest Liu, Andreas Moxnes, Florian Sniekers, Etienne Wasmer, and Jens Wrona. Chen is also affiliated with CEPR and CESifo. Novy is also affiliated with CEPR, CEP/LSE and CESifo. Perroni is also affiliated with CESifo. Wong is also affiliated with the Rockwool Foundation Berlin.

†Department of Economics, University of Warwick. Email: n.a.chen@warwick.ac.uk
‡Department of Economics, University of Warwick. Email: d.novy@warwick.ac.uk
§Department of Economics, University of Warwick. Email: c.perroni@warwick.ac.uk
¶Department of Economics, Stockholm University. Email: horngchernwong@gmail.com

1 Introduction

Public debate on living standards often centers on cost-of-living pressures. In less dense places, these pressures are often associated with sluggish wage and employment growth relative to larger cities (Weber and Tickamyer, 2020; International Labour Organization, 2024). In dense urban areas, by contrast, they increasingly reflect house prices that have risen faster than wages (Baum-Snow and Duranton, 2025). At the same time, recent decades have seen growing spatial divides coincide with major shifts in the sectoral composition of economic activity.

In this paper, we study how these forces played out in France between 1995 and 2018 using administrative data that link plants, firms, and workers across locations. We document that dense cities experienced a markedly faster shift toward tradable services than less dense places, despite already being more service-oriented at the start of the period. This uneven reallocation was driven disproportionately by large firms: large tradable-services firms expanded further in dense cities, while large manufacturing firms declined there. At the same time, house prices rose sharply in dense cities, but urban nominal wage premia did not keep pace and instead fell. How did dense cities become more attractive to large tradable-services firms even as they became much more expensive places to live in without offering commensurately higher nominal wages?

To interpret these patterns, we build a quantitative spatial equilibrium model in which firms sort across cities and workers value both housing and non-tradable local services such as restaurants and entertainment. In the model, faster productivity growth in tradable services shifts economic activity toward dense cities, where large tradable-services firms are more prevalent. This raises labor demand and housing costs in those locations, but it also increases demand for local services, inducing entry of new local varieties. Because residents value these varieties, tradable-services growth endogenously creates a local amenity in dense cities. That endogenous amenity reduces the nominal wage increase needed to attract workers despite higher house prices. By relaxing wage pressure, it allows large tradable-services firms to expand further in expensive dense cities, while higher house prices weigh more heavily on manufacturing firms, which are more housing-intensive.

This mechanism can help explain how large tradable-services firms expanded further in dense cities even as urban house prices rose sharply and urban nominal wage premia showed no compensating increase. Local services do not only respond to the expansion of tradable services; they help sustain it by easing the labor-cost pressure that would otherwise limit the growth of large tradable-services firms in expensive dense cities. Without the endogenous expansion of local-service variety, faster growth in tradable services would still raise housing costs in dense cities, but nominal wages would need to rise more sharply and the urban concentration of tradable-services activity would be much weaker. The model would then no longer match the joint evolution of sectoral reallocation, house prices, and nominal wages in the data. More broadly, the framework implies

that conventional indicators based on wages and house prices understate the extent to which the rise of tradable services widened spatial welfare gaps.

We begin our analysis by constructing measures of structural change across different commuting zones ('cities' hereafter) in France between 1995 and 2018. Our French administrative data provide detailed information on plant location and sector within multi-plant firms, which are often missing from conventional sources. We use these to measure economic activity by sector across cities, fully accounting for large firms.

We first document how structural change differed across French cities between 1995 and 2018. By the 1990s, services already dominated dense cities such as London and New York (Martin, Gardiner, and Tyler, 2003; Glaeser, 2005), while less dense places remained more manufacturing-heavy. The same was true in France. In 1995, cities like Paris and Lyon were already highly service-oriented, with tradable services accounting for 45% of value added, local services another 25%, and manufacturing the remainder. By contrast, smaller cities such as Poitiers remained much more manufacturing-intensive. Despite this, subsequent structural change in France was more concentrated in dense cities: both tradable and local services expanded more rapidly in larger cities than in smaller ones, while manufacturing grew faster in smaller cities.

This uneven reallocation was driven disproportionately by large firms in tradable services and manufacturing. We define large firms as those in the top 5% of the value-added distribution and show that they are disproportionately located in dense cities, generating a positive firm size–density gradient. Between 1995 and 2018, this gradient steepened in tradable services but flattened in manufacturing, reflecting the further expansion of large tradable-services firms and the relative decline of large manufacturers in urban areas. These evolving firm size–density patterns are an important part of the explanation for why the reallocation toward tradable services favored dense cities.

These changes were accompanied by a sharp rise in urban house prices. In 1995, houses in the densest cities, such as Paris and Lyon, cost nearly three times as much per square meter as in the least dense cities, such as Poitiers; by 2018, that gap had widened to almost fourfold. Over the same period, urban nominal wages rose more slowly and did not keep pace with house prices: in 1995, workers in the densest cities earned about 15% more per hour than comparable workers in the least dense areas, but by 2018 this premium had fallen to roughly 10%. Taken together, these facts point to a puzzle: dense cities attracted an increasing share of tradable-services activity, especially through large firms, even as rising housing costs were not matched by higher nominal wages.

We develop and estimate a quantitative spatial equilibrium model with structural change to explain these joint patterns, combining firm sorting across cities with endogenous local amenity formation. Building on Gaubert (2018), the model features heterogeneous firms and sectors that sort across cities with different densities, shaped by agglomeration and congestion forces. We extend this framework by distinguishing between tradable services, whose output can be sold nationally, and non-tradable local services, whose output is consumed within a city. As in tradable sectors, local-service firms pro-

duce differentiated varieties and face free entry. Their local scope implies that the number of available varieties differs across cities, so an expansion in local-service variety operates as an endogenous local amenity.[1] We also allow residents' access to local service varieties within cities to be imperfect, so city-wide variety need not map one-for-one into the varieties effectively available to each resident. Structural change enters through sector-specific productivity growth, which we use as a parsimonious way of modeling forces that reallocate activity across sectors. In turn, this leads to reallocation across space through firm sorting. Workers consume both local services and a freely traded final good, while the final good itself bundles manufacturing and tradable services with an empirically disciplined elasticity of substitution.[2]

Congestion operates through house prices: as economic activity expands in a city, labor demand rises, pushing up both housing costs and nominal wages. The model allows these higher housing costs to affect firms both indirectly, through wages, and directly, through sector-specific use of housing in production. It also allows housing-sector productivity to vary across cities and over time, so slower construction productivity can amplify urban house-price growth. These features help the model explain why rising tradable-services activity in dense cities coincided with sharply higher house prices, weaker nominal wage premia, and further concentration of large tradable-services firms.

We discipline the model using the French micro-data to estimate the key parameters governing how sectoral reallocation plays out across cities: sector-specific productivity growth, firm sorting and agglomeration, housing intensity in production, access to local-service variety, substitution between manufacturing and tradable services, and worker mobility costs. The estimated model matches the main empirical patterns that motivate the paper: the faster shift toward services in dense cities, the differential spatial concentration of large and small firms across sectors, and the prominent role of large firms in that reallocation. In this sense, the model provides a quantitative account of how structural change and firm sorting jointly translated into spatial divergence.

Two differences between manufacturing and tradable services play a key role in the model's quantitative results. First, large tradable-services firms sort more strongly into dense cities than large manufacturing firms, consistent with the steeper firm size–density gradient for tradable services in the data. Second, manufacturing is more housing-intensive than tradable services, so rising urban house prices weigh more heavily on manufacturing. This housing-intensity margin is identified from cross-city variation in house prices: conditional on local wages, manufacturing value added covaries more strongly with house prices than value added in tradable services. To match the evolution of sectoral shares between 1995 and 2018, the model assigns faster productivity growth to tradable services than to manufacturing, with both outpacing local services.

[1] Diamond (2016) shows that endogenous city amenities are crucial for understanding skill sorting across US cities. Other factors, such as falling crime rates, have also played a central role (Levitt, 2004).

[2] Not imposing restrictions on substitutability is crucial to rationalize both high productivity growth in tradable services and their rising aggregate share (Duernecker, Herrendorf, and Valentinyi, 2024).

We then use the model to study how differential sectoral productivity growth translates into sectoral reallocation, house prices, and wages across cities. Starting from the model-implied 1995 equilibrium, we feed in only the productivity-growth differential across sectors. The resulting counterfactual indicates that faster productivity growth in tradable services is a key force behind the observed reallocation of activity in France. Because tradable services are disproportionately concentrated in dense cities, this reallocation mainly raises labor demand there, pulling workers out of manufacturing and from less dense locations and putting upward pressure on both wages and house prices.

Local services are central to how the model resolves this tension. As workers move toward dense cities and spending rises there, demand for local services expands, inducing entry of new local varieties. The resulting increase in local-service variety acts as an endogenous amenity that partly offsets higher housing costs, moderates nominal wage growth, and allows large tradable-services firms to expand further in dense cities despite rising house prices. In this way, the local-services channel does not merely accompany the rise of tradable services; it amplifies it by easing the labor-cost pressure that would otherwise limit the growth of large urban firms. Higher house prices then weigh more heavily on manufacturing, reinforcing the relative decline of large manufacturing firms in dense cities.

To quantify the role of local-service variety, we recalibrate the model so that residents' effective access to local service varieties is severely limited and responds little to the wider increase in city-level variety. Under the same sector-specific productivity-growth differential, the model provides a substantially poorer account of the joint evolution of sectoral reallocation, house prices, and nominal wages in the data: tradable-services growth becomes less concentrated in dense cities, the expansion of large tradable-services firms there weakens, urban house prices rise more modestly, and the urban nominal wage premium steepens sharply. This counterfactual shows that the endogenous expansion of local-service variety is quantitatively important for generating the full joint pattern in the data, including the relative decline of large manufacturing firms alongside the expansion of large tradable-services firms in dense cities.

Consistent with the local-variety channel in our model, the data show that the density of local-service providers rose most in the densest French cities. Broader empirical evidence provides direct support for the idea that greater local variety makes cities more attractive to consumers. Using U.S. retail data, Handbury and Weinstein (2015) show that product variety is wider in dense cities and that accounting for variety lowers effective price levels there.[3] Similarly, Hottman (2021) finds that local-services price indices decline with city size because larger markets offer greater store variety. Focusing on restaurants, Couture (2016) estimates that gains from variety account for a large share of the consumption value of U.S. cities.[4] Taken together, these studies provide support

[3] Combes, Duranton, Gobillon, Puga, and Roux (2012) provide a similar finding using a broader product classification.

[4] See also Schiff (2015) and Su (2022) for further evidence.

for the amenity component of our mechanism: larger cities offer broader local-service variety, and that variety is valued by residents.

Our results highlight an interaction between the sorting of heterogeneous firms and local-service variety that is central to the spatial pattern of structural change in France. Faster productivity growth in tradable services reallocated activity toward dense cities, where large tradable-services firms are more strongly concentrated. The induced expansion of local-service variety then raised urban amenities and amplified that reallocation by easing the labor-cost pressure on those firms, allowing them to expand further in dense cities. In the model, these forces account for about two-thirds of the increase in the urban-rural house-price gap while keeping the urban nominal wage premium broadly stable. Yet the narrowing of measured urban-rural real wage gaps masked a widening welfare gap between urban and rural residents.

Related literature. This paper relates to the broader literature on structural change across sectors (Kongsamut, Rebelo, and Xie, 2001; Ngai and Pissarides, 2007; Herrendorf, Rogerson, and Valentinyi, 2014; Boppart, 2014; Comin, Lashkari, and Mestieri, 2021). Recent work shows that, in high-income economies, much of this reallocation has been driven by tradable services (Duernecker et al., 2024); our paper studies how one such episode played out across cities within a country.

Our paper is, therefore, closely related to work on spatial structural change and urban divergence. Recent research shows that technological change has concentrated tradable services in dense cities and highlights an important role for large firms in that process (Desmet and Rossi-Hansberg, 2014; Eckert, 2019; Giannone, 2022; Kleinman, 2022; Hsieh and Rossi-Hansberg, 2023; Eckert, Ganapati, and Walsh, 2025).[5] Relative to this literature, our contribution is not a new production-side shock, but a consumption-side amplification mechanism: tradable-services growth creates local-service variety in dense cities, and that endogenous amenity relaxes wage pressure enough to let large tradable-services firms expand further in expensive cities. This mechanism can explain why tradable-services activity became more concentrated in dense French cities despite surging house prices and a flattening urban nominal wage premium, and why wages and house prices can be misleading about the resulting change in spatial welfare.

Our paper also relates to Diamond (2016) and the broader literature on how endogenous amenities determine workers' location choices across cities. In our model, endogenous amenities are given a sectoral and firm-level foundation, which introduces a connection between sectoral reallocation and changes in local amenities through the expansion of local service varieties. These changes, in turn, sustain the urban expansion of large firms.

[5]Related work studies how structural change shapes regional inequality through trade, migration, and technology diffusion, particularly in earlier stages of industrialization (Fajgelbaum and Redding, 2022; Nagy, 2023; Garriga, Hedlund, Tang, and Wang, 2023; Eckert and Peters, 2025; Pijoan-Mas and Budí-Ors, 2025). Our focus is on a later episode in which tradable-services growth interacts with firm sorting, local amenities, and urban housing costs.

Finally, the paper builds on Gaubert (2018), which shows how heterogeneous firms sort across cities in the cross-section. We show that firm sorting is a key determinant of how sectoral reallocation reshapes economic activity across space, and how sectoral reallocation itself changes the relationship between firm size and city density. Quantitatively, the joint evolution of sectoral reallocation, firm size, house prices, and wages across cities is difficult to understand without combining firm sorting and endogenous local-service variety in a spatial equilibrium model of structural change.

Our paper is also related to historical work on how structural change affects the amenity value of cities. Industrialization often reduced local amenities, for example through pollution (Kahn, 1999; Hanlon, 2020; Heblich, Trew, and Zylberberg, 2021). By contrast, our findings suggest that the more recent shift from manufacturing toward tradable services can make dense cities more desirable places to live by expanding local consumption amenities.[6] This complements evidence from other contexts in which service-sector growth raised urban welfare (Fan, Peters, and Zilibotti, 2023; Aiba and Yamagishi, 2025). In our setting, the welfare gains also operate through an amenity channel: tradable-services growth in dense cities induces an expansion of local-service variety that raises the value of living there.

Roadmap. Section 2 describes the key data patterns that motivate our analysis. In Section 3, we develop our model of differential structural change across locations. In Section 4, we estimate the model. In Section 5, we use the estimated model to decompose structural change into the various driving forces that our framework highlights. Section 6 concludes.

2 Urban-biased structural change: Evidence from France

In this section, we describe the French administrative data and document the main empirical patterns of structural change across sectors and cities between 1995 and 2018. These facts motivate the theoretical framework in Section 3 and provide the empirical targets for the structural estimation and calibration in Section 4.

2.1 Data description

To study structural change at both the aggregate and city levels in France, we combine several administrative data sources. Our main firm-level data come from the balance-sheet datasets FICUS (1995–2007) and FARE (2008–2018), which cover the universe of active firms and report value added, employment, exports, and firms' main geographic location. We link these data to the DADS matched employer–employee records, which report wages and employment for all workers and allow us to measure the geographic

[6] As Glaeser, Kolko, and Saiz (2001) put it, "the future of cities increasingly depends on whether cities are attractive places for consumers to live."

distribution of activity within multi-plant firms and to document the evolution of urban wage premia. To capture house price dynamics across cities, we use transaction-level data from the French land registry (*cadastre*), which report prices per square meter for existing dwellings. Our analysis focuses on 1995 and 2018 as the initial and final years.[7]

Measuring population density. Following Combes et al. (2012) and Gaubert (2018), we define a city as a commuting zone ("zone d'emploi"). There are 297 commuting zones covering all of mainland France (excluding Corsica and overseas regions) based on the 2010 revision. We combine commuting zones in Île-de-France into one (referred to as 'Paris' hereafter), leaving us with 279 zones.[8] To arrive at a measure of population density by commuting zone, we rely on the DADS matched employer-employee data set, which records the workplace and residence of all employees at the commune level—a finer unit of geography than commuting zones.[9] We use the total number of employees in the initial year (across all sectors and firm types, including multi-plant firms) as our measure of commune population, and combine this with INSEE's publicly available land area data to calculate population density for each commune.[10] We then construct commuting-zone population density as a weighted average of commune-level densities, with weights given by commune population size. This procedure accounts for the fact that some communes within a commuting zone are very dense while others are sparsely populated. Figure A.1 in Appendix A.1 maps population across commuting zones.

Measuring structural change. Measuring structural change at the aggregate and city levels requires tracking economic activity across both sectors and locations. This is not straightforward because many firms operate multiple establishments in different sectors and cities. Standard balance-sheet data, including FICUS and FARE, report firm-level value added, employment, and sector classification, and assign each firm to its headquarters location. Using these data alone would therefore mismeasure the spatial and sectoral distribution of activity, especially for large multi-establishment firms.

To address this issue, we use the DADS data, which report each establishment's commuting-zone location, sector, employment, and wage bill, together with information linking establishments to parent firms. These data allow us to measure the spatial-sectoral distribution of employment directly. To allocate firm-level value added across establishments, we combine two ingredients: (i) the establishment's share of the firm's wage bill, and (ii) the sectoral median labor share of value added. This approach rests on two assumptions: (a) firms are profit-maximizing, and (b) the labor share of value added is common within a sector. Intuitively, establishments that account for a larger share of a firm's wage bill are assigned a larger share of its value added, with the mapping allowed to differ across sectors through differences in typical labor shares.

Formally, for establishment e of firm i in sector j, we assume that the labor share of

[7] The key empirical patterns that discipline the model evolve gradually and smoothly over time.
[8] Roissy-Sud Picardie is a separate commuting zone that we do not include in Île-de-France.
[9] Mainland France comprises more than 33,000 communes.
[10] Population in dense cities (except Paris) has grown faster than in smaller cities between 1995 and 2018.

output takes the sector-specific form

$$\frac{W_{eij}L_{eij}}{P_{eij}Y_{eij}} = \tau_j^{-1}\alpha_j \equiv \tilde{\alpha}_j\,,$$

where W_{eij}, L_{eij}, P_{eij}, and Y_{eij} are plant-level wages, employment, prices, and output. The common labor share restriction imposes that τ_j, a parameter capturing any sector-wide distortion to labor (e.g., price-cost markups and wage markdowns), is uniform across firms within a sector. To derive $\tilde{\alpha}_j$, we focus on single-plant firms. Given $\tilde{\alpha}_j$, we allocate value added across plants of multi-plant firms using the first-order condition characterizing optimal labor demand:

$$\frac{P_{eij}Y_{eij}}{\sum_{e\in\mathcal{E}_i} P_{eij}Y_{eij}} = \frac{W_{eij}L_{eij}\tilde{\alpha}_j^{-1}}{\sum_{e\in\mathcal{E}_i} W_{eij}L_{eij}\tilde{\alpha}_j^{-1}}\,,$$

where $\mathcal{E}_i$ is the set of firm i's plants. In Figure A.7 in the Online Appendix, we show that our main structural change patterns are robust to measuring $\tilde{\alpha}_j$ at the one-, two-, or five-digit sector level (our baseline) and to restricting attention to single-plant firms. For brevity, we refer to establishments as firms in the discussion that follows.

Classifying sectors as tradable or non-tradable. The French administrative balance-sheet data report export revenues not only for manufacturing firms but also for firms in services. We use this information as an empirical proxy for tradability and classify services as tradable or non-tradable (local): sectors with at least 5% of revenue from exports are classified as tradable, and the rest as non-tradable.[11] Under this definition, manufacturing is tradable. Tradable services include finance and insurance, information and communications technology, professional, scientific, and technical services, administrative and support services, real estate, and wholesale trade.[12] Non-tradable local services include accommodation and food, arts, entertainment and recreation, retail, transportation, education, health, and personal services. This classification is broadly consistent with related distinctions in the literature, such as the split between 'progressive' and 'stagnant' services in Duernecker et al. (2024) and between producer and consumer services in Fan et al. (2023). To focus on private-sector manufacturing and services, we exclude public services, mining, and agriculture, which together account for only a small share of French value added.[13]

[11] Exports can be viewed as a sufficient, though not necessary, indicator of domestic tradability. In Figure A.6 in the Online Appendix, we show that our results are robust to using a 10% export-share threshold.

[12] The patterns of sectoral reallocation we document are essentially unchanged when we exclude finance and insurance.

[13] The value added shares of agriculture, forestry, and fishing in France were 2.7% in 1995 and 1.9% in 2018. The corresponding shares for mining and quarrying were 0.2% and 0.1%.

2.2 Empirical patterns

We next document how structural change unfolded across French cities between 1995 and 2018. To do so, we group commuting zones into five bins based on their 1995 population density and compare outcomes across these bins over time. We refer to these as city-size bins, with bin 1 containing the least dense cities and bin 5 the densest. By construction, each bin contains roughly the same total employment in 1995.[14] We keep cities in their initial bins throughout the analysis, so the comparisons are not affected by changes in relative density over time.[15]

STYLIZED FACT 1: AGGREGATE STRUCTURAL CHANGE WITH AN URBAN BIAS
France experienced the usual aggregate shift from manufacturing toward services between 1995 and 2018. But this reallocation was uneven across space: services expanded faster than manufacturing in denser cities.

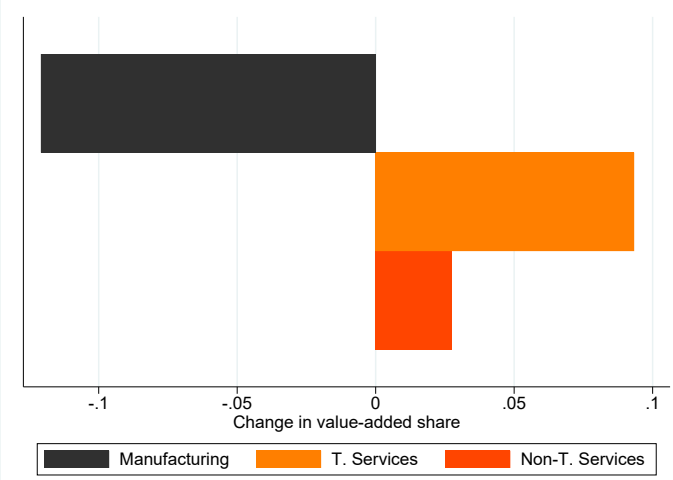


Figure 1: Aggregate structural change in France, 1995-2018

Notes: The bars show the change in aggregate sectoral value added shares for manufacturing, tradable services, and non-tradable local services in 1995 and 2018. These changes add up to zero.

At the aggregate level, France displays the familiar shift from manufacturing toward services over our sample period. Figure 1 shows that manufacturing's share of aggregate value added fell from almost 40% in 1995 to 27% in 2018, while the services share rose by a roughly offsetting amount. Much of this increase came from tradable services, whose value added share increased from 34% to 43%. The corresponding employment-share changes are very similar.[16] This aggregate shift toward services is broadly similar to that documented for other high-income economies; see, for example, Herrendorf et al. (2014).

Figure 2 shows our main empirical motivation: the reallocation from manufacturing

[14] Employment is not exactly equal across bins because cities are indivisible units. The ranking of cities by total employment is, however, very similar to the ranking by working-age population.

[15] The two densest cities in each bin are: Nimes and Abbeville (bin 1), Lisieux and La Vallée de l'Arve (bin 2), Rennes and Nantes (bin 3), Roubaix-Tourcoing and Grenoble (bin 4), Paris and Lyon (bin 5).

[16] See Figure A.5. Manufacturing employment falls by 14 percentage points, close to the corresponding change in value added.

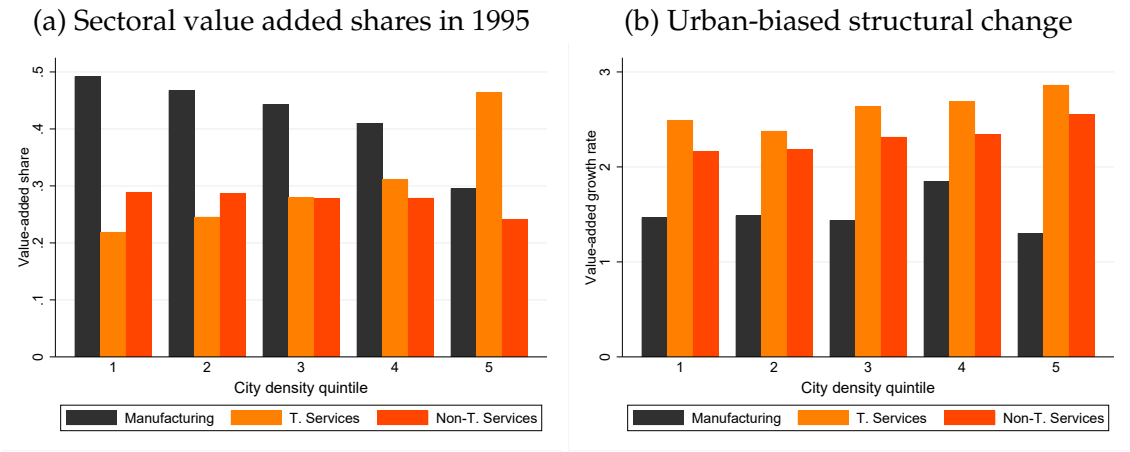


Figure 2: Urban-biased structural change in France, 1995-2018

Notes: In panel (a) the bars show the sectoral value added shares for manufacturing and services in 1995. The shares of the three sectors add up to 1. The horizontal axis represents city bins, with city bin 1 representing the least dense cities and bin 5 the densest cities. Panel (b) shows structural change within French city bins. The bars show the inflation-adjusted sectoral value added *growth rate* for manufacturing and services in each city bin between 1995 and 2018. A value of zero implies zero growth. The vertical axis represents city bins.

Table 1: Sectoral value added growth across French city size bins, 1995-2018

	Inflation-adjusted growth rates		
City density bin	Manufacturing	Tradable services	Non-tradable services
1	1.47	2.49	2.16
2	1.49	2.37	2.18
3	1.44	2.66	2.32
4	1.85	2.69	2.34
5	1.30	2.86	2.55

Notes: The table reports the inflation-adjusted value added growth rate in each city size bin. Bin 1 represents the least dense cities and bin 5 the densest cities. Growth rates are computed as value added in 2018 divided by those in 1995. For example, 1.30 for manufacturing in bin 5 means a growth rate of 30%. Accounting for compounding, this growth rate corresponds to an annual growth rate of 1.1%.

toward services was disproportionately concentrated in denser cities. Panel (a) shows that dense cities were already more service-oriented in 1995. Panel (b) shows that both tradable and local services grew faster in denser cities, while manufacturing grew more slowly there. We refer to this uneven spatial pattern as *urban-biased structural change*.

As summarized in Table 1, manufacturing value added rose by nearly 50% in the least dense cities, compared with only 30% in dense cities (annual rates of 1.6% and 1.1%). In contrast, tradable services expanded by 186% in dense cities and 149% in rural areas (annual rates of 4.5% and 3.8%), while local services grew by 155% and 116%, respectively. The gap between services growth and manufacturing growth therefore widens systematically with city density. This pattern is not driven only by Paris: Figure A.2 in the Online Appendix shows a similar relationship across the full set of cities, and Figure A.4 shows that a similar urban bias emerges when cities are grouped by population size rather than

density.

STYLIZED FACT 2: THE URBAN BIAS IS A LARGE-FIRM PHENOMENON

The urban bias in structural change is a large-firm phenomenon. Among other firms, structural change displays little systematic urban bias.

Differences in firm size across sectors suggest one possible source of the urban bias documented above. Measuring firm size by value added, the median manufacturing firm in 1995 is about 16% and 88% larger than the median tradable and local services firm, respectively (Table A.1 in the Online Appendix). At the top of the distribution, these differences are even larger: at the 95th percentile, manufacturing firms are 98% and 399% larger than tradable and local services firms. These cross-sector firm size differences matter because large firms may contribute disproportionately to sectoral growth, and because the location of large firms differs systematically across cities.

To assess the role of firm size more directly, we decompose sectoral value added growth within each city-density bin into the contributions of large and other firms. Using the same city-bin growth measure as in Figure 2b, we write the growth rate of sector j in city bin i between 1995 and 2018 as

$$\%\Delta\omega_{j,2018}(i) = \underbrace{\varsigma^{\text{large}}_{j,1995}(i) \cdot \%\Delta\omega^{\text{large}}_{j,2018}(i)}_{\text{Contribution of large firms}} + \underbrace{\varsigma^{\text{non-large}}_{j,1995}(i) \cdot \%\Delta\omega^{\text{non-large}}_{j,2018}(i)}_{\text{Contribution of other firms}}, \tag{1}$$

where $\varsigma^{\text{large}}_{j,1995}(i) \equiv \text{VA}^{\text{large}}_{j,1995}(i)/\text{VA}_{j,1995}(i)$ denotes the share of sector j's value added in city i that is generated by large firms in 1995, and $\%\Delta\omega^{\text{large}}_{j,2018}(i) \equiv \text{VA}^{\text{large}}_{j,2018}(i)/\text{VA}^{\text{large}}_{j,1995}(i)$ is the corresponding growth rate. The first term therefore measures the contribution of large firms to sectoral value added growth in each city, and the second gives the contribution of all other firms. We use this decomposition to compare the growth of each service sector with that of manufacturing across city bins. Specifically, we compute $\%\Delta\omega_{j,2018}(i) - \%\Delta\omega_{\text{manufacturing},2018}(i)$, where j denotes either tradable or non-tradable services.

Table 2: Contribution of large firms to urban-biased structural change

	TRADABLE SERVICES			NON-TRADABLE SERVICES		
CITY BIN	All	Large	Non-large	All	Large	Non-large
1	1.02	0.30	0.72	0.70	−0.02	0.72
2	0.88	0.26	0.63	0.69	0.04	0.65
3	1.22	0.67	0.55	0.89	0.33	0.56
4	0.84	0.29	0.55	0.49	−0.10	0.59
5	1.56	1.26	0.30	1.25	0.79	0.45

Notes: The table decomposes the gap in value added growth between services and manufacturing in each city density bin between 1995 and 2018 into the contribution of large firms and non-large firms. Large firms are defined as those in the top 5% of value added. The columns 'Large' report the share of sectoral growth gap in a given city account for by large firms, so columns 'Large' and 'Non-large' sum to 'All'. Large City density bin in 1 represents the least dense cities and bin 5 the densest cities.

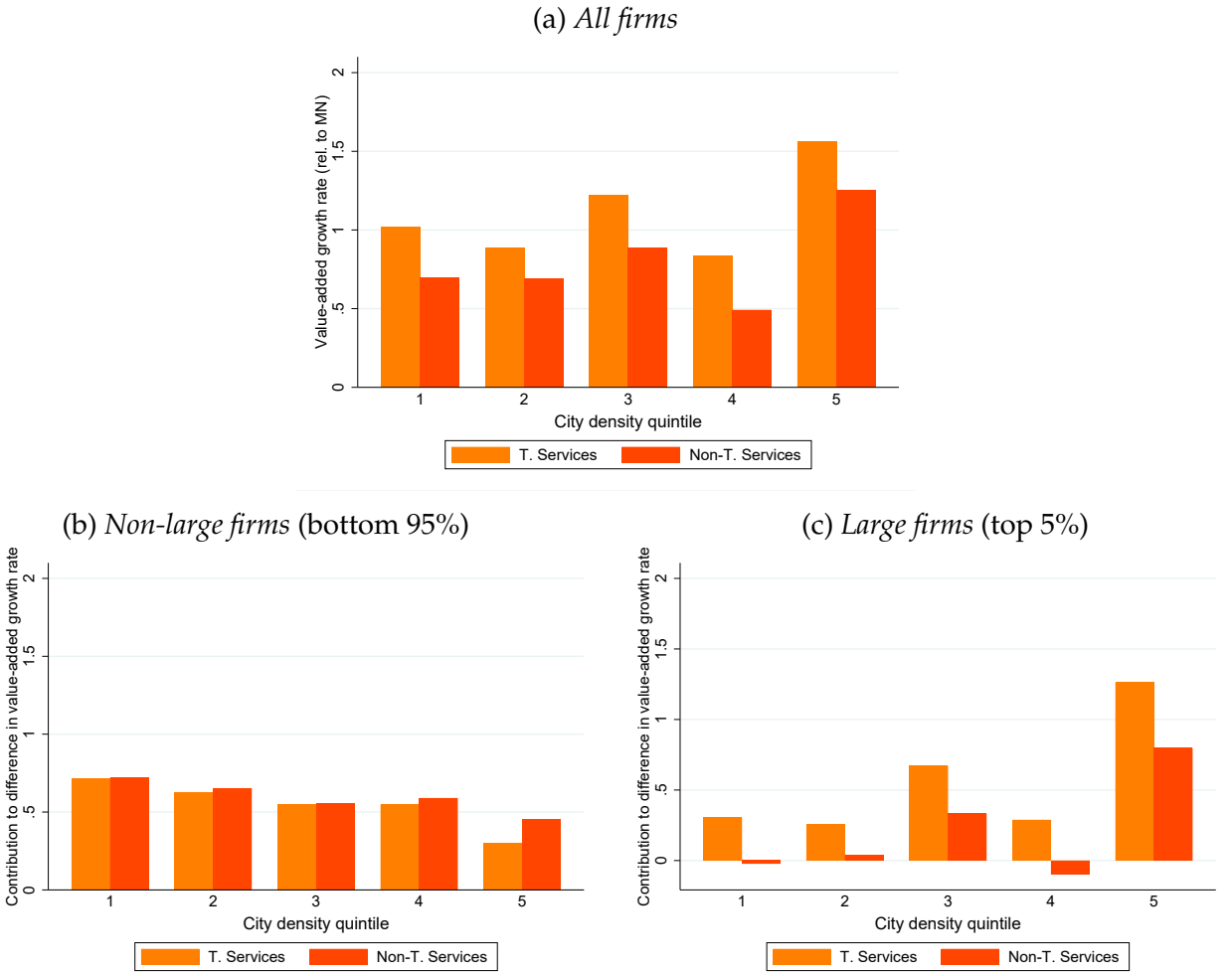


Figure 3: Large firms and urban-biased structural change in France

Notes: City size bin 1 represents the least dense cities and bin 5 the densest cities. Large firms are defined as those in the top 5% of the log value added distribution (at 1995 prices). Panel (a) shows the difference in value added growth rates between services and manufacturing in each city bin, i.e., the bars represent the gap in Figure 2b between the orange/red and black bars. In panel (b) the bars show the contribution of non-large firms to the gap in value added growth between services and manufacturing. The numbers correspond to the second term in the decomposition formula (1). Panel (c) does the same among large firms only. The numbers correspond to the first term in the decomposition formula (1). The sum of the orange/red bars within each city bin in panels (b) and (c) gives the corresponding bar in panel (a).

Figure 3 shows that the urban bias documented in Stylized Fact 1 is almost entirely a large-firm phenomenon. Panel (a) plots the overall difference in value added growth between services and manufacturing across city-density bins. Panel (b) shows that this difference rises sharply with city density among large firms: in denser cities, large firms grow much more in services than in manufacturing. By contrast, panel (c) shows little systematic urban bias among other firms. Table 2 reports the corresponding decomposition numerically. The columns labeled 'All' correspond to the total sectoral growth rate gaps shown in Figure 3a, while the columns labeled 'Large' isolate the contribution of large firms. The key implication is that faster services growth in dense cities is driven overwhelmingly by large firms. This shifts attention from sectoral reallocation per se to the evolution of large firms across sectors and space, which we examine next.

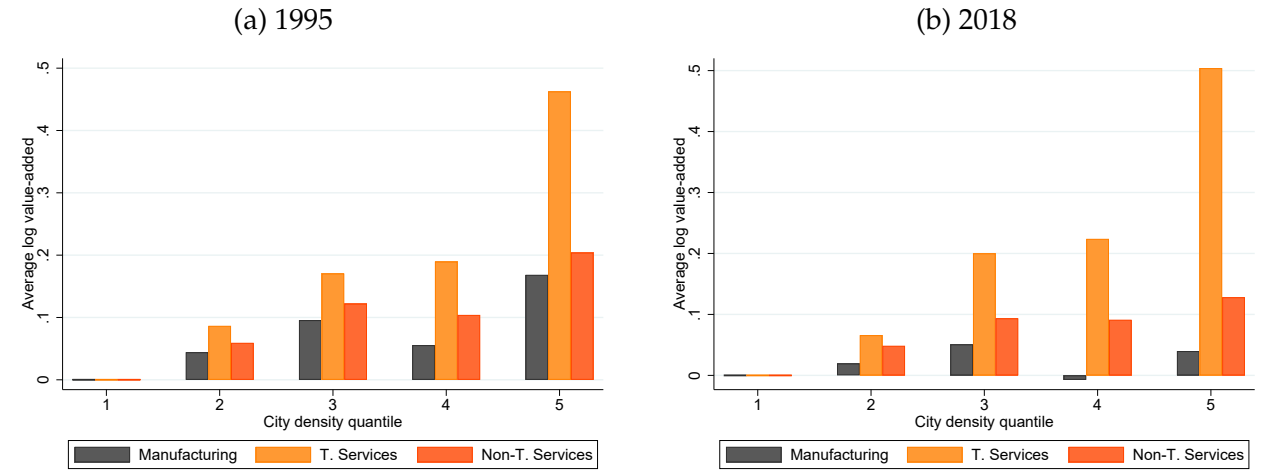


Figure 4: Relationship between firm size and city density

Notes: City density bin 1 represents the smallest cities and bin 5 the largest cities. In panel (a) the bars show the average log value added of firms in a given sector in a city density bin relative to those from the same sector but located in bin 1 in 1995. Panel (b) shows the corresponding figure for 2018.

Stylized fact 3: Differential firm sorting across sectors

In both tradable services and manufacturing, larger firms are more likely to be located in denser cities. But this size-density gradient is much steeper in tradable services, and the gap relative to manufacturing widens over time.

Figure 4 plots average log firm value added across city-density bins for manufacturing and services, normalized to zero in the least dense bin. In 1995, Figure 4a shows a clear positive size-density gradient in all three sectors: larger firms are more likely to be located in denser cities. But the gradient differs markedly across sectors. In tradable services, firms in the densest cities have average value added about 46 log points higher than firms in the least dense cities. The corresponding differences are much smaller in manufacturing and local services, at 16 and 20 log points.

By 2018, these sectoral differences have widened. The size-density gradient steepens further in tradable services and remains positive in local services, but it has nearly disappeared in manufacturing. Put differently, firm size in manufacturing becomes much less tilted toward dense cities over time, while the opposite is true in tradable services.

Taken together, these patterns show that the urban distribution of firm size evolves very differently across sectors. This is important because the urban bias documented above is concentrated among large firms, and firms in tradable services become increasingly larger in dense cities relative to less dense ones over time. We next document how urban house prices and wages evolved over the same period.

Stylized fact 4: Sharply rising urban house prices

The relationship between city density and house prices became markedly steeper between 1995 and 2018.

The French land registry (*cadastre*) records all property transactions in France (except new

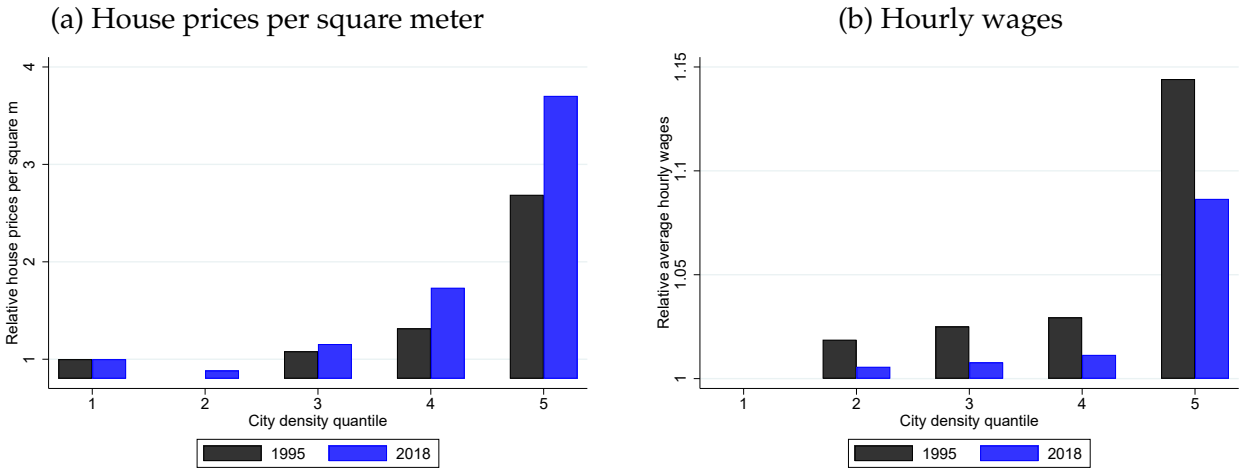


Figure 5: House prices and nominal wages across cities

Notes: City density bin 1 represents the smallest cities and bin 5 the largest cities. In panel (a) the bars show the average residualized house price in a city density bin relative to those of bin 1 (normalized to one). Black bars represent 1995 and blue 2018. Panel (b) shows the corresponding figure for residualized nominal hourly wages.

construction) along with price, size, type (e.g., apartment, house, or commercial space), and location. We use these data to construct residualized house prices that are comparable across space and time. Since the dataset is only publicly available from 2017,[17] we used it to build house price indices for 2018. To construct the indices for 1995, we purchased data from ADNOV, a private notary firm, which are based on the same underlying *cadastre* records and used the same methodology, making the 1995 and 2018 indices directly comparable. A limitation of the ADNOV data is that it omits Île-de-France. To compute the 1995 house price index for Île-de-France, we used publicly available data from INSEE to adjust the 2018 price index for this municipality back to its 1995 level.[18]

Figure 5a shows that urban house prices rose sharply between 1995 and 2018. In 1995, prices were already substantially higher in the densest cities, such as Paris and Lyon, than elsewhere: per square meter, prices in the densest cities (bin 5) were almost three times those in the least dense locations (bin 1). By 2018, this urban–rural house price gap had widened to nearly fourfold.[19] The next fact shows that nominal wages did not rise commensurately.

Stylized fact 5: Declining urban nominal wage premium

The urban nominal wage premium fell between 1995 and 2018.

The DADS matched employer–employee data provide detailed information on wages,

[17] https://cadastre.data.gouv.fr/datasets/cadastre-etalab.

[18] Île-de-France is a collection of commuting zones. To address the missing 1995 house prices for this municipality, we treat Île-de-France as a single city throughout the paper, while treating commuting zones as cities in all other cases.

[19] Similar to the urban bias in structural change, the sharp increase in house prices is not a "Paris versus the rest" phenomenon. Figure A.3 in the Online Appendix shows that a similar pattern remains after excluding Île-de-France.

occupations, sectors, and workplace locations. We use these data to track how nominal wage differences across cities evolved over time. Our baseline measure of the urban nominal wage premium is a composition-adjusted wage premium: separately in 1995 and 2018, we regress log hourly wages on city fixed effects and worker and job characteristics, including gender, part-time status, occupation fixed effects (two-digit), and sector fixed effects (two-digit). We then define the urban wage premium in each year as the estimated city fixed effect.

Figure 5b shows that the relationship between nominal wages and city density weakened between 1995 and 2018, even as house prices rose sharply in denser cities. In 1995, hourly wages in the densest cities were about 15% higher than in the least dense cities. By 2018, this premium had fallen to roughly 10%.[20] This flattening is not an artifact of the controls used in our baseline specification. In Figure A.8 in the Online Appendix, we show similar patterns when (i) comparing raw average wages, (ii) using finer occupation and sector controls, and (iii) restricting comparisons to workers within the same occupation-sector cells.

STYLIZED FACT 6: RISING LOCAL SERVICES VARIETY IN DENSE CITIES

The density of distinct local-services providers increased more in denser cities over time.

What helps reconcile sharply rising urban house prices with a flattening urban nominal wage premium? One possibility is that dense cities became more attractive places to consume, not just more expensive places to live. To assess this possibility, we track how the number of local-services firms per square kilometer—our proxy for local-services variety—changed across cities between 1995 and 2018.

Figure 6 shows that this proxy for local-services variety increased most in the densest cities. In 1995, dense cities such as Paris and Lyon (bin 5) already had about nine times as many local-services firms per square kilometer as the least dense cities (bin 1). By 2018, this gap had widened by roughly 50 percentage points, while differences among bins 2 to 4 remained much more stable.

Panels (b)–(f) show that this pattern is broad-based across local-services subsectors, including food and accommodation, arts and entertainment, transportation, and health services, with retail as the main exception.[21]

This evidence is consistent with a growing literature showing that denser cities offer broader consumption possibilities and that such variety can raise urban welfare. Handbury and Weinstein (2015) document greater product variety in larger US markets, implying lower effective prices once variety is taken into account. Combes et al. (2012) reach a similar conclusion using broader product categories, while Hottman (2021) shows that local-services price indices decline with city size because of greater store variety. In re-

[20] This pattern differs from recent US evidence, where nominal urban wage premia have widened (Giannone, 2022; Eckert et al., 2025), although it is consistent with the broader finding that housing costs in dense cities have risen faster than wages (Baum-Snow and Duranton, 2025).

[21] It is possible that the range of varieties offered within each retail store expanded over this period, which our data do not allow us to observe.

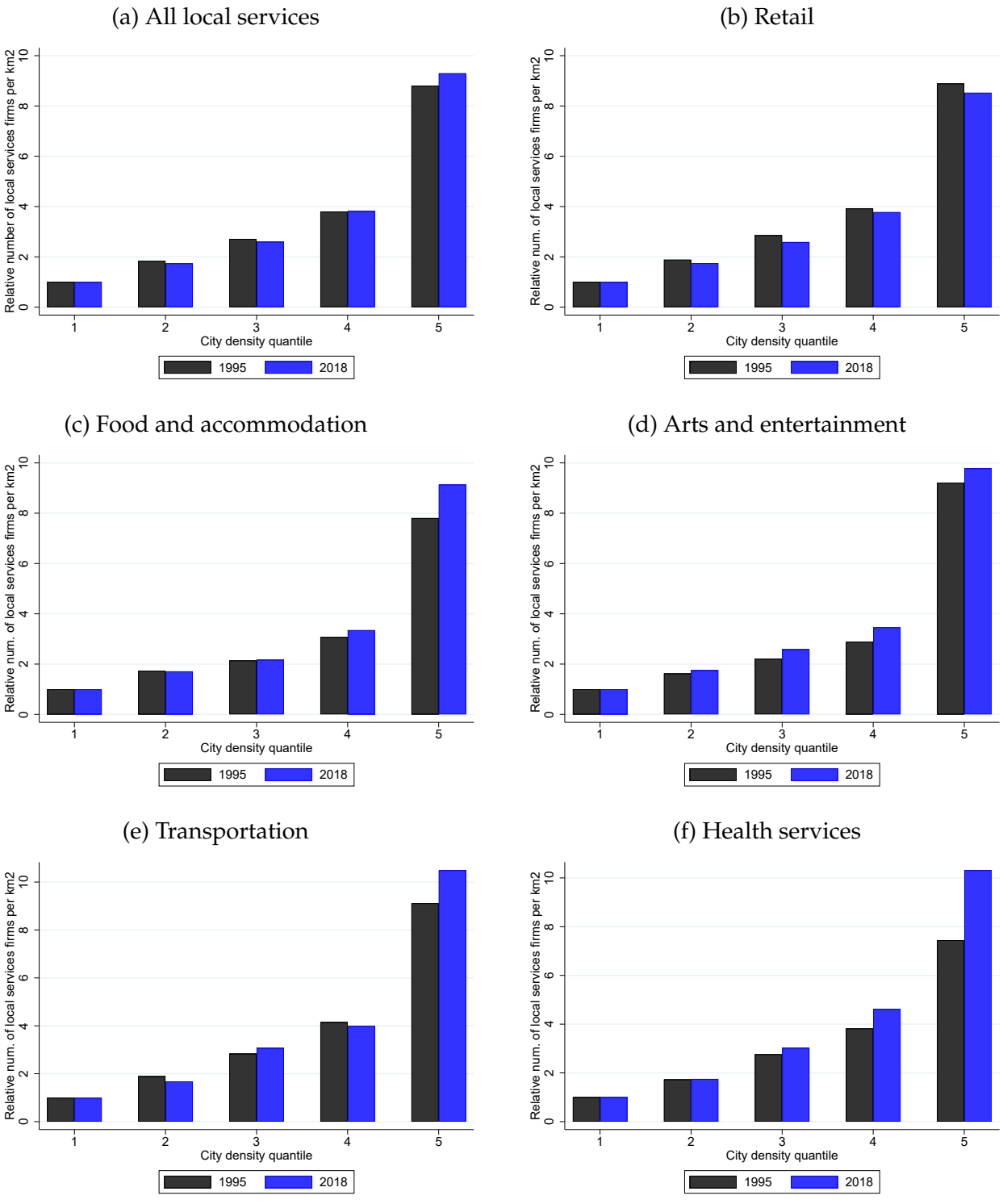


Figure 6: Number of local services variety across cities

Notes: City density bin 1 represents the smallest cities and bin 5 the largest cities. The bars in each panel shows the number of firms within a square kilometer in a city bin relative to bin 1 (normalized to one). Black bars represent 1995 and blue 2018.

lated work, Couture (2016) and Schiff (2015) show that consumption variety is an important component of the value of city life, and Su (2022) finds that households in dense cities substitute home production toward market-provided amenities. While our evidence is

only descriptive, it points to a local-services margin that may help explain why denser cities became more expensive without experiencing stronger nominal wage growth.

Summary. Taken together, Stylized Facts 1–5 reveal a key tension in the data: the cities that experienced the strongest shift toward services also saw the sharpest increases in house prices, but not corresponding increases in nominal wages. Stylized Fact 6 highlights a plausible margin that may help reconcile these patterns: denser cities experienced a disproportionate expansion in local services providers, which may have increased urban consumption amenities. We next develop a quantitative spatial model to formalize this mechanism and assess whether the interaction of firm sorting and endogenous local-service variety can account for these joint empirical patterns in equilibrium.

3 A model of cities and structural change

Our model features heterogeneous firms in manufacturing and services that sort across cities of different sizes, and households that value both housing and local consumption amenities. Sector-specific—but location-neutral—TFP growth shifts activity from manufacturing toward services, while endogenous changes in local service provision affect the attractiveness of dense cities. Through this interaction of firm sorting and local-service variety, the model can generate urban-biased structural change. The framework builds on quantitative spatial equilibrium models with heterogeneous firms sorting across cities (Behrens, Duranton, and Robert-Nicoud, 2014; Gaubert, 2018).

Cities, population, and industries. The economy consists of $\bar{L}$ workers distributed across I cities, with $L(i)$ denoting the equilibrium population of city i. Each city hosts three sectors: manufacturing, tradable services, and non-tradable local services, indexed by $j \in \{m, s, n\}$. Manufactured goods and tradable services are freely traded across cities at zero cost.[22]

Workers and local demand. A worker in city i derives utility $U(i)$ from consuming freely traded goods ($C_m(i)$) and tradable services ($C_s(i)$), local non-tradable services ($C_n(i)$), and housing $h(i)$:

$$U(i) = \frac{\tilde{B}\, B(i)}{\eta} \left(\nu\, C_c(i)^{\frac{\rho-1}{\rho}} + (1-\nu)\, C_n(i)^{\frac{\rho-1}{\rho}} \right)^{\frac{\rho}{\rho-1}\eta} \frac{h(i)^{1-\eta}}{1-\eta} \exp\left(\epsilon_w(i)\right),$$

$$C_c(i) = \left(\zeta\, C_s(i)^{\frac{\gamma-1}{\gamma}} + (1-\zeta)\, C_m(i)^{\frac{\gamma-1}{\gamma}} \right)^{\frac{\gamma}{\gamma-1}},$$

Here, $C_c(i)$ denotes the composite of freely traded goods, built from tradable services

[22] With product differentiation, positive internal trade costs could generate a home-market effect that concentrates production in denser cities (Krugman, 1980). To the extent that trade costs for the services we classify as tradable declined more than they did for manufacturing goods, this force would tend to raise the manufacturing share in denser areas relative to tradable services, not lower it.

$C_s(i)$ and manufactured goods $C_m(i)$; $C_n(i)$ denotes local non-tradable services; and $h(i)$ denotes housing. The term $B(i)$ captures exogenous city-specific amenities, while $\tilde{B}$ captures location-neutral public goods. The parameter ρ governs substitution between the traded composite and local services, and γ governs substitution between manufactured goods and tradable services within the traded composite. As in Ngai and Pissarides (2007), this demand system provides a parsimonious way to represent aggregate sectoral reallocation. We use sector-specific productivity growth as a reduced-form device to generate the shift toward tradable services, and study how that shift propagates across cities through firm sorting and local-service variety rather than the deeper sources behind it.[23]

Workers face the budget constraint:

$$P_s C_s(i) + P_m C_m(i) + P_n(i)\, C_n(i) + P_h(i)\, h(i) = W(i),$$

where P_s and P_m are the prices of tradable services and manufactured goods, which are common across cities; $P_n(i)$ is the local price of non-tradable services; $P_h(i)$ is the local price of housing; and $W(i)$ is the local wage.

The price index for the bundle of freely traded goods (P_c) and the local price index ($P(i)$) are given by:

$$\begin{aligned} &\text{Traded bundle:} && P_c = \left(\zeta^{\gamma} {P_s}^{1-\gamma} + (1-\zeta)^{\gamma} {P_m}^{1-\gamma}\right)^{\frac{1}{1-\gamma}}; \\ &\text{Local price index:} && P(i) = \left(\nu^{\rho} {P_c}^{1-\rho} + (1-\nu)^{\rho} P_n(i)^{1-\rho}\right)^{\frac{\eta}{1-\rho}} P_h(i)^{1-\eta}. \end{aligned}$$

We normalize the price of the traded composite to one, so $P_c = 1$.

To capture imperfect mobility, workers are assumed to draw idiosyncratic preference shocks $\epsilon_w(i)$, which are Fréchet distributed with shape parameter ξ. Solving workers' location choice problem and aggregating over individuals yields the population share of each city:

$$\frac{L(i)}{\bar{L}} = \frac{\tilde{U}(i)^{\xi}}{\sum_{i' \in I} \tilde{U}(i')^{\xi}}, \quad \text{where } \tilde{U}(i) \propto B(i) \frac{W(i)}{P(i)}.$$

The supply of workers in city i thus depends on the average utility of workers in location i, $\tilde{U}(i)$, which increases with local wages $W(i)$ and amenities $B(i)$, and decreases with local house prices $P_h(i)$ and the price of local services $P_n(i)$.

Production of non-tradable local services. Local services are non-traded across cities and are horizontally differentiated. This sector is the source of endogenous local consumption amenities in the model. In each city i, an endogenous mass $M_n(i)$ of monopolistically competitive firms with identical productivity produces distinct local-service

[23] In particular, the framework abstracts from non-homothetic income effects of the type emphasized by Comin et al. (2021).

varieties, indexed by ω. Entry is determined by a city-specific free-entry condition:

$$E\left[\pi_n(\omega, i) \mid i\right] = f_n^e(i),$$

where $\pi_n(\omega, i)$ denotes the profit of a firm producing variety ω in city i, and $f_n^e(i)$ is the city-specific entry cost, measured in units of the traded consumption bundle.[24]

Residents derive utility from a CES basket of local-service varieties that are effectively accessible within city i. To capture within-city access frictions in a parsimonious way, suppose city i contains $K(i) = L(i)^\lambda$ symmetric local consumption neighborhoods. A household can costlessly consume local services supplied in its own neighborhood but faces prohibitive costs of consuming those supplied in other neighborhoods. If there are $M_n(i)$ local-service firms in city i and these firms are symmetrically distributed across neighborhoods, a representative resident effectively accesses $M_n(i)/K(i) = M_n(i)/L(i)^\lambda$ varieties. Expenditure minimization then implies the following local-services price index:

$$P_n(i) = \left(\frac{M_n(i)}{L(i)^\lambda} E\left[p_n(\omega, i)^{1-\sigma_n} \mid i\right]\right)^{\frac{1}{1-\sigma_n}}.$$

Here σ_n is the elasticity of substitution across local-service varieties and therefore governs the standard love-of-variety force. The term $L(i)^{-\lambda}$ is instead an *access-to-variety* adjustment: it converts city-wide firm counts into the effective menu available to a resident. When $\lambda = 0$, the city behaves as a single integrated consumption market and all residents access the full city-wide menu, so the variety gain depends only on $M_n(i)$. When $\lambda > 0$, the number of effective consumption neighborhoods rises with city size, so accessible variety increases less than one-for-one with total firm entry. This captures the idea that cities are valued not only as places of production but also as places of consumption, in the spirit of Glaeser et al. (2001). It parsimoniously captures within-city travel, search, and information frictions that limit the set of varieties effectively available to any given household, consistent with recent work on amenity access and within-city consumption frictions (Su, 2022; Davis, Dingel, Monras, and Morales, 2019; Anenberg and Kung, 2015); see also Handbury and Weinstein (2015). In the limiting case $\lambda = 1$, the number of effective neighborhoods is proportional to population, so effective variety is proportional to the number of varieties per resident. Appendix B.1 provides a simple microfoundation.

Each local-service firm combines labor, housing, and non-housing capital using a Cobb-Douglas production technology:

$$q_n(\omega, i) = \tilde{A}_n l^{\alpha_n} h^{\beta_n} k^{1-\alpha_n-\beta_n},$$

where $\tilde{A}_n$ is sector-wide productivity in local services, α_n and β_n are the labor and housing cost shares, and the remaining share $1 - \alpha_n - \beta_n$ is non-housing capital. As in Gaubert

[24] Figure 4 shows that average firm size in local services rises with city density. Allowing entry costs to vary across cities helps the model match this pattern.

(2018), non-housing capital is perfectly mobile across cities and supplied competitively by absentee capitalists. Its rental price, P_k, is therefore common across locations and fixed exogenously in international capital markets. Since this common capital cost does not affect relative production costs across cities, we absorb it into sector-wide productivity and define:

$$A_n \equiv \tilde{A}_n \left(\frac{1 - \alpha_n - \beta_n}{P_k} \right)^{1-\alpha_n-\beta_n}$$

as local services productivity. Firms are price-takers in input markets but monopolistic competitors in the local-services output market. Their price is therefore a constant markup over marginal cost:

$$p_n(\omega, i) = \frac{\sigma_n}{\sigma_n - 1} A_n^{-1} \left(\frac{W(i)}{\alpha_n} \right)^{\alpha_n} \left(\frac{P_h(i)}{\beta_n} \right)^{\beta_n}.$$

Production of goods and tradable services. Firms in the tradable sectors, manufacturing and tradable services, are monopolistic competitors that produce horizontally differentiated varieties, indexed by ω. In each sector $j \in \{m, s\}$, output is a CES aggregate of firm-level varieties, which implies the sectoral price index:

$$P_j = \left(\sum_i \int_{\omega \in \Omega_j(i)} p_j(\omega, i)^{1-\sigma_j} \, d\omega \right)^{\frac{1}{1-\sigma_j}}.$$

Because manufactured goods and tradable services are costlessly traded across cities, these price indices are common across locations.

Production technologies and agglomeration in tradable sectors. In each tradable sector $j \in \{m, s\}$, firms pay an ex-ante entry cost f_j^e, denominated in the traded consumption bundle, and then draw an idiosyncratic efficiency type z from a sector-specific distribution $G_j(z)$ with support $[1, \infty)$. After entry, a firm that chooses city i produces using labor, housing, and non-housing capital according to:

$$q_j(z, i) = \Psi_j(z, i) \, l^{\alpha_j} \, h^{\beta_j} \, k^{1-\alpha_j-\beta_j},$$

where α_j and β_j are the labor and housing cost shares, and the remaining share $1 - \alpha_j - \beta_j$ is non-housing capital. These parameters govern the strength of local congestion forces: firms with higher α_j are more exposed to local wages, while firms with higher β_j are more exposed to local housing costs. Changes in house prices therefore affect tradable firms both indirectly, through wages, and directly, through their own demand for space.

A firm's productivity $\Psi_j(z, i)$ depends on its efficiency draw z, the sector in which it operates, and the population density $L(i)$ of the city it chooses. The dependence on city density captures agglomeration forces: firms may be more productive in denser cities because of knowledge spillovers, labor pooling, input linkages, or related local externalities (Duranton and Puga, 2020; Dauth, Findeisen, Moretti, and Suedekum, 2022). To generate

sorting, we follow Gaubert (2018) and assume that $\Psi_j(z,i)$ is log-supermodular in firm efficiency and city size, so that more efficient firms benefit more from locating in larger cities. This implies positive assortative matching between firm efficiency and city size.

We allow this sorting force to be imperfect by introducing an idiosyncratic location-specific productivity shock. In addition to permanent efficiency z, firm ω draws a city-specific shock $\hat{\epsilon}(\omega,i)$. Overall productivity is therefore:

$$\Phi_j(z,i) \equiv \Psi_j(z,i)\, e^{\hat{\epsilon}(\omega,i)}.$$

We assume that these shocks are i.i.d. across cities and firms and follow a Type-I Extreme Value distribution. As a result, firms with the same permanent efficiency need not choose the same location.

Following Gaubert (2018), we parameterize productivity as:

$$\log \Psi_j(z,i) = \log A_j + a_j \log \frac{L(i)}{L(1)} + \left(1 + \log \frac{L(i)}{L(1)}\right)^{s_j} \log z, \tag{2}$$

where A_j is sectoral, location-neutral productivity. The parameter $a_j \geq 0$ captures agglomeration forces common to all firms in sector j, while $s_j \geq 0$ governs how strongly those agglomeration gains rise with firm efficiency and therefore how strongly firms sort across cities. We assume that the efficiency draw z follows a Gamma distribution with shape parameter $\nu_{z,j}^{shape}$ and scale parameter $\nu_{z,j}^{scale}$.

Conditional on choosing city i, firms take local wages and housing costs as given. Under monopolistic competition, each firm charges a constant markup over marginal cost:

$$p_j(\omega,i) = \frac{\sigma_j}{\sigma_j - 1}\, \Phi_j(z,i)^{-1} \left(\frac{W(i)}{\alpha_j}\right)^{\alpha_j} \left(\frac{P_h(i)}{\beta_j}\right)^{\beta_j}.$$

Because location-specific productivity shocks enter multiplicatively, profits can be written as the product of a deterministic component and the idiosyncratic location draw, $\pi_j(z,i) = v_j(z,i)\, \epsilon(\omega,i)$. The firm's location choice is therefore:

$$i_j^*(z) = \arg\max_{i \in \mathcal{I}}\, v_j(z,i)\, \epsilon(\omega,i). \tag{3}$$

Production of residential housing and commercial real estate. Each city $i \in I$ has a fixed unit measure of land and a representative housing developer. Housing is used both for residential consumption and as a production input by firms. Developers combine land and labor to produce housing according to:

$$h(i) = z_h(i)\, l^{\delta},$$

where $\delta \in [0,1]$ and $z_h(i)$ captures local housing-sector productivity, reflecting factors such as regulation, terrain, and construction technology. Housing is supplied competi-

tively, and developers take wages and house prices as given. Profit maximization then implies the local housing supply schedule:

$$h(i) = z_h(i)^{\frac{1}{1-\delta}} \left(\delta \frac{P_h(i)}{W(i)} \right)^{\frac{\delta}{1-\delta}}.$$

Because land is fixed within each city, housing production exhibits decreasing returns at the city level, so housing developers earn positive rents. We assume that these rents are fully taxed by a national government and rebated in the form of location-neutral public goods, $\tilde{B}$, that accrue equally to all workers.

Equilibrium. An equilibrium consists of local wages $W(i)$, house prices $P_h(i)$, local-services price indices $P_n(i)$, the mass of local-services firms $M_n(i)$, tradable-sector price indices P_j, and worker and firm location choices such that: (i) city-specific markets for labor, housing, and local services clear; (ii) national markets for manufactured goods and tradable services clear; (iii) sector-specific free-entry conditions are satisfied; and (iv) workers maximize utility and firms maximize profits, taking input prices as given.

4 Model quantification

We now quantify the model to assess the importance of the mechanisms highlighted above for the observed patterns of sectoral reallocation across French cities. Our quantification combines structural estimation and calibration. The key objects are those governing the spatial distribution of economic activity—sorting, agglomeration, and congestion forces—and those governing aggregate structural change, captured through sectoral TFP growth.

Our baseline quantification is designed to match both the aggregate reallocation of activity across sectors and the observed evolution of local house prices and wages between 1995 and 2018. To do so, we allow sectoral TFP (A_j), city-specific housing productivity ($z_h(i)$), and city-specific exogenous amenities ($B(i)$) to differ across the two years. We therefore recover separate values of these shifters for 1995 and 2018, while keeping the remaining model parameters fixed over time.

We proceed in two steps. First, we structurally estimate the time-invariant parameters that govern sorting, agglomeration, and congestion forces. Second, conditional on these estimates and the remaining calibrated parameters, we recover the year-specific shifters $A_j, z_h(i), B(i)$ that allow the model to match the cross-sectional and aggregate moments in 1995 and 2018. Table 3 reports the structurally estimated parameters, and Table B.1 reports the calibrated ones. We begin by explaining which parameters are estimated, which are calibrated, and which empirical moments are most informative for each.

4.1 Structural estimation of sorting, agglomeration, and congestion parameters

Parameters we estimate. We assume that firm-specific efficiency $\log z$ is drawn from a Gamma distribution with scale parameter $\nu_{z,j}^{scale}$ and shape parameter $\nu_{z,j}^{shape}$. Firm and location-specific shocks $\epsilon(\omega, i)$ are drawn from a Gumbel distribution with scale parameter $\nu_{\epsilon,j}^{scale}$. Given the functional form for firms' composite productivity $\Psi_j(z, i)$ (see equation (2)), the sector-specific parameters to estimate include the agglomeration externality parameter a_j, the sorting parameter s_j, and the sector-specific elasticity of firm value added with respect to local house prices β_j. We keep these parameters constant over time. For each tradable sector, the parameter vector is:

$$\mathbf{\Theta}_j = \left\{ a_j, s_j, \beta_j, \nu_{z,j}^{shape}, \nu_{z,j}^{scale}, \nu_{\epsilon,j}^{scale} \right\}.$$

As discussed in Section 3, these parameters pertain only to the tradable sectors.

Identification. We estimate the parameters $\mathbf{\Theta}_j$ in partial equilibrium by solving the firm location choice problem (3). We do so separately for manufacturing and tradable services, matching the sector-specific moments described below. Given the composite productivity function in equation (2), firm value added relative to the sectoral average in the least dense city (indexed by $i = 1$) can be written as:

$$\begin{aligned} \log R_j(z,i) - E\big[\log R_j(1)\big] = (\sigma_j - 1)\Bigg(& \log \Psi_j(z,i) - E\big[\log \Psi_j(z,1) \mid z \in \mathcal{Z}_j(1)\big] \\ & - \alpha_j \log \frac{W(i)}{W(1)} - \beta_j \log \frac{P_h(i)}{P_h(1)} \Bigg) + \hat{\epsilon}(z,i)\,. \end{aligned} \tag{4}$$

where $\mathcal{Z}_j(1)$ denotes the set of firms in sector j located in the least densely populated city. Because the sectoral TFP shifter A_j is Hicks-neutral, it differences out when firms in a given city are compared to firms in the least dense city. In the data, we observe $\log R_j(z,i) - E[\log R_j(1)]$, relative city size $L(i)/L(1)$, relative wages $W(i)/W(1)$, and relative house prices $P_h(i)/P_h(1)$. Conditional on the calibrated parameters (σ_j, α_j), the observed firm and city size distributions, and the local wage and house-price gradients, we estimate $\mathbf{\Theta}_j$ to match moments that are informative about its underlying values.

Intuition behind identification. The agglomeration parameter a_j and the sorting parameter s_j are both disciplined by how firm size varies with city size, but they operate through different margins. A higher a_j raises firm value added in denser cities in a proportional, log-linear way for all firms within a sector. By contrast, a higher s_j steepens the firm size–city size gradient in the upper tail: average firm size rises more than proportionally with city density because more efficient firms benefit disproportionately from denser cities and therefore sort into them.

This distinction implies two complementary sources of identification for s_j. First, s_j is informed by departures from the proportional pattern implied by a_j alone in the mo-

ments for average normalized log value added across city-size quintiles. Second, s_j is informed by moments that capture where the largest firms locate. When $s_j > 0$, value added generated by top firms is disproportionately concentrated in denser cities relative to the sector's overall value-added distribution. For this reason, in addition to the moments used by Gaubert (2018), we also target moments for the spatial distribution of value added among the top 5% of firms, defined by value added.

The parameters $\nu_{z,j}^{shape}$ and $\nu_{z,j}^{scale}$, which govern the distribution of firm efficiency draws, are disciplined by the overall, non-location-specific dispersion of $\log R_j(z,i) - E[\log R_j(1)]$. The parameter $\nu_{\epsilon,j}^{scale}$ governs the dispersion of firm-location-specific shocks, and hence the degree of imperfect sorting between firm size and city size; it is disciplined by the correlation between $\log R_j(z,i) - E[\log R_j(1)]$ and $\log\big(L(i)/L(1)\big)$.

Finally, β_j is informed by how local house prices affect firms' value added, conditional on population density and wages. Because β_j enters firms' marginal costs as the coefficient on local house prices, it captures the part of firms' non-wage production costs that is exposed to measured current local property prices. It is therefore not identified here as a production-function elasticity of output with respect to housing inputs.

Targeted moments. Guided by the discussion above, we choose moments that capture four features of the data for each tradable sector: the overall dispersion of firm size, how average firm size varies with city size, how sectoral value added is distributed across city sizes, and how the upper tail of firms is distributed across space. The first three sets of moments follow Gaubert (2018), while the fourth helps sharpen identification of s_j. The moments are:

1. the 50–10, 75–25, 90–50, and 90–10 differences of the distribution of log value added;
2. average normalized log value added by city-size quintile $i \in \mathcal{I}$;
3. the share of sectoral value added originating from each city-size quintile $i \in \mathcal{I}$;
4. the share of top-5%-firm value added originating from each city, where the top 5% is defined by value added.

Estimation is carried out by the Method of Simulated Moments using a pooled specification for 1995 and 2018. We denote the combined vector of empirical moments for 1995 and 2018 by $\boldsymbol{m}$, with $\widehat{\boldsymbol{m}}(\boldsymbol{\Theta})$ the corresponding vector of model moments. With $\mathcal{W}$ an estimate of the matrix of variances and covariances of the empirical moments (obtained by bootstrapping), we derive an estimate $\widehat{\boldsymbol{\Theta}}$ as:

$$\widehat{\boldsymbol{\Theta}} = \arg\min_{\boldsymbol{\Theta}} \Big(\boldsymbol{m} - \widehat{\boldsymbol{m}}(\boldsymbol{\Theta})\Big)' \mathcal{W}^{-1} \Big(\boldsymbol{m} - \widehat{\boldsymbol{m}}(\boldsymbol{\Theta})\Big).$$

In practice, we solve this problem using the Differential Evolution algorithm, a global optimizer. For the within-sector elasticity of substitution across product varieties, we set a common value of $\sigma_j = \sigma = 3$ in all three sectors: manufacturing, tradable services, and

Table 3: Summary of estimated parameters

PARAMETER		MANUFACTURING	TRADABLE SERVICES
Agglomeration externalities	a_j	0.11	0.15
		(0.01)	(0.02)
Sorting	s_j	0.03	0.27
		(0.01)	(0.01)
Housing output elasticity	β_j	0.23	0.01
		(0.03)	(0.01)
Shape of firm efficiency distribution	$\nu_{z,j}^{shape}$	0.61	2.48
		(0.02)	(0.00)
Scale of firm efficiency distribution	$\nu_{z,j}^{scale}$	0.61	0.21
		(0.02)	(0.02)
Shape of firm efficiency distribution	$\nu_{\epsilon,j}$	0.49	0.42
		(0.01)	(0.01)

Notes: The table reports the parameter values inferred through structural estimation. Asymptotic standard errors are provided in parentheses.

local services. We then set the labor output elasticity α_j to match the median labor share of value added in each sector.

Results. Our estimates, reported in Table 3, point to three reasons why tradable services are more concentrated in dense cities than manufacturing. First, tradable services benefit more from agglomeration externalities, with $a_j = 0.15$ compared with 0.11 in manufacturing. Second, this difference is especially pronounced for large firms: the sorting parameter is $s_j = 0.27$ in tradable services and only 0.03 in manufacturing. Third, tradable services are less responsive to local housing costs, with a baseline estimate of $\beta_j = 0.01$ compared with 0.23 in manufacturing. Appendix B.3 reports the model's fit to the targeted and untargeted moments.

At the same time, the low baseline estimate for tradable-services β_s should be interpreted with care. As discussed above, our tradable-sector estimation does not recover a production-function elasticity of premises use. Instead, it identifies the component of firms' non-wage production costs that covaries with current local property prices through the cross-sectional relationship between firm value added and local house prices, conditional on local wages and city size. For manufacturing, we continue to use this baseline estimate, since the house-price response of firm value added is likely to remain more informative than current expenditure on real-estate services alone. For tradable services, however, a natural alternative is to calibrate β_s using observed expenditure on real-estate services, which provides a transparent measure of current occupancy costs.[25] Appendix

[25]Observed expenditure on real-estate services is especially informative for service activities because many of them rely heavily on leased space, and lease payments are recorded directly as user-side operating expenses. By contrast, current expenditure flows are more likely to miss part of manufacturing firms' exposure to local property costs when production uses owner-occupied, specialized, or single-tenant premises. Existing institutional and academic evidence is consistent with this distinction (Moussaly and Wang, 2014; International Accounting Standards Board, 2025; Smith and Wakeman, 1985; Wheaton and Torto, 1990; Sharpe and Nguyen, 1995).

B.4.1 describes this alternative calibration in detail. It implies an alternative value of $\beta_s = 0.04$. Reassuringly, using this value for tradable services leaves the paper's main quantitative conclusions essentially unchanged. We implement the same expenditure-based robustness check for local services below.

4.2 Calibration of parameters related to local services

Parameters we calibrate. The key parameters to calibrate for the local services sector are entry costs ($f_n^e(i)$), access-to-variety effect (λ), and the value added elasticity to local house prices (β_n). As noted above, we set the within-sector elasticity of substitution across product varieties to $\sigma_n = 3$, the same value used in manufacturing and tradable services, and we set the labor output elasticity α_n to match the median labor share of value added in local services.

Entry costs. In our model, local services firms do not face the same location choice problem as firms in tradable sectors. Instead, they pay a city-specific entry cost $f_n^e(i)$ before entering the local market. We recover this object from the free-entry condition:

$$f_n^e(i) = E\left[\pi_n(z,i) \,\middle|\, z \in \mathcal{Z}(i)\right] \propto \frac{R_n(i)}{M_n(i)},$$

where $R_n(i)$ denotes total local-services value added in city i and $M_n(i)$ denotes the measure of local-services firms there. Thus, entry costs are proportional to average firm size in the local-services sector. We normalize entry costs in the least dense city to one, $f_n^e(1) = 1$, and express entry costs in all other cities relative to that benchmark.

Access to variety and housing cost exposure. We next calibrate λ and β_n using the model-implied relationship between local-services expenditure shares and local production costs. The expenditure share on local services in city i is:

$$\chi_n(i) \equiv \frac{P_n(i)\, Q_n(i)}{W(i)\, L(i)} = \frac{\eta}{1 + \left(\frac{\nu}{1-\nu}\right)^{\rho} P_n(i)^{\rho-1}}.$$

Although the local-services price index $P_n(i)$ is not directly observed, this equation implies that once we observe $\chi_n(i)$ and assign values to η, we can back out the local-services price index on the left-hand side of equation (5) up to normalization. Substituting the model-implied expression for $P_n(i)$ then gives:

$$\frac{P_n(i)}{P_n(1)} = \left(\frac{\eta\chi_n(i)^{-1} - 1}{\eta\chi_n(1)^{-1} - 1}\right)^{\frac{1}{\rho-1}} = \left[\frac{M_n(i)}{M_n(1)}\left(\frac{L(i)}{L(1)}\right)^{-\lambda}\right]^{\frac{1}{1-\sigma_n}} \left(\frac{W(i)}{W(1)}\right)^{\alpha_n} \left(\frac{P_h(i)}{P_h(1)}\right)^{\beta_n}. \quad (5)$$

This equation makes clear where the two key local-services parameters enter. Holding wages and house prices fixed, a larger number of local-services firms $M_n(i)$ lowers the local-services price index through greater variety, while a larger population $L(i)$ attenu-

ates that effect through the access-to-variety parameter λ. The parameter β_n governs how strongly local-services production costs, and hence the local-services price index, respond to local house prices. Our calibration approach therefore chooses λ and β_n to match the cross-sectional relationship between the inferred local-services price index and the number of local-services firms, population density, house prices, and wages in the pooled 1995 and 2018 sample.

In implementation, we measure the left-hand side of equation (5) using the expenditure-share relationship above. On the right-hand side, we use data on the number of local-services firms, population density, local hourly wages, and local house prices. Because cities differ in land area, we measure $M_n(i)$ using the number of local-services firms per square kilometer, analogous to our population-density measure for $L(i)$. We set $\eta = 0.8$ to match the expenditure share of household income spent on housing-related costs in INSEE's 2013 household expenditure survey. We set $\rho = 0.4$, following standard estimates in the structural-change literature (Herrendorf et al., 2014; Comin et al., 2021; Lewis, Monarch, Sposi, and Zhang, 2022). This value implies that local services and the traded consumption bundle are complements.

In the baseline calibration, we obtain $\lambda = 0.47$, suggesting that access to local-services varieties lies between two extremes: fully neighborhood-specific consumption within cities and frictionless access within the city as a whole.

We also obtain a low value of β_n, approximately zero, suggesting little residual correlation between the inferred local-services price index and local house prices, conditional on wages, population density, and the number of local-services firms. As with tradable services, this estimate should be interpreted with care: it reflects the conditional relationship between the inferred local-services price index and local house prices, rather than an independent production-function elasticity of premises use. Appendix B.4.1 implements the same expenditure-based robustness check discussed above for tradable services. Under that alternative, we retain the baseline estimate for manufacturing and derive β_n from observed expenditure on real-estate services for the service sectors, obtaining $\beta_n = 0.12$. Using this alternative value has little effect on the calibrated value of λ, which declines modestly to 0.41, and leaves the main quantitative conclusions essentially unchanged.

4.3 Other parameters

Before recovering sectoral TFP growth, housing-sector productivity, and exogenous amenities, we calibrate several remaining parameters: fixed entry costs in the tradable sectors (f_m^e and f_s^e), the elasticity of substitution between manufactured goods and tradable services (γ), the housing supply elasticity (δ), and worker mobility frictions (ξ).

We calibrate f_m^e and f_s^e to match average firm size, measured by value added, in each tradable sector relative to local services. We set the housing supply elasticity parameter δ to match an elasticity of housing production with respect to non-land inputs of 0.8, in line

with evidence for France from Combes, Duranton, and Gobillon (2021).[26] We calibrate worker mobility frictions to $\xi = 7$, following the estimate for France in Zerecero (2021). Appendix B.4.2 and Appendix B.4.3 examine the sensitivity of our main quantitative results to alternative values of ξ and δ commonly used in the literature.

To recover the elasticity of substitution γ between the outputs of the two tradable sectors, we use the model-implied relationship between changes in relative sectoral value added and relative sectoral prices:

$$\Delta \log \frac{R_m}{R_s} = (1 - \gamma) \Delta \log \frac{P_m}{P_s},$$

where we impose that the preference weight ζ remains constant over time. We implement this calibration using quarterly INSEE data on sectoral value added and producer price indices. The implied value is $\gamma = 1.89$, indicating that manufacturing and tradable services are substitutes, consistent with existing evidence (Duernecker et al., 2024).

4.4 Calibrating sectoral TFP growth, housing TFP, and amenities

Given the parameters estimated and calibrated above, we recover the remaining parameters by solving the model in general equilibrium to match the corresponding aggregate and cross-sectional moments in the data.

The remaining time-invariant parameters are the preference weight between manufactured goods and tradable services (ζ) and the preference weight between local services and the freely traded consumption bundle (ν). We calibrate these parameters to match the aggregate value-added shares of manufacturing and tradable services relative to local services in 1995.

The remaining time-varying parameters are sectoral TFP (A_j), local housing-sector productivity ($z_h(i)$), and exogenous local amenities ($B(i)$). We normalize sectoral TFP in each sector to one in 1995 and then calibrate A_m and A_s to match the aggregate value-added shares of manufacturing and tradable services relative to local services in 2018, holding local-services TFP fixed at $A_n = 1$ throughout. We normalize local housing-sector productivity $z_h(i)$ to one in the least dense city and recover city-specific values to match relative house prices per square meter across cities, separately for 1995 and 2018. Similarly, we normalize amenities $B(i)$ to one in the least dense city and calibrate them to match the cross-sectional relationship between local hourly wages and population density in each year.

Calibrated parameter values. To account for the 13 percentage point decline in the aggregate manufacturing value-added share and the 9 percentage point increase in tradable services between 1995 and 2018, the model requires TFP in manufacturing and tradable

[26] That is, we set δ equal to 0.8 multiplied by the inverse of the median labor share of value added in housing production.

services—relative to local services—to rise by 31% and 70%, respectively. Under annual compounding, this corresponds to average annual TFP growth that is 1.1 percentage points higher in manufacturing and 2.2 percentage points higher in tradable services than in local services.

The model also implies meaningful changes in the cross-sectional distribution of housing-sector productivity and exogenous amenities. Figure B.1a shows that in 1995 the housing sector in the densest cities was about 1.7 times as productive as in the least dense cities, with a similarly large advantage in mid-density cities. By 2018, this advantage remained about unchanged in the densest cities, but fell to between 1.1 and 1.6 in mid-density cities. Finally, to match the observed wage–density relationship, the model implies that exogenous amenities $B(i)$ were about 35% higher in the densest cities than in the least dense ones in 1995, with this gap widening to 45% by 2018; see Figure B.1b.

5 Spatial implications of aggregate sectoral reallocation

We next use the estimated model to examine how aggregate sectoral reallocation, driven by differential sectoral TFP growth, translates into changes in the spatial distribution of economic activity, house prices, and wages across cities. We begin by showing that the model reproduces the main spatial patterns that motivate the paper, in particular the disproportionate rise of tradable services in dense cities and the prominent role of large firms in that reallocation. We then use counterfactual exercises to isolate the role of differential sectoral TFP growth and to show how its interaction with local-service variety shapes the evolution of sectoral reallocation, house prices, and nominal wages across locations. Finally, we examine how the strength of these results depends on other forces in the model and relate them to alternative mechanisms discussed in the literature.

5.1 Spatial reallocation in the data and the model

In the model's 1995 equilibrium, the cross-sectional distribution of value added across cities closely resembles that in the data. Figure 2a shows that, in the data, the tradable-services share of value added rises systematically with city density, the local-services share remains broadly stable, and the manufacturing share declines. Figure B.5b shows that the model reproduces these cross-sectional patterns both qualitatively and quantitatively. In this sense, the estimated model provides a good account of the baseline spatial allocation of economic activity across sectors and cities.

We next turn to changes between 1995 and 2018. Figure B.6a reports the growth of value added in tradable and local services relative to manufacturing across city-density bins.[27] The data show that sectoral reallocation was disproportionately concentrated in

[27] This figure corresponds directly to Figure 2 in Section 2.2, except that it reports the difference in value added growth between tradable or local services and manufacturing within each density bin. Since the

dense cities: in the densest cities (bin 5), value added in tradable services grew about 156 percentage points faster than in manufacturing between 1995 and 2018, while local services grew about 125 percentage points faster. In the least dense cities (bin 1), the corresponding numbers are 102 and 70 percentage points. Figure B.6b shows that the model reproduces this pattern reasonably well, although it understates services growth, especially in less densely populated cities.

Finally, the model also matches the role of large firms in this spatial reallocation. In the data, large firms account for nearly all of the disproportionate rise of services relative to manufacturing in dense cities. Figure B.7 shows that the model captures this feature as well: as in Figure 3, most of the differential reallocation toward dense cities is accounted for by large firms rather than by the rest of the firm-size distribution.[28]

5.2 From aggregate sectoral reallocation to urban divergence

We next isolate the effects of differential sectoral TFP growth and trace how they propagate across cities in the model. To match aggregate reallocation in France between 1995 and 2018—a 13 percentage point decline in the manufacturing value-added share and a 9 percentage point rise in the tradable-services share—the model requires manufacturing and tradable-services TFP to grow by 31% and 70%, respectively, relative to local services. Starting from the model's 1995 equilibrium, we introduce only this calibrated differential TFP growth across sectors and compute the resulting counterfactual equilibrium. Comparing this counterfactual to the 1995 benchmark allows us to assess how differential sectoral productivity growth, by itself, reshapes the spatial distribution of economic activity, house prices, and nominal wages.

Structural reallocation across sectors and cities. Figure 7a shows that differential sectoral TFP growth alone generates the observed aggregate reallocation: the manufacturing value-added share falls by 12 percentage points, while the shares of tradable and local services rise by 8 and 4 percentage points, respectively.

This aggregate reallocation is accompanied by a pronounced spatial gradient. Figure 7b shows that services grow much faster relative to manufacturing in dense cities than in less dense ones. In the densest cities, value added in both service sectors rises by more than 80 percentage points relative to manufacturing, whereas in the least dense cities the corresponding gap is only about 20 percentage points. Thus, even though the underlying productivity changes are sector-wide rather than city-specific, their effects are disproportionately concentrated in dense cities.

Urban house prices and nominal wages. This concentration of activity in dense cities

model abstracts from forces that generate common productivity growth across sectors, this normalization makes the data and model outcomes comparable.

[28] As Figure B.7 shows, the contribution of large firms to the gap in value added growth between tradable services and manufacturing is negative in smaller cities. This reflects the fact that, in the model, tradable-services value added grows less than manufacturing overall in those locations.

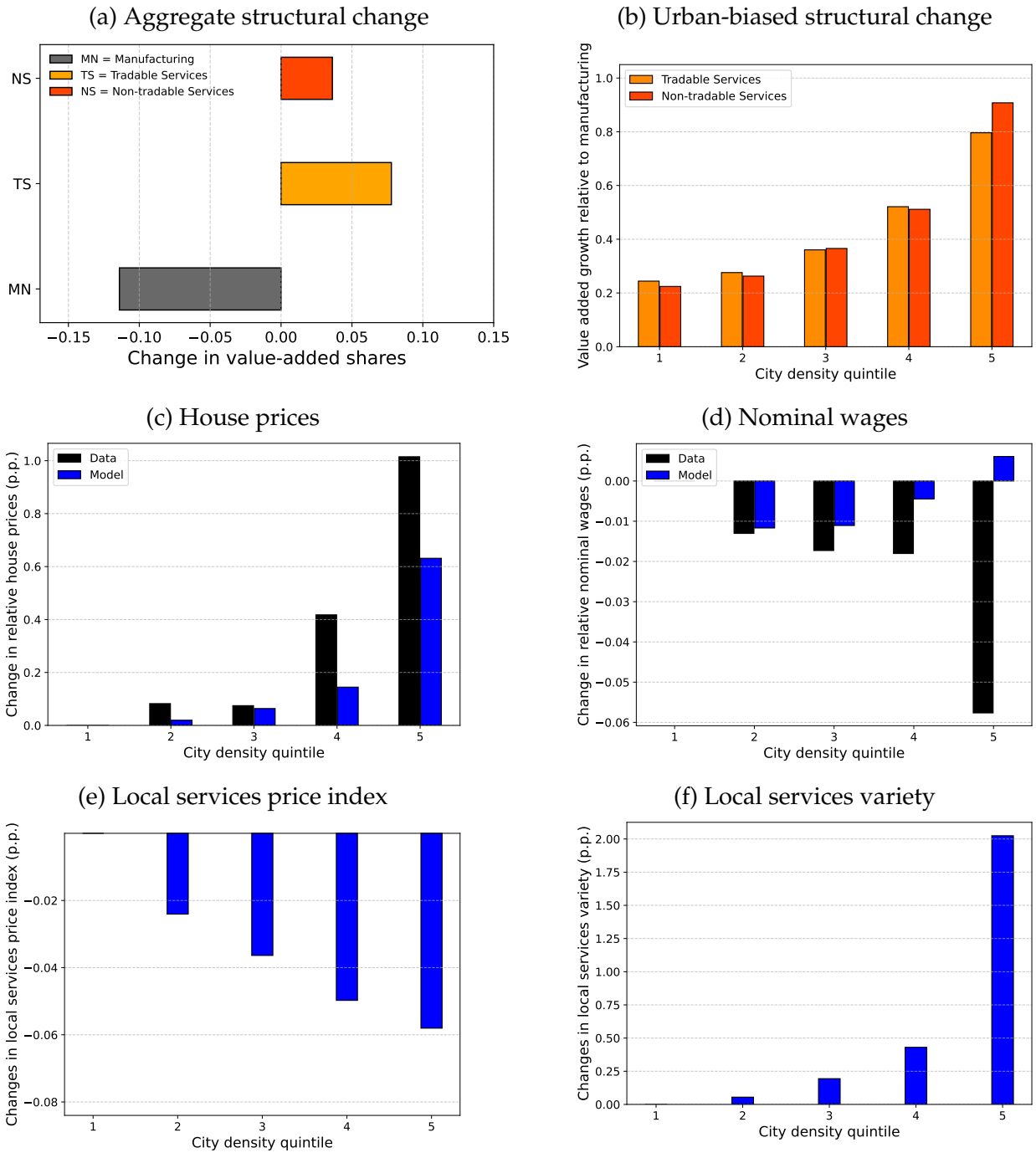


Figure 7: Effects of sectoral TFP growth

Notes: These figures present the effects of introducing only sectoral TFP growth into the estimated model's 1995 equilibrium. City density bin 1 represents the smallest cities and bin 5 the largest cities.

puts upward pressure on local housing demand. Consistent with the patterns documented in Section 2.2, Figure 7c shows that house prices in the densest cities rise sharply—by 63 percentage points, compared with 101 percentage points in the data—while increases in house prices are much less pronounced in less dense locations.

At the same time, the urban nominal wage premium remains stable. Figure 7d shows that the wage premium in the densest cities rises by about 0.6 percentage points relative to the least dense locations. Differential sectoral productivity growth therefore raises urban house prices while keeping the urban nominal wage premium broadly stable.

Local services variety and local price indices. The key mechanism linking these outcomes is the response of the local services sector. As tradable-services activity expands in dense cities, it raises local incomes and attracts additional workers, increasing demand for local services. Entry of local-services firms then expands the range of varieties available in those locations. Figure 7f shows an increase in local-services variety in dense cities, and Figure 7e shows that this expansion lowers the local-services price index there by about 8 percentage points relative to less dense places.

This decline in the local-services price index is what allows the model to account for the joint pattern of a disproportionate rise of services in dense cities, sharply rising urban house prices, and a weakening urban nominal wage premium in the data. By improving urban consumption amenities, the expansion of local services reduces the nominal wage increase required to attract workers despite higher house prices. In that sense, the local-services sector does not merely respond to the rise of tradable services; it amplifies it by easing the labor-cost pressure that would otherwise limit firm expansion in dense cities.

Firm size distribution. The same forces disproportionately benefit large firms in tradable services. Relative to manufacturing firms, their production costs are less sensitive to local house prices and they benefit more from agglomeration externalities. As a result, these firms expand substantially in the densest cities, increasing their average size by about 14 percentage points relative to tradable-services firms in the least dense locations (Figure 8a). By contrast, average manufacturing firm size in dense cities declines, reflecting the sector's greater sensitivity to rising local house prices and weaker agglomeration benefits.

Because the largest tradable-services firms are concentrated in dense cities, this urban expansion also widens the firm-size distribution within the sector. Figure 8b shows that the distribution of log value added in tradable services develops a noticeably fatter right tail in the counterfactual economy: the interquartile range of log value added rises by 3.3 points, and the 90–50 and 95–90 differences increase by 3.6 and 3.0 points, respectively. By contrast, the corresponding distribution for manufacturing remains largely unchanged.

Urban-rural welfare gap. Despite the increase in urban house prices and the stable urban nominal wage premium, welfare improves by about 13 percentage points more in

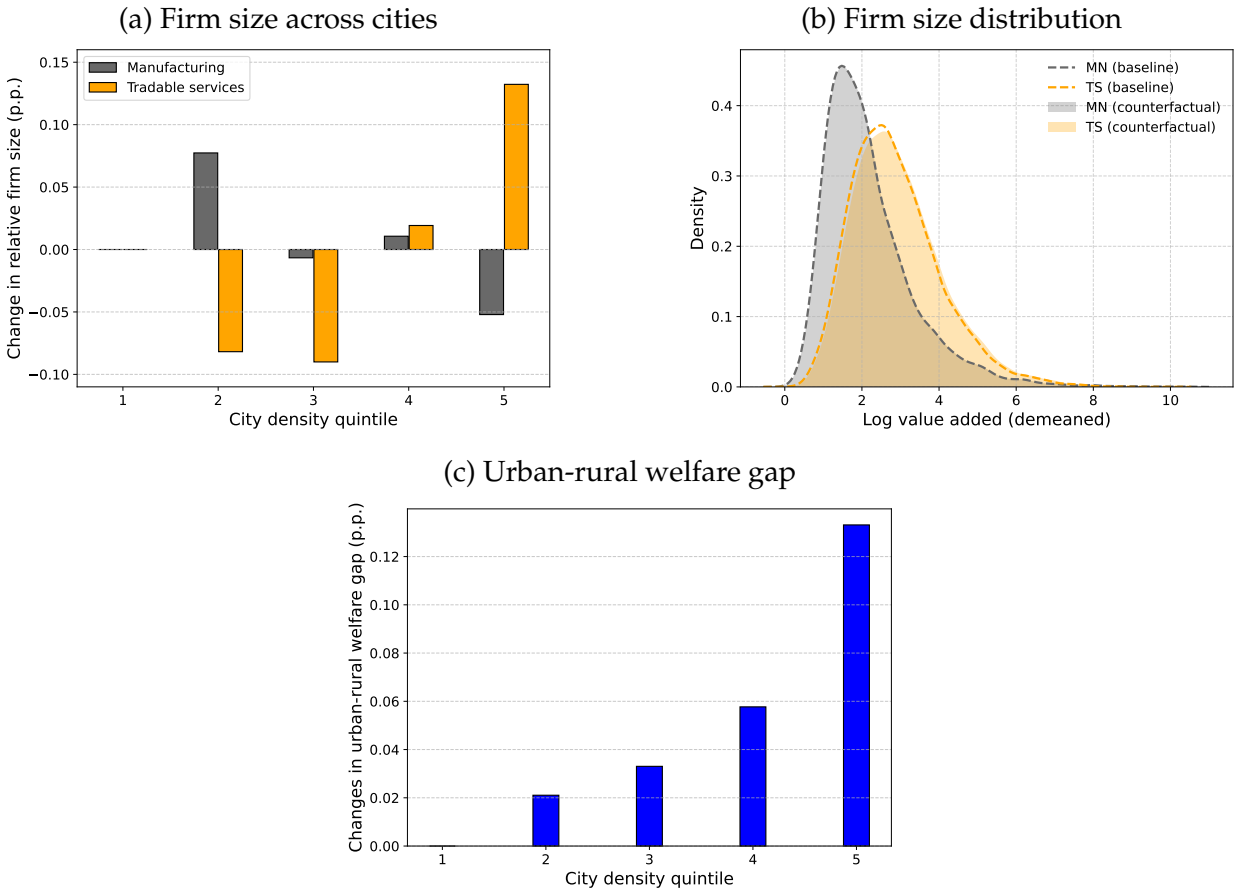


Figure 8: Effects of sectoral TFP growth on firm size and welfare

Notes: These figures present the effects of introducing only sectoral TFP growth into the estimated model's 1995 equilibrium. City density bin 1 represents the smallest cities and bin 5 the largest cities. In panel (c), the change in urban-rural welfare gap is computed as the percentage point change in the ratio of urban and rural welfare.

the densest cities than in the least dense ones (Figure 8c).[29] In the model, the aggregate reallocation toward tradable services raises demand for urban local services, which expands variety and lowers the local-services price index. As a result, the gap between nominal wages and house prices becomes a misleading measure of welfare differences across space because it omits changes in local consumption amenities. Indeed, the model highlights that focusing only on nominal wage growth relative to house price growth would suggest the opposite conclusion: that the urban-rural welfare gap narrowed.

5.2.1 The role of local-service variety

To further isolate the role of local-service variety, we consider an alternative exercise in which the access-to-variety channel is weakened by setting $\lambda = 1$, so that only the number of local service varieties per capita enters the price index. We then re-calibrate the

[29] With linearly homogeneous utility, as we model it, proportional changes in utility provide a meaningful money-metric measure of welfare changes: they can be interpreted as equivalent variations expressed as a fraction of baseline income.

remaining model parameters to match the 1995 economy and, as in the baseline exercise, introduce only the same differential sectoral TFP growth across sectors.

Figure B.2 compares the resulting changes in sectoral reallocation, house prices, and nominal wages to the baseline model. Aggregate sectoral reallocation is weaker: the manufacturing value-added share declines by about 9 percentage points instead of 12, with correspondingly smaller increases in tradable and local services. The spatial concentration of this reallocation also becomes more muted. In particular, dense cities experience a much smaller rise in services relative to manufacturing.

House price growth in dense cities is also weaker than in the baseline. But the more striking difference is that the urban nominal wage premium now rises sharply, opposite to what we observe in the data. The reason is that, once the local variety channel is weakened, the local services price index no longer falls in dense cities and instead rises there. As a result, the expansion of local services can no longer offset the wage pressures created by higher housing demand.

This weaker local-services response also changes which firms benefit from aggregate reallocation, substantially limiting the expansion of large tradable-services firms in dense cities. The smaller increase in house prices reduces the pressure on housing-intensive manufacturing firms, while the stronger wage response constrains the expansion of tradable services in those locations. Consequently, manufacturing firm size no longer declines in dense cities, whereas the increase in tradable-services firm size is more limited: 10 percentage points rather than 14 percentage points in the baseline. The implied increase in spatial welfare disparities is also substantially smaller: welfare rises by only 3.5 percentage points more in the densest cities than in the least dense, compared with about 13 percentage points in the baseline.

Taken together, these results show that the local variety channel is central to the model's account of urban divergence. When local-service variety expands less strongly, the model generates less concentration of services in dense cities, less house-price growth there, a steeper urban nominal wage premium, and a much smaller increase in the urban-rural welfare gap.

5.3 Other forces shaping the baseline results

Beyond the local-service variety channel emphasized above, several other forces in the model affect the baseline results, including large-firm-biased agglomeration, worker mobility costs, housing supply elasticities, and changes in housing-sector productivity. We briefly discuss their roles here; Appendix B.4 provides more detailed analyses.

Large-firm-biased agglomeration externalities. In the baseline model, more productive firms sort into dense cities because they benefit more from agglomeration externalities. Appendix B.4.4 examines how the main counterfactual changes when this large-firm bias is shut down by fixing these disproportionate agglomeration gains at their 1995 levels. In

that case, differential sectoral TFP growth attracts smaller and less productive tradable-services firms into dense cities instead of expanding large incumbents there. As a result, aggregate reallocation is weaker, the concentration of activity in dense cities is less pronounced, and the increases in urban house prices and local-service variety are both smaller than in the baseline.

Worker mobility costs. In the baseline calibration, we set the Fréchet shape parameter governing idiosyncratic worker location preferences, ξ, to 7, guided by estimates for France (Zerecero, 2021). Lower values of ξ correspond to greater dispersion in location preferences and hence higher mobility costs. Appendix B.4.2 considers alternative values of ξ between 1 and 5, consistent with Artuç, Chaudhuri, and McLaren (2010), Bryan and Morten (2019), and Morten and Oliveira (2024). Higher mobility costs dampen the concentration of reallocation in dense cities, while lower mobility costs amplify it. Across this range, however, the expansion of local-service variety and its restraining effect on wage growth remain important in sustaining tradable-services growth in dense cities.

Housing supply elasticities. In the baseline calibration, we set the labor output elasticity in housing production, δ, to 0.60, informed by Combes et al. (2021). This corresponds to a housing supply elasticity of 1.5, well within the range estimated for US cities (Saiz, 2010). Appendix B.4.3 considers alternative values of δ chosen to match the housing supply elasticities of New York and Atlanta reported in Saiz (2010). A lower housing supply elasticity dampens the urban bias, while a higher elasticity amplifies it. Across these values, however, the expansion of local-service variety in response to the rise of tradable services remains an important force behind the baseline results.

Local housing-sector productivity growth. Section 4 shows that housing-sector productivity in the densest cities, relative to the least dense locations, changed little between 1995 and 2018. By contrast, housing productivity declined in some mid-density cities, especially density bins 2 and 4 (Figure B.1a). Appendix B.4.5 examines the effect of this change by introducing only it into the model's 1995 equilibrium. The decline in mid-tier housing productivity shifts activity toward both the least dense and the densest cities, lowers welfare in mid-density locations, and contributes to aggregate sectoral reallocation through its stronger effect on manufacturing. Its effect on the concentration of sectoral reallocation in dense cities, however, is limited.

5.4 Policy counterfactuals

The baseline results highlight two policy-relevant margins in the model: local service entry costs and housing supply in dense cities. Restrictions on firm entry can limit the expansion of local-service variety, while constraints on housing supply can intensify urban house-price pressures. We therefore use the model to study two illustrative counterfactuals: lower entry costs for local service firms and higher housing-sector productivity in the densest cities.

Reducing entry costs for local services. Existing evidence suggests that red tape can raise entry costs and reduce firm entry and growth (Djankov, La Porta, Lopez-de-Silanes, and Shleifer, 2002; Klapper, Laeven, and Rajan, 2006). In France, several reforms over the past two decades aimed to simplify the process of starting a business.[30] In the model, entry costs in local services are calibrated to match average firm size across cities, implying entry costs that are 17% higher in the densest cities than in the least dense locations. Our first counterfactual equalizes these entry costs across cities at the level prevailing in the least dense locations, which implies a 17% reduction in the densest cities.

Figure B.3 reports the results. Lower entry costs increase local-service variety disproportionately in dense cities and reduce the local services price index there. This expansion of local services raises manufacturing and tradable-services value added in dense cities at the expense of less dense locations. Urban house prices rise, while urban nominal wages fall. On net, the urban-rural welfare gap widens by nearly 3 percentage points.

Boosting housing-sector productivity in dense cities. Recent work suggests that productivity growth in construction has been slow, with regulation potentially playing an important role (Goolsbee and Syverson, 2023; D'Amico, Glaeser, Gyourko, Kerr, and Ponzetto, 2024). In France, several policies have aimed to facilitate new housing construction.[31] Our second counterfactual considers a 10% increase in housing-sector productivity in the densest French cities (city-density bin 5).

Figure B.4 reports the results. Higher housing-sector productivity lowers house prices in the densest cities and reallocates activity toward them: value added rises across all sectors there and falls elsewhere. local-service variety expands in dense cities, while urban nominal wages decline. Overall, this counterfactual also widens the urban-rural welfare gap, by about 3 percentage points.

6 Conclusion

This paper studies how recent structural change in France reshaped the spatial distribution of economic activity, house prices, wages, and welfare. Using detailed French micro-data from 1995 to 2018 and a quantitative spatial equilibrium model, we document that the rise of tradable services disproportionately favored dense cities, especially through the expansion of large tradable-services firms and the relative decline of large manufacturing firms. Over the same period, urban house prices rose sharply while urban nominal wage premia weakened, raising the question of how dense cities continued

[30] "Choc de simplification," launched in 2013, streamlined administrative interactions for businesses and citizens. The 2019 "Loi PACTE" established the legal basis for a single electronic portal for business formalities, implemented as the "guichet unique" in 2023, replacing multiple "centres de formalités des entreprises" and simplifying procedures for opening and closing businesses.

[31] For example, "Loi ELAN" (Évolution du Logement, de l'Aménagement et du Numérique) was enacted in 2018 to simplify urban-planning procedures to facilitate and accelerate the construction of housing. French housing policy debate has also revolved around the concept of "Choc de l'offre", which calls for increased housing construction in major French cities.

to attract more activity despite becoming much more expensive places to live.

Our analysis highlights the interaction of firm sorting and endogenous local-service variety as a key mechanism behind these patterns. Faster growth in tradable services reallocates activity toward dense cities, where large tradable-services firms are more strongly concentrated. As workers move toward those cities, demand for local services expands, inducing entry of new varieties. The resulting increase in local-service variety raises the amenity value of dense cities and moderates nominal wage growth, allowing large tradable-services firms to expand further despite rising housing costs. In this way, local services do not merely respond to tradable-services growth; they amplify it by relaxing the wage pressure that would otherwise constrain firm expansion in dense cities. Without this endogenous expansion of local-service variety, the model implies much weaker growth of large tradable-services firms in dense cities, together with smaller increases in urban house prices and a steeper urban nominal wage premium.

This mechanism also changes how the observed combination of rising urban house prices and a flattening nominal wage premium should be interpreted. Taken on their own, those patterns can make dense cities appear less attractive, even when endogenous amenity gains allow them to attract more activity and sustain larger welfare gains. Quantitatively, we find that these forces account for a large share of the increase in the urban-rural house-price gap while keeping the urban nominal wage premium broadly stable. As a result, measured real wage gaps understate the extent to which welfare gaps between urban and rural residents widened over this period.

More broadly, our findings suggest that the spatial consequences of service-led structural change depend not only on where highly productive tradable firms locate, but also on whether local-service variety expands enough to sustain their growth in expensive dense cities. Understanding recent urban divergence therefore requires studying sectoral reallocation, firm sorting, and local amenities together.

References

Aiba, I. and A. Yamagishi (2025). Urbanization without Industrialization: Evidence from US Bases in Okinawa. Working Paper, University of Tokyo.

Anenberg, E. and E. Kung (2015). Information Technology and Product Variety in the City: The Case of Food Trucks. *Journal of Urban Economics 90*, 60–78.

Artuç, E., S. Chaudhuri, and J. McLaren (2010). Trade Shocks and Labor Adjustment: A Structural Empirical Approach. *American Economic Review 100*(3), 1008–1045.

Baum-Snow, N. and G. Duranton (2025). Housing Supply and Housing Affordability. Working Paper 33694, National Bureau of Economic Research.

Behrens, K., G. Duranton, and F. Robert-Nicoud (2014). Productive Cities: Sorting, Selection, and Agglomeration. *Journal of Political Economy 122*(3), 507–553.

Boppart, T. (2014). Structural Change and the Kaldor Facts in a Growth Model With Relative Price

Effects and Non-Gorman Preferences. *Econometrica 82*(6), 2167–2199.

Bryan, G. and M. Morten (2019). The Aggregate Productivity Effects of Internal Migration: Evidence from Indonesia. *Journal of Political Economy 127*(5), 2229–2268.

Combes, P., G. Duranton, and L. Gobillon (2021). The Production Function for Housing: Evidence from France. *Journal of Political Economy 129*(10), 2766–2816.

Combes, P.-P., G. Duranton, L. Gobillon, D. Puga, and S. Roux (2012). The Productivity Advantages of Large Cities: Distinguishing Agglomeration from Firm Selection. *Econometrica 80*(6), 2543–2594.

Comin, D., D. Lashkari, and M. Mestieri (2021). Structural Change with Long-Run Income and Price Effects. *Econometrica 89*(1), 311–374.

Couture, V. (2016). Valuing the Consumption Benefits of Urban Density. Working paper.

D'Amico, L., E. L. Glaeser, J. Gyourko, W. R. Kerr, and G. A. M. Ponzetto (2024). Why Has Construction Productivity Stagnated? The Role of Land-Use Regulation. Working Paper 33188, National Bureau of Economic Research.

Dauth, W., S. Findeisen, E. Moretti, and J. Suedekum (2022). Matching in Cities. *Journal of the European Economic Association 20*(4), 1478–1521.

Davis, D. R., J. I. Dingel, J. Monras, and E. Morales (2019). How Segregated Is Urban Consumption? *Journal of Political Economy 127*(4), 1684–1738.

Desmet, K. and E. Rossi-Hansberg (2014). Spatial Development. *American Economic Review 104*(4), 1211–1243.

Diamond, R. (2016). The Determinants and Welfare Implications of US Workers' Diverging Location Choices by Skill: 1980–2000. *American Economic Review 106*(3), 479–524.

Djankov, S., R. La Porta, F. Lopez-de-Silanes, and A. Shleifer (2002). The Regulation of Entry. *Quarterly Journal of Economics 117*(1), 1–37.

Duernecker, G., B. Herrendorf, and A. Valentinyi (2024). Structural Change Within the Services Sector and the Future of Cost Disease. *Journal of the European Economic Association 22*(1), 428–473.

Duranton, G. and D. Puga (2020). The Economics of Density. *Journal of Economic Perspectives 34*(3), 3–26.

Eckert, F. (2019). Growing Apart: Tradable Services and the Fragmentation of the U.S. Economy. Working Paper, Yale University.

Eckert, F., S. Ganapati, and C. Walsh (2025). Urban-Biased Growth: A Macroeconomic Analysis. Working Paper 30515, National Bureau of Economic Research.

Eckert, F. and M. Peters (2025). Spatial Structural Change. Working Paper 30489, National Bureau of Economic Research.

Fajgelbaum, P. and S. Redding (2022). Trade, Structural Transformation and Development: Evidence from Argentina 1869–1914. *Journal of Political Economy 130*(5), 1249–1318.

Fan, T., M. Peters, and F. Zilibotti (2023). Growing Like India—the Unequal Effects of Service-Led Growth. *Econometrica 91*(4), 1457–1494.

Garriga, C., A. Hedlund, Y. Tang, and P. Wang (2023). Rural-Urban Migration, Structural Transformation, and Housing Markets in China. *American Economic Journal: Macroeconomics 15*(2),

413–440.

Gaubert, C. (2018). Firm Sorting and Agglomeration. *American Economic Review 108*(11), 3117–3153.

Giannone, E. (2022). Skilled-biased Technical Change and Regional Convergence. Working Paper, CREI.

Glaeser, E. L. (2005). Urban Colossus: Why Is New York America's Largest City? Technical Report 2, Federal Reserve Bank of New York.

Glaeser, E. L., J. Kolko, and A. Saiz (2001). Consumer City. *Journal of Economic Geography 1*(1), 27–50.

Goolsbee, A. and C. Syverson (2023). The Strange and Awful Path of Productivity in the U.S. Construction Sector. Working Paper 30845, National Bureau of Economic Research.

Handbury, J. and D. E. Weinstein (2015). Goods Prices and Availability in Cities. *Review of Economic Studies 82*(1), 258–296.

Hanlon, W. W. (2020). Coal Smoke, City Growth, and the Costs of the Industrial Revolution. *Economic Journal 130*(626), 462–501.

Heblich, S. H., A. Trew, and Y. Zylberberg (2021). East Side Story: Historical Pollution and Persistent Neighborhood Sorting. *Journal of Political Economy 129*(5), 1508–1552.

Herrendorf, B., R. Rogerson, and A. Valentinyi (2014). Growth and Structural Transformation. In P. Aghion and S. Durlauf (Eds.), *Handbook of Economic Growth*, Volume 2, pp. 855–941. Amsterdam: Elsevier.

Hottman, C. (2021). Retail Markups, Misallocation, and Store Variety in the US. Working Paper, Board of Governors of the Federal Reserve System.

Hsieh, C.-T. and E. Rossi-Hansberg (2023). The Industrial Revolution in Services. *Journal of Political Economy Macroeconomics 1*(1), 3–42.

International Accounting Standards Board (2025, March). Post-implementation review of IFRS 16 leases: Review of academic literature. IASB staff paper Agenda Paper 7F, IFRS Foundation. Discussed at the International Accounting Standards Board meeting of March 18, 2025.

International Labour Organization (2024). Employment and Wage Disparities Between Rural and Urban Areas.

Kahn, M. E. (1999). The Silver Lining of Rust Belt Manufacturing Decline. *Journal of Urban Economics 46*(3), 360–376.

Klapper, L., L. Laeven, and R. Rajan (2006). Entry Regulation as a Barrier to Entrepreneurship. *Journal of Financial Economics 82*(3), 591–629.

Kleinman, B. (2022). Wage Inequality and the Spatial Expansion of Firms. Mimeo. Unpublished manuscript.

Kongsamut, P., S. Rebelo, and D. Xie (2001). Beyond Balanced Growth. *Review of Economic Studies 68*(4), 869–882.

Krugman, P. R. (1980). Scale economies, product differentiation, and the pattern of trade. *American Economic Review 70*(5), 950–959.

Levitt, S. D. (2004). Understanding why crime fell in the 1990s: Four factors that explain the

decline and six that do not. *Journal of Economic Perspectives 18*(1), 163–190.

Lewis, L., R. Monarch, M. Sposi, and J. Zhang (2022). Structural Change and Global Trade. *Journal of the European Economic Association 20*(1), 476–512.

Martin, R., B. Gardiner, and P. Tyler (2003). The Changing Spatial Distribution of Employment in London. Technical report, London, UK. Greater London Authority (GLA) Economics Report.

Morten, M. and J. Oliveira (2024). The Effects of Roads on Trade and Migration: Evidence from a Planned Capital City. *American Economic Journal: Applied Economics 16*(2), 389–421.

Moussaly, K. and W. Wang (2014, July). The Impact of Leased and Rented Assets on Industry Productivity Measurement. Technical Report 36, Statistics Canada. Statistics Canada Catalogue no. 15-206-X, released July 22, 2014.

Nagy, D. K. (2023). Hinterlands, City Formation and Growth: Evidence from the American Frontier. *Review of Economic Studies 90*(6), 3238–3284.

Ngai, L. R. and C. Pissarides (2007). Structural Change in a Multisector Model of Growth. *American Economic Review 97*(1), 429–443.

Pijoan-Mas, J. and T. Budí-Ors (2025). Macroeconomic Development, Rural Exodus, and Uneven Industrialization. Working Paper 013, Structural Transformation and Economic Growth (CEPR).

Saiz, A. (2010). The Geographic Determinants of Housing Supply. *Quarterly Journal of Economics 125*(3), 1253–1296.

Schiff, N. (2015). Cities and Product Variety: Evidence from Restaurants. *Journal of Economic Geography 15*(6), 1085–1123.

Sharpe, S. A. and H. H. Nguyen (1995). Capital Market Imperfections and the Incentive to Lease. *Journal of Financial Economics 39*(2–3), 271–294.

Smith, Clifford W., J. and L. M. Wakeman (1985, July). Determinants of Corporate Leasing Policy. *The Journal of Finance 40*(3), 895–908.

Su, Y. (2022). Measuring the Value of Urban Consumption Amenities: A Time-Use Approach. *Journal of Urban Economics 132*, 103495.

Weber, B. and A. Tickamyer (2020). Many Rural Americans Are Still "Left Behind". *Fast Focus* No. 44-2020. Institute for Research on Poverty, University of Wisconsin–Madison.

Wheaton, W. C. and R. G. Torto (1990). An Investment Model of the Demand and Supply for Industrial Real Estate. *Real Estate Economics 18*(4), 530–547.

Zerecero, M. (2021). The Birthplace Premium. Working Paper, UC Irvine.

Online Appendix

Urban-Biased Structural Change

Natalie Chen[1], Dennis Novy[1], Carlo Perroni[1], Horng Chern Wong[2]

[1]University of Warwick
[2]Stockholm University

Email: n.a.chen@warwick.ac.uk, d.novy@warwick.ac.uk, c.perroni@warwick.ac.uk, horngchernwong@gmail.com

A Data Appendix

A.1 Additional tables and figures

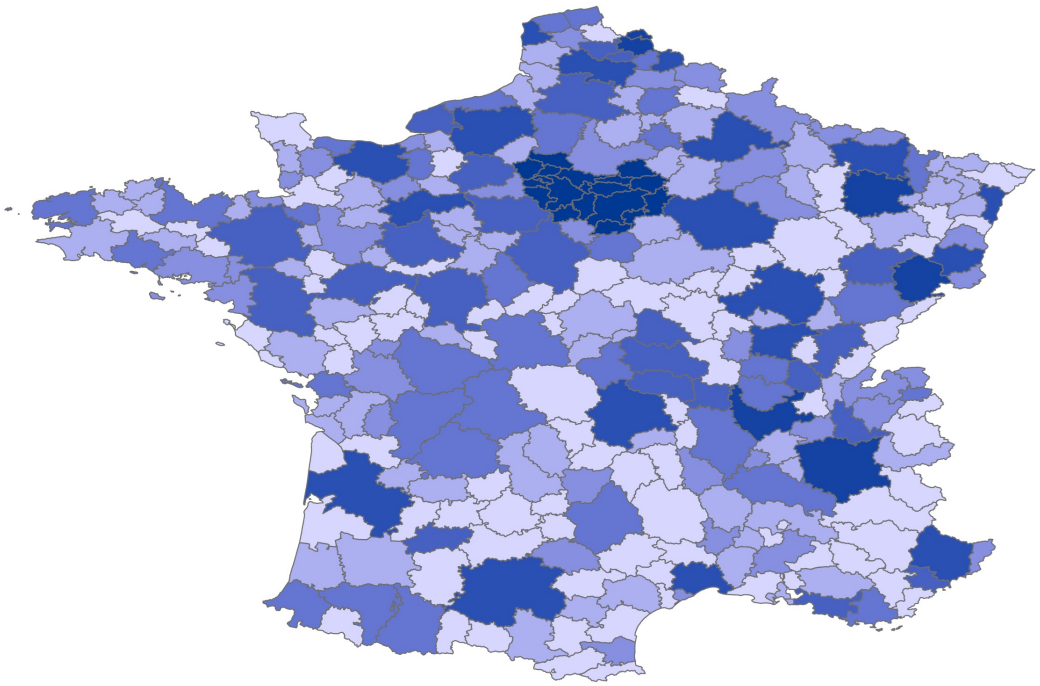


Figure A.1: Population density across French cities

Notes: The map illustrates population density in 1995 across 279 French cities (commuting zones). Population density is measured as the weighted average of commune-level densities, with weights given by population size. The darker the color, the higher population density. See Section 2 for more information.

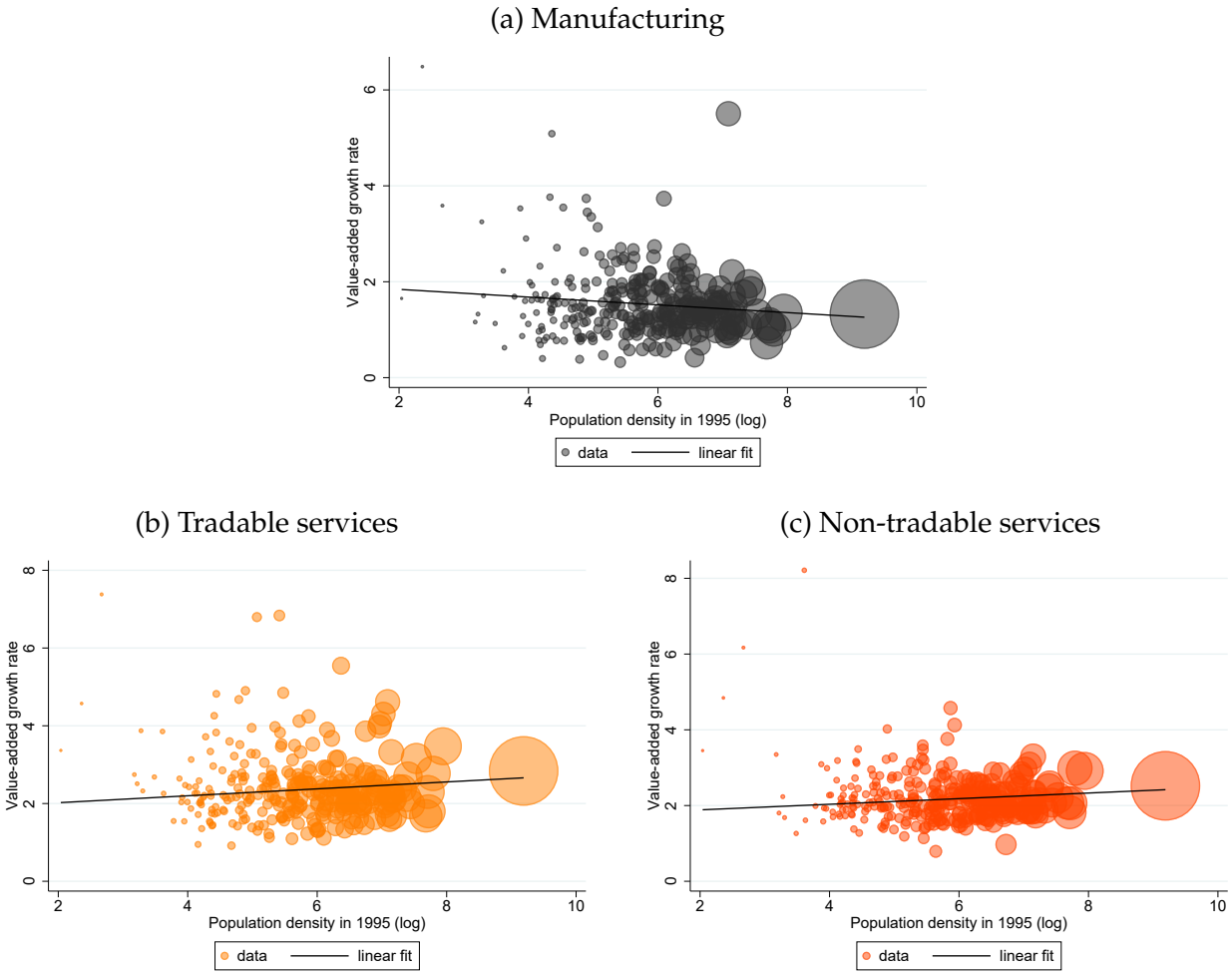


Figure A.2: City density and sectoral value added growth across French cities, excluding Île-de-France, 1995-2018

Notes: This figure plots the sectoral value added growth rates across 279 French cities (commuting zones) between 1995 and 2018, excluding Paris. The dots are proportional to city population size. The densest two cities are Lyon and Lille.

Table A.1: Descriptive statistics on establishment size

		Value added				Employment			
Sector	Year	25^{th}	50^{th}	75^{th}	95^{th}	25^{th}	50^{th}	75^{th}	95^{th}
Manufacturing	1995	68	147	450	3365	2	6	17	103
	2018	78	185	612	5581	3	7	17	96
Tradable services	1995	56	127	323	1698	2	4	10	58
	2018	66	157	414	2300	2	4	9	55
Local services	1995	40	78	162	674	1	3	7	33
	2018	49	105	244	1226	2	4	9	40

Notes: The table reports descriptive statistics on establishment size for each sector in 1995 and 2018. Value added is reported in 1000s of Euros.

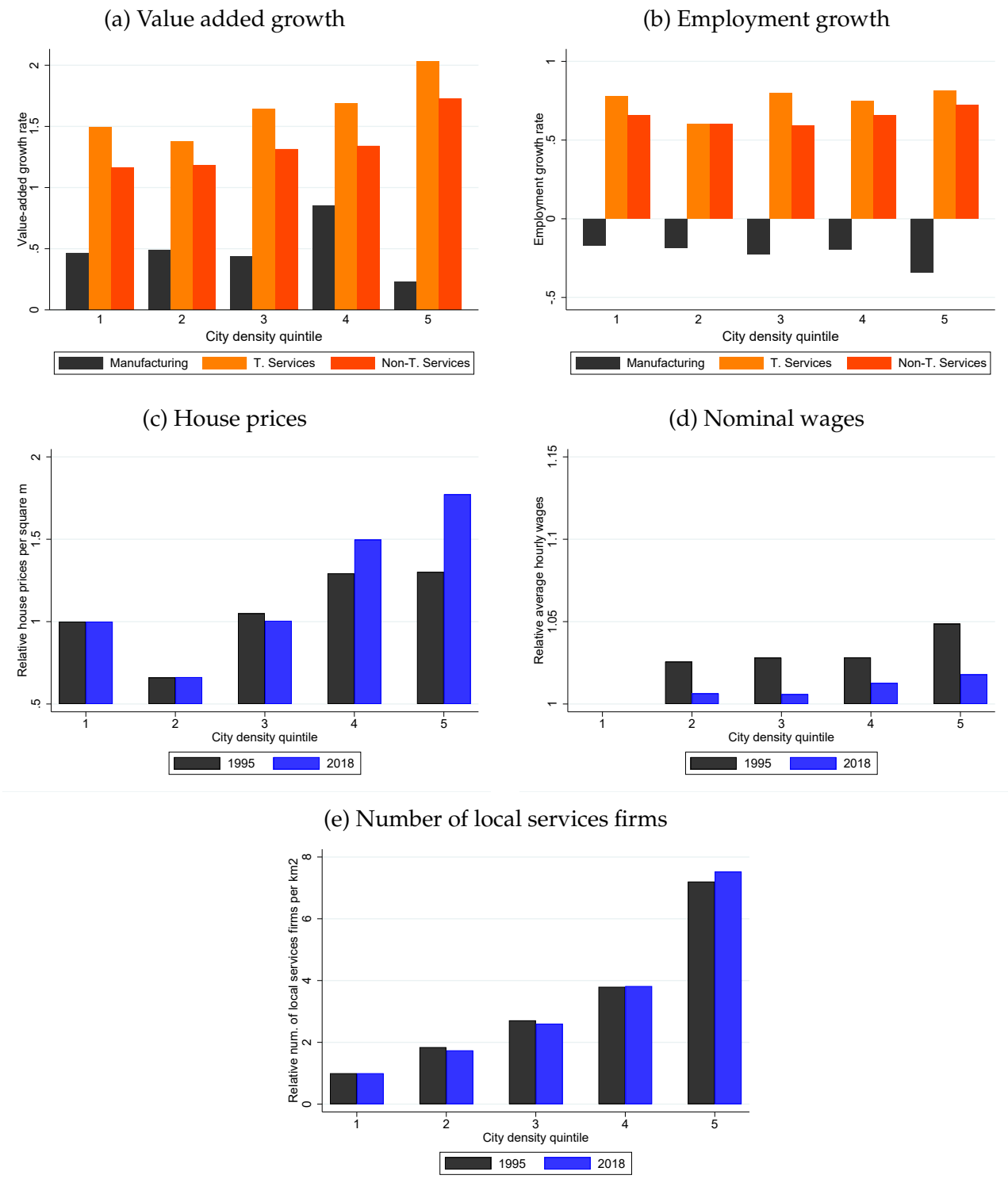
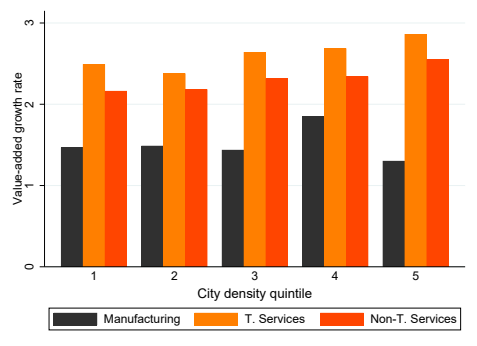


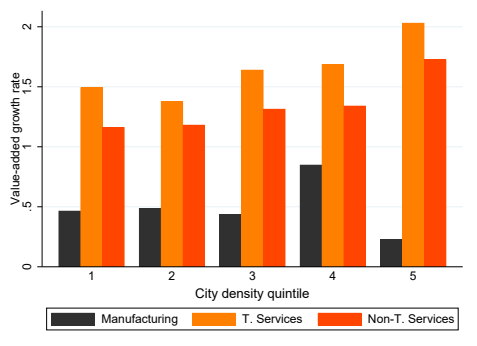
Figure A.3: Structural change patterns (excluding Île-de-France)

Notes: These figures present structural change patterns by city density bin. City density bin 1 represents the smallest cities and bin 5 the largest cities. House prices, nominal wages, and the number of local services firms per square kilometer are normalized to 1 in city bin 1.

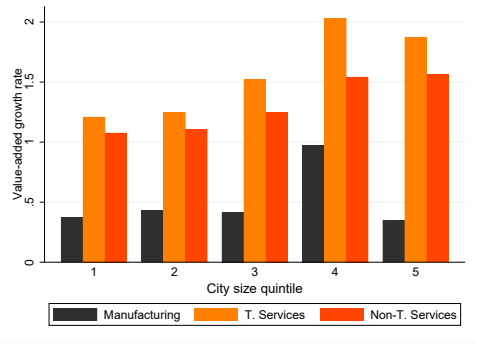
(a) Value added growth, population density



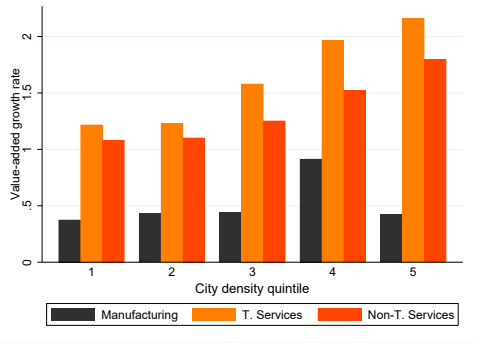
(b) Value added growth, population size



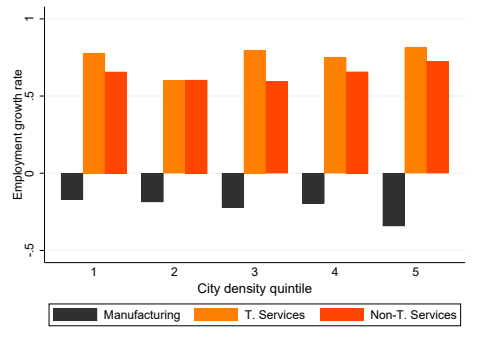
(c) Value added growth, population density (exc. Île-de-France)



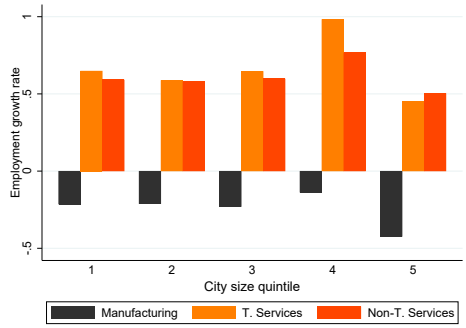
(d) Value added growth, population size (exc. Île-de-France)



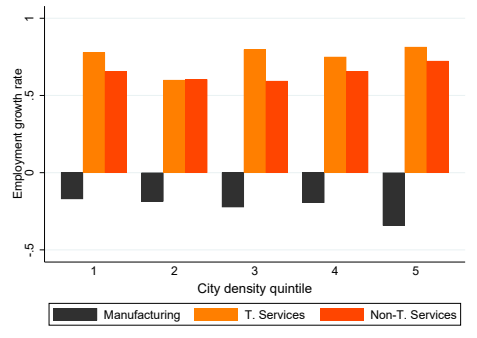
(e) Employment growth, population density



(f) Employment, population size



(g) Employment, population density (exc. Île-de-France)



(h) Employment, population size (exc. Île-de-France)

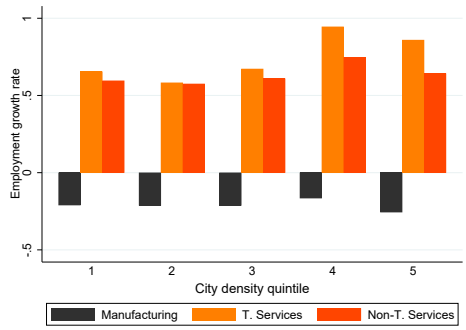


Figure A.4: Structural change patterns by city density and size

Notes: These figures present structural change patterns by city density and size bin. City density/size bin 1 represents the least dense/smallest cities and bin 5 the densest/largest cities.

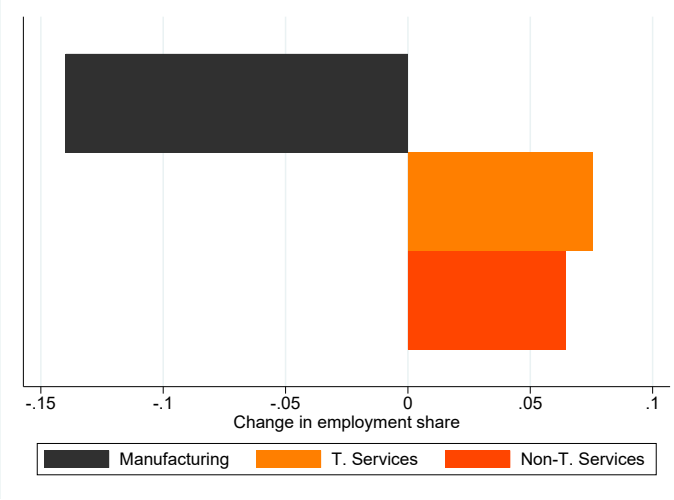
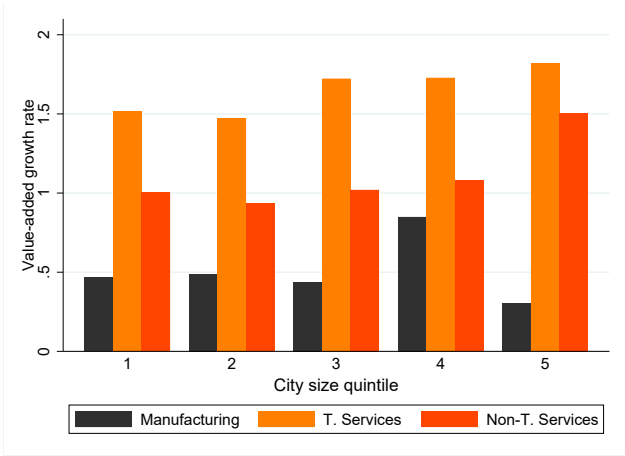


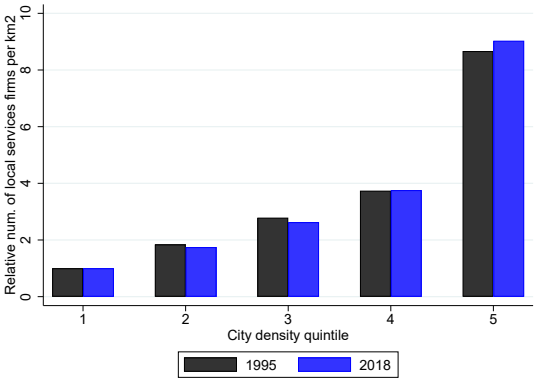
Figure A.5: Aggregate structural change (employment) in France, 1995-2018

Notes: The bars show the change in aggregate sectoral employment shares for manufacturing, tradable services, and non-tradable local services in 1995 and 2018. These changes add up to 0.

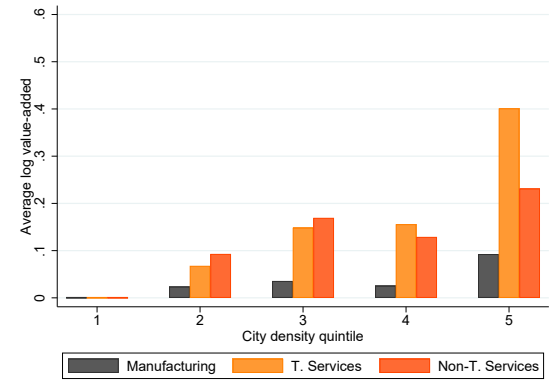
(a) Urban-biased structural change



(b) Number of local services firms



(c) Firm size by city density in 1995



(d) Firm size by city density in 2018

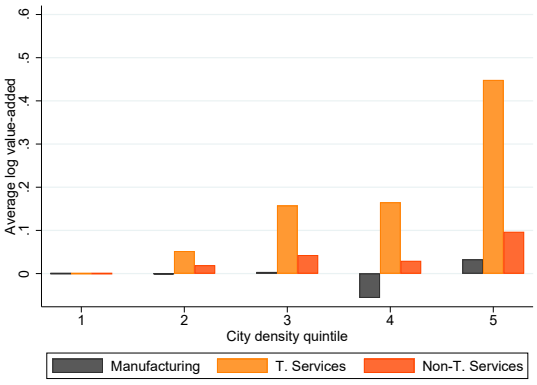
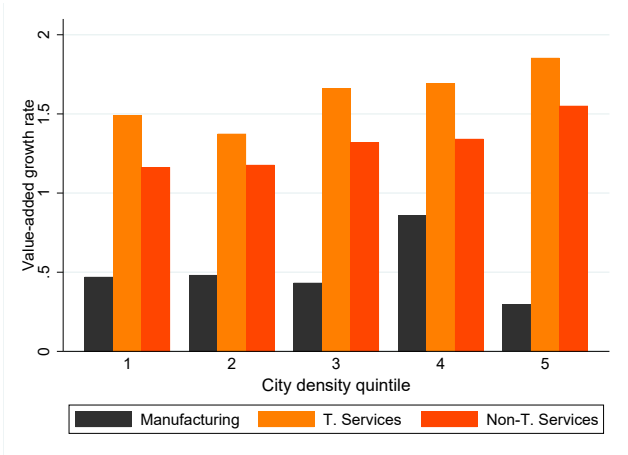


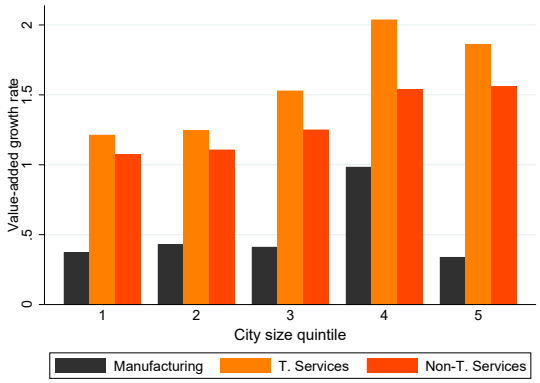
Figure A.6: Structural change patterns under an alternative definition of tradable services

Notes: These figures present structural change patterns by city density bin using an alternative definition of domestic tradability of local services: sectors with at least 10% of revenue from exports are classed as tradable; the rest as non-tradable. Under this definition, tradable services include finance and insurance, information and communications technology, professional, specialized, and technical services, administrative and support services, real estate, wholesale trade, and transportation.

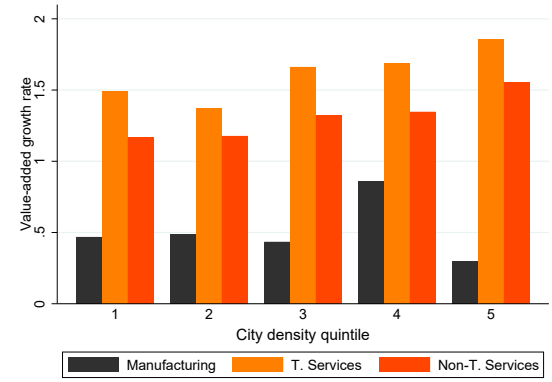
(a) One-digit sector, population density



(b) One-digit sector, population size



(c) Two-digit sector, population density



(d) Two-digit sector, population size

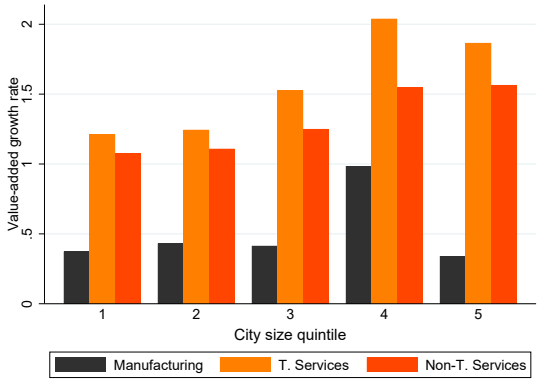


Figure A.7: Structural change patterns when we allocate firm-level value added to plants using one-digit or two-digit sector codes

Notes: These figures present structural change patterns by city population density or size bin when we allocate firm-level value added to individual plants based on their one-digit or two-digit sector classification.

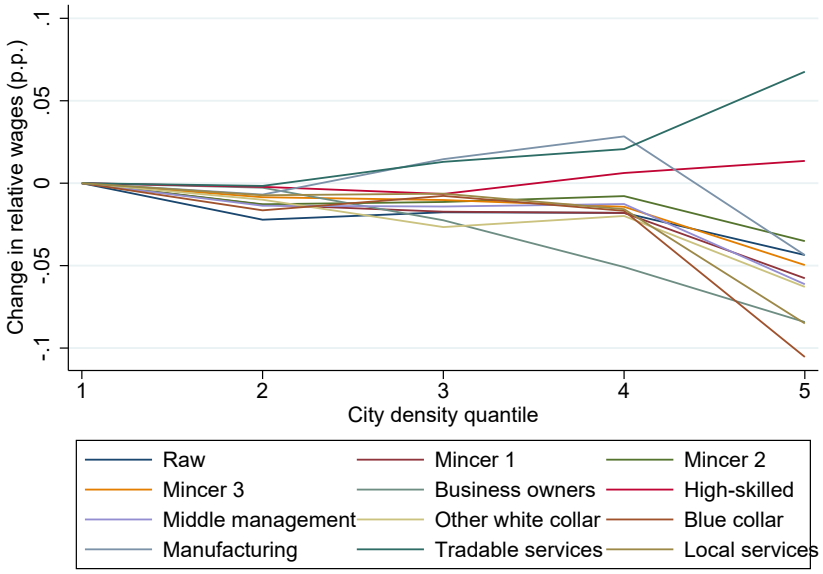


Figure A.8: Changes in the urban nominal wage premium between 1995 and 2018

Notes: This figure presents percentage point changes in relative wages in each city density bin under various measures of city-level wages. A value of -0.05 in density bin 5 indicates a 5 percentage point decrease in the average wage in the densest cities relative to the least dense cities (bin 1), i.e., a flattening of the urban nominal wage premium. 'Raw' denotes the unconditional mean wage, 'Mincer 1' controls for gender and part-time status, 'Mincer 2' further controls for two-digit occupations, 'Mincer 3' further interacts two-digit occupations with two-digit sector codes. All other lines present changes in the urban nominal wage premium by one-digit occupation or sector categories, each controlling for gender and part-time status.

B Model Appendix

B.1 Microfoundation for the accessibility-adjusted variety term

Consider city i. Let the city contain a measure $K(i) = L(i)^{\lambda}$ of symmetric local consumption neighborhoods, indexed by $b \in [0, K(i)]$. Each neighborhood contains $L(i)/K(i)$ residents. Local-service firms choose one neighborhood in which to operate and supply only to residents of that neighborhood. Let $M_n(i)$ denote the city-wide measure of local-service firms. Under symmetry, each neighborhood hosts $M_n(i)/K(i)$ firms.

A resident in neighborhood b has CES preferences over the local-service varieties available in that neighborhood:

$$C_n(b,i) = \left[\int_{\omega \in \Omega_n(b,i)} c_n(\omega, b, i)^{\frac{\sigma_n - 1}{\sigma_n}} \, d\omega \right]^{\frac{\sigma_n}{\sigma_n - 1}}.$$

The associated unit-expenditure function is

$$P_n(b,i) = \left[\int_{\omega \in \Omega_n(b,i)} p_n(\omega, b, i)^{1-\sigma_n} \, d\omega \right]^{\frac{1}{1-\sigma_n}}.$$

If firms are symmetric within a city, the distribution of prices is the same across neighborhoods, so

$$P_n(b,i) = \left(\frac{M_n(i)}{K(i)} \, E[p_n(\omega,i)^{1-\sigma_n} \mid i] \right)^{\frac{1}{1-\sigma_n}} = \left(\frac{M_n(i)}{L(i)^{\lambda}} \, E[p_n(\omega,i)^{1-\sigma_n} \mid i] \right)^{\frac{1}{1-\sigma_n}}.$$

Hence the term $M_n(i)/L(i)^{\lambda}$ is the measure of varieties effectively accessible to a representative resident. When $\lambda = 0$, $K(i) = 1$ and the city is an integrated local consumption market. When $\lambda = 1$, the number of effective neighborhoods is proportional to population, so resident-level variety depends on varieties per resident.

B.2 Additional tables and figures

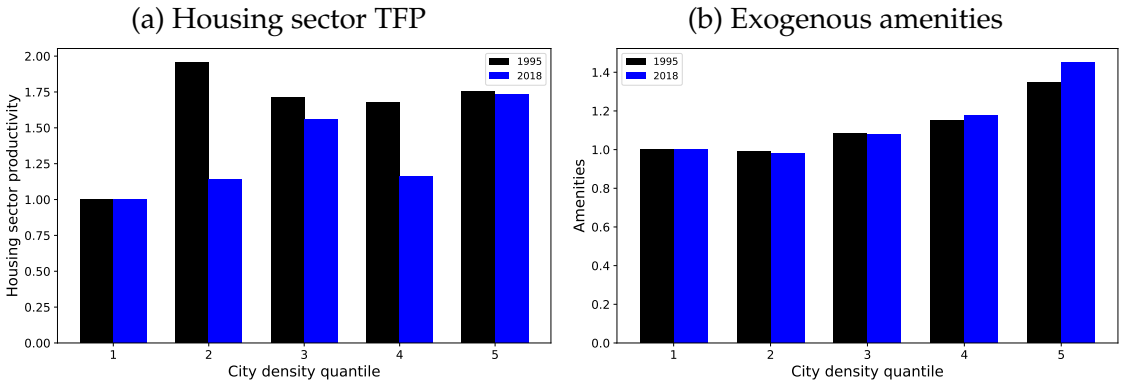


Figure B.1: Model-implied housing sector TFP and exogenous amenities

Notes: In panel (a) the bars show the model-implied housing sector TFP (relative to those in the least dense cities), $z_h(i)$, in 1995 and 2018. The horizontal axis represents city bins, with city bin 1 representing the least dense cities and bin 5 the densest cities. Panel (b) shows the corresponding patterns for exogenous amenities, $B(i)$. The vertical axis represents city bins.

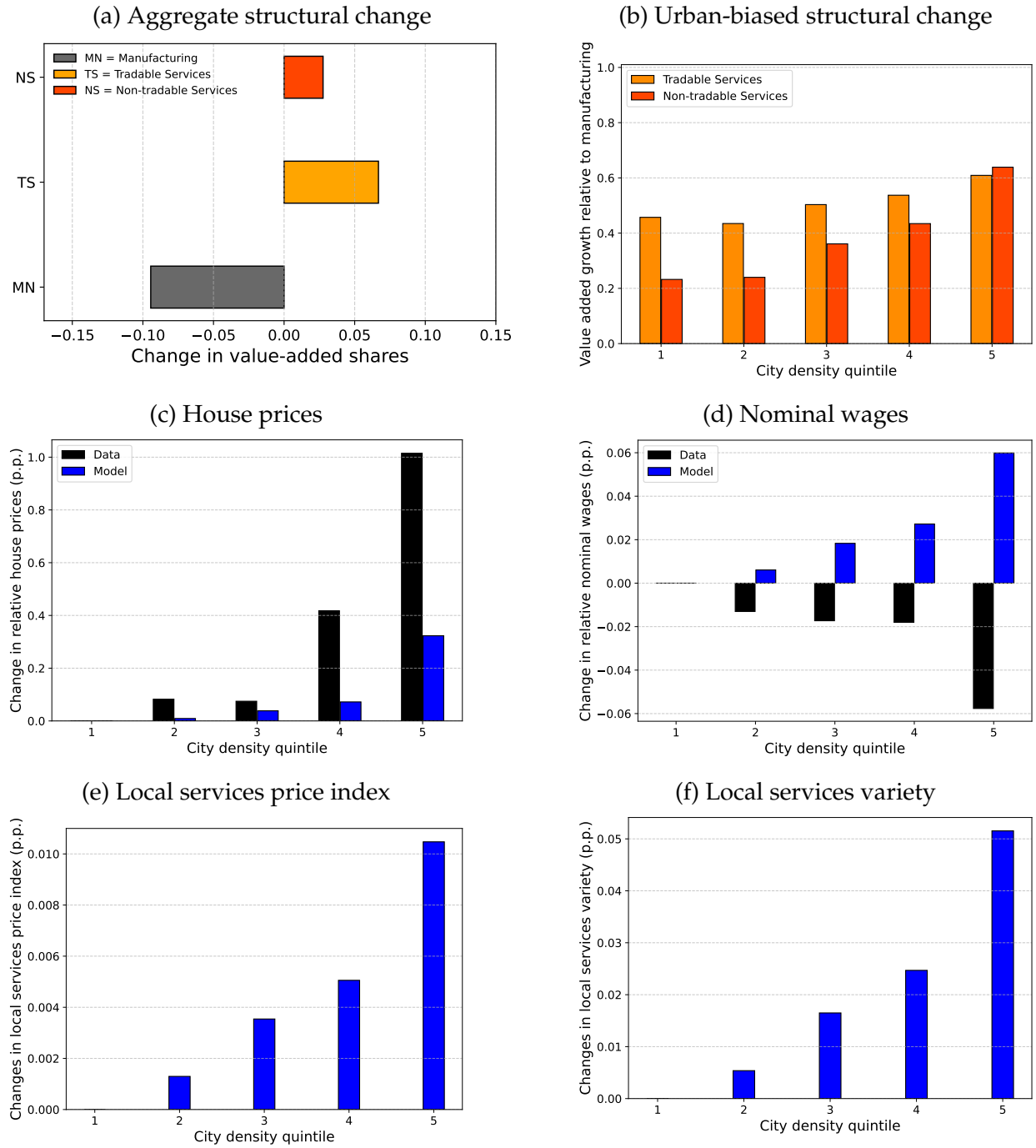


Figure B.2: Effects of sectoral TFP growth under weak access-to-variety ($\lambda = 1$)

Notes: These figures present the effects of introducing only sectoral TFP growth into the estimated model's 1995 equilibrium under weak access-to-variety ($\lambda = 1$). City density bin 1 represents the smallest cities and bin 5 the largest cities.

Table B.1: Summary of calibrated parameters

PARAMETER		VALUE	SOURCE/TARGET
Elasticity of substitution between local services and traded bundle	ρ	0.4	Lewis et al. (2022)
Elasticity of substitution between manufacturing and tradable services	γ	1.89	Section 4.3
Household expenditure share on non-housing-related costs	η	0.80	INSEE household expenditure survey 2013
labor output elasticity	$\alpha_m, \alpha_s, \alpha_n$	0.65, 0.66, 0.68	Median labor share
Within-sector elasticity of substitution	$\sigma_m, \sigma_s, \sigma_n$	3, 3, 3	Eaton, Kortum, and Kramarz (2011)
Tradable sector entry costs	f_m^e, f_s^e	4.27, 1.88	Average firm size relative to local services
Local services entry costs	$f_n^e(i)$	1.00 to 1.17	Average firm size relative to smallest cities (bin 1)
Access-to-variety	λ	0.47	See Section 4.2
Local services housing output elasticity	β_n	0.00	See Section 4.2
Housing production returns to scale	δ	0.60	Combes et al. (2021)
Dispersion of idiosyncratic worker location preferences	ξ	7	Zerecero (2021)
Preference weight on services within traded bundle	ζ	0.42	Sectoral value added in 1995
Preference weight on traded bundle	ν	0.73	Sectoral value added in 1995
Sectoral TFP in 1995	$A_m^{1995}, A_s^{1995}, A_n^{1995}$	1, 1, 1	-
Sectoral TFP in 2018	$A_m^{2018}, A_s^{2018}, A_n^{2018}$	1.31, 1.70, 1	Sectoral value added in 2018
Local housing sector TFP	$z_h(i)$	1 to 1.73	House price–density relationship in 1995 and 2018
Exogenous amenities	$B(i)$	1 to 1.45	Wage–density relationship in 1995 and 2018

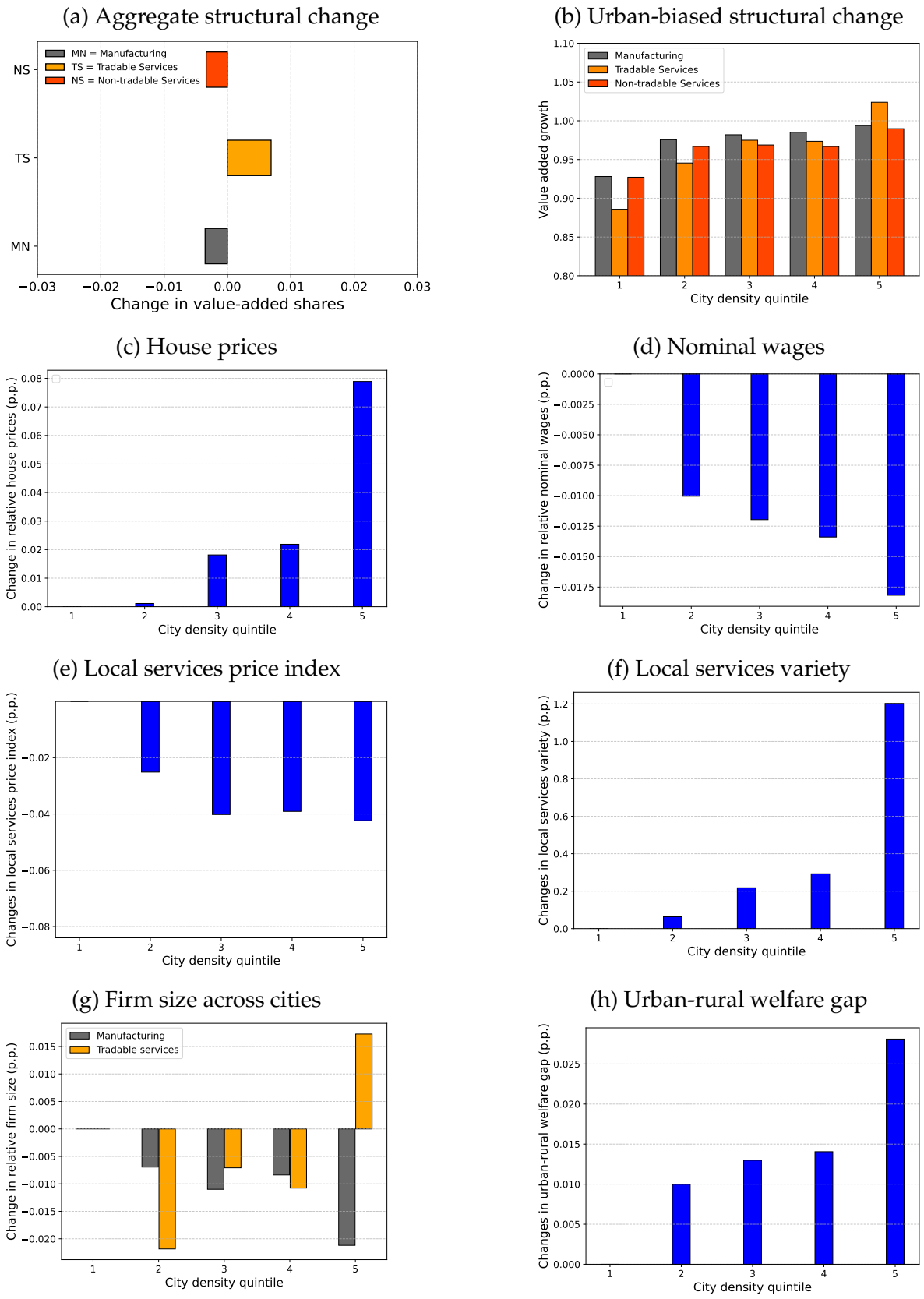


Figure B.3: Effects reducing entry costs for local services in dense cities

Notes: These figures present the effects of only reducing fixed entry costs (f_n^e) for local services to one in all cities compared to the estimated model's 1995 equilibrium in which f_n^e is 17% higher in the densest cities (bin 5) than in the least dense locations (bin 1). City density bin 1 represents the smallest cities and bin 5 the largest cities.

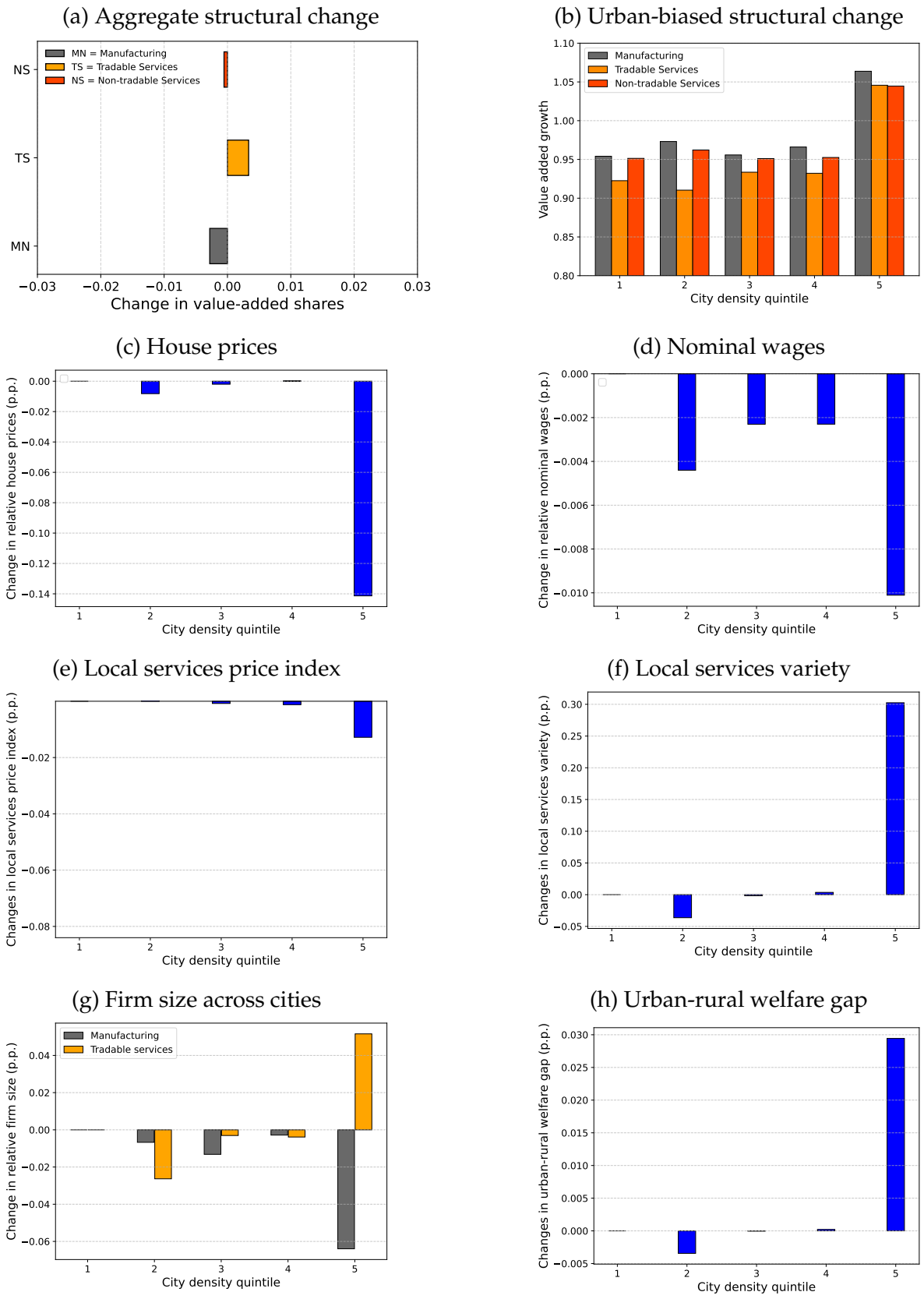


Figure B.4: Effects of increasing housing sector TFP in the densest cities

Notes: These figures present the effects of raising only local housing sector TFP in the densest cities (bin 5) by 10% compared to the estimated model's 1995 equilibrium. City density bin 1 represents the smallest cities and bin 5 the largest cities.

B.3 Model fit

B.3.1 Targeted moments

Table B.2: Model's fit to targeted moments

		1995		2018	
MOMENTS	SECTOR	DATA	MODEL	DATA	MODEL
50-10 difference of log value added	MN	1.37	1.46	1.50	1.45
	TS	1.25	1.17	1.37	1.19
75-25 difference of log value added	MN	1.88	1.90	2.04	1.93
	TS	1.52	1.56	1.60	1.62
90-50 difference of log value added	MN	2.33	2.28	2.54	2.29
	TS	1.76	1.91	1.85	1.92
90-10 difference of log value added	MN	3.70	3.73	4.03	3.74
	TS	3.01	3.08	3.22	3.11
Mean normalized value added in city bin 2	MN	0.04	0.10	0.03	0.07
	TS	0.05	0.17	0.09	0.13
Mean normalized value added in city bin 3	MN	0.11	0.08	0.10	0.05
	TS	0.11	0.24	0.19	0.24
Mean normalized value added in city bin 4	MN	0.07	0.15	0.02	0.10
	TS	0.28	0.33	0.32	0.36
Mean normalized value added in city bin 5	MN	0.23	0.10	0.07	0.11
	TS	0.60	0.55	0.69	0.63
City bin 1's share of sector value added	MN	0.19	0.25	0.18	0.33
	TS	0.08	0.06	0.07	0.05
City bin 2's share of sector value added	MN	0.18	0.21	0.18	0.21
	TS	0.09	0.10	0.09	0.09
City bin 3's share of sector value added	MN	0.19	0.24	0.18	0.11
	TS	0.13	0.15	0.13	0.09
City bin 4's share of sector value added	MN	0.16	0.17	0.20	0.24
	TS	0.24	0.25	0.23	0.23
City bin 5's share of sector value added	MN	0.29	0.14	0.26	0.11
	TS	0.46	0.43	0.48	0.53
City bin 1's share of sector value added (large firms)	MN	0.18	0.27	0.18	0.36
	TS	0.04	0.04	0.03	0.03
City bin 2's share of sector value added (large firms)	MN	0.18	0.21	0.18	0.21
	TS	0.05	0.07	0.05	0.07
City bin 3's share of sector value added (large firms)	MN	0.18	0.24	0.18	0.09
	TS	0.10	0.14	0.10	0.07
City bin 4's share of sector value added (large firms)	MN	0.16	0.16	0.21	0.25
	TS	0.24	0.26	0.20	0.23
City bin 5's share of sector value added (large firms)	MN	0.30	0.13	0.27	0.09
	TS	0.57	0.49	0.62	0.60

Notes: The table reports the model's fit to the targeted moments in the structural estimation routine in Section 4. 'MN' represents manufacturing and 'TS' represents tradable services.

B.3.2 Untargeted moments

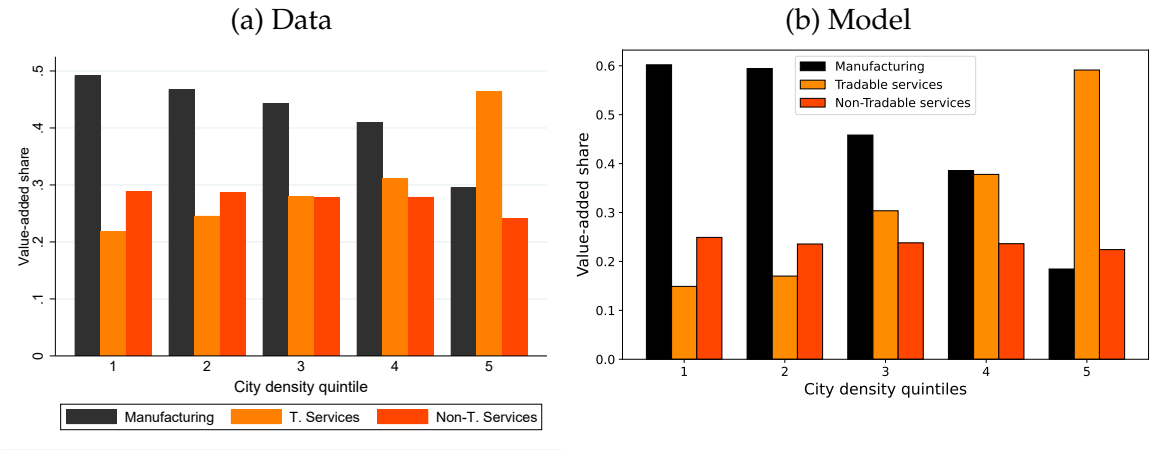


Figure B.5: Spatial distribution of value added in 1995: data vs model

Notes: In panel (a) the bars show the sectoral value added shares for manufacturing and services in 1995 in the data. The shares of the three sectors add up to 1. The horizontal axis represents city bins, with city bin 1 representing the least dense cities and bin 5 the densest cities. Panel (b) shows the corresponding patterns in the data. The vertical axis represents city bins.

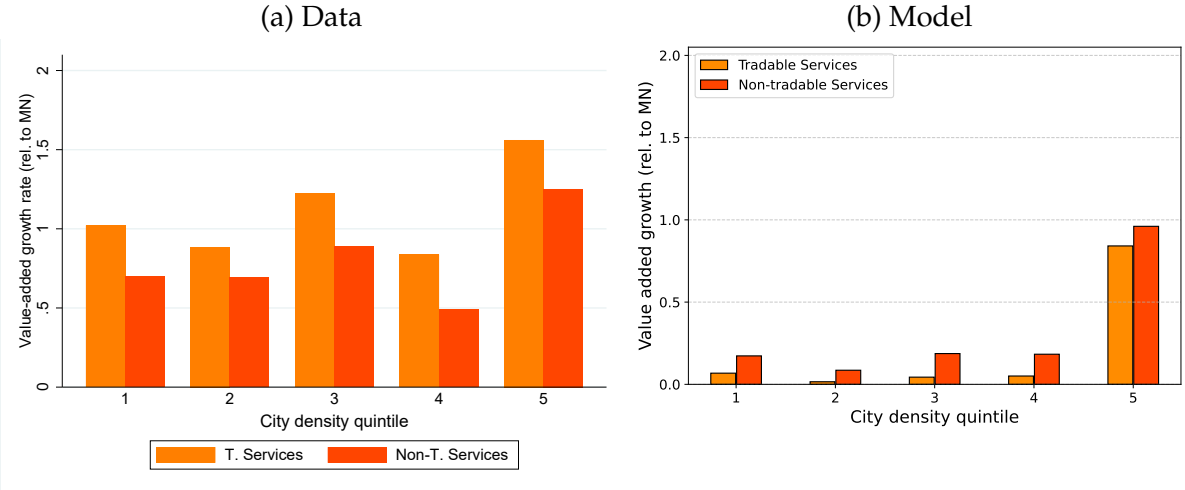
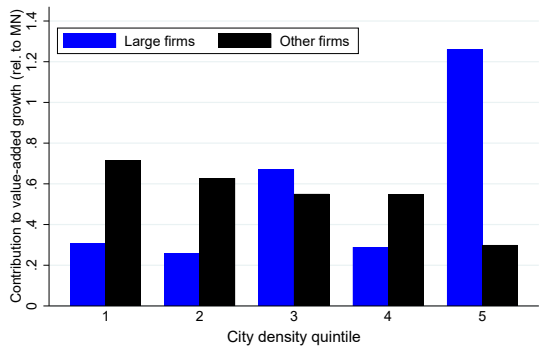


Figure B.6: Urban-biased structural change: data vs model

Notes: In panel (a) the bars show the growth rate of value added in tradable and local services relative to manufacturing in the data between 1995 and 2018. That is, $g_j^{\text{value added}} - g_{\text{manufacturing}}^{\text{value added}}$ where $j \in \{\text{tradable services}, \text{local services}\}$. Panel (b) shows the corresponding patterns produced by the model. The vertical axis represents city bins. Bin 5 are the densest cities while bin 1 are the least dense cities

(a) Data



(b) Model

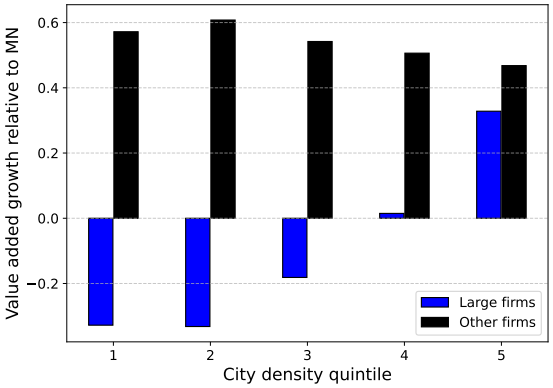


Figure B.7: Large firms and urban-biased structural change in the model

Notes: City size bin 1 represents the least dense cities and bin 5 the densest cities. Large firms are defined as those in the top 5% of the log value added distribution (adjusted to 1995 prices). In panel (a) the bars show the gap in value added growth between tradable services and manufacturing within city bins in the data, between 1995 and 2018, accounted for by large and non-large firms. The numbers correspond to the blue and red elements of the decomposition formula (1). Panel (b) presents the corresponding bars in the model.

B.4 Sensitivity of main quantitative results to alternative parameter values and additional exercises

B.4.1 Alternative calibration of housing cost share (β_j) for services sectors

The baseline estimates of firms' housing cost share parameter β_j in Section 4 imply very low values for tradable and local services. In this section, we consider an alternative calibration for the service sectors based on observed expenditure on real-estate services, and assess the robustness of our main quantitative results. This approach is especially informative for the service sectors, where current expenditure on rented premises and related real-estate services provides a relatively transparent proxy for firms' direct exposure to local structure costs. By contrast, for manufacturing, current rental expenditure is more likely to understate the relevant exposure to local property prices. Existing finance, real-estate, and accounting research shows that industrial and manufacturing premises are more likely to be owner-occupied or single-tenant, whereas many service activities—especially business services, retail, hotels, and transportation—are more lease-intensive and exhibit lower owned-real-estate ratios (Smith and Wakeman, 1985; Wheaton and Torto, 1990; Sharpe and Nguyen, 1995; Moussaly and Wang, 2014; International Accounting Standards Board, 2025). We therefore retain the baseline manufacturing estimate and replace only the service-sector values in our preferred alternative calibration.

Measurement. To motivate our alternative calibration, consider the firm-level production function in Section 3, rewritten as:

$$q_j(z,i) = \Psi_j(z,i) l^{\alpha_j} \left(h^{\vartheta_j} k^{1-\vartheta_j} \right)^{1-\alpha_j},$$

where $\beta_j \equiv (1-\alpha_j)\vartheta_j$. Since α_j is calibrated from the data (see Section 4), the remaining object to calibrate is ϑ_j, which governs the share of the non-labor input composite accounted for by structures. To connect ϑ_j to observable expenditure data, we make two assumptions. First, production exhibits constant returns to scale. Second, mobile capital k is supplied competitively and frictionlessly.

Let $\tilde{h}_j^{rent}$ denote sector j's expenditure on rented premises and related real-estate services, and let $\tilde{k}_j$ denote sector j's expenditure on mobile capital. Under the assumptions above, cost minimization implies that ϑ_j is given by the expenditure share

$$\vartheta_j = \frac{\tilde{h}_j^{rent}}{\tilde{h}_j^{rent} + \tilde{k}_j}.$$

This expression provides the basis for our alternative calibration. Implementing it requires empirical measures of $\tilde{h}_j^{rent}$ and $\tilde{k}_j$.

Data and implementation. We measure $\tilde{h}_j^{rent}$ using INSEE's *Tableau des entrées intermédiaires* (TEI) from the annual French national accounts. The TEI reports, for each industry, inter-

mediate consumption by product category. We use each sector's intermediate consumption of the product category "real-estate activities," which provides a direct expenditure-side measure of purchased real-estate services used in production and is therefore a natural proxy for firms' current occupancy costs. We then aggregate this measure across the sub-sectors that make up manufacturing, tradable services, and local services under the sector definitions in Section 2.1.

We measure mobile-capital expenditure $\tilde{k}_j$ using processed asset-specific capital-cost variables derived from EU KLEMS. EU KLEMS provides sector-level capital measures by asset type using national-accounts investment and capital-stock data together with a user-cost methodology. Specifically, we construct $\tilde{k}_j$ as the sum of the capital-cost components for computing equipment, communications equipment, transport equipment, other machinery and equipment, R&D, software and databases, and other intellectual property products. We then aggregate these components across the sub-sectors that make up manufacturing, tradable services, and local services under the sector definitions in Section 2.1.

Results. The rent-based measures imply materially larger housing cost share parameters for the service sectors than in the baseline estimation, namely $(\beta_s, \beta_n) = (0.043, 0.118)$.

Given this alternative value for tradable services, we assign β_s externally and re-estimate the tradable-services agglomeration, sorting, and efficiency-distribution parameters

$$\mathbf{\Theta}_s = \left\{ a_s, s_s, \nu_{z,s}^{shape}, \nu_{z,s}^{scale}, \nu_{\epsilon,s}^{scale} \right\},$$

conditional on that value. Similarly, for local services, we assign β_n externally and recalibrate the access-to-variety parameter λ conditional on that value. Finally, given these alternative parameter values, we recalibrate sectoral TFP (A_m, A_s) to match the change in aggregate value-added shares between 1995 and 2018.[32] Table B.3 reports the resulting parameter values. Overall, they remain close to the baseline estimates in Tables 3 and B.1.

Table B.3: Estimated parameter values under an alternative calibration of housing cost share for services

Parameters	a_s	s_s	$\nu_{z,s}^{shape}$	$\nu_{z,s}^{scale}$	$\nu_{\epsilon,s}^{scale}$	λ	A_m^{2018}	A_s^{2018}
Values	0.17	0.28	2.48	0.21	0.42	0.41	1.46	1.91

Notes: The table reports the re-estimated parameter vector for tradable services $\mathbf{\Theta}_s = \{a_s, s_s, \nu_{z,s}^{shape}, \nu_{z,s}^{scale}, \nu_{\epsilon,s}^{scale}\}$, the access-to-variety parameter λ for local services, and TFP in the tradable sectors in 2018, conditional on the calibrated values of housing cost shares $(\beta_s, \beta_n) = (0.043, 0.118)$. As a reminder 1995 TFP in all sectors are normalized to one.

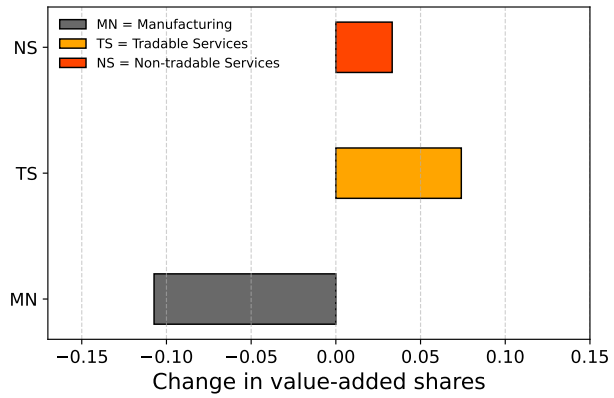
Using this alternative parameterization for tradable and local services, we revisit our main quantitative exercise. Starting from the model's estimated 1995 equilibrium, we introduce only sectoral TFP growth. Figure B.8 shows that the results closely resemble our

[32] As a reminder, local services TFP A_n is normalized to one in both 1995 and 2018.

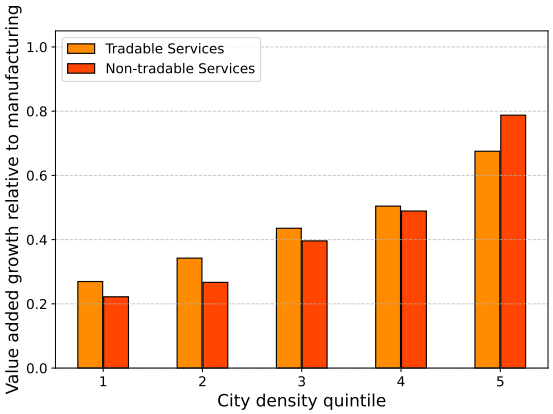
baseline findings (see Figure 7). Under this alternative calibration, the model still implies that sectoral reallocation proceeds faster in dense cities and is accompanied by rising urban house prices and a relatively stable urban nominal wage premium. The widening gap between urban house prices and wages reflects the fact that sectoral reallocation raises demand for local services, which induces entry of new local-service varieties and lowers the urban local-services price index. As a result, urban nominal wage growth remains subdued. The main difference with our baseline findings is that the decline in the urban local services price index is somewhat smaller, because in this alternative calibration, the production costs of local services firms is more sensitive to increases in house prices.

Figure B.9 further shows that the implications for the firm-size distribution and the urban-rural welfare gap also remain close to the baseline findings (see Figure 8). In particular, large tradable-services firms in dense cities expand, while manufacturing firms do not. At the same time, the urban-rural welfare gap widens even though urban house price growth outpaces urban nominal wage growth.

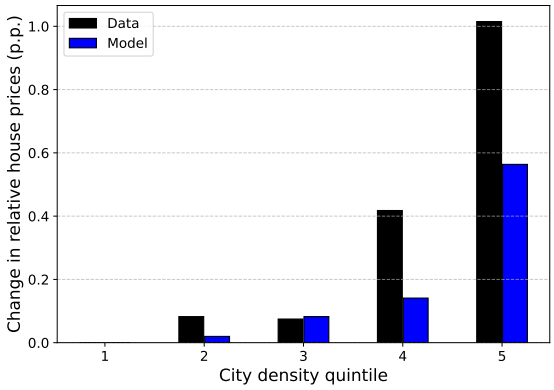
(a) Aggregate structural change



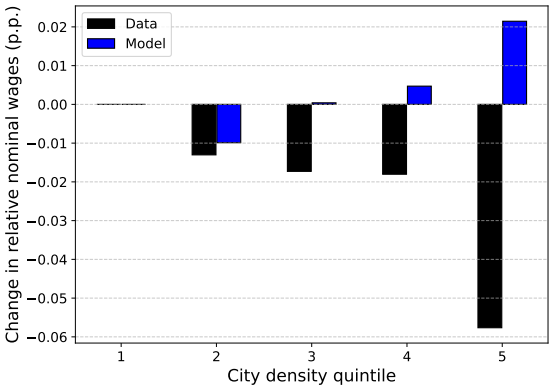
(b) Urban-biased structural change



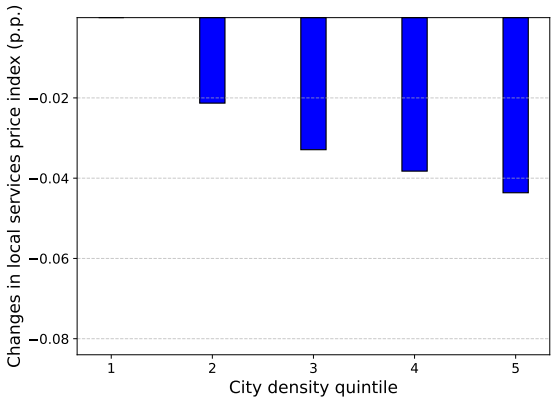
(c) House prices



(d) Nominal wages



(e) Local services price index



(f) Local services variety

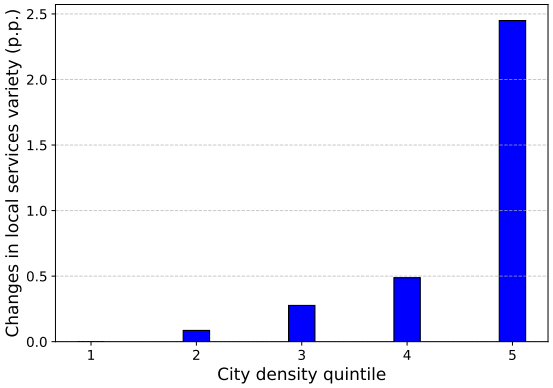


Figure B.8: Effects of sectoral TFP growth (under alternative calibration of β_j)

Notes: These figures present the effects of introducing only sectoral TFP growth into the estimated model's 1995 equilibrium, under a premises-rental-based calibration of service sector housing cost shares described in Section B.4.1. City density bin 1 represents the smallest cities and bin 5 the largest cities.

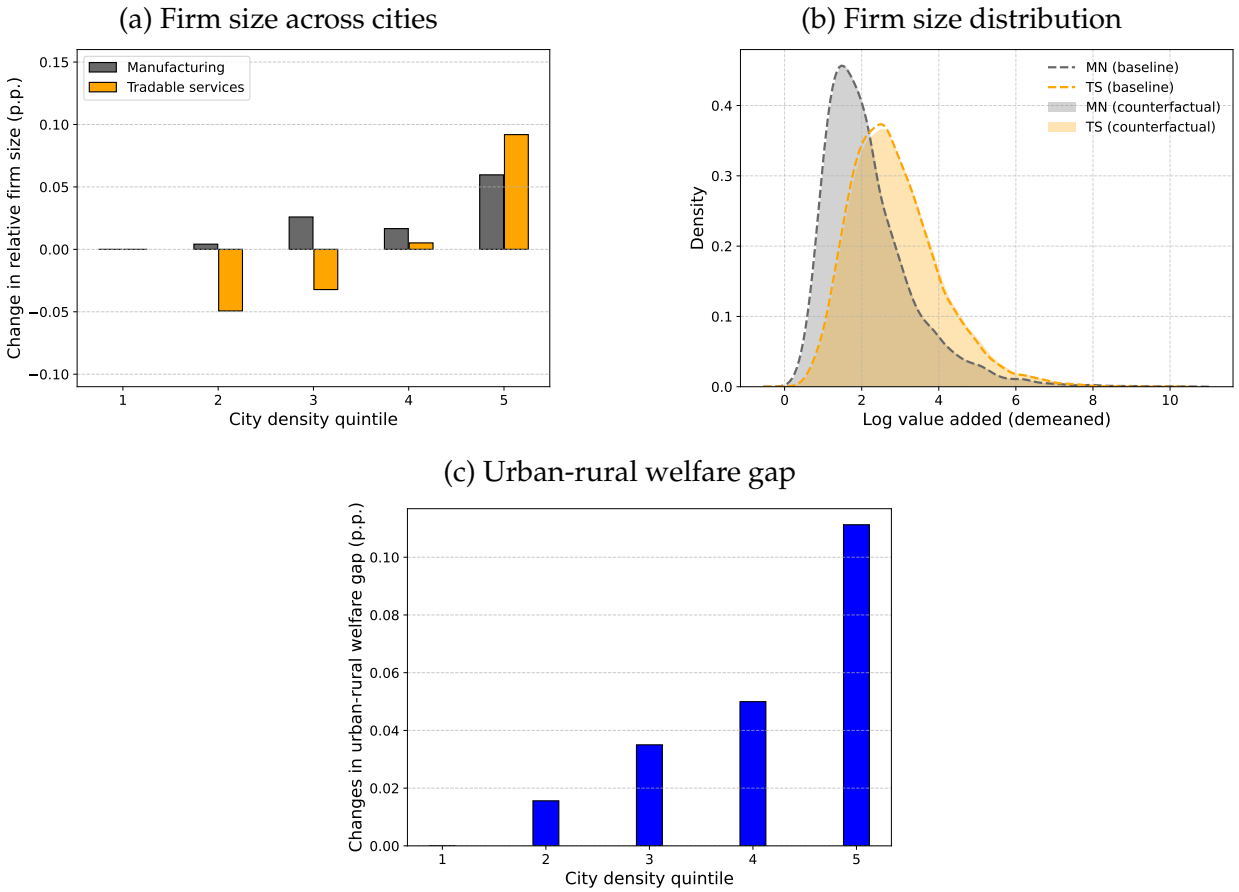


Figure B.9: Effects of sectoral TFP growth on firm size and welfare (under alternative calibration of β_j)

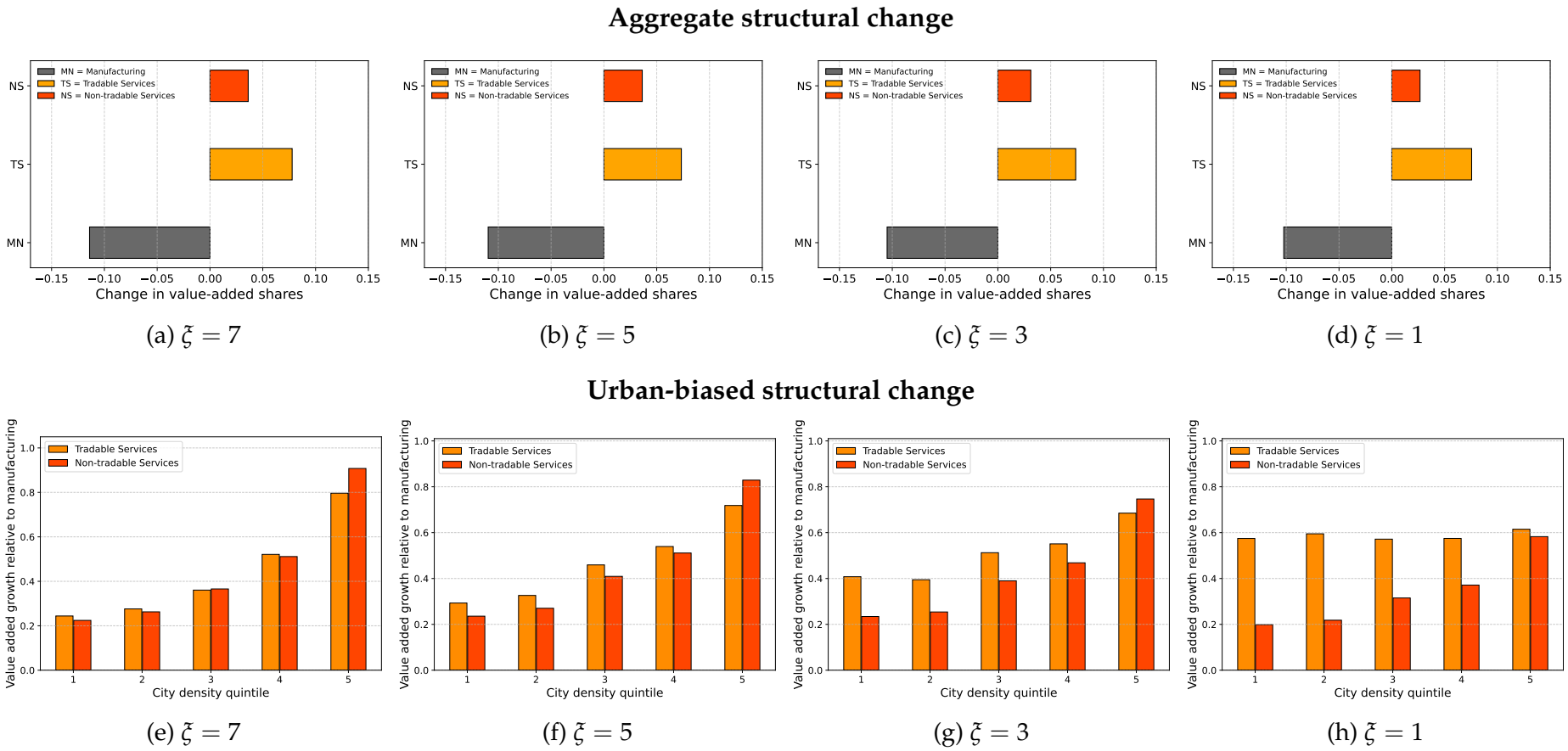
Notes: These figures present the effects of introducing only sectoral TFP growth into the estimated model's 1995 equilibrium, under a premises-rental-based calibration of service sector housing cost shares described in Section B.4.1. City density bin 1 represents the smallest cities and bin 5 the largest cities. In panel (c), the change in urban-rural welfare gap is computed as the percentage point change in the ratio of urban and rural welfare.

B.4.2 Sensitivity to dispersion in worker mobility costs (ξ)

In the baseline calibration of Section 4, we set the Fréchet shape parameter governing idiosyncratic worker location preferences, ξ, to 7, guided by existing estimates for France (Zerecero, 2021). This parameter determines the dispersion of worker preference draws and therefore the degree of imperfect mobility across cities; we interpret greater dispersion (lower ξ) as reflecting higher mobility costs. In this section, we consider alternative values of ξ between 1 and 5, consistent with evidence in Artuç et al. (2010), Bryan and Morten (2019), and Morten and Oliveira (2024). For each value of ξ, we re-calibrate the model to match the 1995 economy—changing only ξ—and simulate the effects of the same sectoral TFP growth used in our baseline (31% faster growth in manufacturing relative to local services, and 70% faster growth in tradable services). Our main conclusion is that, across this range of mobility costs, expansions in local services variety in response to rapid tradable services productivity growth remain a key mechanism restraining nominal wage growth in dense cities.

Figure B.10 summarizes the results. The first row shows that higher mobility costs have only modest effects on aggregate structural change: the decline in the manufacturing value added share is 1–2 percentage points smaller, and urban-biased services growth remains substantial for most values of ξ. The second row shows that as ξ declines from 7 to 3, the urban bias becomes slightly weaker because higher mobility costs limit the expansion of services firms in dense cities. When ξ becomes very low, tradable services growth is significantly restricted in dense cities, which in turn limits the growth of local services.

The last row shows that reduced mobility into dense cities, combined with a more constrained expansion of tradable services, lowers the entry of local services varieties. As a result, the decline in local services price indices in dense cities becomes less pronounced. Higher mobility costs and weaker growth in local services variety also moderate housing demand, leading to smaller increases in house prices. Because the expansion of local services variety plays a central role in dampening urban wage growth in the baseline, its attenuation at lower ξ leads the urban nominal wage premium to rise. Nonetheless, comparing nominal wages and local services price indices across columns shows that—even when mobility costs are high—growth in local services variety remains an important channel limiting nominal wage growth in dense cities.



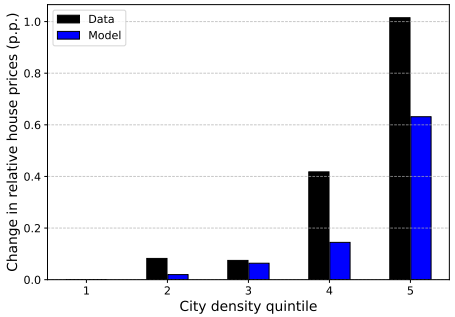
(a) $\xi = 7$ (b) $\xi = 5$ (c) $\xi = 3$ (d) $\xi = 1$

(e) $\xi = 7$ (f) $\xi = 5$ (g) $\xi = 3$ (h) $\xi = 1$

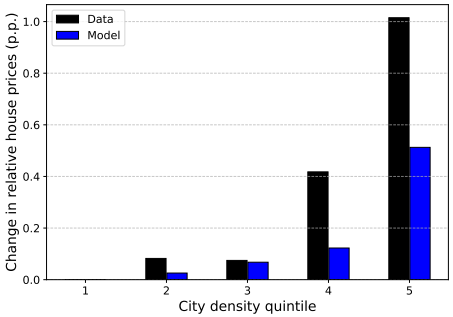
Figure B.10: Simulating the effects of sectoral TFP growth under different worker mobility costs (ξ).

Notes: This figure compares the model's predictions for structural change, house prices, and nominal wages across cities under various worker mobility costs. City density bin 1 represents the least dense cities and bin 5 the densest cities. The parameter ξ governs the distribution of idiosyncratic worker preferences over locations, interpreted as worker mobility costs. Our baseline value is $\xi = 7$, calibrated from Zerecero (2021). We compare this to the model's predictions under alternative values for ξ of 5 (Morten and Oliveira, 2024), 3 (Bryan and Morten, 2019), and 1 (Artuç et al., 2010).

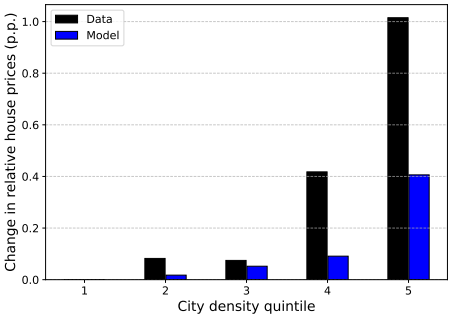
House prices



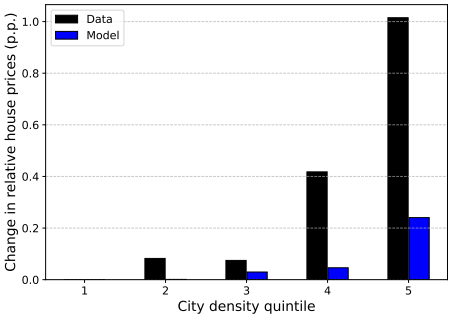
(a) $\xi = 7$



(b) $\xi = 5$

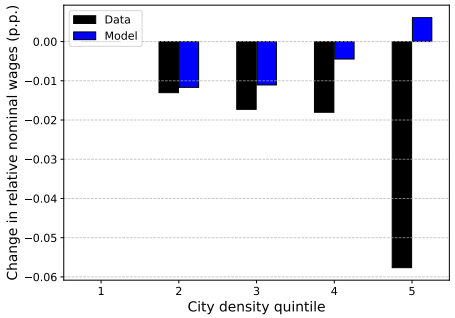


(c) $\xi = 3$

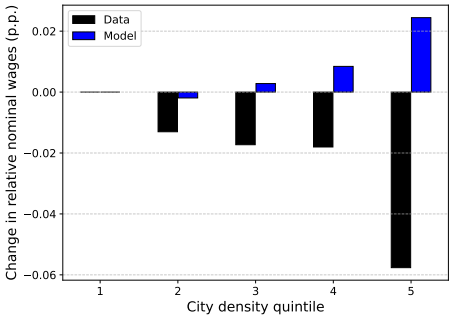


(d) $\xi = 1$

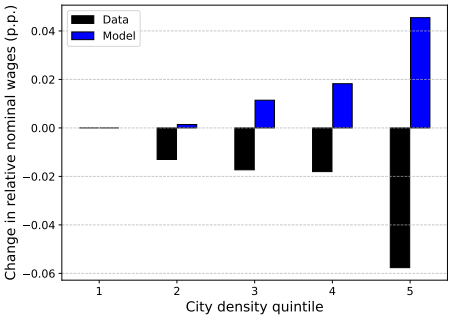
Nominal wages



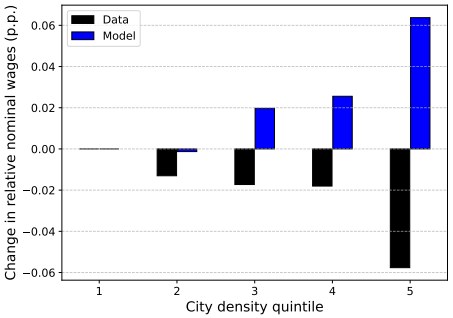
(e) $\xi = 7$



(f) $\xi = 5$

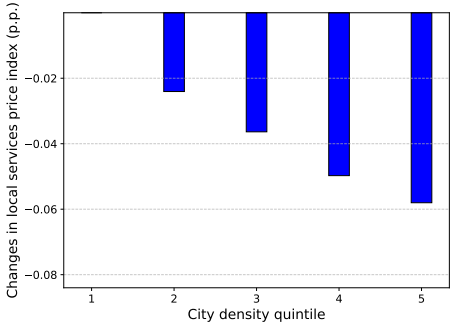


(g) $\xi = 3$

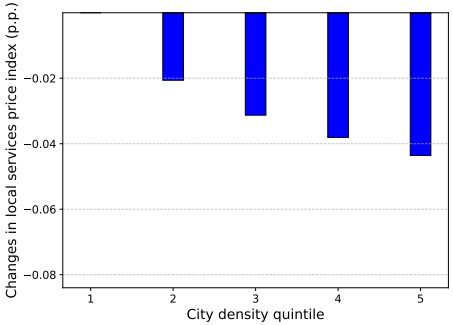


(h) $\xi = 1$

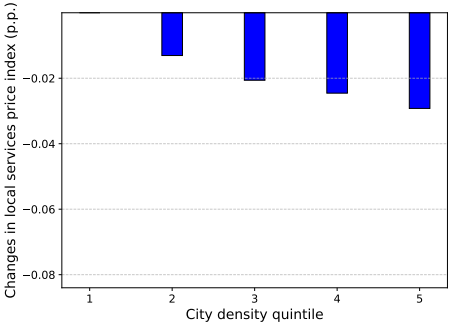
Local services price indices



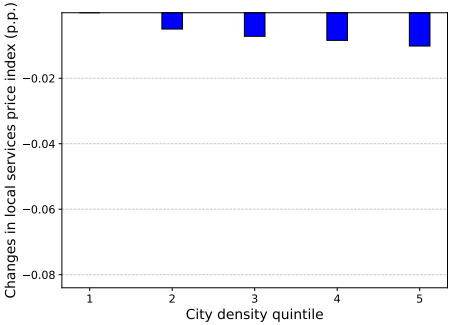
(i) $\xi = 7$



(j) $\xi = 5$



(k) $\xi = 3$



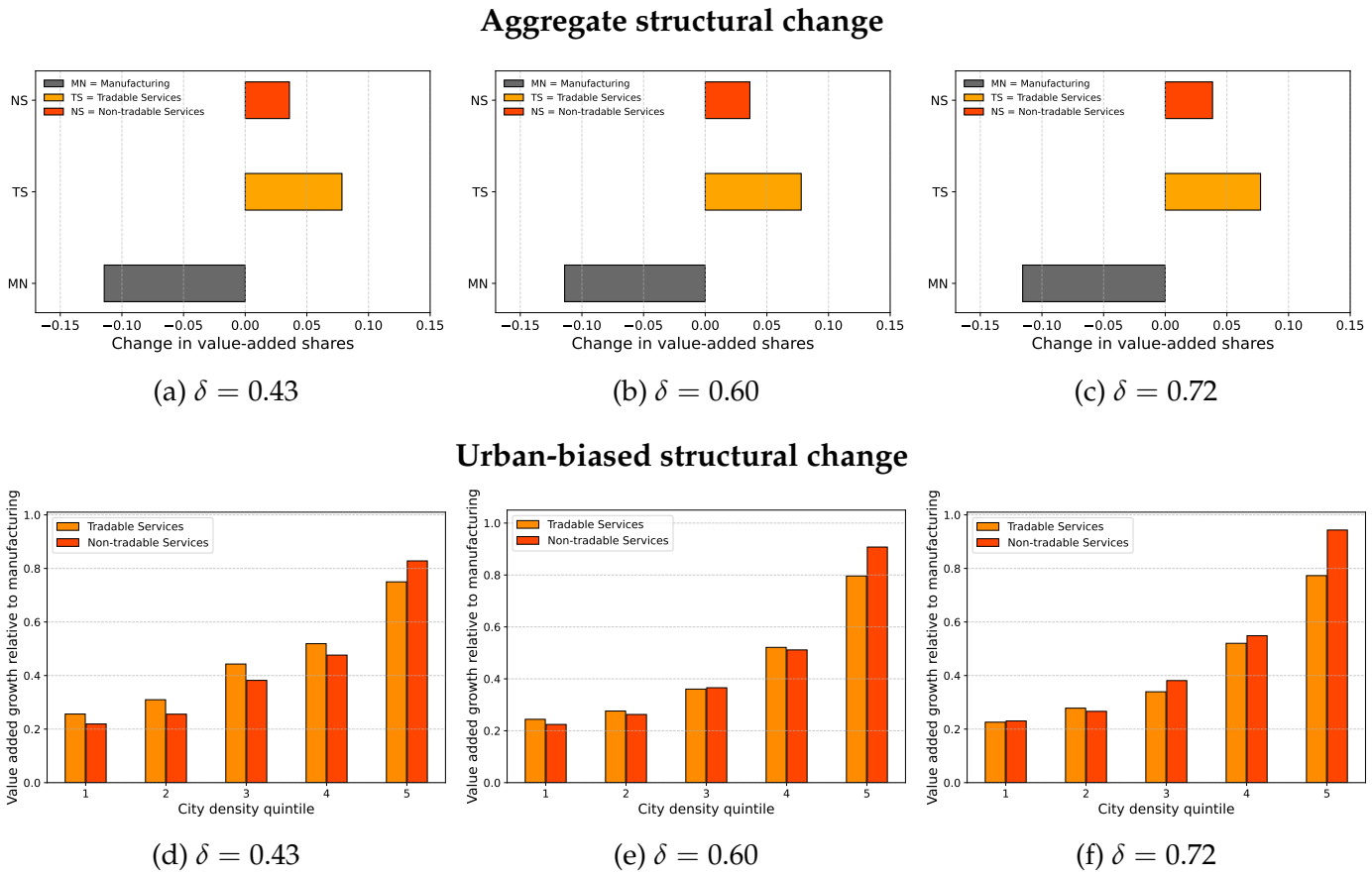
(l) $\xi = 1$

B.4.3 Sensitivity to labor output elasticity in the housing sector (δ)

In the baseline calibration of Section 4, we set the labor output elasticity in housing production, δ, to 0.60. We obtain at this number by combining two pieces of information: the median labor share in the construction industry and the estimate in Combes et al. (2021) that the output elasticity with respect to non-land inputs in housing production for France is 0.80. Together, these imply a housing supply elasticity of 1.5, well within the range estimated for US cities (Saiz, 2010). To assess the sensitivity of our quantitative results, we consider two alternative values of δ chosen to reproduce the housing supply elasticities of New York (0.76) and Atlanta (2.55) reported in Table VI of Saiz (2010). These correspond to $\delta = 0.43$ and $\delta = 0.72$, respectively. We recalibrate the model to match the 1995 economy under each value of δ and then introduce the same differential sectoral TFP growth as in the baseline.

Figure B.12 summarizes our findings. The value of δ has little impact on both aggregate structural change and the urban bias. However, lower housing supply elasticities (smaller δ) lead to larger increases in urban house prices in response to rapid tradable services productivity growth. Higher house prices, in turn, dampen worker mobility toward dense cities and generate a larger urban nominal wage premium. Conversely, higher housing supply elasticities moderate these effects.

Across all values of δ, however, our main quantitative result remains robust: expansions in local services variety triggered by rapid tradable services TFP growth remain a central mechanism restraining nominal wage growth in dense cities.



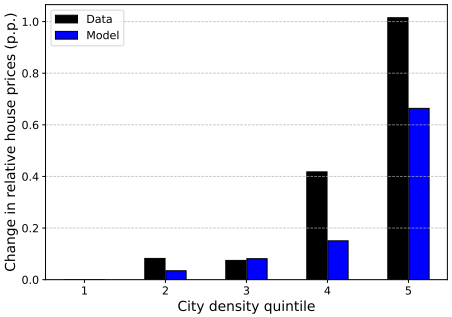
(a) $\delta = 0.43$ (b) $\delta = 0.60$ (c) $\delta = 0.72$

(d) $\delta = 0.43$ (e) $\delta = 0.60$ (f) $\delta = 0.72$

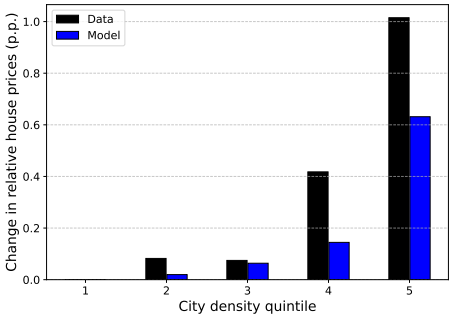
Figure B.12: Simulating the effects of sectoral TFP growth under different housing supply elasticities (δ).

Notes: This figure compares the model's predictions for structural change, house prices, and nominal wages across cities under various housing supply elasticities. City density bin 1 represents the least dense cities and bin 5 the densest cities. The parameter δ governs the elasticity of housing supply. Our baseline value is $\delta = 0.60$, corresponding to a housing supply elasticity of 1.5. We compare this to the model's predictions under alternative values for δ of 0.43 and 0.72 for New York and Atlanta estimated by Saiz (2010).

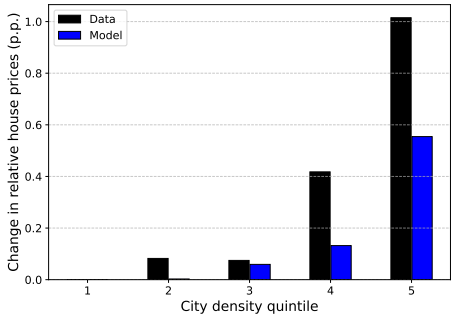
House prices



(a) $\delta = 0.43$

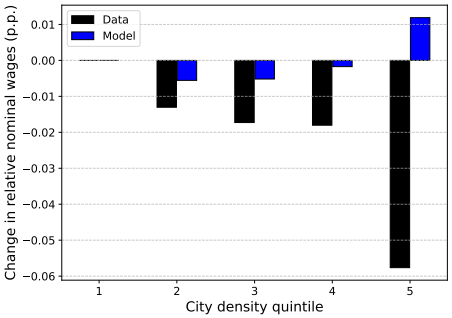


(b) $\delta = 0.60$

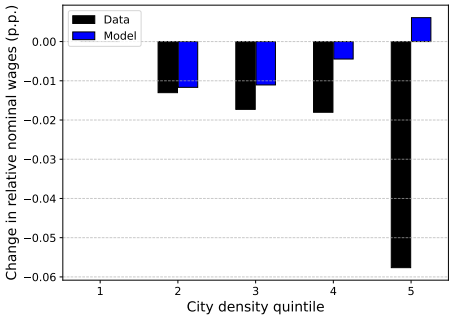


(c) $\delta = 0.72$

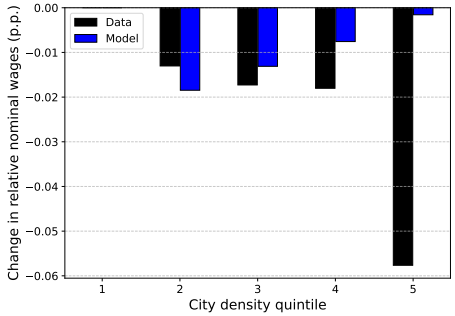
Nominal wages



(d) $\delta = 0.43$

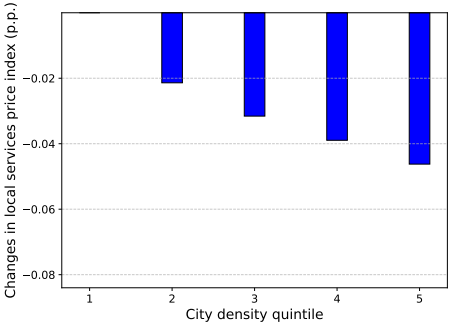


(e) $\delta = 0.60$

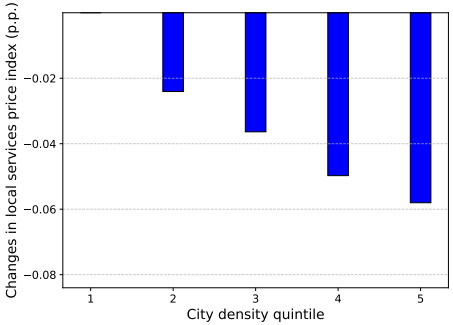


(f) $\delta = 0.72$

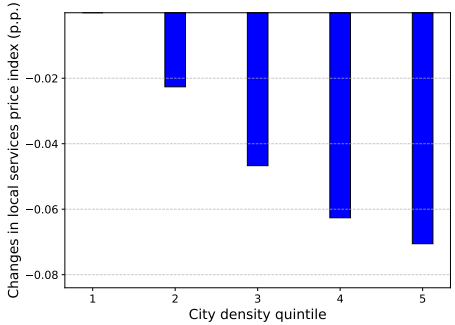
Local services price indices



(g) $\delta = 0.43$



(h) $\delta = 0.60$



(i) $\delta = 0.72$

B.4.4 The role of endogenous sorting in driving UBSC

In our baseline model, more productive firms endogenously sort into high-density cities because they benefit more from the agglomeration externalities associated with density. As shown in Section 5, rapid productivity growth in tradable services raises urban density and induces large firms—especially in tradable services—to expand. This expansion contributes to higher house prices, growth in the local services sector, changes in urban nominal wages, a widening urban–rural welfare gap, and aggregate structural change. In this section, we examine how sectoral TFP growth affects these city-level outcomes when this large-firm-biased agglomeration force is shut down. We do so by repeating the quantitative exercise in Section 5 but now freezing the disproportionate agglomeration externalities accruing to large firms at their 1995 level. That is, we implement the following productivity function in the counterfactual economy:

$$\log \Psi_j(z,i) = \log A_j + a_j \log \frac{L(i)}{L(1)} + \underbrace{\left(1 + \log \frac{L_{1995}(i)}{L_{1995}(1)}\right)^{s_j} \log z}_{\substack{\text{Freezing large-firm-biased agglomeration} \\ \text{externality at the 1995 level}}}$$

Figure B.14 reports the results. Panel B.14g shows that eliminating large-firm-biased agglomeration effects leads to a substantial decrease in the relative size of tradable services firms in dense cities; opposite to both our baseline results (Figure 8) and the empirical evidence (Figure 4). In the absence of large incumbent firms' expansion, tradable services productivity growth instead attracts smaller, less productive firms into dense cities. This shift generates several notable differences relative to the baseline findings in Figure 7. Aggregate structural change becomes more limited: the rise in the tradable services value added share is roughly 2 percentage points smaller. Services growth remains urban-biased, but the gap between services and manufacturing growth narrows markedly. As a result, both the increase in housing demand and the expansion of local services in dense cities are less pronounced, with the latter continuing to dominate the former, resulting in a decline in the urban nominal wage premium. Finally, the urban–rural welfare gap still widens, but to a more limited extent than in the baseline.

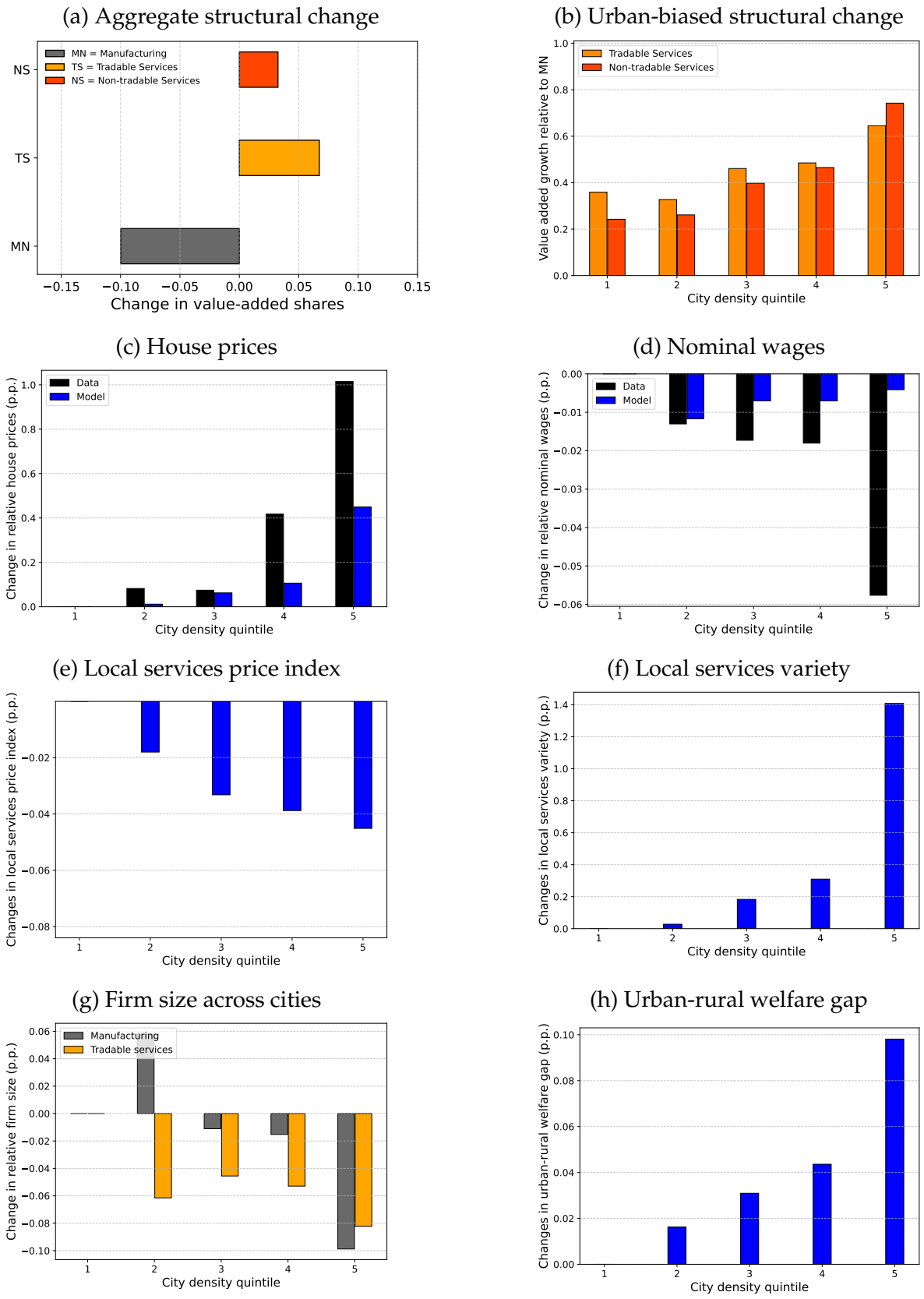


Figure B.14: Effects of sectoral TFP growth (keeping sorting effect at 1995 level)

Notes: These figures present the effects of introducing only sectoral TFP growth into the estimated model's 1995 equilibrium. In this version of the model, we free the sorting effect at the 1995 level—i.e. $\log \Psi_j(z,i) = \log A_j + a_j \log\left(\frac{L(i)}{L(1)}\right) + (\log z)\left[1 + \log\left(\frac{L_{1995}(i)}{L_{1995}(1)}\right)\right]^{s_j}$—therefore, changes in density only affects firms (neutrally) through a_j. City density bin 1 represents the smallest cities and bin 5 the largest cities.

B.4.5 Effects of local housing sector TFP growth

In Section 4, we calibrate local housing sector TFP, $z_h(i)$, to match local house prices relative to those in the least densely populated cities. Figure B.1a shows that the productivity of the housing sector in the densest cities relative to the least dense locations changed very little between 1995 and 2018. However, in mid-tier cities—particularly city density bins 2 and 4—the housing sector became relatively less productive. We now assess the effects of this decline by introducing only this change into the model's 1995 equilibrium.

Figure B.15 presents the results. Declining housing productivity in mid-tier cities raises house prices there. Since manufacturing is more sensitive to house prices than tradable services and manufacturing firms are more prevalent in mid-tier cities, the productivity decline raises the relative price of manufactured goods. Manufacturing's aggregate value added share falls while tradable services' share rises. Higher house prices also raise the relative price of traded goods and services to local services; given their complementarity, local services' value added share rises.

The decline in mid-tier housing productivity pushes firms and workers toward the least dense and densest cities. Large manufacturing firms, which were previously concentrated in mid-tier locations, relocate to dense cities. Consequently, value added in both services and manufacturing declines in mid-tier cities and grows in the least dense and the densest locations. As economic activity leaves mid-tier cities, the number of local-services varieties contracts and local price indices rise. Welfare therefore declines in mid-tier cities relative to both the densest and the least dense locations.

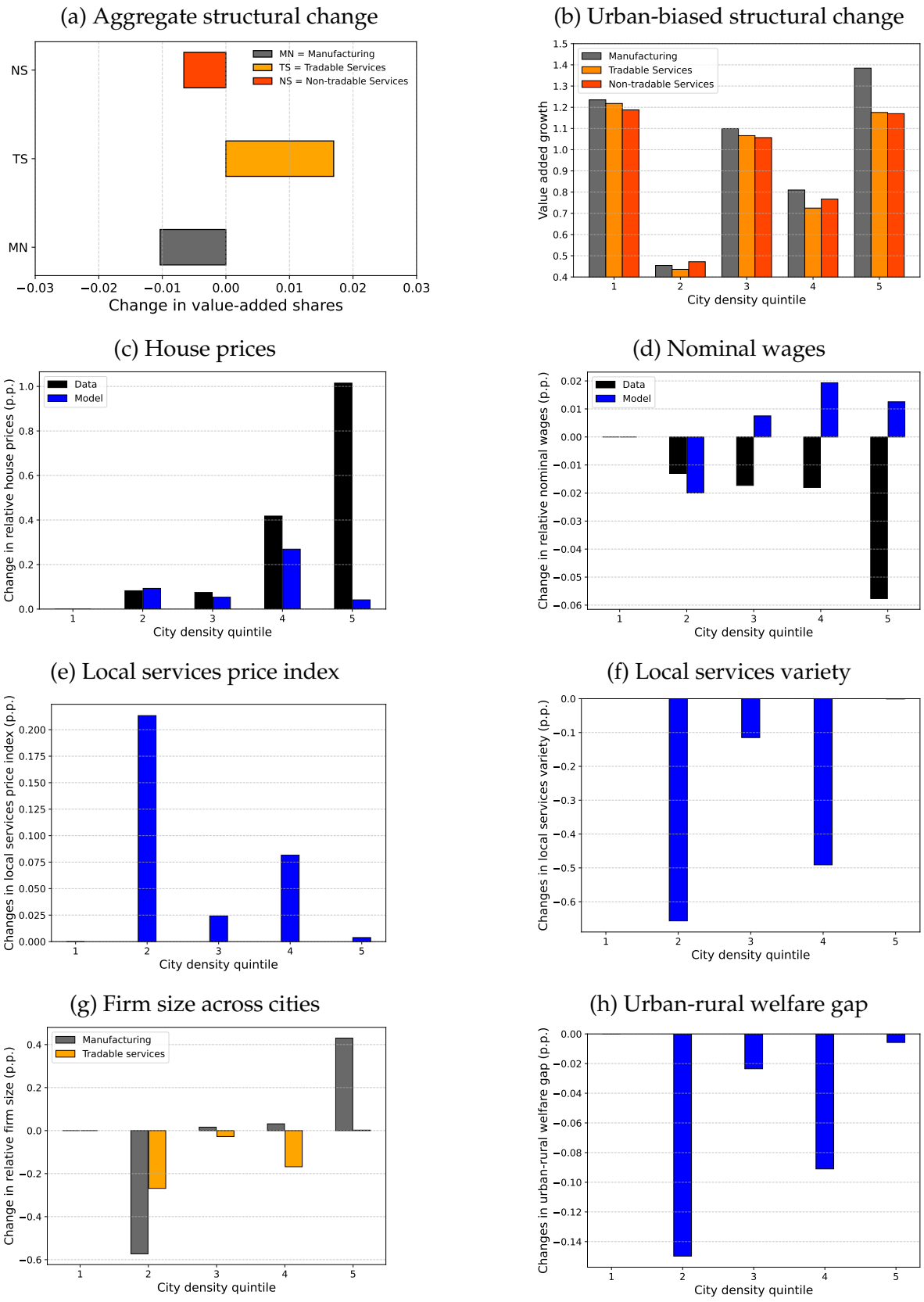


Figure B.15: Effects of uneven local housing sector TFP growth

Notes: These figures present the effects of introducing only changes in local housing sector TFP into the estimated model's 1995 equilibrium. City density bin 1 represents the smallest cities and bin 5 the largest cities.

B.5 Extension: Time-varying firm efficiency distribution and agglomeration externalities

In our baseline calibration and estimation (Section 4), we hold agglomeration externalities a_j and the distribution of firm efficiency $F_j(z)$ fixed over time.[33] Recent research on spatial structural change, however, suggests that both forces may have evolved over time. Desmet and Rossi-Hansberg (2014) develop a theory in which structural transformation induces innovation in services, concentrating employment and production in locations that specialize in services. Giannone (2022) argues that skill-biased structural change has increased the concentration of skilled workers in dense U.S. cities, thereby strengthening agglomeration forces in those locations. These mechanisms imply that agglomeration effects may have intensified for tradable services and weakened for manufacturing. In addition, Eckert et al. (2025) show that the falling price of intangible capital disproportionately benefits large business services firms, which tend to be located in dense cities, leading to their disproportionate expansion. This suggests a widening firm efficiency distribution in tradable services, with a thicker right tail.

In this section, we extend our model quantification exercise in Section 4 to allow agglomeration effects (a_j) and the shape parameter governing the firm efficiency distribution ($\nu_{z,j}^{shape}$) to vary over time. We continue to use the same set of moments in the estimation, but now the year-specific moments—one set for 1995 and another for 2018—identify the corresponding year-specific parameters. We first present the estimated values for these parameters and then analyze how changes in a_j, $\nu^{shape}z, j$, and sectoral TFP (A_j) jointly shape the evolution of structural change, house prices, and wages across cities.

To preview the main results, we continue to find that tradable services TFP grows fastest, followed by manufacturing, with local services exhibiting the slowest productivity growth. Introducing this differential sectoral TFP growth into the model's 1995 equilibrium shows that the key qualitative findings from our baseline analysis remain: structural change is strongly urban biased, house price growth is concentrated in dense cities, and the urban nominal wage premium flattens.

Parameter estimates and calibrated sectoral TFP. Table B.4 reports the parameter estimates. The results indicate that agglomeration externalities strengthened in tradable services and weakened in manufacturing between 1995 and 2018, consistent with the mechanisms highlighted by Desmet and Rossi-Hansberg (2014) and Giannone (2022). We also find notable changes in the firm efficiency distributions: the dispersion of firm efficiency widens substantially in manufacturing but narrows in tradable services. The decline in efficiency dispersion for tradable services reflects two forces. First, stronger agglomeration effects in services—associated with the growing concentration of services activity in dense cities—tend to increase firm size dispersion. Second, the data show that the widening of firm size dispersion in services is considerably more modest than in

[33] In the structural estimation exercise, all estimated parameters are treated as time invariant.

Table B.4: Summary of estimated parameters

PARAMETER		MANUFACTURING		TRADABLE SERVICES	
		1995	2018	1995	2018
Agglomeration externalities	a_j	0.09	0.01	0.10	0.20
		(0.01)	(0.01)	(0.02)	(0.02)
Sorting	s_j	0.04		0.34	
		(0.01)		(0.01)	
Housing output elasticity	β_j	0.14		0.01	
		(0.03)		(0.01)	
Shape of firm efficiency distribution	$\nu_{z,j}^{shape}$	0.53	0.82	1.89	1.77
		(0.02)	(0.02)	(0.00)	(0.00)
Scale of firm efficiency distribution	$\nu_{z,j}^{scale}$	0.66		0.22	
		(0.02)		(0.02)	
Shape of firm efficiency distribution	$\nu_{\epsilon,j}$	0.45		0.43	
		(0.01)		(0.01)	

Notes: The table reports the parameter values inferred through structural estimation. Asymptotic standard errors are provided in parentheses.

manufacturing. Reconciling these patterns requires a narrower underlying efficiency distribution in tradable services. In this calibration, the TFP of tradable services relative to manufacturing rises by about 60%, compared to 29% in the baseline. Other parameters, which are held constant over time, remain close to their baseline values in Table 3.

We next conduct a series of simulation exercises to assess the extent to which changes in agglomeration externalities and firm efficiency distributions over time contribute to aggregate structural change. First, we allow agglomeration externalities and sectoral TFP to vary over time while holding the firm efficiency distributions fixed at their 1995 levels. Second, we allow the firm efficiency distributions and sectoral TFP to vary while keeping agglomeration externalities at their 1995 values. Finally, we freeze both agglomeration externalities and firm efficiency distributions at their 1995 levels and allow only sectoral TFP to evolve over time.

Freezing the firm efficiency distributions at 1995 levels. Figure B.16 reports the results when we hold firm efficiency distributions fixed at their 1995 values while allowing agglomeration externalities and sectoral TFP to evolve. Relative to the baseline, both aggregate structural change and the urban bias in services growth become considerably more pronounced. Urban house prices also rise more sharply, and local services price indices fall more steeply in dense cities. In this case, the increase in urban housing costs outweighs the decline in local services price indices, producing a substantial steepening of the urban nominal wage premium.

Two forces account for these sharper effects. First, the strengthening of agglomeration externalities in tradable services and their weakening in manufacturing amplify the expansion of tradable services and the contraction of manufacturing in dense areas. Second, time variation in firm efficiency distributions plays an attenuating role: the estimated narrowing of efficiency dispersion in tradable services limits the growth of large

firms in dense cities, while the widening of the manufacturing distribution diffuses activity toward mid-tier cities, where large manufacturing firms are more prevalent. Freezing efficiency distributions at their 1995 levels removes these dampening forces, thereby magnifying the extent of urban-biased structural change.

Freezing agglomeration externalities at 1995 levels. Figure B.17 reports the results when we hold agglomeration externalities fixed at their 1995 values while allowing firm efficiency distributions and sectoral TFP to evolve. The results show that changing agglomeration externalities can be first-order determinants of urban-biased structural change, rising urban house prices, and the flattening of the urban nominal wage premium. In this extension, absent any change in agglomeration forces, structural change reverses direction: the value added share of manufacturing rises while that of tradable services falls. The urban bias in structural change also disappears. In the more parsimonious parameterization we focus on in our main discussion, urban bias is accounted for solely by differential TFP growth through the interplay of heterogeneous sorting, changes in house prices, and local services variety, which together generate effects analogous to those of time-varying agglomeration externalities.

The effects of sectoral TFP growth. Figure B.18 presents the results when only sectoral TFP growth is introduced relative to the model's 1995 equilibrium—the same exercise described in Section 5. The results closely mirror our baseline findings. Sectoral TFP growth raises the aggregate value added share of tradable services relative to manufacturing and generates urban-biased services growth. This, in turn, increases urban house prices while reducing the urban local-services price index. In this scenario, however, the decline in the urban local-services price index is not large enough to offset the rise in urban house prices, leading to a steeper urban nominal wage premium.

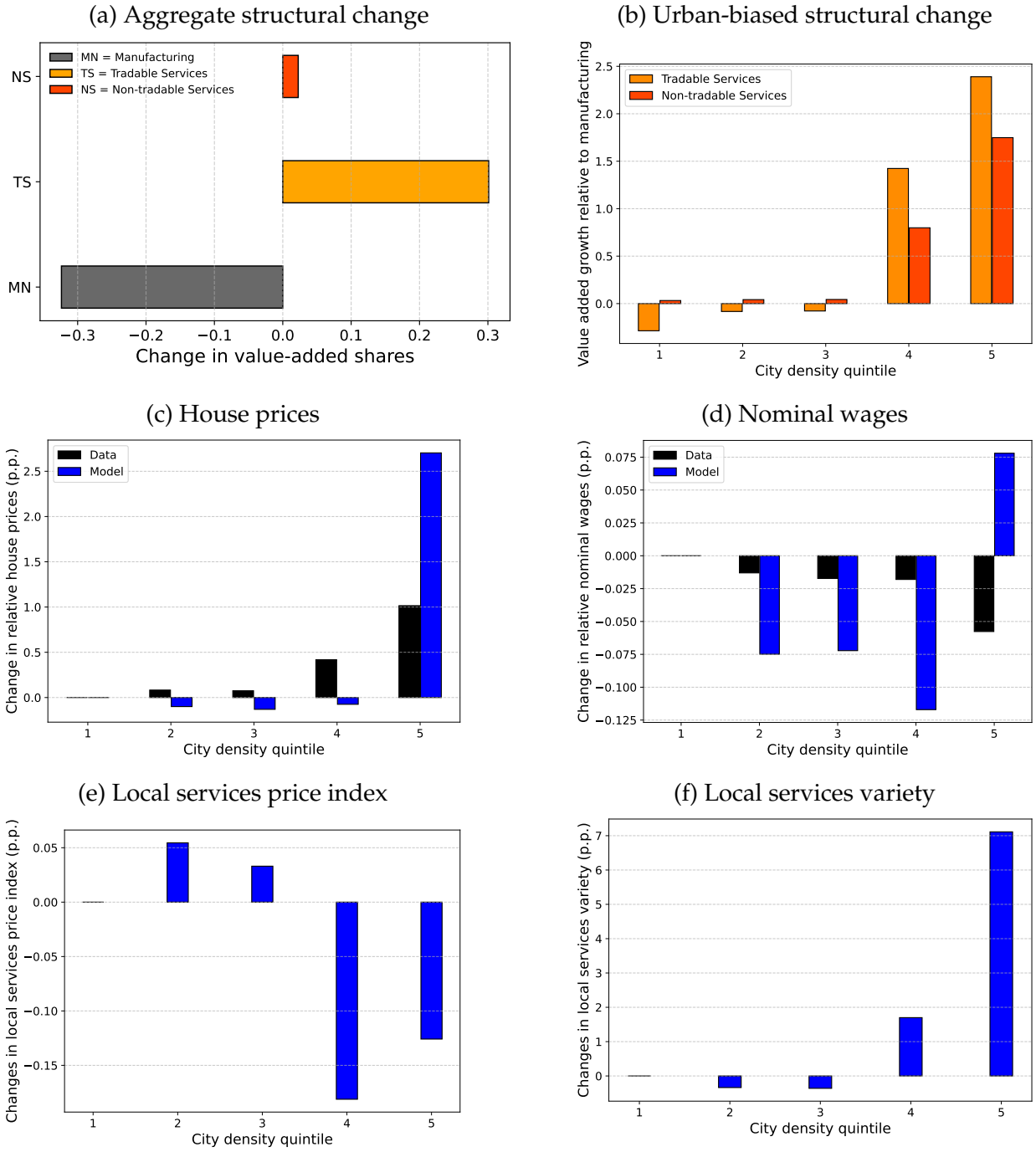


Figure B.16: Effects of freezing time-varying firm efficiency distribution ($F_j(z)$) at 1995 levels

Notes: These figures present the effects of freezing the firm efficiency distributions ($F_j(z)$) at the estimated model's 1995 level, forcing them to remain constant even as other forces change. City density bin 1 represents the smallest cities and bin 5 the largest cities.

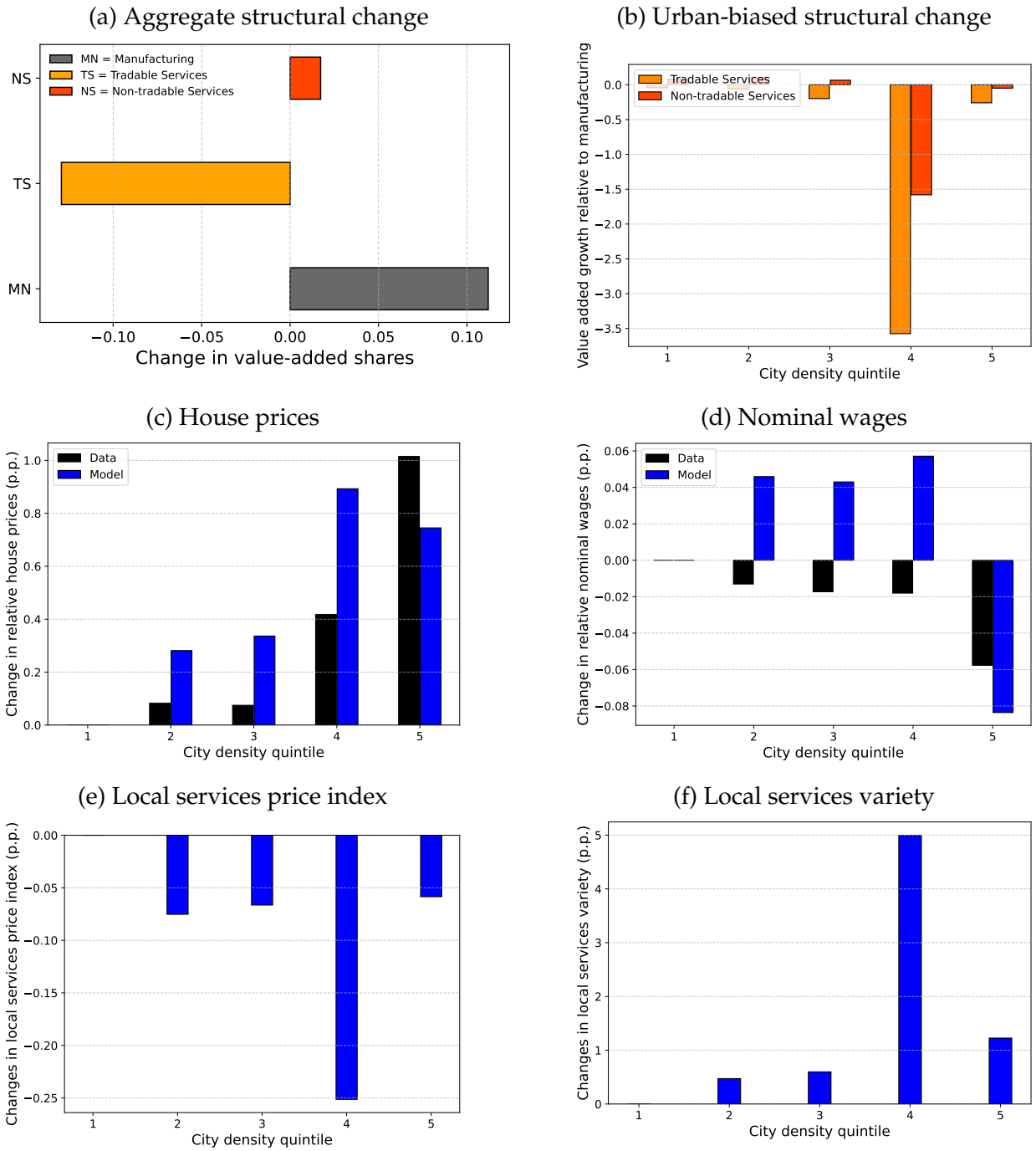


Figure B.17: Effects of freezing time-varying agglomeration externalities (a_j) at 1995 levels

Notes: These figures present the effects of freezing agglomeration externalities (a_j) at the estimated model's 1995 level, forcing them to remain constant even as other forces change. City density bin 1 represents the smallest cities and bin 5 the largest cities.

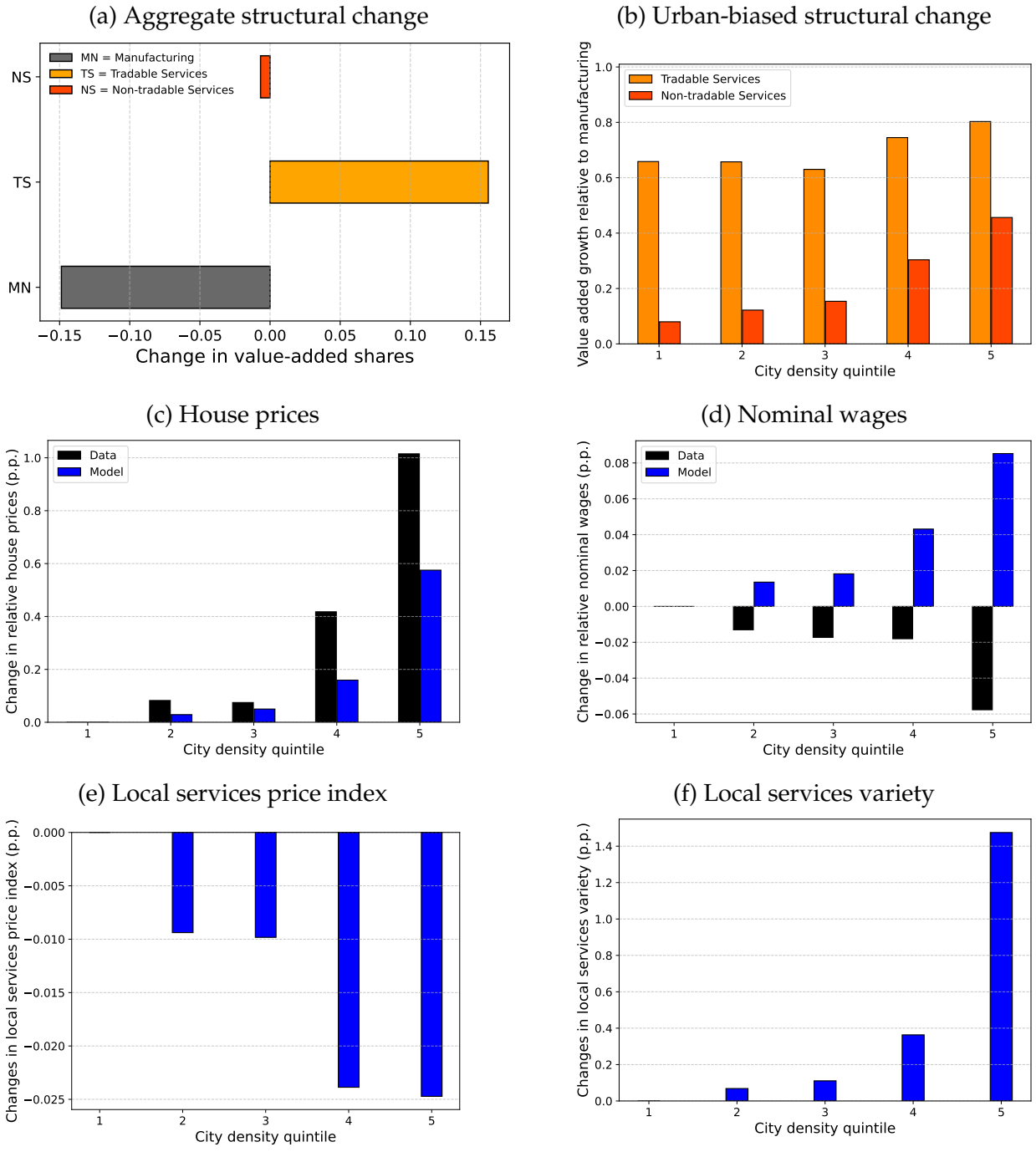


Figure B.18: Effects of sectoral TFP growth, accounting for time-varying firm efficiency and agglomeration externalities

Notes: These figures present the effects of introducing only sectoral TFP growth into the estimated model's 1995 equilibrium. In this version of the model, we infer sectoral TFP growth while allowing both the firm efficiency distribution ($F_j(z)$) and agglomeration externalities (a_j) to vary between 1995 and 2018. City density bin 1 represents the smallest cities and bin 5 the largest cities.

References

Artuç, E., S. Chaudhuri, and J. McLaren (2010). Trade Shocks and Labor Adjustment: A Structural Empirical Approach. *American Economic Review 100*(3), 1008–1045.

Bryan, G. and M. Morten (2019). The Aggregate Productivity Effects of Internal Migration: Evidence from Indonesia. *Journal of Political Economy 127*(5), 2229–2268.

Combes, P., G. Duranton, and L. Gobillon (2021). The Production Function for Housing: Evidence from France. *Journal of Political Economy 129*(10), 2766–2816.

Desmet, K. and E. Rossi-Hansberg (2014). Spatial Development. *American Economic Review 104*(4), 1211–1243.

Eaton, J., S. Kortum, and F. Kramarz (2011). An Anatomy of International Trade: Evidence From French Firms. *Econometrica 79*(5), 1453–1498.

Eckert, F., S. Ganapati, and C. Walsh (2025). Urban-Biased Growth: A Macroeconomic Analysis. Working Paper 30515, National Bureau of Economic Research.

Giannone, E. (2022). Skilled-biased Technical Change and Regional Convergence. Working Paper, CREI.

International Accounting Standards Board (2025, March). Post-implementation review of IFRS 16 leases: Review of academic literature. IASB staff paper Agenda Paper 7F, IFRS Foundation. Discussed at the International Accounting Standards Board meeting of March 18, 2025.

Lewis, L., R. Monarch, M. Sposi, and J. Zhang (2022). Structural Change and Global Trade. *Journal of the European Economic Association 20*(1), 476–512.

Morten, M. and J. Oliveira (2024). The Effects of Roads on Trade and Migration: Evidence from a Planned Capital City. *American Economic Journal: Applied Economics 16*(2), 389–421.

Moussaly, K. and W. Wang (2014, July). The Impact of Leased and Rented Assets on Industry Productivity Measurement. Technical Report 36, Statistics Canada. Statistics Canada Catalogue no. 15-206-X, released July 22, 2014.

Saiz, A. (2010). The Geographic Determinants of Housing Supply. *Quarterly Journal of Economics 125*(3), 1253–1296.

Sharpe, S. A. and H. H. Nguyen (1995). Capital Market Imperfections and the Incentive to Lease. *Journal of Financial Economics 39*(2–3), 271–294.

Smith, Clifford W., J. and L. M. Wakeman (1985, July). Determinants of Corporate Leasing Policy. *The Journal of Finance 40*(3), 895–908.

Wheaton, W. C. and R. G. Torto (1990). An Investment Model of the Demand and Supply for Industrial Real Estate. *Real Estate Economics 18*(4), 530–547.

Zerecero, M. (2021). The Birthplace Premium. Working Paper, UC Irvine.