# Making European Reforms a Success on the Ground: Online Appendix[1]

*The appendix includes technical details of the results backing the main text of the Note. Appendix 1 documents the comparability of US counties and EU NUTS3 regions. Appendix 2 contains robustness checks of the labor productivity-density elasticity, across various dimensions. Appendix 3 presents empirical results on the determinants of agglomeration externalities. Appendix 4 includes the math details of the diagnostic model and additional results. Appendix 5 explains the quantitative model in depth, along with additional simulation results. Appendices 6 and 7 include additional details and results for Boxes 2.1 and 2.2, respectively.*

## Appendix 1. Making the US and the EU comparable

**Matching US and EU density.** The US is about twice the size of the EU in land area, while has about ¾ the population, making it not immediately comparable to the EU in terms of employment density.[2] The upper panel of Appendix Table 1 shows some basic geographical descriptive statistics. Specifically, in 2021, the US had a total employment of about 159 million persons and occupies about 9.3 million km$^2$ of land area; while the EU had a total employment of about 203 million persons, over 4.3 million km$^2$ land area. As such, the average employment density for the EU is about 2.8 times the US level (47.6 persons/km$^2$ in EU versus 17.0 persons/km$^2$ in the US). The pattern is driven by a large number of very sparsely populated counties in the US that have very few counterparts in EU NUTS3 regions.

**Appendix Table 1 Employment Density: EU and US (2021)**

| | Land Area (km2) | Employment (persons) | Density (persons/km2) |
|---|---|---|---|
| *All regions* | | | |
| U.S. | 9,336,721 | 158,566,825 | 17 |
| EU | 4,268,016 | 203,213,250 | 47.6 |
| *Regions with >10 employment/km2* | | | |
| U.S. Dense | 2,222,754 | 143,628,736 | 64.6 |
| EU Dense | 3,152,037 | 198,697,160 | 63 |

Sources: Eurostat, American Community Survey; and IMF staff calculation.

The underlying economic structure can be very different in sparsely versus densely populated areas. Take 2021 for example. The relationship between labor productivity and employment density (in logs) is U-shaped as shown in Appendix Figure 1. The structural break is observed around 10 employees/km$^2$: for counties with less than 10 employees/km$^2$, labor productivity decreases with density, while it increases for those with more than 10 employees/km$^2$. The reason for such structural breaks can be that the agricultural sector plays a dominant role in very sparsely populated counties, for which agglomeration externalities tend to be weak. Michaels and others (2012) argue that this is what drove the urbanization and structural transformation patterns in the US in the late 19th century. They found a cut-off of 7 people/km$^2$.

Dropping regions for which employment density is less than 10 persons/km$^2$ in both the US and the EU brings employment density in the two economies close to each other. After the truncation, in the US, total employment

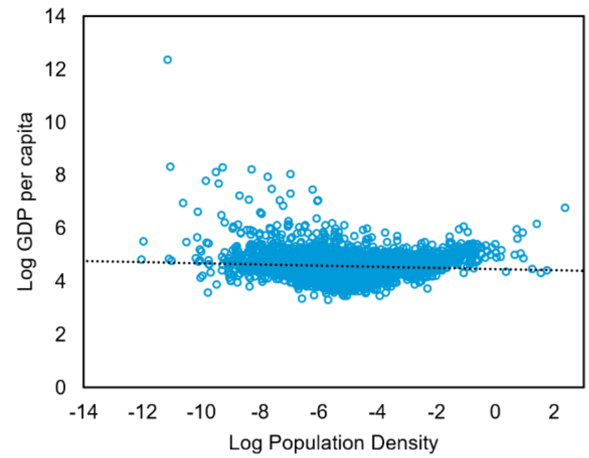
[1] This Note was prepared by Stephen Ayerst (co-lead), Yueling Huang, Ben Park, Lorenzo Rotunno, Xin Tang (co-lead) and Maryam Vaziri under the guidance of Diego Cerdeiro and the supervision of Helge Berger and Stephan Danninger. Agnesa Zalezakova provided outstanding administrative support.

[2] Throughout the appendix, the focus is on employment (rather than population) density. At times terms will refer to population (e.g., “densely populated”) but the underlying data are always exclusively on employment.

decreases by 10 percent to 143 million persons, while land area is reduced by about 75 percent to 2.2 million km$^2$. Average employment density is now 64.6 persons/km$^2$. For the EU, a total employment of 199 million persons (2 percent less) now spreads over 3.2 million km$^2$ of land (25 percent less), with an average employment density of 63.0 persons/km$^2$ (bottom panel of Appendix Table 1). Appendix Figure 5 shows geographically the counties and NUTS3 regions in the sample after the truncation. These are the samples used throughout the Note unless otherwise stated.

**Properties of EU NUTS3 regions and US counties.** Europe is on average more densely populated than the US, and its population is more evenly distributed. Most NUTS3 regions in the EU are much denser than counties in the US on average (Appendix Figure 2 left panel). The median density of US counties is 30 employees/km$^2$, while for EU NUTS3 regions it is 58 employees/km$^2$.[3] Therefore, although Europe has its share of mega-metropolitans at the tail of the distribution (outliers in Appendix Figure 2 left panel), overall, the US employment distribution is more skewed to the right than the EU. Most European countries have a few economic centers that are much denser than the rest of the country (Appendix Figure 2 right panel). The ratio of employment density of the largest city relative to the median is much larger in the US and EU than all European countries, except France (countries ranked by this order in Appendix Figure 2 right panel).[4]

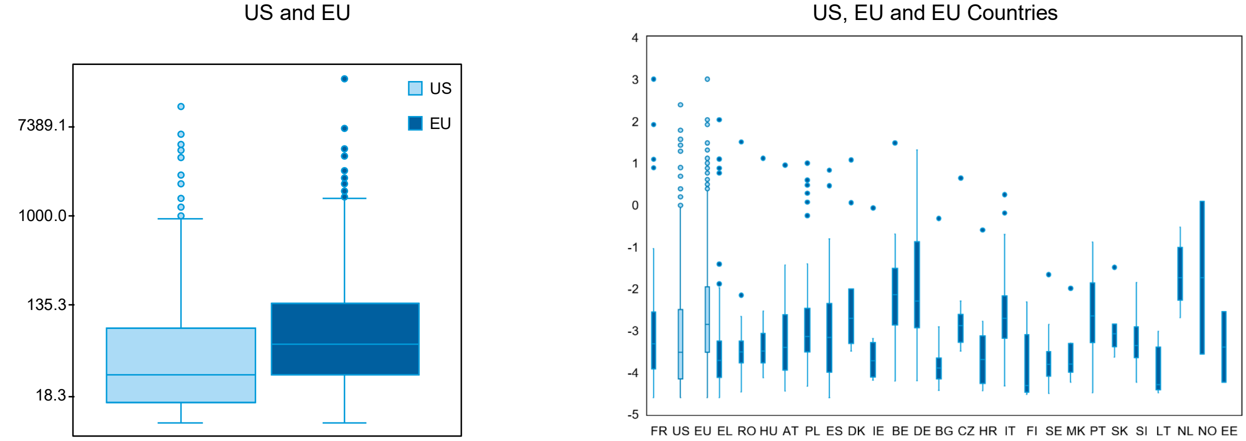
**Appendix Figure 1. Labor Productivity and Employment Density: United States**




Sources: American Community Survey; Bureau of Economic Analysis; and IMF staff calculation.

**Appendix Figure 2. Employment Density Distribution: EU and US**

US and EU | US, EU and EU Countries




Sources: Eurostat; American Community Survey; and IMF staff calculation.
Note: The y-axis is in persons/km$^2$.

Sources: Eurostat; American Community Survey; and IMF staff calculation.
Note: The y-axis is in log of persons/km$^2$.

EU NUTS3 regions are also on average larger than US counties and are more widely dispersed. In the truncated sample, the EU has 1,081 NUTS3 regions covering 3.2 million km$^2$ of land area, while the 1,353 US counties span

[3] The bulge in the density function for log densities between zero and one includes a large number of German cities (Berlin, Nuremberg, Stuttgart, etc.), as well as major cities in other countries (Vienna, Milan, Oslo, Krakow), mostly in central Europe.

[4] In the US, the comparison is between New York county and Sevier County, TN, with New York having an employment density of about 370 times that of Sevier County. For EU, the comparison is between Paris and Kassel (Germany), with the ratio being about 350. The ratio is less than 100 for all European countries except four: France (Paris and Vendee, 560), Greece (Athens and Pella, 315), Romania (Bucharest and Bralia, 151) and Hungary (Budapest and Heves, 100).

across 2.2 million km$^2$; mechanically, an average NUTS3 region will be 1.8 times larger than an average US county. The distribution of EU NUTS3 regions' areas is more dispersed (Appendix Figure 3 left panel).

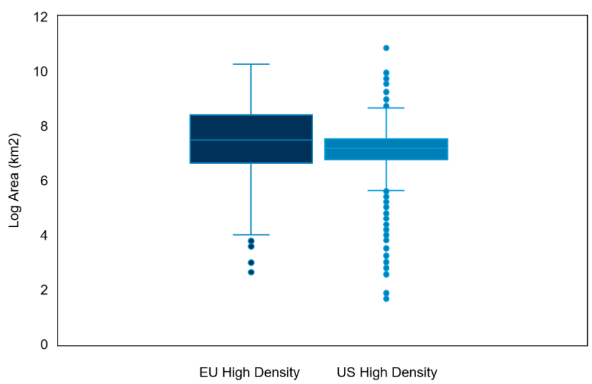
The similar average employment density of the EU and the US is reconciled with the overall lower density and smaller size of US counties by the relatively larger size of high-density US counties. To see this mathematically, let $L$ and $S$ be the sizes of employment and land area, respectively, $\mu_i$ and $s_i$ be the employment density and size of region $i$, and $F(\mu)$ be the cumulative distribution function of $\mu_i$. Then total employment satisfies

$$L = \int_i \mu_i s_i dF(\mu).$$

The distribution of employment density of the EU, call it $G(\mu)$, can be thought of as one that first-orderly stochastically dominates the US one. Therefore, the above equation will continue to hold when replacing $F(\mu)$ by $G(\mu)$, if higher $\mu_i$ pairs with lower $s_i$. This is indeed the case. The elasticity of land area over employment density (all in logarithmic) is $-0.77$ in the EU and $-0.39$ in the US, suggesting that the size of NUTS3 region decreases rapidly as density rises (Appendix Figure 3 right panel).[5]

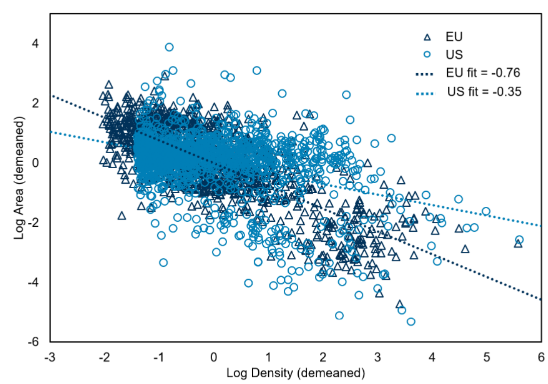
**Appendix Figure 3. Land Area and Employment Density: EU and US**

Distribution of Land Area: EU NUTS3 and US Counties




Source: Eurostat; American Community Survey; and IMF staff calculation.

Land Area and Employment Density




Sources: Eurostat; American Community Survey; and IMF staff calculation.

**Divergence between economic and administrative boundaries.** It should be caveated that neither US counties or EU NUTS3 regions are defined by economic boundaries and there can be important heterogeneity within these regions. In both economies, there are regions including both densely populated urban areas and inhabited wild areas. This can potentially bias the estimates of labor productivity-density elasticity. Appendix Figure 4 shows the Los Angeles County in the US and Barcelona (ES511) in Spain as illustrations. The LA county includes both the LA metropolitan and the Angeles National Forest, while ES511 covers both the city of Barcelona and the Collserola National Park. It can be shown that compared to the hypothetical case in which the wildland and urban section can be measured separately, if the true labor productivity-density elasticity is less than one, which is the empirically relevant case, then the less granular data tend to underestimate the true elasticity (Ciccone and Hall, 1996).[6]

[5] While this could reflect that dense regions in EU face more constraints in expanding spatially, it can also be because NUTS3 regions are defined. Specifically, while US counties reflect directly administrative unit, in the EU regions are defined "statistically"—based on existing administrative units *and* with their population ranging between 150,000 and 800,000 people.

[6] The proof is omitted here. The key is to use Jensen's Inequality and note that the sum of output, population and land area of more granular division must be equal to that observed at less granular level.

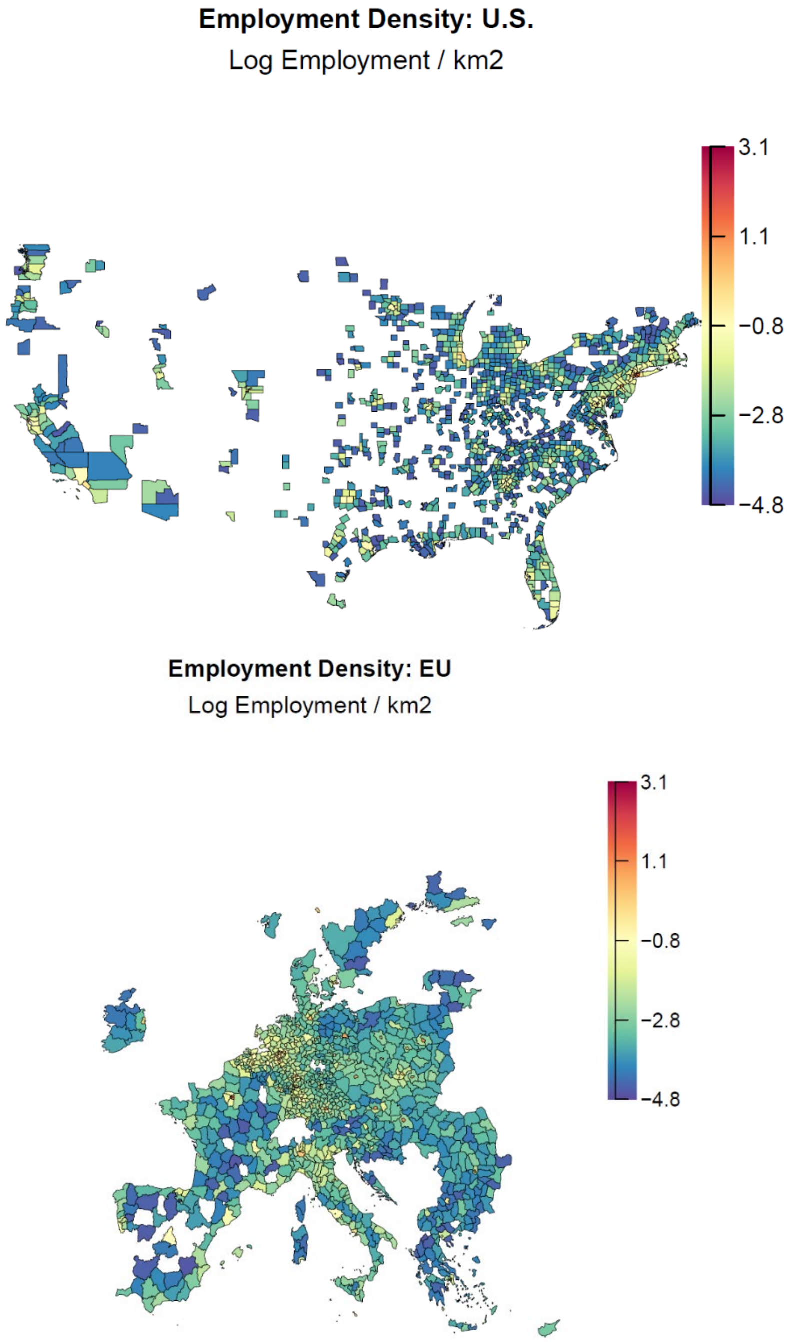
**Appendix Figure 4. Within Region Heterogeneity in Landscape**

Los Angeles County


Barcelona (ES511)


Source: IMF staff.

**Appendix Figure 5. Geographic Distribution of Denser US and EU Regions**
(Regions with employment density of at least 10 employees/km2)




Source: Eurostat; American Community Survey; and IMF staff calculation.

# Appendix 2. Labor Productivity and Employment Density across Dimensions

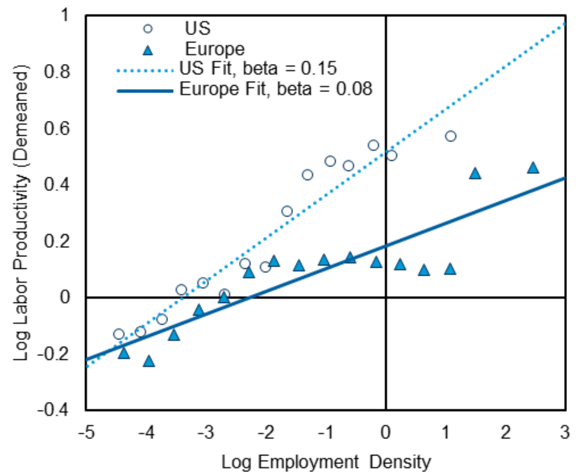
**Labor productivity and density.** The main empirical specification for Section 3 of the Note is

$$ln\, y_i = \beta_0 + \beta_1\, ln\, \mu_i + \varepsilon_i,$$

where subscript $i$ indexes NUTS3 regions (for Europe) or counties (for the US), $y_i$ is the labor productivity, $\mu_i$ is employment density, and $\varepsilon_i$ is the error term. Figure 2.5 reports the bin-scatter plot for the year 2021.

For Figure 2.6, the same specification is applied to individual European countries, adding Norway, Switzerland, and UK on top of the countries belonging to the European Union, for each year. The results in the bar plot are the average across time for each individual country. The time coverage varies by country. For countries submitting data to Eurostat (EU countries plus Norway), the data cover 2001 to 2020; the coverage for Switzerland, UK, and the US are 2011 to 2021, 2004 to 2021, and 2011 to 2021, respectively.

**Appendix Figure 6. Labor Productivity and Employment Density: European Countries and the US**

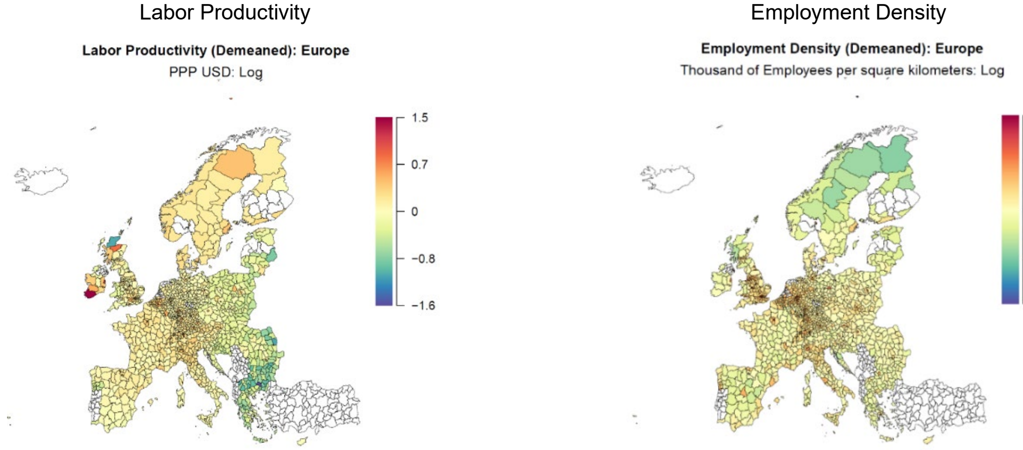



Sources: Eurostat; OECD; WEO; American Community Survey; Bureau of Economic Analysis; and IMF staff calculation.

A version of Figure 2.5 including Norway, Switzerland, and UK is also produced (Appendix Figure 6). Adding these three countries will further reduce the elasticity of labor productivity to density to about 0.8, or around half of the US level. The result is mainly driven by the UK, for which the average elasticity 0.05 is lower than EU average. The two panels in Appendix Figure 7 visualize the relationship spatially (including the regions with less than 10 employees/km$^2$). The left panel shows the log labor productivity across NUTS3 regions, while the right panel shows that of log employment density. The similar pattern of color between the two panels corresponds to the positive correlation between regional labor productivity and employment density.

**Appendix Figure 7. Labor Productivity and Employment Density: Spatial Distribution**

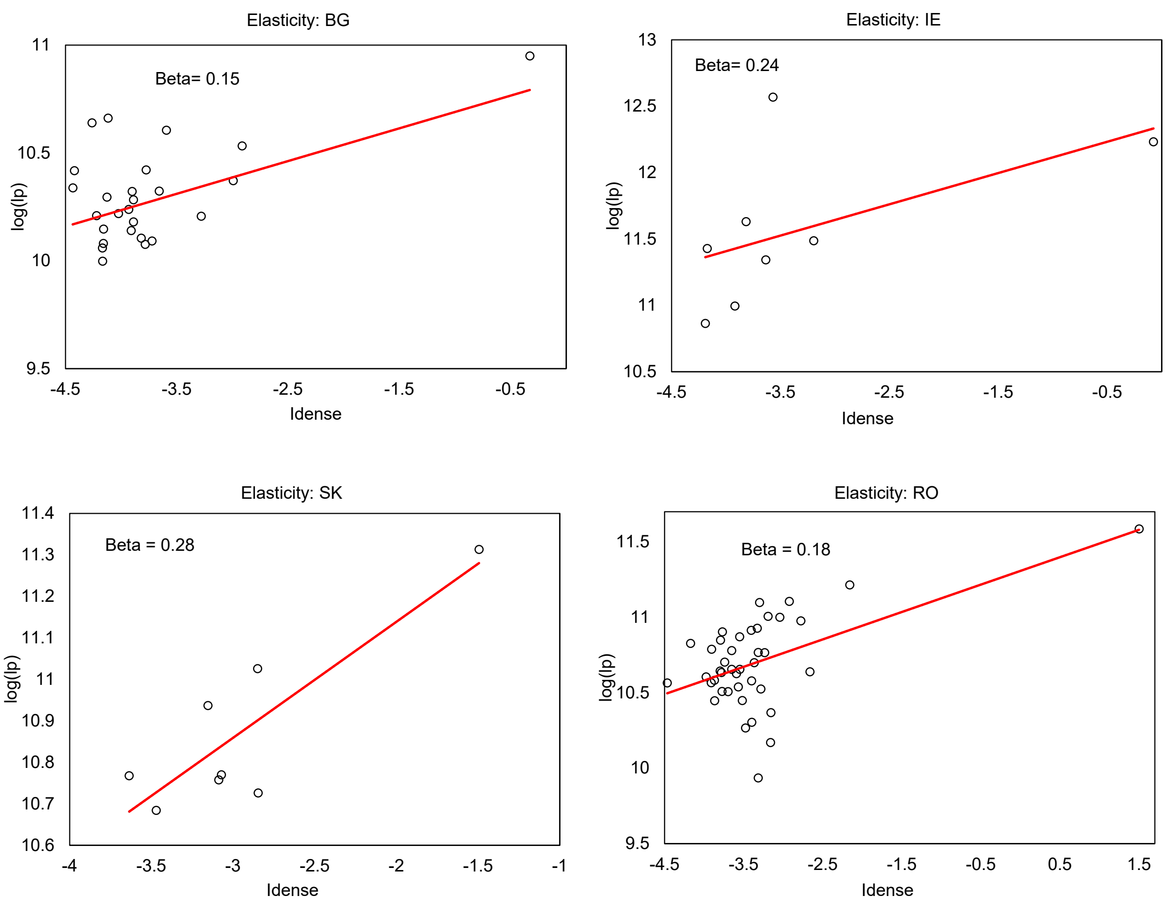
Labor Productivity | Employment Density




Source: Eurostat; OECD; WEO; and IMF staff calculation.
Note: Missing data shown as white color.

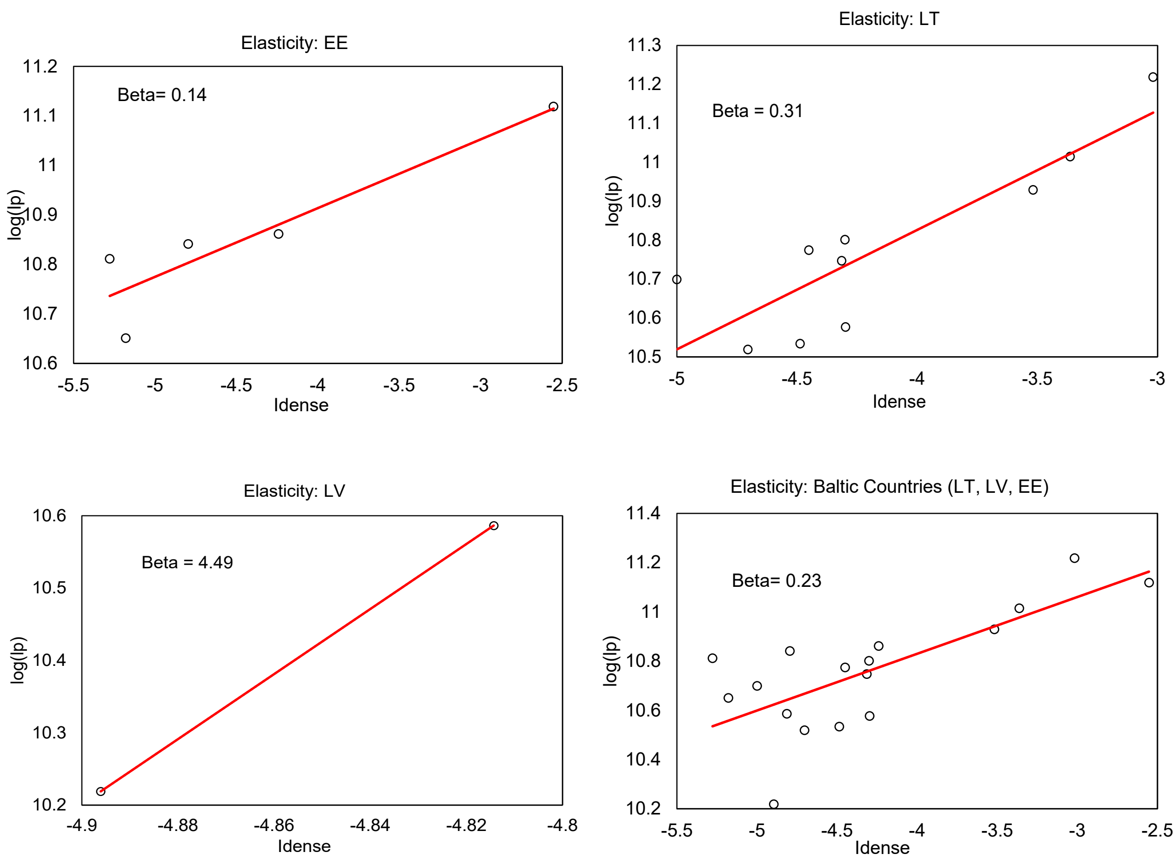
It is mentioned in the main text that the high elasticity for countries in Figure 2.6 is driven mostly by the capital city or national economic center. The four panels in Appendix Figure 8 show the scatterplots (for 2021) of Slovakia, Ireland, Bulgaria, Romania, and the four panels in Appendix Figure 9 shows those (also for 2021) of the three Baltic countries, Estonia, Latvia, and Lithuania, and all three countries grouped together. Because of their smaller size, all NUTS3 regions (that is including those with less than 10 employees/km$^2$) are used for the three Baltic countries.

**Appendix Figure 8. Elasticity of Labor Productivity and Employment Density: Bulgaria, Ireland, Slovakia, and Romania**




Source: Eurostat; and IMF staff calculation.

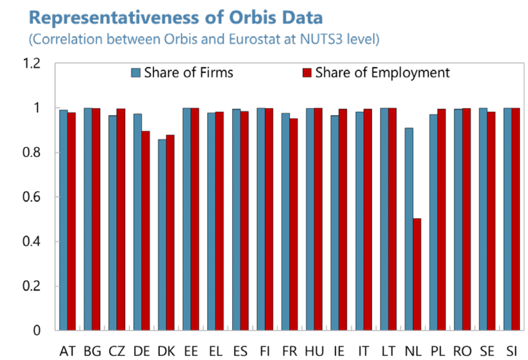
**Appendix Figure 9. Elasticity of Labor Productivity and Employment Density: Baltic countries**



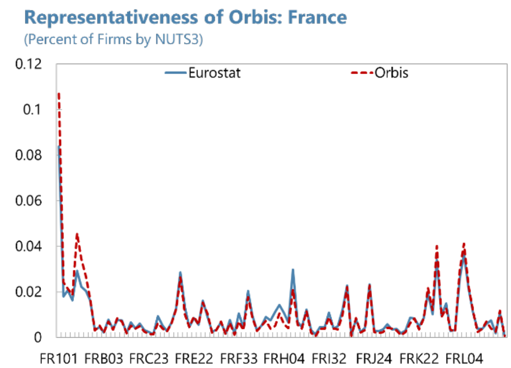

Source: Eurostat; and IMF staff calculation.

**Spatial representativeness of Orbis data.** In the Note, Orbis data are used in calculating the gains from spatial misallocation and in the calibration of the quantitative model (Section 3). It is thus important to ensure that Orbis has adequate coverage spatially. Appendix Figure 10 (left panel) compares the distribution of firms, measured by firm share distribution and employment share distribution, over NUTS3 regions in Orbis and in Eurostat. The results suggest that Orbis does a remarkable job in capturing the spatial distribution of firms in Europe. In most countries, the correlations between the shares (either firm or employment) in each NUTS3 region calculated from Orbis and Eurostat are all higher than 0.9. The right panel shows the correlation of firm distribution between Orbis and Eurostat across France NUTS3 regions as an example. Meanwhile, Kalemli-Ozcan and others (2024) have demonstrated that Orbis captures reasonably well also the size distribution. The two pieces of evidence suggest that Orbis can be a reliable source of information for this Note.

**Appendix Figure 10. Spatial Representativeness of Orbis Data**




Sources: Eurostat; Orbis; and IMF staff calculation.




Sources: Eurostat; Orbis; and IMF staff calculation.

**Specialization.** One commonly hypothesis behind the estimated agglomeration externalities is that certain sectors, like ICT, may exhibit strong agglomeration externalities and the US may be able to achieve higher specialization locally in these sectors. To test this hypothesis, this appendix first examines the degree of specialization at local level and then estimate the sectoral difference in the elasticity of labor productivity to density.

To measure the local degree of specialization, the appendix follows Duranton and Puga (2001) by calculating the Herfindahl index of each NUTS3 region and US county of employment and value-added share by 1-digit sector. The difference is rather small: 0.26 and 0.24 under the six-sector Eurostat classification, and 0.18 and 0.17 under the eleven-sector Eurostat classification.[7] Using employment or weighted average leads to the same results. The results thus suggest that at 1-digit level, the US economy does not appear to feature higher degree of spatial specialization. That said, such specialization can happen at a more granular level, which the Note unfortunately does not have the adequate data to assess.

**Benefits of density by sector**. To estimate labor productivity and density elasticity by sector, the economies are divided into manufacturing, ICT, modern services (including ICT), and other services. The appendix then explores if the aggregate labor productivity advantage of the US is due to higher degree of concentration in certain sectors or stronger agglomeration externalities. The evidence suggests that it is the latter that matters at sectoral level, as the two economies share a similar relative structure of employment densities, echoing the finding of similar regional specialization in the previous paragraph. Specifically, in both economies, the employment density distribution is the most compressed in manufacturing and most skewed in ICT, with modern and other services standing in between (Appendix Figure 11 left panel).[8,9] Europe's lag in agglomeration externalities stems mainly from shortfalls in services sectors, while it leads the US in the manufacturing sector; and in both economies, labor productivity increases the fastest with density in ICT sector and the difference in the estimated elasticities is not statistically significant (Appendix Figure 11 right panel). The lower elasticity of modern services in the EU is mostly due to that of financial, real estate and professional services.[10] Similar to the Note, these estimates are identified using within country variations, and thus are not driven by the fact that US in on average more productive than Europe.

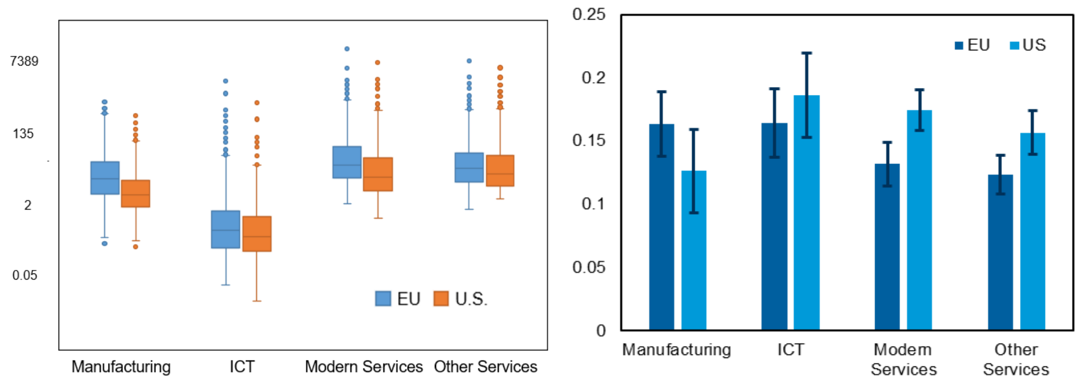
[7] Under the four-sector classification, the average Herfindahl index across of value added is 0.37 for US counties and 0.30 for NUTS3 regions. However, this could simply be because services take a larger share of the US economy.

[8] The distribution of ICT does not include Austria, Germany and Spain, as they do not report separately the gross value added of ICT to Eurostat at NUTS3 level. Modern services include wholesale, retail, transportation, ICT, finance, and professional services, while other services include education and health services, arts and entertainment, public administration and others.

[9] Comparing between the two economies, manufacturing sector density shows the largest difference, with that of the EU having a higher average and wider spread, while the distributions of ICT sector are similar. The kernel densities of ICT, modern services, and other services of European regions show a similar bulge in the upper end of the distribution as seen in the overall density, which is driven in the same way by major cities of smaller countries.

[10] Specifically, these are sectors K-N under NACE Rev. 2; the estimated elasticity is 0.10 for Europe.

**Appendix Figure 11. Density and Elasticity by Sector**




Sources: Eurostat; American Community Survey; and IMF staff calculation.
Notes: Left panel y-axis is persons/km$^2$. Right panel y-axis shows the elasticity of labor productivity on employment density.

## Appendix 3. Determinants of Agglomeration Externality at Local Level

**Empirical specification.** The empirical models in Section 3 take the general form of

$$ln\, y_i = \beta_c + \beta_1\, ln\, \mu_i + \gamma x_i + \varepsilon_i,$$

where $y_i$ and $\mu_i$ are regional labor productivity and employment density as before, $\beta_c$s are country fixed effects, and $x_i$ represents one of the indicators that can potentially be relevant to the strength of agglomeration externalities. These variables will be introduced shortly in the next subsection. The Note first includes these indicators one at a time to see if they help explain the effects of density on labor productivity. The Note then runs a regression where all the $x_i$s are included

$$ln\, y_i = \beta_c + \beta_1\, ln\, \mu_i + \boldsymbol{X_i}\boldsymbol{\gamma} + \varepsilon_i,$$

where $\boldsymbol{X_i}$ is the vector of all the indicators which have a statistically significant effects individually, and $\boldsymbol{\gamma}$ is the vector of coefficients. For this specification, the note is interested in which indicator remains statistically significant.

**Explanatory variables.** The following indicators are used in the analysis, in light of the common sources of agglomeration externalities (Rosenthal and Strange, 2004). The analyses are conducted at NUTS2 level:

- *Access to markets:* Market access is measured following Redding and Venables (2004). In particular, it is measured as weighted average of the income of a region's trading partners, with bilateral trade costs being the weight:

$$\mathrm{MA}_i = \sum_j (\tau_{ij})^{1-\sigma} m_j,$$

  where $\tau_{ij}$ is the bilateral trade cost between NUTS2 regions, $\sigma$ is the standard CES elasticity (which is set to be equal to 5), and $m_j$ is the PPS-adjusted nominal GDP of region $j$. Bilateral trade cost data are taken from the EU's Regional Trade Cost dataset, and regional income data come from Eurostat. Because the data only account for intra-EU trade, the metric used is best seen as a proxy of regions' market access when the rest of the world is also included.
- *Financial market development:* Two indicators are used to measure financial market development at regional level: average external financing ratio and average risky financing ratio; both are calculated using firm level data of Orbis and then take average by region. External financing ratio is defined as share of total financing that does not come from shareholders. Risky financing ratio is calculated as the share of equity financing over total financing.

- *Human capital:* It is measured using the share of working age population with tertiary education from Eurostat.
- *Local infrastructure:* It is approximated using the total length of railways, motorways, and navigable inland waterways per square kilometers in a region. All the variables are drawn from Eurostat.
- *R&D Ecosystem:* Two indicators are used to measure R&D ecosystem: public-private co-publications which reflect the collaboration between the public and the private sector; and innovative small- and medium-sized enterprises collaborating with others, which captures the knowledge spillovers among firms. Both indicators are taken from the European Commission's Regional Innovation Scoreboard, and both have been normalized.
- *Business environment:* Business environment is proxied using the share of employment in private sector, taken from Eurostat.

**Empirical results.** Appendix Table 2 shows the estimates from incorporating the variables first individually (specifications #2 to #9) and then jointly. In the joint regression (specification #10), only those variables that are statistically significant when included individually are used; and using SME innovation instead of PPP very similar results.

Most variables, when regressed individually, are statistically significant and have the expected sign. These include market access, external financing ratio, human capital, SME innovation, PPP-collaboration, and private sector employment share. The ratio of equity financing is negatively correlated with regional labor productivity can reflect that European firms rely more on bank rather than stock market financing. Though the estimate for local infrastructure appears insignificant, the p-value is in fact 0.11. In addition, the indicator only measures the development of transportation network within a region and not how well it is connected into the overall network. The estimates can thus underestimate the true effects of transportation network as suggested by findings in the literature; see for example, Allen and Arkolakis, (2014), Donaldson (2018), and the references therein.

Except human capital, all other variables do not affect the point estimates of density and its statistical significance. While it may seem that the 0.05 in specification #1 should be the benchmark, and some variables (for instance external financing in specification #3) show up as strengthening the agglomeration externality, it should be pointed out that the specifications vary in their regional coverage, as can be seen from the varying number of observations across specifications.

**Appendix Table 2. The Effects of Local Conditions on the Elasticity of Density**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Intercept | 4.46*** | 4.57*** | 4.5*** | 4.35*** | 2.8*** | 3.2*** | 2.84*** | 4.67*** | 4.74*** | 2.10*** |
| | (0.06) | (0.05) | (0.05) | (0.06) | (0.18) | (0.17) | (0.15) | (0.09) | (0.07) | (0.22) |
| Density | 0.05*** | 0.05*** | 0.06*** | 0.04*** | 0.02** | 0.07*** | 0.05*** | 0.07*** | 0.06*** | 0.00 |
| | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) |
| Market access | | 0.02** | | | | | | | | 0.02** |
| | | (0.01) | | | | | | | | (0.01) |
| External financing | | | 0.09*** | | | | | | | 0.04 |
| | | | (0.02) | | | | | | | (0.04) |
| Equity financing | | | | -0.05* | | | | | | |
| | | | | (0.02) | | | | | | |
| Human capital | | | | | 0.45*** | | | | | 0.46*** |
| | | | | | (0.05) | | | | | (0.08) |
| SME Innovation | | | | | | 0.11** | | | | |
| | | | | | | (0.04) | | | | |
| PPP | | | | | | | 0.18*** | | | -0.01 |
| | | | | | | | (0.03) | | | (0.03) |
| Infrastructure. | | | | | | | | 0.04 | | |
| | | | | | | | | (0.03) | | |
| Private employment | | | | | | | | | 0.77*** | 0.33* |
| | | | | | | | | | (0.11) | (0.13) |
| Country Fixed Effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| R-squared | 0.73 | 0.80 | 0.77 | 0.81 | 0.84 | 0.77 | 0.80 | 0.81 | 0.78 | 0.88 |
| # of obs. | 247 | 222 | 238 | 186 | 242 | 175 | 176 | 200 | 247 | 157 |

. p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Sources: Eurostat; EU Regional Trade Costs Database; Orbis; European Commission Regional Innovation Scoreboard; and IMF staff calculation.

## Appendix 4. Barriers to Efficient Spatial Allocation in Europe

**Diagnostic model of spatial misallocation**. The diagnostic model describes the production side of the EU. The model is divided into sectors $h$ where the analysis is done within sector. EU output in each sector is given by a CES aggregate of intermediate inputs,

$$Y^h = \left( \sum_{f \in F^h} y_f^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}},$$

where $f \in F^h$ are the set of firms that operate in sector, $y_f$ is output produced by firm $f$, and $\sigma$ is the elasticity of substitution between goods.

Intermediate firms produce output using capital and labor as inputs, according to $y_f = z_f k_f^{\alpha} n_f^{1-\alpha}$ where $z_f$ is a firm-specific productivity that is assumed to be drawn from a log normal distribution. Payments to capital and labor are denoted by the interest rate $r$ and wage rate $w$. In addition to firm-specific productivity, firms differ in wedges or distortions $\theta^k$ and $\theta^n$ that cause the cost of capital and labor to the firm to differ from payments received by those factors, such that total payments become $\theta_f^k r$ and $\theta_f^n w$. Firms may also face output distortions (i.e., $\theta_f^y$) that cause prices received by firms to differ from payments by consumers, but these wedges are suppressed with the understanding that capital and labor wedges will also capture output wedges. While wedges are modeled as a cost to the firm, in practice, these wedges could capture a number of direct and indirect costs that would distort firm inputs and production decisions relative to the efficient allocation.

Wedges are drawn from the distribution $\log \theta_f^x = \mu_{c,r} + \rho \log z_f + \epsilon_f$ for $x \in \{k, n\}$ and where $\epsilon_f$ is drawn from a log normal distribution. The first term captures a country-region component of the wedge that captures better or worse access to capital and labor markets in these areas, such as, for example, worse access to investors, specialized labor, and / or trade routes. The second term increases the wedge with the productivity of the firm capturing that more productive firms may face larger costs for acquiring capital and labor. For example, credit constraints may be more binding for larger firms (conditional on age and previous sales). Larger firms may also face size-dependent institutional constraints (e.g., many countries require firms with more than 50 employees to pay additional expenses) that encourage them to remain small or make labor more expensive. The third term captures an idiosyncratic component of the wedge, unrelated to firm productivity, such as, for example, policy-related hiring and firing costs that may impact any firms trying to grow or shrink their labor force.

**Measurement**. The data are divided into NUTS1 regions and seven sectors capturing (1) mining, electricity, (2) manufacturing, (3) construction, (4) trade, transportation, and food, (5) ICT, (6) professional services, and (7) public services. Following Hsieh and Klenow (2009), the productivity and wedges at the firm level are measured as

$$z_f = \frac{(p_f y_f)^{\frac{\sigma}{\sigma-1}}}{k_f^{\alpha} n_f^{1-\alpha}}$$

and

$$\theta_f^x = \bar{\theta} \frac{p_f y_f}{k_f^{\alpha} n_f^{1-\alpha}}$$

where $\bar{\theta}$ is a constant term that does not impact the analysis using firm-level financial data from Orbis. Given that Orbis data may not capture the universe of firms, the region-level distributions can then be estimated using the firm-level estimates of productivity and wedges. The above estimates are scaled at the region level using Eurostat information on output (real PPP-adjusted GDP) and employment at the NUTS1 level. Specifically, average TFP in each region is set to match total output and the average wedge is set to match total employment[11]

**Spatial Misallocation**. To generate the results, 10,000 firms in each region are simulated with productivity and wedges drawn from the estimated distributions. Using the simulated firms, two experiments are considered to quantify the extent of spatial misallocation.

1. *Across-country* misallocation is calculated as the potential gain in each sector from reallocating capital and labor across countries, holding the distributions of firms $f$ within countries fixed.
2. *Between-region* misallocation is calculated as the potential gain in each sector from reallocating capital and labor in each country between NUTS1 regions holding the distribution of firms $f$ within each region fixed.

In both experiments, the total gains are reported as the change in output at the EU level from these reallocations. Because the total stocks of labor and capital are fixed, these results also reflect changes in aggregate total factor productivity.

## Appendix 5. Quantifying the Spatial Implications of EU Policies

The model describes production, location decisions of workers, and trade at the regional level. The economy is divided into regions, indexed by $r \in R$, that are the economic units of analysis.

**Preferences and the consumption good**. There is a total stock $N$ of workers that choose to locate in each region $r$. Workers have log inter-temporal preferences over period utility and discount future utility at rate $\beta$. Period utility in region $r$ is equal to $u_r(i) = b_r(i)c_r^{\gamma}a_r^{1-\gamma}$, where $b_r(i)$ is a worker-specific preference for living in region $r$, $c_r$ is the consumption of the final good, and $a_r$ is consumption of the amenity (e.g., housing). At the beginning of each period, each worker draws a vector of locational preferences from a Fréchet distribution given by $b_r \sim \exp(-B_r \times b^{-\zeta})$, where $B_r$ is the average attractiveness of region $r$. Amenities are fixed at the regional level with stock $A_r$ and non-tradable. Workers in region $r$ choose to supply labor inelastically and are paid a wage rate $w_r$. For simplicity, workers in region $r$ are assumed to be the final owners of all firms located in region $r$.

The final good is produced by a representative firm using a CES aggregate of intermediate firm goods. The final good technology is given by:

$$Y_r = \left(\int_{f \in F_r} y_r(f)^{\frac{\sigma-1}{\sigma}} df\right)^{\frac{\sigma}{\sigma-1}},$$

where $y_r(f)$ is the quantity of intermediate goods sold by firm $f$ in region $r$ and $F_r$ is the set of firms that sell in region $r$.

**Firm-level production and distortions**. Intermediate goods are produced by monopolistic firms using labor as the only input. Firms in region $r$ must pay iceberg trade costs $\tau_{r,r'}$ to access other regions. Firms produce according to $\tilde{y}(f) = z(f)n(f)$ where $z(f)$ is firm-level productivity. Firm-level productivity $z_f = \bar{z}_r N_r^{\kappa} s_f$ depends on a region-level component $\bar{z}_r$, an agglomeration spillover $N_r^{\kappa}$ where $\kappa$>0 is the extent that firm productivity increases with the employment of the region, and $s_f \sim \log N(0, \sigma_s^2)$ is an idiosyncratic firm productivity.

[11] Note that while the production function has increasing returns to scale at each geography of production, this is captured in the region-specific productivity scaling.

Firm also differ in idiosyncratic wedges $\theta_n(f)$ that distort their relative cost of labor, such that firms pay $\theta_n(f) w_r n$ for labor. In both cases, the wedge is drawn from a distribution given by $\log \theta_n(f) = \rho_r \log z(f) + \epsilon(f)$ where $\rho_r$ determines the relative correlation of distortions to firm productivity while $\epsilon(f)$ is an idiosyncratic component drawn from a log normal distribution with standard deviation $\sigma_r$. Following Restuccia and Rogerson (2008), these wedges are modeled as idiosyncratic taxes on firms that are then transfers to local workers through a non-distortionary lump-sum transfer $T_r$. Firms may freely exit the market. New firms enter the market by paying $\phi$. Entrants learn about their productivity $z(f)$ and wedge $\theta_n(f)$ after paying the entry costs. The total mass of operating firms in region $r$ is denoted by $M_r$.

**Equilibrium**. The equilibrium is the set of values $\{P_r, Y_r, c_r, a_r, N_r, X_r, M_r, w_r, q_r, T_r\}$ and the functions $\{p_{r,r'}(z,\theta_n), y_{r,r'}(z,\theta_n), n_r(z,\theta_n)\}$, such that: (i) workers choose region $r$ to maximize utility; (ii) the final good producer chooses inputs $y_{r,r'}(z,\theta_n)$ to maximize profits, (iii) Firms choose prices in each region and labor inputs to maximize profits; (iv) the mass of firms $M_r$ is determined by firm entry and exit decisions; (vi) Trade is balanced; (vii) the goods, amenities, and labor market in each region clear.

**Model estimation**. The model calibration involves choosing the common parameters $\{\beta, \gamma, \zeta, \sigma, \kappa, \phi\}$, the region-parameters $\{\rho_r^n, \sigma_r, \bar{z}_r, A_r, B_r\}$, and the bilateral region parameters $\{\tau_{r,r'}\}$. The discount rate is set to $\beta = 0.96$ implying an interest rate of 4 percent. The consumption share of utility is set to $\gamma = 0.75$ based on Redding (2016). The Frechet distribution curvature is set to $\zeta = 1.5$, lower than used in the literature to account for coarser regions and multiple countries—for example, Peters (2022) finds an elasticity of around 2 using NUTS3 regions and Alhlfeldt and others (2015) find an elasticity of close to 7 using much more granular regions in Germany—where locational decisions are likely to be less elastic to economic factors. The CES elasticity is set to $\sigma = 5$ as a midpoint for estimates in the trade literature. The agglomeration spillover elasticity is set to $\kappa = 0.13$, the average estimate from Bartelme and others (2025). The entry costs are normalized to one in each region. Region-level amenities $A_r$ are set to be proportional to the total area of the region.

The parameters determining firm-level distortions in each region are estimated empirically using Orbis data. Firm level productivity and wedges are estimated following Hsieh and Klenow (2009) as described in the previous Appendix.

Trade costs are estimated following Head and Reis (2004) by assuming trade costs are symmetric, i.e., $\tau_{r,r'} = \tau_{r',r}$. This implies that trade costs in the model can be calculated using trade shares $d_{r,r'}$ as $\tau_{r,r'} = \left(d_{r,r'} d_{r',r} / d_{r,r} d_{r',r'}\right)^{1/2\sigma}$. Data for region-level trade is taken from the European Road Freight Transport survey (ERFT) that is a micro-level survey of freight road shipments collected by Eurostat. Santamaria, Ventura, and Yesilbayraktar (2024) provide a detailed discussion of the dataset. Trade shares in the ERFT data are scaled to match country-level trade shares from the World Input Output Database for 2014, with the adjustments offset by the region's home shares. The fully calibrated model produces an average home share of around 53 percent relative to 51 percent in the data. For the experiments, the trade cost attributable to distance is assumed to not be adjusted. The trade cost is calculated as $\tau_{r,r'}^{dist} = \exp\left(\frac{\beta\left(\log dist_{r,r'} - \log dist_{r',r'}\right)}{1-\sigma}\right)$ where the coefficient is set to $\beta = 1$ consistent with findings in the literature and empirical estimates using the ERFT data. The resulting policy-relevant portion of trade costs are then calculated as $1 - \lambda_{r,r'} = 1 - \tau_{r,r'}^{dist} / \tau_{r,r'}$.

Average firm-level productivity $\bar{z}_r$ and the region preference $B_r$ are set to match region-level technical efficiency and employment of each region, following the choice of the other parameters. The calibrated model is able to fully replicate the employment distribution across regions. Technical efficiency does not align exactly with output per worker but still provides a close fit with the data. The correlation of log output per worker and log output in the data and calibrated model are around 96 percent.

**Quantitative analysis**. The main text describes four experiments performed using the model. The experiments, reported in Figure 2.3 examine two magnitudes of reforms corresponding to closing the full policy gap (closing all gaps) and closing half of the policy gap (intermediate reform package).

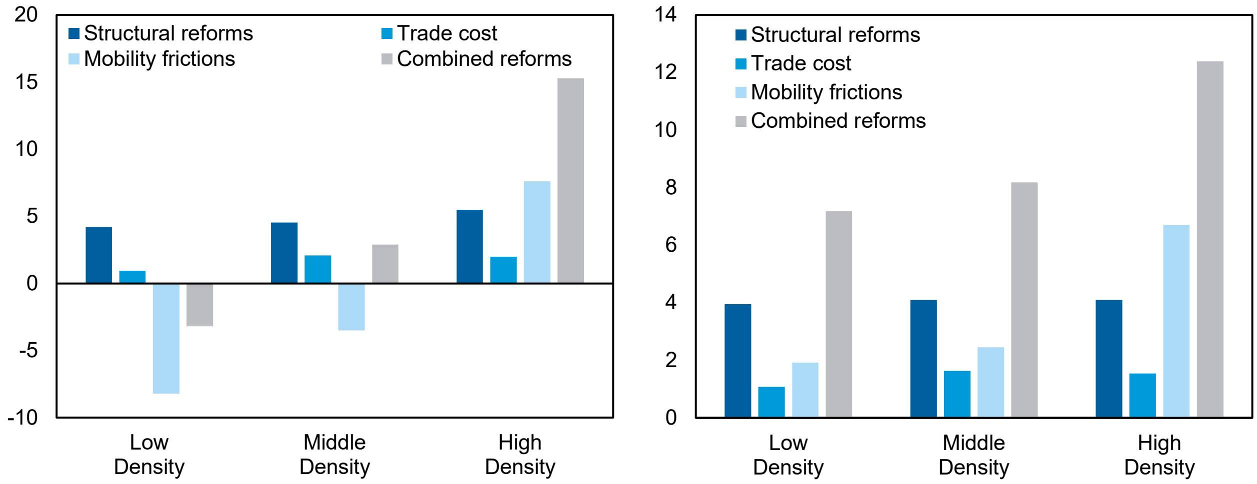
1. *Structural reforms* to decrease misallocation. The counterfactual wedge distribution is drawn from $\log \theta_n'(f) = \left((1-\xi)\bar{\rho} + \xi\rho_r\right)\log z(f) + \xi\epsilon(f)$ where $\xi \in \{0.05, 0.10\}$ is the adjustment scale and $\bar{\rho} = \min_r \rho_r$. The magnitude of adjustment is set to match the estimated gains from closing half ($\xi = 0.05$) and the full policy gaps with the global frontier in Budina and others (2025).
2. Lowering *trade costs* to lower the between EU country and US state trade cost gap. Let $R_c$ denote the regions in country $c$, then for $r \in R_c$ and $r' \notin R_c$ the adjusted trade cost is calculated as $\tau'_{r,r'} = \tau_{r,r'} - \xi \times \left(\tau_{r,r'} - 1\right) \times \left(1 - \lambda_{r,r'}\right)$ and $\tau'_{r,r'} = \tau_{r,r'}$ for $\xi \in \{0.25, 0.50\}$ $r, r' \in R_c$. The magnitude of the trade cost reduction is calculated based on closing half ($\xi = 0.25$) and the full ($\xi = 0.50$) gap in intra-EU and intra-US trade costs estimated in Box 2.1 of this Note (Figure 2.8). The gap is relatively stable with intra-US trade costs being around twice as large as intra-EU trade costs, other than the final year of data where the gap shrinks due to an increase in intra-US trade costs. Given that the experiment is meant to capture the total feasible drop in intra-EU trade costs, the magnitude of potential reforms is disciplined to earlier data where intra-US trade costs are around half intra-EU trade costs.
3. Lowering *mobility barriers* to lower the gap between the EU and US spatial employment distribution. The measured elasticity between output per worker and employment in the US is around 0.15 and in the model is around 0.12.[12] The experiment adjusts the distribution of amenities according to $A_r' = A_r(Y_r/\bar{Y})^{\xi}$ by setting the adjustment parameter to $\xi \in \{0.25, 0.55\}$ to increase the model elasticity by 0.015 and 0.030. The model calibration cannot separately identify locational preferences from mobility barriers that prevent workers from moving to economic opportunities—such as those found in the diagnostic model (Appendix 4) and discussed by IMF (2024) and Arnold and others (2025)—and so the calibrated preference term $B_r$ captures both factors. Adjusting the amenity term, as in the experiment, can be thought of as reducing the mobility barriers captured in household preferences that prevent workers from moving to economic opportunities. As the model does not capture bilateral locational frictions—and modeling bilateral decisions is, in practice, difficult—in this experiment, mobility barriers are reduced within countries as well as between countries. The adjustment to the amenity term can be interpreted as tackling both cross-border mobility frictions (e.g. the higher cost of transferring pensions across countries) and obstacles to labor mobility between regions within the same countries (e.g. housing reforms that would lower congestion in dense regions, consistent with evidence [e.g., Elfayoumi and others, 2021] of European barriers to within country mobility).

The final experiment combines all three of the above listed reform simulations.

**Impact of reforms by initial regional density**. Appendix Figure 12 reports the simulated impact of the reforms by the initial tercile of regional density. Structural reforms tend to have a relatively similar impact on regions regardless of their initial density. Trade costs tend to have a larger impact in middle- and high-density regions as these regions are most exposed to trade and benefit most from lower trade costs enabling these regions to boost efficiency and further exploit scale economies and agglomeration spillovers. Low-density regions are still better off as a result of lower trade costs. Reducing mobility frictions tend to disproportionately shift economic activity towards high density regions, as it allows workers to move to regions with highest wages. Higher concentration of workers in these regions leads to productivity gains from scale economies and agglomeration spillovers. After the loss in workers is accounted for, output per worker increases, on average, across all density groups from lower mobility frictions.

[12] The model and data elasticities differ slightly due to the model not capturing all regions in the data and the model not matching exactly the distribution of output-per-worker in the data.

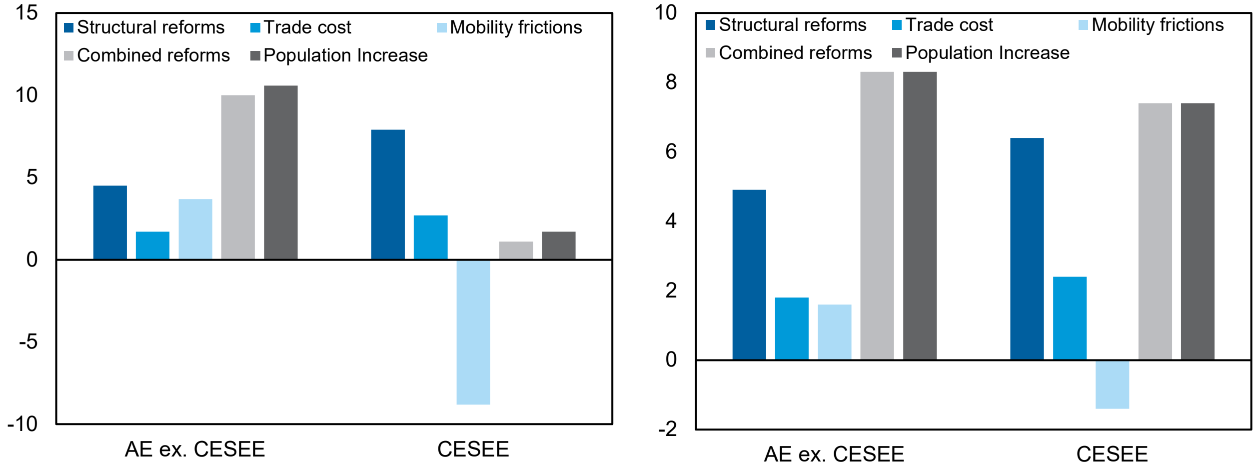
**Appendix Figure 12. Impact of simulated structural reforms by initial employment-density tertile**
(Percent)




Sources: Orbis; Eurostat; IMF staff calculations.
Note: Estimated long-term output (left) and output-per-worker (right) gains from structural reforms, lowering trade costs, and lowering mobility frictions by the initial tercile of the regional density distribution. Structural reforms lower dispersion in estimated firm-level wedges in each region. Trade costs lower estimated (within EU) trade costs by half of the between EU country and US state gap for each bilateral region pair in different countries. Mobility frictions lower the barriers to labor reallocation to close half of the spatial pattern of output per worker and density gap with the US. Combined reforms estimates the impact of the three reforms implemented simultaneously. Population increase adds a 0.5 percent increase in total employment to the combined reform scenario.

**AE and CESEE aggregate output results**. Appendix Figure 13 reports the results of the simulated reforms by advanced economies excluding CESEE countries and CESEE countries. As a group, CESEE countries tend to benefit comparatively more from structural reform and trade costs reflecting more substantial misallocation and higher costs of trade. Mobility reforms tend to hurt CESEE countries while benefiting advanced economies. Mobility reforms allow workers to move towards higher productivity regions where wages and consumption are higher, leading to a net outflow of around 7.5 percent of workers in CESEE countries, potentially accelerating existing unfavorable population dynamics (see Batog and others, 2019). However, it is important to caveat the above reforms in the context of the pace of their transition path. While not immediate, gains from structural reforms and reducing trade costs are likely to occur relatively quickly as they require firms to scale up, or down, production at the margin. Locational decisions of workers reflect long-term equilibria, rather than short-run changes. In practice, the reallocation of workers across regions is a lengthier process as new opportunities for these workers must be created and then found. That said, many of the higher impact benefits from lowering mobility barriers, such as access to specific skills, can be quickly realized. Another caveat is that stronger productivity growth in CESEE countries—where opportunities to benefit from structural reforms and leap-frog technological progress are highest—can help to counter forces that may otherwise result in net emigration. Simulating all three reforms together would allow the net benefit from structural reforms and lower trade costs to compensate for the loss in output from reducing mobility frictions, causing the benefits to CESEE countries to shift to the positive region.

**Appendix Figure 13. Impact of simulated structural reforms on advanced and CESEE economies**
(Percent)




Sources: Orbis; Eurostat; IMF staff calculations.
Note: Estimated long-term output (left) and output-per-worker (right) gains from structural reforms, lowering trade costs, and lowering mobility frictions at the aggregate EU level and by AE excluding CESEE and CESEE countries. Structural reforms lower dispersion in estimated firm-level wedges in each region. Trade costs lower estimated (within EU) trade costs by half of the between EU country and US state gap for each bilateral region pair in different countries. Mobility frictions lower the barriers to labor reallocation to close half of the spatial pattern of output per worker and density gap with the US. Combined reforms estimates the impact of the three reforms implemented simultaneously. Population increase adds a 0.5 percent increase in total employment to the combined reform scenario.

**An approximation to the effects of extra EU immigration**. The main experiments abstract from the possibility that higher productivity may also increase the total stock of employment through more migration into the EU and a higher employment rate. It is difficult to assess the total increase in employment from higher productivity. A simple back-of-the-envelope calculation is to multiply the migration rate (around 1.1 percent in 2024) with the productivity increase adjusted by the elasticity of migration to real income ($\approx 1.087^{1/2} - 1 = 0.043$) suggesting that over a 10-year period, total employment could increase by around 0.5 percent ($= 1.1 \times 0.043 \times 10$).[13] Adding in an employment increase of around 0.5 percent, as described above, would result in equal increase in output by both advanced economies and CESEE countries as the new population is proportionally divided across regions. Mechanically, workers equate marginal utility of each region when making location decisions implying that any increase in the aggregate stock of workers will benefit all regions equally. EU output would also increase to 9.3 percent, where the increase in output is larger than the increase in employment due to scale economies and agglomeration spillovers. However, the above calculation should be taken as an approximation as the model does not have migration from outside the EU and the assumed elasticity of migration may not directly align with the model assumptions.

## Appendix 6. Barriers to Trade

This section spells out the econometric model used to estimate the ad-valorem equivalent of trade barriers in Box 2.1. The empirical specification follows the gravity model by Adilbish et al. (2025) and Head and Mayer (2021), with country-pair observations for the US replaced by US states, and extended to allow for time-varying effects of control variables:

[13] The elasticity of migration to real income is taken to be ½ from Caliendo, Dvorkin, and Parro (2019).

$$X_{in,t} = exp\left(\sum_{p\in\Omega} \beta_{p,t}p_{in,t} + \beta_{TA,t}TA_{in,t} + \beta_{\tau,t}\tau_{in,t} + \chi_{i,t} + \varphi_{n,t} + \mu_{in} + \varepsilon_{in,t}\right)$$

Bilateral exports from origin $i$ to destination $n$ (with $i = n$ for domestic sales) are regressed on a set $\Omega$ of dummy variables denoted by $p$ that decompose international trade flows into cross-border flows between different sets of countries or states, each interacted with time dummies. In particular, $p = EU$ for trade flows between EU-27 countries; $p = US$ for flows between US states; $p = USEU$ for trade flows between EU-27 countries and US states; $p = EUCHN$ for trade between EU-27 countries and China; $p = USCHN$ for flows between US states and China; $p = EUROW$ for trade between EU-27 countries and countries other than the US and China; and $p = USROW$ for trade flows between US states and countries other than EU-27 and China. The associated $\beta$ coefficients are allowed to vary over time by interacting each of the trade flows indicators with time dummies. Importantly, the trade flows indicators are time-invariant – their effect is allowed to vary over time.[14] For example, the variable $EU_{in,2022}$ is defined as a dummy for trade flows between EU-27 countries ($p = EU$) interacted with an indicator for the year 2022: $EU_{in,2022} \equiv EU_{in} \times [t = 2022]_t$. Trade barriers are inferred from the $\beta_p$ coefficients as these identify how different types of international trade flows evolve relative to domestic trade flows. To measure trade costs, the estimated coefficients are converted into ad-valorem equivalent trade cost using the formula $\left[\exp\left(\frac{\beta_{p,t}}{\theta}\right) - 1\right] \times 100$, where $\theta$ is the aggregate elasticity of trade with respect to trade costs, which we set equal to 5 following Head and Mayer (2021).

The model controls for other policy and structural determinants of trade flows, all interacted with year dummies to flexibly account for time-varying confounding factors. In particular, participation in Preferential Trade Agreements (PTAs) other than the EU and membership in the World Trade Organization (each interacted with time indicators) are collected in the $TA$ matrix. The matrix $\tau$ instead includes trade cost shifters such as distance (in logs, internal and international) and dummies for sharing a border, an official language, and the origin of the legal system, each interacted with time dummies. While time-invariant, the coefficients associated with these variables (collected in the vector $\beta_{\tau,t}$) vary over time because of the interactions with the time dummies, controlling, e.g. for the time-varying influence of distance (a proxy for developments in transportation technologies (Feyer, 2019)). The gravity specification also includes time-varying exporter ($\chi$) and importer ($\varphi$) fixed effects.

Country-pair fixed effects ($\mu$) further absorb the influence of all time-invariant determinants of trade. These are included in the panel specification, which thus exploits variation in bilateral trade within country pairs and over time. In this specification, only *changes* in bilateral trade costs from the trade flows indicators *p* can be inferred. In particular, we omit the 2007 interaction so that the estimates identify changes in trade costs at time *t* relative to 2007 – the first year of the sample; similarly for the interactions with time-invariant controls in $\tau$.

In an alternative specification, we estimate the *level* of trade barriers between EU countries and other country pairs by omitting country-pair fixed effects. The model controls for the levels of time-invariant covariates and their interactions with time indicators.[15] As highlighted in Adilbish et al. (2025), the implicit identifying assumption in this alternative model is that the set of control variables and their interactions with time dummies fully absorb the influence of country-pair-level determinants of bilateral trade flows. This is a strong assumption given that other potentially influent unobserved determinants of bilateral trade flows, such as home bias in consumer preferences, cannot be controlled for. Therefore, the levels of trade costs inferred from this approach should be seen as upper bounds.

[14] EU membership is fixed by taking the current EU-27 definition. This implies that Croatia is assumed part of EU-27, while the UK is not, throughout the sample period between 2007 and 2022. The UK and EU-27 countries share an FTA throughout the sample period.

[15] In this alternative specification, all the time interactions of the trade flow indicators in $\Omega$ and of the time-invariant controls in $\tau$ are included. This is equivalent to having the level of the time-invariant variables and their interactions with all the time indicators but one.

The data on domestic and international trade flows excluding US states are computed from the OECD TiVA inter-country input-output database (2025 version). To measure intra-US trade flows (between and within US states), we use data from the Commodity Flow Surveys (CFS), which cover shipments of goods through different modes of transportation. Data on exports and imports of US states come from the US Census. The regressions are estimated on total manufacturing and mining trade, including the CFS and OECD TiVA sectors that could be matched. The sample covers the 79 countries in the OECD TiVA data (without the US) and 51 US territories (50 states and the District of Columbia). The time periods included in the sample are the ones for which the CFS data are available: 2007, 2012, 2017, and 2022.

## Appendix 7. Capital Misallocation in Europe: The Case of Venture Capital

This section outlines the methodology used in Box 2. Venture capital data from PitchBook focuses on VC deals by European and US firms between 2015 and 2024. For the US, the analysis is conducted at the state level.

A gravity model is estimated on bilateral VC investment flows across countries using Poisson Pseudo-Maximum Likelihood (PPML).

$$V_{ijt} = exp(\chi_{it} + \xi_{jt} + \beta_{bilateral} X_{ijt})\epsilon_{ijt}$$

Where $V_{ijt}$ indicates bilateral VC flows from country i to destination j at year t. $\chi_{it}$ and $\xi_{jt}$ show exporter (investor) country-time and importer (firm) country-time fixed effect respectively. $\epsilon_{ijt}$ is the error term.

The model controls for various bilateral factors $X_{ijt}$, including distance, contiguity, common legal system, language, and capital taxes. The analysis primarily emphasizes policy-relevant factors such as the legal system and capital taxes. The results from the exercise on removing withholding taxes should be interpreted as an upper bound since, in practice, such taxes will not be completely eliminated; rather, they reflect the potential impact of CMU proposals aimed at simplifying withholding tax procedures. The results on the effect of common legal system could be considered as a lower bound to proxy the effect of the 28$^{th}$ corporate regime, as the proposal moves beyond legal harmonization, and covers areas such as taxes and insolvency frameworks. Moreover, the results assume a perfectly elastic VC supply, which implies that all VC demand could be met. Otherwise, to the extent that European investors are not deep-pocketed, existing VC investments may be crowded out. Finally, the exercise does not account for the virtuous general equilibrium feedback loop: that increases in VC inflows boost innovation, growth, and wealth, which makes investor more deep-pocked and further increases VC supply, and so on.

## References


Adilbish, O., Cerdeiro, D., Duval, R., Hong, G. H., Mazzone, L., Rotunno, L., Toprak, H., and M. Vaziri 2025. Europe's Productivity Weakness. Firm-Level Roots and Remedies. *IMF Working Paper* 40.

Ahlfeldt, G.M., S.J. Redding, D.M. Strum, and N. Wolf. 2015. “The Economics of Density: Evidence from the Berlin Wall.” *Econometrica*, 83(6), 2127-89.

Allen, T. and C. Arkolakis. 2014. “Trade and the Topography of the Spatial Economy.” *Quarterly Journal of Economics*, 129(3), 1085-1140.

Arnold, N., A. Dizioli, A. Fotiou, J. Frie, B. Hacibedel, T. Iyer, H. Lin, M. Nabar, H. Tong, and F. Toscani. 2025. “Lifting Binding Constraints on Growth in Europe: Actionable Priorities to Deepen the Single Market.” *IMF Working Paper 25/113*, International Monetary Fund, Washington D.C.

Batog, C., E. Crivelli, A. Ilyina, Z. Jakab, J. Lee, A. Musayev, I. Petrova, A. Scott, A. Shabunina, A. Tudyka, X. Xu, and R. Zhang. 2019. “Demographic Headwinds in Central and Eastern Europe.” *IMF Departmental Papers 19/11*, International Monetary Fund European Department, Washington D.C.

Bartelme D., A. Costinot, D. Donaldson, and A. Rodríguez-Clare. 2025. “The Textbook Case for Industrial Policy: Theory Meets Data.” *Journal of Political Economy*, 133(5), 1527-73

Caliendo, L., M. Dvorkin, and F. Parro. 2019. “Trade and Labor Market Dynamics: General Equilibrium Analysis of the China Trade Shock.” *Econometrica*. 87(3) 741-835.

Ciccone, A., and R.E. Hall. 1996. “Productivity and the Density of Economic Activity.” *American Economic Review*, 86(1), 54-70.

Donaldson D. 2015. “The Gains from Market Integration.” *Annual Review of Economics*, 7, 617-47.

—. 2018. “Railroads of the Raj: Estimating the Impact of Transportation Infrastructure.” *American Economic Review*, 108(4-5), 899-934.

Duranton G., and D. Puga. 2001. “Nursery Cities: Urban Diversity, Process Innovation, and the Life Cycle of Products.” *American Economic Review*, 91(5), 1454-77.

Ehrlich M. and H.G. Overman. “Place-Based Polices and Spatial Disparities across European Cities.” *Journal of Economic Perspectives*, 34(3), 128-49.

Elfayoumi K., I. Karpowicz, J. Lee, M. Marinkov, A. Mineshima, J. Salas, A. Tudyka, and A. Schaechter. 2021. “Affordable Rental Housing: Making It Part of Europe’s Recovery.” *IMF Departmental Paper 21/13*, International Monetary Fund European Department, Washington D.C.

Feyrer, J. 2019. “Trade and Income—Exploiting Time Series in Geography.” *American Economic Journal: Applied Economics*, *11*(4), 1-35.

Head, K., and T. Mayer 2021. “The United States of Europe: A Gravity Model Evaluation of the Four Freedoms.” *Journal of Economic Perspectives*, *35*(2), 23-48.

Head, K., and J. Reis. 2004. “Exporting and FDI as Alternative Strategies.” *Oxford Review of Economic Policy*, 20(3), 409-23.

Hsieh C.T. and P. Klenow. 2009. “Misallocation and Manufacturing TFP in China and India.” *Quarterly Journal of Economics*, 124(4), 1403-48.

International Monetary Fund. 2024. *Regional Economic Outlook for Europe Note 1: Europe's Declining Productivity Growth: Diagnoses and Remedies.* October.

Kalemli-Ozcan, S., B.E. Sorensen, C. Villegas-Sanchez, V. Volosovych, and S. Yesiltas. 2024. "How to Construct Nationally Representative Firm-Level Data from the Orbis Global Database: New Facts on SMEs and Aggregate Implications for Industry Concentration." *American Economic Journal: Macroeconomics*, 16(2), 353-74.

Michaels G., F. Rauch, and S.J. Redding. 2012. "Urbanization and Structural Transformation." *Quarterly Journal of Economics*, 127(2), 535-86.

Peters, M. 2022. "Market Size and Spatial Growth—Evidence from Germany's Post-War Population Expulsions." *Econometrica*, 90(5), 2357-96.

Redding S. and A.J. Venables. 2004. "Economic Geography and International Inequality." *Journal of International Economics*, 62(1), 53-82.

Redding S. 2016. "Goods Trade, Factor Mobility and Welfare." *Journal of International Economics*, 101, 146-67.

Restuccia, D., and R. Rogerson. 2008. "Policy distortions and Aggregate Productivity with Heterogeneous Establishments." *Review of Economic Dynamics*, 11(4), 707-20.

Santamaria, M., J. Ventura, and U. Yesilbayraktar. 2024. "Borders within Europe." *NBER Working Paper No.28301* National Bureau of Economic Research, Cambridge, Massachusetts.

PUBLICATIONS

REGIONAL ECONOMIC OUTLOOK

EUROPE – NOVEMBER 2025