



# **Closer Together or Further Apart? Within-Country Regional Disparities and Adjustment in Advanced Economies**

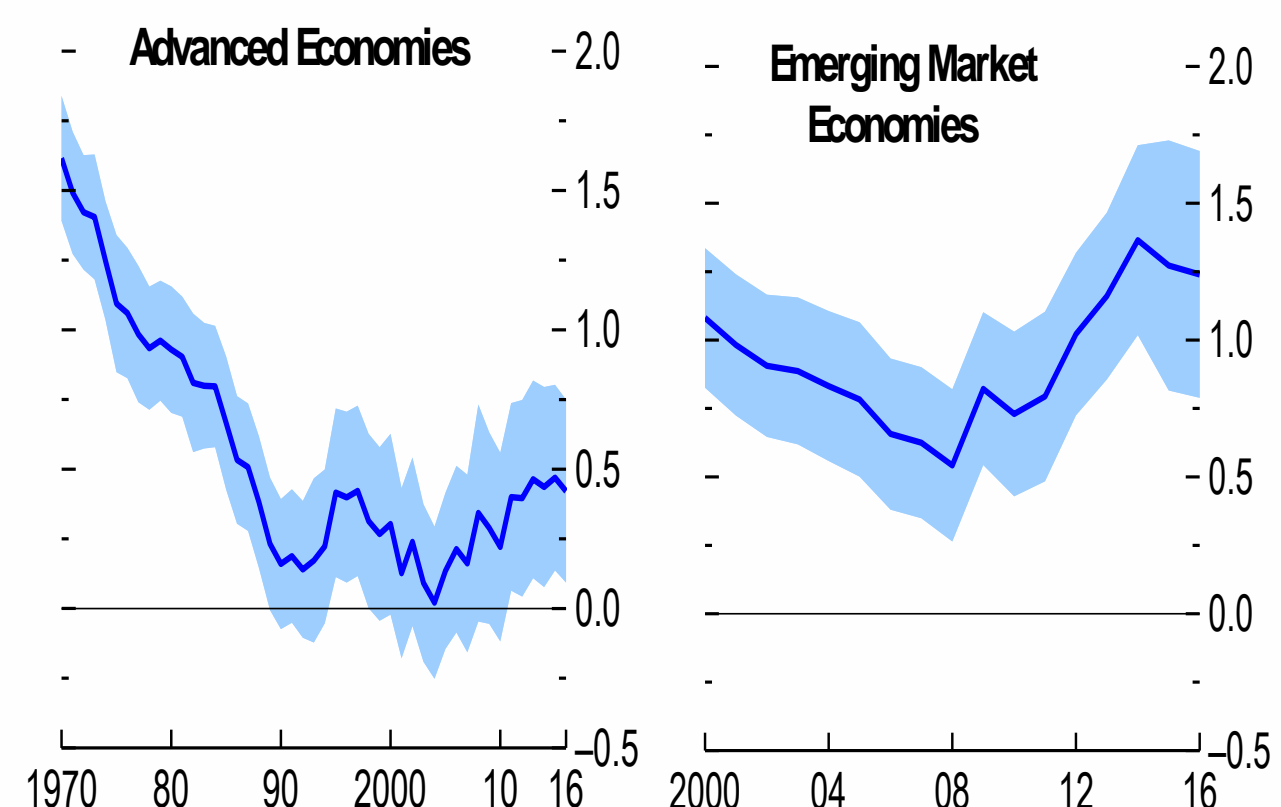
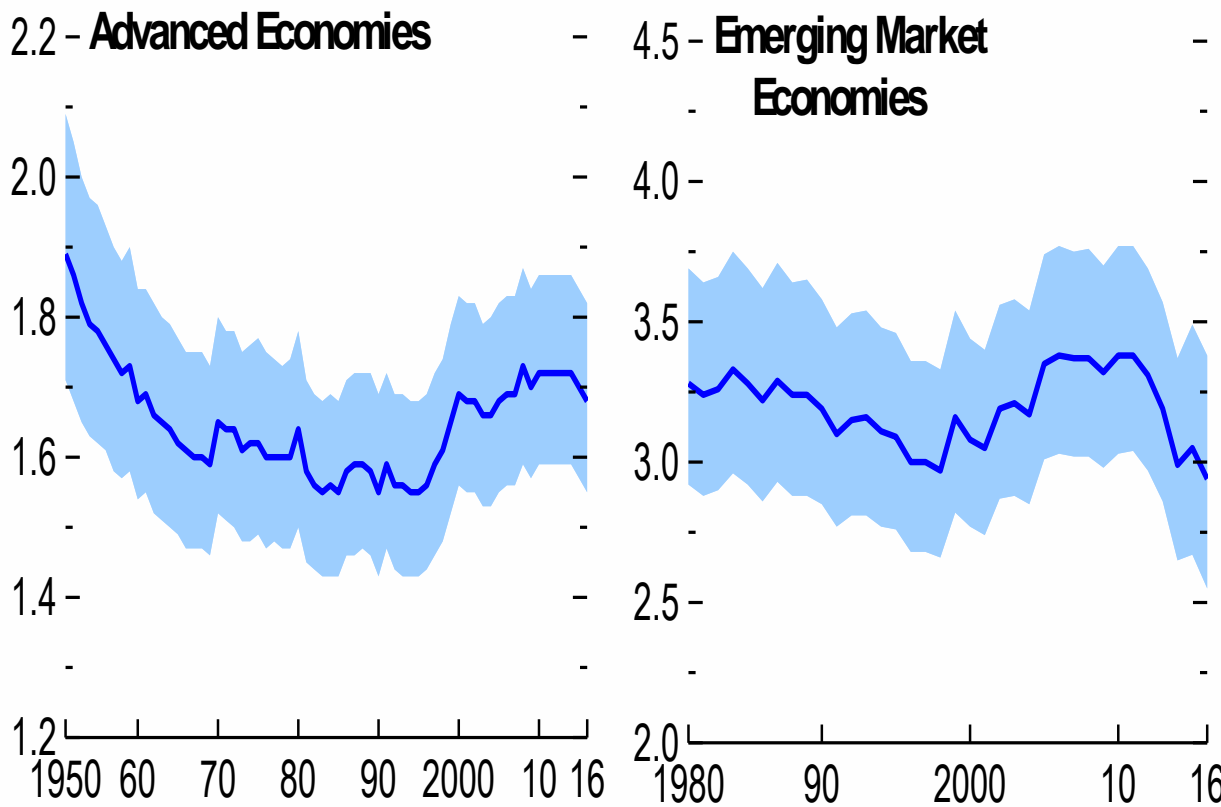
**OCTOBER 14, 2019    JOINT VIENNA INSTITUTE**

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# Within-country regional disparities and convergence: rising disparities in AEs, declining in EMEs

1. Average 90/10 Ratio of Regional Real GDP per Capita  
(Ratio)

2. Average Speed of Convergence  
(Percent, past 20 years)

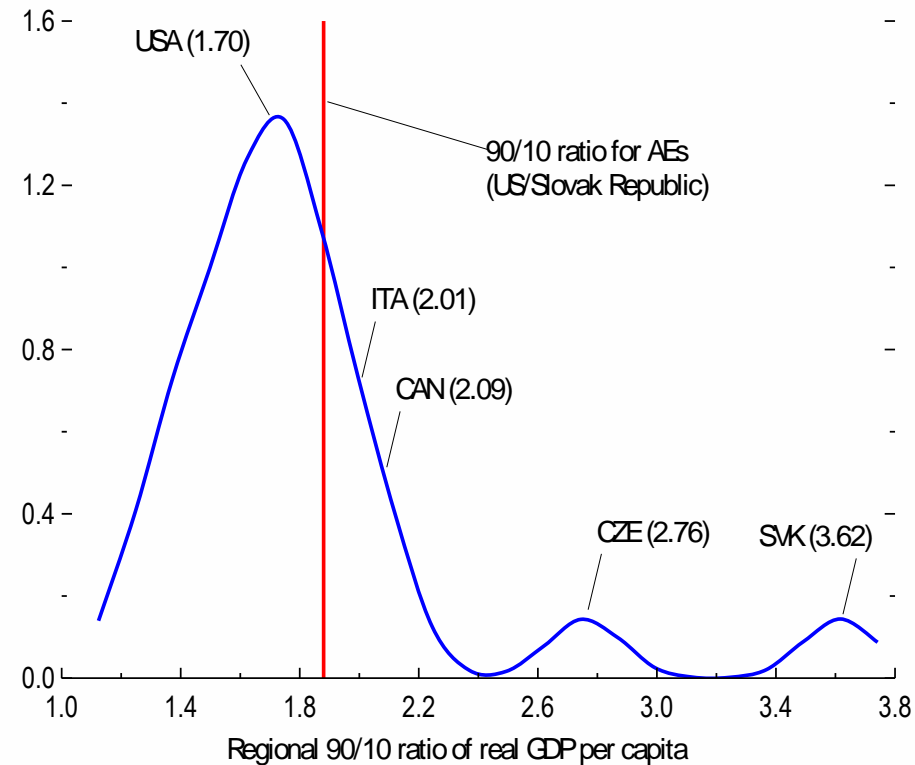


Sources: Gennaioli and others (2014); OECD Regional Database; and IMF staff calculations.

Note: The regional 90/10 ratio for a country is defined as real GDP per capita in the region at the 90th percentile over that of the region at the 10th percentile. Year fixed effects from a regression of regional 90/10 ratios on year fixed effects and country fixed effects are shown. The convergence speed comes from standard convergence regressions estimated over 20-year rolling windows, including country fixed effects. Blue shaded areas are 90 percent confidence intervals.

# Within-country regional disparities can be as large as across country disparities

Distribution of Subnational Regional Disparities in AEs  
(Density, 2013)

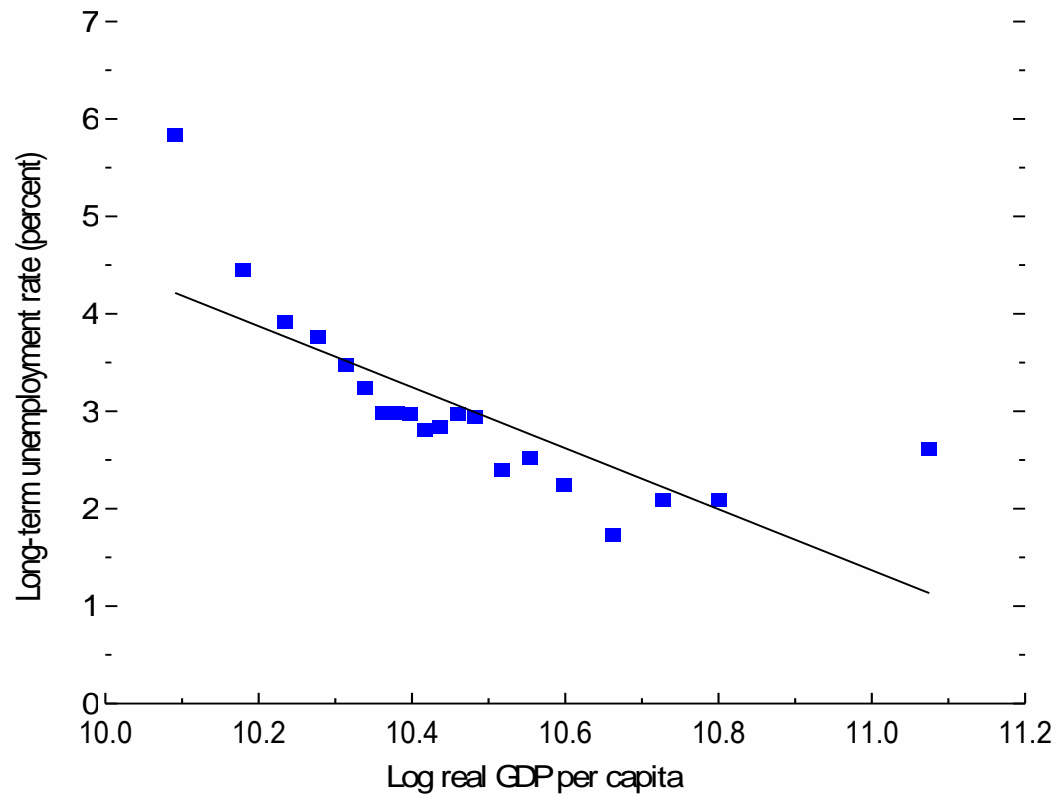


Sources: OECD Regional Database; and IMF staff calculations.

Note: The figure shows the kernel density of the country-level regional 90/10 ratio across advanced economies (the ratio of real GDP per capita, PPP-adjusted, of the 90th percentile subnational region to the 10th percentile subnational region, calculated for each country). The vertical line indicates the national 90/10 ratio within the same group of advanced economies (that is, the ratio of real GDP per capita, PPP-adjusted, of the country at the 90th percentile to the country at the 10th percentile).

# Regional disparities in economic activity associated with worse structural outcomes

## 1. Subnational Regional Unemployment and Economic Activity in AEs, 1999–2016

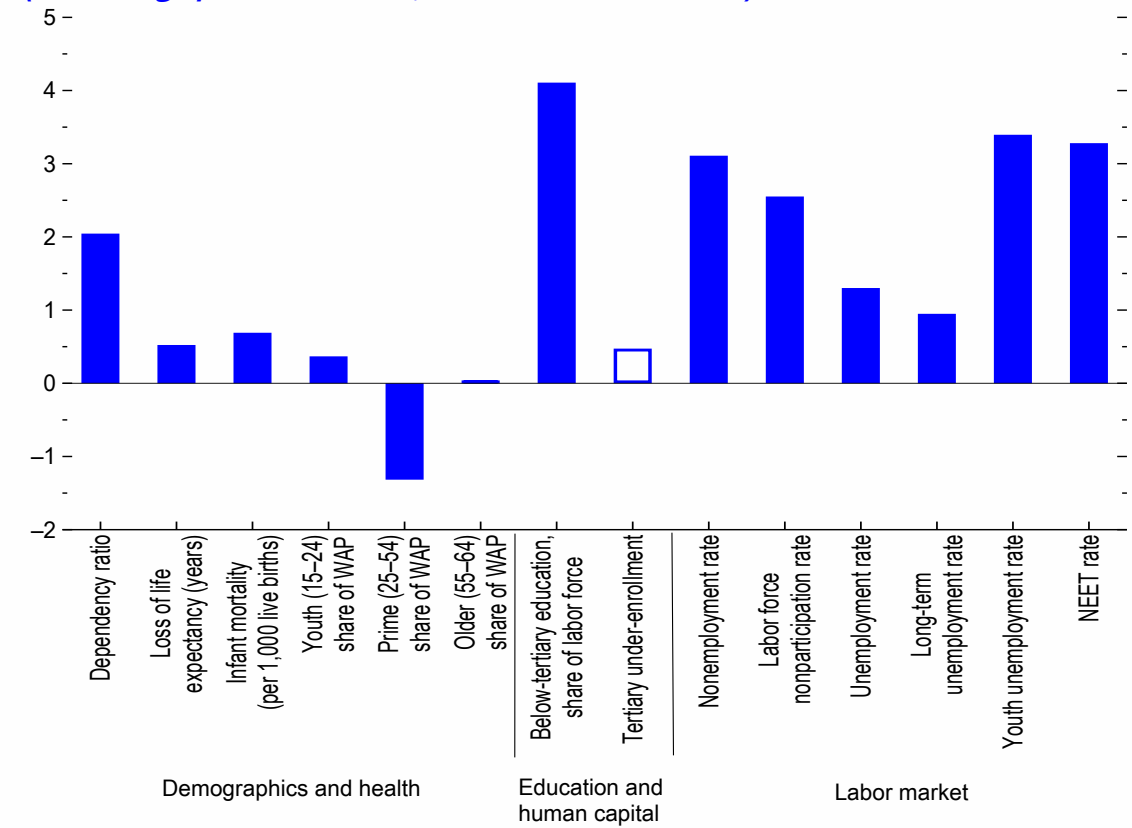


Sources: OECD Regional Database; and IMF staff calculations.

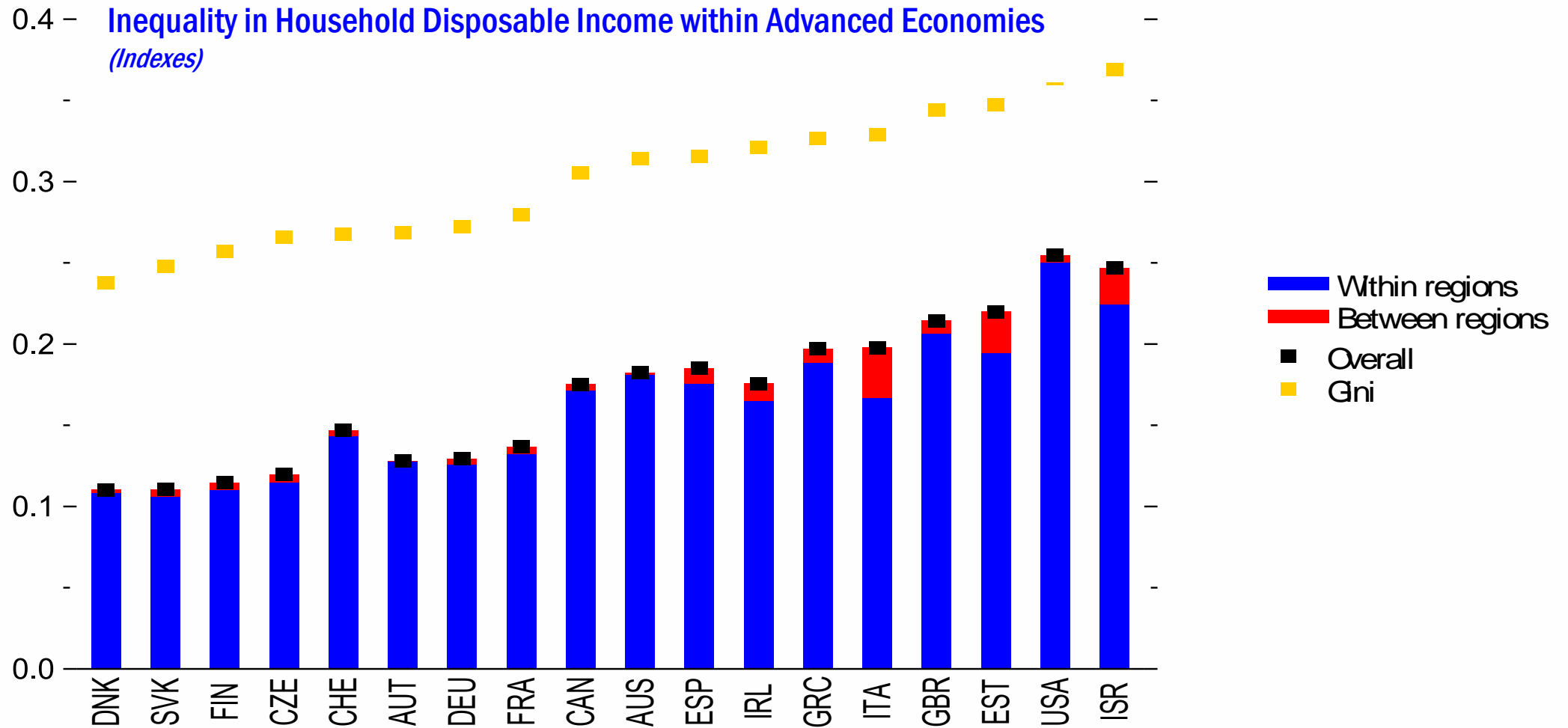
Note: Left figure shows the relationship between regional long-term unemployment rates and log regional real GDP per capita after controlling for country-year fixed effects, with dots showing the binned underlying data (Chetty, Friedman, and Rockoff 2014). Right figure shows the difference in lagging regions versus other regions for each of the variables after controlling for country-year fixed effects. Lagging regions in a country are defined as those with real GDP per capita below the country's regional median in 2000 and with average growth below the country's average over 2000–16. Solid bars indicate that the estimated coefficient on the lagging indicator is statistically significant at the 10 percent level.

## 2. Demographics and Labor Market Outcomes in AEs: Lagging versus Other Regions

(Percentage point difference, unless otherwise noted)



# Regional component of disposable income inequality is small – focus more on labor market outcomes



Sources: Luxembourg Income Study; and IMF staff calculations.

Note: The overall index shown is the generalized entropy index or the mean log deviation index of inequality. The income measure used is equivalized household disposable income (household income after tax and transfers transformed to account for household size differences), by country after 2008. The overall index is decomposed into two components: (1) inequality attributable to average income differences across regions (the between components), and (2) inequality attributable to income differences across households within regions, after adjusting for average regional income differences (the within component).

# Research questions

- **How different are advanced economies in the extent of regional disparities in economic activity?**
- **How do lagging regions—initially poorer regions within a country that have been failing to converge—compare with other regions in terms of sectoral mix of employment, productivity, and responses to structural changes?**
- **What are the regional labor market effects of local labor demand shocks—trade and technology shocks—in advanced economies?**
- **Do national policies and distortions play a role in regional disparities and adjustment in advanced economies?**

# Main findings

- **The extent of regional disparities differs markedly across advanced economies.**
- **Average lagging region's employment is more concentrated in agriculture and industry, and less in services, and labor productivity across sectors is lower in lagging regions than in others.**
- **Adverse trade and technology shocks affect more exposed regional labor markets, but only technology shocks tend to have lasting effects, with lagging regions more affected.**
- **National policies may ease adjustment and boost resilience.**
  - **Policies supporting more flexible labor markets associated with dampened unemployment rises to adverse shocks.**
  - **Policies supporting more open and flexible product markets associated with improved capital reallocation within and across regions.**

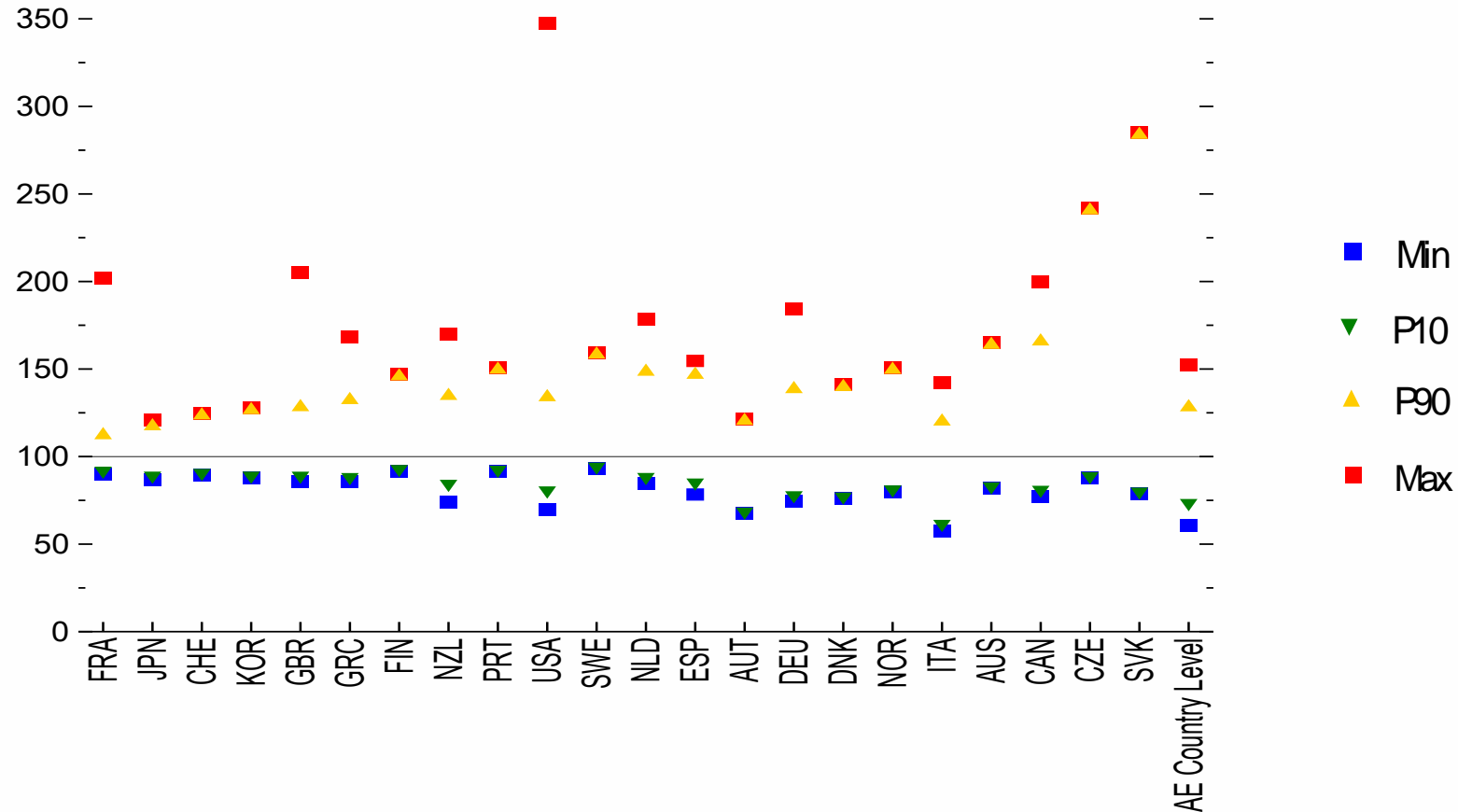
# How to think about within-country regional disparities

- Subnational regional performance – many of same drivers as countries (development accounting – Caselli 2005; Hsieh and Klenow 2010)
- But different context – subnational regions within a country share overarching institutional structure (political and economic)
- Subnational differences in real GDP per capita may be consistent with efficient resource allocation
  - Subnational differences in TFP and technology with multiple inputs, including human capital
  - Agglomeration economies (Krugman and Venables 1995)
- But may also reflect market imperfections and resource misallocation – which policies may ameliorate.
  - Sluggish or poor adjustment to shocks in some subnational regions
  - Frictions within and across subnational regions within a country to reallocation



# Extents of within-country regional disparities differ widely

Subnational Regional Disparities in Real GDP per Capita  
(Ratio to regional median times 100, 2013)

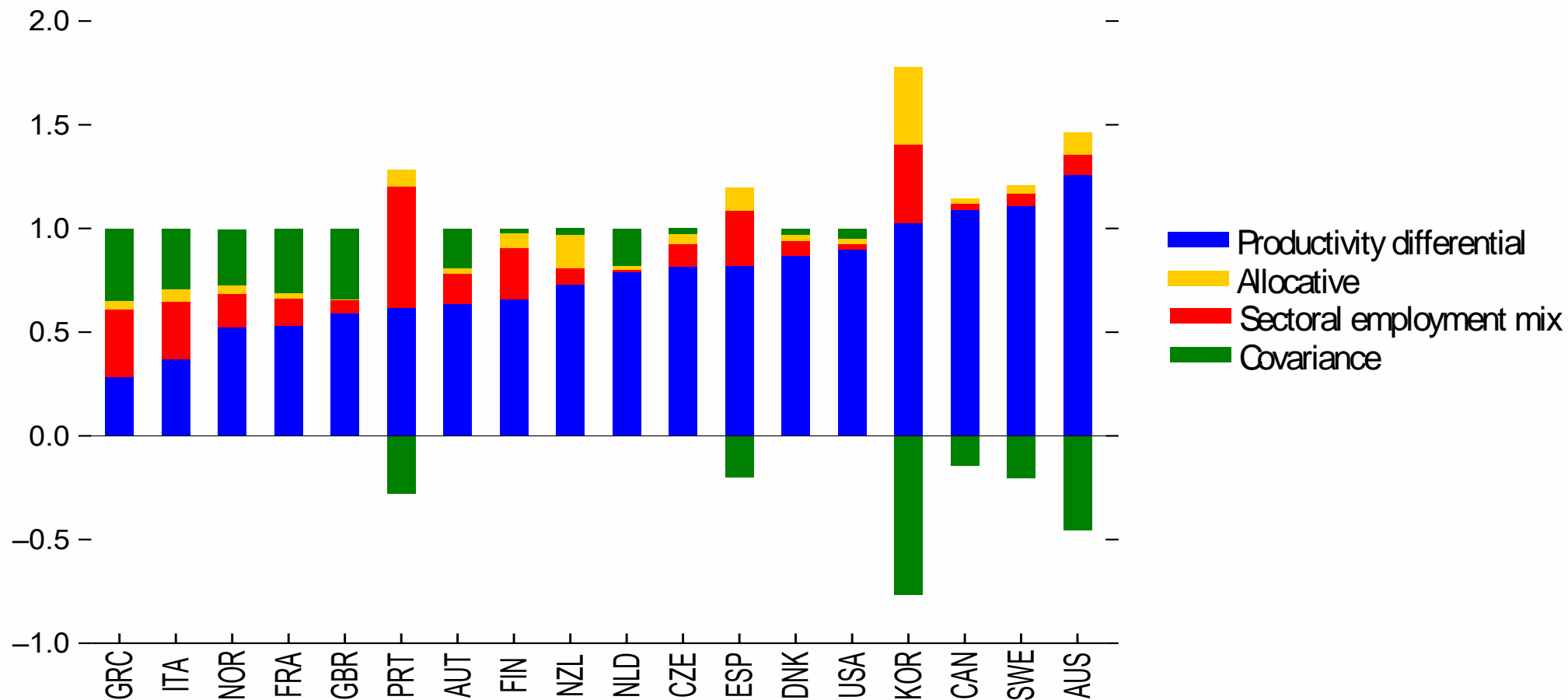


Sources: OECD Regional Database; and IMF staff calculations.

Note: P10(50, 90) indicates the 10(50, 90)th percentile of the regional real GDP per capita (purchasing power parity-adjusted) distribution within the country. Countries are sorted by the ratio of the within-country 90th percentile to the 10th percentile of regional real GDP per capita. National medians (P50) are normalized to 100, with other percentiles and the maximum and minimum shown relative to the median. Underlying regions are OECD territorial level 2 entities. The AE country level shows the corresponding quantiles calculated over the country-level sample of advanced economies.

# Intrinsic sectoral productivities account for much of regional variance, but sectoral employment mix also matters

Shift-Share Variance Decomposition in Regional Labor Productivities, by Country, 2003–14  
*(Share of overall average regional variance)*

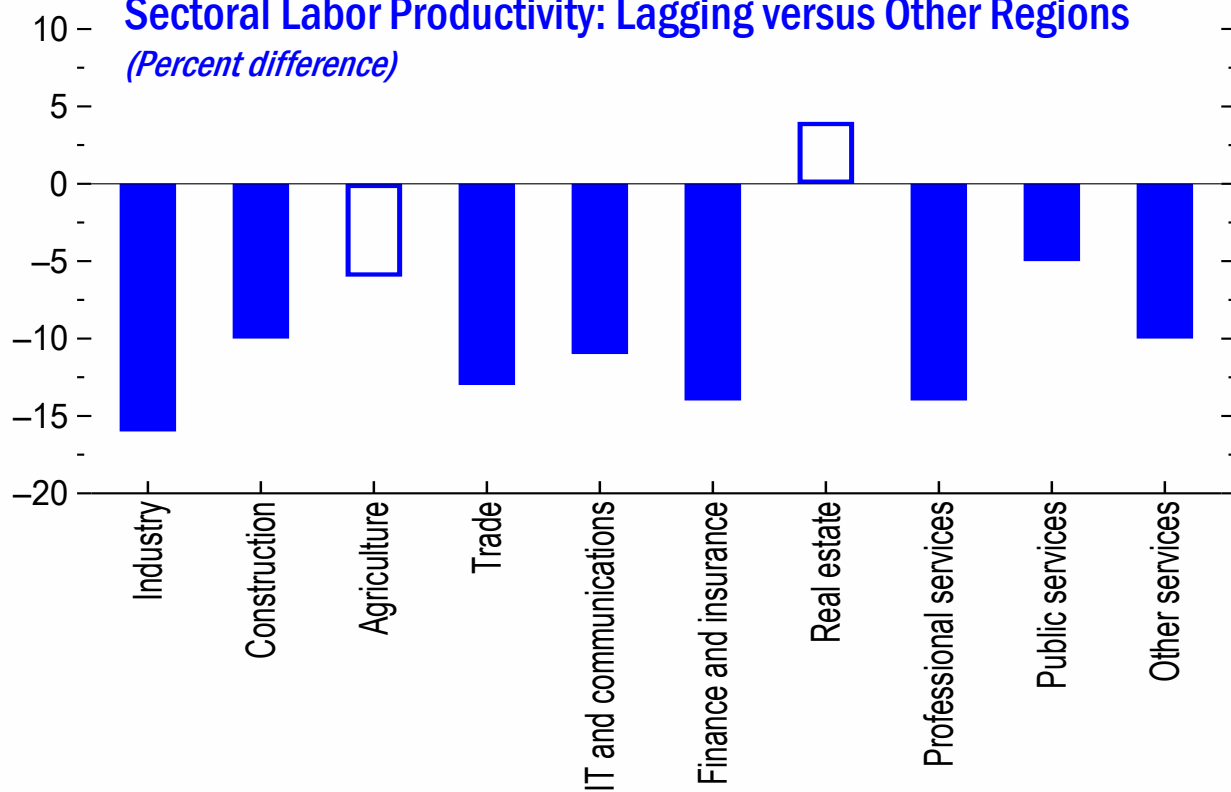


Sources: OECD Regional Database; and IMF staff calculations.

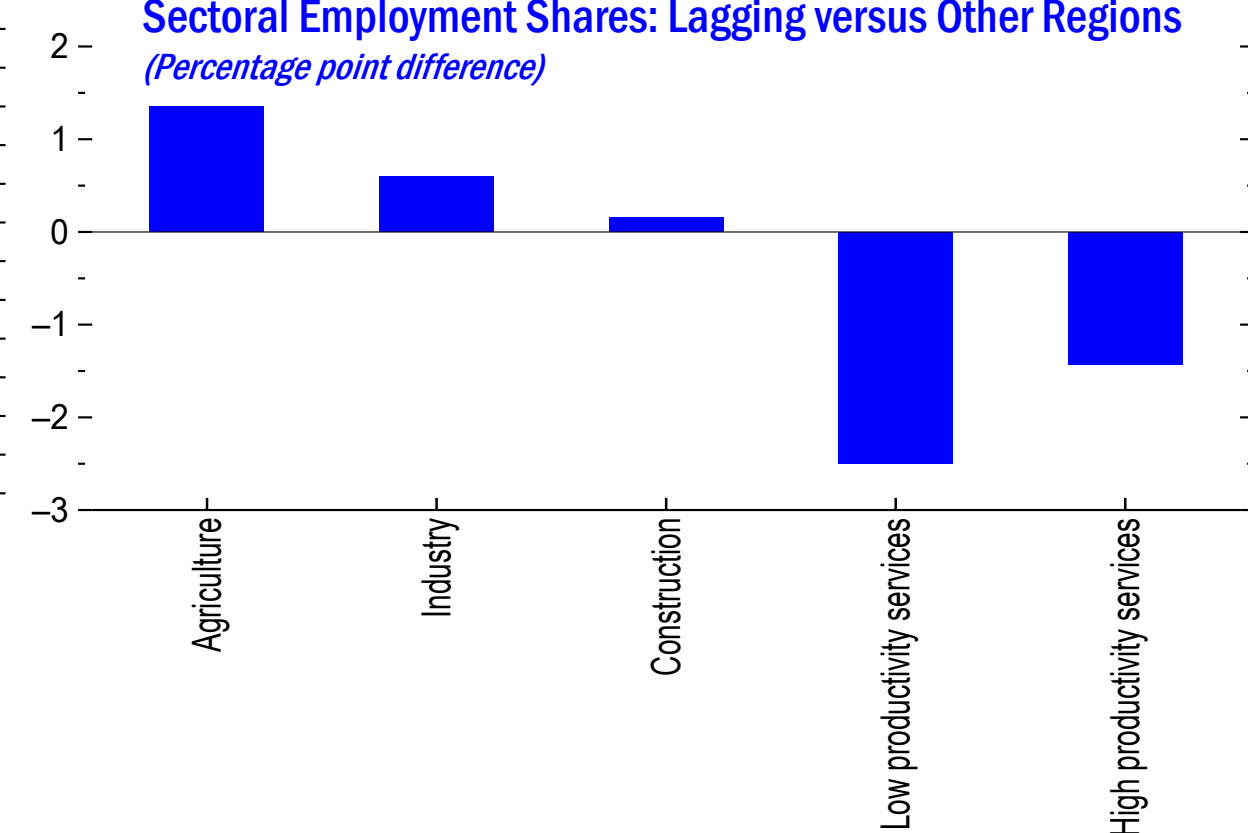
Note: The figure illustrates the shift-share analysis and variance decomposition for regional differences by country from Esteban (2000), sorted according to the share of the overall average regional variance explained by regional productivity differentials across sectors. For all countries, the 10-sector ISIC Revision 4 classification of the OECD regional database is used. Bars sum up to 1 (overall average regional variance by country).

# Lagging regions have lower productivity across sectors and greater employment in agriculture and industry

**Sectoral Labor Productivity: Lagging versus Other Regions**  
(Percent difference)



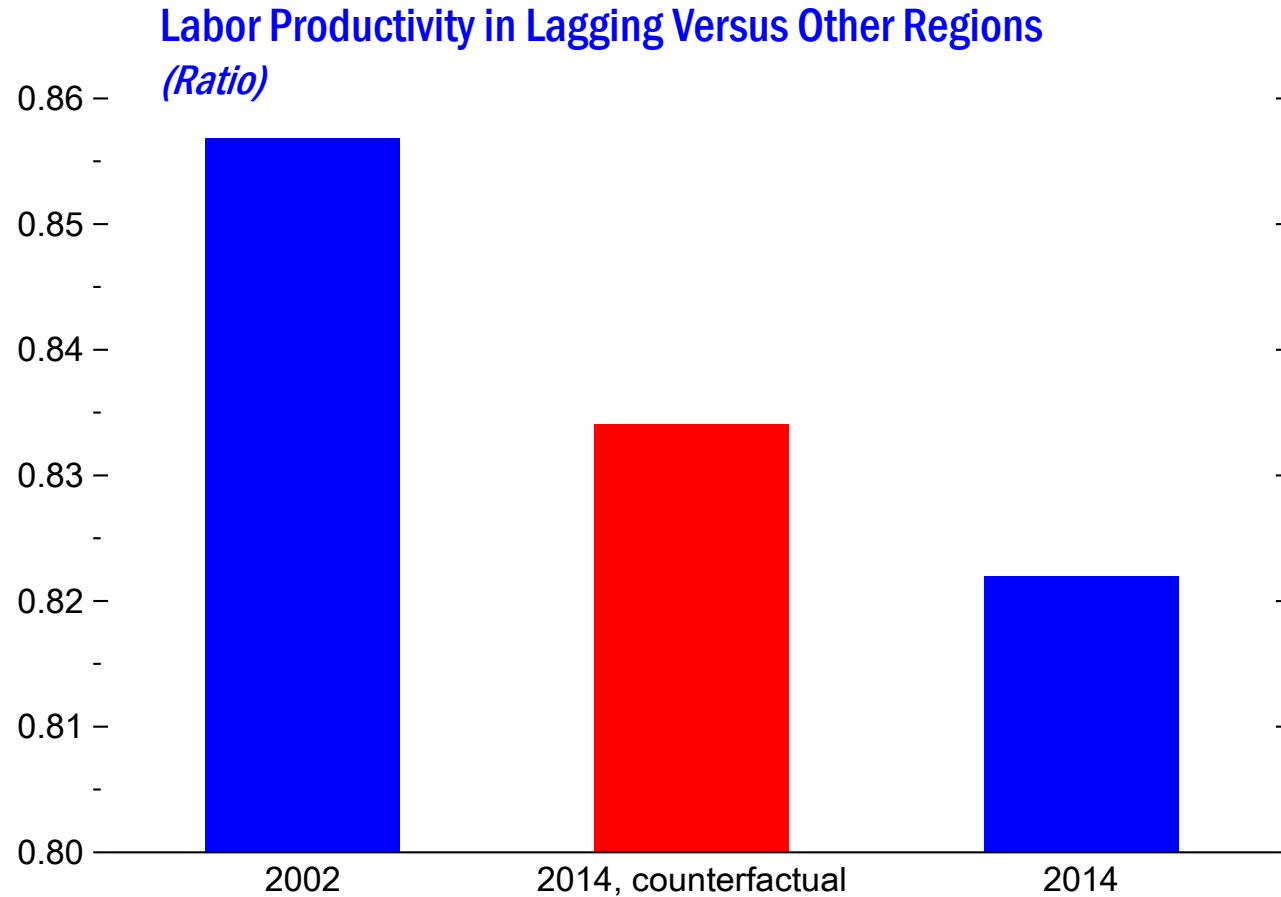
**Sectoral Employment Shares: Lagging versus Other Regions**  
(Percentage point difference)



Sources: OECD Regional Database; and IMF staff calculations.

Note: Lagging regions in a country are defined as those with real GDP per capita below the country's regional median in 2000 and with average growth below the country's average over 2000–16. Panel 1 shows the estimated difference in sectoral labor productivity in lagging versus other regions. All models control for country-year fixed effects with standard errors clustered at the country-year level. Solid bars indicate statistical significance at the 10 percent level while hollow bars do not. Panel 2 shows the estimated difference in sectoral employment shares between lagging and other regions. High productivity service sectors are finance and insurance, information technology and communications, and real estate. All other service sectors are low productivity service sectors.

# Average ratio of lagging to other regions' labor productivity fell: 1/3 due to worse labor reallocation across sectors



Sources: OECD Regional Database; IMF staff calculations.

Note: Bars show the average country ratio of labor productivity (defined as real gross value-added per worker) in lagging regions to that of other regions in 2002 and 2014 across advanced economies. In the counterfactual scenario, sectoral employment shares are held constant at their 2002 levels while sectoral productivities are set at their realized values. Lagging regions in a country are defined as those with real GDP per capita below the country's regional median in 2000 and with average growth below the country's average over 2000-16.

# Identifying import competition and automation shocks at the within-country regional level

- Trade and technology shocks may explain differences in subnational performance (Topalova 2007; Autor, Dorn, and Hanson 2013, 2015; Acemoglu and Restrepo 2018)
- Differences in initial industry mix across regions imply different exposures to trade and technology shocks (Bartik 1991; Blanchard and Katz 1992; Topalova 2007; Autor, Dorn, and Hanson 2013)
- **Trade:** Import competition from China (per worker) in external markets
  - $\Delta IPW_{r,c,t} = \sum_s \frac{L_{r,c,s,2000}}{L_{r,c,2000}} \frac{\Delta M_{o,s,t}}{L_{c,s,2000}}$ , where  $\Delta M_{o,s,t}$  is the difference in log imports from China in external markets
- **Technology:** Vulnerability to automation and a decline in the relative price of machinery and equipment capital
  - $\Delta RTM_{r,c,t} = \sum_s \frac{L_{r,c,s,t}}{L_{r,c,t}} RTI_{c,s} \frac{\Delta P_{c,t}}{P_{c,t-1}}$ , where RTI is the routinization index, and  $\Delta P_{c,t}/P_{c,t-1}$  is the growth of the relative price of machinery and equipment capital goods

# Econometric strategy and model specification

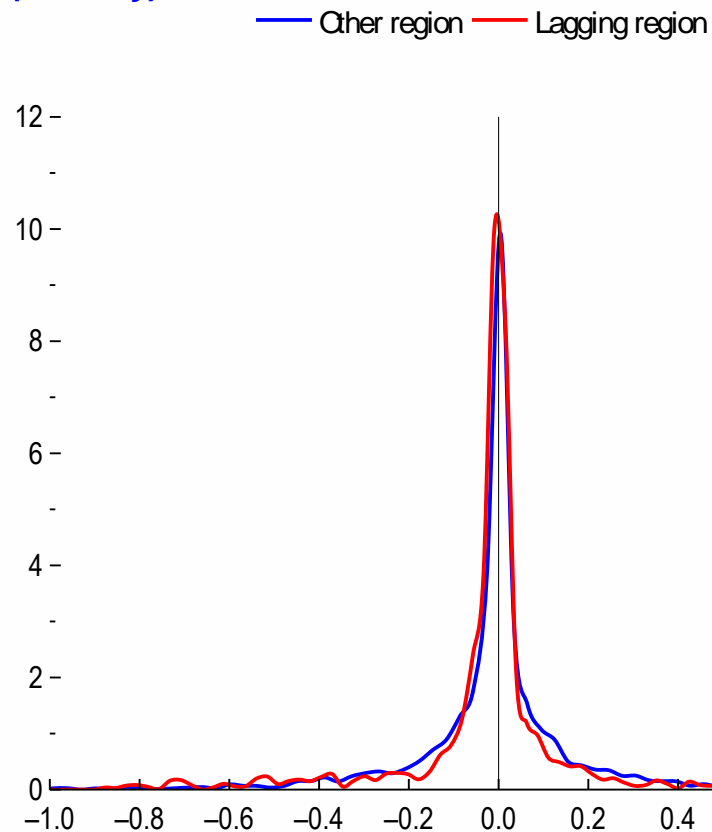
- Local projection approach to modeling impulse responses (Jorda 2005).
- For a region  $r$  in country  $c$  in year  $t$ , the regional employment and labor force participation response  $h$  periods after a shock is given by the coefficient  $\beta_h$ :

$$y_{r,c,t+h} - y_{r,c,t-1} = \beta_h z_{r,c,t} + \gamma' X_{r,c,t} + \alpha_{r,c,h} + \alpha_{t,h} + \epsilon_{r,c,h,t}$$

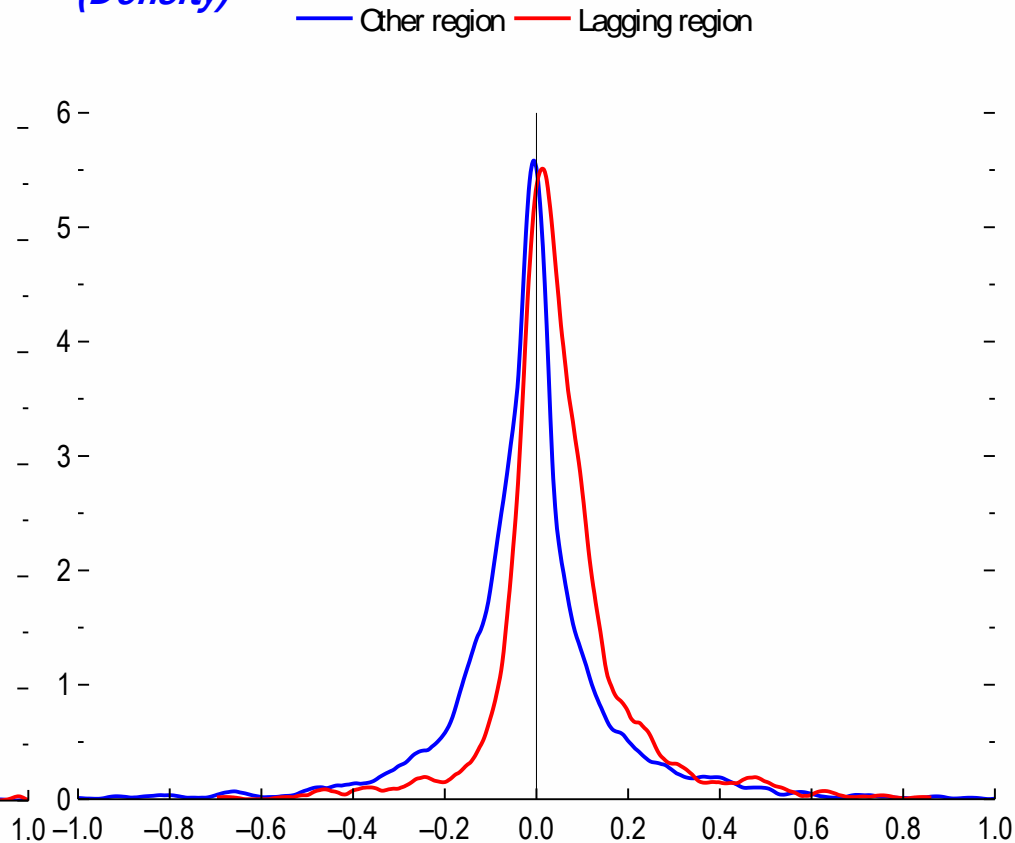
- $y$  is outcome of interest (unemployment rate or labor force participation rate)
- $\beta$  is the response at horizon  $h$  to the shock  $z$  (import competition or automation)
- $X$  controls include lagged log regional real GDP per capita, lagged log national real GDP per capita, lagged log population density
- $\alpha$  are region and year fixed effects
- Estimation sample of 20-30 countries at TL2 level from the OECD Regional Database, from 2000-2014

# Lagging regions actually slightly less likely to be hit by adverse trade and technology shocks

## Import Competition (Density)



## Automation (Density)

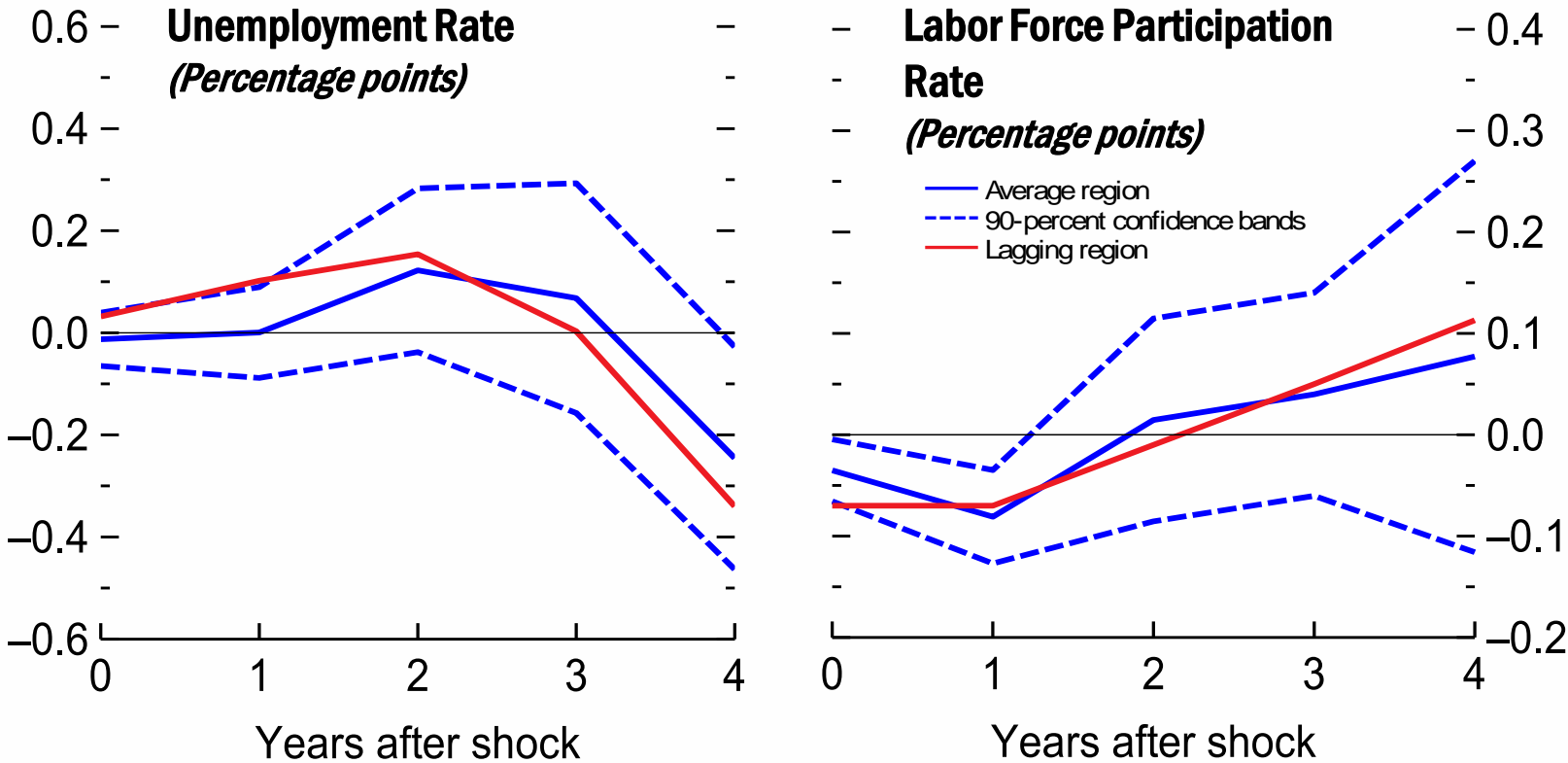


Sources: OECD Regional Database; and IMF staff calculations.

Note: Figures show the kernel densities of the residuals from a regression of the indicated shocks on country-year fixed effects, according to whether or not the shocks were to a lagging or other region. Lagging regions in a country are defined as those with real GDP per capita below the country regional median in 2000 and with average growth below the country's growth over 2000–16. A Kolmogorov-Smirnov test of the difference in the distributions of shocks for lagging versus others is statistically significant and indicates milder adverse shocks (import competition or automation) for lagging regions on average.

# Trade shock effects not different between lagging and other regions, with limited regional labor market impacts

## Import Competition Shock



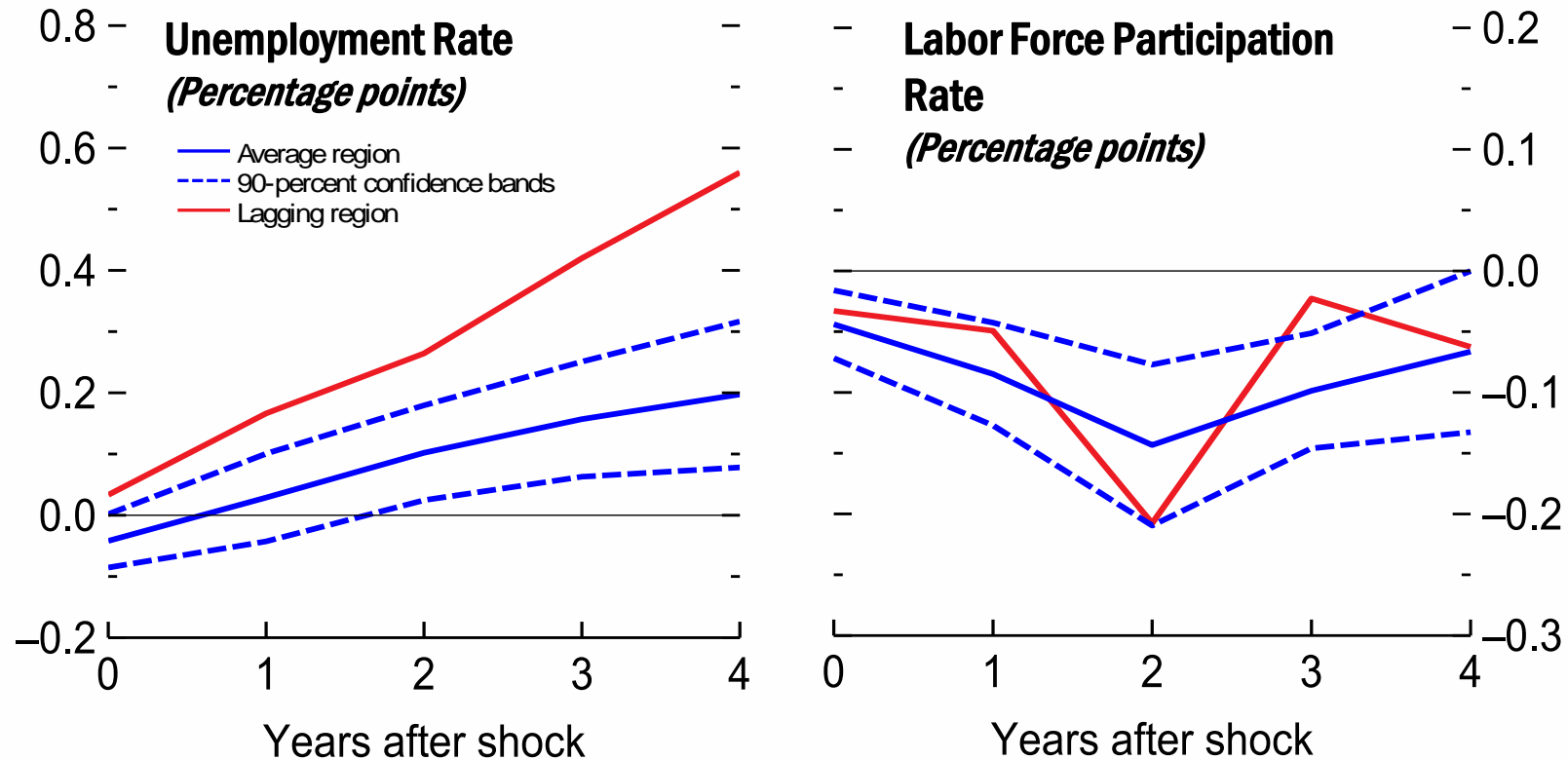
Sources: IMF staff calculations.

Note: The blue and red solid lines plot the impulse responses of the indicated variable to a one standard deviation import competition shock, defined as the difference in log Chinese imports per worker in external markets weighted by the lagged regional employment mix. Impulse responses are estimated using the local projection method of Jordà (2005). Horizon 0 is the year of the shock. Lagging regions in a country are defined as those with real GDP per capita below the country's regional median in 2000 and with average growth below the country's average over 2000-16.



# Technology shocks have marked regional labor market effects, with lagging regions more impacted on average

## Automation Shocks



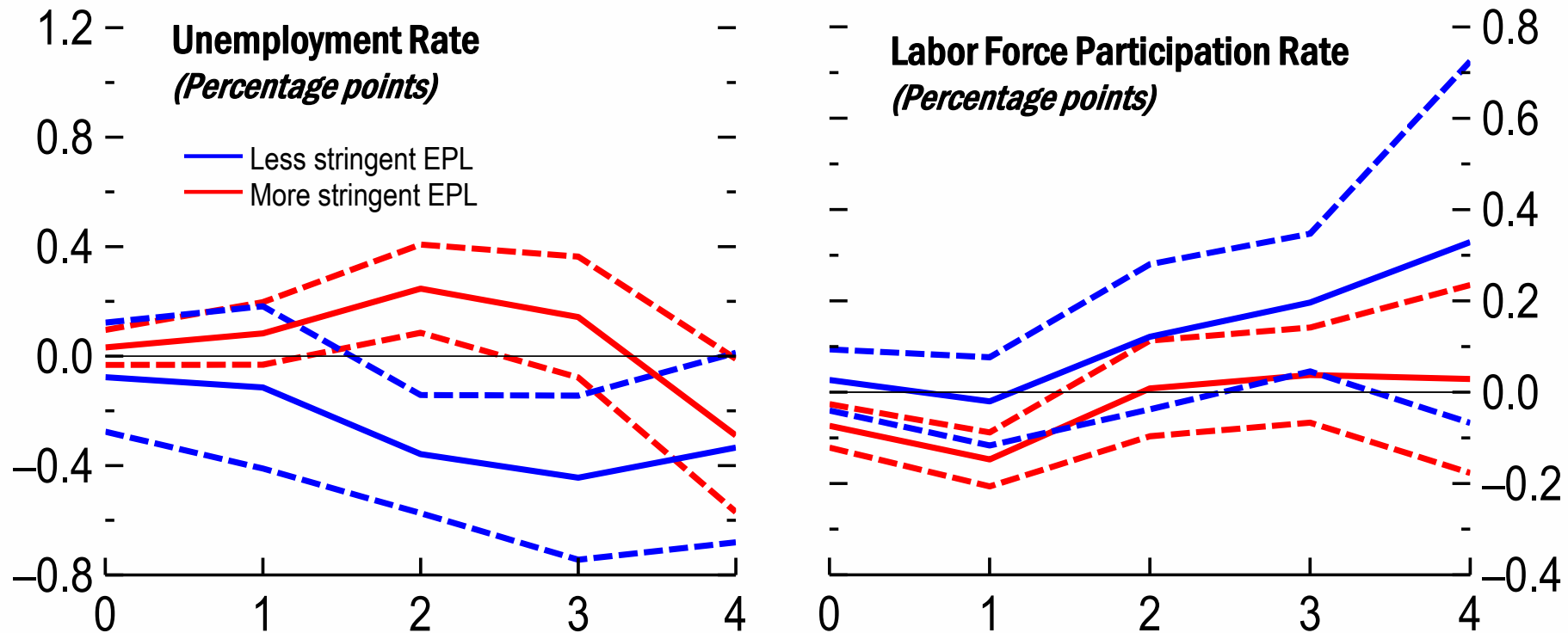
Sources: IMF staff calculations.

Note: The blue and red solid lines plot the impulse responses of the indicated variable to an automation shock, defined as a one standard deviation decline in machinery and equipment capital price growth for a region that experiences a one standard deviation rise in its vulnerability to automation (Autor and Dorn 2013; Lian and others 2019). Horizon 0 is the year of the shock. Lagging regions in a country are defined as those with real GDP per capita below the country's regional median in 2000 and with average growth below the country's average over 2000–16.

# More stringent employment protection regulations exacerbate adverse impact of trade shocks...

## Employment Protection Legislation

### Import Competition Shock



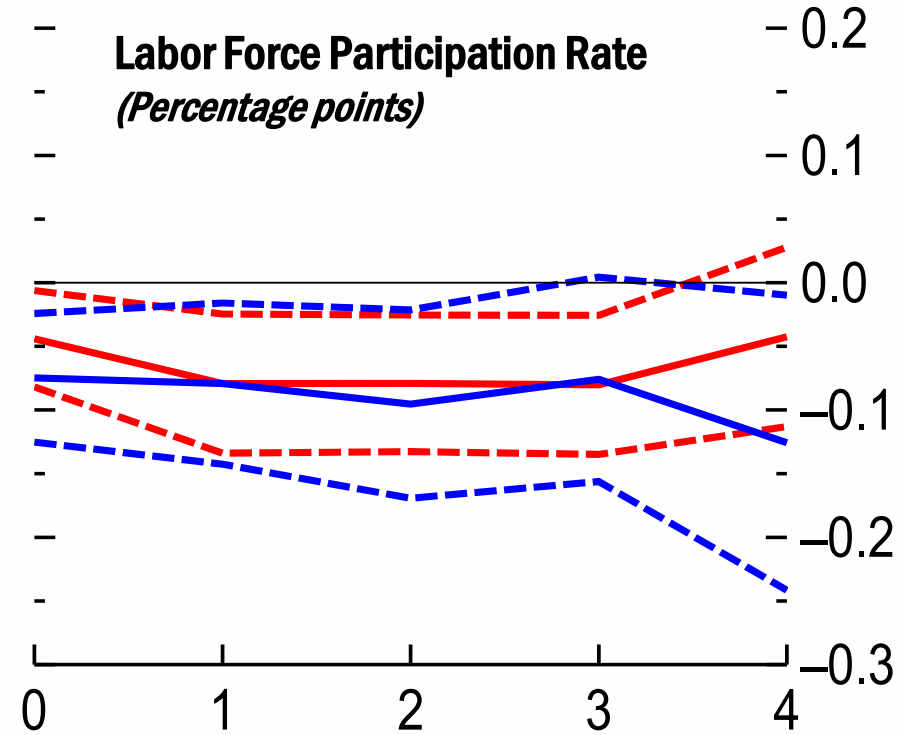
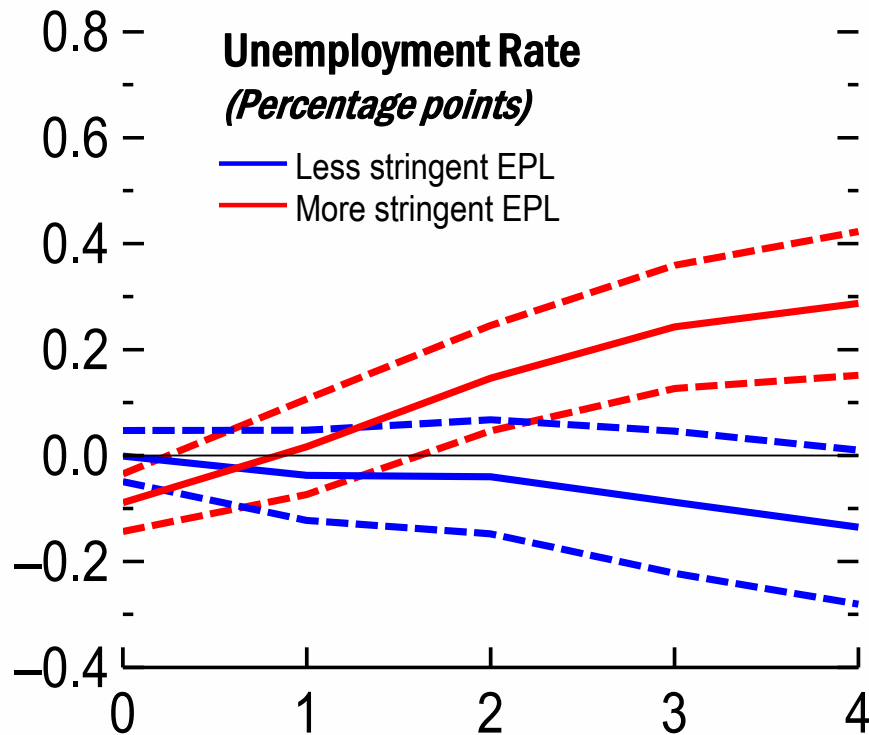
Sources: IMF staff calculations.

Note: Years after impact on x-axis. Less (more) stringent/low (high) = 25th (75th) percentile of the indicated variable. Dashed lines indicate the 90 percent confidence bands.

# ...and technology shock effects on unemployment

## Employment Protection Legislation

### Automation Shock



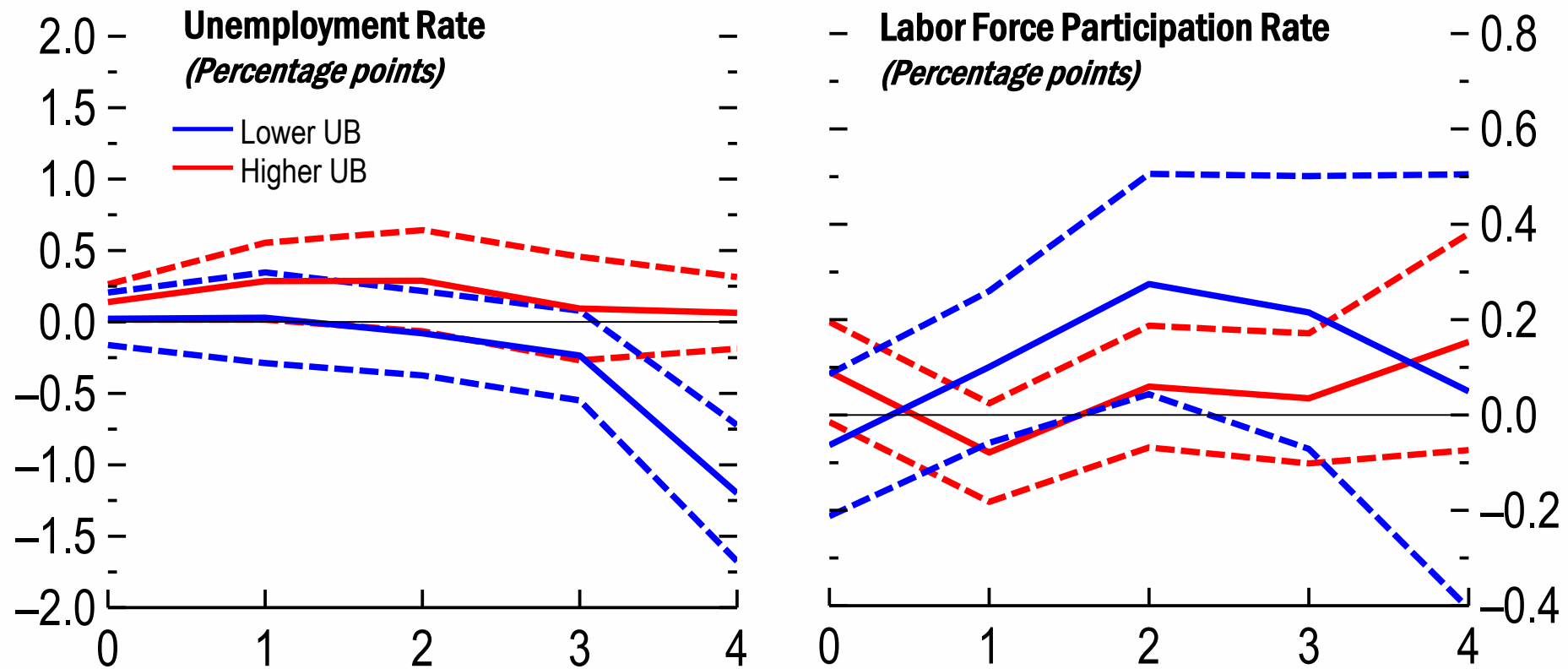
Sources: IMF staff calculations.

Note: Years after impact on x-axis. Less (more) stringent/low (high) = 25th (75th) percentile of the indicated variable. Dashed lines indicate the 90 percent confidence bands.

# No strong difference in trade shock effects between higher versus lower unemployment benefit regimes...

## Unemployment Benefits

### Import Competition Shock

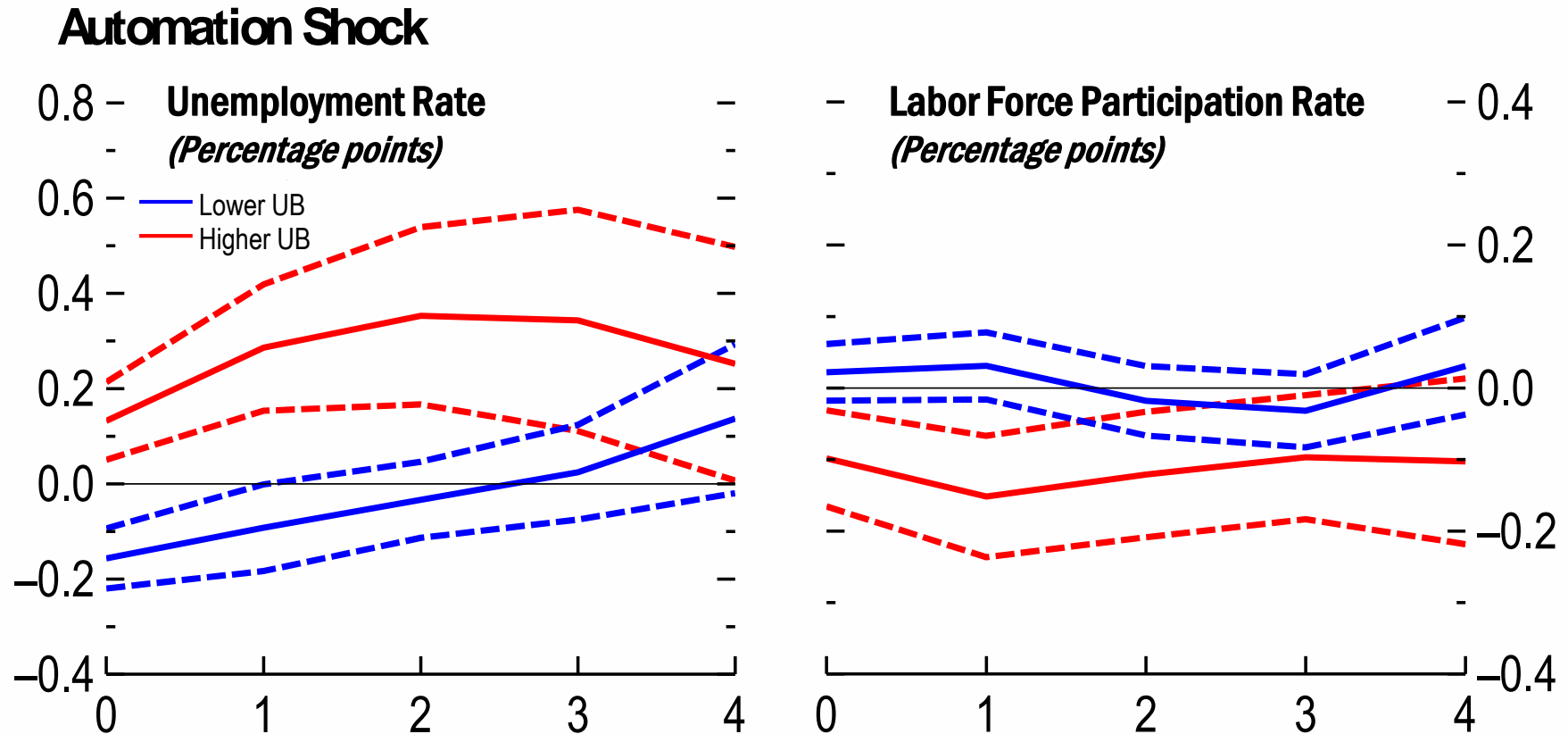


Sources: IMF staff calculations.

Note: Years after impact on x-axis. Less (more) stringent/low (high) = 25th (75th) percentile of the indicated variable. Dashed lines indicate the 90 percent confidence bands.

# ... but worse effects from automation shocks when benefits are higher

## Unemployment Benefits

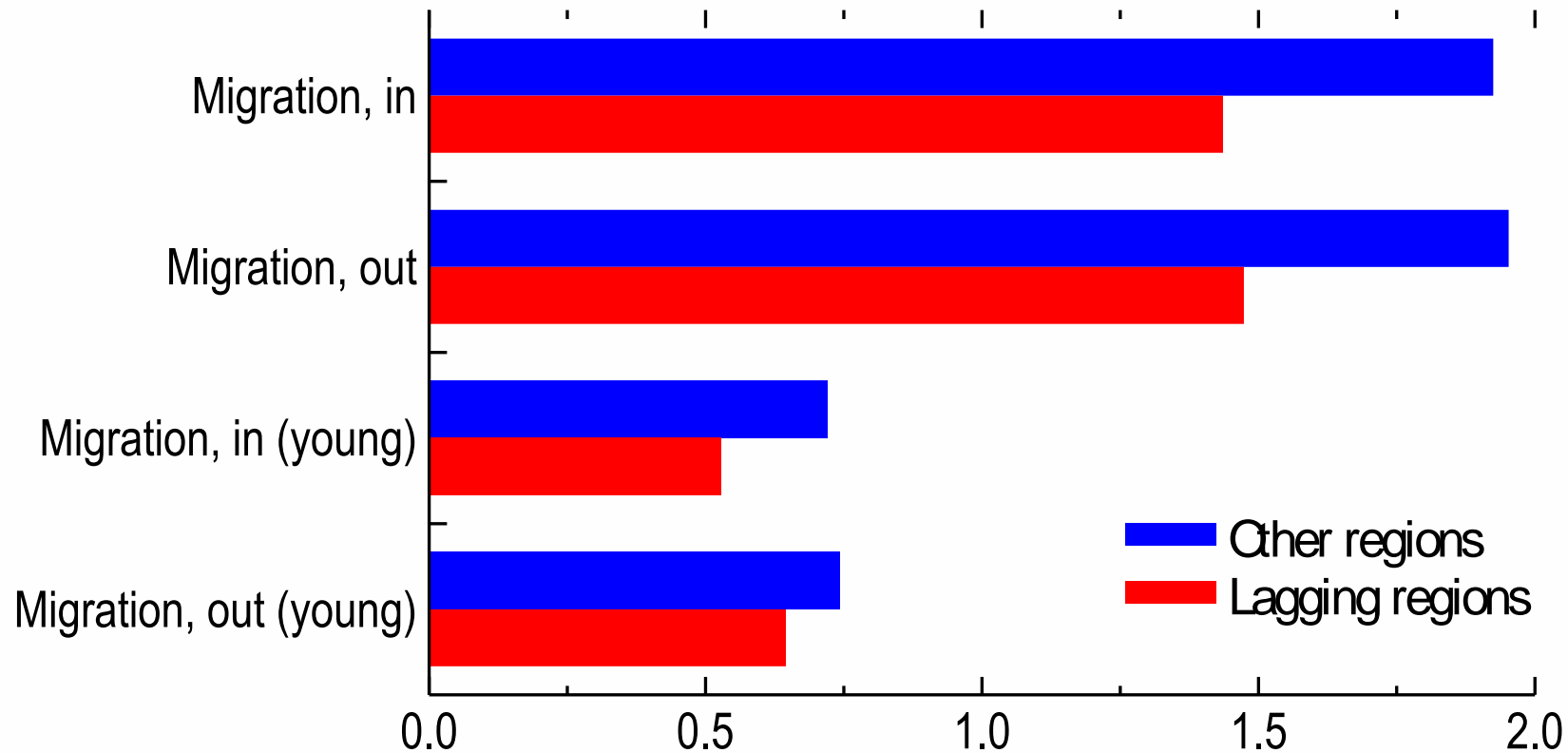


Sources: IMF staff calculations.

Note: Years after impact on x-axis. Less (more) stringent/low (high) = 25th (75th) percentile of the indicated variable. Dashed lines indicate the 90 percent confidence bands.

# Lagging regions had less dynamic migration flows

Migration into and out of Lagging and Other Regions  
(Percent of population)

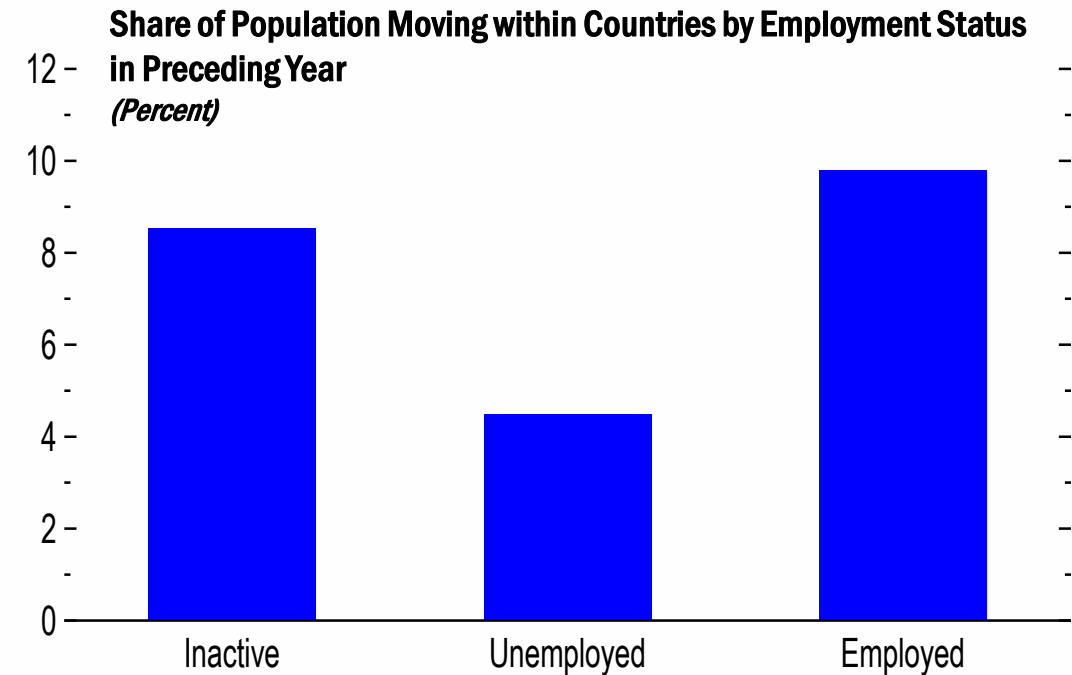
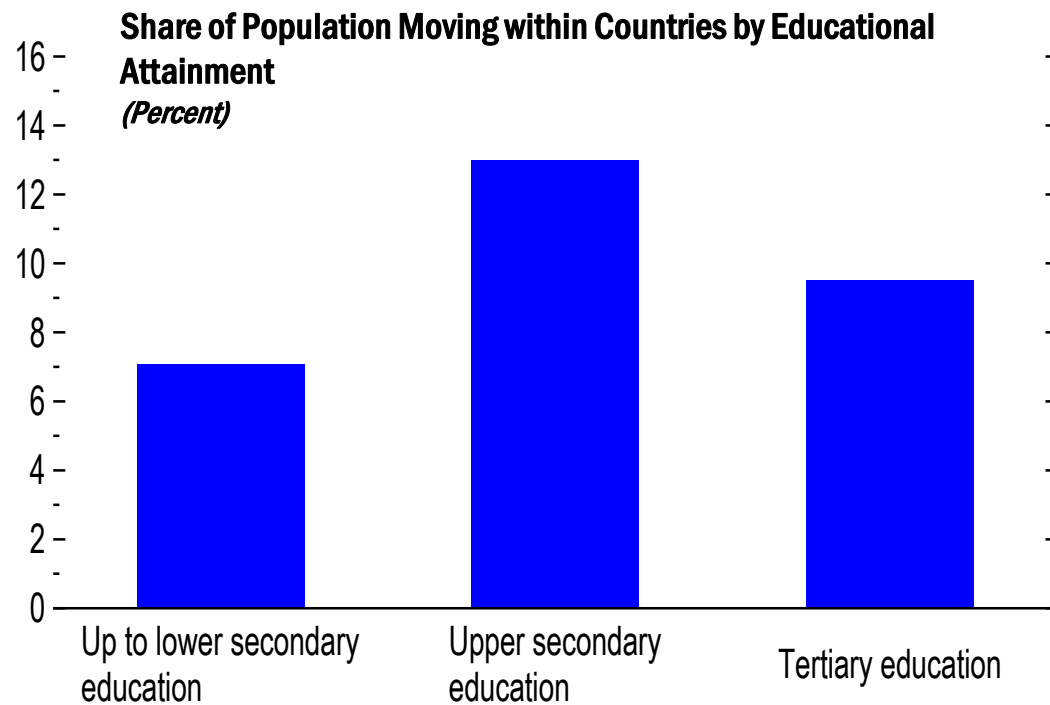


Sources: OECD Regional Database; and IMF staff calculations.

Note: This figure shows migration into and out of lagging regions versus other regions between 2000–16, defined as gross inflows and outflows of migrants divided by the population in the previous period in the region. Lagging regions in a country are defined as those with real GDP per capita below country regional median in 2000 and with average growth below the country's average over 2000–16.

# Higher-skilled workers and the employed are more mobile

## Subnational Region Migration and Labor Mobility



Sources: European Union (EU) Labor Force Survey; and IMF staff calculations.

Note: Left figure plots the share of the population who moved within the past year by education level, based on individual worker level data from the EU Labor Force Survey between 2000–16. Lower secondary education indicates educational attainment less than 9 years, upper secondary education between 9 and 12 years, and tertiary education greater than 12 years. Right figure plots the share of the population who moved within the past year by employment status, based on individual worker level data from the EU Labor Force Survey between 2000–16.

# Regional differences and factor allocation: analytical approach to allocative efficiency at the firm-level

- Subnational differences in performance may partly reflect differences in firms' allocative efficiency across regions.
- Estimate sensitivities of firm-level capital growth to its marginal revenue product by subnational region and sector

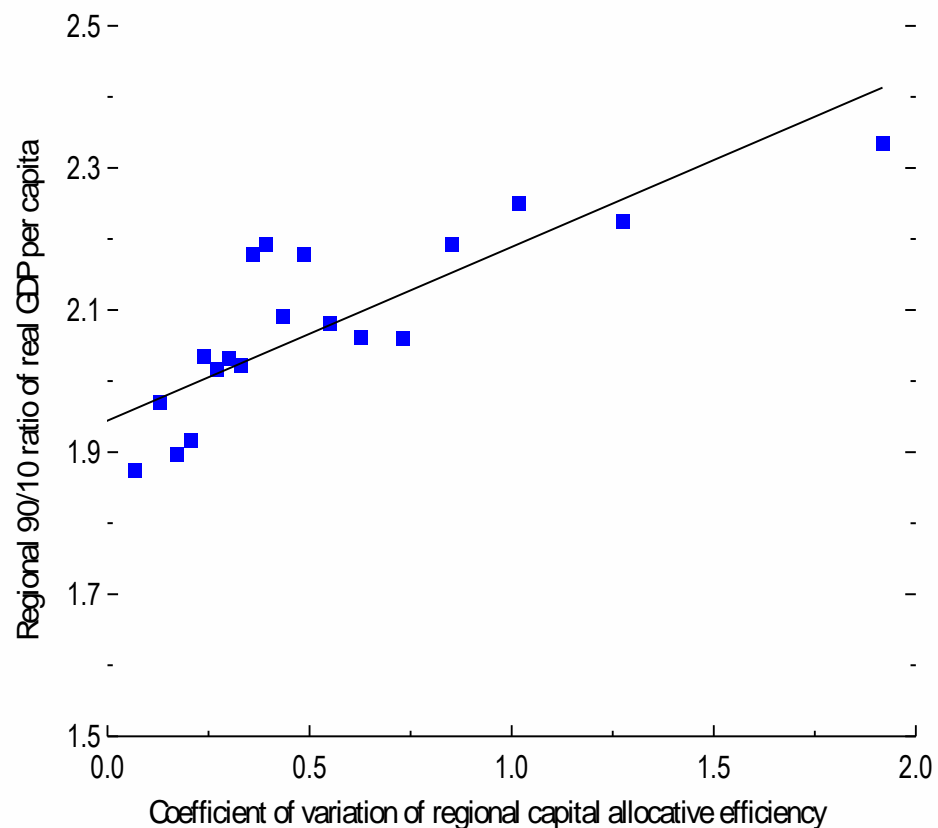
$$\Delta Y_{i,t} = \beta_{r,c,s,t} \cdot MP_{i,t-1} + \alpha_{r,c,s,t} + \alpha_i + \epsilon_{i,t}$$

- $\Delta Y$  is log difference of capital stock
- $\alpha_i$  is a firm fixed effect,  $\alpha_{r,c,s,t}$  is a region-country-sector-time fixed effect
- $MP$  is the marginal revenue product of capital, defined as the log of value added divided by capital (Hsieh and Klenow 2009)
- $\beta_{r,c,s,t}$  reflects the average sensitivity of capital growth to its marginal product across all firms within each region-country-sector-year
- 2,580,600 firms from 24 countries from 1985 to 2016 in 264 regions in 10 sectors
- Examine distribution of subnational  $\beta_{r,c,s,t}$  by country – focus on coefficient of variation.



# Cross-region dispersion in capital allocation efficiency is associated with regional disparity and can be influenced by national policies

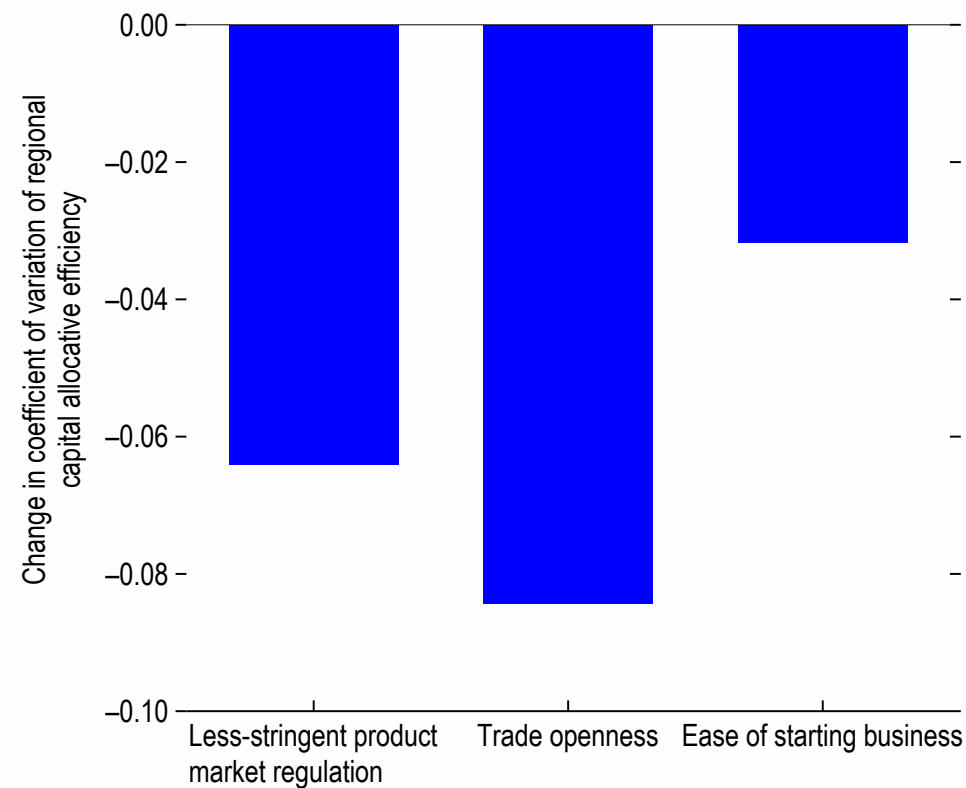
## Regional Disparity and Regional Variation in Capital Allocative Efficiency



Sources: OECD Regional Database; Orbis; and IMF staff calculations.

Note: The figure illustrates the relationship between regional 90/10 ratios of real GDP per capita and the coefficient of variation of regional capital allocative efficiency after controlling for country-sector-year fixed effects (regression binned scatterplot; Chetty, Friedman, and Rockoff 2014).

## Impact of National Policies on Cross-region Variation in Allocative Efficiency



Source: IMF staff calculations.

Note: Bars show the associated average change in the coefficient of variation of regional capital allocative efficiency, calculated by country-sector-year, for a one standard deviation change in the indicated structural policy variable. All effects shown are statistically significant at the 10 percent level.

# Summary of Findings

- **Subnational disparities rose and the regional convergence slowed in recent decades in AEs.**
- **Lagging regions within countries:**
  - tend to have worse health, education, and labor market outcomes.
  - typically have lower productivity across sectors and higher shares of employment in agriculture and industry.
- **Persistent local labor demand shocks, especially technology shocks, may play a role in the gap between lagging versus others.**
- **National policies supporting more flexible labor markets may dampen adverse responses to both trade and technology shocks. Policies supporting more open and flexible markets associated with smaller within country variation in allocative efficiency and subnational performance.**

# Policy implications

- **Improve education and health policies, which enhance human capital quality and benefit lagging regions disproportionately.**
- **Recalibrate labor and product market regulations to support greater flexibility and openness, enhancing resilience to adverse local labor demand shocks and improving capital allocation.**
  - **Greater flexibility can be accompanied by active labor market policies that strengthen retraining and job assistance to help ensure displaced workers reskilled and reemployed.**
- **Place-based fiscal policies may play a role in narrowing differences, but have to be carefully designed to create new economic activity rather than simply relocate it from elsewhere.**



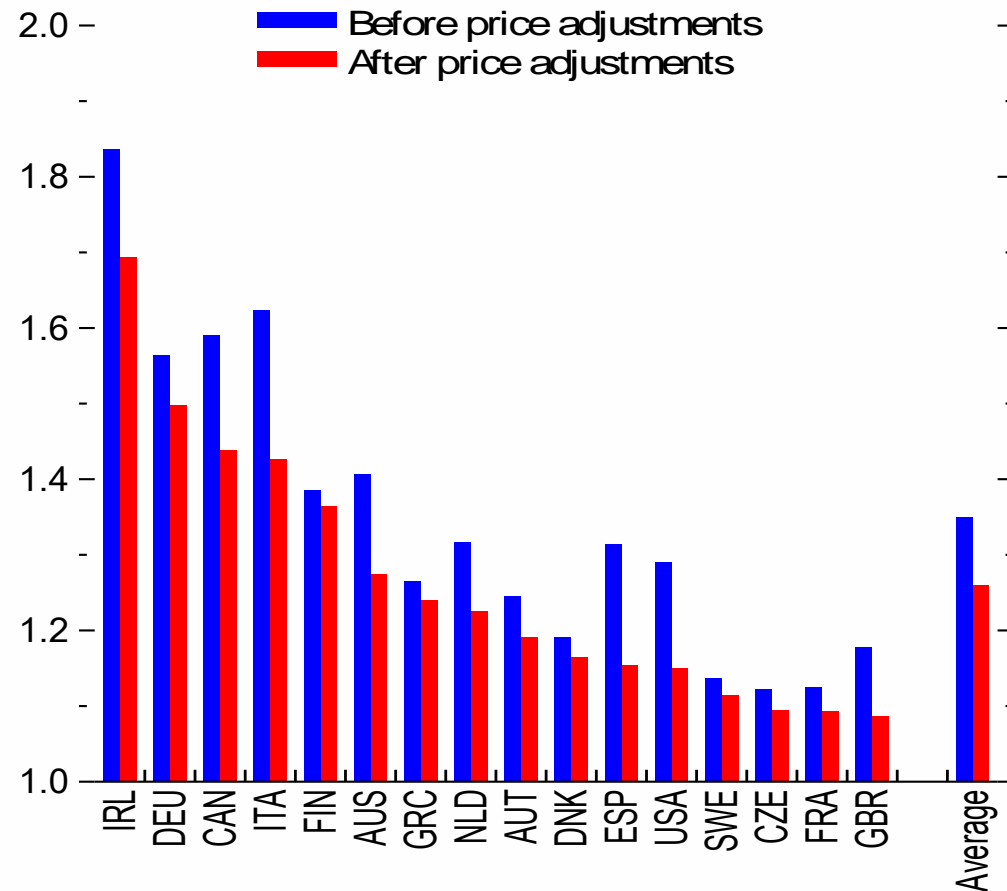
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**THANK YOU!**

# Even after adjusting for regional price differences, regional disparities remain substantial

## Subnational Regional Disparities: Before and after Regional Price Adjustment

*(Ratio for the interquartile range of real GDP per capita across subnational regions by country during 2010–14)*

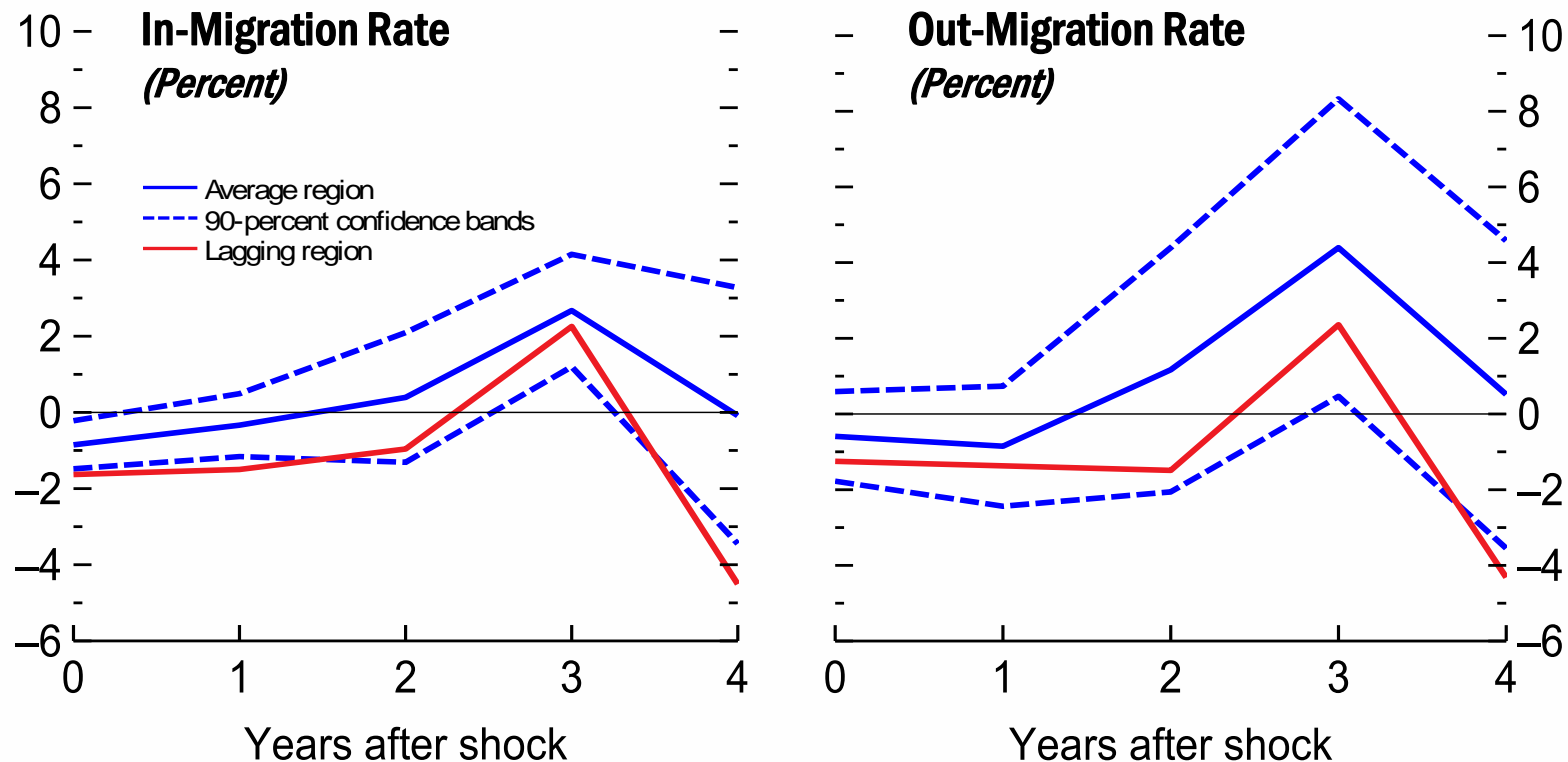


Source: Gbohoui, Lam, and Lledo (2019).

Note: Constructed from Organization for Economic Co-operation and Development Regional Database, Gennaioli and others (2014), and Luxembourg Income Study for available years. The price adjustment is based on the housing deflator.

# Little difference in impact of import competition shocks on lagging regions

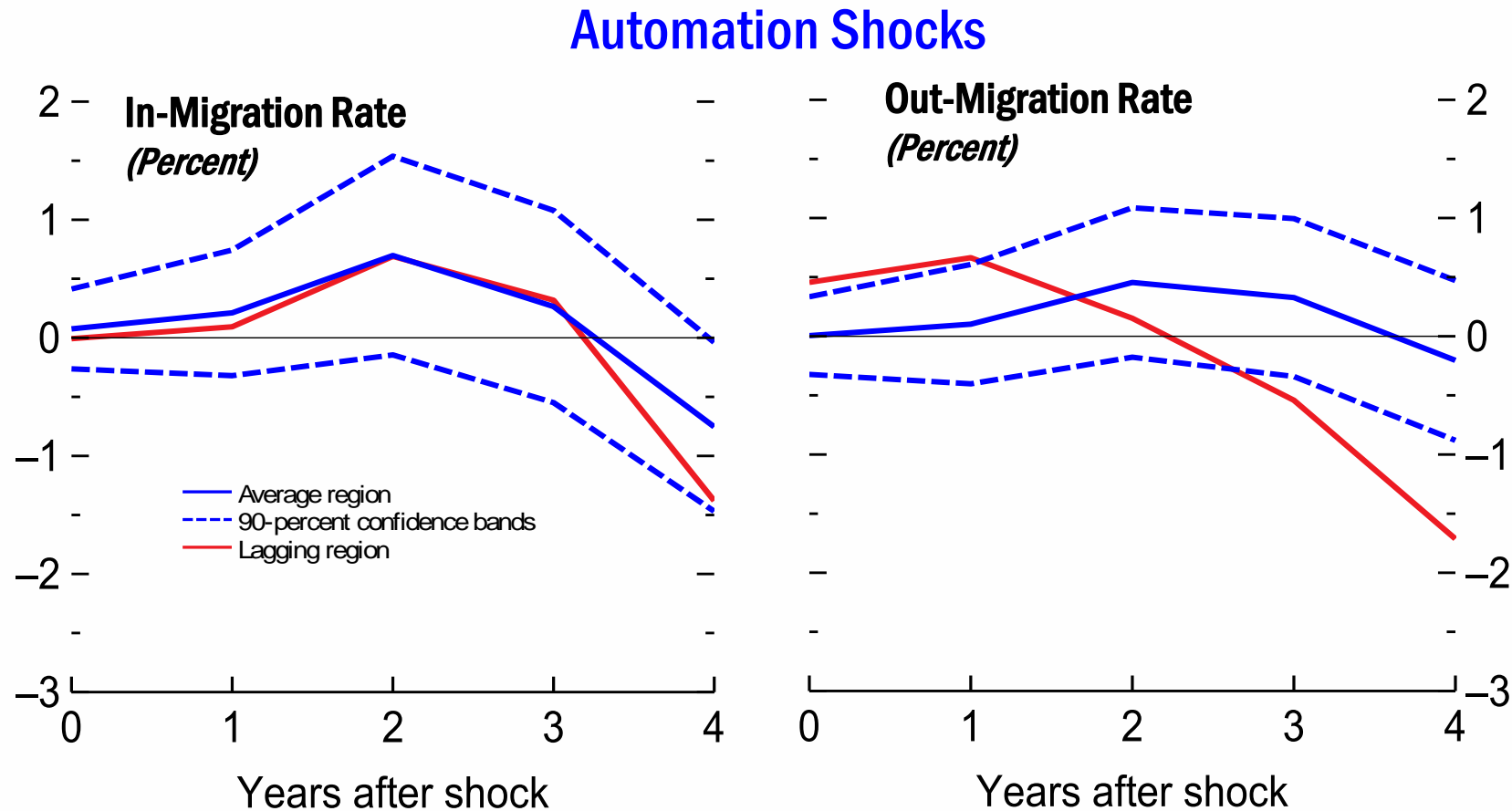
## Import Competition Shock



Sources: IMF staff calculations.

Note: The blue and red solid lines plot the impulse responses of the indicated variable to a one standard deviation import competition shock, defined as the growth of Chinese imports per worker in external markets weighted by the lagged regional employment mix. Impulse responses are estimated using the local projection method of Jordà (2005). Horizon 0 is the year of the shock. Lagging regions in a country are defined as those with real GDP per capita below the country's regional median in 2000 and with average growth below the country's average over 2000–16. See Online Annex 2.1 for the country sample and Online Annex 2.5 for further details about the shock definition and econometric specification.

# Automation shocks led to lower out-migration from lagging regions



Sources: IMF staff calculations.

Note: The blue and red solid lines plot the impulse responses of the indicated variable to an automation shock, defined as a one standard deviation decline in machinery and equipment capital price growth for a region that experiences a one standard deviation rise in its vulnerability to automation (Autor and Dorn 2013; Lian and others 2019). Horizon 0 is the year of the shock. Lagging regions in a country are defined as those with real GDP per capita below the country's regional median in 2000 and with average growth below the country's average over 2000–16. See Online Annex 2.1 for the country sample and Online Annex 2.5 for further details about the shock definition and econometric specification.