THE RISE OF CORPORATE MARKET POWER AND ITS MACROECONOMIC EFFECTS
APRIL 2019 IMF WEO CHAPTER 2

ROMAIN DUVAL
ADVISOR TO THE CHIEF ECONOMIST
INTERNATIONAL MONETARY FUND

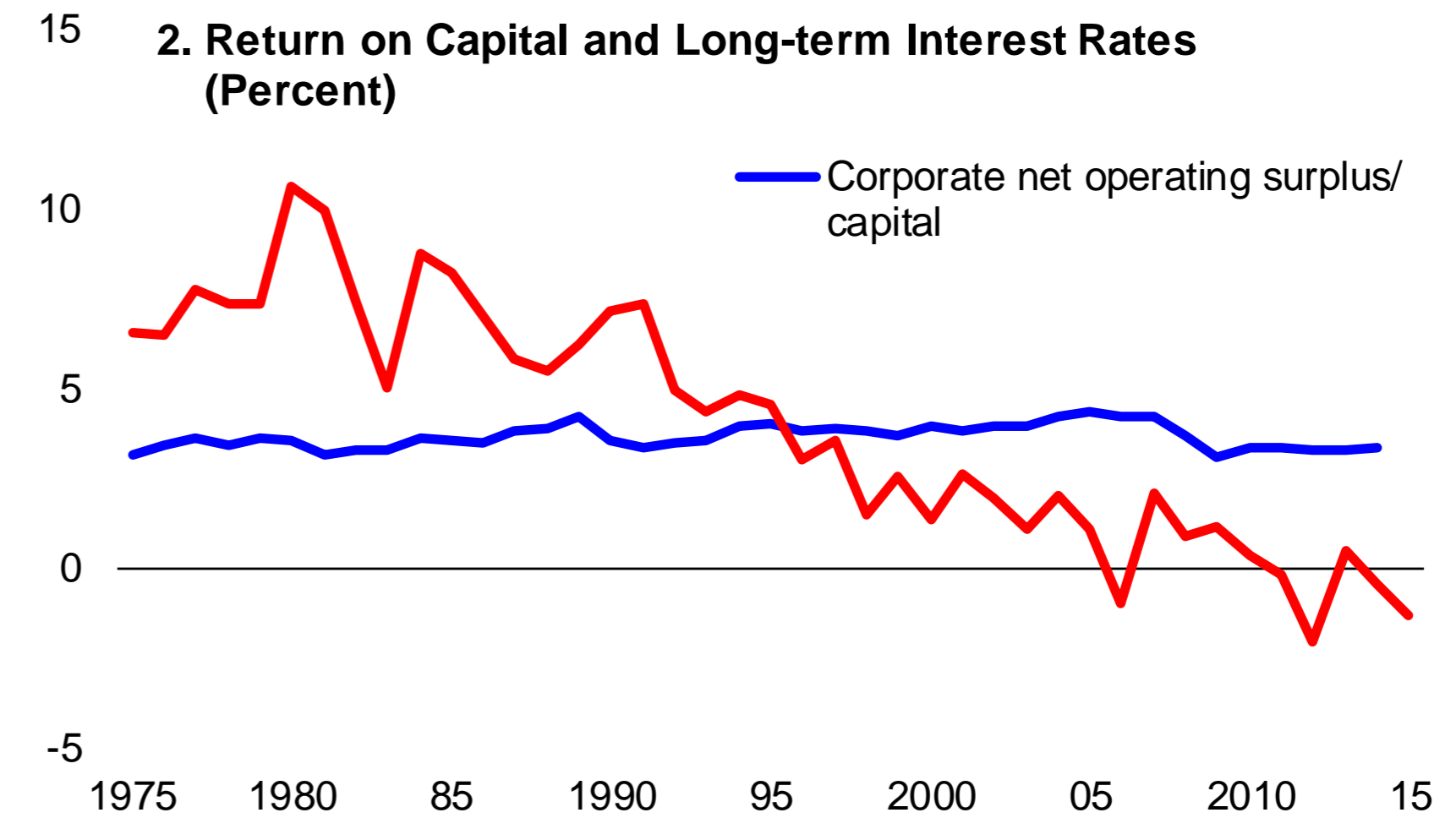## BANQUE NATIONALE DE BELGIQUE, 9TH APRIL 2019

Wenjie Chen, Federico Díez (lead author), Romain Duval (lead author), Callum Jones, Carolina Villegas-Sanchez (consultant) with contributions from Mai Dao, Nan Li, and support from Jiayue Fan and Christopher Johns.

Background: worrisome macro trends, common cause?

Sluggish investment despite rising expected returns from investment

1. Tobin's Q and Investment
(Ratio (LHS), Percent (RHS))
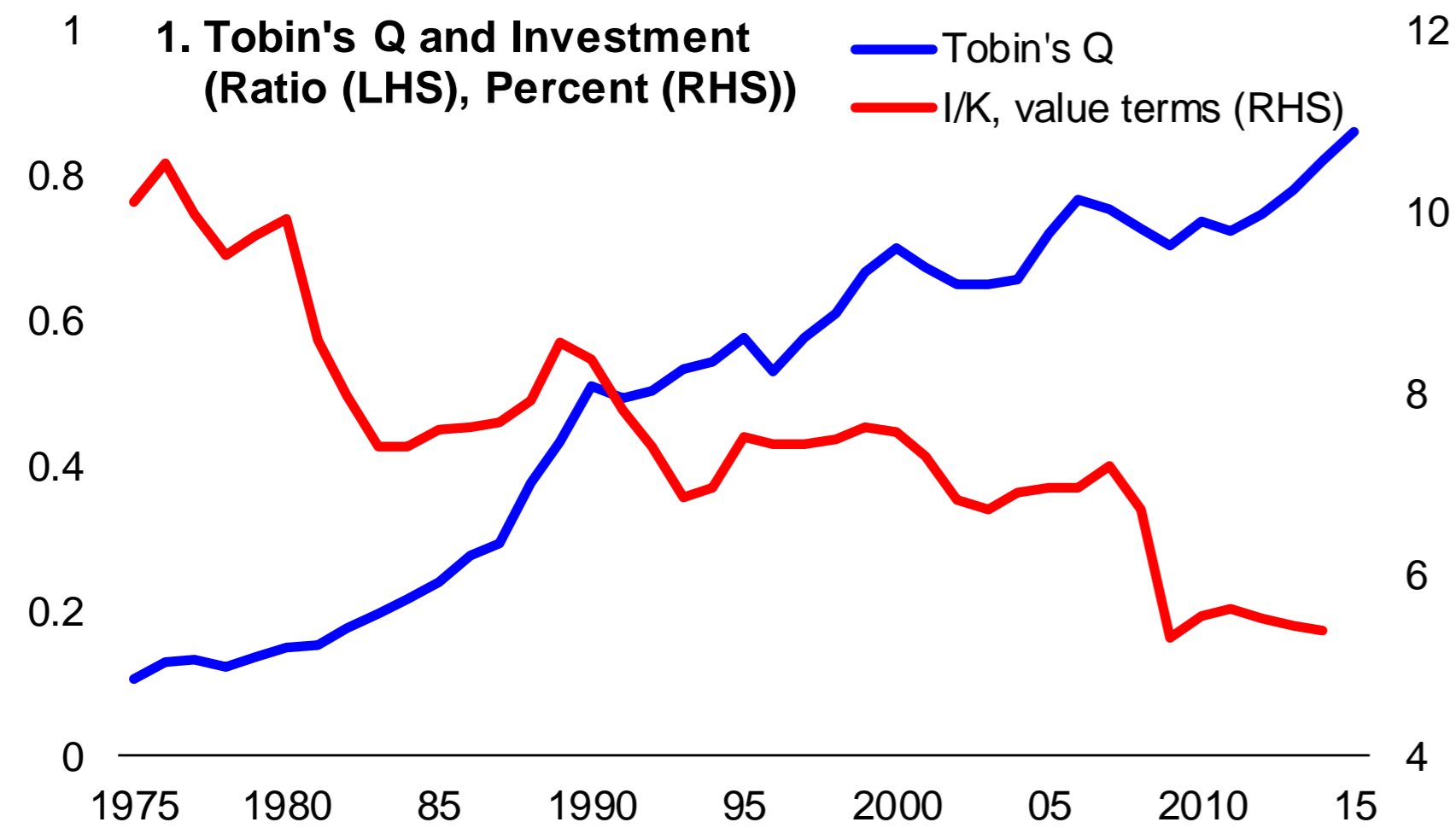
Growing disconnect between returns on productive capital and safe assets

2. Return on Capital and Long-term Interest Rates
(Percent)

Growing disconnect between financial wealth and value of productive capital

3. Wealth and Capital
(Percent)
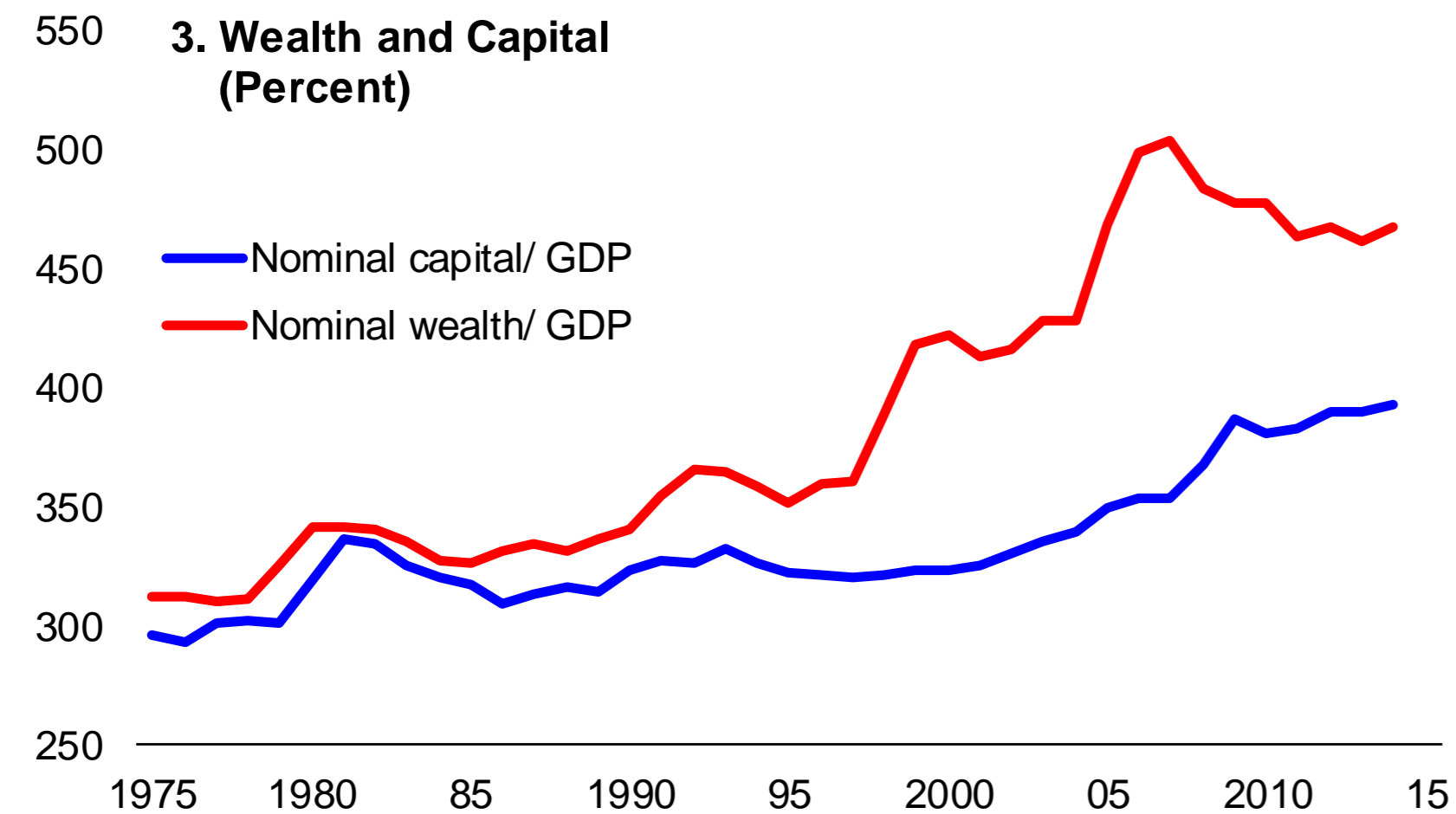
Falling labor income shares

4. Labor Share
(Percent)
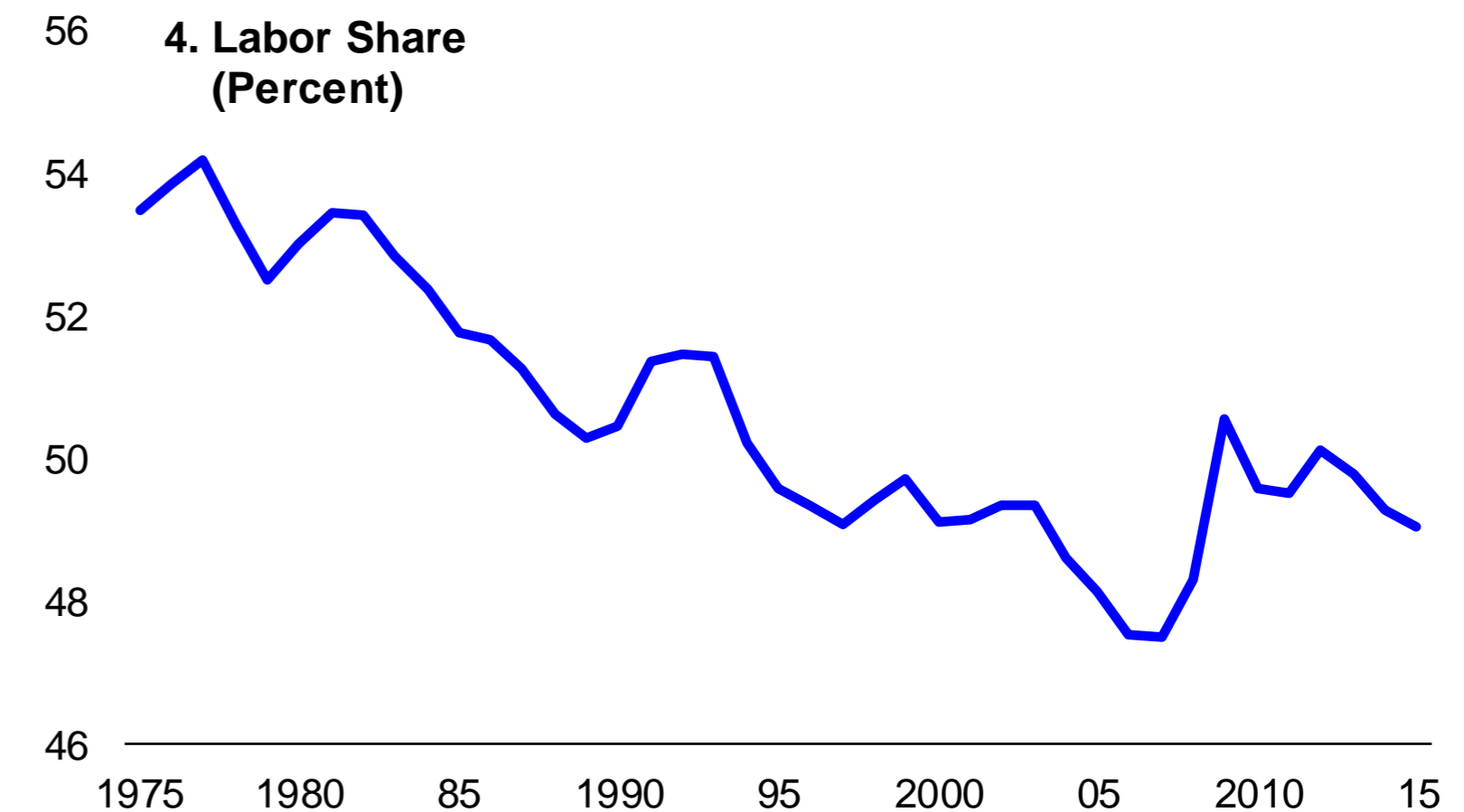
Unsettled Literature

- *Facts*
  - Large increases in markups (~ 40-50% in AEs since 1980), particularly in the US, but focus on listed firms (De Loecker and Eeckhout, 2017, 2018; Diez et al, 2018)
  - Increases in industry concentration, larger in US than EU (Gutierrez and Philippon, 2018; Bajgar et al., 2019). But hard to interpret (Shapiro, 2019; Rossi-Hansberg et al, 2018...etc)

- *Implications for growth and income distribution*
  - Could be behind macro trends (Caballero et al., 2017; Eggertsson et al., 2018; Stiglitz, 2015)
  - But empirical evidence still patchy (De Loecker and Eeckhout, 2017, 2018; Diez et al., 2018)

- *Drivers*
  - Dismal view: antitrust enforcement (Gutierrez and Philippon, 2018)
  - Benign view: technology/reallocation/superstars (Autor et al., 2018; Baqaee and Farhi, 2017; Calligaris et al., 2018; Syverson, 2018; Van Reenen, 2018)

- *Policy implications.* Do we need to strengthen/rethink competition law and policy? (US)

Questions

- ***Facts***. *Has corporate market power increased? How do trends in market power differ across countries (US vs EU), industries and firms?*

- ***Implications for growth and income distribution***:
    - o *Impact on innovation, investment? What implications for interest rates, inflation and slack post-2008 financial crisis?*
    - o *Contribution to fall in labor income shares?*

- ***Drivers?*** *Changing structure of product markets or policy-driven weakening of competition?*

- ***Policy implications.*** *What policy implications and in which areas?*

Approaches

Data:

    o Large cross-country firm-level dataset (cleaned Orbis) for which data coverage is good: 27 countries, of which 2/3 are AEs ➔ goes (way) beyond existing studies (includes private firms)

    o Market power: mainly markups, mostly following De Loecker and Warzynski (AER 2012)

• **Macroeconomic implications:**

    o Firm-level and industry-level regressions, address endogeneity through IV techniques

    o DSGE model-based analysis, for EA and US, of:
- Impact of trend rise in markups on inflation, output, interest rates, impact of the crisis
- Output-inflation trade-off

Main Findings

- **Facts:**
  - Moderate increase in market power across AEs. Broad-based across countries and industries, albeit with some heterogeneity: US > EU
  - Rise concentrated among small fraction of high-markup firms – US seems different

- **Macroeconomic effects: modest so far but could become increasingly negative**
  - Growth:
  - Investment: 3% lower K stock, 1% lower output in average AE today relative to counterfactual
  - Innovation: ~ 0 effect so far but increasingly < 0 in future if market power rose further
  - Macroeconomic stabilization: tougher, including after 2008 crisis, due to lower natural rate
  - Income distribution: at least 10% (~ 0.2 pct pt) of decline in labor shares in average AE

- **Drivers?** Tentative evidence supporting market forces (e.g. technology) story more than policy-driven weakening of competition

- **Policy implications**: product market (de)regulation, competition policy, technological diffusion

Market Power Trends
Across Countries, Industries, and Firms

Measuring market power

- **Markups—De Loecker and Warszynski (AER 2012):**
    - Based on firm's cost-minimization problem, which in turn builds partly on Hall (1986, 1988):

$$\mu_{it} \equiv \frac{P_{it}}{MC_{it}} = \underbrace{\frac{\partial \mathcal{F}_{it}(\cdot)}{\partial \mathcal{V}_{it}} \frac{\mathcal{V}_{it}}{\mathcal{F}_{it}(\cdot)}}_{OutputElasticity} \Bigg/ \underbrace{\frac{P_{it}^{\mathcal{V}_{it}} \mathcal{V}_{it}}{P_{it} Q_{it}}}_{ExpenditureShare} = \frac{\beta_{it}^{\mathcal{V}}}{\alpha_{it}^{\mathcal{V}}} \; ,$$

    - All results are qualitatively—and for the most part quantitatively—robust to:
    - ✓ Underlying production function estimation approach
    - ✓ Variable input choice (COGS, materials)
    - ✓ Fixed (overhead) costs
    - ✓ Weighting scheme to aggregate markups (sales, VA, wage bill, COGS)
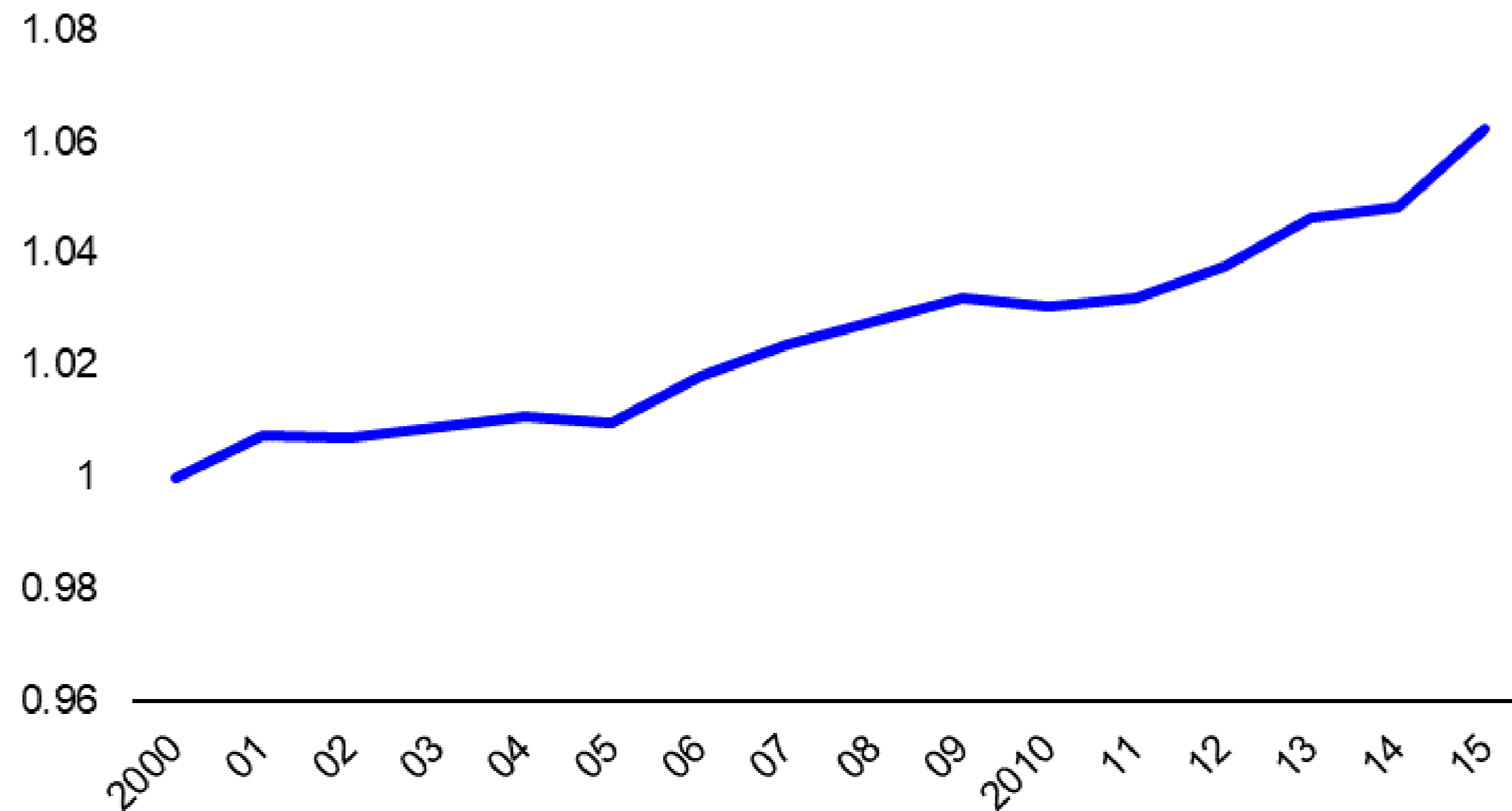
- **Lerner Index—see e.g. Aghion et al. (2005)**:
    - Ratio of EBIT to operating revenue (country-industry average in industry-level analysis)

- **Industry Concentration**: (Sales of top 4 firms)/(sales of top 20 firms) for country-industry-year

A moderate rise in market power…

Markups have increased since 2000…

(ratio of price to marginal cost; index, 2000 = 1)

… and so has profitability (Lerner index),

(ratio of EBIT to turnover revenue; index, 2000 = 1)
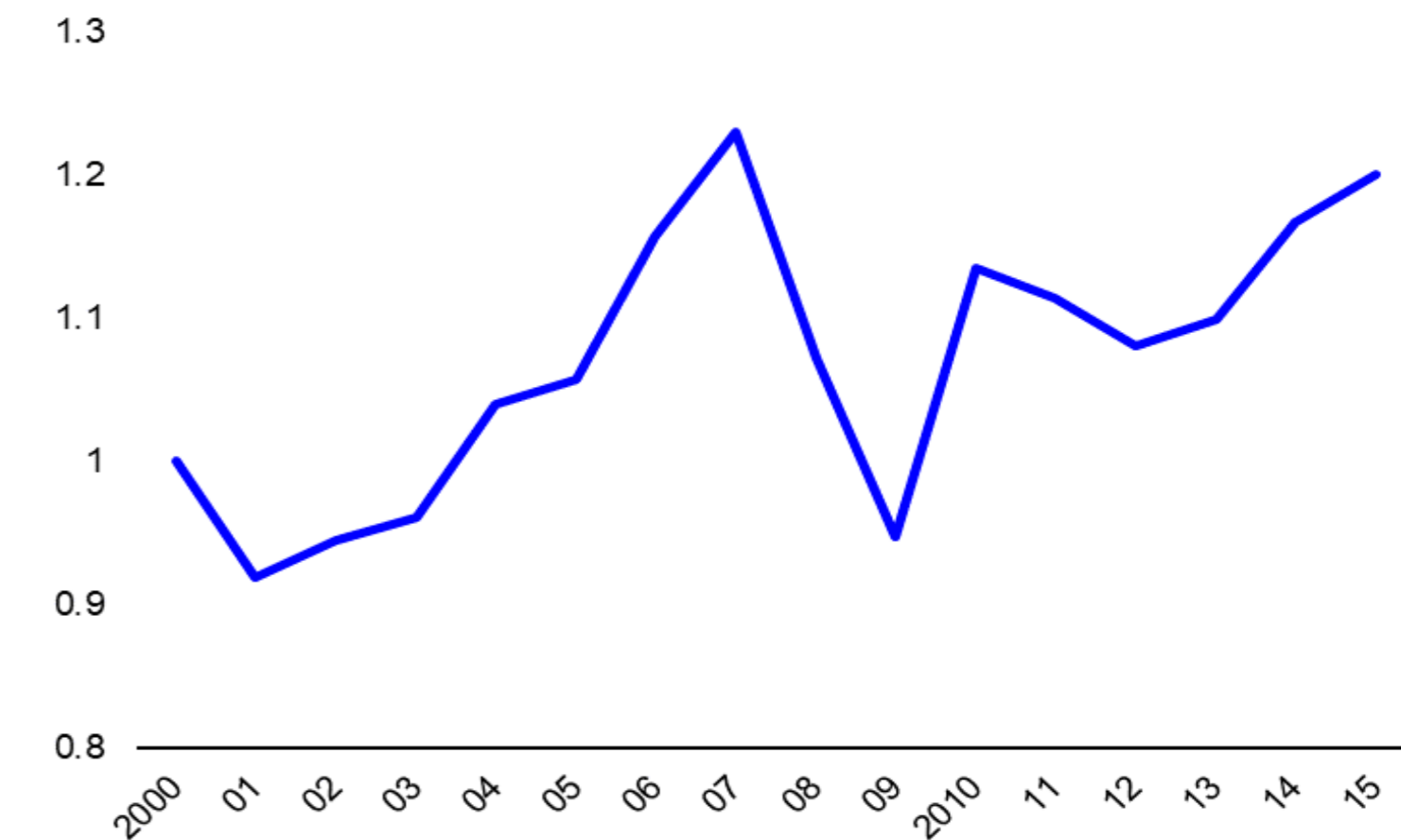

… and, to a lesser extent, concentration.

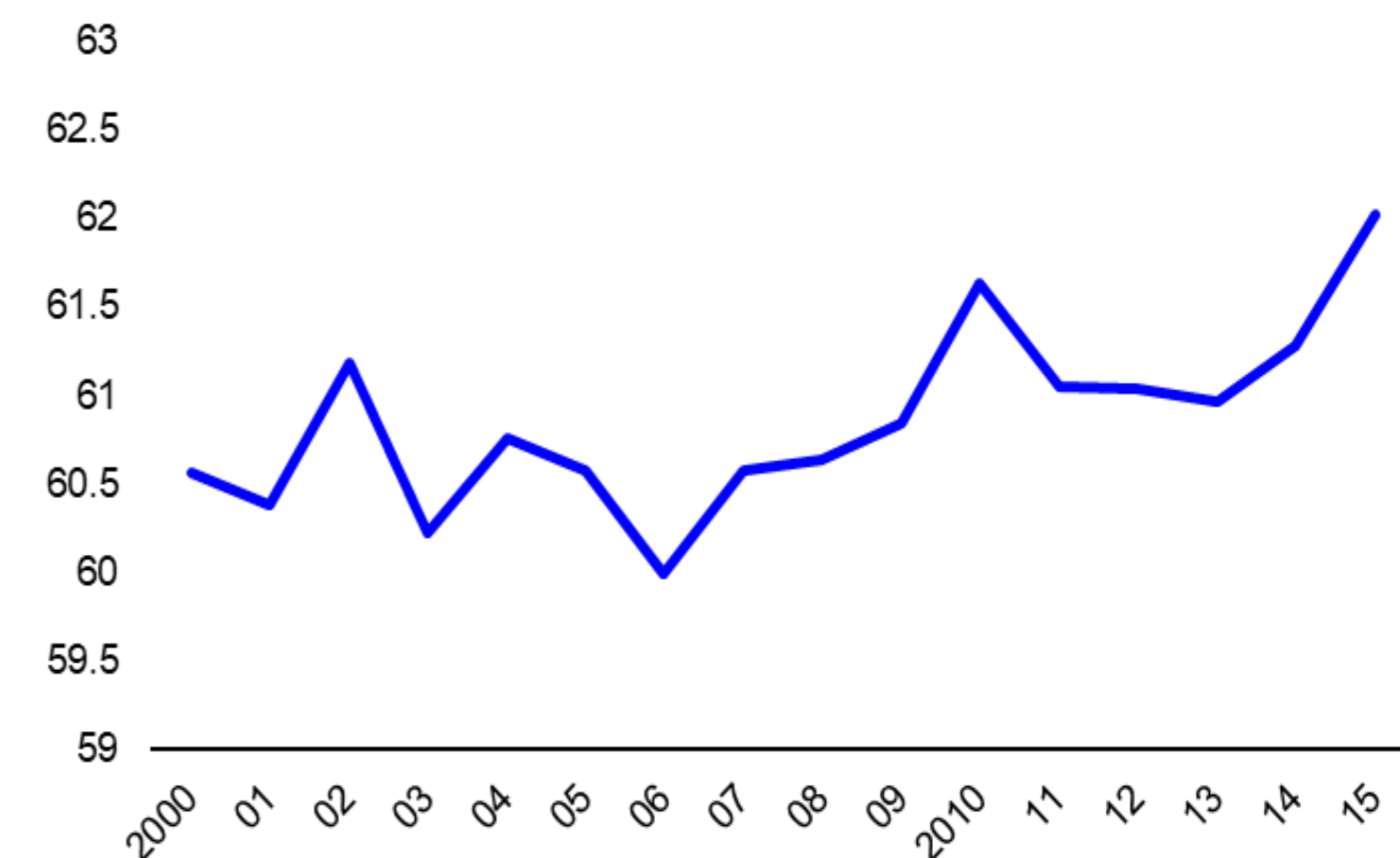Source: Orbis; and IMF staff calculations.
Notes: markup calculations based on the approach of De Loecker and Warzynski (AER, 2012) using RES' Orbis dataset. The figure above plots year fixed effects from regressions of markups that also include country fixed effects to account for entry and exit to/from the sample. Regressions weighted by firms' turnover revenue. Lerner index computed as the weighted average of firms' EBIT to revenue ratio. Concentration computed as average of the ratio of sales of top 4 to top 20 firms within each country-sector bin. Markups and profitability normalized to 2000 = 1.

Markup increases are concentrated among AEs

(Cumulative 2000-2015, percentage)

Decomposition of Markup Increase
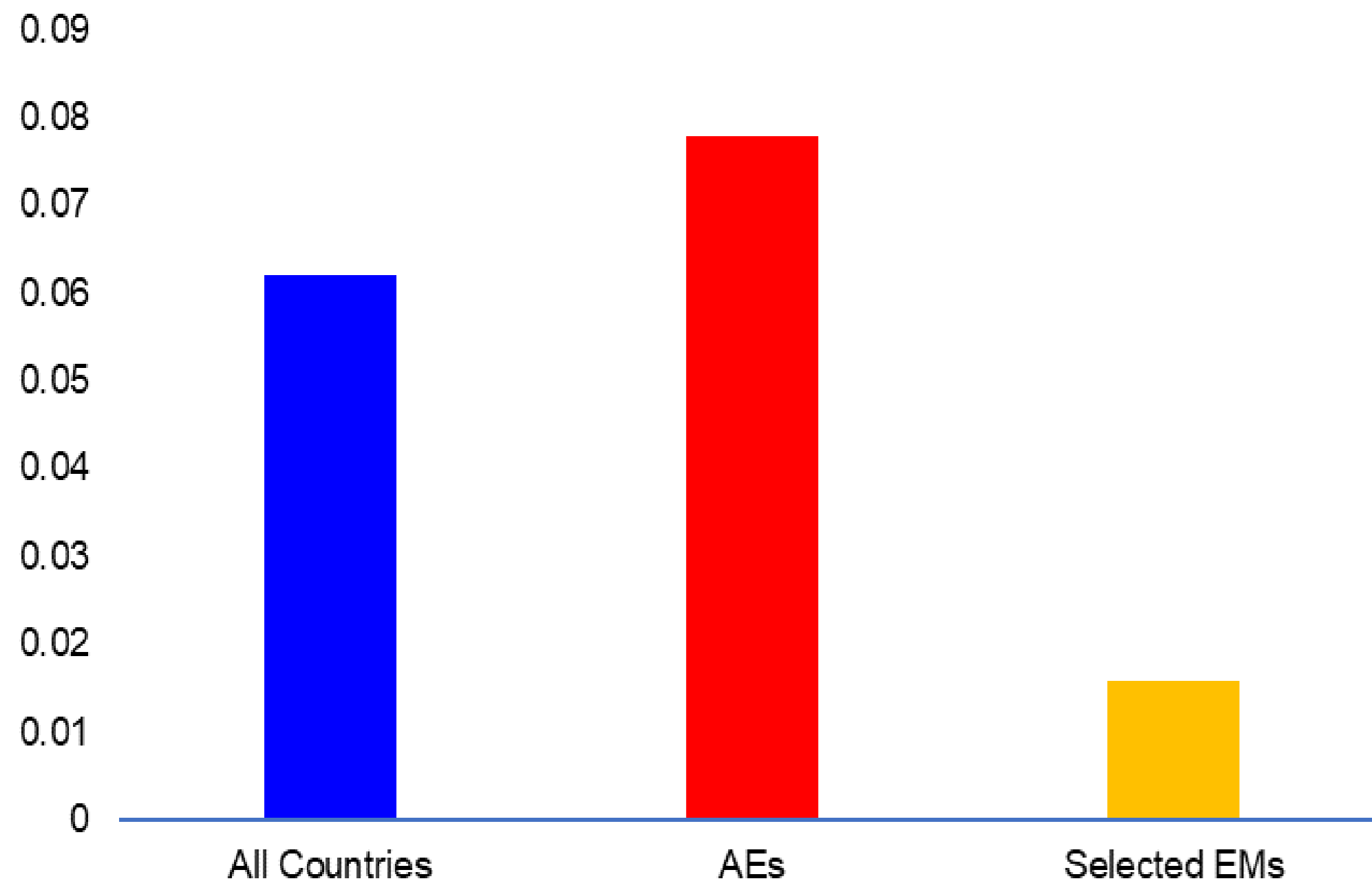
(Percent)

Source: Orbis; and IMF staff calculations.
Note: graph uses the 2000 WEO definition for Advanced Economies.
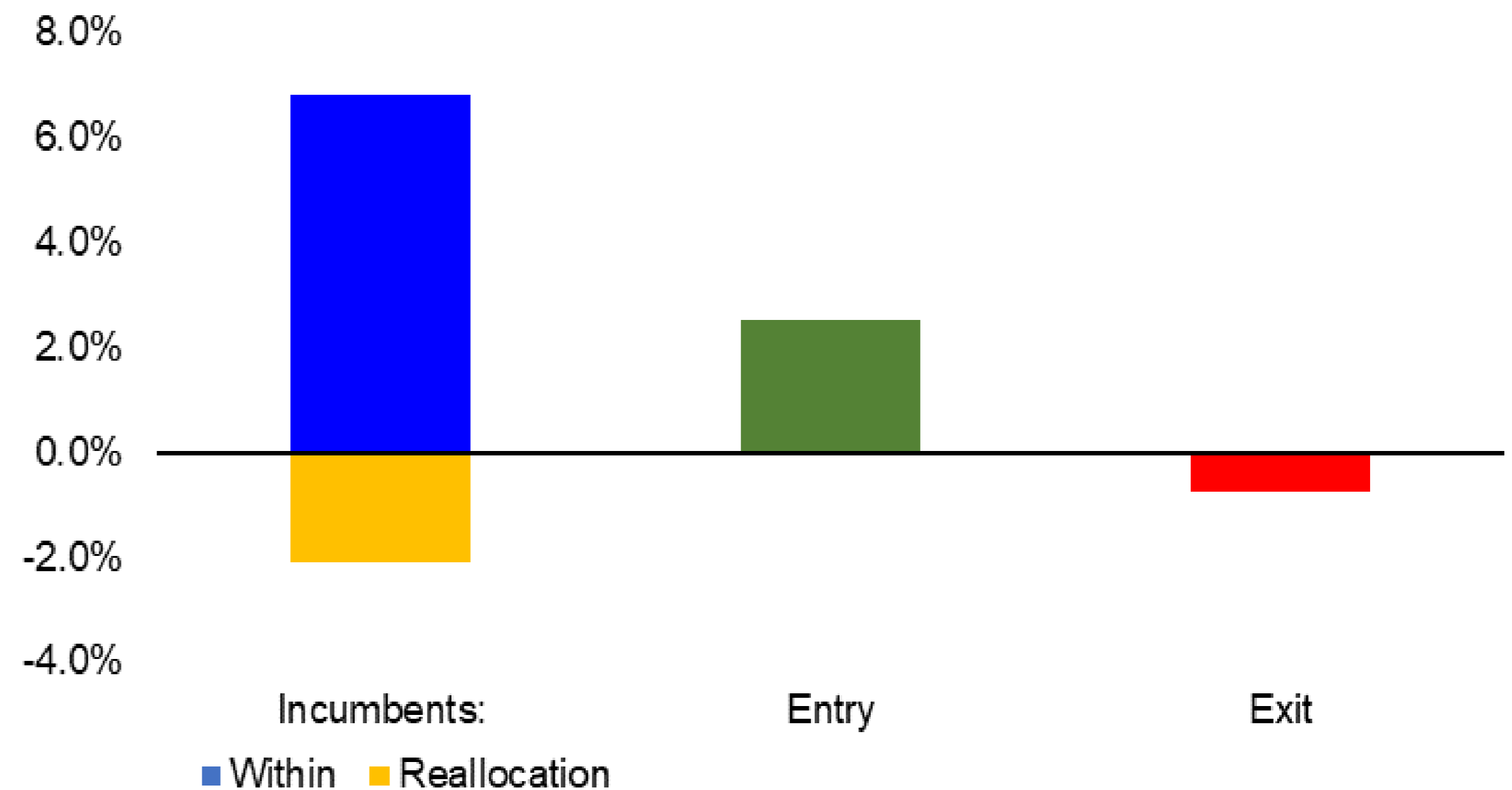
Source: Orbis; and IMF staff calculations.
Note: the columns plot the change in overall markups explained by each component, after applying a Melitz-Polanec decomposition to the markups changes occurred between 2000 and 2015.

❑ Markup increase in almost 2/3 of industries, mostly non-manufacturing. Larger in digital-intensive industries

❑ Markup increase mostly driven by incumbents NB: US is different—reallocation effect dominates

10

1. Evolution of Markups by Firm Groups
(Index, 2000 = 1)

— Top decile firms
— Rest of firms
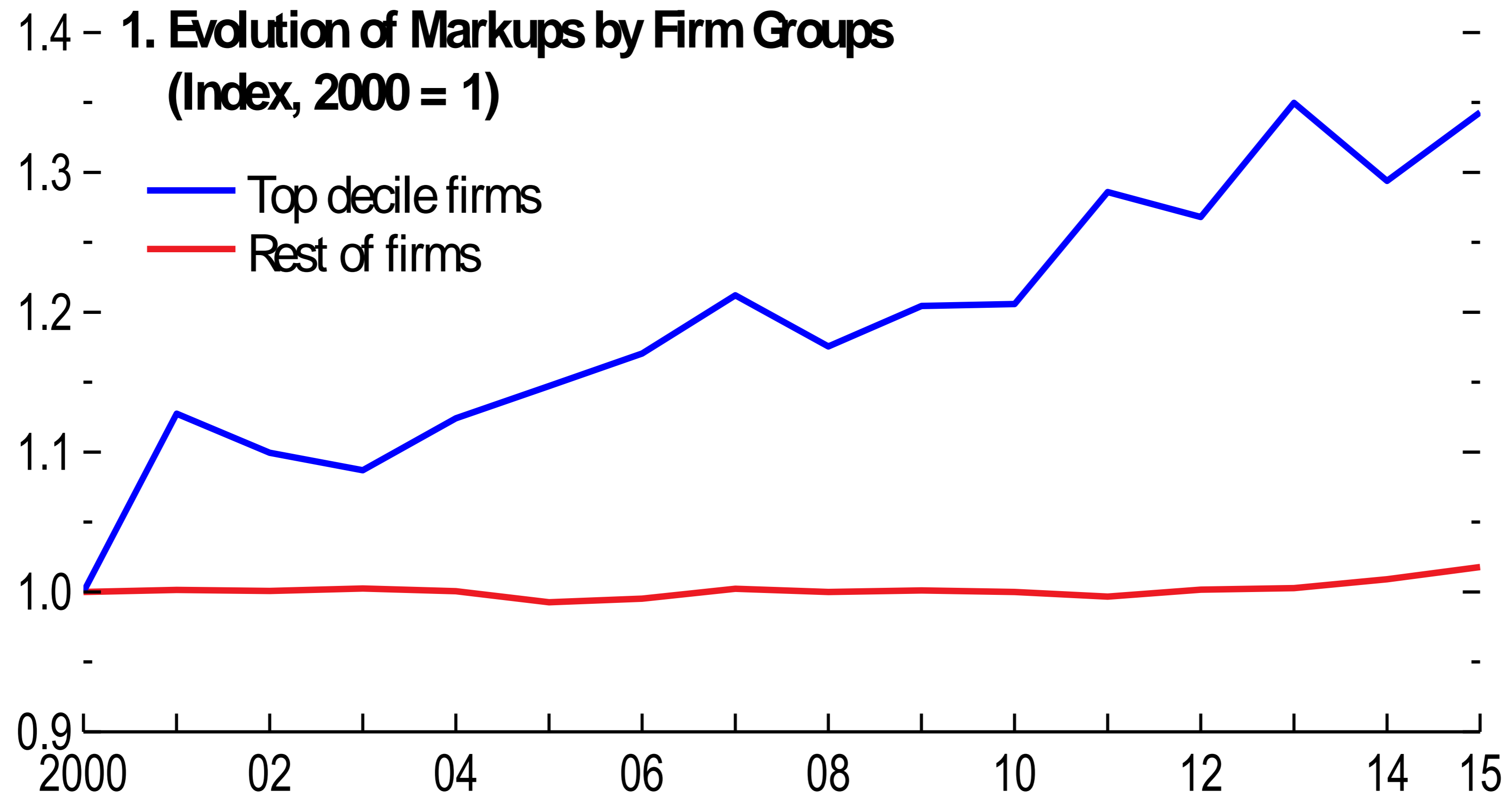
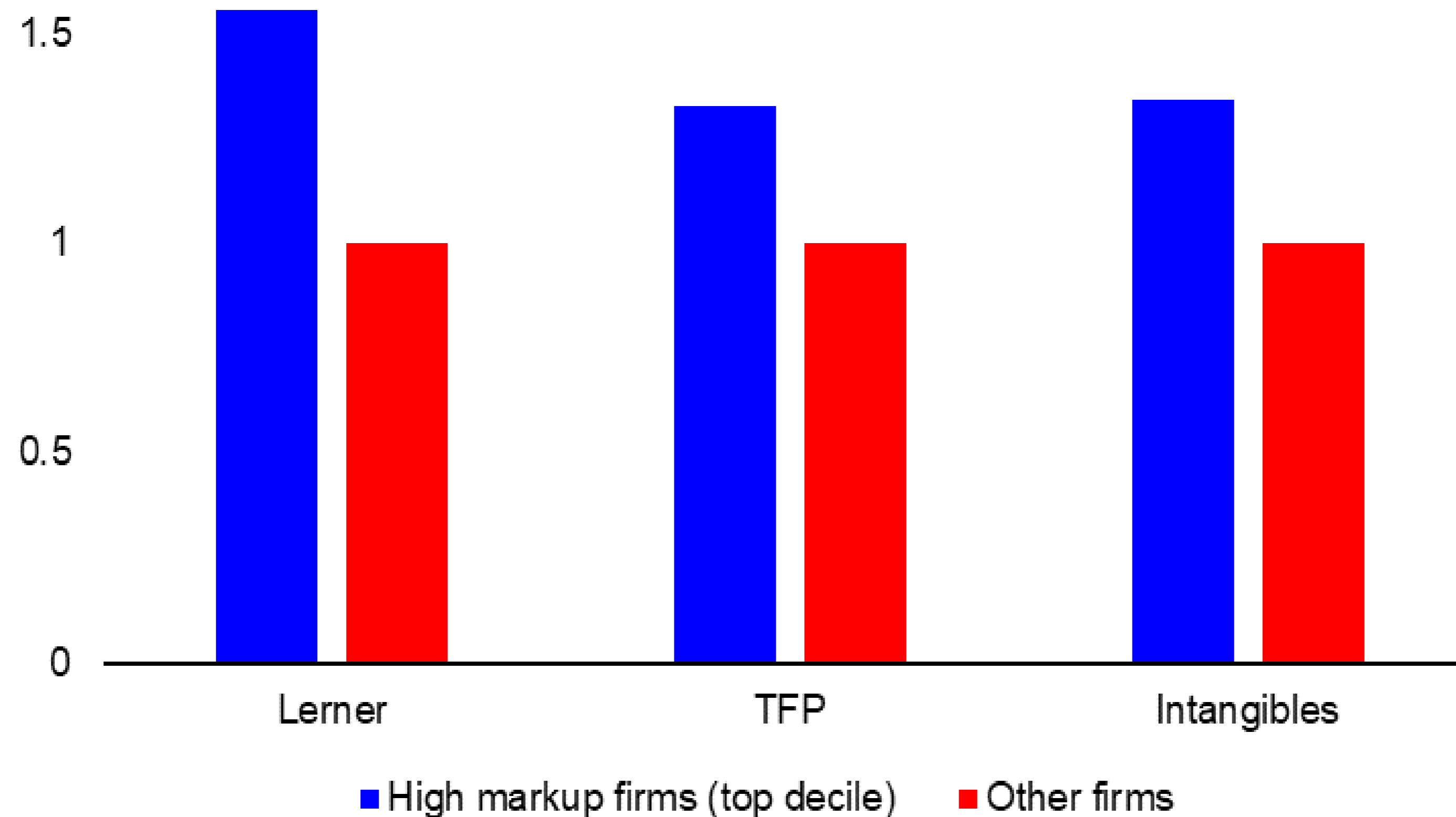Source: Orbis; and IMF staff calculations.
Notes: firms sorted by their average markups into two groups: top decile and the rest of firms. The figure plots, for each group, year fixed effects from regressions of markups that also include country fixed effects to account for entry and exit to/from the sample. The regressions are weighted by firms' operating revenue. Year fixed effects normalized to 2000 = 1.

11

These firms tend to perform better than others

Differences Across Group of Firms

(Index, 'Other firms' = 1)

Legend: ■ High markup firms (top decile) ■ Other firms

Source: Orbis; and IMF staff calculations.
Notes: each column plots average value of the Lerner index/TFP/Intangibles ratio for the firms in the top decile of the markup distribution (blue) and for the other firms (orange). The values for the "other firms" were normalized to 1.

Implications of Rising Market Power for Growth

Market power and innovation: set-up

- Relationship between competition and innovation:
  - Schumpeter vs. Arrow ("escape competition") effects
  - Hypothesis: hump-shaped (Aghion et al., 2005; Kamien and Schwartz, 1976)

- Poisson specification:

$$E[P_{jct}|mp_{jct-1}] = \exp\{\overset{(+)}{\beta_1 * mp_{jct-1}} + \overset{(-)}{\beta_2 * mp_{jct-1}^2} + \gamma_{ct} + \gamma_{cj}\},$$

- where j - *sector*, c - *country*, and $t -$ year; 27 economies (2000-2015)
- P_{jct}: Average citation weighted patents
- mp_{jct}: market power measure (log markup, Lerner index)
- γ_{ct}, γ_{cj}: country-year and country-sector fixed effects

- Firm-level analysis:
  - Idem with firm-level controls and γ_{cjt} in some specifications
  - Endogeneity: lags, IV (median markup of other firms in 4-digit country-industry pair)

Annex Table 2.3.1. Market Power and Innovation: Sector-Level Analysis

	(1) Citation Weighted Patents	(2) Citation Weighted Patents	(3) Citation Weighted Patents in Triadic	(4) Citation Weighted Patents in Triadic
1-year Lagged Lerner	6.373***		7.977***	
	(1.384)		(1.859)	
1-year Lagged Lerner Squared	-43.196***		-51.832***	
	(10.925)		(14.221)	
1-year Lagged Log Markup		4.016**		4.629**
		(1.713)		(1.890)
1-year Lagged Log Markup Squared		-3.123**		-4.665**
		(1.428)		(1.902)
Country-Year Fixed Effects	Yes	Yes	Yes	Yes
Country-Industry[1] Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	11,735	11,735	11,735	11,735

Source: IMF staff calculations.

Note: Poisson estimation. The dependent variable in columns (1) and (2) is the average number of citation-weighted patents in the country-industry-year. The dependent variable in columns (3) and (4) is the average number of citation-weighted patents jointly filed in the European Union, Japan, and the United States in the country-industry-year. Lerner is the average EBIT-to-turnover ratio in the country-industry-year. Sample is of annual frequency from 2000 to 2015. See Annex Table 2.1.2 for countries in sample. Standard errors clustered at the country-industry[1] level.

Standard errors in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

[1] Industries are NACE revision 2 4-digit sectors.

15

Market power and innovation: firm-level results

Annex Table 2.3.2. Market Power and Innovation: Firm-Level Analysis

	(1) log (Citation Weighted+1) OLS	(2) Citation Weighted Poisson	(3) log (Citation Weighted+1) OLS	(4) Citation Weighted Poisson CF[1]
1-year Lagged Log Markup	0.0019** (0.0006)	0.7304** (0.2340)	0.0022*** (0.0006)	0.732*** (0.199)
1-year Lagged Log Markup Squared	-0.0005* (0.0003)	-0.5987*** (0.1774)	-0.0005* (0.0003)	-0.488** (0.151)
1-year Lagged Log Operating Revenue	0.0006*** (0.0001)	0.1242*** (0.0227)	0.0007*** (0.0001)	0.120*** (0.018)
1-year Lagged Residual				-0.047 (0.083)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Country-Industry[2]-Year Fixed Effects	Yes	Yes	No	No
Country-Year Fixed Effects	No	No	Yes	Yes
Industry[2]-Year Fixed Effects	No	No	Yes	Yes
First-Stage F-statistics above 10				Yes
Number of Observations	4,723,475	4,723,475	4,723,475	4,723,475

Source: IMF staff calculations.

Note: The dependent variable in columns (1) and (3) is one plus the logarithm of the number of citation-weighted patents filed jointly in the European Union, Japan, and United States. In columns (2) and (4) the dependent variable is the number of citation-weighted patents filed jointly in the European Union, Japan, and the United States. The instrumental variable for lagged logarithm markup is the lag of the logarithm median markup in a firm's country-industry[2]-year, while excluding that firm. Sample is of annual frequency from 2000 to 2015. See Annex Table 2.1.2 for countries in sample. Standard errors clustered at the firm level.
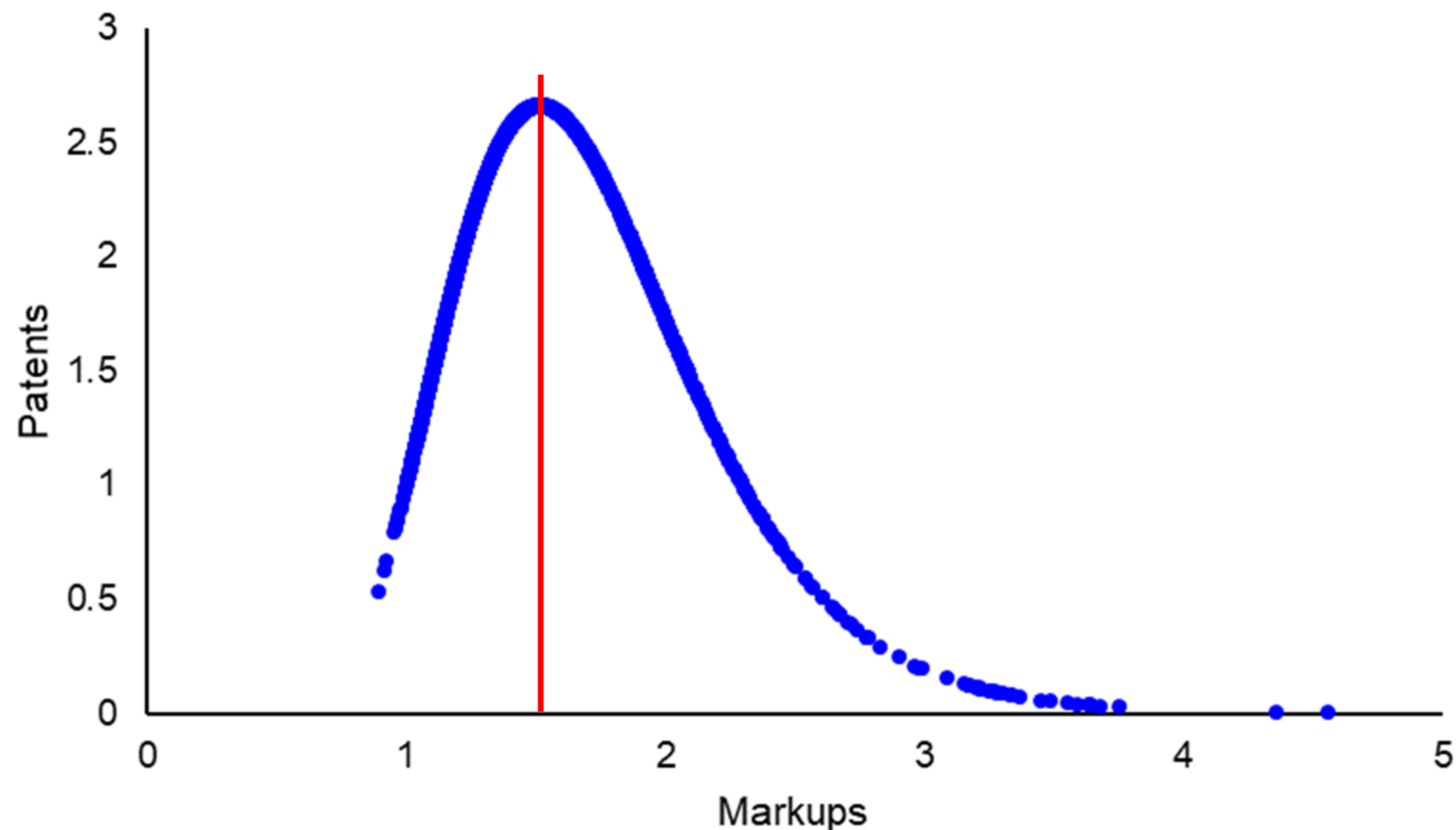
Standard errors in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

[1] The instrumental variable for lagged markups is the lag of median markups in a firm's country-sector-year, while excluding that firm.

[2] Industries are NACE revision 2 4-digit sectors.

Ambiguous effects on innovation...

Hump-shaped relationship between market power and innovation

Source: Orbis; PATSTAT; and IMF staff calculations.
Note: The figure plots the effects of markups on the predicted average number of patents by country-sector. Predicted patents normalized to 1 for markups = 1.

❑ Growing, albeit still small, share of firms on right-hand side (21% of country-industry pairs, 7% of firms in 2015)
❑ But most high markup-firms are already on the RHS

...that could turn increasingly negative if market power of high-markup firms increases further

Implied Relationship between Higher Markups and Patents

(Percent change)
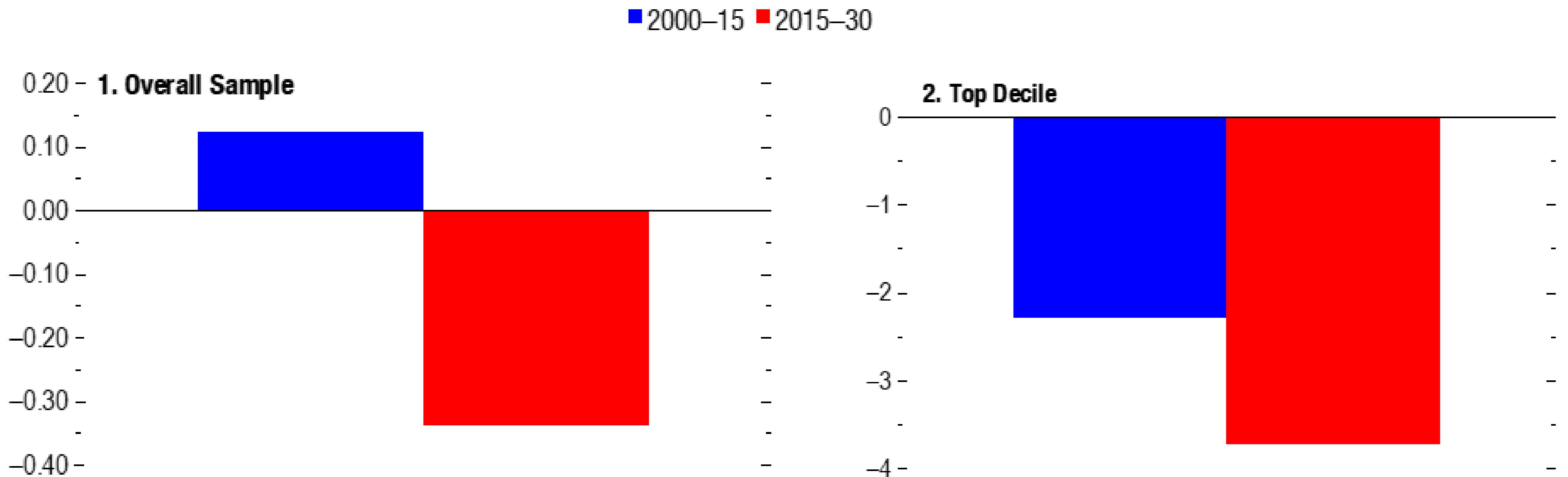
Sources: Orbis and PATSTAT; and IMF staff calculations.
Notes: The '2000-2015' bars show the implied predicted percent change in patents resulting from the markup increase in 2000-2015. The '2015-2030' bars show the implied predicted change if markups were to increase in 2015-2030 at the same rate as in 2000-2015. The left panel makes use of the whole sample while the right panel uses information only from the top decile of the markup distribution.

Markups and physical capital investment: set-up

- Theory:
  - ST: Profit-maximizing Y falls, so desired K falls and so does I/Y
  - LT: Lower Y and K, and also lower K/Y and I/Y if small open economy with fixed L supply

- Empirical (firm-level) specification:

$$I_{ijct} = \beta_1 + \beta_2 * \overset{(-)}{markup_{ijct-1}} + \beta_3 * \ln size_{ijct-1} + \theta_i + \gamma_{cjt} + \varepsilon_{ijct},$$

- where *i - firm*, *j - sector* (4-digit NACE), *c - country*, and *t* - year
- *I: Net Inv rate$_t$* = (tangible assets$_t$ – tangible assets$_{t-1}$)/value added$_{t-1}$
- *markups*: ratio of price to marginal cost
- *ln size*: log of turnover operating revenue
- θ_i: firm fixed effect
- γ_{cjt}: country-sector-year fixed effect

- Endogeneity: same IV strategy as for innovation analysis

Market power and investment: firm-level results

Annex Table 2.3.3. Markups and the Ratio of Investment to Value Added

	(1) OLS	(2) OLS	(3) IV[1]
1-year Lagged Markup	-0.062***	-0.059***	-0.093***
	(0.003)	(0.003)	(0.021)
1-year Lagged Log Operating Revenue	-0.029***	-0.027***	-0.033***
	(0.001)	(0.001)	(0.004)
Firm Fixed Effects	Yes	Yes	Yes
Country-Industry[2]-Year Fixed Effects	Yes	No	No
Country-Year Fixed Effects	No	Yes	Yes
Industry[2]-Year Fixed Effects	No	Yes	Yes
First Stage F-statistic			101.7
Number of Observations	2,510,177	2,530,445	2,520,465
R^2	0.347	0.310	0.002

Source: IMF staff calculations.

Note: Dependent variable = net investment in tangible assets / value added. IV = instrumental variable. OLS = ordinary least squares. Sample is of annual frequency from 2000 to 2015. See Annex Table 2.1.2 for countries in sample.

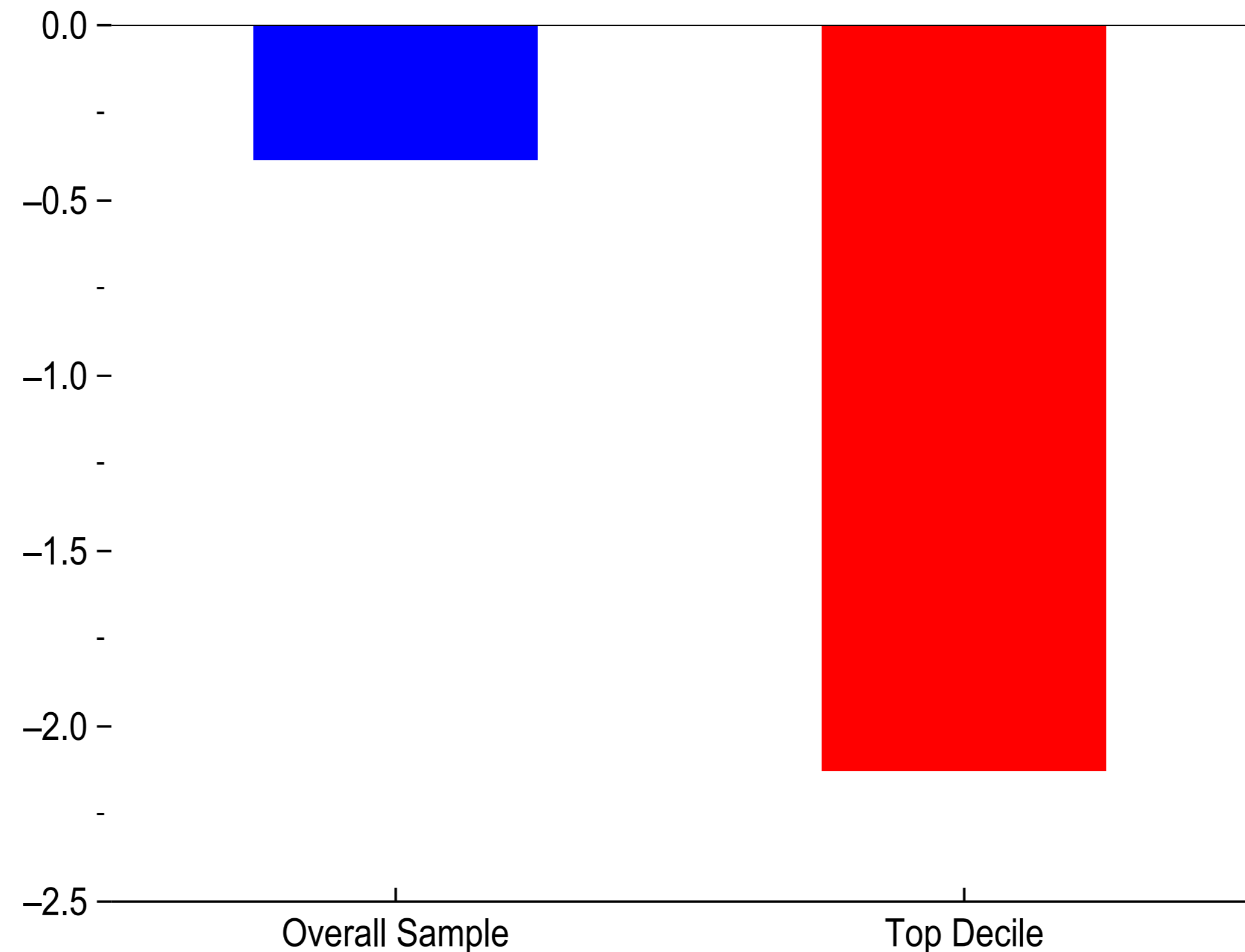Robust standard errors in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

[1] The instrumental variable for lagged markups is the lag of median markups in a firm's country-industry[2]-year, while excluding that firm.

[2] Industries are NACE revision 2 4-digit sectors.

Negative impact on investment…

Implied Relationship between Higher Markups and Investment Rate

(Percent point change)

➔ Under constant markups, aggregate K today could be 3% higher, and Y 1% higher, in average AE

Sources: Orbis; and IMF staff calculations.
Note: Average changes in markups are weighted by operating revenue.

N.B. These estimated effects are purely *within* firms; potentially other effects from *between* firm estimation.

• Build DSGE model to explore impact of higher markups for inflation, interest rates and output-inflation trade-off (~ Smets-Wouters AER 2007):

  o Households, firms, monetary policy (subject to ZLB)

  o Capital & labor in production, price & wage stickiness

  o Estimated on euro area and US data, respectively

  o Period-by-period, exogenous rise in markups (calibrated on within-firm increase in data)

• 3 key findings (US ~ EA):

  o Slightly higher inflation (~ 0.2 pct pt during 2000s), but lower investment & slack ➔ trade-off

  o Slight fall in natural rate (~ 0.1 pct pt by 2015) as potential output growth falls

  o Impact on slope of Phillips curve unclear (Calvo vs. Rotemberg), but small in any event

Negative impact of higher markups on investment and the natural interest rate…

Implied Relationship between Higher Markups, Investment Rate and Natural Interest Rate

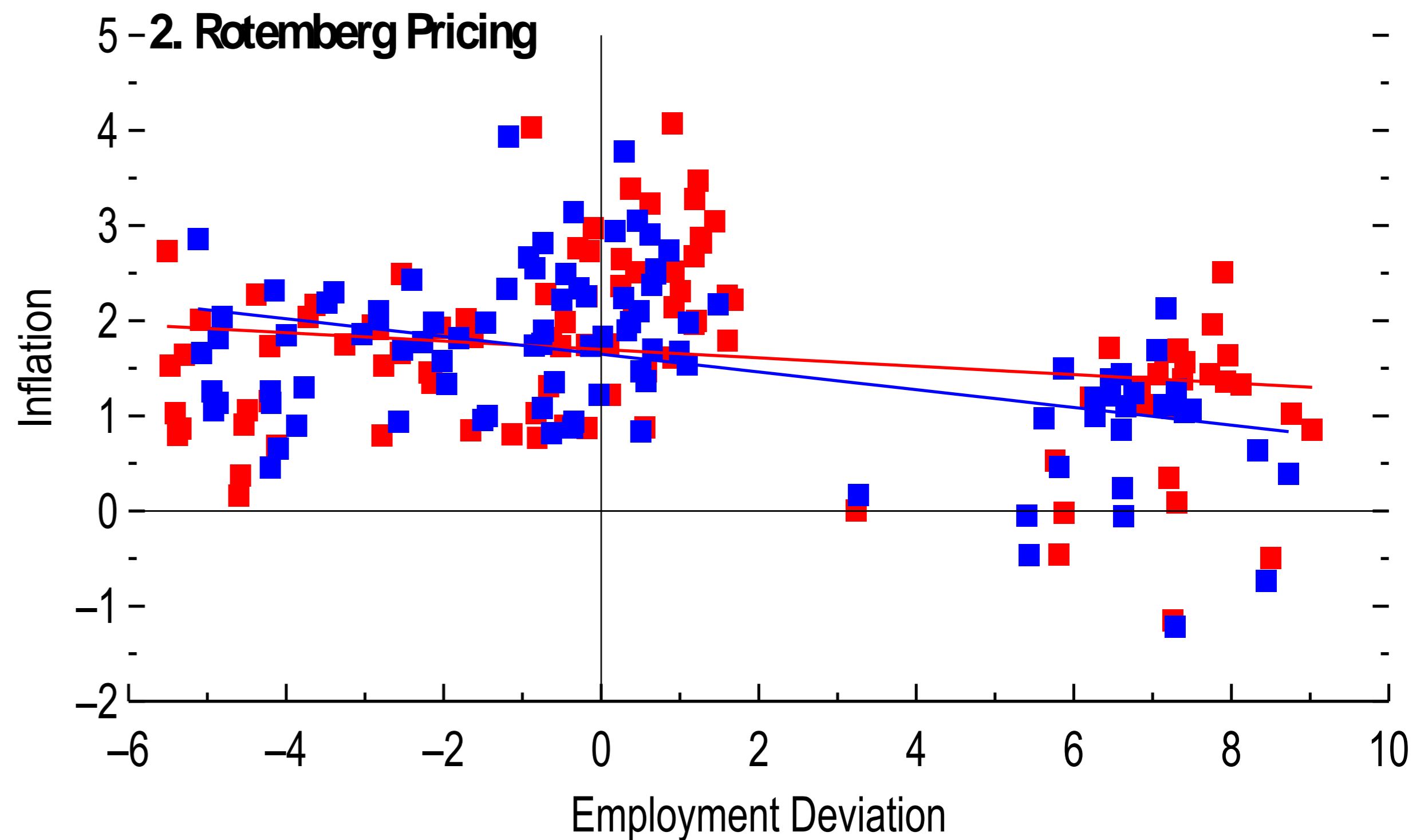(Percentage point change, Euro Area and United States average)
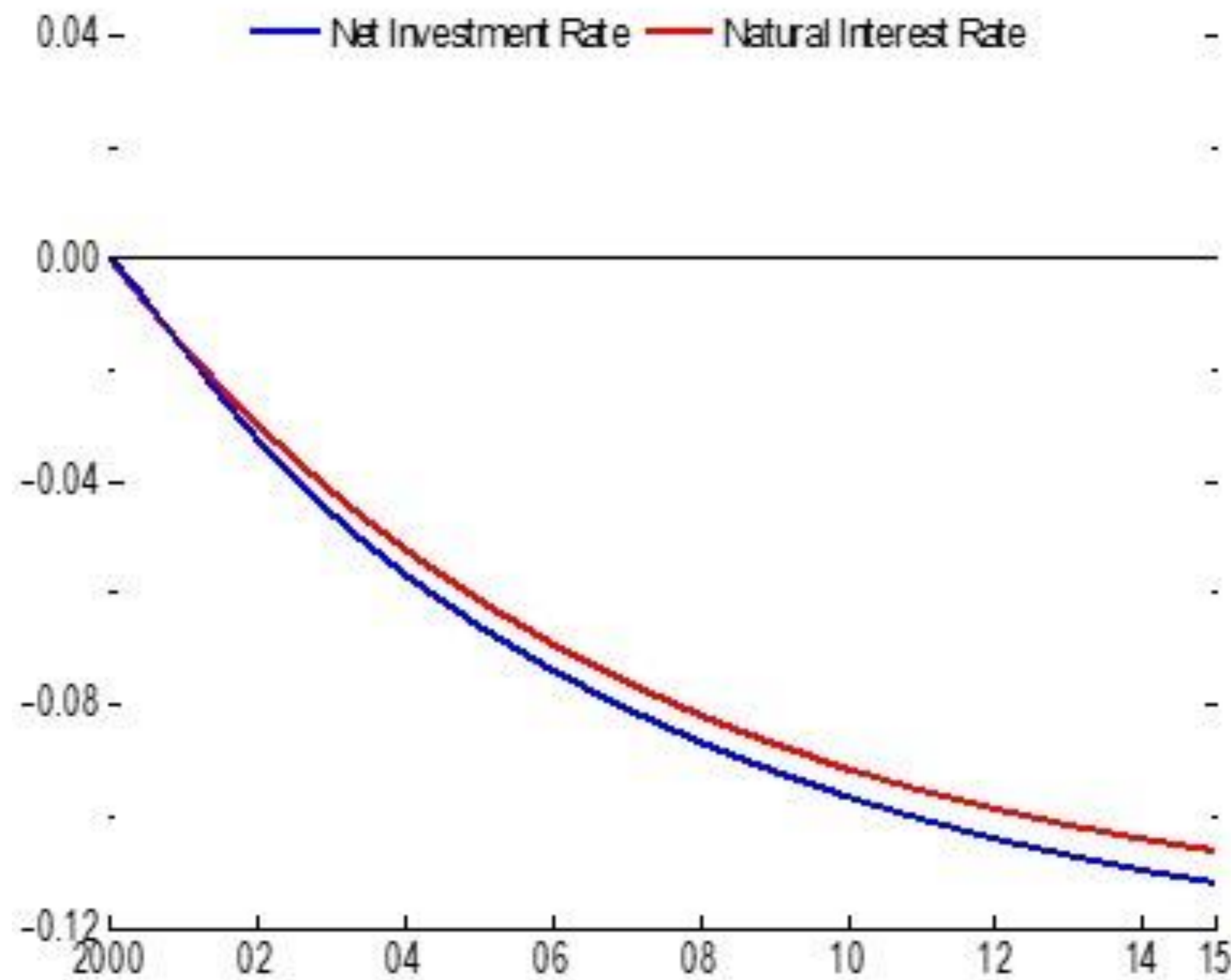
Source: IMF staff calculations.
Note: Interest rates are annualized.

Implied Impact of Higher Markups on Phillips Curve in the US: Calvo vs. Rotemberg Pricing

(Simulated impact of estimated shocks to US economy on employment and inflation under high (2015) and low (2000) markups)
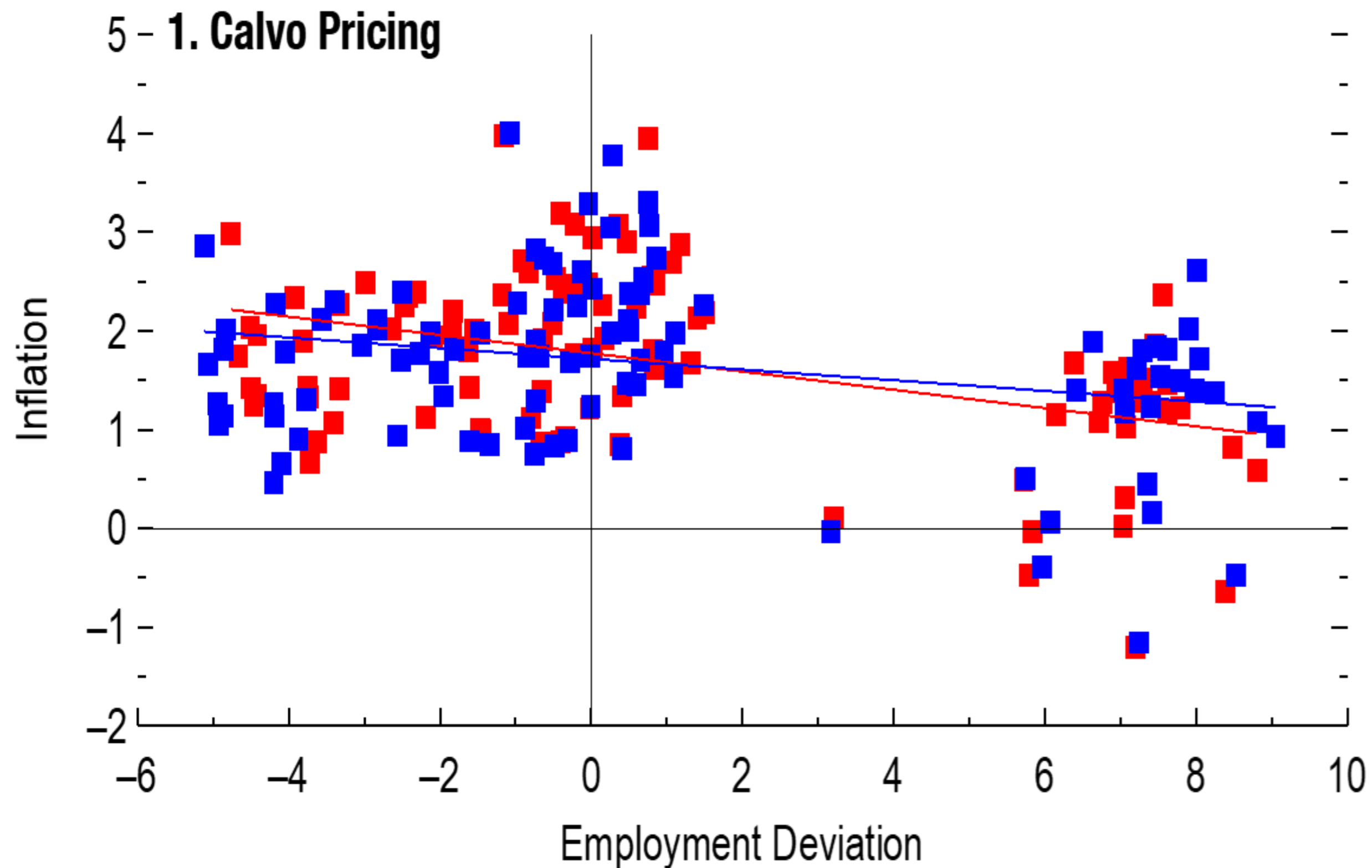
Source: IMF staff calculations.

Implications of Rising Market Power for Income Distribution

Market power and labor share: firm-level results

Annex Table 2.3.10. Markups and Labor Share

	(1) OLS	(2) OLS	(3) IV[1]
1-year Lagged Markup	-0.032***	-0.031***	-0.018*
	(0.001)	(0.001)	(0.011)
1-year Lagged Log Operating Revenue	-0.033***	-0.034***	-0.031***
	(0.000)	(0.000)	(0.002)
Firm Fixed Effects	Yes	Yes	Yes
Country-Industry[2]-Year Fixed Effects	Yes	No	No
Country-Year Fixed Effects	No	Yes	Yes
Industry[2]-Year Fixed Effects	No	Yes	Yes
First Stage F-statistic			87.02
Number of Observations	2,515,925	2,535,858	2,526,009
R^2	0.735	0.721	0.008

Source: IMF staff calculations.

Note: Dependent variable = wage bill / value added. IV = instrumental variable. OLS = ordinary least squares. Sample is of annual frequency from 2000 to 2015. See Annex Table 2.1.2 for countries in sample.

Robust standard errors in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

[1]The instrumental variable for lagged markups is the lag of median markups in a firm's country-industry[2]-year, while excluding that firm.

[2]Industries are NACE revision 2 4-digit sectors.

Negative impact on labor income share

Implied Relationship between Higher Markups and Labor income Share

(Percent point change)
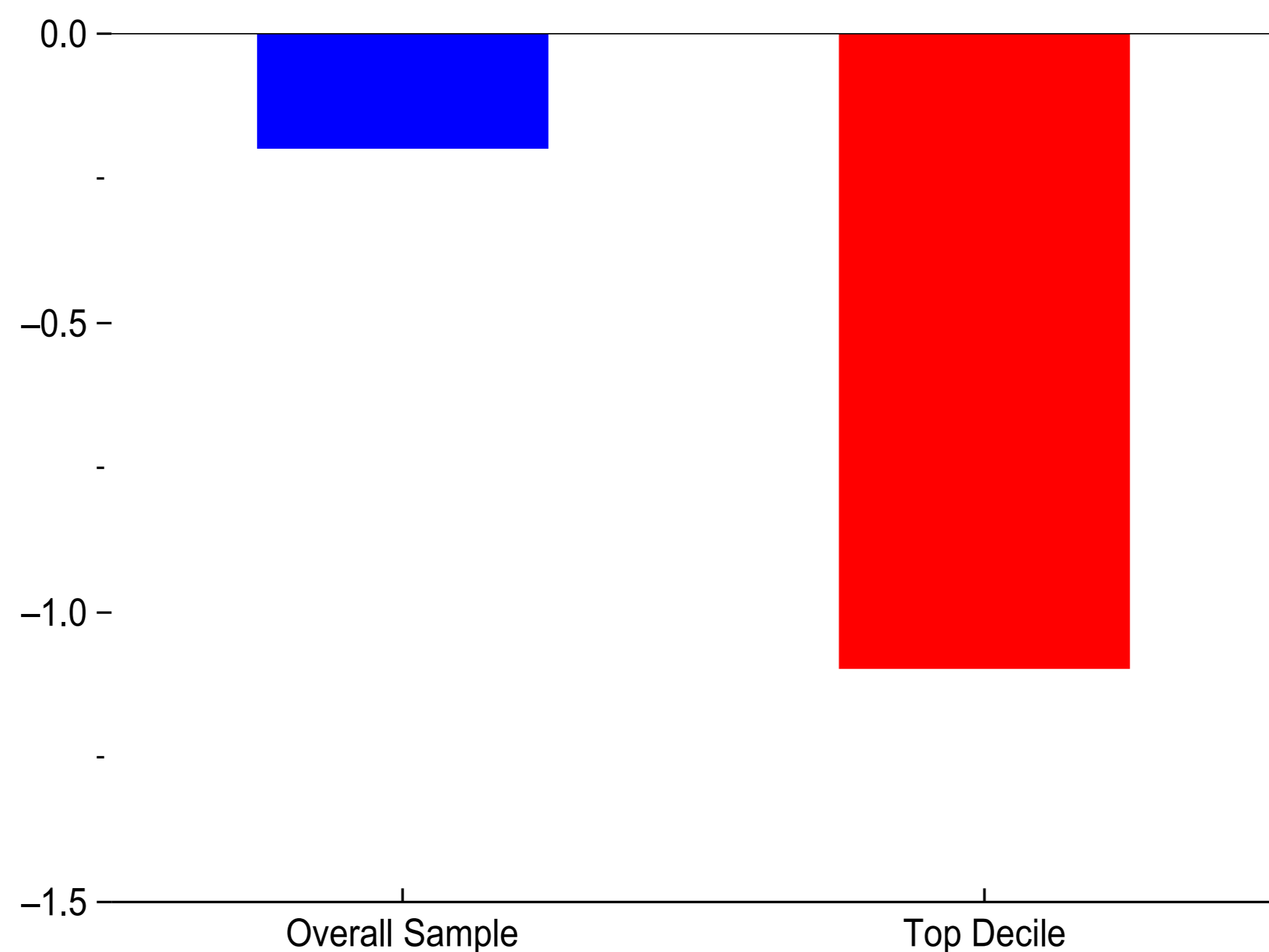
➔ Under constant markups, aggregate labor share today could be 0.2 percentage point higher in average AE

➔ Effect on overall income inequality could be broader

Sources: Orbis; and IMF staff calculations.
Note: Average changes in markups are weighted by operating revenue.

N.B. These estimated effects are purely *within* firms, and as such they represent a lower bound for the total (within + between) effect

Summary and Policy Implications

Summing up

- **Facts:**
  - *Moderate rise in markups across AEs*—8% since 2000, broad-based, services >> manuf, US > EU
  - *Mostly within firms*. US seems different (large between component)
  - *Rise concentrated among small fraction* of high-markup firms in each industry

- **Growth:**
  - *Innovation.* Negligible impact so far, could grow increasingly negative if rising market power of high-markup firms kept unchecked

  - *Investment.* Lower investment—reducing capital stock by some 3% since 2000 in average AE

  - *Macroeconomic stabilization*. Made it somewhat more difficult, due to decline in natural rate

- **Income distribution:**
  - *Labor share.* Contributed at least 10% (~ 0.2 pct pt) to decline in labor share in average AE.

Policy Implications (1)

- Changing structure of product markets more than policy-driven weakening of competition...
  - Concentration among small fraction of firms in many countries and industries

  - Larger markup increases in better-performing firms

  - Larger increase in the US but also larger (growth-enhancing?) reallocation component

  - Market *deregulation* over past three decades (domestic, trade, FDI)

- ...does *not* warrant inaction:
  - "Winner-takes-most" more likely where competition policy makes it easier to happen

  - Firms that achieved dominance through innovative product and business practices may entrench positions by erecting barriers to entry (e.g. proprietary intangibles)

30

Policy Implications (2)

- Over-arching goal: level playing field across all competitors, including new firms:
  - o Domestic and foreign competition: entry barriers, particularly in services (licensing requirements…etc); trade and FDI liberalization

  - o Competition policy—key complement to product market deregulation:
    - Market examinations and remedies
    - Greater attention to potential loss of competition (?)
    - Competition authorities' resources
    - Dynamic perspective: magnitude and persistence of industry-level profits matters

  - o Diffusion: IPRs to reward disruptive innovations much more than incremental ones

  - o Corporate taxation: shift from profit to economic rent taxation (e.g. cash flow tax); destination-based > sourced-based (e.g. destination-based cash-flow tax)

Thank you!

THE RISE OF CORPORATE MARKET POWER AND ITS MACROECONOMIC EFFECTS

Wenjie Chen, Federico Diez (lead author), Romain Duval (lead author), Callum Jones, Carolina Villegas-Sanchez (consultant) with contributions from Mai Dao, Nan Li, and support from Jiayue Fan and Christopher Johns.

THE RISE OF CORPORATE MARKET POWER AND ITS MACROECONOMIC EFFECTS

Additional Slides

Boxes

- The role of rising concentration and market power for corporate savings

- Are M&As followed by market power increases? Cross-country firm-level evidence

Model: Key Ingredients

• Households consume, supply labor, invest in capital subject to quadratic capital adjustment costs, and save through one-period bonds

• Intermediate goods-producing firms hire capital and labor in competitive markets
   • They produce a substitutable good
   • They face frictions on price setting and set a price which is a markup over marginal costs

• Final goods-producing firms aggregate the intermediate goods into a final good which is used for consumption and investment

• Monetary authority sets the policy interest rate following a Taylor rule

• Stochastic shocks to productivity, discount, Phillips curve, investment, Taylor rule