



Manufacturing the future: The next era of global growth and innovation

McKinsey Global Institute

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DG Enterprise

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Today's discussion



Manufacturing matters —
but it is not monolithic and its nature, role,
and relative size are changing



Global trends are dramatically changing
the manufacturing landscape —
new opportunities arise in a more complex
and uncertain environment



Companies and policy makers need a new
mindset, new capabilities, and a conviction to
act to “manufacture the future”

Manufacturing makes outsized contributions

Direct economic contributions

2011; Percent



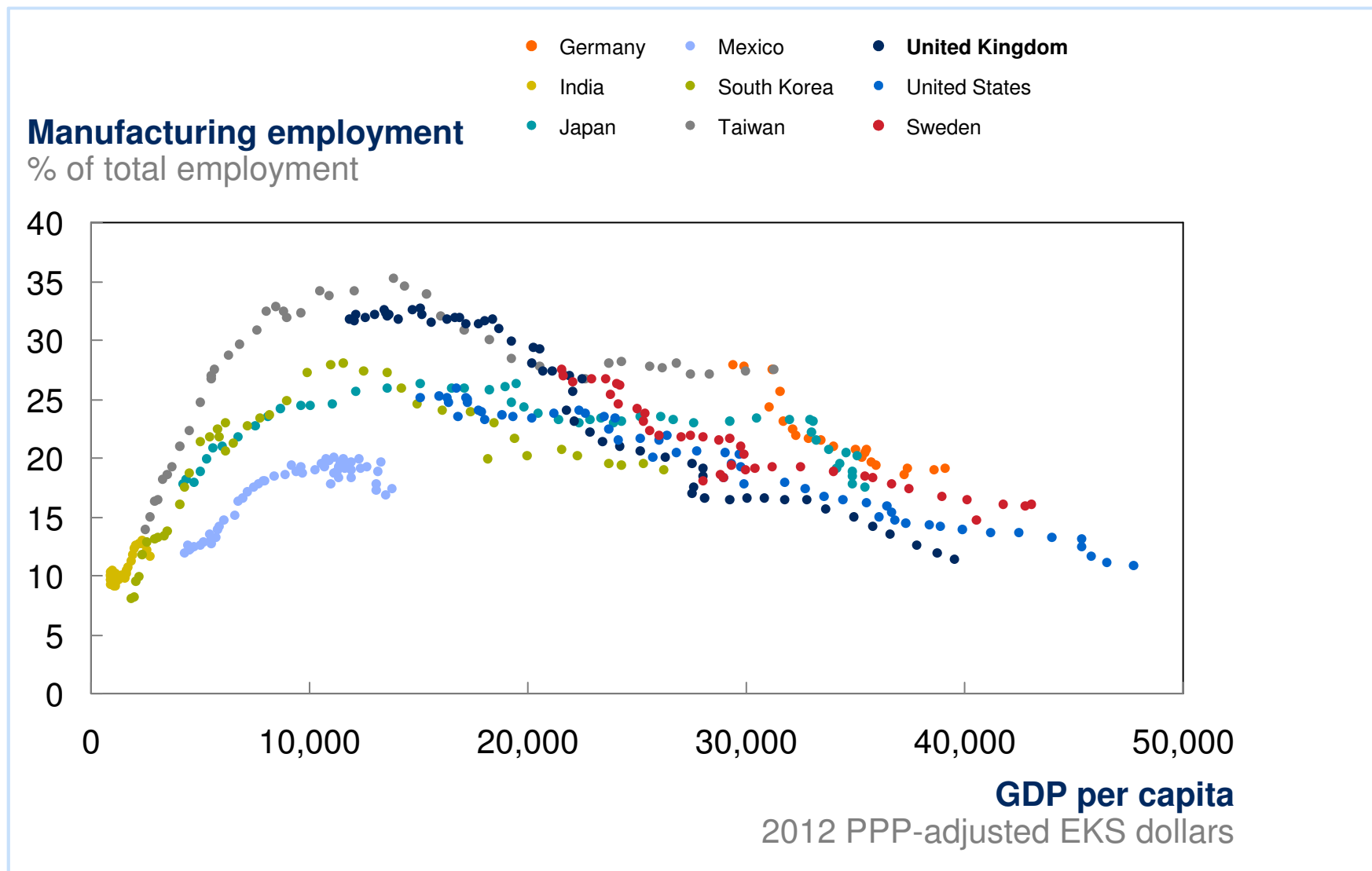
Value added	16	12
Employment	14	9
Exports ¹	72	61
Private sector R&D ²	74-89	67
Productivity growth ³	37	30
Value-added growth ⁴	13	12
Employment growth ⁵	-43	-62

Indirect contributions

- Productivity gains are passed on to consumers as **lower prices**
- Technology innovation results in **spillover effects**
- Providing **solutions to societal challenges** such as reducing energy and resource consumption

1 US: 2010 2 2008; Germany (89%); UK (39% plus 35% contracted by manufacturers) 3 1995-2005
4 2000-2011 (EU-27), 2000-2010 (US), 2001-2011 (UK) 5 2000-2011 (EU-27), 2000-2007 (US), 2001-2011 (UK)

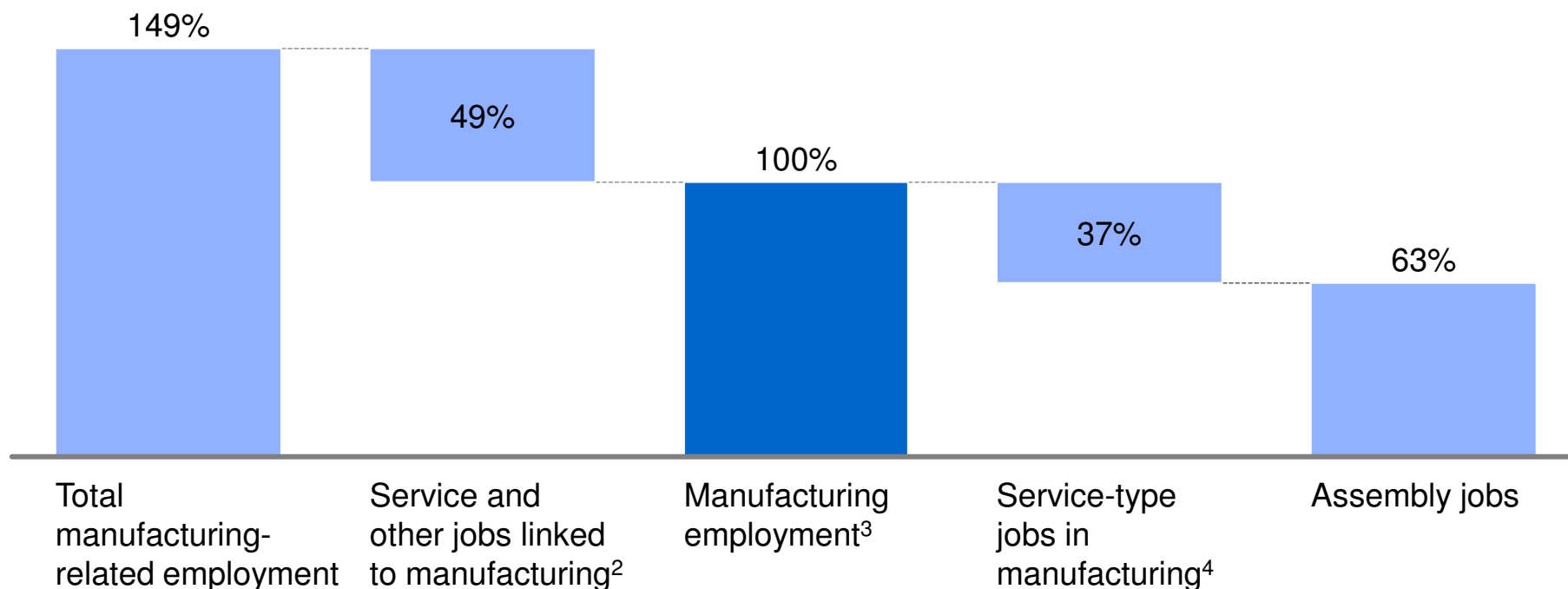
Manufacturing share of total employment follows an inverted U-shape pattern as an economy becomes more prosperous



Assembly accounts for less than half of manufacturing-related employment

US manufacturing employment, 2010¹

Normalized; manufacturing employment=100



1 Employment is total FTEs plus self-employed.

2 4.7 million jobs in services and 1 million jobs in primary resource industries that are directly and indirectly linked to manufacturing. Employment multipliers were applied to import-adjusted final demand for manufacturing. Employment multipliers were calculated applying employment to output ratios to the output multiplier table. Output multipliers were advanced using an import-adjusted input-output table.

3 Manufacturing employment as reported by the US Bureau of Economic Analysis.

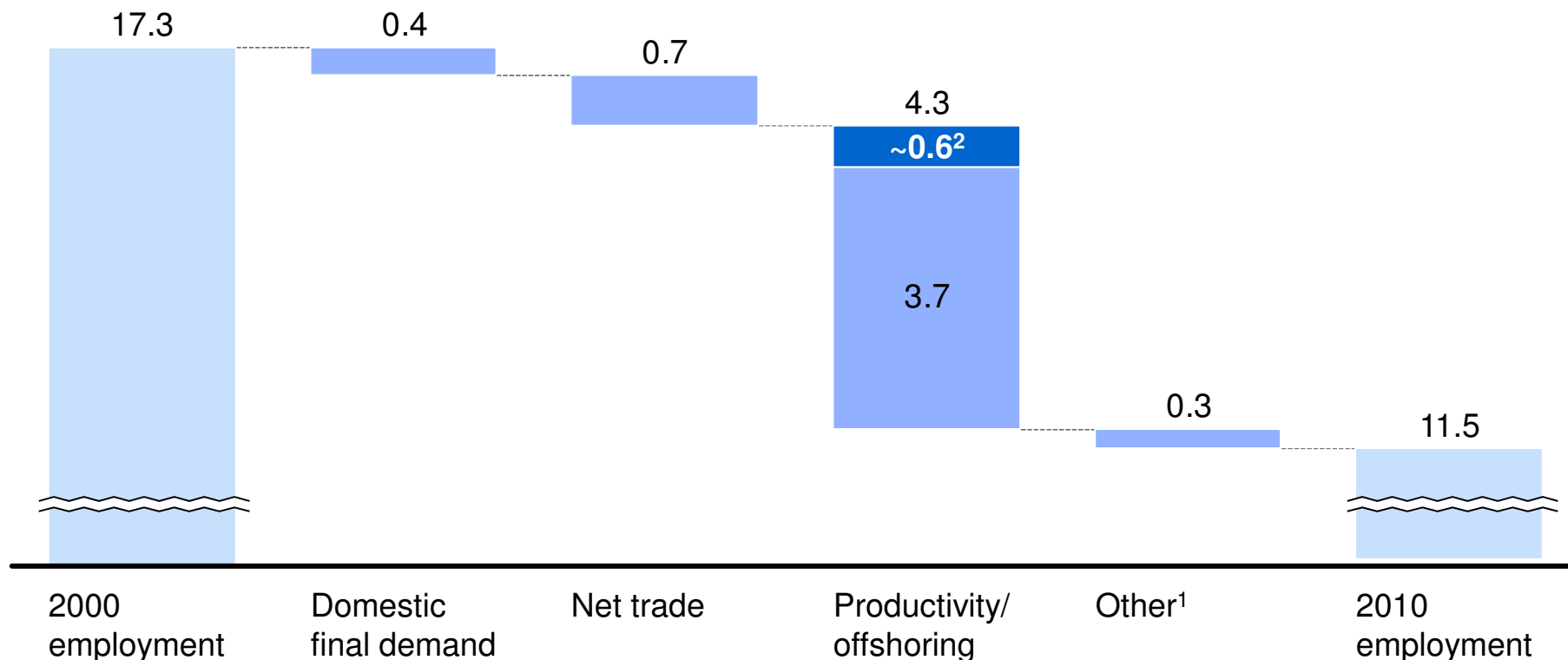
4 Non-production jobs in manufacturing sectors, such as product R&D, marketing and sales, customer care and service, back-office functions, and facilities management.

US manufacturing job losses in the past decade were driven mostly by productivity gains that were not matched by demand growth

ESTIMATES

Contribution of various factors to US manufacturing job losses, 2000–10

Million FTEs



1 Includes the multiplicative effect of productivity and demand combined; changes in value-chain compositions, e.g., increased outsourcing (-), more demand from outsourcers (+), or substitution of inputs; and residual differences.

2 Cost savings from offshoring and low-cost imports; this leads to overstating of productivity metrics rather than being reflected in net trade.

NOTE: Not to scale. Numbers may not sum due to rounding; FTE is full-time equivalent.

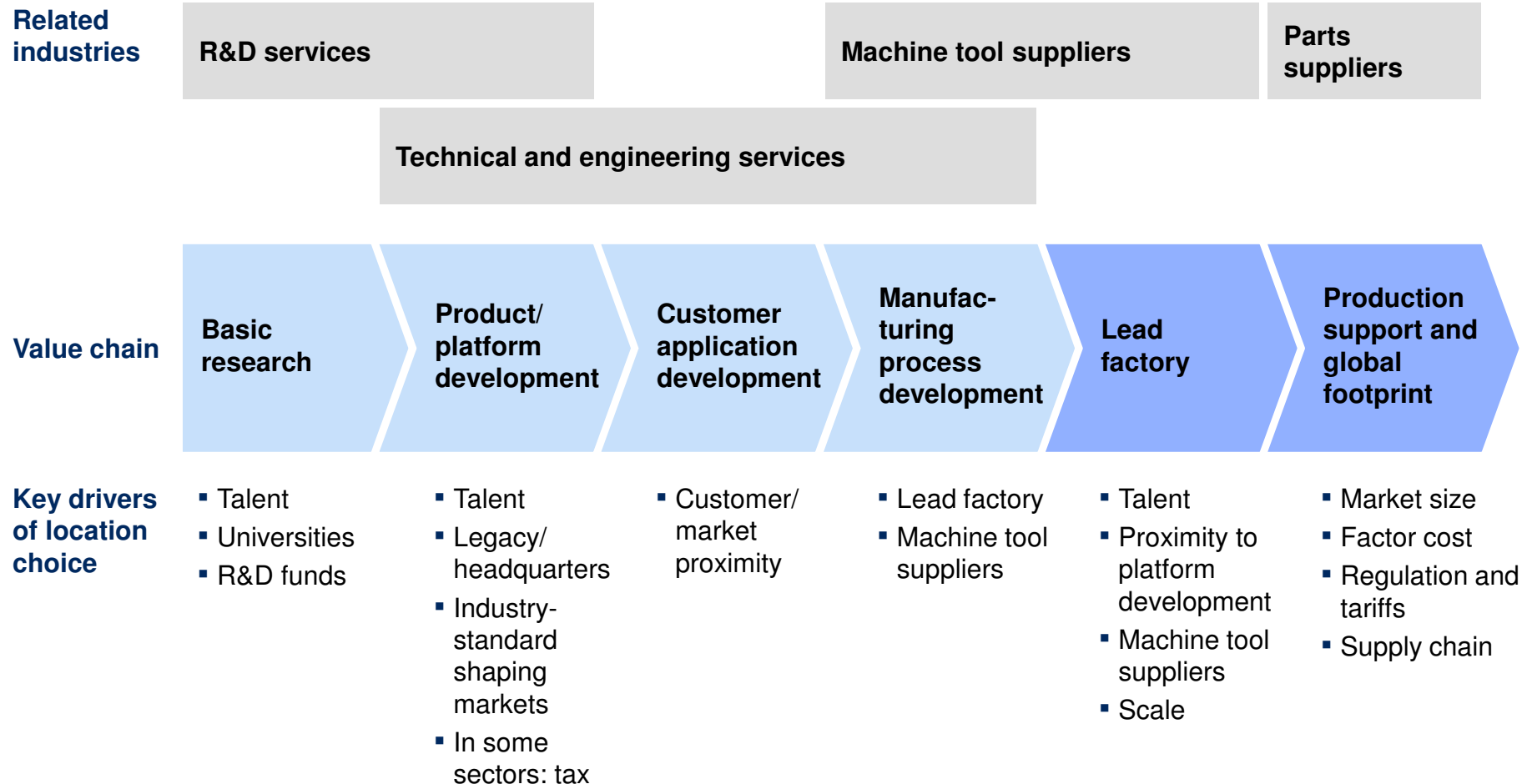
SOURCE: BEA; Susan Houseman et al., "Offshoring bias in US manufacturing," *Journal of Economic Perspectives*, volume 25, number 2, Spring 2011; McKinsey Global Institute analysis

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R&D: Need for proximity to production strongly dependent on the phase of innovation

ILLUSTRATIVE

■ Innovation
■ Production



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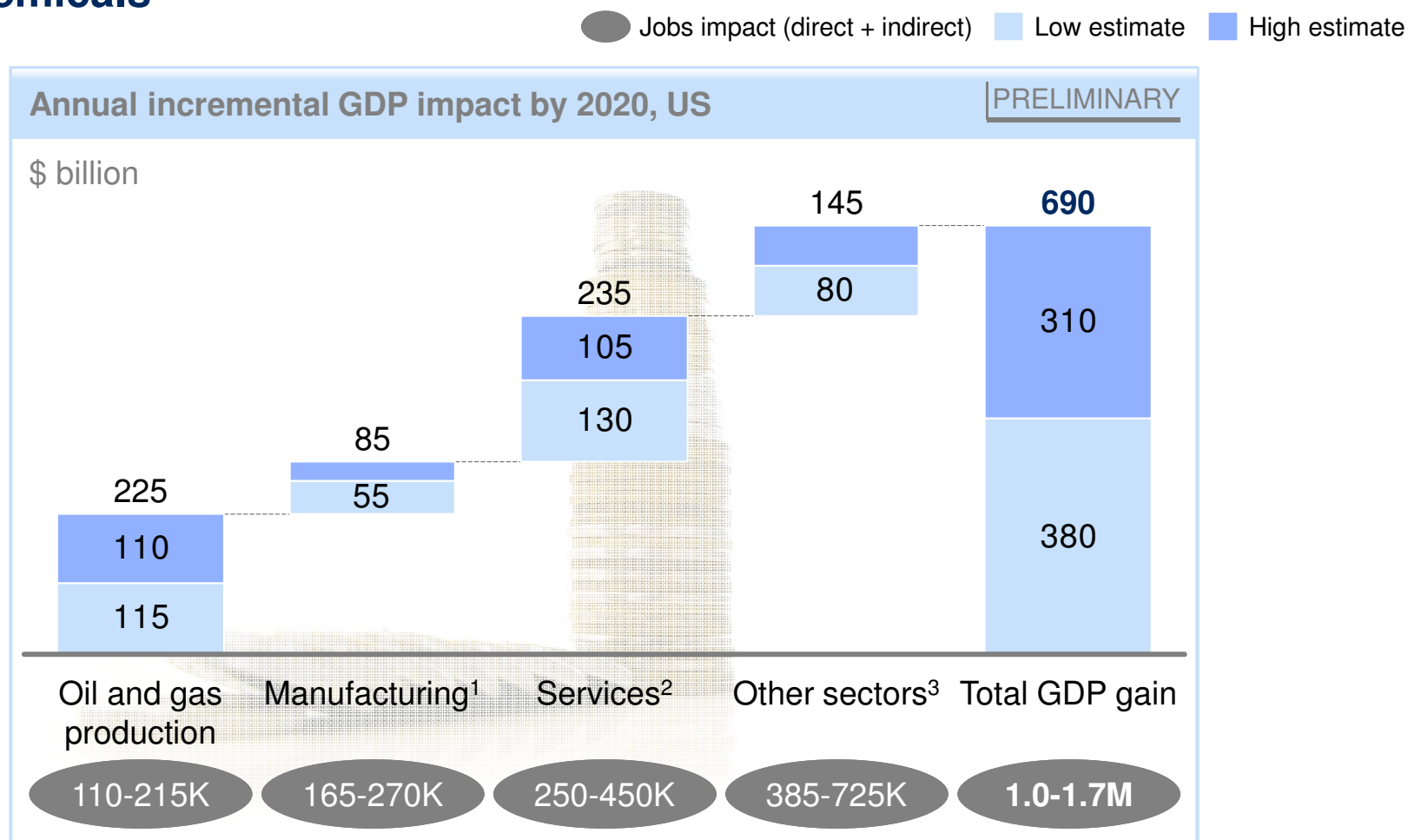
SOURCE: E. Abele et al., eds., *Global production: A handbook for strategy and implementation*; McKinsey Global Institute analysis

Five manufacturing segments



Group	Industry	R&D intensity	Labor intensity	Capital intensity	Energy intensity	Trade intensity	Value density
34 Global innovation for local markets	Chemicals	High	Low	High	Upper-middle	Upper-middle	Lower-middle
	Motor vehicles, trailers, parts	Upper-middle	Low	Low	Low	Upper-middle	Upper-middle
	Other transport equipment	High	Upper-middle	Low	Low	Upper-middle	Upper-middle
	Electrical machinery	Upper-middle	Low	Low	Lower-middle	Upper-middle	Upper-middle
	Machinery, equipment, appliances	Upper-middle	Low	Low	Lower-middle	Upper-middle	Upper-middle
28 Regional processing	Rubber and plastics products	Upper-middle	Upper-middle	Low	Upper-middle	Low	Upper-middle
	Fabricated metal products	Low	High	Low	Upper-middle	Low	Low
	Food, beverage, and tobacco	Upper-middle	High	High	Upper-middle	Low	Low
	Printing and publishing	Upper-middle	Upper-middle	Low	Lower-middle	Low	Upper-middle
22 Energy-/resource-intensive commodities	Wood products	Low	High	Upper-middle	High	Low	Low
	Refined petroleum, coke, nuclear	Upper-middle	Low	High	High	Upper-middle	Low
	Paper and pulp	Upper-middle	Upper-middle	Upper-middle	High	Upper-middle	Low
	Mineral-based products	Upper-middle	Upper-middle	Upper-middle	High	Low	Low
	Basic metals	Upper-middle	Low	High	High	Upper-middle	Low
9 Global technologies/innovators	Computers and office machinery	High	Low	High	Low	High	High
	Semiconductors and electronics	High	Low	Upper-middle	Low	High	High
	Medical, precision, and optical	High	Low	Upper-middle	Low	High	High
7 Labor-intensive tradables	Textiles, apparel, leather	Low	High	Low	Upper-middle	High	Upper-middle
	Furniture, jewelry, toys, other	Low	High	Low	Low	High	Upper-middle

Example shale gas US: Potential to create up to 1.7 million jobs – but only around 200K in manufacturing, focused in suppliers to the industry and petrochemicals



1 Includes chemicals, metals, paper and pulp, and rubber and plastics manufacturing.

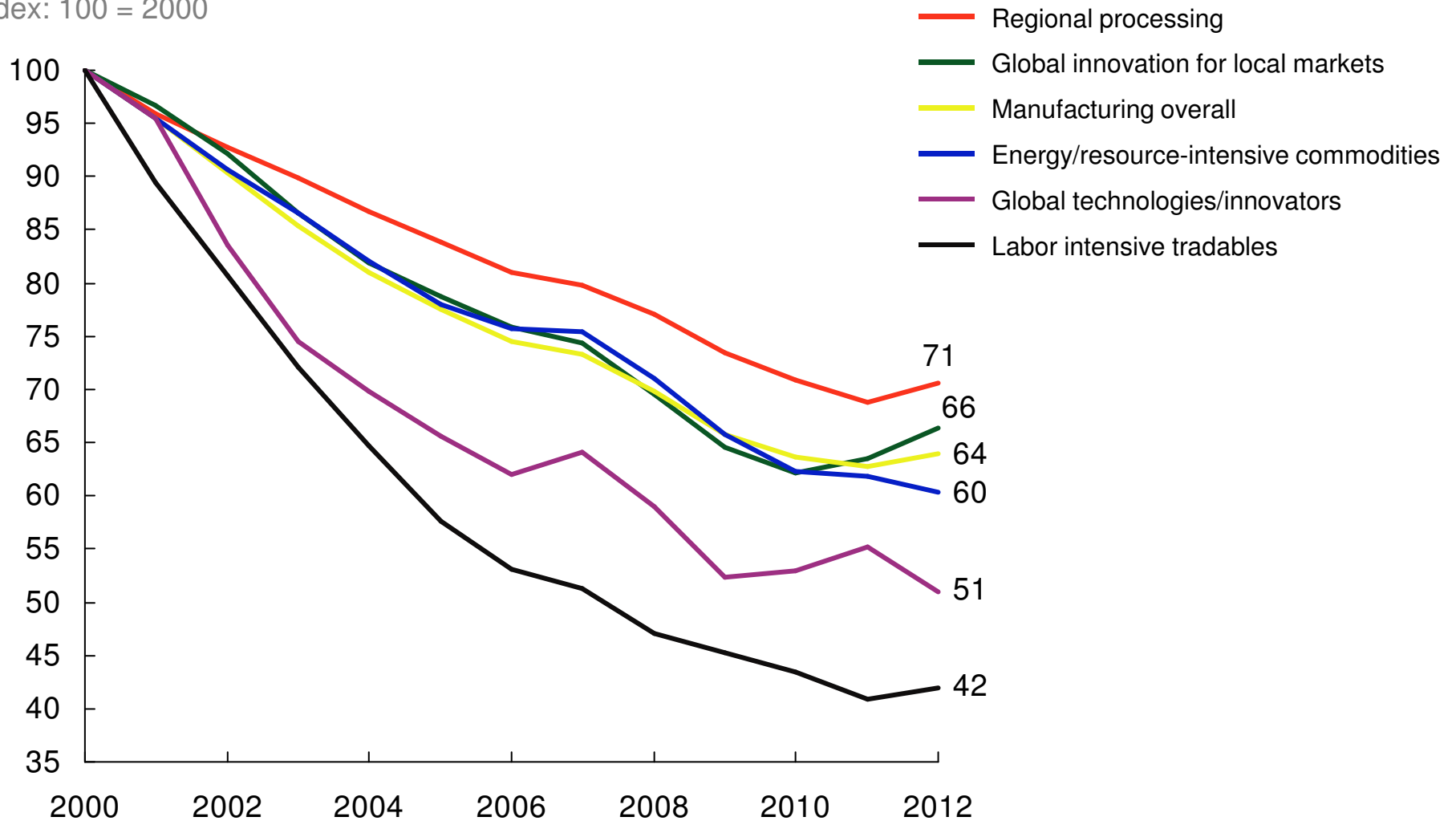
2 Includes financial, legal and professional services, management, real estate, healthcare and education, waste management, and leisure and hospitality

3 Includes wholesale and retail trade, construction, transport and warehousing and government.

Manufacturing employment declined most in labor-intensive tradables and least in regional processing

Manufacturing employment by group in UK, 2000–2012

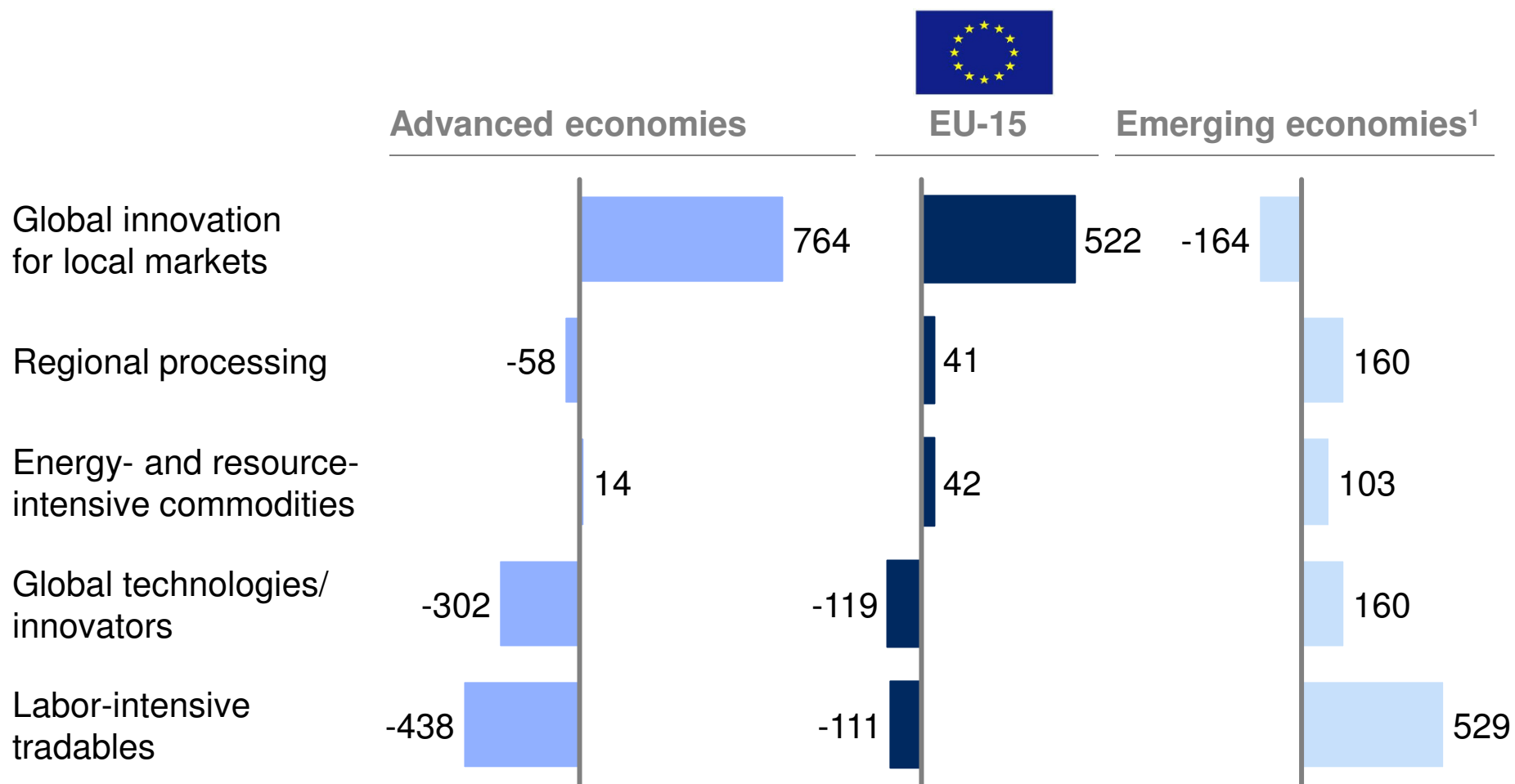
index: 100 = 2000



Advanced economies run a large trade surplus in global innovation for local markets, but import most labor-intensive tradables

Net exports, 2012

\$ billion



¹ Includes: Brazil, China, India, Russia, Indonesia, Mexico, Turkey, and Thailand.

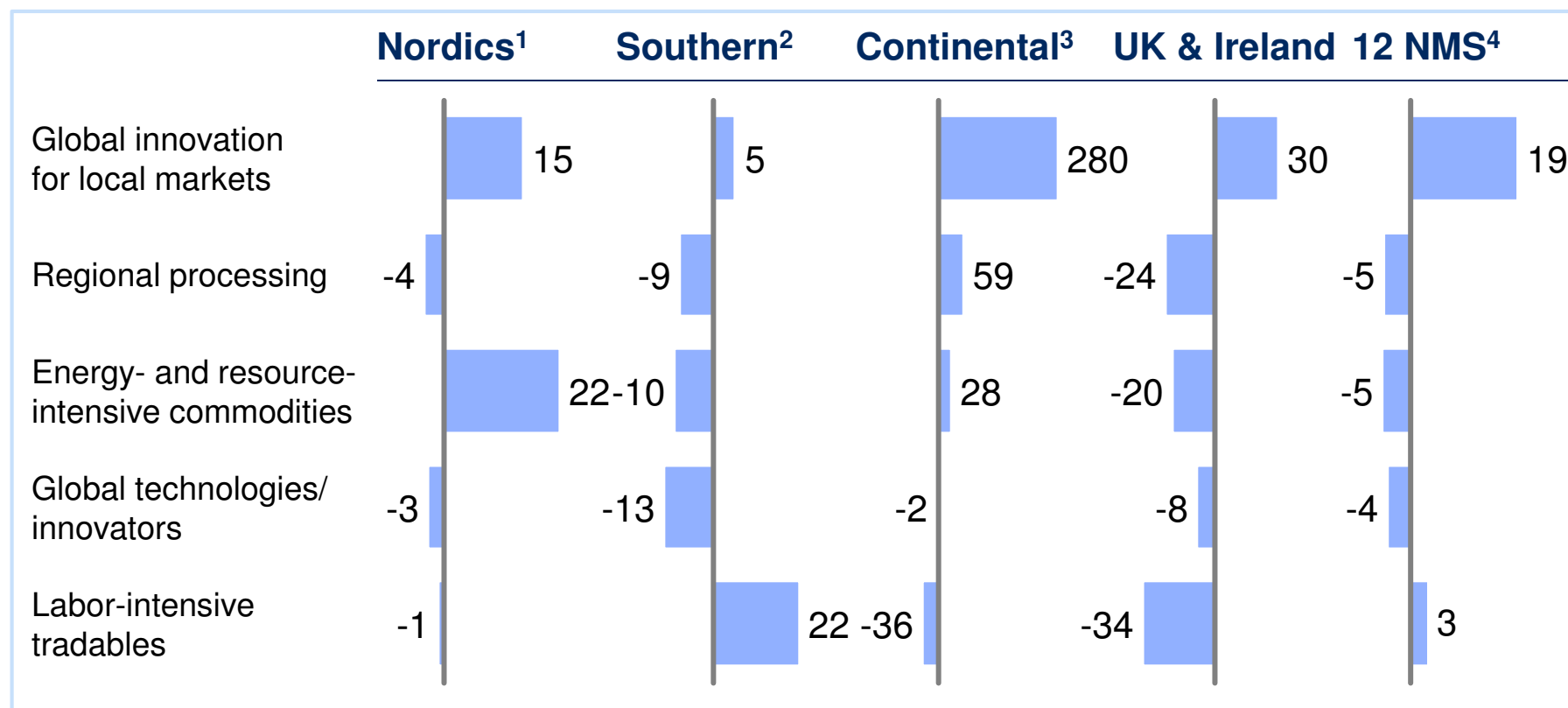
SOURCE: IHS Global Insight; McKinsey Global Institute analysis

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Different trade regional patterns exemplified by Southern European strength in labor-intensive tradables vs. Continental European strength in Global innovation for local markets

Net exports, 2011

EUR billion



1 Sweden, Finland, Denmark;

2 Greece, Spain, Italy, Portugal,

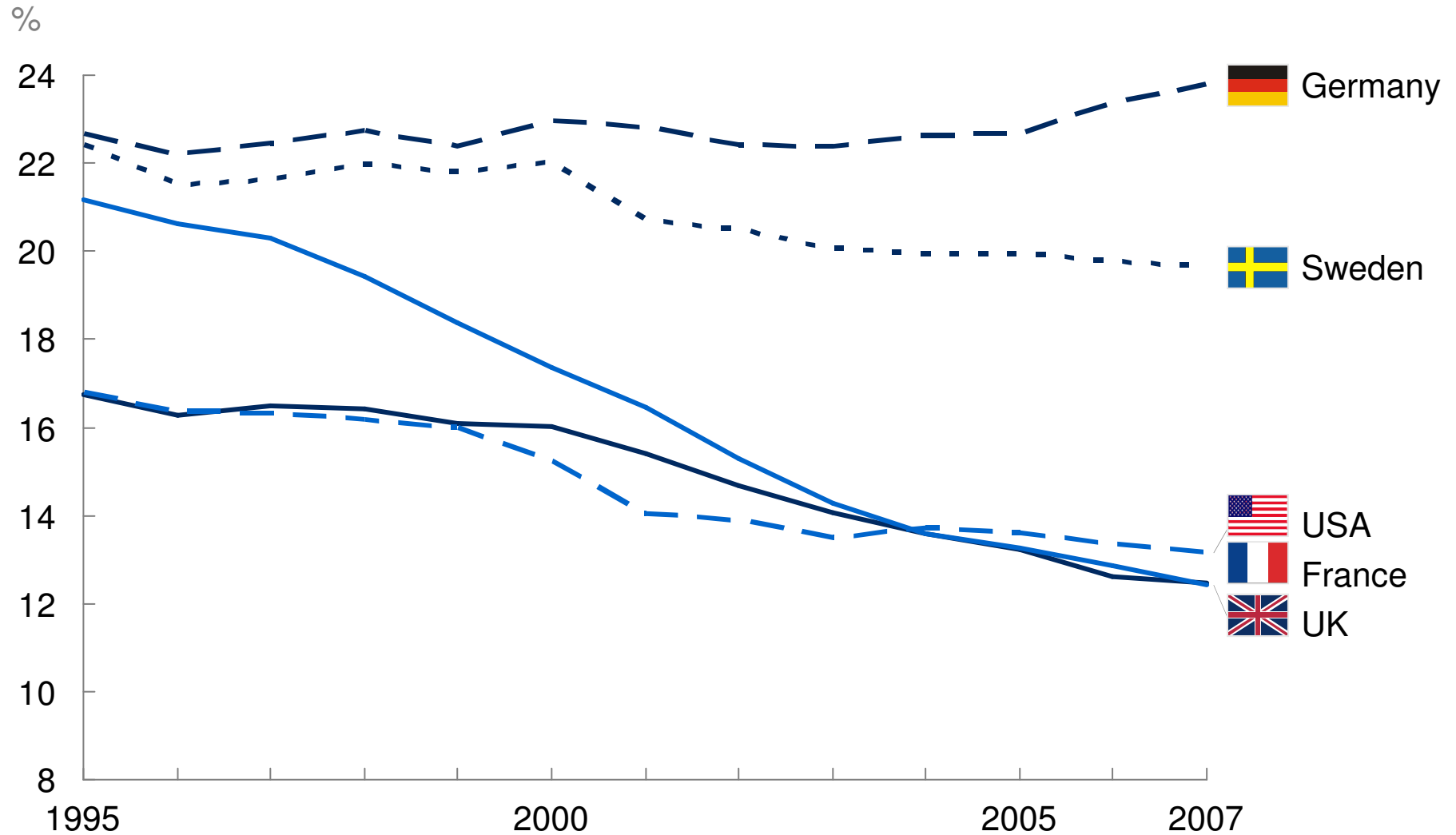
3 Germany, Austria, Luxembourg, Belgium, France, Netherlands; 4 Poland, Czech Republic, Cyprus, Latvia, Lithuania, Slovenia, Slovakia, Estonia, Hungary, Malta, Bulgaria, Romania

SOURCE: Eurostat

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Among advanced economies, Germany and Sweden maintained a comparatively high share of manufacturing

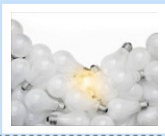
Manufacturing share of GDP



Attributes of Germany's and Sweden's competitiveness reflect policy but also company decisions

Attribute in economy

✓ Yes
✓ To some extent

Attribute		Germany	Sweden
Productivity	 Strong vocational training and high skilled engineers	✓	✓
	 R&D, innovation, premium positioning	✓	✓
	 Strong supply chains and clusters, good infrastructure	✓	✓
Costs	 Tailwind from weak currency; wage restraint and favorable employer-union relationship	✓	✓
Globalization	 Exposure to high-growth segments with demand from EMs	✓	✓
	 Focus on high value activities in global supply chains	✓	✓
	 Internationalization on the back of strong MNCs	✓	✓

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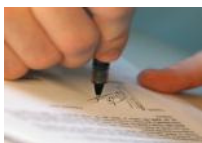


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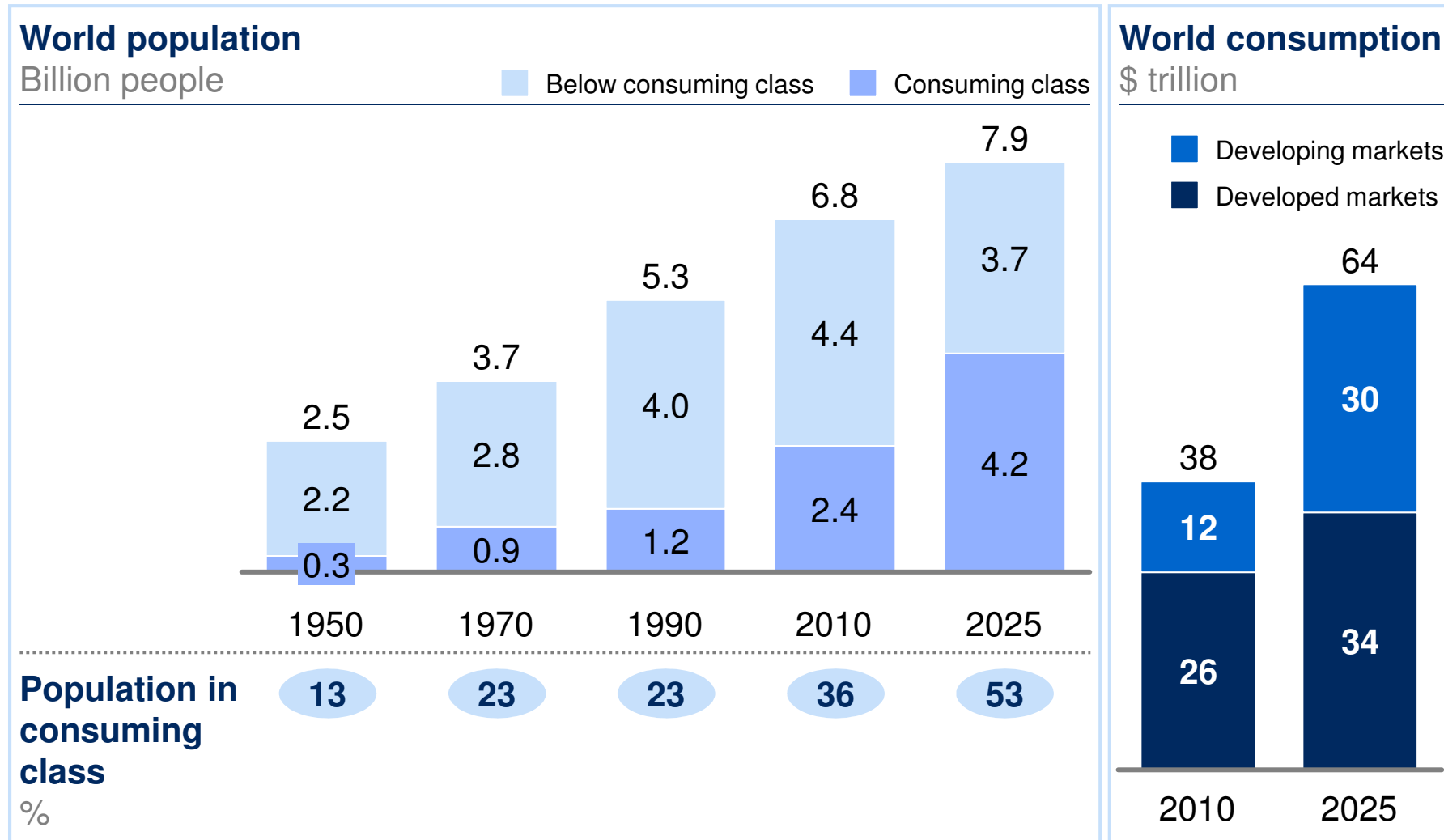
Companies and policy makers need a new
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act to “manufacture the future”

Six disruptive trends and trend breaks

From...			To
1	Demand	 ▪ Demographic dividend driving growth ▪ High growth but low volume in emerging economies	▪ Aging and the productivity imperative ▪ High absolute growth in emerging economy cities ▪ Demand fragmentation
2	Factor inputs	 ▪ Decreasing global cost	▪ Increasing scarcity of talent, resources, and (risk) capital
3	Policy	 ▪ Ultimate trust in market efficiency; liberalization and deregulation	▪ Re-regulation, intervention... in nation states
4	Technology	 ▪ Automation and efficiency in production and transactions ▪ Several new technologies hyped but in infancy	▪ Big data and knowledge-worker effectiveness ▪ Gaining scale in advanced materials, robotics, nanotech, biotech, etc.
5	Industry and competition	 ▪ Emerging economies as low cost production centers	▪ Truly global competition ▪ Blurring of manufacturing and services
6	Volatility	 ▪ 'Great Moderation'	▪ 'Great Uncertainty'

1. Demand

Demand shift: By 2025, half of global consumption will be in emerging markets

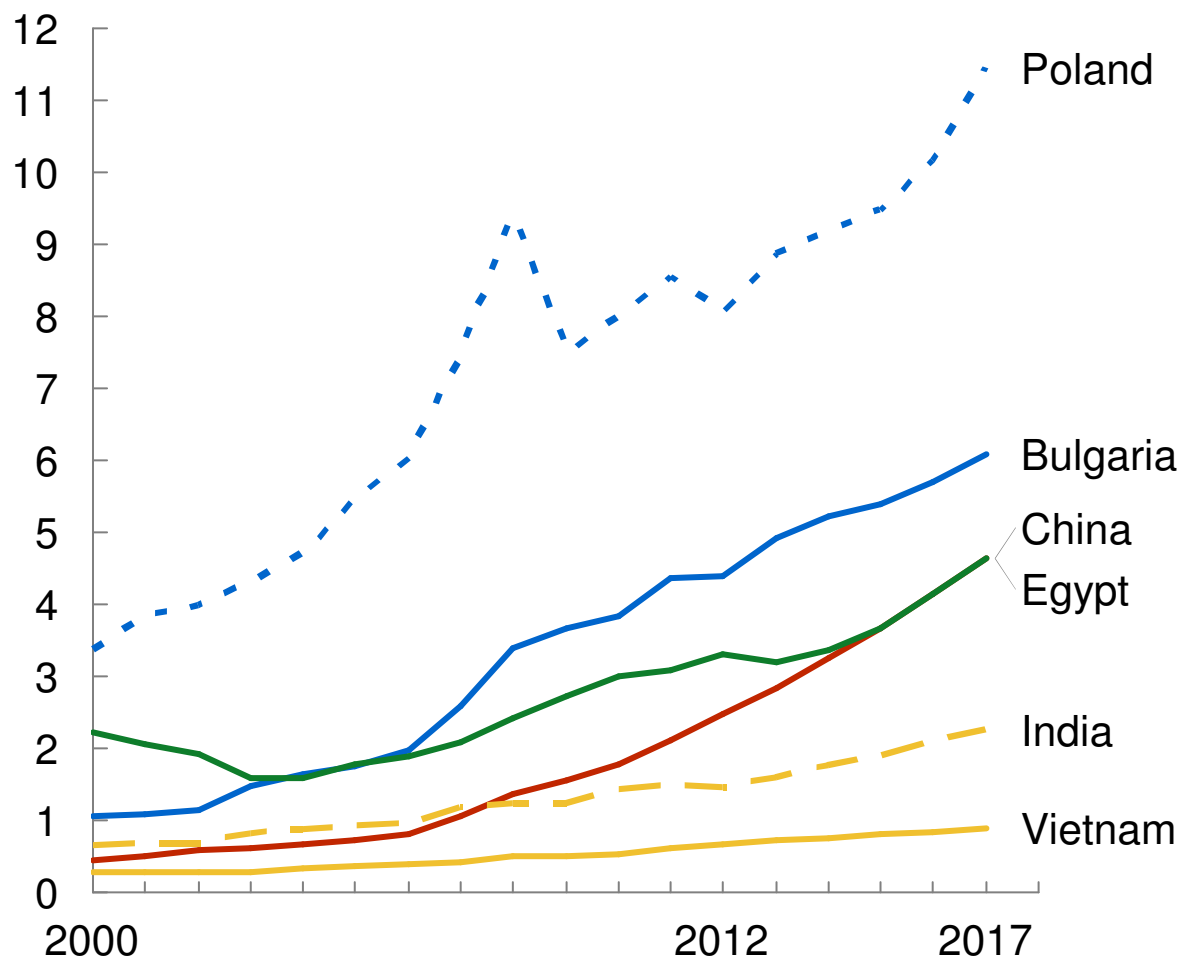


2. Factor inputs

CEE countries starting to become competitive on wages with China – South-East Asia, North Africa and others gaining in attractiveness

Hourly manufacturing cost of labor

USD; Projections from 2013

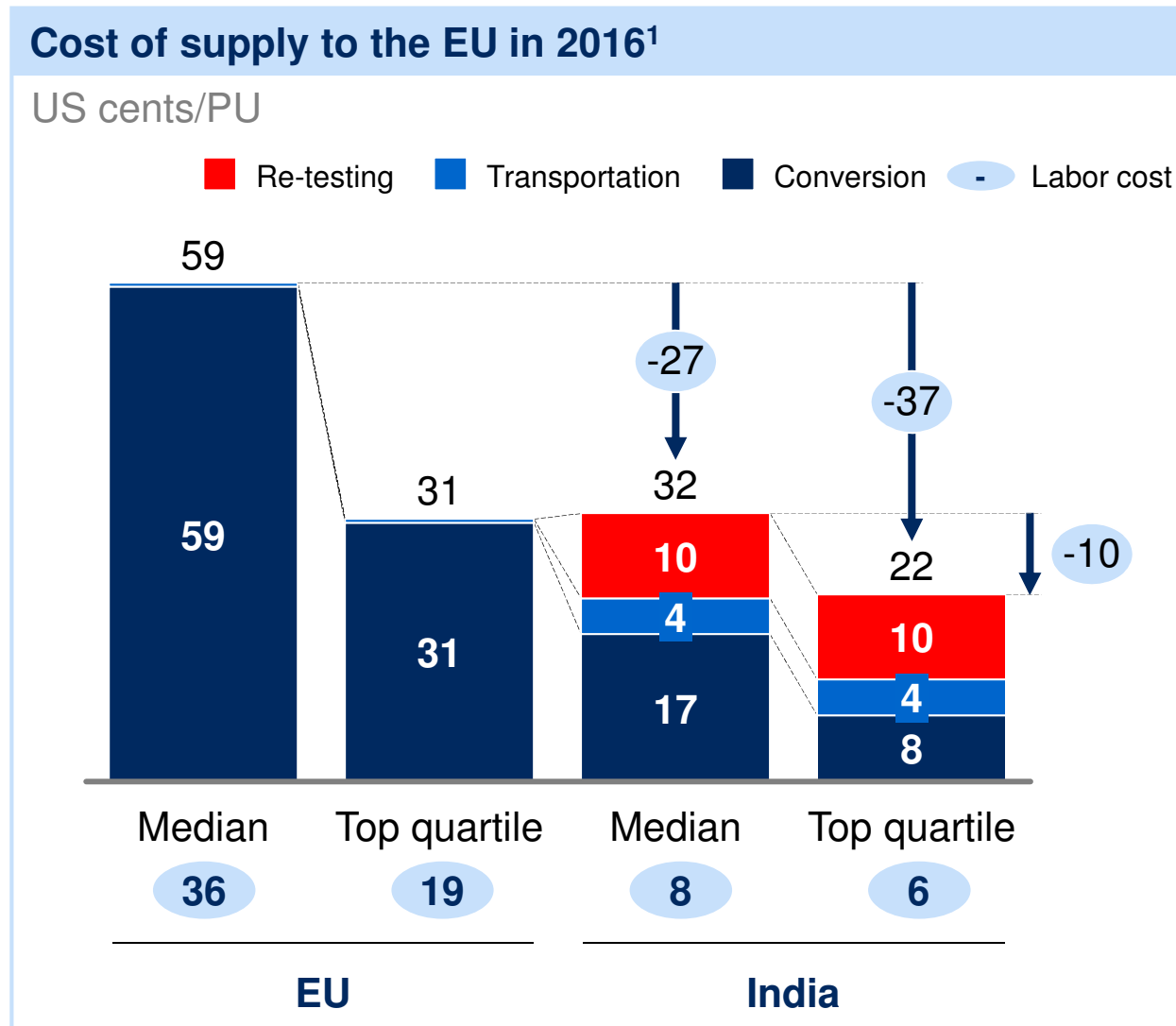


Note:

- Average wages never reflect the specifics of the region, industry, or job profile (blue collar/ low-skilled, machine operator, etc.), owner (multinationals pay more), and required retention policy
- Need to adjust for productivity, which strongly depends on the type of management introduced but also the scale of the industry in the respective country
- Experience values exist for those adjustments

2. Factor inputs

Regulations can significantly affect landed cost



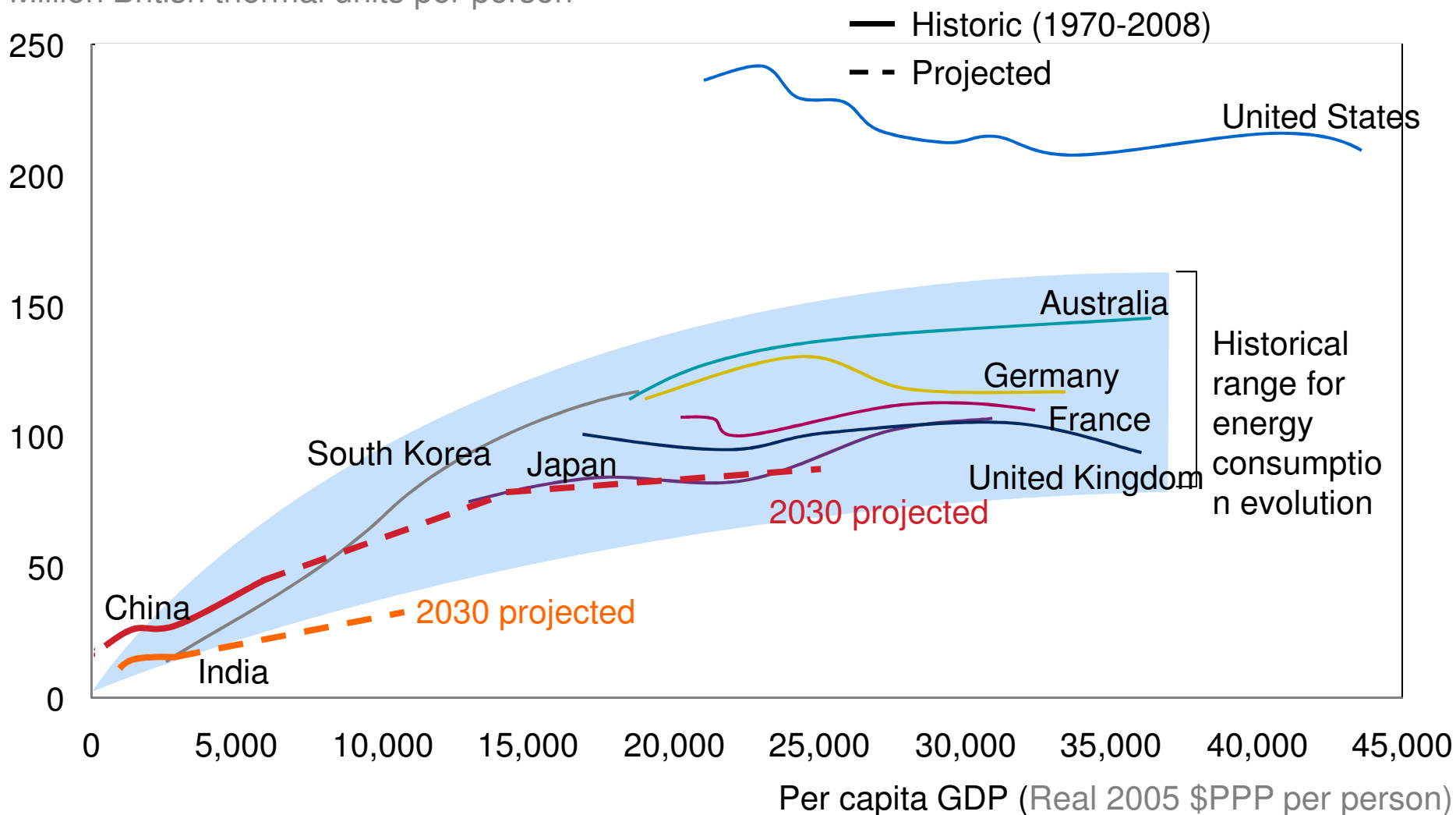
¹ Excludes cost of raw materials, assumed not to play a role in geographical footprint decisions

SOURCE: POBOS, Drewry maritime research, US government shipping rates guide, World bank WITS, expert interviews, team analysis

2. Factor inputs

Demand for resources set to continue to steeply increase – putting pressure on prices

Per capita energy consumption, 1970–2008, projected to 2030 for India and China
Million British thermal units per person



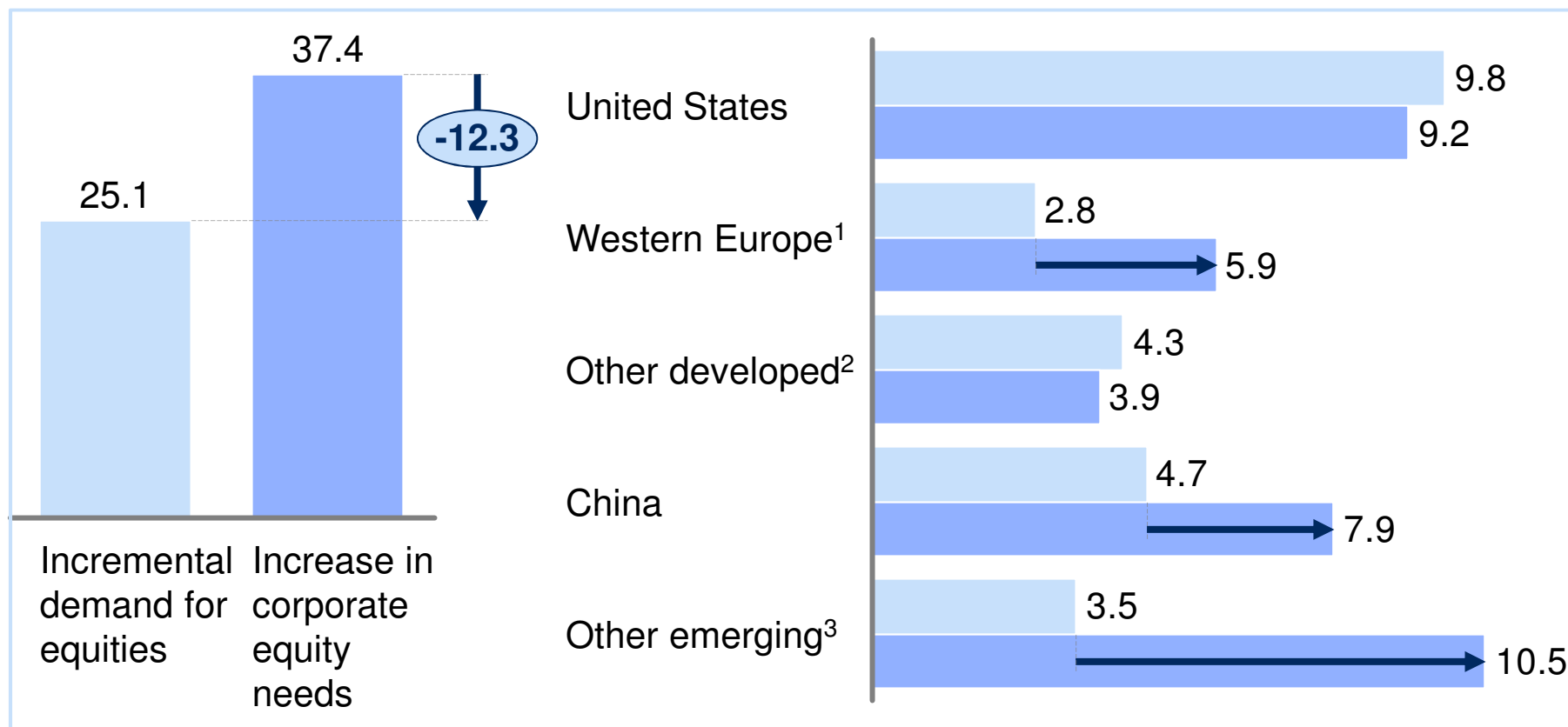
2. Factor inputs

The emerging equity gap: Demand for equities may not satisfy corporate needs once central bank money recedes

Incremental demand for equities by domestic investors vs. increase in corporate equity needs, 2010–20F

\$ trillion; 2010 exchange rates

- Incremental demand for equities
- Increase in corporate equity needs



¹ France, Germany, Italy, Spain, and the United Kingdom.

² Australia, Canada, Japan, and South Korea.

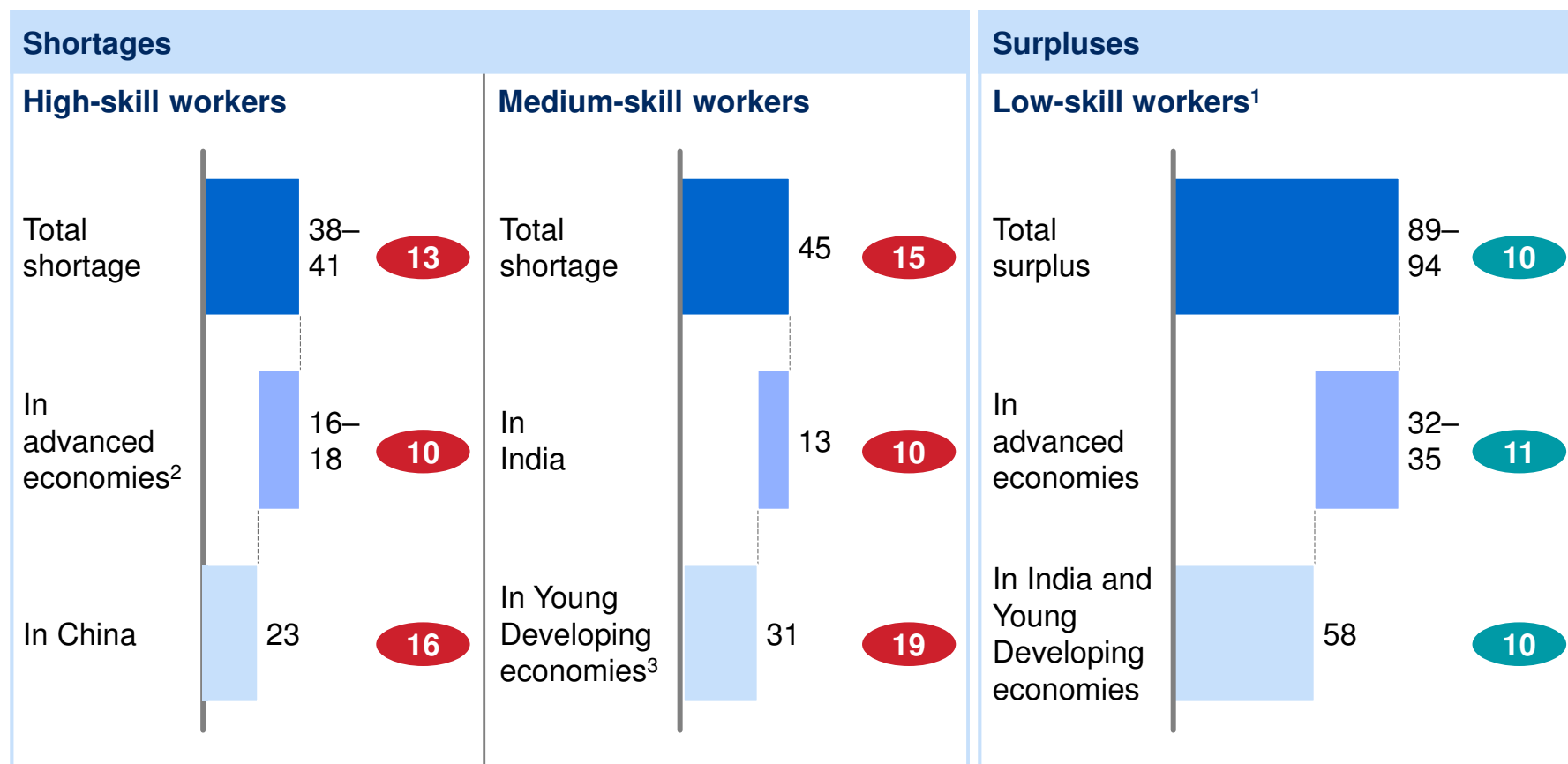
³ Brazil, India, Indonesia, Mexico, Russia, South Africa, and Turkey.

2. Factor inputs

The world is likely to have too few highly-skilled workers and not enough jobs for low-skilled workers

Gap between demand and supply of workers by educational attainment, 2020E Million workers

● % of supply of skill cohort
● % of demand for skill cohort



¹ Low-skill defined in advanced economies as no post-secondary education; in developing, low skill is primary education or less.

² 25 countries from the analyzed set of 70 countries, that have GDP per capita greater than US\$ 20,000 at 2005 purchasing power parity (PPP) levels in 2010.

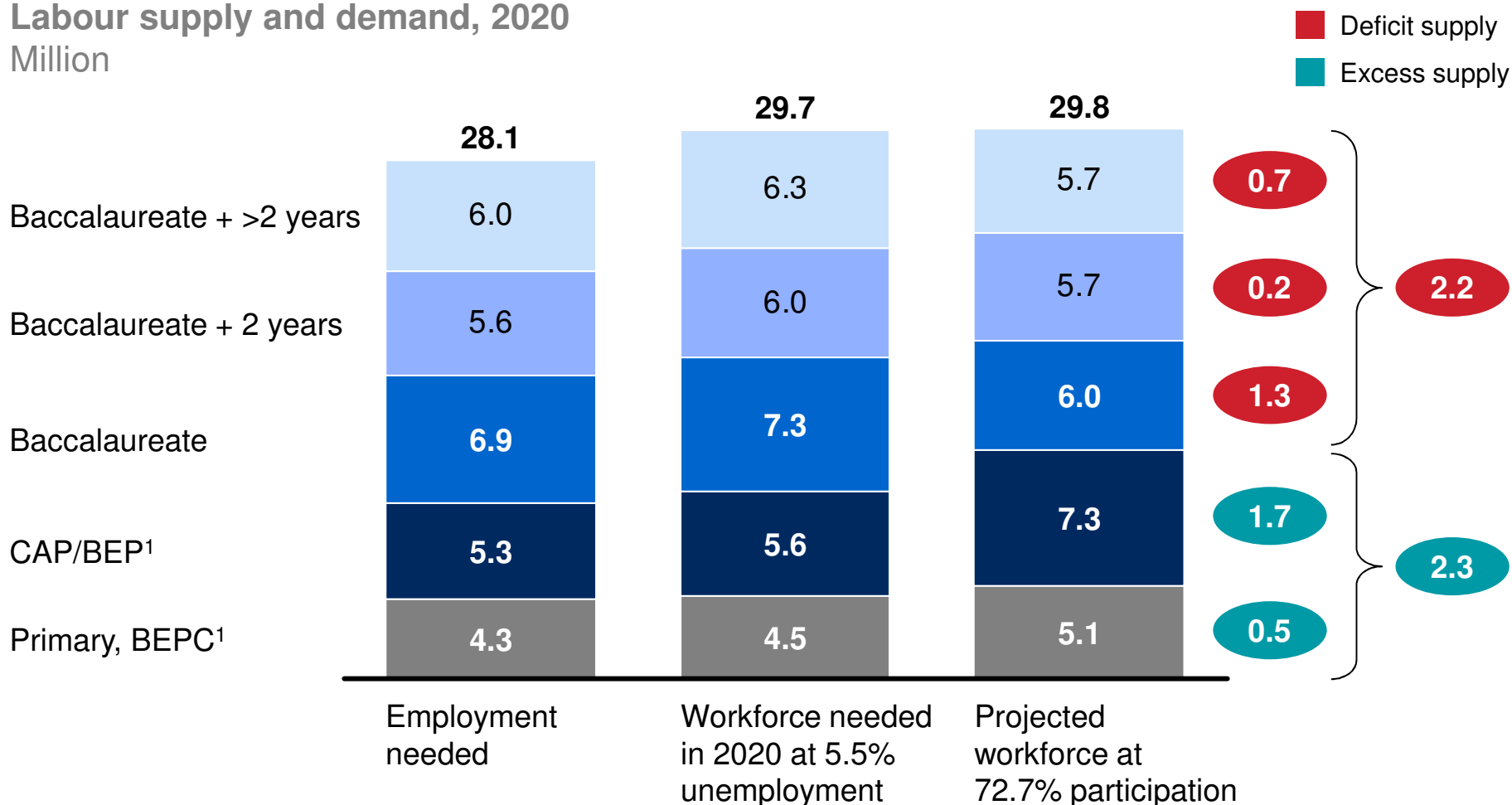
³ 11 countries from the analyzed set of 70 countries, from South Asia and sub-Saharan Africa, with GDP per capita less than \$3,000 at 2005 PPP levels in 2010.

2. Factor inputs – Deep-dive France skills

Skills mismatches will increase, leading to a shortage of 2.2 million high-skilled workers and 2.3 million low-skilled jobs by 2020

Labour supply and demand, 2020

Million



1 CAP: "Certificat d'Aptitude Professionnelle"; BEP: "Brevet d'Etudes Professionnelles"; BEPC: "Brevet d'Etudes du Premier Cycle".

NOTE: Numbers may not sum due to rounding.

SOURCE: Global Insight; National Institute of Statistics and Economic Studies, France; International Institute for Applied Systems Analysis; McKinsey Global Institute analysis

3. Policy

Changes in the debate on the role of state vs. the economy

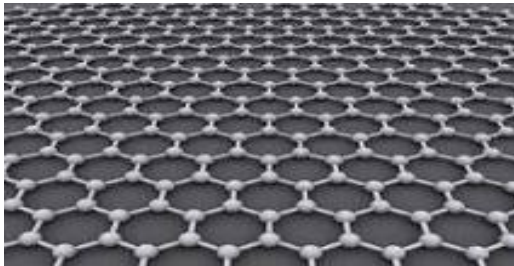


4. Technology

New technologies change manufacturing value chains and processes

New materials

- Nanotech
- Composites
- Biologics



Product design

- Collaboration, co-creation
- Rapid prototyping
- Crowd sourcing



Production processes

- Advanced robotics
- Additive manufacturing
- Modeling and simulation



Information technology

- Big Data and analytics
- Computer-aided design
- Internet of things



Business models

- Frugal innovation
- Circular economy
- New service models



Value and supply chains

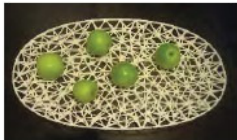
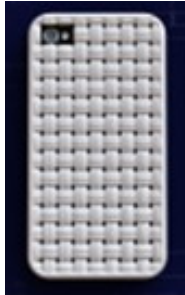
- Agile supply chains
- Integration and visibility
- New ecosystems



4. Technology

Additive direct part production is starting to affect both industrial and consumer industries

NOT EXHAUSTIVE

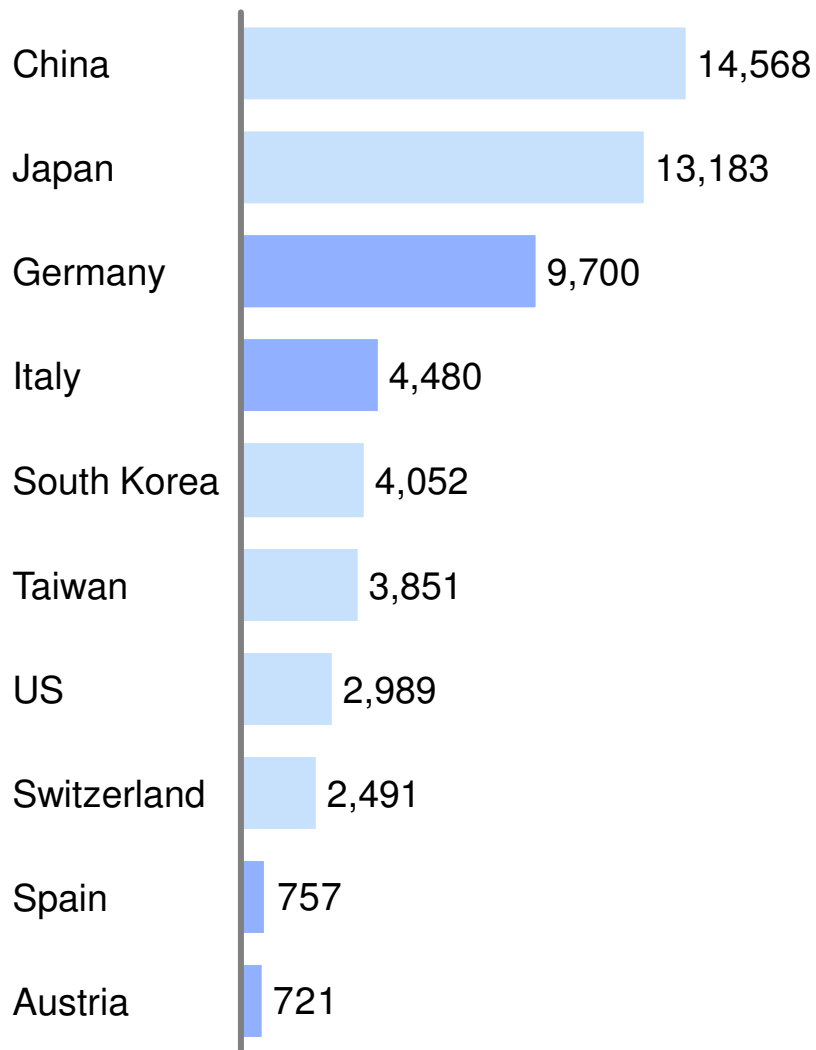
Industrial	Aerospace	Medical	Dentistry	Industrial	Military
					Motorsports
					Automotive
Consumer	Lighting	Home accessories	Fashionable consumer products	Collectables	Trophies
					Sporting goods
					Jewelry and Art

4. Technology

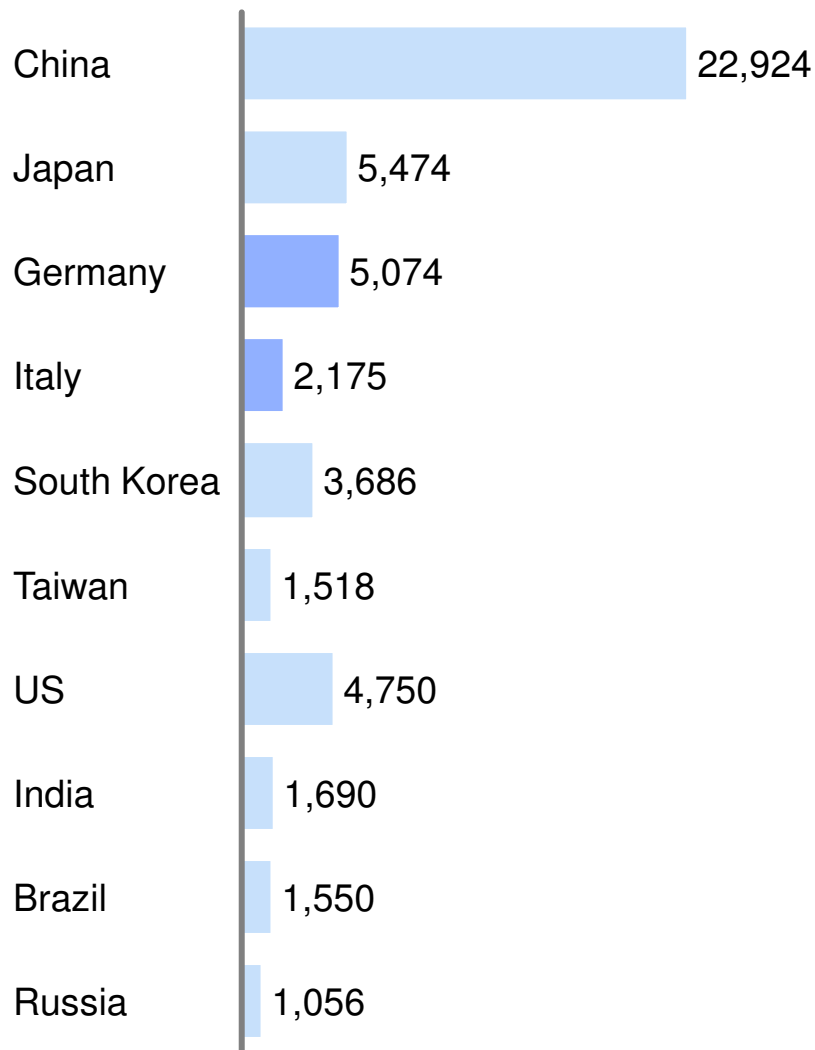
China increasingly tops the list also in tooling

Gross output; EUR million, 2011

Machine tool production



Machine tool consumption

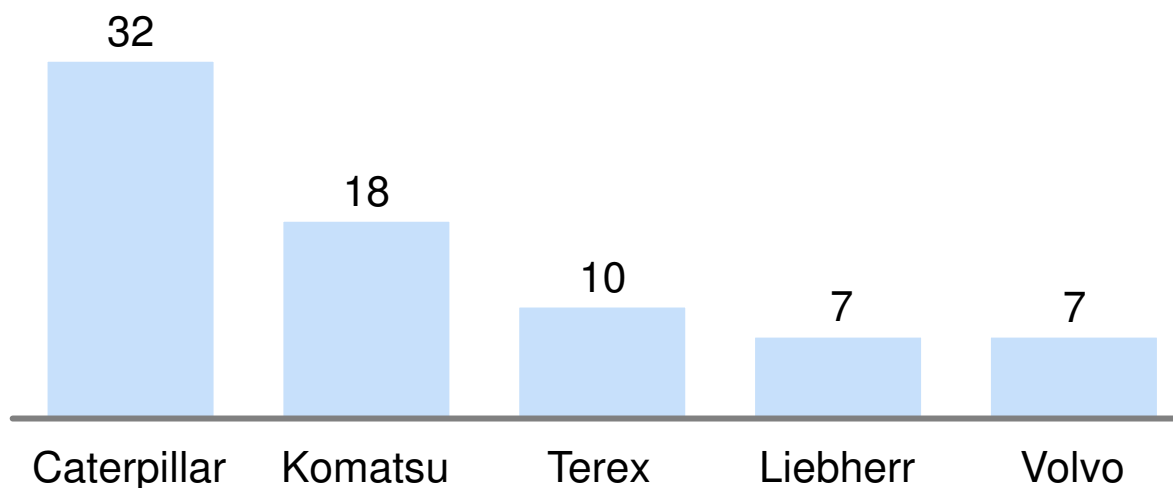


5. Global competition

Major value-volume disconnects are evident as emerging-market players capture the growth in their home markets

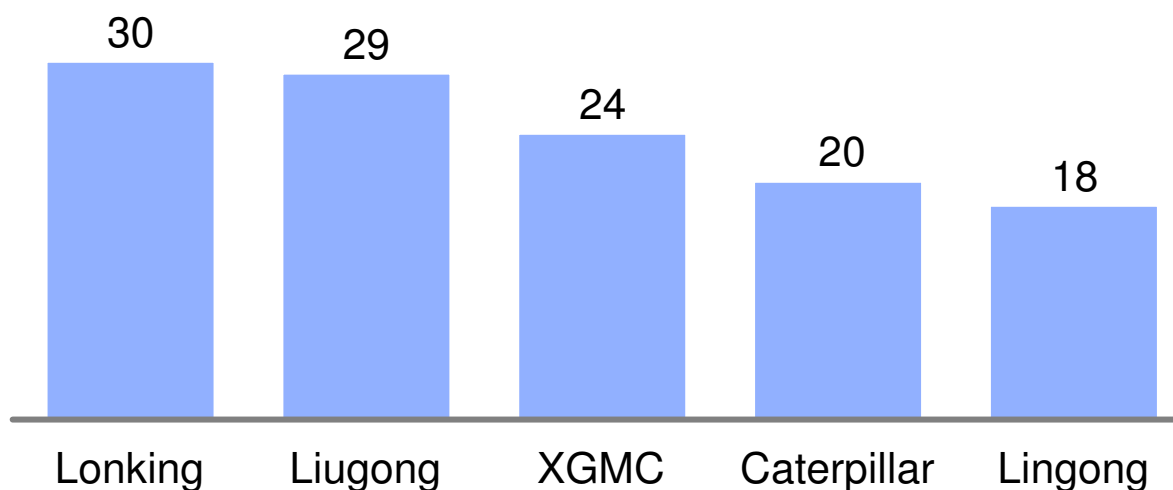
Top five construction equipment manufacturers by revenue, 2008

\$ billion



Top five volume producers of high-selling construction equipment SKU

Wheel loaders (thousand)

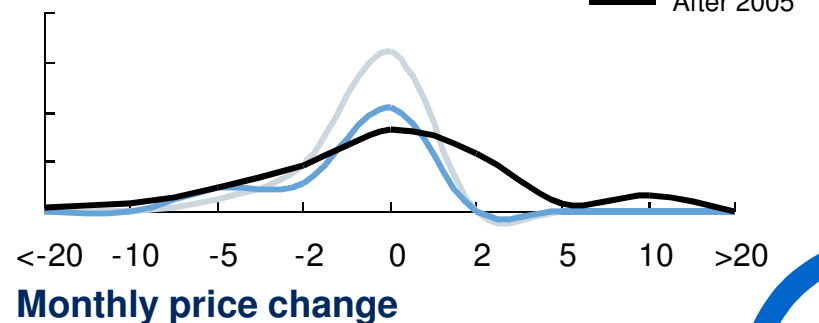


6. Uncertainty

Volatility and uncertainty are amplified in an increasingly globalized world

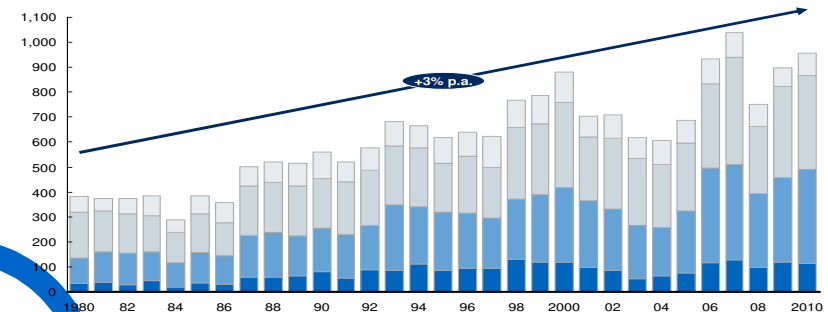
Value stream

Probability steel price change

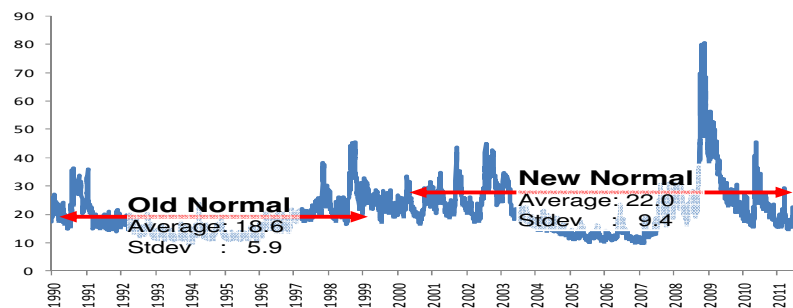


Non-economic

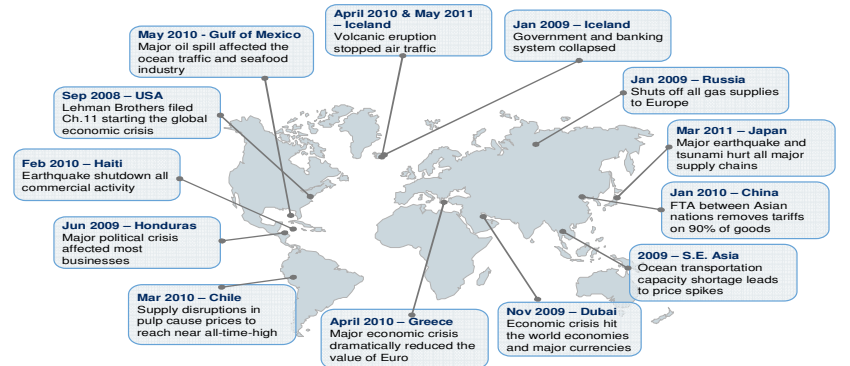
Number of disruptive events



S&P 500 volatility index (1990–2011)



Macro/regulatory



Global interconnectedness

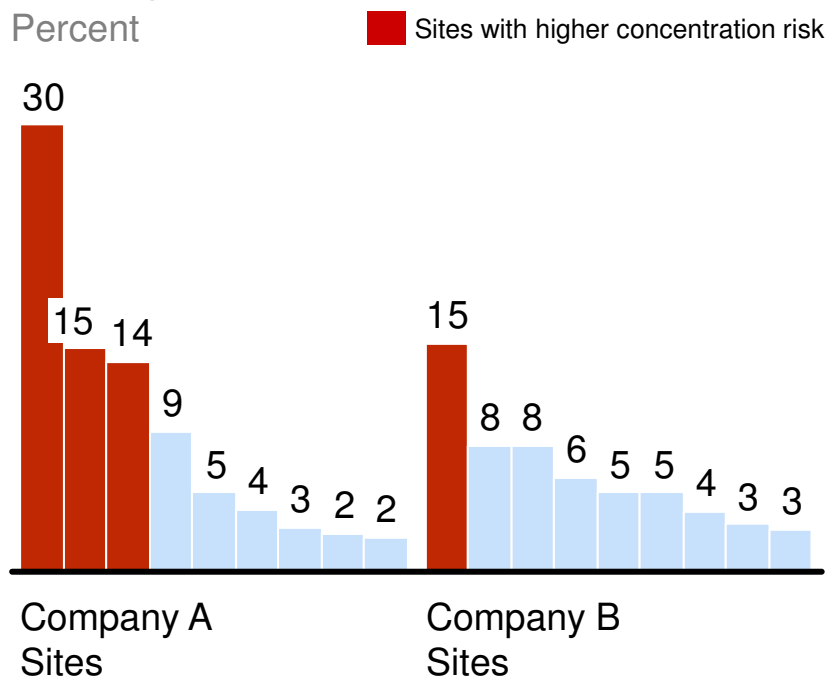
6. Uncertainty

But companies are typically not well prepared for volatility and risk – example concentration risk in pharma

Example #1: Site concentration risks

Large portions of a business have historically been concentrated in just a single plant (or handful of plants)

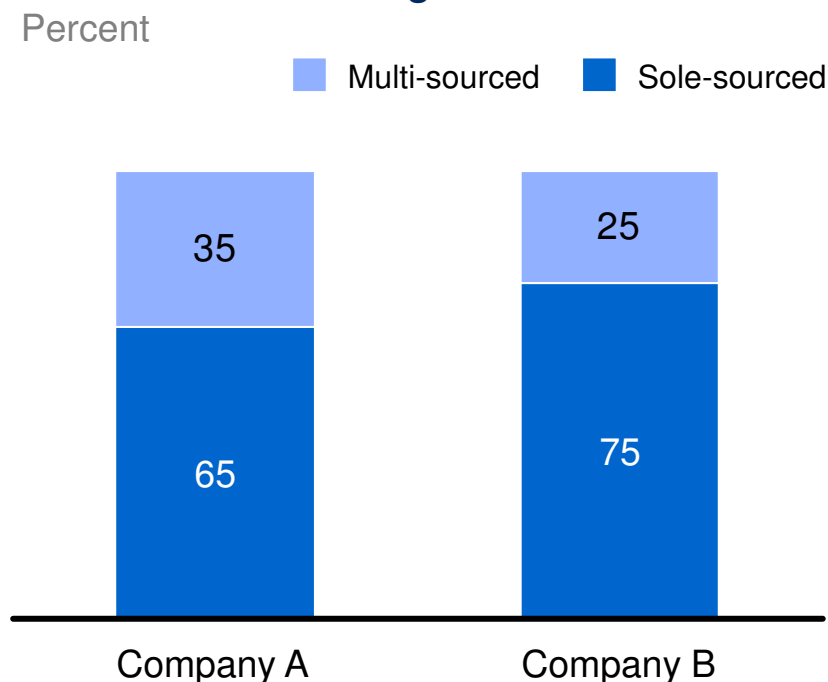
Portion of total company revenue in a single site



Example #2: Single-source inflexibility risks

Somewhere along the value chain, many “blockbuster” products are single-sourced (i.e. lack alternative back-up)

Portion of revenue single sourced



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Best practice for developing manufacturing policy in today's environment

- Assess nation's competitive position and endowments
- Understand impact of emerging trends in demand, factor costs, innovation, as well as effects of rising risk and uncertainty

Benchmark competitive position in context of emerging trends

Set goals and build alignment

- Set realistic policy objectives in current environment
- Align the private sector, academia, and other stakeholders to create a broad coalition behind policy objectives

- Set clear accountability for delivery and action plans to address any under-performance from targets
- Attract capable leaders to help with execution of policy
- Build a strong customer-focused and performance-based organization

Track progress

Choose the right policy for the task

- Consider the full policy tool kit, ranging from setting ground rules to coordinated interventions
- Choose the right policy depending on broad-based versus industry-specific need

Trends and trend breaks require shifts in policy

Potential policy implications to be discussed

1	Demand		- Work with demand shifts, not against them, e.g. - Free trade agreements with high growth regions, and diplomatic and commercial links to high growth cities - Research and education on customer insights, as well as platforming and modularization - Upgrading infrastructure
2	Factor inputs		- Double down on educational efforts – vocational, graduate, and life-long learning and guide students to the most important and promising skills (e.g. in advanced analytics, general STEM, etc.); targeted immigration - Define a credible energy strategy - Review of financial markets and long-term provision of risk capital
3	Policy		- Push for global governance in global industries - Beware the long-term consequences of interventionism
4	Technology		- Spur demand for innovation via regulation, standards, and public procurement - Ensure supply of talent, risk capital, R&D budgets, and university-industry links Emphasize the „D“ in R&D more than traditionally
5	Industry and competition		- Embrace – and foster – international value chains, and help shape distinct regional competitiveness profiles and value propositions in sweet spots - Link local clusters to global R&D and knowledge networks - Include development of related service offerings and service suppliers in scope
6	Volatility		Don't add to the risks or create barriers to corporate agility - Continue focus on macro stability (e.g., banks, currencies, fiscal debt) - Avoid creating policy uncertainty (e.g., carbon regulation) - Remove barriers to corporate agility (e.g., ease of doing business, labor laws) - Help buffer market uncertainty (e.g., flexible work hour arrangements)

Thank you

The full report is available at
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