The slowdown of German productivity growth

presented at the Nomura Foundation's 2016 Conference "Productivity, Technology, and Growth"

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16th November 2016, Nomura Foundation, Tokyo

Outline

1. Motivation
2. The effects of German labor market reforms on productivity
3. An end to outsourcing in German manufacturing
4. Digitization and productivity (Industry 4.0)
5. Conclusion

1. Motivation

Facts about the German economy

- **fourth largest economy** of the world:
- ➢ Share in world GDP (US-Dollar, 2016): 4,6%
- ➢ U.S. (24.7%), China (15.1%), Japan (6.3%), U.K. (3.5%) and Italy (2.5%)
- very **export-oriented**: export share roughly 47% of GDP
- ➢ Germany's share in world merchandise exports of 2015 was 8.1% (WTO)
- ➢ U.S. (9.1%), China (13.8%), Japan (3.8%), U.K. (2.8%) and Italy (2.8%)
- high importance of **manufacturing** (roughly 23% in GVA)
- relatively **high level of labor productivity**

Major challenge: demographic change
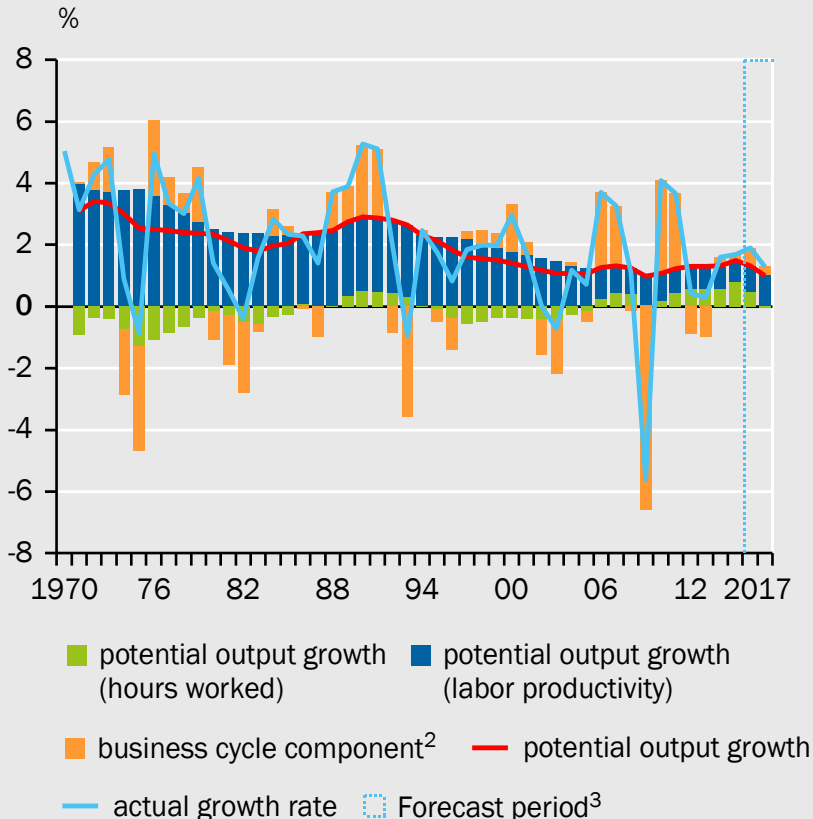
Unemployment by occupational groups[1,2]

%

Chemists, physicists, mathematicians[3] — Engineers[3] — Total
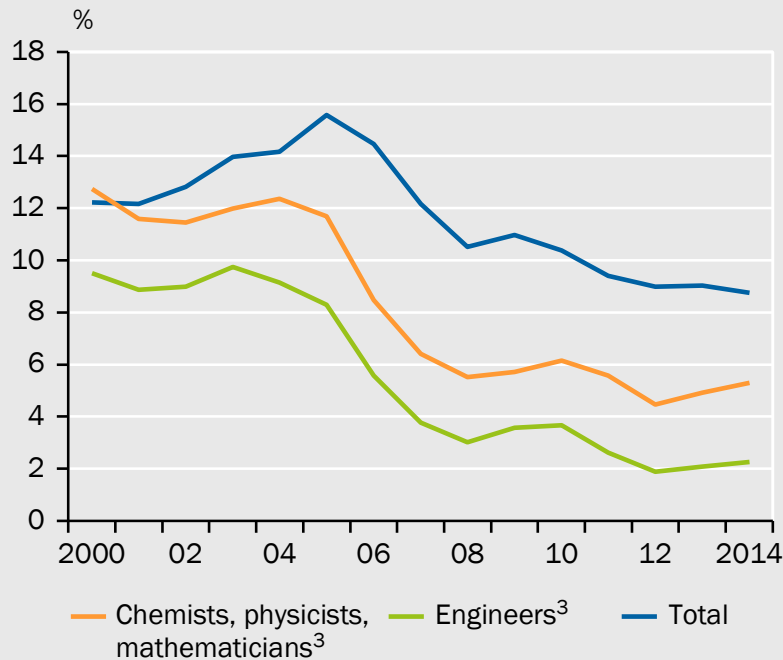
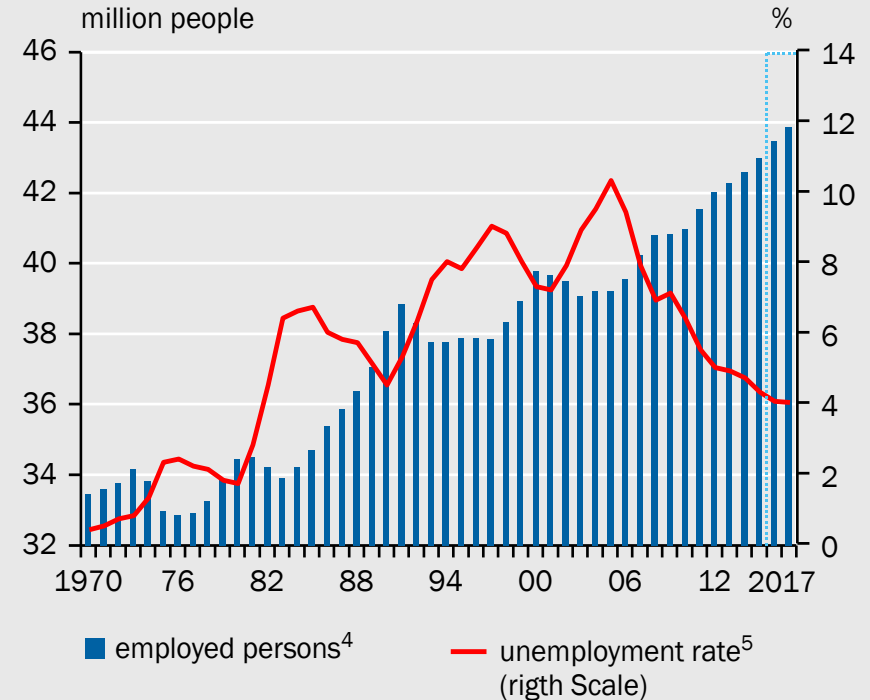**Median age in Germany[4]**

Men — Women
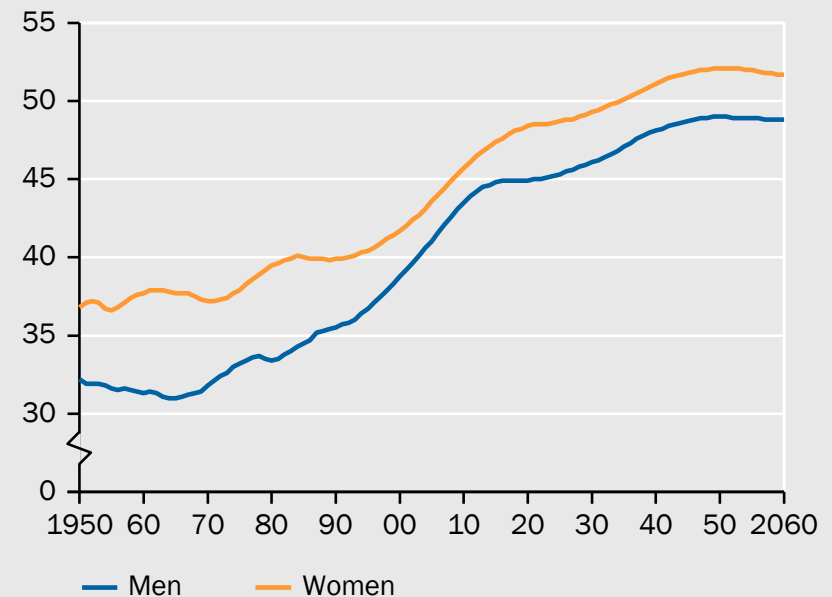
- laborforce will decline in future; in particular, in innovative professions
- acceptance of new business models will tend to decline in an ageing society (technology diffusion)

Importance of labor productivity growth
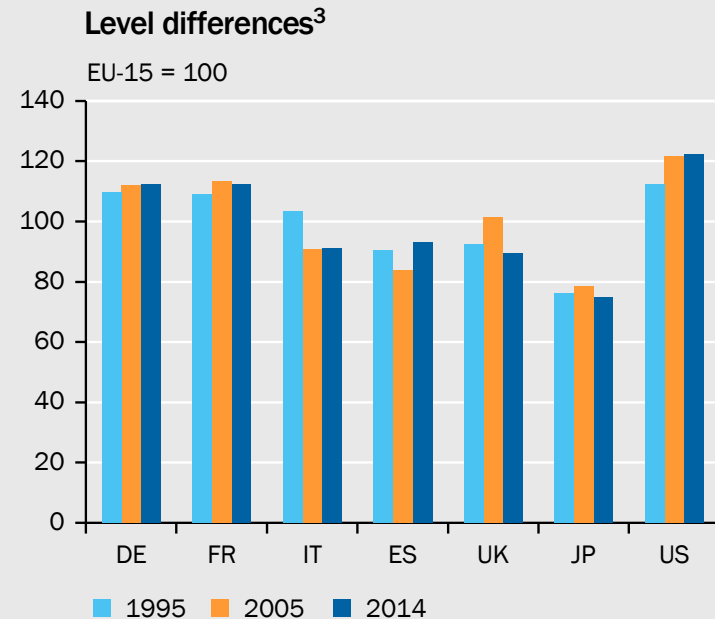
Change in GDP

%

- potential output growth (hours worked)
- potential output growth (labor productivity)
- business cycle component[2]
- potential output growth
- actual growth rate
- Forecast period[3]

Labor market

million people   %

- employed persons[4]
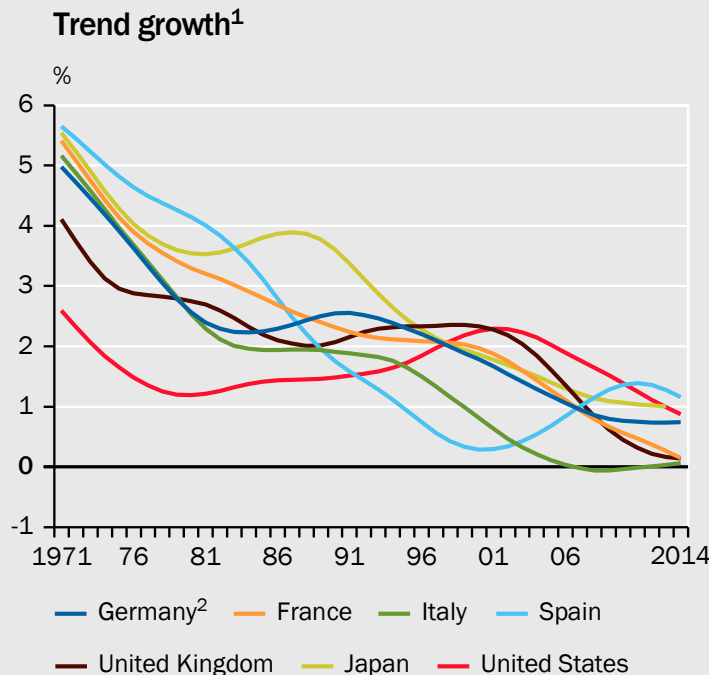- unemployment rate[5] (rigth Scale)
- Forecast period[3]

- in last decades GDP growth primarily driven by productivity growth
- since the year 2005 the picture has changed

Since the mid-2000s: weak labor productivity growth in almost all industrial countries

Labor productivity per hours worked in selected countries

Trend growth[1]

%

Germany[2] — France — Italy — Spain
United Kingdom — Japan — United States

Level differences[3]

EU-15 = 100
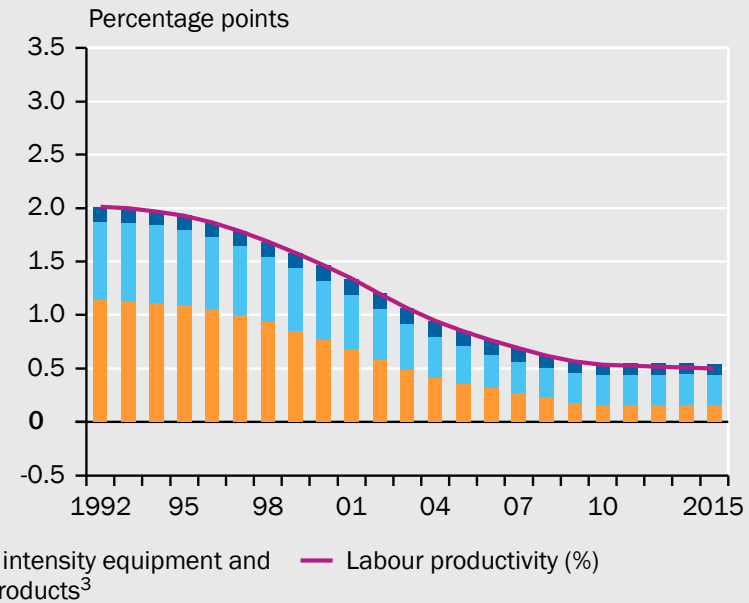
DE FR IT ES UK JP US

1995   2005   2014

- no productivity growth in Italy; „ICT revolution" in the US; recovery in productivity growth in Spain

Differences between manufacturing and service sectors (results obtained with HP-filter)

Growth contributions of the components to trend productivity growth in manufacturing

Percentage points
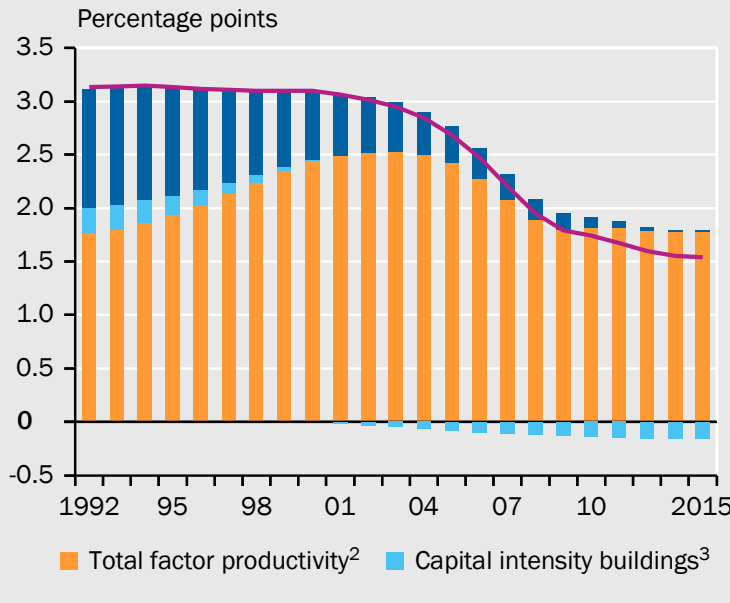
Growth contributions of the components to trend productivity growth in service sectors

Percentage points

■ Total factor productivity[2]   ■ Capital intensity buildings[3]   ■ Capital intensity equipment and other products[3]   — Labour productivity (%)

- manufacturing: high TFP, low investment
- service sectors: low TFP, robust investment

2.The effects of German labor market reforms on productivity

Key terms and relationships

- labor productivity: highly complex variable with a large number of influencing factors

$$\Delta lny_t = \alpha \Delta lnk_t + (1 - \alpha)\Delta lnE_t + \Delta lnA_t$$

- k_t: **capital deepening**/ capital services per hour/person
- E_t: **average labor quality** per hour/person
- A_t: **total factor productivity** (innovation activity)
- not mentioned: outsourcing, dismissing productivity, intensity of competition and so on.
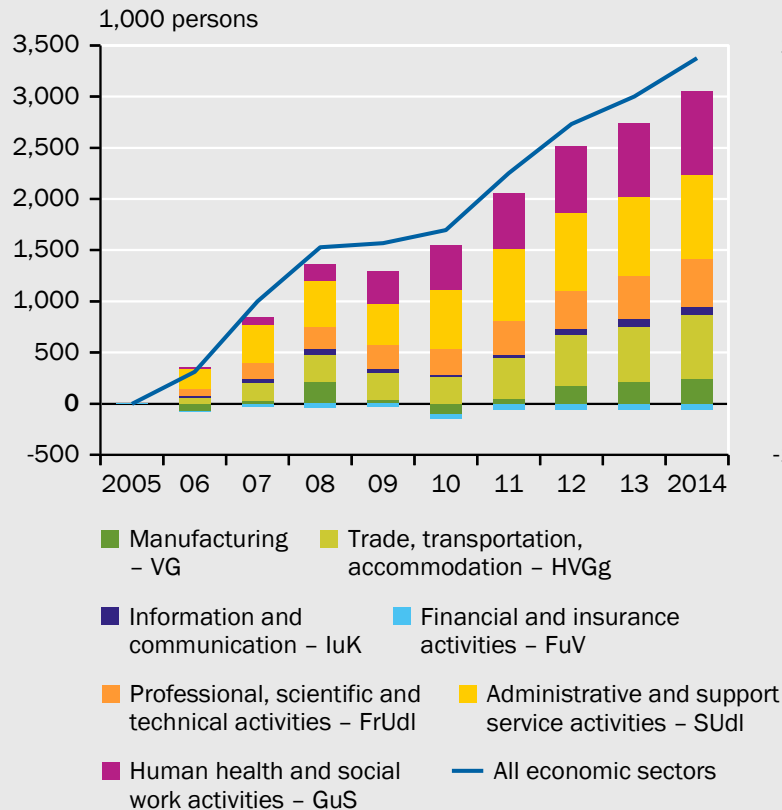
Definition composition effect

- increase in employment by roughly 3.4 million persons between the years 2005 and 2014
- – successful integration of less-qualified workers into the labor market
- – decline in average productivity per employed person (composition effect, effect on average labor quality)
- **side effect** of **successful reforms**

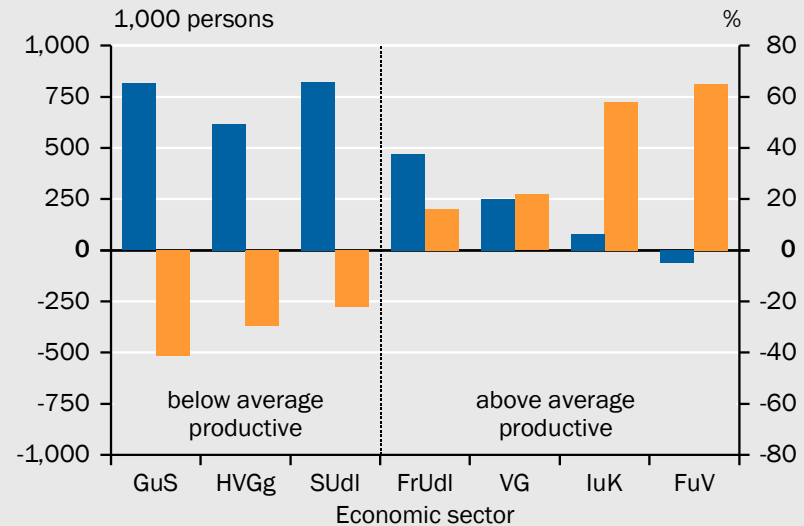Effect becomes visible by the following developments:

1. structural shift towards specific service sectors (reallocation effect)
2. sector-specific effects within these sectors

Strong increases in employment: trade, accommodation, health services and personnel leasing

Increase in employment

1,000 persons

Employment development and level of labor productivity

1,000 persons   %

below average productive | above average productive

Economic sector

- ■ Manufacturing – VG
- ■ Trade, transportation, accommodation – HVGg
- ■ Information and communication – IuK
- ■ Financial and insurance activities – FuV
- ■ Professional, scientific and technical activities – FrUdl
- ■ Administrative and support service activities – SUdl
- ■ Human health and social work activities – GuS
- — All economic sectors

- ■ Absolute change in employment between the years 2005 and 2014
- ■ Difference (in percent) to the average level of labor productivity in the year 2005 (right hand scale)

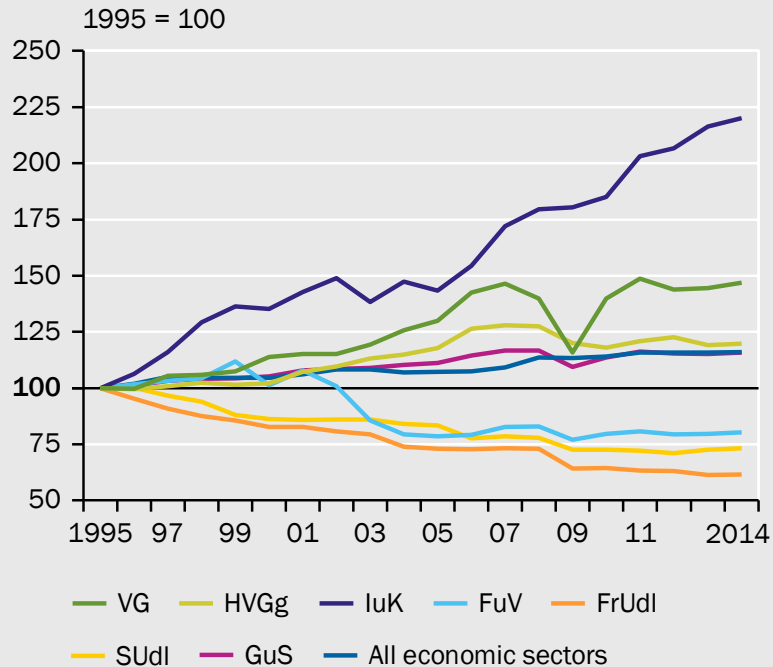# Decomposition of labor productivity

decompose aggregate labor productivity into:

1. within sector specific effects (1. term, right side)
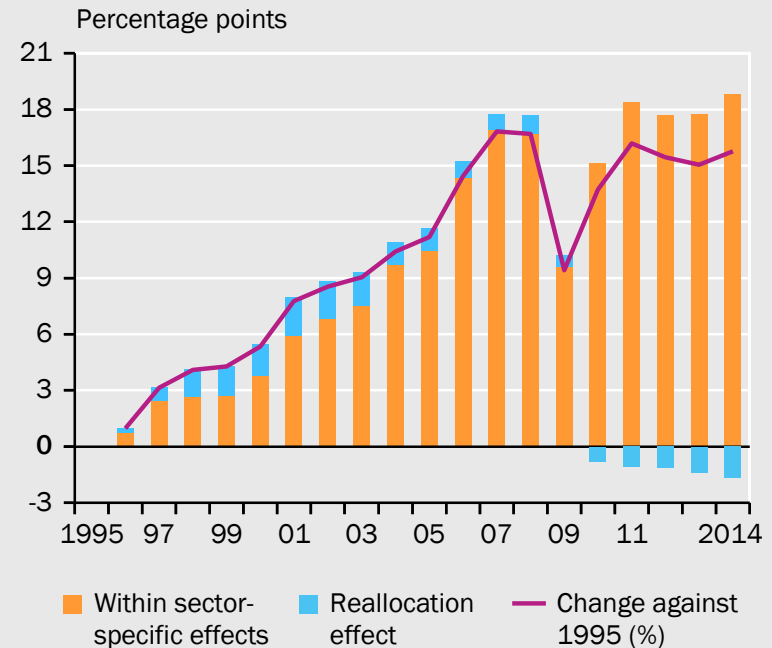2. reallocation effect (2. term, right side)

$$\left(\frac{AP_t - AP_0}{AP_0}\right) = \sum_{i=1}^{N}\left(\frac{AP_t^i - AP_0^i}{AP_0}\right)n_0^i + \sum_{i=1}^{N}\left(n_t^i - n_0^i\right)\frac{AP_t^i}{AP_0}$$

Growth contributions to aggregate labor productivity
Percentage points

	Share[1]	Per person employed		Per hour	
	%	1995 – 2005	2005 – 2014	1995 – 2005	2005 – 2014
Within sector-specific growth contributions					
Manufacturing	22.4	0.7	0.3	0.8	0.4
Service sector	69.8	0.2	0.3	0.8	0.6
including:					
Whosesale and retail trade, repair of motor vehicles, transport and storage, accommodation	16.5	0.3	0.0	0.5	0.1
Information and communication	4.6	0.2	0.3	0.2	0.3
Professional, scientific and technical activities	6.3	– 0.2	– 0.1	– 0.1	– 0.1
Administrative and support service activites	4.3	– 0.1	– 0.1	– 0.0	– 0.0
Human health and social work activities	6.6	0.0	0.1	0.1	0.1
Reallocation effect		0.1	– 0.2	0.2	– 0.2
Development of labor productivity (%)					
Actual development[2]		1.1	0.4	1.9	0.8
Development without structural shifts[3]		0.9	0.7	1.6	1.0

1 – Share of the corresponding sector in total gross value added in the year 2005. 2 – Average annual change of total gross value added per person employed and per hour, respectively. 3 – Without the reallocation effect. Difference in total due to rounding.

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3. An end to outsourcing in German manufacturing

Growth contributions: labor productivity in manufacturing sector (output per hour)

Labor productivity (output per hour)

Change 2005 against 1995

Change 2013 against 2005

Manufacturing
- Chemical products
- Metal production and metal products
- Electrical engineering[2]
- Machinery
- Vehicle production

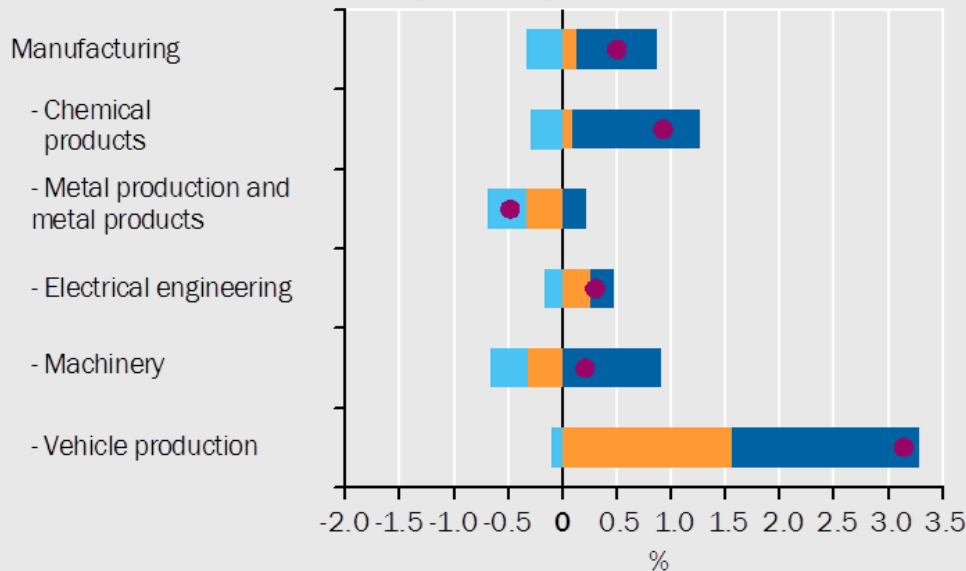● Labor productivity   ■ Gross value added[3]   ■ Decline in hours[3]

- adjustment of total hours worked played an important role

Growth contributions: capital stock

Capital stock (gross stock of fixed assets)
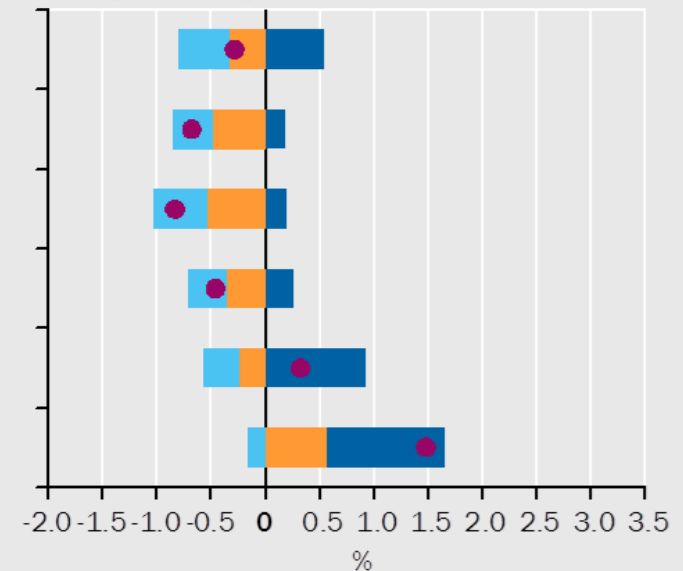
- no clear link between labor productivity growth and the change of the capital stock
- important role for research and development

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Productivity gains through outsourcing

- change in production value can be written as follows:
$$\Delta lnPW_t = \Delta lnA_t + \alpha\Delta lnK_t + \beta\Delta lnVL_t + (1 - \alpha - \beta)\Delta lnL_t$$

- link between production value and value added:
$$\Delta lnPW_t = \gamma\Delta lnY_t + \beta\Delta lnVL_t$$

- change in value added is then:
$$\Delta lnY_t = \frac{1}{\gamma}\Delta lnA_t + \frac{\alpha}{\gamma}\Delta lnK_t + \frac{(1 - \alpha - \beta)}{\gamma}\Delta lnL_t$$

- $\frac{1}{\gamma}\Delta lnA_t$ denotes measured tfp and ΔlnA_t is purified tfp ("technological progress")

Growth contributions to labour productivity in selected sectors of manufacturing
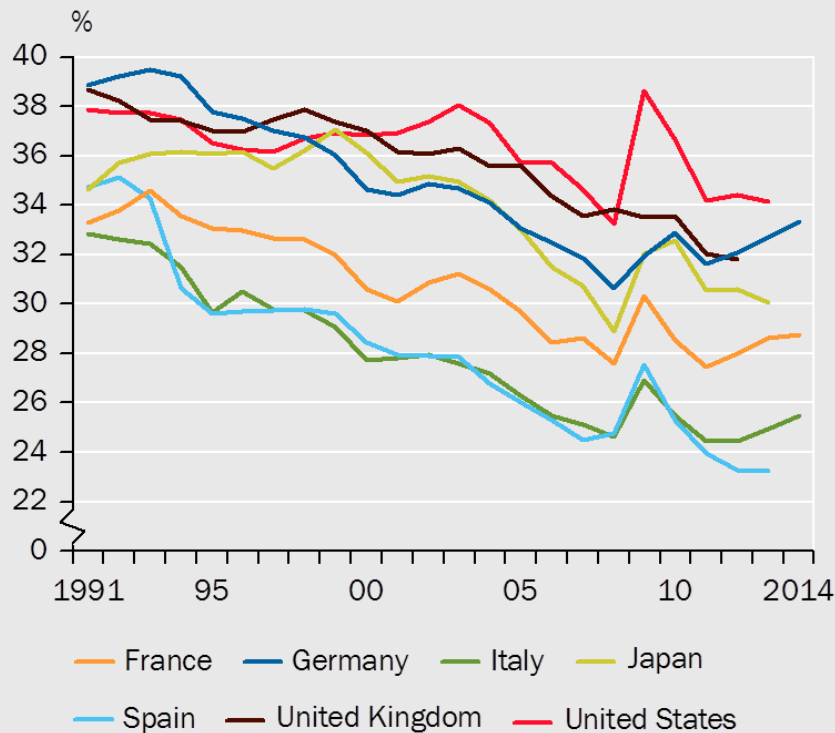Percentage points

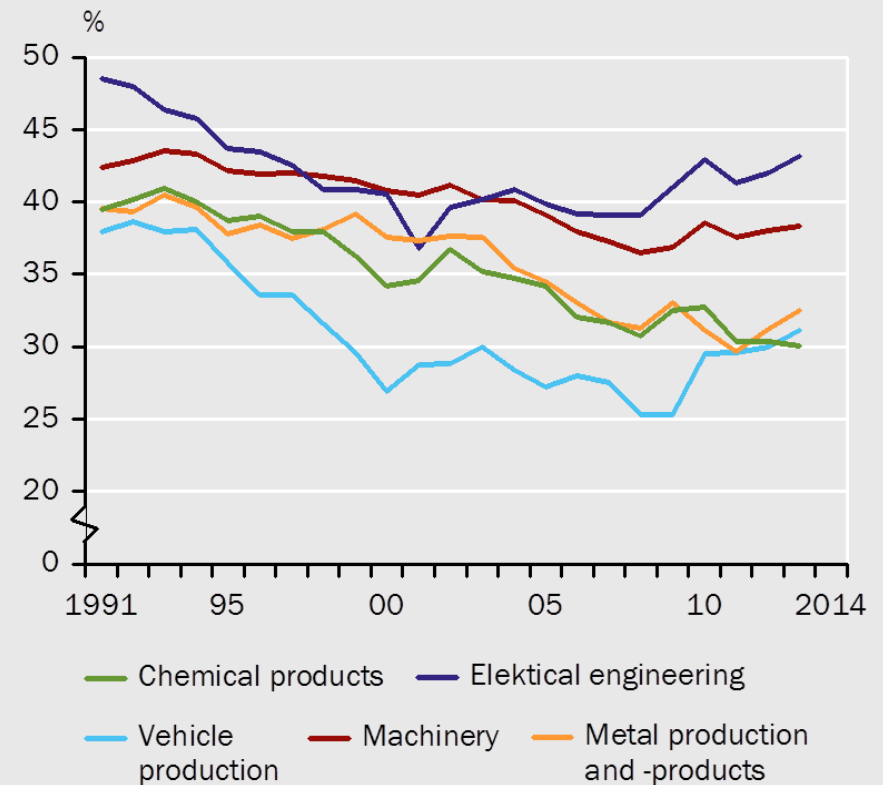|	Share[1]	Per person employed		Per hour	
	%	1995 – 2005	2005 – 2013	1995 – 2005	2005 – 2013
Within sector-specific growth contributions					
Manufacturing		2.7	1.1	3.1	1.8
including:					
Vehicle production	17.1	0.2	0.7	0.2	0.9
Machinery	14.7	0.2	– 0.2	0.3	– 0.2
Electrical equipment	7.1	0.1	0.0	0.1	0.0
Computer, electronic and optical products	6.6	0.9	0.4	1.0	0.7
Metal production and metal products	13.1	0.2	0.1	0.3	0.1
Chemical products	7.6	0.4	– 0.0	0.5	– 0.0
Reallocation effect		– 0.1	0.1	– 0.0	0.0
Actual development %[2]		2.7	1.3	3.1	1.6

1 – Share of the corresponding sector in total gross value added of manufacturing in the year 2005. 2 – Average annual change of real gross value added per person employed and per hour worked, respectively.

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Depth of production (vertical integration) does not decline anymore

International comparison

France — Germany — Italy — Japan — Spain — United Kingdom — United States

Sources: Eurostat, Federal Statistical Office, OECD, Thomson Financial Datastream

Selected sectors

Chemical products — Elektical engineering — Vehicle production — Machinery — Metal production and -products

Source: Federal Statistical Office

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Important: Relocation abroad

Value added, production value and intermediate goods

Log. scale 1991 = 100

Legend: Value added — Production value — Foreign intermediate goods — Domestic intermediate goods — Total intermediate goods

Source: Federal Statistical Office
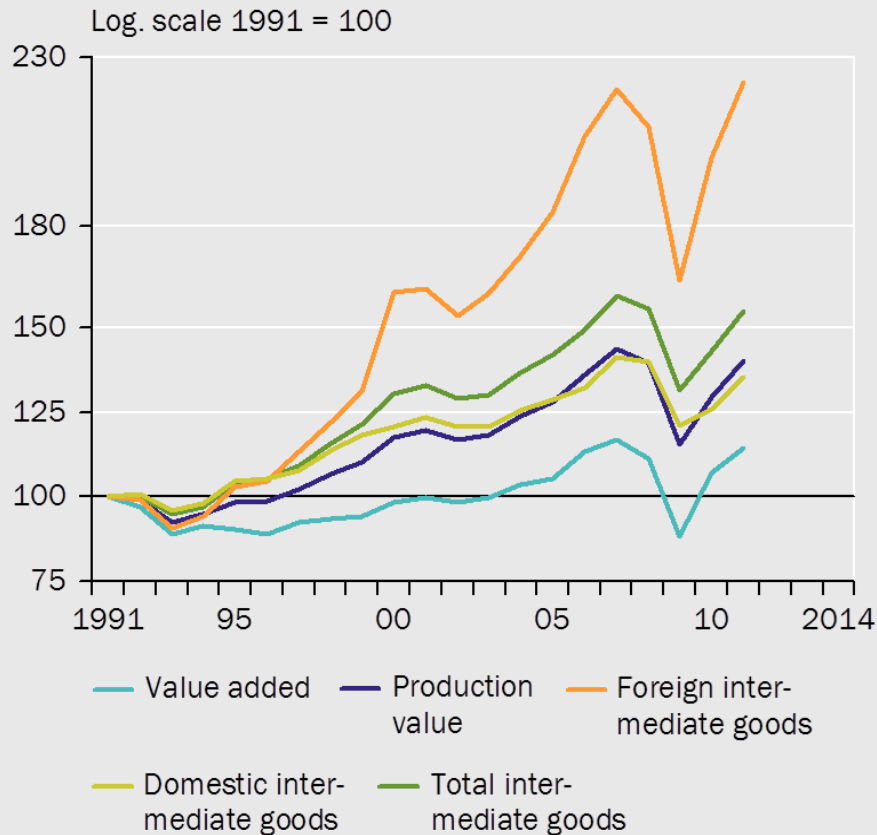
Share of intermediate goods in production value

%

Legend: Abroad — Home — Total
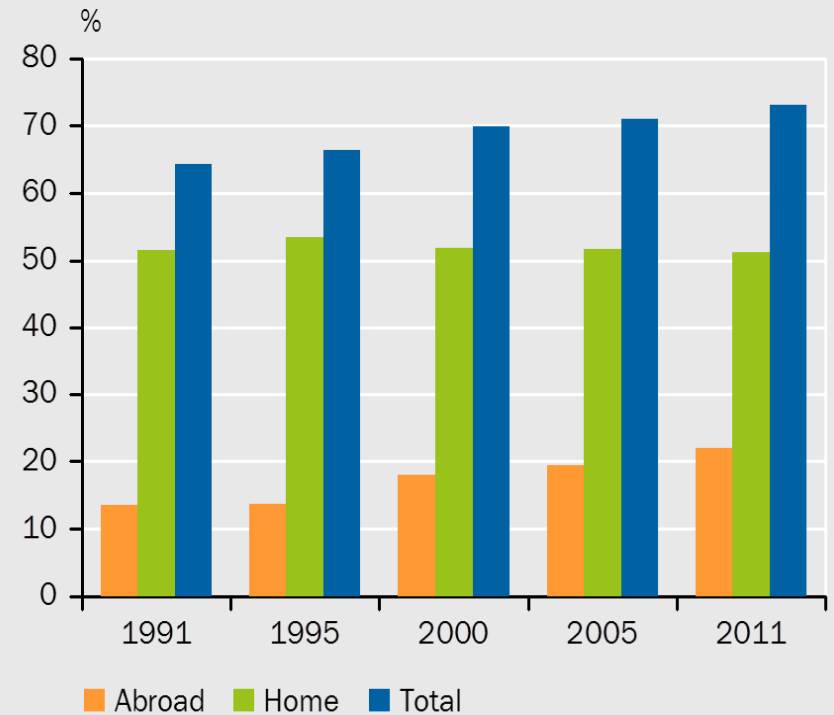
Source: Federal Statistical Office

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4. Digitization and productivity (Industry 4.0)
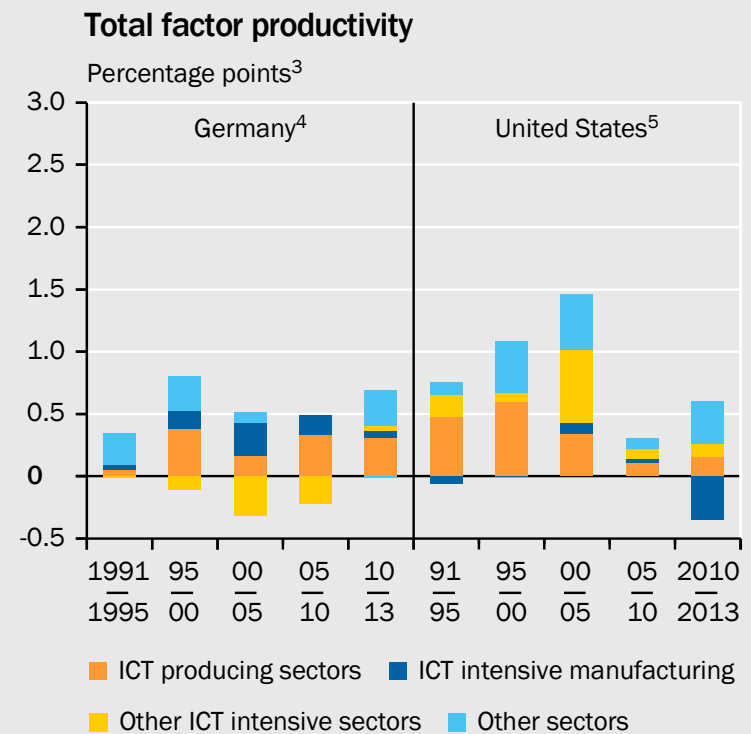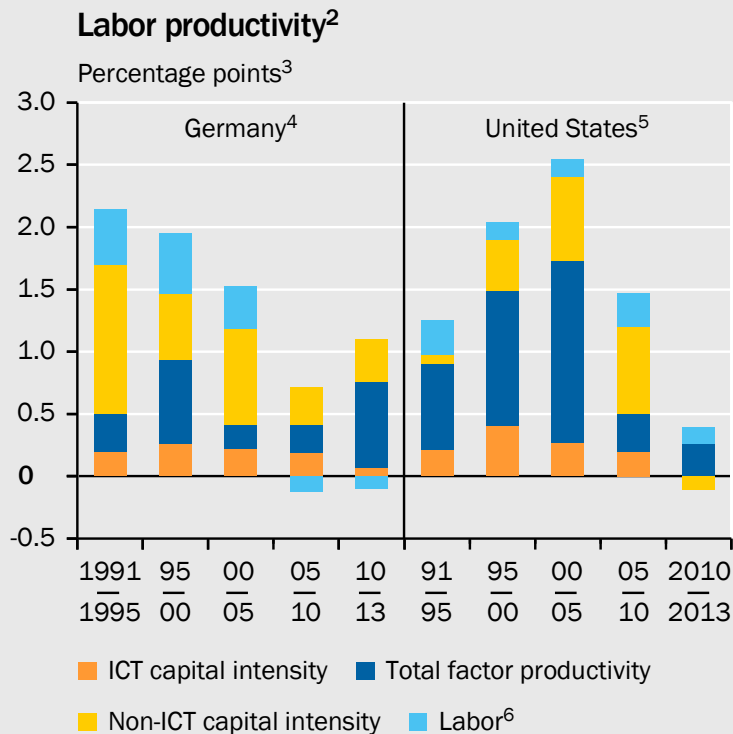
Growth Accounting

- update of the analysis done by Eicher und Röhn (2007)
- use of the ifo Investment Database
- at the industry level (industry i):

$$\Delta \ln y_i = v_i^{ICT} \Delta \ln k_i^{ICT} + v_i^{NICT} \Delta \ln k_i^{NICT} + v_i^{L} \Delta \ln E_i + \Delta \ln A_i$$

- consideration of the following groups:
1. ICT-producing sectors (roughly 5% of total value added)
2. ICT-intensive sectors (roughly 40% of total value added)
3. other sectors (roughly 55% of total value added)

ICT productivity paradox in service sectors

Comparison of the contributions to labor productivity and total factor productivity between Germany and the United States[1]

Labor productivity[2]

Percentage points[3]

Germany[4] United States[5]

- ICT capital intensity
- Total factor productivity
- Non-ICT capital intensity
- Labor[6]

Total factor productivity

Percentage points[3]

Germany[4] United States[5]

- ICT producing sectors
- ICT intensive manufacturing
- Other ICT intensive sectors
- Other sectors

Paradox: no clear positive link between ICT-investment and "genuine" productivity gains in ICT-intensive sectors

Paradox: Difference to the US

- paradox only exists in service sectors

- Bloom, Sadu und van Reenen (AER, 2012):

– complementary factors (e.g. firm structure and -organisation)

  – regulation factor- and product markets (competition)

  – human capital

  – firms are not successful in implementing ICT-investments efficiently (e.g. due to demographic change)

– quality of management (remuneration systems, promotions, "hire and fire")

- demographic change

Industry 4.0

- digitization and networking of the value added chains in manufacturing with ICT

- increase in total factor productivity:

– elimination of rising returns to scale; declining set up costs for special productions

– new product innovations induced by better data

– provision of new services by producer

- professions, workplaces and products come under pressure (industrial revolution)

5. Conclusion

Summary

1. dampening „composition effect" of successful labor market reforms at the beginning of the 2000s

2. manufacturing: outsourcing process seemingly over

3. no productivity enhancing impulses from the ICT-intensive sectors

4. important role for education and training, teaching of necessary IT-skills

5. against a too strong regulation of labor and goods markets, in particular, in several service sectors

6. financing of start-ups: Removing distortions instead of creating new subsidies (invest grant)

6. Appendix
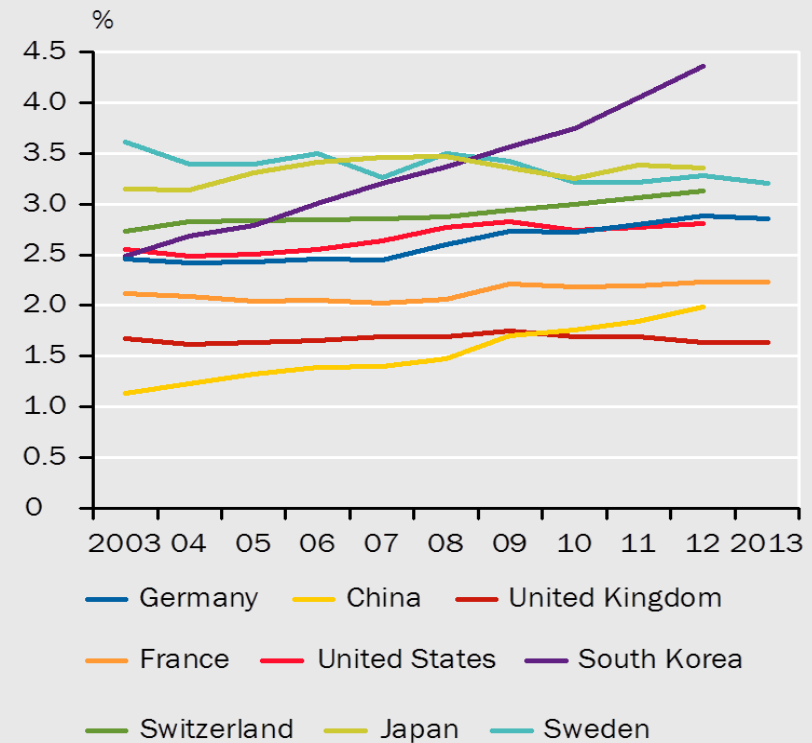
Investment Research and Development
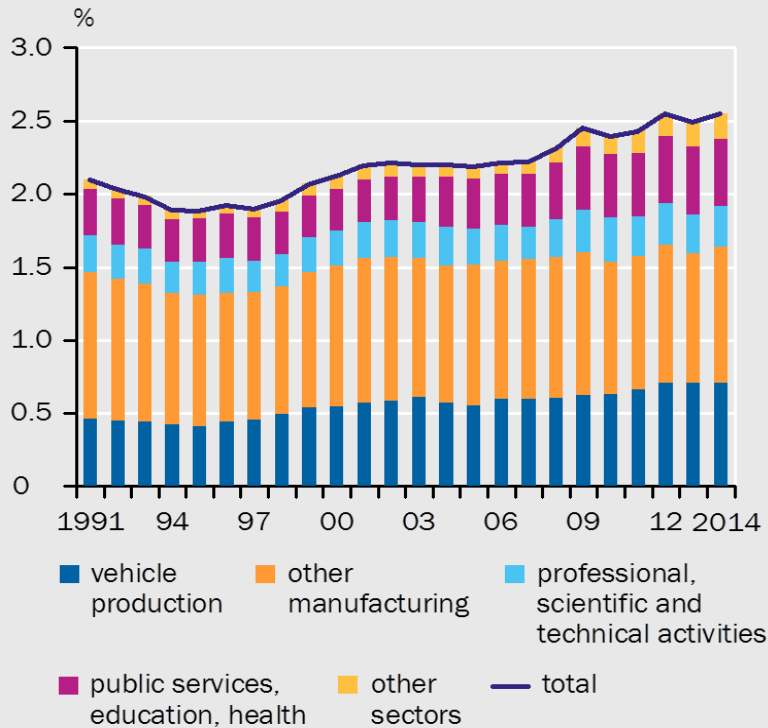
64 % of total R&D investment is done by manufacturing, weaker development of R&D in small and medium businesses