Pro-Productivity Policies in Germany: Same Tools, Different Paths

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Abstract

This paper examines (the absence of effective) pro-productivity policies in Germany. Peculiarities such as the German reunification, the strong export orientation, the still sizeable manufacturing sector as well as the large share of medium-sized companies may require different pro-productivity policies compared to those in other countries. The paper begins with a comprehensive review of productivity trends and sources in Germany, followed by an overview of the most significant (pro)-productivity policies implemented after the German reunification in 1990. The role of these key (pro)-productivity policies is discussed within the broader context of the ongoing productivity slowdown. Persistently weak productivity growth suggests that either these reforms were not sufficiently far-reaching, or other factors continue to hinder productivity growth. Overall, it can be concluded that Germany frequently adopts proven policy approaches from other countries, albeit often with a certain time lag, while also relying on tailored national strategies. This pattern reflects a “same tools, different paths” model.

1 Introduction

The importance of productivity for economic growth and development highlights the necessity of research to better understand the drivers of productivity growth. Evaluating existing pro-productivity policies across different countries could provide valuable insights into how different policy measures work. This is of particular importance in the light of the productivity slowdown observed in a large proportion of developed countries over the past two decades. Moreover, basically all economies are currently affected by the twin transition which refers to the digital and green transformations of economies and societies, accelerated by the rapid spread of generative AI. In addition, other challenges such as an ageing workforce in many industrialised countries and, more recently, disruptions to international trade, are likely to affect productivity growth.

In light of these trends, Van Ark et al. (2023) have developed a typology of pro-productivity policies, which helps to uncover policy differences between countries in a structured way. They distinguished between four categories of pro-productivity policies: (1) policies related to the accumulation of the production factors, (2) policies aimed at markets and resource allocation, (3) policies supporting technological and structural change, and (4) policies for internationalisation. This paper will focus on (the lack of) pro-productivity policies in Germany. Beyond its rather modest productivity growth rates in the past two and a half decades, Germany has rather unique characteristics that make the analysis particularly interesting. These factors include, among others, the German reunification and its long-term implications, the strong export orientation of the German economy, its still relatively large manufacturing sector, the distinctive features of the German education system ("vocational training", "dual education system"), the unique role of medium-sized global companies ("German Mittelstand", "hidden champions") and Germany's economic significance as Europe's largest economy. Even though the period after the Second World War also reveals interesting developments, the main focus of the paper will be on the decades after the German reunification in 1990.

The causes of the productivity slowdown over the past decades in a large number of industrialised countries remain a hotly disputed topic (Crafts, 2018).[1] Overall, there appears to be broad consensus that no single factor fully explains this slowdown (Goldin et al., 2024). In addition to the previously mentioned international studies, there are a number of studies particularly focussing on the productivity slowdown in Germany, such as Ademmer et al. (2017), Christofzik et al. (2024), Geis-Thöne et al. (2021), Grömling et al. (2021), and Peters et al. (2018), as well as the reports by the National Productivity Board within the German Council of Economic Experts.[2]

German politics frequently adopts proven policy approaches from other countries, albeit quite often with a notable time lag. One prominent example is innovation policy with the establishment of an agency for the development of emerging technologies inspired by the US DARPA and the introduction of R&D tax credits[3]. However, it is open to debate whether this rather conservative approach remains appropriate in rapidly changing times.

The rather unique characteristics of the German economy, however, lead to distinct approaches

[1] The slowdown is particularly striking given the rapid diffusion of information and communication technologies (ICT), which were widely expected to generate substantial productivity gains. See, e.g., Van Ark (2016), Elstner et al. (2022) as well as Goldin et al. (2024).

[2] See German Council of Economic Experts (2019, 2020, 2021, 2022, 2023a, 2024b).

[3] The R&D tax credit in Germany was introduced in 2020, whereas in the US in the year 1981. See, e.g., Bloom et al. (2019).

in certain areas, at least to some extent. One distinctive characteristic is the continuing importance of the manufacturing sector, closely linked to the prominent role of dual vocational education and training, both of which call for "different" policy approaches. Therefore, the title of the paper "same tools, different paths" was chosen.

The fast diffusion of generative AI technologies with its mixed current and still pretty much unclear future productivity impact is a major source of uncertainty.[4] Much of Germany's future economic performance depends on whether the recently announced half trillion euro special fund, intended for both public infrastructure and the green and digital transformation, will be spent in a pro-productivity manner. This is where civil society plays a crucial role, as emphasised by Aghion and Van Reenen (2025). They argue that "the proper functioning of an economy of innovation and creative destruction rests on the triangle between firms that innovate, the state, which is meant to regulate and invest, and civil society, which serves as a watchdog to induce firms and the state to do the right things." Yet, according to initial evaluations, the money from the new special fund is currently being spent only to a limited extent in a productivity-enhancing manner, raising questions about the effectiveness of civil society's watchdog function in the area of pro-productivity policies.

This paper is structured as follows: Section 2 provides a review of productivity trends and drivers of productivity growth in Germany. Section 3 briefly introduces the typology of pro-productivity policies and provides an overview of the most important (pro) productivity policies of the past three decades in Germany. The role of these policies in supporting or hindering productivity growth is discussed in Section 4. This is followed by a discussion of the lessons learned and a forward-looking perspective for the German case.

2 Productivity trends and drivers of productivity growth in Germany

The analysis starts with a comprehensive review of productivity trends in Germany at the total economy level by sub-periods and is based on the most recent release of the Conference Board Total Economy Database (TED)[5]. Figure 2.1 provides a decomposition of Germany's GDP growth into the contributions of labour input measured as hours worked and labour productivity. The figure highlights the importance of labour productivity for economic growth since the 1950s. The contribution of labour productivity to GDP growth in the 1950s to 1970s was four percentage points or more, declining to an average of slightly more than two percentage points in the 1980s and 1990s. In the 2000s and 2010s this number was even lower with contributions of about one percentage point.

For most decades, the contribution of labour input growth in Germany was negative. This was predominantly driven by the increase in part-time work and the reduction of weekly working hours, as documented, for example, by Wanger et al. (2016) and Wanger et al. (2024). Between 2010 and 2019, total hours worked deviated from the prevailing trend, increasing by nearly one percent on average. Looking at employment instead of hours worked as labour input[6], we see consistently positive contributions of labour input to GDP growth in Germany since the 1950s with the exception of the

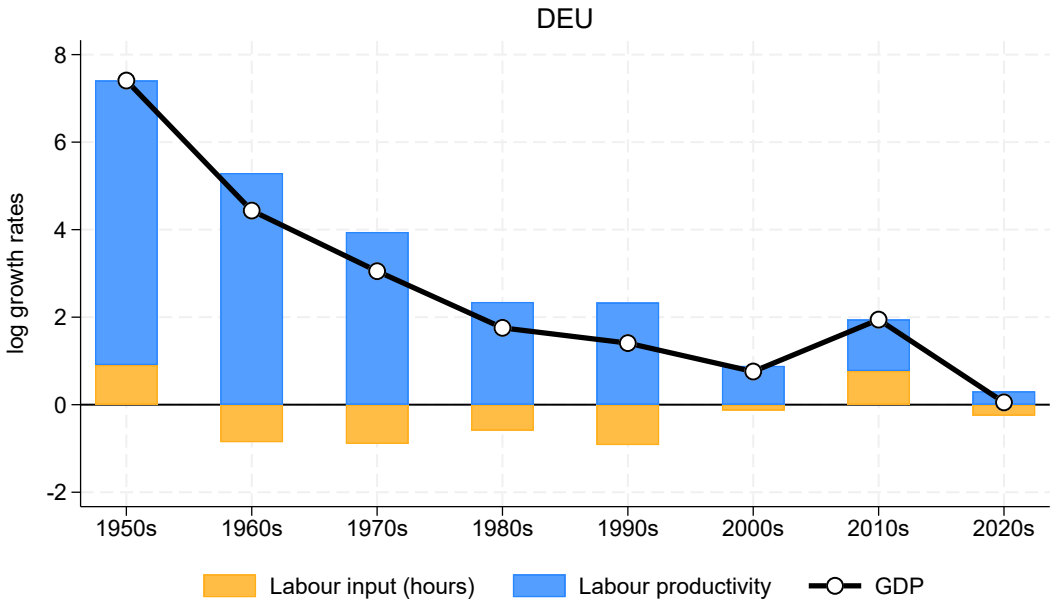
[4] Especially when it comes to artificial general intelligence (Brynjolfsson et al., 2025a; Korinek and Suh, 2024).

[5] See De Vries and Erumban (2022) for details. Data prior to 1990 also include East Germany and are inter alia based on Maddison (2010).

[6] See Figure A.1 in the Appendix.

1990s. The contribution of labour productivity (measured as GDP over employment) to GDP growth is correspondingly lower. However, no matter whether labour productivity is measured by GDP per hour worked or GDP per person employed, labour productivity was the dominant factor for GDP growth.

Figure 2.1: Decomposition of GDP growth into contributions of labour input and labour productivity growth - Germany (DEU)

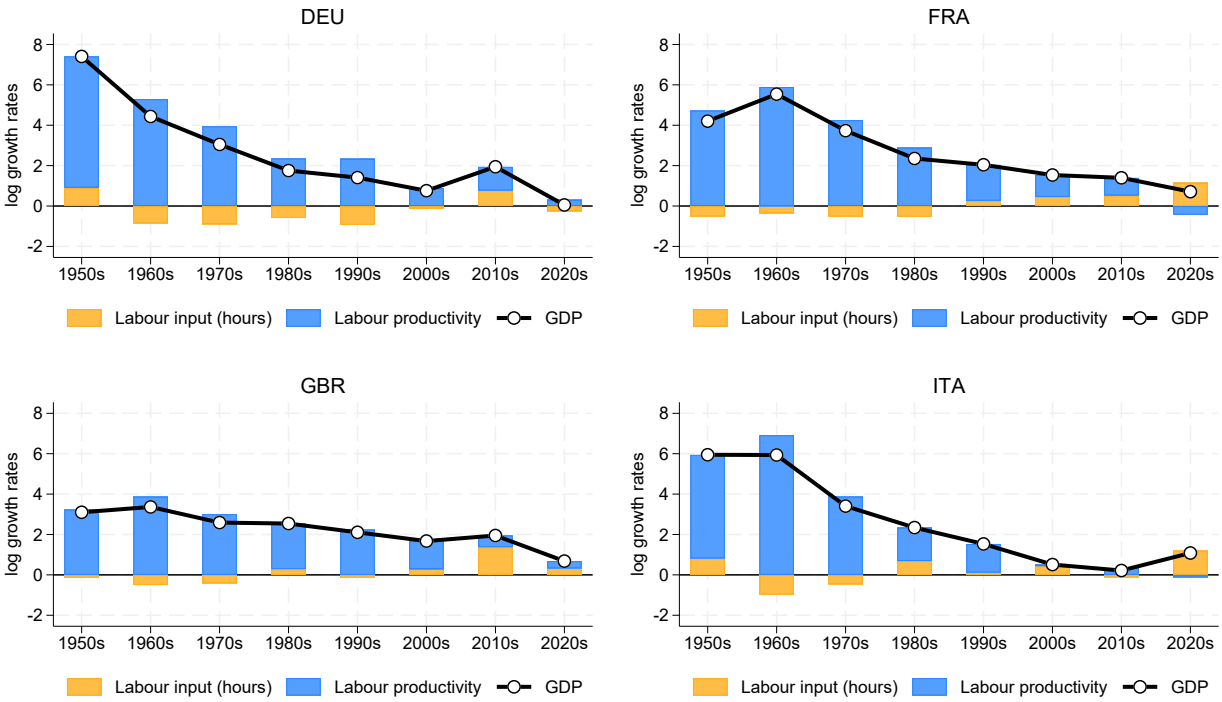


Note: Values for the 1950s exclude the year 1950, values for the 2020s include data for the years 2020 to 2024.
Source: The Conference Board Total Economy Database™, September 2025, author's calculation.

However, only looking at decadal averages is somewhat misleading due to global shocks and structural breaks like the Global Financial Crisis (GFC). The huge decline in GDP and hours worked in the year 2009 reduced the averages for the 2000s, whereas the strong economic recovery afterwards was part of the average for the 2010s. Figure A.2a in the Appendix therefore provides averages for the period before German reunification, the period following reunification up to the GFC, the GFC itself and the post-GFC period as well as the pandemic and post-pandemic period. The analysis of these alternative periods provides a more gradual slowdown in productivity growth compared to the decadal averages shown in Figure 2.1.

Figure 2.2 compares the finding on the critical role of labour productivity growth in driving GDP growth in Germany with that of three other large European countries. Ignoring the early postwar recovery during the 1950s, we have since seen very similar patterns in France, Italy and UK as in Germany. The productivity slowdown is clearly visible and, with very few exceptions, it was the dominant contributor to GDP growth. Labour input growth, in the comparison group of countries is also often slightly negative.

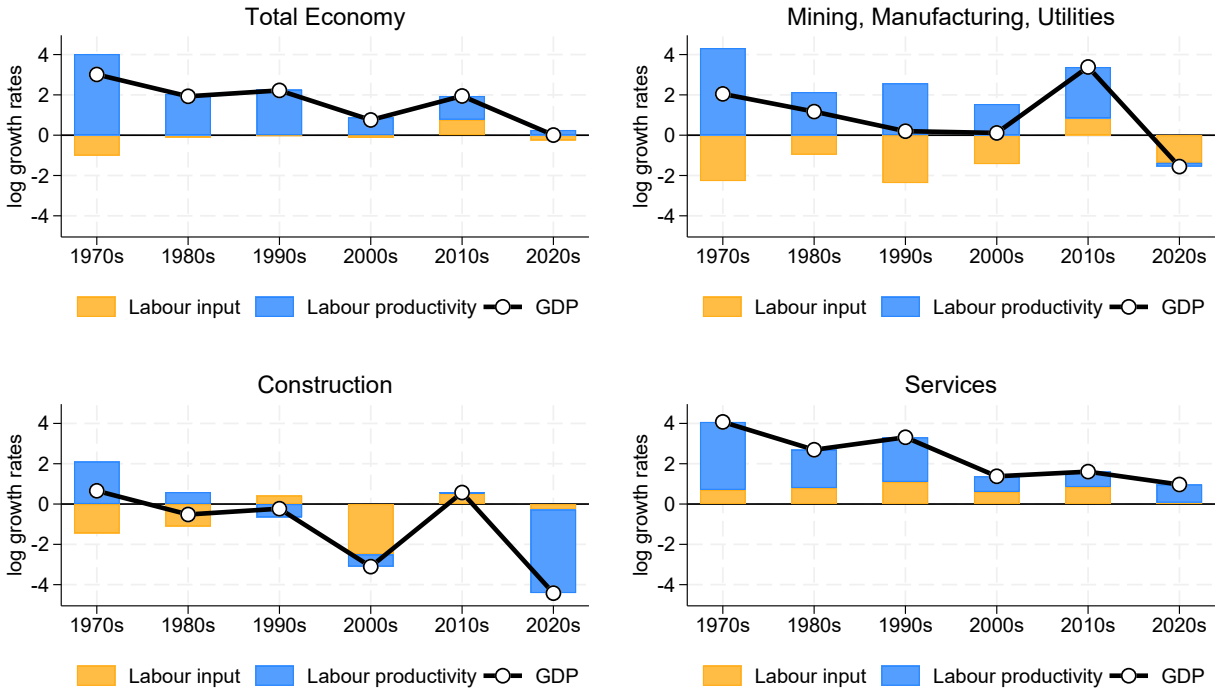
Figure 2.2: Decomposition of GDP growth into contributions of labour input (hours) and labour productivity growth - selected countries



Notes: Values for the 1950s exclude the year 1950, values for the 2020s include data for the years 2020 to 2024. DEU: Germany, FRA: France, GBR: United Kingdom, ITA: Italy.
Source: The Conference Board Total Economy Database™, September 2025, author's calculation.

To account for the importance of the manufacturing sector in Germany, Figure 2.3 provides a decomposition GDP growth into contributions of labour input and labour productivity growth for a set of broad industry groups/sectors. Data for this analysis are provided by the German statistical office. It covers the years 1970 to 2023, but prior to 1991, only West Germany is included. Since the 1980s, the industry group comprising Mining, Manufacturing and Utilities still achieved rather substantial labour productivity growth contributions to GDP, but experienced remarkable declines in total hours worked except for the 2010s. In contrast, labour productivity growth rates in the service sector (especially in the 2000s and 2010s) were often lower, while labour input experienced a constant yet modest growth. The construction sector often saw negative productivity growth rates and low or even negative growth in hours worked especially since the 1990s.

Figure 2.3: Decomposition of GDP growth into contributions of labour input and labour productivity growth - (West) Germany - selected industries



Notes: Without year 1970, until 1991 values just for West Germany. See Table A.2 for detailed numbers.
Source: Destatis (2025), author's calculation.

Next, we look at the drivers of labour productivity growth. De Vries and Erumban (2022, Equation 8) use growth accounting to decompose labour productivity growth into contributions from ICT and non-ICT capital deepening, labour quality growth and total factor productivity growth (TFP).[7] Unfortunately, the specific choice of one of the commonly used databases results in significant differences in the outcomes of the decomposition exercise for Germany. The way the data in the Conference Board Total Economy Database is constructed generally leads to higher contributions for capital and respectively lower contributions from TFP compared to other data sources like the EUKLEMS & INTANProd data base.[8] However, an important advantage of the Conference Board Total Economy Database is the availability of a very long time series, and the data for an aggregate of East and West Germany prior to the German reunification.

Figure 2.4 provides a decomposition of Germany's labour productivity growth into the contributions from ICT and non-ICT capital deepening, labour quality growth and total factor productivity growth for the decades since the 1970s.[9] It shows a strong decline in the TFP contribution between the 1970s

[7] For a general description of the growth accounting approach see, e.g., O'Mahony and Timmer (2009).

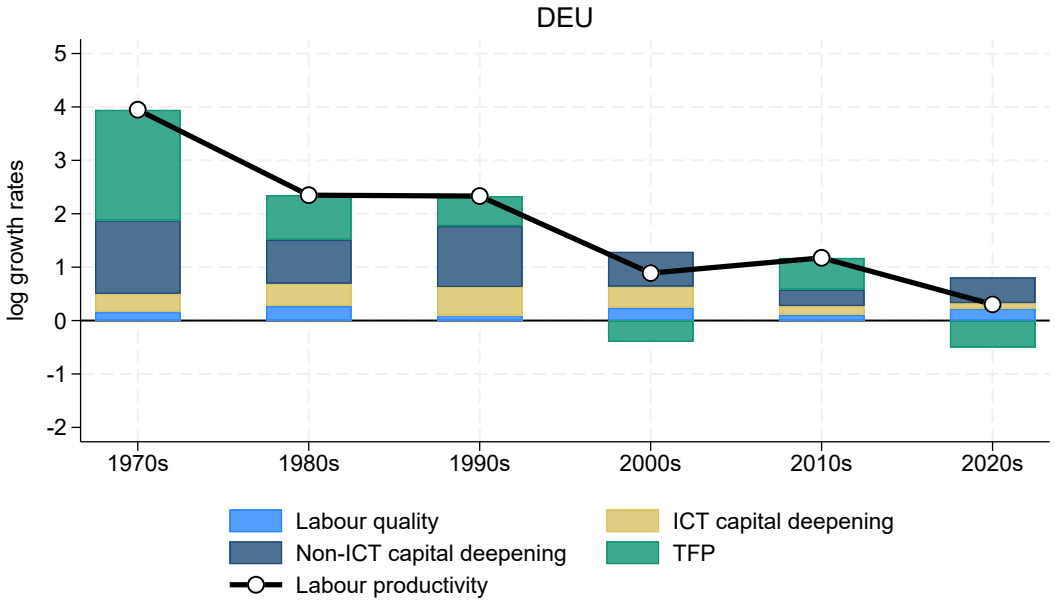
[8] See Chart 1 in Gouma and Inklaar (2023). Refer to Annex A in Van Ark et al. (2023) for a detailed discussion on appropriate ICT deflators and their relation to embodied and disembodied technological change. The huge cross-country differences in ICT deflators can be seen in Figures A.9 and A.10 in the Appendix. Moreover, compare Figure 2.4 with Figures A.4 and A.5, which show substantially higher TFP growth rates with the EUKLEMS data.

[9] See Table A.3 in the Appendix for detailed numbers. See Figure A.2b and Table A.1 for labour productivity growth contributions for alternative time periods deviating from the decadal approach in Figure 2.4. Also see Tables A.4, A.5, A.6 and A.7 for results based on EUKLEMS & INTANProd data for different types of capital input, industries as well as for alternative periods.

and the 2000s, with the TFP contribution in the 2000s even being negative, mostly driven by the sharp decline during the Global Financial Crisis.[10] This strong decline in TFP during the 2000s is, at least to some extent, a statistical artefact, as it is partly driven by the lower capacity utilisation during a recession.[11] During the 2010s, the TFP contribution was positive again and even higher than in the 1990s.

Turning to capital, the contribution of non-ICT capital deepening was especially pronounced in the 1970s and the 1990s. Besides, the contribution of ICT capital deepening was always clearly below the non-ICT capital contribution, with the highest ICT capital contribution to labour productivity growth of 0.5 percentage points in the 1990s. In the 2010s, the contribution of ICT capital deepening in Germany was remarkably low, despite the emergence of new digital technologies such as cloud computing, big data and the widespread adoption of industry 4.0 technologies.

Figure 2.4: Decomposition of labour productivity growth into contributions of labour quality, ICT capital deepening, non-ICT capital deepening and total factor productivity - Germany



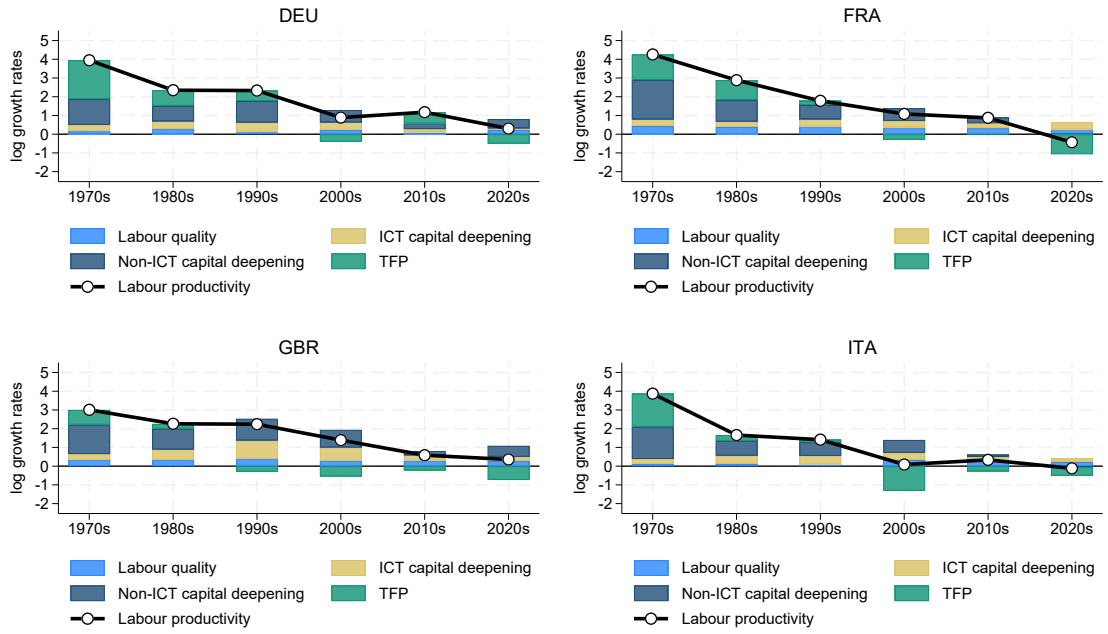
Note: Values for the 2020s include data for the years 2020 to 2024.
Source: The Conference Board Total Economy Database™, September 2025, author's calculation.

Figure 2.5 presents four panels with the same labour productivity growth decomposition into the contributions from labour quality, ICT and non-ICT capital deepening and total factor productivity growth for Germany, compared to France, UK and Italy.[12] The clear downward trend of the TFP contributions between the 1970s and the 2000s is evident for all three comparison countries but especially pronounced in the UK, where TFP has recorded negative contributions every decade since the 1990s. Remarkably, Germany's TFP performance in the 2010s was much stronger than in the other three European economies. The UK on the other hand showed very large contributions from ICT

[10] See Figure 2.6b.
[11] See, e.g., Comin et al. (2025).
[12] For detailed numbers see Table A.3 in the Appendix. A similar figure showing the contribution of total capital deepening can be found in Figure A.3 in the Appendix.

capital deepening in the 1990s compared to Germany but also to France and Italy. France, however, had remarkable large and stable ICT capital contributions since the beginning of the 1990s.

Figure 2.5: Decomposition of labour productivity growth into contributions of labour quality, ICT capital deepening, non-ICT capital deepening and total factor productivity - selected countries



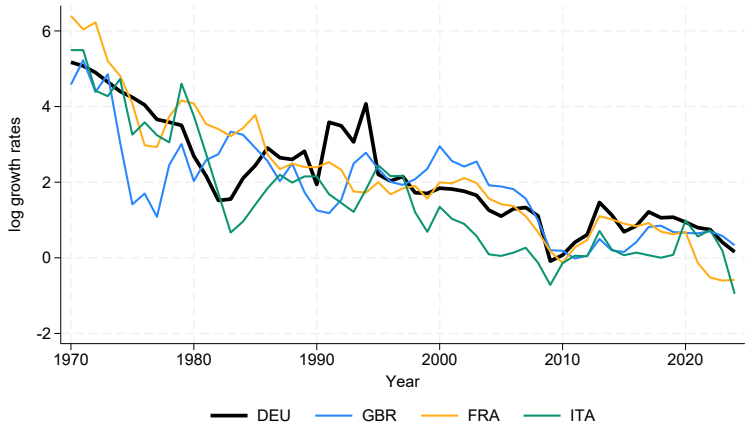
Notes: Values for the 2020s include data for the years 2020 to 2024. DEU: Germany, FRA: France, GBR: United Kingdom, ITA: Italy. See right part of Table A.3 for detailed numbers.
Source: The Conference Board Total Economy Database™, September 2025, author's calculation.

Finally, Figure 2.6 visualises the evolution of the labour productivity (Panel a) and TFP (Panel b) growth rates between 1970 and 2024 as 4-year trailing averages. The general slowdown in labour and total factor productivity over previous periods is also visible in these graphs. Two aspects however were not visible in the previous graphs with decadal averages. First, the labour productivity slowdown was brought to a halt just after the reunification. Second, the Global Financial Crisis largely affected capacity utilisation and therefore TFP during that time. Recent research by Comin et al. (2025), based on capacity utilisation adjusted TFP measures, indicates that long-run TFP growth is indeed less volatile and less cyclical than shown in Figure 2.6b.

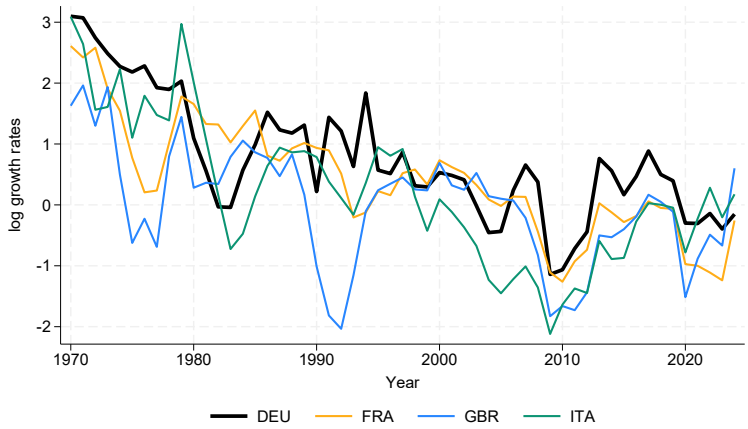
Overall, we see a strong labour productivity slowdown in the past decades. Together with the mostly negative net contributions of labour input (measured as hours worked), there is a corresponding decline in GDP growth. A closer look at the (diminishing) contributions to labour productivity growth reveals a strong decline in the contributions of TFP growth between the 1970s and the 2000s. Compared to other large European countries, labour productivity growth and the contribution of its drivers overall look relatively similar since the 1990s. Only the UK is slightly different, with two decades of negative TFP growth but, on the other hand, it shows strong contributions by ICT capital deepening in the 1990s.

Figure 2.6: Evolution of labour productivity and TFP growth rates - 4-year trailing average - selected countries

(a) Panel A: GDP per hour worked (labour productivity) - 4-year trailing average



(b) Panel B: Total factor productivity- 4-year trailing average



Notes: Values for the 2020s include data for the years 2020 to 2024. DEU: Germany, FRA: France, GBR: United Kingdom, ITA: Italy.
Source: The Conference Board Total Economy Database™, September 2025, author's calculation.

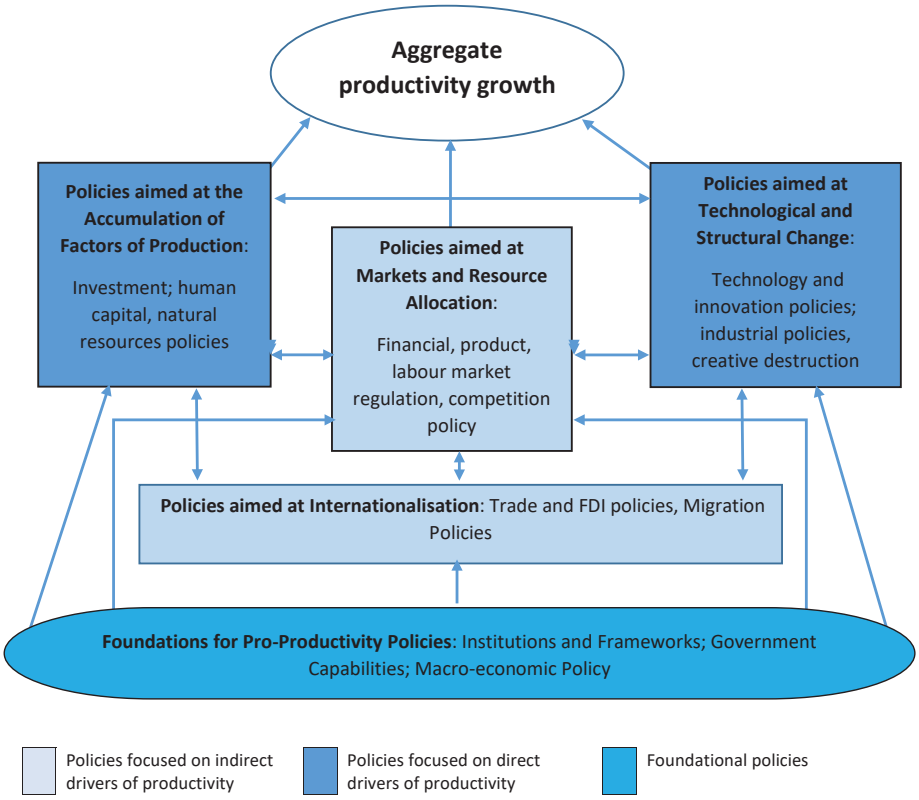
3 Overview of pro-productivity policies in Germany after the reunification

This section provides an overview of the most important (pro)-productivity policies of the past three decades. It draws heavily on the previous literature regarding the productivity slowdown in Germany (Ademmer et al., 2017; van Ark et al., 2009; Geis-Thöne et al., 2021; Grömling et al., 2021; Peters et al., 2018). In particular, Ademmer et al. (2017) provide a very comprehensive overview including numerous empirical analyses conducted by the authors themselves. However, most of the literature is focussed on the causes of the productivity slowdown rather than on policies that have enhanced productivity in the past. One of the exceptions are the reports by the National Productivity Board within the German Council of Economic Experts (German Council of Economic Experts, 2019, 2020, 2021, 2022, 2023a, 2024b).

3.1 Typology of pro-productivity policies

The slowdown in productivity as described in Section 2 underscores the urgent need for pro-productivity policies. However, as pointed out by Van Ark et al. (2023), there is no guarantee that pro-productivity policies from previous decades or lessons learned from other countries will work universally. To evaluate and compare these policies in a structured manner, Van Ark et al. (2023)[13] build on previous efforts in this area such as Cusolito and Maloney (2018) and Pilat (2023).[14] Van Ark et al. (2023) eventually came up with four different categories of pro-productivity policies as displayed in Figure 3.1: (1) policies related to the accumulation of the production factors, (2) policies aimed at markets and resource allocation, (3) policies supporting technological and structural change, and (4) policies for internationalisation. Especially the latter two are of great importance for Germany due to the German reunification and the strong export orientation of the German economy.

Figure 3.1: Typology of pro-productivity policies



Source: Van Ark et al. (2023).

Apart from the four categories, Van Ark et al. (2023) also introduced an additional category called "foundations for pro-productivity policies" which, among other things, refers to well-functioning institutions and frameworks. In essence, these can be seen as necessary but not sufficient conditions for sustained productivity growth.

The following overview of pro-productivity policies in Germany will be structured according to this typology. Whenever measurable or at least deducible from the literature, the impact of the different types of policies on labour productivity growth in Germany will be discussed in more detail in Section

[13] See Van Ark et al. (2024) and Van Ark and Pilat (2024) for related published versions of the paper.
[14] A recent OECD publication also reviews pro-productivity policies (André and Gal, 2024).

4. A graphical overview of the (subjectively) most important (pro-) productivity policies of the past three decades in Germany is shown in Figure 3.2.

3.2 Policies aimed at institutions and frameworks

Two historical events have shaped Germany in the 1990s. The German reunification in 1990 and the establishment of the European Union in 1993. Both had a direct impact on institutions and frameworks, with policies that significantly influenced productivity.

3.2.1 Institution building

In 1990, a new institution called Treuhandanstalt ("Trust Agency") was created to restructure and divest the former state-owned firms in Eastern Germany.[15] This newly created institution and the approach it took, undoubtedly had a significant impact on the German economy in the 1990s and the industry structure in East Germany until now. In the late 1990s, the focus was more on institutions in the area of regulation and competition with the creation of the Regulatory Authority for Telecommunications and Posts to ensure non-discriminatory competition in network industries. The establishment of this authority was driven by European legislation, and was later renamed the Federal Network Agency expanding its scope to cover additional (regulatory) tasks.[16]

3.2.2 Government capabilities

Generally speaking, the capabilities of the German government are still regarded as strong, based on the World Bank Government Effectiveness Indicator.[17] Furthermore, the bureaucratic burden perceived by business leaders is surprisingly low.[18] One key area where Germany is strongly lagging behind is the development of a digital government. Especially the lack of digital public services at the local, regional and national level is evident (European Commission, 2024b,c). Dealing with non-digitalised administration processes is time consuming and costly for firms. The importance of this issue was recognised in 2025, with a newly established Federal Ministry for Digital and State Modernisation[19] that bundles all digitalisation topics, especially those related to e-government.

The German federal system is characterised by a rather complex relationship between the federal government and the states (Länder). A key feature is the division of powers between the federal and state levels. However, whenever a federal law affects the administrative competencies of the states or has financial implications for the states or municipalities, approval from the second chamber of parliament (Bundesrat) is required. This results in the need for negotiation, often limiting the scope of change, the so-called "joint-decision trap" (Benz, 2022; Bury and Feld, 2023). A series of reforms have been implemented in the past,[20] but it remains unclear whether these changes to the federal system were sufficiently far-reaching to succeed in an era of major transformation.

[15] See Mergele et al. (2025) for a comprehensive overview.
[16] See `https://www.bundesnetzagentur.de/EN/General/Bundesnetzagentur/AboutUs/start.html`.
[17] See, e.g., Scheuermeyer and Köhler-Geib (2021, Figure 4).
[18] See, e.g., Borger et al. (2024, Figure S2). On the other hand, it took German SMEs in 2023 almost seven per cent of their working time to meet administrative requirements.
[19] `https://www.bundesregierung.de/breg-en/federal-government/ministries/ministry-for-digitalisation-and-state-modernisation`.
[20] See, e.g., Bury and Feld (2023) and Benz and Sonnicksen (2018).

3.2.3 Macroeconomic policy

The establishment of the European Union with the Maastricht Treaty and the launch of the Euro as the common currency for the majority of the EU countries were the largest macroeconomic policy changes in the 1990s. Both lead to deeper economic integration and, on the positive side, raise the potential for reduced transaction costs, the elimination of exchange rate risks and greater price transparency.[21]

3.3 Policies aimed at the accumulation of the factors of production

3.3.1 Investment

There is evidence of insufficient public investment in Germany in the past decades as the public capital stock is substantially older than private capital stock and the net capital expenditures, particularly at the municipal level, has been weak (German Council of Economic Experts, 2024a). In order to improve the public infrastructure, a half trillion euro fund to overhaul the public infrastructure was set up in the beginning of 2025.[22] To encourage private investment, the newly established government has also introduced a so-called "investment booster" in the form of a 30% declining balance depreciation applicable for the next three years.[23]

Another ongoing concern is the rather average use of digital technologies in German firms, especially within SMEs.[24] Support schemes specially tailored for SMEs like "go-digital" (consultancy services for digitalisation) as well as "Digital Jetzt" (grants for investments in digital technologies and training) were implemented in 2017 and 2020 respectively. However, there is empirical evidence that such support schemes may actually distort the diffusion of advanced digital technologies, as firms are incentivised to invest in their own hardware rather than adopting more advanced (public) cloud services.[25] Meanwhile, both support schemes have since been discontinued. However, the Mittelstand-Digital Innovation Hubs[26], a nationwide network of centres to support small and medium-sized enterprises in adapting new technologies and digital applications, still exists today (Mittelstand-Digital, 2025).

3.3.2 Education and skills

In the late 2000s, Germany experienced a rapid expansion of the higher education system. The number of students enrolled at universities and similar higher education institutions increased from less than two million in 2005 to almost 3 million in 2020.[27] At the same time the number of graduates almost doubled with an even larger increase for STEM graduates specifically. Nevertheless, dual vocational

[21] See, e.g., SVR (2005, p. 425).

[22] See, e.g., Hentze (2025), Ochsner and Zuber (2025) and `https://www.gtai.de/en/invest/business-location-germany/new-government-to-invest-half-trillion-in-germany-1881468`.

[23] See `https://www.bundesfinanzministerium.de/Web/EN/Issues/Taxation/Growth-booster/growth-booster.html`.

[24] See, e.g., KfW (2025). ICT investment in real terms (accounting for the improved quality of ICT goods), grew substantially between 1995 and 2021 (see Figure A.6). In nominal terms, only the years 2019 and 2021 recorded higher ICT investments than the previous record high in the year 2020 (see Figure A.7). The share of nominal ICT investment in total nominal investment is nowadays much lower than 20 years ago (see Figure A.8). This is most likely also related to the diffusion of cloud computing, with fast declining prices and the fact that cloud services are treated as intermediate goods and not investments, which will have a large effect if cloud services are predominately purchased from abroad (see Coyle and Nguyen, 2018, Section 5).

[25] See R. Andres et al. (2024) and DeStefano et al. (2024).

[26] `https://www.mittelstand-digital.de/MD/Navigation/DE/Service/EnglischeSeite/englische-seite.html`.

[27] See Figure A.12 in the Appendix. For a general overview of the higher education system in Germany, see Hüther and Krücken (2018).

education and training (VET) is still highly important in Germany.[28] As Backes-Gellner and Lehnert (2021) note, the high-quality vocational skills provided by the dual VET programs complement those of academic graduates. One key aspect of this are the regular curriculum updates. During the years 2011 to 2022, 124 training regulations were updated.[29]

3.3.3 Natural resources

Legislation at the European and national level targeted the more sustainable use of natural resources in the past two and a half decades. One key pillar at the national level is the Renewable Energy Sources Act (EEG), which came into force in the year 2000.[30] The goal was to increase the share of renewable energy sources but this was at least to some extent accompanied by rising prices. At the European level, the European Green Deal and the European Climate Law of 2021[31] were major policy changes aiming at sustainable growth with the goal of no net emissions of greenhouse gases in 2050. Germany follows even more ambitious goals with the Federal Climate Action Act which targets net greenhouse gas neutrality in 2045.[32] A significant shift in energy and natural resources policies was the rapid substitution of energy imports following the Russian invasion of Ukraine (Bachmann et al., 2024a).

3.4 Policies aimed at technological and structural change

3.4.1 Innovation & technology

There is empirical evidence for the US that ideas are getting harder to find, in other words research productivity is declining (Bloom et al., 2020). Boeing and Hünermund (2020) find similar diminishing returns in idea production for China and Germany. Policies encouraging the innovation of firms and the creation of innovation ecosystems are increasingly important. In 2006, Germany therefore established the Commission of Experts for Research and Innovation (EFI), which is mandated to draw up recommendations for the development of the German research and innovation system. A yearly report with recommendations is handed over to the chancellor. One of the recommendations of the EFI commission was an R&D tax credit which was finally introduced in 2020.[33] In 2018, another major policy change in the area of innovation & technology was the introduction of the Federal Agency for Breakthrough Innovation (SPRIND) in the spirit of the US Defense Advanced Research Projects Agency (DARPA). The aim is to support high-risk research in order to foster breakthrough innovations in Germany.[34]

3.4.2 Industrial policy

At least since the breakdown of global supply chains during the COVID pandemic, the Russian invasion of Ukraine and the trade tensions of 2025, policies aimed at supplier diversification and enhancing

[28] See BIBB (2024).
[29] See Cedefop and BIBB (2023, Chapter 10).
[30] See Büsgen and Dürrschmidt (2009) and for the 2014 revision, M. Lang and A. Lang (2015). A very detailed overview is provided by Egerer et al. (2018).
[31] See `https://eur-lex.europa.eu/eli/reg/2021/1119/oj`.
[32] See `https://www.gesetze-im-internet.de/englisch_ksg/englisch_ksg.html`.
[33] See Falck et al. (2023) for details.
[34] `https://www.sprind.org/en/we`.

resilience have gained priority at both the national and European level. One goal is to regain technological sovereignty with initiatives like the European Chips Act, which includes inter alia the objective to build up capacity to manufacture (advanced) chips.[35] Already in the 1990s, Germany laid the foundation via various (local) policy measures for the so-called "Silicon Saxony" microelectronics hub.[36]

The German economy nowadays is still characterised by a relatively large manufacturing share in total employment. Nevertheless, Germany also has experienced an almost continuous decline in the manufacturing share since 1990. However, as shown by Boddin and Kroeger (2021), the official employment statistics based on the industry affiliation of firms tend to overstate this structural change, since the magnitude of the decline in manufacturing occupations is considerably less pronounced. In other words, they show that manufacturing jobs disappear from the manufacturing sector but often reappear in the service sector under the same or similar job titles. Furthermore, the decline is also related to the outsourcing of food, cleaning, security, and logistics services by manufacturing firms (Goldschmidt and Schmieder, 2017, Figure 1). Another unique characteristic of the German economy is the large share of small and medium sized firms (SMEs — the so-called "German Mittelstand"). Supporting the German Mittelstand as well as the manufacturing firms were among the key priorities for German politics in the past decades. In this respect, there are still ramifications of the German reunification. One striking aspect is the failure to attract large (and correspondingly highly productive) manufacturing firms in East Germany (Ragnitz, 2024).[37]

3.4.3 Creative destruction

Since the mid-1990s, business dynamics in Germany has been relatively weak. The number of newly founded firms in the total economy and especially in the manufacturing sector is substantially lower nowadays than in 1995.[38] This decline has occurred against the backdrop of several policy initiatives aimed at increasing the number of high-tech start-ups in particular. In 1998, for instance, Germany established the large scale EXIST funding programme for academic spin-offs, which continues to exist until today albeit with some modifications over the years. Its funding lines support prospective founders as well as universities to create a better environment for start-ups.[39] In 2021, the federal government established the "Future Fund" ("Zukunftsfonds") for innovative, technology-based start-ups with a special focus on the capital-intensive scale-up phase.[40] The "Future Fund" is one of the central building blocks of the German government's comprehensive start-up strategy introduced in 2022.[41] One major barrier to growth for start-ups seems to be the lack of scale-up financing in Germany and the European Union in general (Draghi, 2024; European Investment Bank, 2024; Viete, 2025).

[35] See `https://digital-strategy.ec.europa.eu/en/policies/european-chips-act`.
[36] See, e.g., Johnston and Huggins (2023).
[37] See also Figure A.11 in the Appendix for a comparison of labour productivity levels of East and West Germany in the total economy as well as in the manufacturing sector.
[38] See Figure A.13 in the Appendix.
[39] See Mueller and Eckardt (2024) for a detailed description.
[40] See BMWK (2022), `https://www.kfw-capital.de/Investment-focus/Zukunftsfonds-(Future-Fund)/`, `https://www.bundeswirtschaftsministerium.de/Redaktion/EN/Artikel/Economy/future-fund.html` and Metzger and Viete (2024) for more details.
[41] `https://www.bundeswirtschaftsministerium.de/Redaktion/EN/Publikationen/Wirtschaft/2022-startup-strategy-of-the-federal-government.pdf`.

3.5 Policies aimed at markets and market functioning

3.5.1 Financial markets

The German financial sector is large and well developed (IMF, 2022) but also characterised by low concentration and low profitability (German Council of Economic Experts, 2024b).[42] Despite the common currency, well-integrated capital markets across the Euro Area remain lacking to this day (Arampatzi et al., 2025; German Council of Economic Experts, 2023b). Banking supervision is rather complex as several German and European institutions are involved. Therefore IMF (2022) recommends a strategic agenda for banking supervision. In response to the Wirecard failure, there are already ongoing reforms to the Federal Financial Supervisory Authority (BaFin). However, the IMF calls for further reaching reforms, including greater operational independence of the BaFin. On the positive side, Germany seems to provide a viable environment for fintechs as it hosts the largest amount of neobanks in continental Europe (IMF, 2022).

Historically, Germany was characterised by a network of firms and banks, where banks were both lenders and shareholders, the so-called "Deutschland AG".[43] In an effort to increase the attractiveness of the German financial market, changes to corporate governance legislation and a major corporate tax reform, including the repeal of the 40% tax on corporate capital gains,[44] in the late 1990s and early 2000s led to a strong decline in cross-ownership between German financial institutions and firms (Ringe, 2015). The empirical evidence on the economic impact of this change in the cross-ownership pattern is ambiguous. For example, Gorton and Schmid (2000) find positive effects while Dittmann et al. (2010) find negative effects. Moreover, a recent analysis by Peev (2023) suggests that German companies still hold significant equity stakes in other large German companies despite the decline in cross-ownership.

3.5.2 Product markets

According to the OECD Product Market Regulation (PMR) indicators, Germany ranks better than the average for the OECD. It has also seen some improvements in the PMR since 2018. However, when it comes to professional services, such as accountants and architects, Germany continues to rank poorly compared to other OECD countries (OECD, 2024a). It still takes about twice the number of days to obtain a business operating license compared to the average of advanced economies (IMF, 2024). In May 2025, the federal government adopted draft legislation for regulatory sandboxes.[45]

3.5.3 Labour markets

Germany continues to have a rather high share of workers covered by collective bargaining agreements.[46] However, there has been a gradual flexibilisation and decentralisation of the collective bar-

[42] However, research by Huber (2021) shows that, in the past, low market concentration did not negatively affect the performance of German firms. His study relies on an exogenous shock in the 1950s that allowed certain relationship banks to sharply increase their size without becoming more efficient or having positive effects on borrowing firms.

[43] For a detailed description of the history of the "Deutschland AG" ("Germany Inc") see, e.g., Fohlin (2005), C. Andres et al. (2011) and Rapp and Strenger (2015).

[44] See Rünger (2014) for a detailed description.

[45] `https://www.bundeswirtschaftsministerium.de/Redaktion/DE/Pressemitteilungen/2025/20250519-reallabore-gesetz-schafft-attraktive-rahmenbedingungen-fuer-innovative-unternehmen.html`.

[46] See Jäger et al. (2022, Figure 2).

gaining system since the 1990s, allowing "wages to vary according to regional productivity" (Jäger et al., 2022). This might have increased employment in lower productivity areas but conversely also led to more workers being employed in less productive firms and regions (Boeri et al., 2021; Jäger et al., 2022). During the period 2003 to 2005, Germany implemented major labour market reforms mainly triggered by the high unemployment rate and the unsustainable financing of social security systems. According to Jacobi and Kluve (2007), the core elements were (a) better labour market services and more effective and efficient policy measures, (b) the activation of unemployed persons by relying on the principle of "rights and duties" and (c) the deregulation of the labour market. Hartung et al. (2025) describe this programme as one of the largest unemployment insurance reforms in industrialised countries in the past decades.[47] Judging solely by the reduced unemployment rate, the reform appears to have been successful. In the decade after the reform, the unemployment rate was halved, driven primarily by a decline in job separations, with higher job-finding rates playing a comparatively smaller role (Hartung et al., 2025). Another major reform of the German labour market happened with the introduction of a national minimum wage in 2015, which affected about 15 percent of the employees (Dustmann et al., 2022). This reform somewhat surprisingly had positive productivity implications. Dustmann et al. (2022) provide empirical evidence that the minimum wage induced reallocation of workers from smaller and less productive establishments to larger and more productive ones, while having no negative effects on overall employment.

3.5.4 Competition policy

During the 1990s, Germany has gone through a period of privatisation, deregulation and liberalisation of network industries. These changes were often triggered by requirements of the European Commission, for example in the case of the German telecommunications market (Vogelsang, 2003). However, there is still a considerable share of (partly) state-owned enterprises with associated governance issues (OECD, 2024b). At least at the federal level, the number of state-owned enterprises did not further increase between 2008 and 2019 (Heinemann et al., 2025). When it comes to competition in digital markets, much of the regulation is introduced at the European level nowadays. One notable example is the Digital Markets Act (DMA), which came into force in 2022. The goal of the DMA is to ensure a level playing field for all digital firms and to guarantee a competitive and fair digital sector.[48]

3.6 Policies aimed at internationalisation

3.6.1 Trade and FDI

The German economy is characterised by a strong focus on international trade. The foreign trade ratio (measured as the share of the sum of imports and exports in total GDP) is much higher than in other G7 countries like Japan and the US. In 2000, France and Germany had quite similar foreign trade ratio levels while the German economy had placed a significantly greater emphasis on internationalisation by 2020. This resulted in a gap in the foreign trade ratio between Germany and France of about 20 percentage points.[49] The strong increase of German international trade started around the time of the

[47] A detailed description of the so-called Hartz reforms can be found in Jacobi and Kluve (2007).
[48] `https://www.consilium.europa.eu/en/policies/digital-markets-act/`.
[49] See German Council of Economic Experts (2022, Chart 135).

EU enlargement in 2004.[50] The German Council of Economic Experts (2015) notes that the German economy predominantly saw the offshoring of labour-intensive processes to other countries during the 2000s. The decision to offshore certain production steps is often related to better quality intermediate inputs for a given price.[51] However, geopolitical tensions, tariffs and the breakdown of value chains led to discussions and measures to strengthen the resilience of supply chains in recent years.[52]

3.6.2 Migration

When it comes to migration, a sizeable inflow of immigrants to Germany started in the early 1960s.[53] After the German reunification in 1990, jobs for migrants were often created in low-productivity sectors (Ademmer et al., 2017, p. 226). Immigration from the Eastern European countries following the EU Enlargement of 2004 only increased after 2011, when workers from these countries gained full access to the German labour market (Dorn and Zweimüller, 2021). The demographic change and the ageing population[54] will require a substantial amount of net inward migration especially those with critical skills that Germany is short of (German Council of Economic Experts, 2023a). Currently, the share of tertiary-educated individuals among foreign residents in Germany is rather low compared to other European countries (Dorn and Zweimüller, 2021). There were several initiatives to increase the share of tertiary educated immigrants. In March 2020, the Skilled Immigration Act (FEG — Fachkräfteeinwanderungsgesetz) came into force to overcome the shortage of skilled workers and counteract demographic change.[55] The objective was to make it easier for skilled workers to start a new job in Germany. A major rework of the Skilled Immigration Act happened in 2023.[56] In June 2024, a new so-called Job Search Opportunity Card (Chancenkarte) was introduced which, among other features, implements a points-based system that evaluates applicants according to various criteria.[57]

3.7 Suitability of the policy framework for Germany

Overall, the policy framework proposed by Van Ark et al. (2023) fits a description of the German policy environment remarkably well, despite its rather unique characteristics. Figure 3.2 provides a summary overview of the policies discussed organised over time and qualified as being characteristic of early, medium and late development stages of the economy. I find that some of the sub-categories overlap. For example, product market policies, competition policies and government capabilities often go hand in hand. The same is true for product market policies and policies for innovation and technology (for example, in the case of regulatory sandboxes). Furthermore, technological sovereignty is an industrial policy objective, which is closely linked to trade and FDI, especially with respect to inward FDI in the form of M&A in high-tech sectors.[58]

[50] For a brief history of European integration see Campos et al. (2019).
[51] See, e.g., De Loecker and Goldberg (2014).
[52] See, e.g., German Council of Economic Experts (2022).
[53] See, e.g., Dorn and Zweimüller (2021, Figure 2).
[54] The share of employees aged above 55 is increasing in the vast majority of industries in the German Economy (German Council of Economic Experts, 2023a, Chart 51).
[55] `https://www.bamf.de/SharedDocs/Meldungen/EN/2021/210301-am-fachkraefteeinwanderungsgesetz.html`.
[56] `https://www.make-it-in-germany.com/en/visa-residence/skilled-immigration-act`.
[57] `https://www.make-it-in-germany.com/en/visa-residence/types/job-search-opportunity-card`.
[58] For a detailed description of different FDI types see OECD (2025, Chapter 9).

Figure 3.2: (Pro)-productivity policies for Germany 1990s, 2000s and 2010s-2020s

Policies	1990s	2000s	2010s-2020s
Policies for institutions and frameworks			
Institution building	**Creation of regulatory bodies and institutions (Regulatory Authority for Telecommunications and Posts, Treuhandanstalt)**	**Creation of Federal Network Agency; greater powers for the Federal Cartel Office (sector inquiries)**	
Government capabilities			**Lack of digital public services but newly established Federal Ministry for Digital and State Modernisation in 2025**
Macroeconomic policy	**Establishment of European Union (Maastricht Treaty) and launch of a common currency (Euro)**		
Policies aimed at the accumulation of productive factors			
Investment		**Only limited public investment**	**ICT investment subsidies** **Half trillion euro special fund on public infrastructure** **"Investment booster" via a 30% depreciation allowance**
Education & skills			**Rapid expansion of higher education system** **Constant updating vocational training programs**
Natural resources		**Renewable Energy Sources Act (EEG)**	**Significant revision to the EEG and European Green Deal/European Climate Law**
Policies for technological and structural change			
Innovation & technology		**Introduction of Commission of Experts for Research and Innovation (EFI)**	**Introduction of R&D Tax Credit (2020)** **Introduction of the Federal Agency for Breakthrough Innovation (SPRIND)**
Industrial policy	**Support for the creation of the Silicon Saxony microelectronics hub**	**Failure to attract large manufacturing firms in Eastern Germany**	**Policy with the focus on diversification and resilience (e.g. European Chips Act)**
Creative destruction	**EXIST start-up grants (start-ups from science)**	**Introduction of High-Tech Startup Fund - a public-private venture capital investment fund**	**Comprehensive start-up-strategy and Future Fund**

Figure 3.2 (cont'd)

Policies	1990s	2000s	2010s-2020s
Policies for markets			
Financial markets	Start of the disintegration of corporate cross-ownership structure (Deutschland AG)"	Common currency (Euro) but until today still lack of well-integrated capital markets	Ongoing reform of Federal Financial Supervisory Authority (BaFin) but more reforms needed Rather successful Neobanks/Fintech sector
Product markets	Privatisation of state-owned assets (partly)		Product market deregulation but still issues with professional services and admin burden Federal government adopts draft legislation for regulatory sandboxes
Labour markets	Flexibilisation of collective bargaining system	Deregulation of labour markets (Hartz reforms)	Introduction of a nationwide minimum wage
Competition policy	Privatisation of state-owned assets (partly)	Still considerable share of state-owned enterprises and governance issues	Competition policies for digital markets at the European level (e.g. DMA)
Policies for internationalisation			
Trade		Outsourcing of labour-intensive processes to other countries (related EU enlargement)	Geopolitical tensions, tariffs and the breakdown of value chains
FDI		Increase in outward FDI (related EU enlargement)	Decrease in inward FDI in recent years
Migration		EU enlargement 2004 - freedom of movement and residence but full labour market access not until 2011	(New) Skilled Immigration Act Jobs for migrants often created in low-productivity sectors

Note: Following Van Ark et al. (2023), the colours point to pro-productivity policies typical for different levels of economic development, as follows:

Stylised policies low-income economy
Stylised policy middle-income economy
Stylised policy advanced economy
Potential anti-productivity effects

Source: Authors' elaboration. See beginning of Section 3 for more details.

4 The role of key pro-productivity policies in Germany

Section 3 provided an overview of the most important policies of the past three decades in Germany that have very likely affected productivity. This section explores the role of these key pro-productivity policies in supporting (or holding back) labour productivity growth in Germany. The productivity impact will be discussed along the four categories of pro-productivity policies as outlined in Section 3.1. Empirical evidence will be based on (macroeconomic) literature, stylised facts as well as related firm-level econometric studies. The goal is to broadly quantify the productivity impact of key policy changes in Germany, while identifying areas where such policy measures have not yet been implemented, thus hindering productivity growth.

4.1 The role of policies aimed at the accumulation of the factors of production

In the context of policies aimed at enhancing the accumulation of productive factors, the rapid expansion of the higher education system as well as continuous updates to the vocational training programs serve as the two main pillars. For the latter, Backes-Gellner and Lehnert (2021) demonstrate that these continuous updates are essential for innovation outcomes and therefore most likely also for productivity.[59] Moreover, the rapid expansion of tertiary education systems[60] should in principle be productivity enhancing (Amendola et al., 2020; Bonaccorsi et al., 2024; Schlegel et al., 2022; Valero and Van Reenen, 2019). For Germany, Meier (2024) provides empirical evidence that universities positively affect firm performance through the provision of high-skilled local labour supply. Apart from improvements in the quality of human capital, the accelerated investment into renewable energies via the Renewable Energy Sources Act (EEG) might have had positive productivity implications. For instance, Horbach and Rammer (2018) show that the proximity to renewable electricity production correlates with renewable energy innovations in firms.

Support schemes such as "Digital Jetzt", which provide grants for investments in digital technologies, as well as the Mittelstand-Digital Innovation Hubs were introduced in an effort to foster the uptake of digital technologies. According to Mittelstand-Digital (2025), those schemes were overall assessed positively. One of the main topics was the diffusion of artificial intelligence (AI). The use of AI in German firms is above the EU average (Rammer et al., 2024). There is also empirical evidence for a positive impact of AI usage on innovation (Rammer et al., 2022) and labour productivity (Czarnitzki et al., 2023). However, Demary et al. (2025) do not expect a "productivity miracle" in Germany as a result of the anticipated greater use of AI. Similarly, Acemoglu (2025) provides a simple model on the macroeconomics of AI expecting rather moderate productivity gains. In the case of generative AI, Brynjolfsson et al. (2025b) find larger productivity gains, whereas Humlum and Vestergaard (2025) state that the economic impacts remain minimal.[61]

[59] See, e.g., Mohnen (2019).

[60] Described in Hüther and Krücken (2018, p. 57) as "The German system is thus becoming much more similar in scope to the tertiary education systems of other countries ...".

[61] For a recent overview by OECD see Filippucci et al. (2024, Figure 1). A more general discussion on potential productivity gains of generative AI can be found in Baily et al. (2025) and Filippucci et al. (2025b).

4.2 The role of policies aimed at technological and structural change

Technological change is one of the core drivers of labour productivity growth.[62] This occurs either via disembodied technological change, as captured by TFP growth, which is based on scientific progress and better business practices in general, or by technological change embodied in capital input as described before in the case of the uptake of digital technologies. For disembodied technological change, well-functioning innovation systems are the key, with R&D activities of firms serving as one of the cornerstones.[63] The introduction of the R&D tax credit for German firms can be seen as a promising pro-productivity policy, provided it leads to sustained increases in R&D expenditures over the long term. The general response to the R&D tax credit was positive but with room for improvements as about 71 percent of the R&D-active companies did not yet apply for the tax credit (Finger et al., 2023). Moreover, a study on the machinery industry indicates that the R&D tax credit was well received, with 71 and 44 percent of the firms expecting higher turnover and efficiency gains respectively (Rammer, 2024). Furthermore, recent research for the UK shows that R&D incentives not only enhance a firm's internal innovation capacity but also stimulates technology spillovers (Dechezleprêtre et al., 2023).

There is a large body of research on the economic implications of the industrial policies after the German reunification in 1990. For instance, Mergele et al. (2025) show that the privatisation effort of the "Treuhand" was focusing on high productive firms, which had a much higher survival rate 20 years later.[64] Akcigit et al. (2023) provide evidence that the policy to temporarily oblige the privatised firms to maintain employment generated strong incentives for productivity improvements. However, Bachmann et al. (2024b) show that the failure to establish large firms in East Germany leads to a substantial labour productivity gap.

Germany has undertaken several initiatives, which are aimed to create better conditions, particularly for high-tech start-ups.[65] Nevertheless, the total number of start-ups declined, whereas the numbers for high-tech start-ups appear substantially stronger.[66] In this context, Karahan et al. (2024) show that the decline in the US start-up rate is driven by demographic change. Bersch et al. (2019) note that there is evidence for the same mechanism being at play in Germany. The value of (high-tech) start-ups is illustrated in Schnitzer and Watzinger (2022), who provide evidence that venture-capital-financed firms generate economically significant spillovers. On the question of how to increase the number of (high-tech) start-ups, a recent paper by Sadun et al. (2025) emphasises the economic value of good management practices for firm dynamism.

4.3 The role of policies aimed at markets and market functioning

In the past two to three decades, Germany has implemented a substantial number of reforms aimed at markets and market functioning. However, not all of them can be seen as strictly productivity enhancing.

[62] See Van Ark et al. (2023, p. 10 and p. 21).

[63] However, there is currently an ongoing debate about whether R&D expenditures are actually being made in sectors with high growth potential (Dietrich et al., 2024).

[64] To illustrate the significance of this transformation, "Treuhand" owned more than 10,000 firms with about 4 million employees. About 60 percent of the firms were successfully privatised (Mergele et al., 2025, Section 2).

[65] E.g., the introduction of "High-Tech Startup Fund" - a public-private venture capital investment fund, a comprehensive start-up-strategy and the "Future Fund".

[66] See Figure A.13 in the Appendix and Monte et al. (2025).

The economic impact of the major labour market reforms in the 2000s (known as the Hartz reforms) is still somewhat contested. While it was very successful in reducing unemployment it also increased the number of rather low productive workers (Ademmer et al., 2017, Section 6.6).[67] The collective wage bargaining system, which is still very widespread in Germany, has some distinct productivity implications as well. Compared to other countries with strong collective wage bargaining systems, Germany has a more flexible system that allows for local bargaining in line with local productivity levels (Boeri et al., 2021). While the more flexible system allows for higher employment and earnings in regions with a high share of low productive firms, it might hinder reallocation of workers from less productive to more productive firms or areas. Another distinctive feature of the German labour market is the prominent role of worker representation within firms, whether through the fairly comprehensive co-determination rights of the works council or through guaranteed seats on the supervisory board. Recent research by Jäger et al. (2021) shows that the latter might be productivity enhancing. The former at least does not seem to hinder the adoption of new technologies like robots and also seems to be productivity-enhancing via increased training efforts as shown in Findeisen et al. (2025). A highly disputed labour market policy change was the introduction of the nationwide minimum wage in 2015. As mentioned before, Dustmann et al. (2022) provide empirical evidence that the introduction of the nationwide minimum wage was actually productivity enhancing as it induced a reallocation of workers from smaller, less productive establishments to larger, more productive ones.

4.4 The role of policies aimed at internationalisation

Policies aimed at internationalisation in Germany have been closely linked to the deepening of European integration since the 1990s. The German Council of Economic Experts (2015) claims that a large amount of productivity growth in the 2000s was driven by the offshoring of labour-intensive processes to other countries. However, the analysis by Ademmer et al. (2017, p. 166) challenges this view by presenting empirical evidence that more productive industries showed a greater propensity for offshoring. Novel research by Beyer et al. (2025) utilising regional data, shows not only large economic benefits for the new EU members of 2004 but also substantial benefits for the member states prior to the 2004 EU enlargement. However, Grassi (2024) only found positive effects for the new member states. In general, the literature on the productivity effects of offshoring and a deeper integration into global value chains (GVC) finds positive effects for Germany (Schwörer, 2013) and Hungary (Halpern et al., 2015).[68]

The recent geopolitical tensions, newly introduced tariffs and the breakdown of value chains during the COVID pandemic have led to discussions on measures for greater resilience through increased diversification, among other things. Diversification might actually be positively associated with the performance of firms (Schiersch et al., 2025).

Overall, the effects of migration on productivity are also not that clear cut. In a recent paper on the UK, Hall and Manning (2024) find that "much of the apparent higher productivity of migrants is the result of sorting across areas, industries, and firms". The productivity effects of migration depend on the skill level of the migrants, so attracting high-skilled migrants as stipulated by the "Skilled Immigration Act" seems to be a promising strategy. One interesting aspect is the case of cross-border

[67] Further discussions can be found in Christofzik et al. (2024) and Hartung et al. (2025).
[68] See Criscuolo and Timmis (2017) and Shu and Steinwender (2019) for a broader review of the literature.

workers, showing that removal of restrictions on European cross-border workers increased labour productivity at least for high-tech manufacturers (Beerli et al., 2021). As Germany sees a significant outflow of mainly high-skilled cross-border workers to Luxembourg and Switzerland[69], this might dampen the productivity of German firms in border regions.

5 Discussion and forward-looking perspective

As outlined in the previous sections, Germany has implemented a wide range of reforms over the past three decades, most of which are in principle pro-productivity policies. Despite these reforms, Germany, along with many other developed countries, has experienced a productivity slowdown in the past decades. This suggests that either these reforms were not far reaching enough, or factors continue to hinder sustained productivity growth. Against this backdrop, a wide range of recommendations for productivity-enhancing reforms in general, and specifically for Germany, are mentioned in publications like André and Gal (2024), Christofzik et al. (2024), Grimm (2025), and Grimm et al. (2024). Also the annual reports by the National Productivity Board within the German Council of Economic Experts (GCEE) itself and the Commission of Experts for Research and Innovation (EFI) regularly provide meaningful insights. Moreover, the IMF has recently made proposals aimed at "lifting productivity" in Germany focusing on "entrepreneurship, innovation, digitalisation, and upskilling" (IMF, 2024). These productivity-enhancing reforms in Germany must be closely aligned with the twin transition (the digital and green transformations) accelerated by the rapid diffusion of (generative) AI. Moreover, they must also address the challenges posed by the accelerating demographic change and the current geopolitical tensions.

5.1 Dealing with the technological and structural change

The German electricity system saw a significant growth in renewables, accounting for 54 percent of the gross electricity consumption in 2024.[70] But at the same time Germany remains reliant on fossil fuels. The debate on whether the energy transition undermines the competitiveness of the German economy has started again, due to the steep rise in energy prices in recent years (IEA, 2025, p. 37). Fletcher et al. (2024) note that, while it is still too early to draw definitive conclusions, inward FDI in strategic and energy-intensive sectors has been decreasing since the year 2022. This would be in line with Saussay and Sato (2024), who find that differences in energy costs can impact cross-border M&A, especially in high-energy intensity sectors. Therefore, the lack of inward FDI due to rather high energy prices in Germany could potentially harm productivity of domestic firms through unrealised spillovers as shown by Haskel et al. (2007). On the other hand, IEA (2025) argues that the energy transition provides opportunities to gain competitive advantages in the clean energy industries. They are also advocating for "long-term policy and regulatory stability to support a secure and affordable clean energy transition". This aligns with Pilat (2024), who argues that good policy designs can reduce potential tradeoffs between climate change policies and pro-productivity policies.

With respect to policies for technological and structural change, Germany implemented a remarkable number of reforms. Still, there are multiple areas where improvements are desirable. For instance,

[69] See, e.g., European Commission (2024a).
[70] See IEA (2025, p. 30).

EFI (2024) recommends removing the currently strict separation between military and civilian R&D, as military R&D can have positive effects on civilian R&D.[71] This is especially relevant, as defence expenditures are expected to rise substantially (Ochsner and Zuber, 2025). Regarding disruptive innovation and their potential productivity-enhancing effects, EFI (2024) recommends that the Federal Agency for Breakthrough Innovation (SPRIND) should gain more independence from political influence and the deadlines of the Federal Budget Code.

The availability of high-speed fibre-based broadband is often mentioned as one key driver of productivity. However, as shown by Briglauer et al. (2024), there are indications of diminishing returns to speed beyond certain levels, at least currently. In the past, Germany had a very low diffusion of fibre-based broadband, which has recently changed. The number of active fibre connections increased by about one million between 2023 and 2024.[72]

The enormous transformative potential of (generative) AI is widely recognised. Germany and Europe are falling behind China and the US in technological development, in particular in the case of generative AI (EFI, 2024). On the other hand, the use of traditional AI in German companies is above the EU average (Rammer et al., 2024). The diffusion of these traditional AI applications in Germany is related to innovation (Rammer et al., 2022) as well as productivity (Czarnitzki et al., 2023). In the case of generative AI, Humlum and Vestergaard (2025) find only minimal economic impacts of AI chatbots for Denmark. On the other hand, Brynjolfsson et al. (2025b) find relatively large productivity improvements for customer-support agents using generative AI, that favour less experienced and low-skilled workers. A recent study for Germany conducted by Demary et al. (2025) finds only moderate effects of AI on future growth, aligning with the findings of Acemoglu (2025). [73] The "AI Continent Action Plan" which inter alia includes plans to have 13 operational AI factories by 2026 and even larger AI Gigafactories at a later stage could generate the necessary momentum for a more competitive AI landscape in Europe (European Commission, 2025).[74]

Another interesting aspect is discussed by Mischke et al. (2025). They show that just 13 "standout" firms across four sectors in Germany (retail, automotive and aerospace, travel and logistics, and computers and electronics) accounted for 65 percent of productivity growth in these sectors. This relates to the discussion on technology diffusion and productivity divergence across firms (Andrews et al., 2019).

Both, the German Council of Economic Experts (2025)[75] as well as the IMF (2024) call for reforms of public administration and to lower information requirements in order to "cut red tape to make it easier to start and run a business"[76]. One key aspect of public administration reforms is the acceleration of the widespread roll-out of digital public services.

5.2 A focus on public investments and demographic change

Regarding the recently announced half trillion euro special fund on public infrastructure, the economic impact primarily depends on whether the additionality of investment expenditures is guaranteed. If

[71] See, e.g., Moretti et al. (2025).
[72] `https://www.bundesnetzagentur.de/SharedDocs/Pressemitteilungen/EN/2025/20250516_JB_TK.html?nn=694186`. For details, see the full report (in German) by Bundesnetzagentur (2024).
[73] See related studies by Filippucci et al. (2025a) for G7 economies and Misch et al. (2025) for 31 European countries.
[74] See `https://digital-strategy.ec.europa.eu/en/node/13490/printable/pdf` for a brief overview.
[75] See SVR (2025) for the full version of the report (in German).
[76] See IMF (2024, p. 24).

the special fund on public infrastructure leads to a reduction of investments stemming from the core budget, the growth effect will be substantially lower (Ochsner and Zuber, 2025). A preliminary analysis of the planned budget for 2026 by Beznoska et al. (2025) shows that the special fund on public infrastructure likely fails to generate a substantial net increase in public infrastructure investment. Höslinger (2025) comes to a similar conclusion in her analysis of the federal budget for 2025.

One key issue that is likely affecting future growth and productivity in Germany is the demographic change (German Council of Economic Experts, 2019). Maestas et al. (2023) show for the US that population ageing is projected to slow down growth, with two-thirds of the effect stemming from slower labour productivity growth. The measured effects encompass several implications of an ageing society, like a reduced business start-up rate[77] or a lower adoption rate of new technologies. In this respect, Ochsner et al. (2024) provide potential output projections for Germany up to the year 2070 and conclude that "alleviating the adverse effects of demographic transition is crucial". There are multiple ways to at least partly mitigate the decline in labour volume associated with an aging population. This could, for example, be achieved through an increase in the labour force participation rate or a sufficient level of immigration of (high-skilled) workers. However, attracting high-skilled immigrants may have the unintended side effect of reducing the human capital stock in their home countries. But there is empirical evidence that the direct negative effect of migration to other countries is outweighed by indirect effects for the home country, for example through remittances, FDI and the transfers of knowledge (Batista et al., 2025).

[77] See Karahan et al. (2024).

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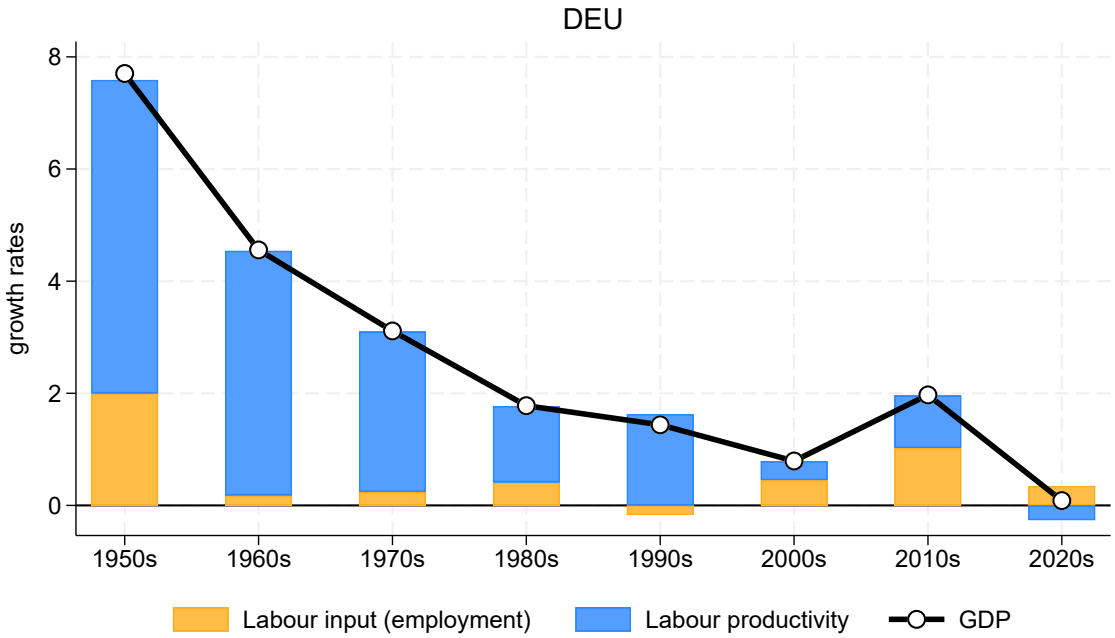
A Appendix

A.1 Additional graphs

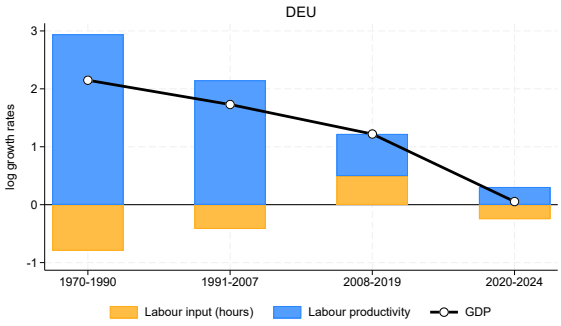
Figure A.1: Decomposition of GDP growth into contributions of labour input (employment) and labour productivity growth - Germany



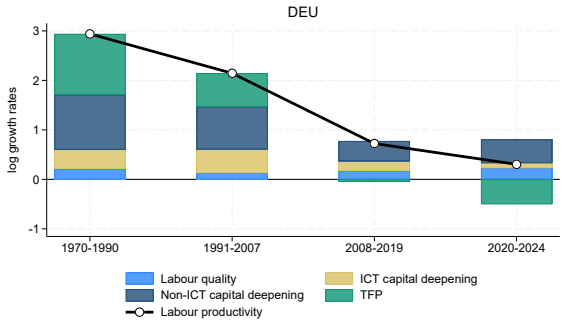
Notes: Values for the 1950s exclude the year 1950, values for the 2020s include data for the years 2020 to 2024. Labour input here refers to employment, in contrast to hours worked used throughout the rest of the paper.
Source: The Conference Board Total Economy Database™, September 2025, author's calculation.

Figure A.2: Decomposition of GDP growth into contributions of labour input and labour productivity growth (left) as well as labour productivity growth contributions (right) - Germany - alternative periods

(a) GDP growth contributions

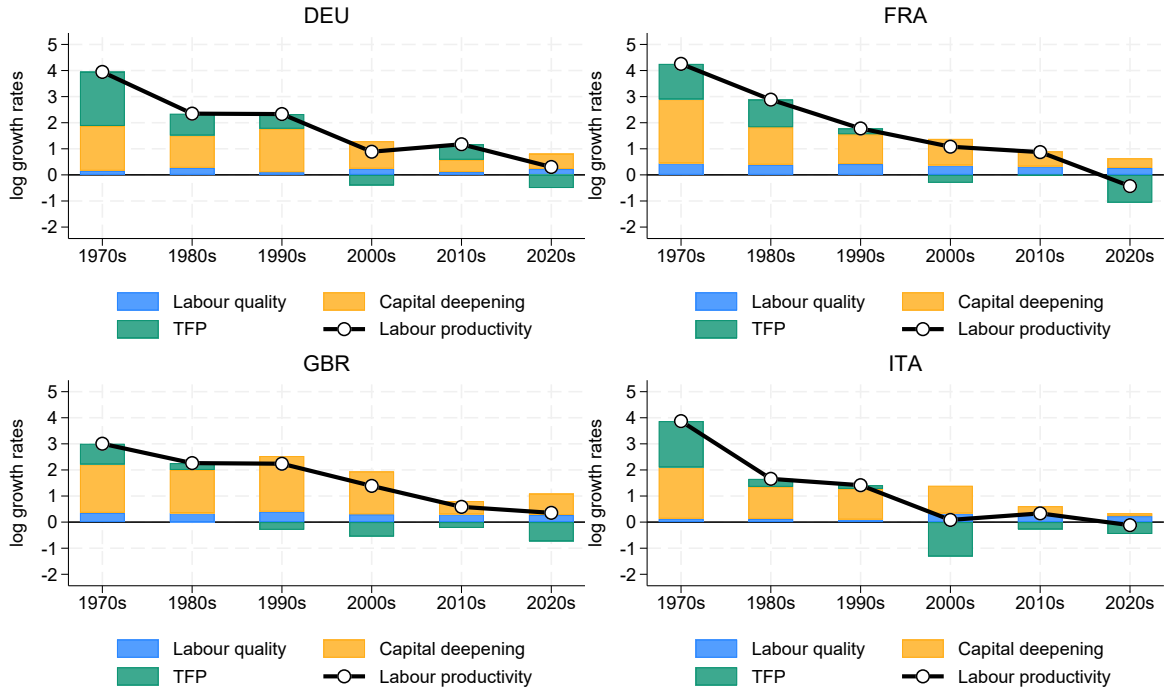


(b) Labour productivity growth contributions



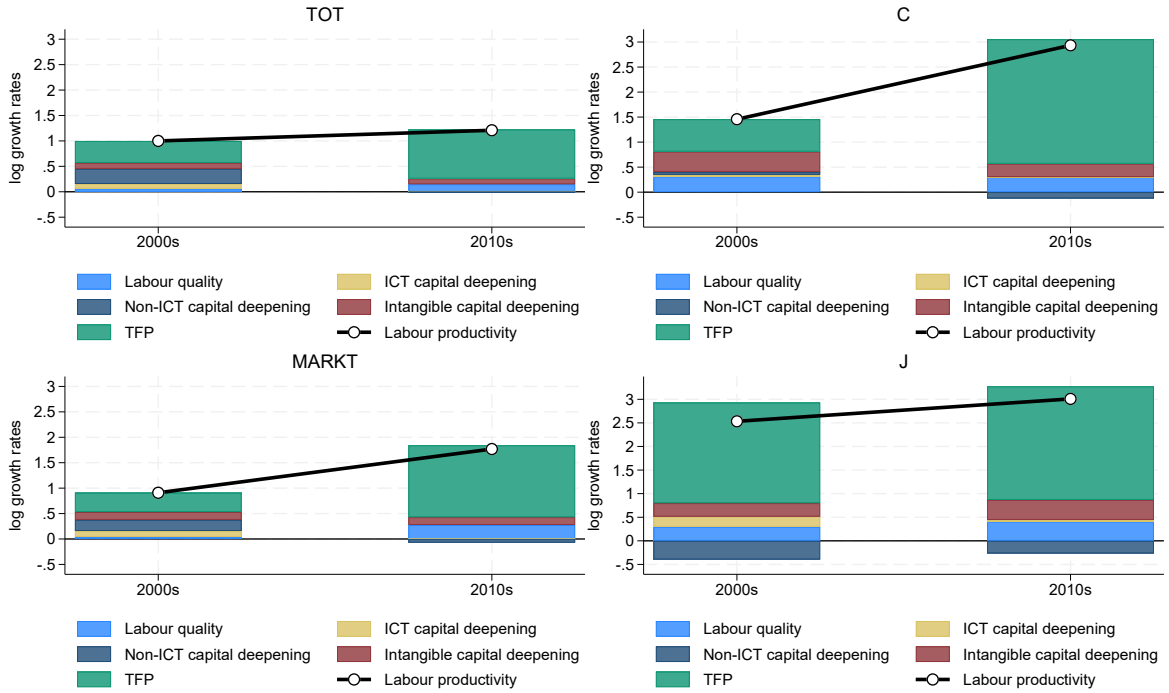
Source: The Conference Board Total Economy Database™, September 2025, author's calculation.

Figure A.3: Decomposition of labour productivity growth into contributions of labour quality, capital deepening and total factor productivity - selected countries



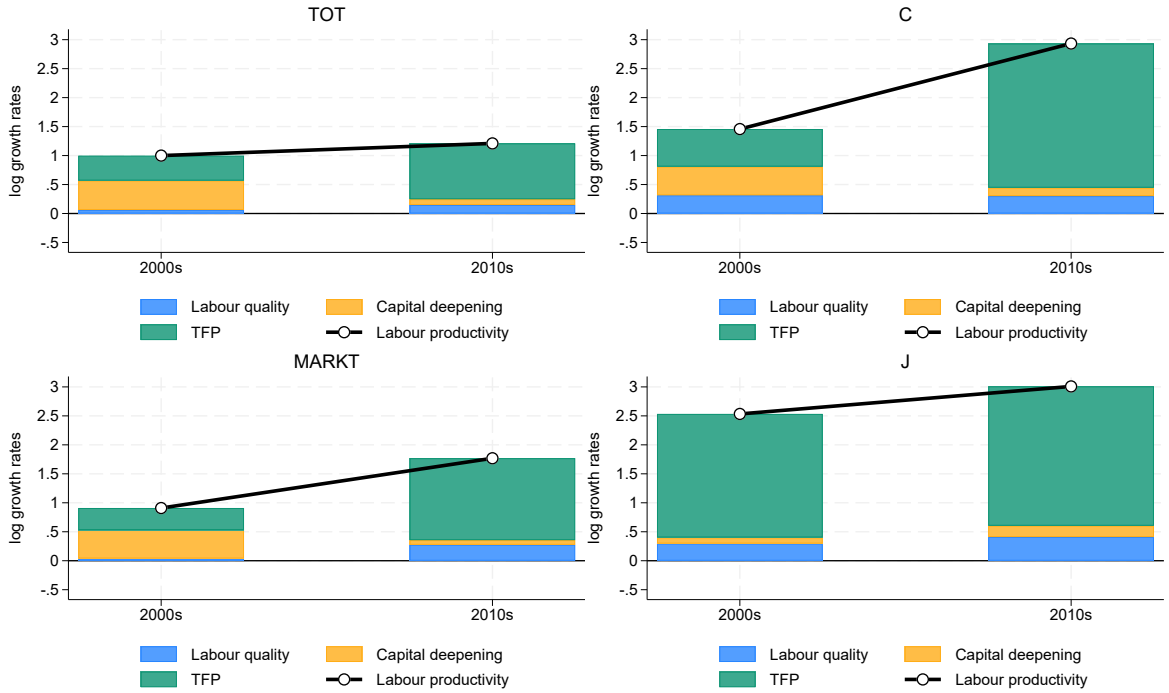
Notes: Values for the 2020s include data for the years 2020 to 2024. DEU: Germany, FRA: France, GBR: United Kingdom, ITA: Italy.
Source: The Conference Board Total Economy Database™, September 2025, author's calculation.

Figure A.4: Decomposition of labour productivity growth into contributions of labour quality, tangible ICT capital deepening, tangible non-ICT capital deepening, Intangible capital deepening and total factor productivity - selected industries



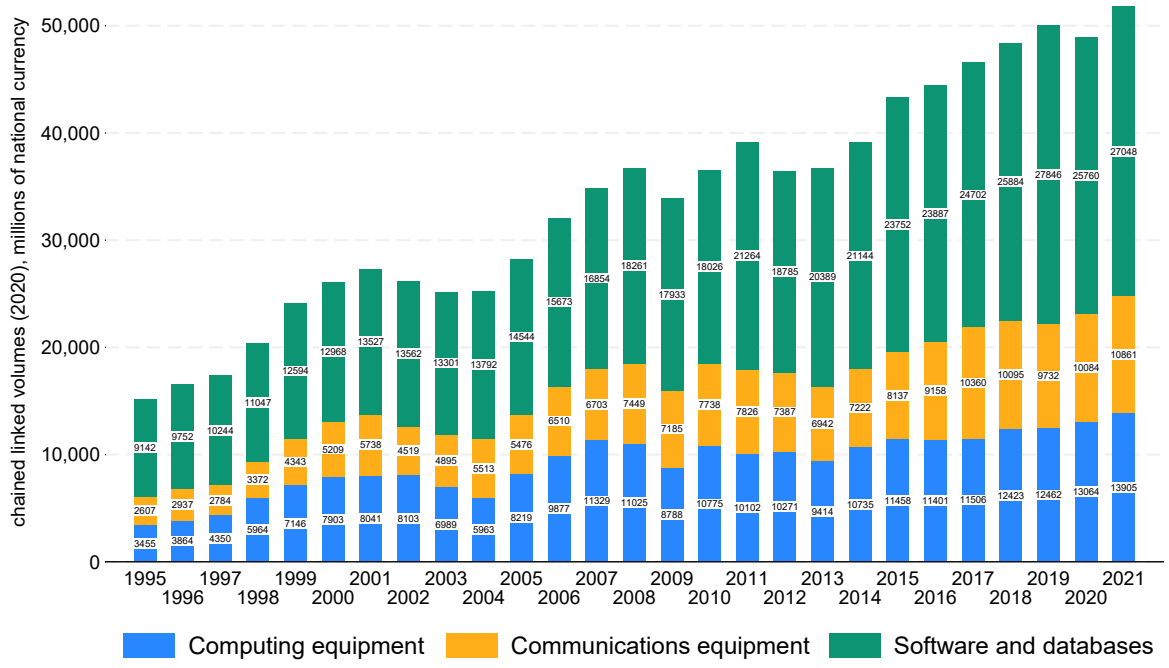
Notes: TOT: all NACE activities, C: Manufacturing, MARKT: Market economy (all industries excluding L, O, P, Q, T and U), J: Information and communication. See Table A.4 for detailed numbers.
Source: EUKLEMS & INTANProd 2025 release, see Bontadini et al. (2023), author's calculation.

Figure A.5: Decomposition of labour productivity growth into contributions of labour quality, capital deepening and total factor productivity - selected industries



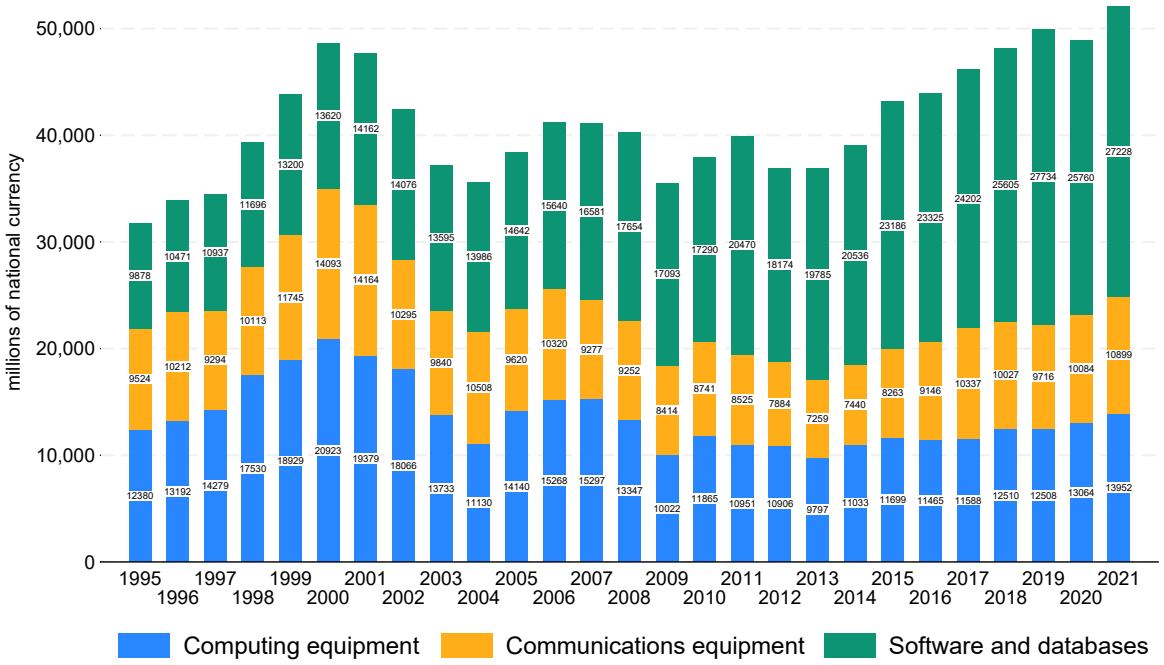
Notes: TOT: all NACE activities, C: Manufacturing, MARKT: Market economy (all industries excluding L, O, P, Q, T and U), J: Information and communication. See Table A.6 for detailed numbers.
Source: EUKLEMS & INTANProd 2025 release, see Bontadini et al. (2023), author's calculation.

Figure A.6: Real investment in ICT - Germany



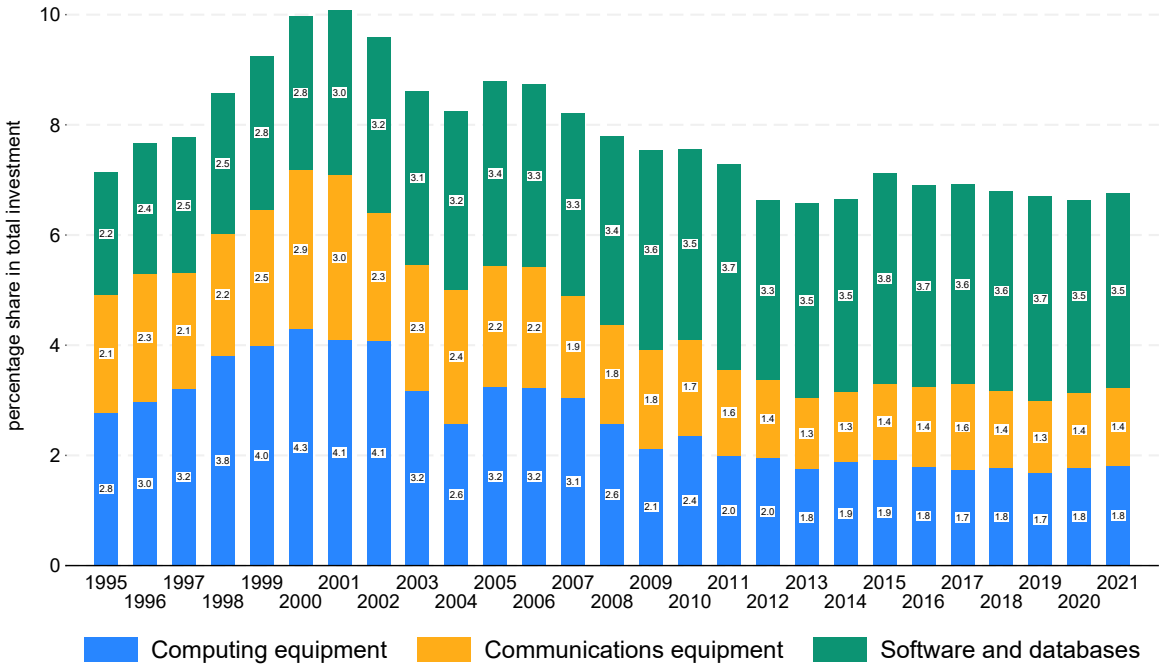
Source: EUKLEMS & INTANProd 2025 release, see Bontadini et al. (2023), author's calculation.

Figure A.7: Nominal investment in ICT - Germany



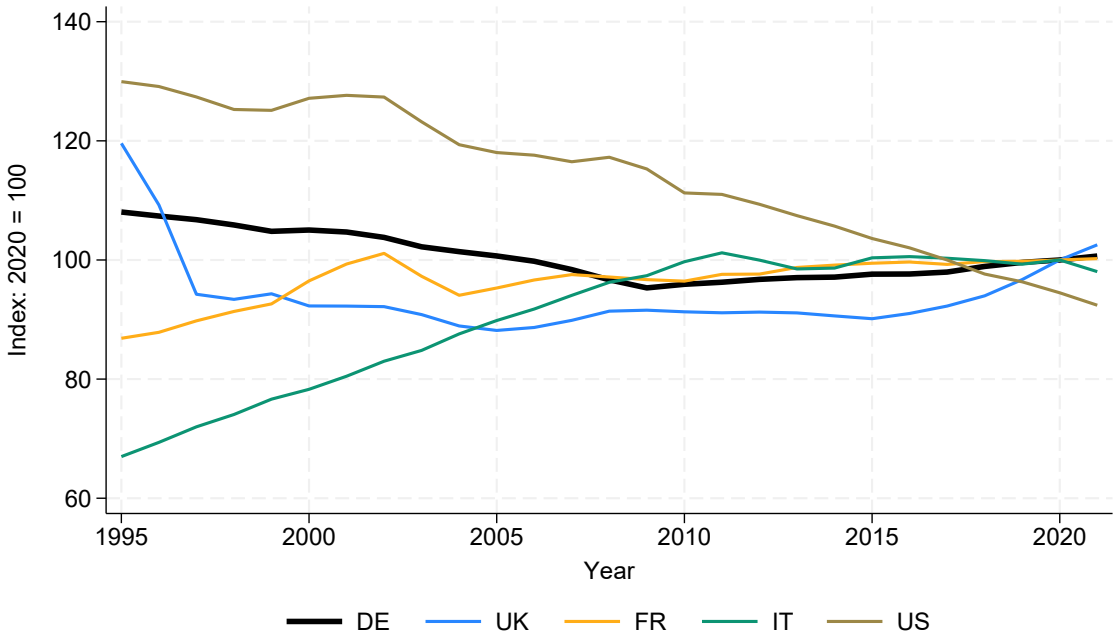
Source: EUKLEMS & INTANProd 2025 release, see Bontadini et al. (2023), author's calculation.

Figure A.8: Share of nominal ICT investment in total investment - Germany



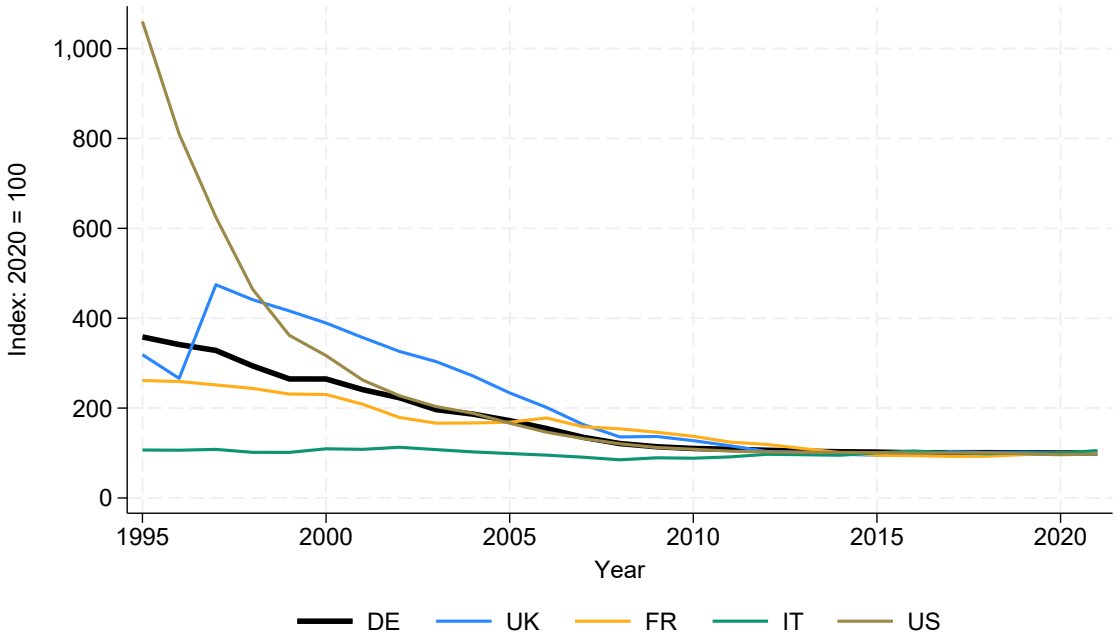
Source: EUKLEMS & INTANProd 2025 release, see Bontadini et al. (2023), author's calculation.

Figure A.9: Software deflator - selected countries



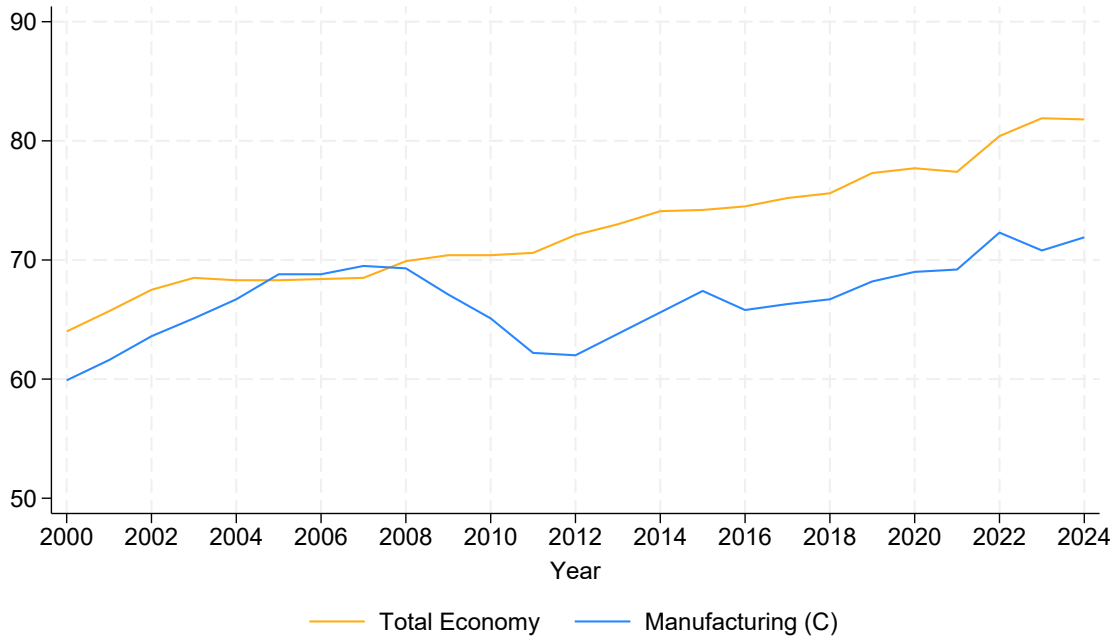
Note: DE: Germany, UK: United Kingdom, FR: France, IT: Italy, US: United States.
Source: EUKLEMS & INTANProd 2025 release, see Bontadini et al. (2023), author's calculation.

Figure A.10: Hardware (IT) deflator - selected countries



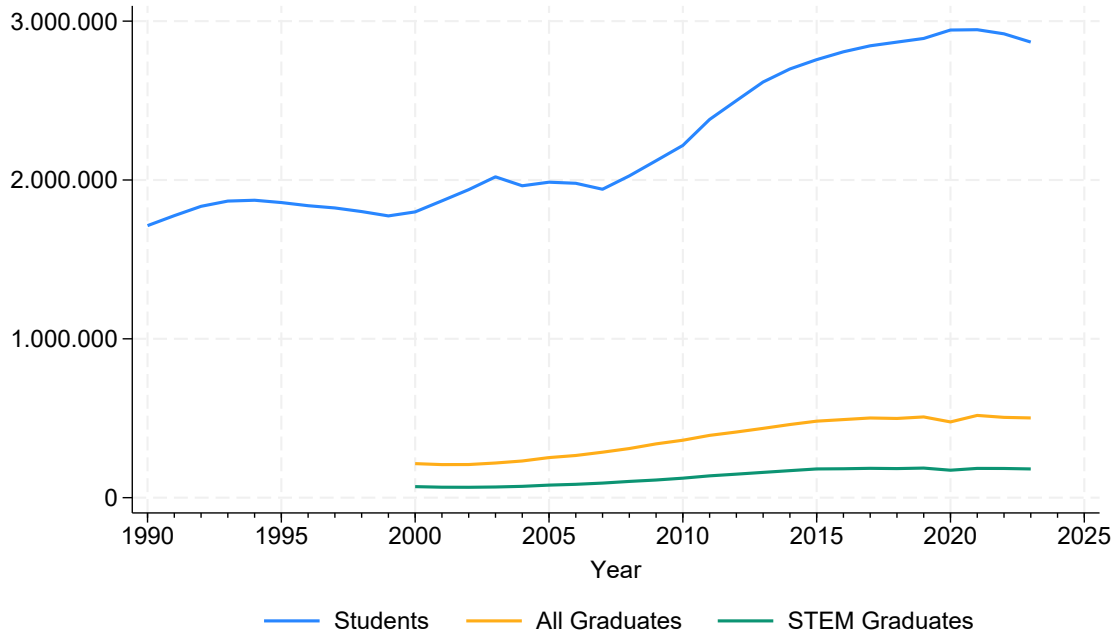
Note: DE: Germany, UK: United Kingdom, FR: France, IT: Italy, US: United States.
Source: EUKLEMS & INTANProd 2025 release, see Bontadini et al. (2023), author's calculation.

Figure A.11: Labour productivity in East Germany excluding Berlin (West Germany = 100)



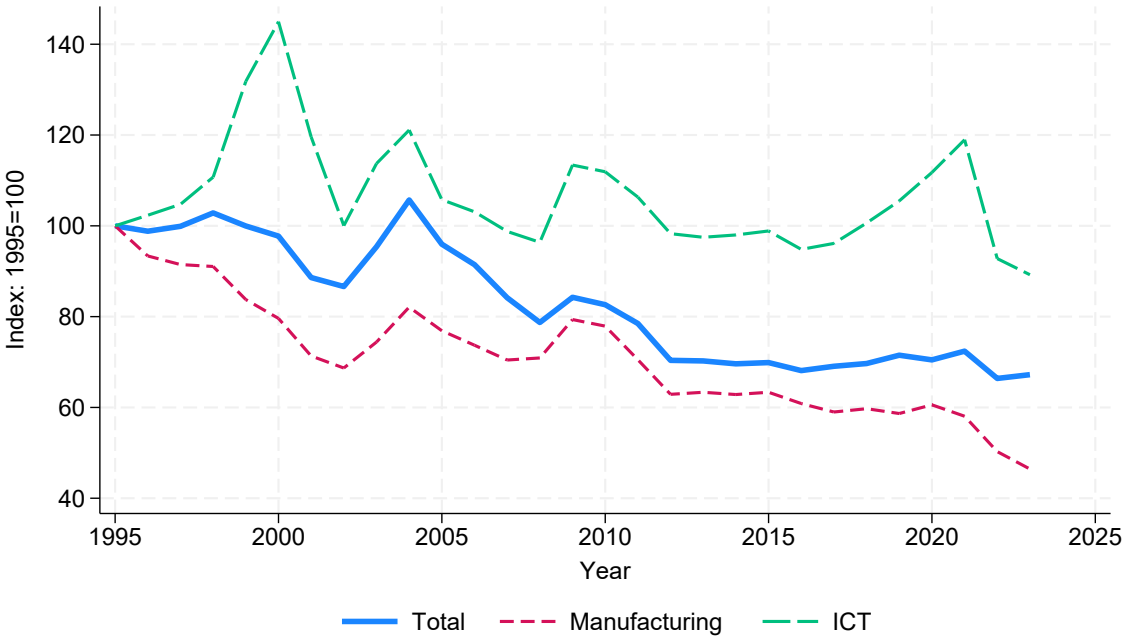
Note: Labour productivity here refers to nominal value added per hour worked, in contrast to real value added per hour worked used throughout the rest of the paper.
Source: Volkswirtschaftliche Gesamtrechnungen der Länder, Bruttoinlandsprodukt, Bruttowertschöpfung in den Ländern der Bundesrepublik Deutschland 1991 bis 2024, `https://www.statistikportal.de/sites/default/files/2025-04/vgrdl_r1b1_bs2024_2.xlsx` Sheets 5.1 and 5.3.1.1, author's calculation.

Figure A.12: Number of students, graduates and STEM graduates in Germany over time



Source: BMBF Data Portal, Tables `https://www.datenportal.bmbf.de/portal/en/Table-2.5.23.xls` and `https://www.datenportal.bmbf.de/portal/en/Table-2.5.46.xls`, author's calculation.

Figure A.13: Number of start-ups in Germany 1995-2023



Source: Mannheim Enterprise Panel (MUP), see Bersch et al. (2014) for details.

A.2 Additional tables

Table A.1: Decomposition of labour productivity growth into contributions of labour quality, ICT capital deepening, non-ICT capital deepening and total factor productivity - Germany - alternative periods

	GDP	Hours	LP	LC	ICT	NICT	TFP
1970-1990	2.1	-0.8	2.9	0.2	0.4	1.1	1.2
1991-2007	1.7	-0.4	2.1	0.1	0.5	0.9	0.7
2008-2019	1.2	0.5	0.7	0.2	0.2	0.4	-0.1
2020-2024	0.1	-0.3	0.3	0.2	0.1	0.5	-0.5

Notes: LP: Labour productivity, LC: Labour quality, ICT: ICT capital, NICT: Non-ICT capital, TFP: Total factor productivity. The growth rates of GDP and hours worked (Hours) on the left side of the table are just for reference. Numbers may not sum exactly due to rounding.
Source: The Conference Board Total Economy Database™, September 2025, author's calculation.

Table A.2: Decomposition of GDP growth into contributions of labour input and labour productivity growth - Germany - selected industries

Panel A: 1970s

	GDP	Hours	LP
Construction	0.7	-1.4	2.1
Mining, Manufacturing, Utilities	2.0	-2.3	4.3
Services	4.1	0.7	3.4
Total Economy	3.0	-1.0	4.0

Panel B: 1980s

	GDP	Hours	LP
Construction	-0.5	-1.1	0.6
Mining, Manufacturing, Utilities	1.2	-1.0	2.1
Services	2.7	0.8	1.9
Total Economy	1.9	-0.1	2.0

Panel C: 1990s

	GDP	Hours	LP
Construction	-0.2	0.4	-0.7
Mining, Manufacturing, Utilities	0.2	-2.4	2.6
Services	3.3	1.1	2.2
Total Economy	2.2	-0.0	2.3

Panel D: 2000s

	GDP	Hours	LP
Construction	-3.1	-2.5	-0.6
Mining, Manufacturing, Utilities	0.1	-1.4	1.5
Services	1.4	0.6	0.8
Total Economy	0.8	-0.1	0.9

Panel E: 2010s

	GDP	Hours	LP
Construction	0.6	0.5	0.0
Mining, Manufacturing, Utilities	3.4	0.8	2.5
Services	1.6	0.8	0.8
Total Economy	1.9	0.8	1.2

Panel F: 2020s

	GDP	Hours	LP
Construction	-4.4	-0.3	-4.1
Mining, Manufacturing, Utilities	-1.6	-1.4	-0.2
Services	1.0	0.1	0.9
Total Economy	0.0	-0.3	0.3

Notes: Without year 1970, until 1991 values just for West Germany. GDP for Total Economy, gross value added (GVA) for sectors/industries. Numbers may not sum exactly due to rounding.
Source: Destatis (2025).

Table A.3: Decomposition of labour productivity growth into contributions of labour quality, ICT capital deepening, non-ICT capital deepening and total factor productivity - selected countries

Panel A: 1970s

	GDP	Hours	LP	LC	ICT	NICT	TFP
DEU	3.1	-0.9	3.9	0.2	0.3	1.4	2.1
FRA	3.7	-0.5	4.3	0.4	0.4	2.1	1.4
GBR	2.6	-0.4	3.0	0.4	0.3	1.6	0.8
ITA	3.4	-0.5	3.9	0.1	0.3	1.7	1.8

Panel B: 1980s

	GDP	Hours	LP	LC	ICT	NICT	TFP
DEU	1.8	-0.6	2.3	0.3	0.4	0.8	0.8
FRA	2.4	-0.5	2.9	0.4	0.3	1.1	1.1
GBR	2.5	0.3	2.3	0.3	0.5	1.1	0.3
ITA	2.3	0.7	1.7	0.1	0.4	0.8	0.3

Panel C: 1990s

	GDP	Hours	LP	LC	ICT	NICT	TFP
DEU	1.4	-0.9	2.3	0.1	0.5	1.1	0.6
FRA	2.0	0.3	1.8	0.4	0.4	0.8	0.2
GBR	2.1	-0.1	2.2	0.4	1.0	1.2	-0.3
ITA	1.5	0.1	1.4	0.1	0.5	0.7	0.1

Panel D: 2000s

	GDP	Hours	LP	LC	ICT	NICT	TFP
DEU	0.8	-0.1	0.9	0.2	0.4	0.6	-0.4
FRA	1.5	0.5	1.1	0.4	0.3	0.7	-0.3
GBR	1.7	0.3	1.4	0.3	0.7	0.9	-0.6
ITA	0.5	0.4	0.1	0.3	0.4	0.7	-1.3

Panel E: 2010s

	GDP	Hours	LP	LC	ICT	NICT	TFP
DEU	1.9	0.8	1.2	0.1	0.2	0.3	0.6
FRA	1.4	0.5	0.9	0.3	0.3	0.3	-0.0
GBR	1.9	1.4	0.6	0.3	0.3	0.2	-0.2
ITA	0.2	-0.1	0.3	0.3	0.2	0.1	-0.3

Panel F: 2020s

	GDP	Hours	LP	LC	ICT	NICT	TFP
DEU	0.1	-0.3	0.3	0.2	0.1	0.5	-0.5
FRA	0.7	1.1	-0.4	0.3	0.4	-0.0	-1.1
GBR	0.7	0.3	0.4	0.3	0.2	0.6	-0.7
ITA	1.1	1.2	-0.1	0.2	0.2	-0.1	-0.5

Notes: LP: Labour productivity, LC: Labour quality, ICT: ICT capital, NICT: Non-ICT capital, TFP: Total factor productivity. The growth rates of GDP and hours worked (Hours) on the left side of the table are just for reference. Values for the 2020s include data for the years 2020 to 2024. Numbers may not sum exactly due to rounding.
Source: The Conference Board Total Economy Database™, September 2025, author's calculation.

Table A.4: Decomposition of labour productivity growth into contributions of labour quality, tangible ICT capital deepening, tangible non-ICT capital deepening, Intangible capital deepening and total factor productivity

Panel A: 2000s

	LP	LC	TangICT	TangNICT	Intang	TFP
C	1.5	0.3	0.0	0.1	0.4	0.6
J	2.5	0.3	0.2	-0.4	0.3	2.1
MARKT	0.9	0.0	0.1	0.2	0.2	0.4
TOT	1.0	0.1	0.1	0.3	0.1	0.4

Panel B: 2010s

	LP	LC	TangICT	TangNICT	Intang	TFP
C	2.9	0.3	0.0	-0.1	0.3	2.5
J	3.0	0.4	0.0	-0.3	0.4	2.4
MARKT	1.8	0.3	-0.0	-0.1	0.2	1.4
TOT	1.2	0.1	-0.0	-0.0	0.1	1.0

Note: LP: Labour productivity, LC: Labour quality, TangICT: Tangible ICT capital, TangNICT: Tangible non-ICT capital, Intang: Intangible capital, TFP: Total factor productivity. Numbers may not sum exactly due to rounding.
Source: EUKLEMS & INTANProd 2025 release, see Bontadini et al. (2023), author's calculation.

Table A.5: Decomposition of labour productivity growth into contributions of labour quality, ICT capital deepening, non-ICT capital deepening and total factor productivity

Panel A: 2000s

	LP	LC	ICT	NICT	TFP
C	1.5	0.3	0.1	0.4	0.6
J	2.5	0.3	0.5	-0.3	2.1
MARKT	0.9	0.0	0.2	0.3	0.4
TOT	1.0	0.1	0.1	0.4	0.4

Panel B: 2010s

	LP	LC	ICT	NICT	TFP
C	2.9	0.3	0.0	0.1	2.5
J	3.0	0.4	0.3	-0.1	2.4
MARKT	1.8	0.3	0.0	0.0	1.4
TOT	1.2	0.1	0.0	0.1	1.0

Notes: LP: Labour productivity, LC: Labour quality, ICT: ICT capital, NICT: Non-ICT capital, TFP: Total factor productivity. In contrast to Table A.4, Software and Databases is now part of ICT capital and R&D is now part of non-ICT capital. Numbers may not sum exactly due to rounding.
Source: EUKLEMS & INTANProd 2025 release, see Bontadini et al. (2023). Author's calculation based on raw capital input data.

Table A.6: Decomposition of labour productivity growth into contributions of labour quality, capital deepening and total factor productivity - Germany - selected industries

Panel A: 2000s

	LP	LC	K	TFP
C	1.5	0.3	0.5	0.6
J	2.5	0.3	0.1	2.1
MARKT	0.9	0.0	0.5	0.4
TOT	1.0	0.1	0.5	0.4

Panel B: 2010s

	LP	LC	K	TFP
C	2.9	0.3	0.1	2.5
J	3.0	0.4	0.2	2.4
MARKT	1.8	0.3	0.1	1.4
TOT	1.2	0.1	0.1	1.0

Notes LP: Labour productivity, LC: Labour quality, K: Total capital, TFP: Total factor productivity. Numbers may not sum exactly due to rounding.
Source: EUKLEMS & INTANProd 2025 release, see Bontadini et al. (2023), author's calculation.

Table A.7: Decomposition of labour productivity growth into contributions of labour quality, ICT capital deepening, non-ICT capital deepening and total factor productivity - alternative periods

Panel A: 1996-2000

	LP	LC	ICT	NICT	TFP
C	2.9	0.1	0.1	0.3	2.4
J	6.2	-0.0	0.3	-0.5	6.4
MARKT	1.9	-0.2	0.3	0.3	1.4
TOT	1.9	-0.1	0.2	0.5	1.3

Panel B: 2001-2005

	LP	LC	ICT	NICT	TFP
C	2.7	0.4	0.0	0.5	1.7
J	1.2	0.6	0.4	-0.3	0.5
MARKT	1.7	0.3	0.1	0.4	0.8
TOT	1.6	0.3	0.1	0.5	0.6

Panel C: 2006-2010

	LP	LC	ICT	NICT	TFP
C	2.0	0.4	0.1	0.2	1.4
J	4.2	0.1	0.5	0.2	3.3
MARKT	0.5	-0.0	0.1	0.1	0.3
TOT	0.5	-0.1	0.1	0.1	0.3

Panel D: 2011-2015

	LP	LC	ICT	NICT	TFP
C	1.4	0.3	0.0	-0.2	1.2
J	4.1	0.5	0.3	-0.2	3.4
MARKT	1.3	0.3	0.0	0.0	1.0
TOT	1.0	0.1	0.0	0.1	0.8

Panel E: 2016-2021

	LP	LC	ICT	NICT	TFP
C	1.9	0.4	0.0	0.6	0.8
J	2.0	0.1	0.2	-0.0	1.6
MARKT	1.6	0.2	0.1	0.2	1.0
TOT	1.1	0.1	0.0	0.3	0.6

Notes: LP: Labour productivity, LC: Labour quality, ICT: ICT capital, NICT: Non-ICT capital, TFP: Total factor productivity. In contrast to Table A.4, Software and Databases is now part of ICT capital and R&D is now part of non-ICT capital. Numbers may not sum exactly due to rounding.
Source: EUKLEMS & INTANProd 2025 release, see Bontadini et al. (2023). Author's calculation based on raw capital input data.