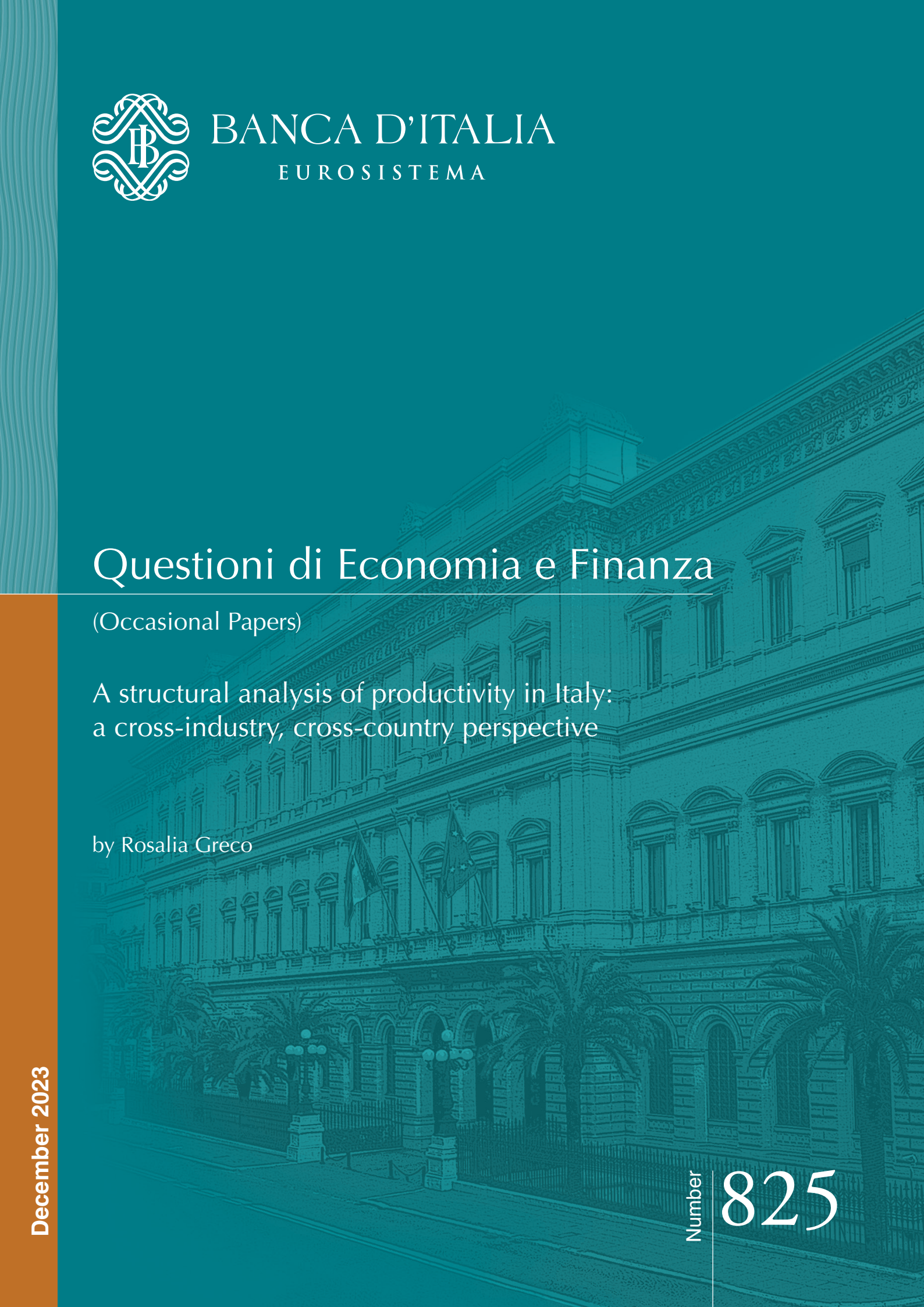

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by Rosalia Greco

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A STRUCTURAL ANALYSIS OF PRODUCTIVITY IN ITALY: A CROSS-INDUSTRY, CROSS-COUNTRY PERSPECTIVE

by Rosalia Greco*

Abstract

Since 2000, Italy's output growth has lagged behind countries like Germany, France and Spain, primarily due to weak labour productivity dynamics. Italy's labour productivity growth, which was especially low before the Great Recession, showed a small improvement afterwards, driven by the business sector. Productivity growth and levels vary across sectors, with the industrial sector generally outperforming market services in all countries. Italy's low aggregate growth cannot be traced back to a composition tilted towards low productivity sectors, however, but rather to insufficient growth in productivity across all sectors. A few exceptions emerged in the industrial sector in 2014-2019: some manufacturing sectors that are more exposed to international trade exhibited higher productivity growth in Italy than elsewhere. Investment affects labour productivity growth through capital deepening. Investment trends, influenced by the financial crisis, varied across countries, sectors and asset types. Investment in intangibles (especially important for innovation) increased consistently, while investment in other assets fluctuated, with Italy and Spain experiencing a delayed recovery. Intangibles constituted a larger share of investment in the industrial sector, and were most significant in France.

JEL Classification: E22, E24, O47, O52.
Keywords: labour productivity, growth, investment.
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Contents

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1. Introduction[1]

Productivity growth is a key element of the prosperity of a nation. After a long period of rising productivity and living standards, productivity growth globally started to slow down since the 1970s. This weak performance has worsened in the last 20 years, especially in the last decade (ECB Strategy review, 2021). The Great Recession witnessed a generalized decline in labour productivity growth in advanced economies (Adler et al., 2017; Syverson, 2017), which extended through the recovery period. Within this global trend, Italy's performance has been particularly sluggish (Bugamelli et al., 2018).

This paper provides a description of productivity dynamics in Italy in comparison with the other main Euro area countries and with the Euro area as whole,[2] mainly focusing on the period 2000 to 2019, before the pandemic crisis.[3] The aim is to highlight both global trends and country-specific features, a necessary prerequisite in order to understand the determinants of productivity growth and the policies which could prove useful to boost it. Among the several factors driving (hourly) labour productivity growth,[4] this paper focuses on sector performance and capital accumulation.

Over the last twenty years, output grew at a much slower pace in Italy than in Germany, France, Spain and the Euro area as a whole (0.32 per cent per year in Italy in 2000-2022, versus 1.21 in the Euro area on average). The main factor negatively affecting output growth in Italy is the weak dynamics of labour productivity.

Productivity growth was especially low in Italy in the years leading up to the Great Recession, while the 2014-19 period was characterized by a small but significant increase in productivity growth with respect to the pre-crisis period, entirely due to the business sector of the economy.[5] The recovery in productivity growth in Italy, together with a slowdown in other countries relative to the pre-crisis period, led to a decrease in cross-country growth differentials.

This is attributable to a positive contribution of total factor productivity (TFP) during the 2014-19 period, in contrast to the earlier years when TFP dynamics were a drag to productivity

[1] Author: Rosalia Greco (SEC-IR). The author would like to thank Francesca Lotti, Roberto Torrini, Andrea Linarello, Filippo Scoccianti and Luigi Federico Signorini for valuable comments and suggestions throughout the process of analysis.

[2] In this note, we refer to the "Euro area" composition as of 2022 (19 countries: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovak Republic, Slovenia and Spain). As of January 1, 2023, Croatia also joined the European monetary union.

[3] The note is based on the most recent version of AMECO and Eurostat national accounts data available as of November 3, 2023. For AMECO, it corresponds to the version released for the Spring 2023 Economic Forecast, last updated on June 13, 2023.

[4] OECD/APO (2022) mentions research and development, digitalization and investment in intangibles, human capital, public infrastructure, as well as competition, globalization, financial development and institutions. Additional drivers of differential productivity growth rates across countries are sector composition, firm size, investment dynamics and technology adoption, and managerial practices.

[5] The business sector is here defined as the private non-financial sector (NACE sections B through N, excluding financial services K and imputed rents of owner-occupied dwellings L68A. Data from National Accounts show that the recovery in Italian labor productivity continued through the pandemic and up to 2022.

growth. This growth in TFP can be partly traced back to the cleansing effect of the recession, which triggered a reallocation of resources towards more productive firms, as documented for the Italian case by Linarello and Petrella (2017). However, over the same period, the positive contribution of the growth in capital intensity[6] which had characterized the pre-crisis period came to a halt, as a result of the slow recovery in capital formation after the recession, paired with the post-recession improvement in hours worked.

Within the private sector, productivity growth, both in Italy and in the comparison countries, differs largely across sectors. In all countries, growth in productivity is highest in the industrial sector, while market services lag behind.[7] After a period of slower growth than in all other major European countries dating back to at least the year 2000, since 2014 Italy's productivity dynamics have fared roughly in line with France and better than Spain in the industrial sector. However, Italy continued to underperform in the services sector. Productivity growth in services over the 2000-2019 period was basically null in Italy.

Moreover, there is a large dispersion in productivity performance within each macro-sector, particularly in the industrial sector. Overall, the degree of cross-sector growth dispersion is similar across countries. Sectoral performance in Italy is on average weaker than in the comparison regions, but there are positive signals coming from a few manufacturing sectors (some of which account for a sizable share of exports, e.g. machinery and equipment, motor vehicles and furniture), where productivity growth in the 2014-19 period was the highest among all countries considered. These sectors account for a sizable part of the Italian economy and Italy holds a relative specialization in many of them. In general, the sectors where labour productivity grew the most are also those more exposed to international trade. In services, which on average performed worse than the industrial sector, retail trade stands out for its remarkable improvements in the last decade.

Sector composition plays a small role in explaining Italy's weak comparative performance in terms of productivity growth, as most of the productivity dynamics come from within-sector productivity gains. Applying other countries' productive structure to Italy would not change productivity dynamics substantially, although it would somewhat affect productivity levels. Structural change between 2007 and 2019 provided a negative albeit small contribution to productivity dynamics, due to the reallocation of employment towards low productivity sectors, common to most developed countries. These results corroborate previous findings on the limited contribution of sectoral reallocation and entry/exit dynamics to recent years' productivity growth, both at the European and Italian level (ECB Strategy review, 2021; De Santis, Reljic and Tamagni; 2022).

Investment was deeply affected by the financial crisis and the Great Recession in all countries. Investment in intellectual property products was the only type of investment which did not suffer a decline: in all countries, investment in intangibles steadily increased throughout the 2000-2019 period. The impact of the double-dip crisis was especially severe in Italy and Spain, where investment started to grow again only in 2014. In all major Euro area economies (except

[6] Capital per hour worked.

[7] The only exception to this pattern is Spain, where productivity growth in the market services sector was on average stronger than in the industrial sector in the 2014-19 period.

France), post-crisis investment dynamics have been more sustained in the industrial sector and weaker in the services sector; the latter, however, accounts for a much larger share of total investment in fixed assets, which reflects the sector's weight in terms of value added. In Italy, investment (both in industry and services) grew throughout the 2014-2019 period at roughly the same rate as in Germany, where, however, the drop in investment during the recession years was smaller and more short-lived. The share of investment over value added, which in Italy had declined sharply during the Great Recession (due mainly to the service sector, where investment contracted more than value added), has slightly increased in all countries since 2014.

At the sectoral level, there are differences in investment composition by type of asset: in the industrial sectors, a large share of investment is made of machinery and equipment, while the most relevant kind of asset in the service sector is construction, driven by the real estate sector, which accounts on average for over a half of private services' investment in fixed assets in the 2000-19 period, and for which construction constitutes almost the sole type of investment. Net of real estate, machinery and equipment are the main investment type also in private services. The main cross-country differences in asset composition involve investment in intellectual property products. In all countries, such assets constitute a larger share of overall investment in fixed assets in the industrial sector as opposed to the construction and services sectors. At the country level, investment in intellectual property products is most relevant in France, where it accounted for 26 per cent of the overall investment in fixed assets in 2019, as opposed to 19 per cent in Germany, 18 in Italy and 15 in Spain. Such a type of investment amounted to almost 15 per cent of the industrial sector's value added in France and 10 per cent in Germany (47 per cent and 43 per cent of the sector's investment in fixed assets in the respective country), in contrast to about 7 per cent in Italy (24 per cent of total investment in fixed assets in the industrial sector).

Although it is well established that a firm size distribution tilted towards small firms (both at the aggregate level and within narrowly defined sectors) like the Italian one is a drag on productivity, this work abstracts from it and focuses exclusively on sectoral heterogeneity.

The paper is organized as follows: Section 2 presents a growth accounting decomposition that highlights possible drivers of productivity growth and their evolution over time. Section 3 presents evidence of sector heterogeneity in productivity levels and growth. Section 4 analyses differences in sectorial structure and investment dynamics as possible drivers of cross country differences in productivity growth. Section 5 concludes.

2. The contribution of productivity to GPD growth

Over the period 2000-22, real output grew on average by 0.3 per cent per year in Italy, versus 1.2-1.3 per cent in Germany, France, Spain and the Euro area (Table 1, panel a). Cumulatively, real output grew by just about 7 per cent in Italy, almost 4 times less than in the comparison countries. Excluding the Covid-19 crisis and the subsequent recovery years, Italy's lag becomes even starker.

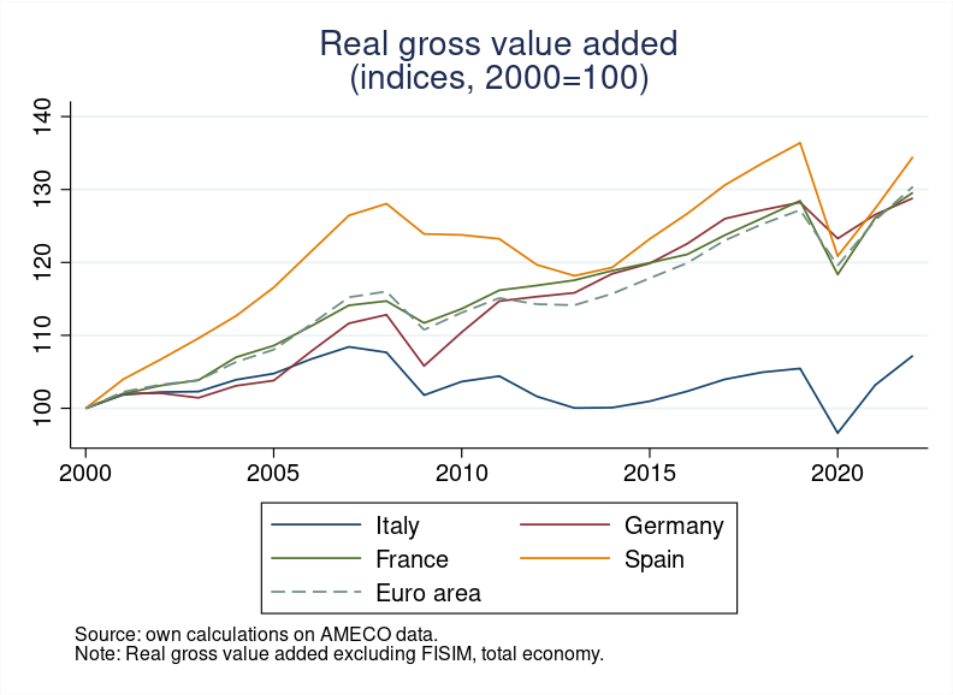
Table 1

Average annual real value added and hourly labour productivity growth rate (1) *(percentage points)*					
	Italy	**Germany**	**France**	**Spain**	**Euro area**
(a) value added					
2000-2007	1.16	1.57	1.89	3.35	2.02
2007-2014	-1.14	0.84	0.58	-0.83	0.06
2014-2019	1.04	1.59	1.55	2.68	1.89
2019-2022	0.55	0.15	0.29	-0.47	0.83
2000-2019	0.28	1.31	1.32	1.63	1.27
2000-2022	0.32	1.15	1.18	1.35	1.21
(b) labour productivity					
2000-2007	0.06	1.58	1.33	0.39	1.10
2007-2014	0.22	0.54	0.58	1.59	0.77
2014-2019	0.20	0.83	0.72	0.38	0.66
2019-2022	0.81	0.70	-1.02	-0.09	0.70
2000-2019	0.16	1.00	0.89	0.83	0.86
2000-2022	0.25	0.96	0.63	0.71	0.84

Source: own calculations on AMECO data. (1) Real gross value added excluding financial intermediation services indirectly measured (FISIM), total economy.

Italy's growth has been slower than the main euro area countries' since the early 2000s, but the divergence became larger during and after the double-dip recession caused by the financial and sovereign debt crises between 2007 and 2014 (Figure 1). Starting from 2014, all major European economies have experienced sustained growth. France, Germany and the Euro area went back to their pre-crisis growth path and Spain registered somewhat lower, but still positive, annual growth rates. Conversely, Italy experienced lower growth rates, both in historical and cross-country perspective. In 2020, the Covid-19 pandemic caused a sharp decline in real output in all countries. However, due to the poor performance of the previous 20 years, Italy was the only country, among those considered, where output in 2020 was lower than the 2000 level. By 2022, the negative impact of the pandemic on output had been reabsorbed in all countries but Spain.

Figure 1

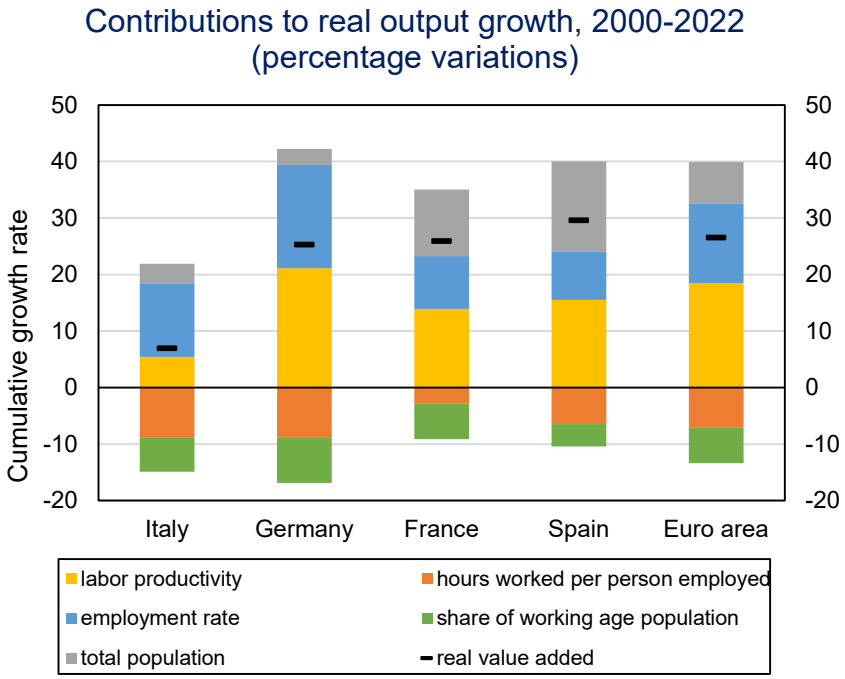


Source: own calculations on AMECO data.
Note: Real gross value added excluding FISIM, total economy.

By decomposing output growth into the contribution of its main components,[8] in the period 2000-22 stagnant labour productivity (defined as real value added per hour worked) and modest demographic dynamics emerge as the main factors affecting Italy's weak output performance. Over the same period, in all countries considered (as well as in the Euro area as a whole) the number of hours worked per person employed and the share of working age population shrank (Figure 2), while countries registered positive trends in the employment rate[9] and total population dynamics. Population and employment trends are not able to explain much of the cross country differences and the weak performance of the Italian economy relative to other countries: the working age population decreased in all countries and the joint contribution of employment rate and population growth was similar across the main euro area economies. Overall, even if hours per worker decreased in Italy more than elsewhere, it is labour productivity that played the lion's share in accounting for Italy's gap in output growth.

[8] For the formal derivation of the decomposition equations, see Appendix 1.
[9] The positive contribution of employment rate to real output growth documented here is only apparently in contrast with Barbiellini Amidei et al. (2018), who find a negative contribution of employment rate to output growth since 2000 for Italy. The seeming contradiction is the result of a different definition of the numerator of the employment rate in the two studies. In Barbiellini Amidei et al., employment is defined as full time equivalents, so its dynamics reflects both changes in the number of workers as well as in hours worked per person employed. Here, we keep these two factors separated and define the employment rate on the basis of the number of workers.

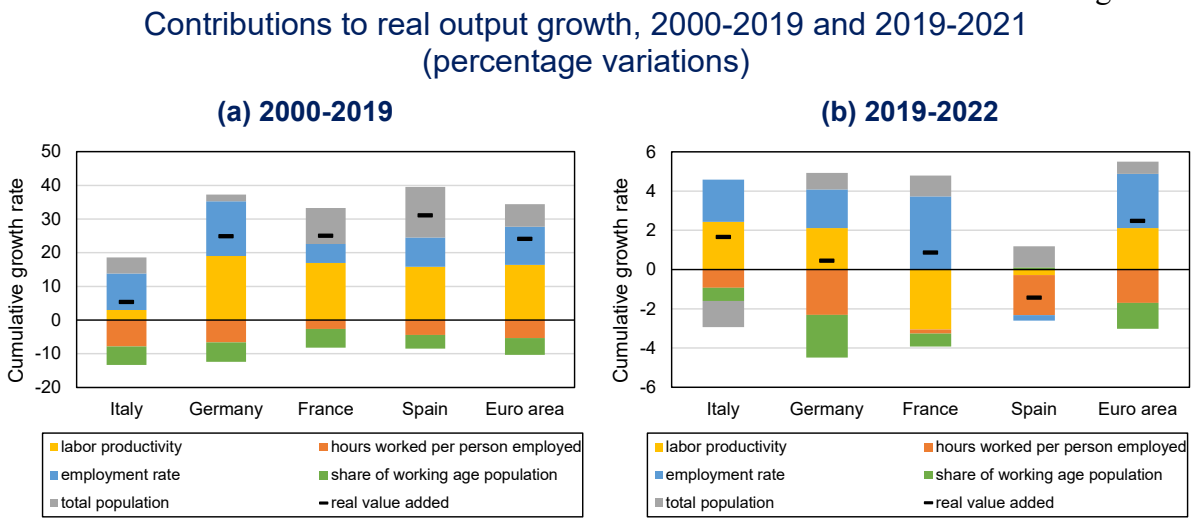
Figure 2



Source: own calculations on AMECO data.

These results remain valid even when we exclude the years 2020-2022 from the analysis (Figure 3, panel a).

Figure 3



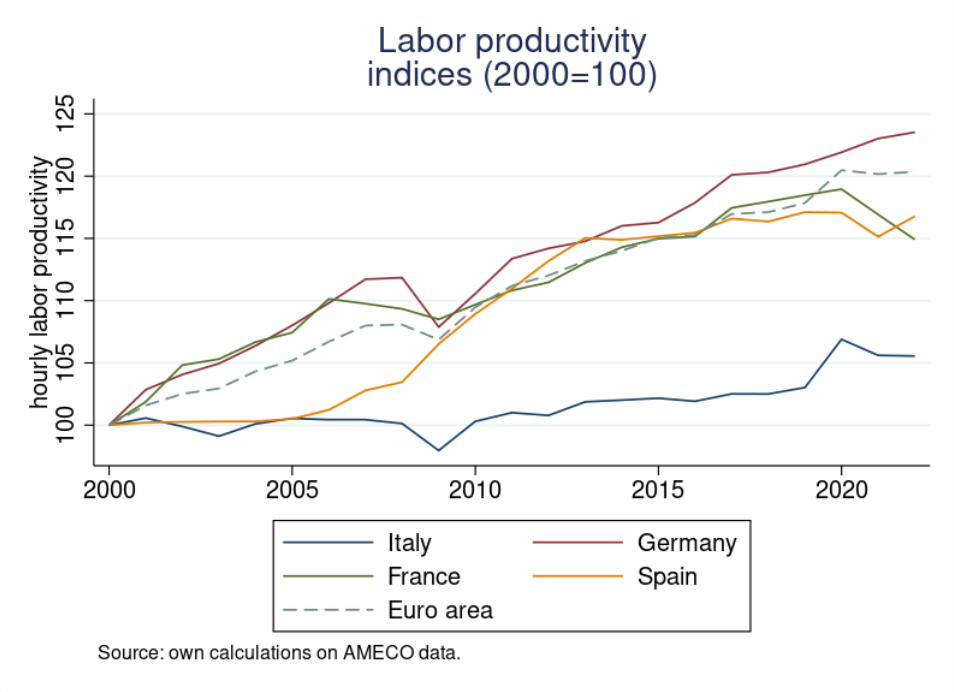
Source: own calculations on AMECO data.

The effect of the Covid-19 pandemic was heterogeneous across countries: in Italy and in the Euro area as a whole, labour productivity bumped up in 2020, as hours worked decreased sharply and much more than output; conversely, in Spain productivity decreased, while in

France and Germany it followed its pre-pandemic trend (Figure 4). In 2021, labour productivity decreased in all countries except Germany. In 2022, labour productivity remained stable (but still above the 2019 level) in Italy and the Euro area, it kept falling in France, and went back to its 2019 level in Spain. Overall, the Covid-19 crisis and the subsequent recovery had only a modest impact on labour productivity dynamics in Germany. Cumulatively, by the end of 2022 hours worked per person employed were still below the 2019 levels in all countries (Figure 3, panel b).

In the remaining part of this note, we will focus on the 2000-19 period, as it is still too early to draw conclusions on the impact of the events that have occurred since 2020 on productivity, as some of them may have had a permanent effect and others a transitory one (see Citino et al, 2023).

Figure 4



Labour productivity's 2000-19 average annual growth rate was 0.16 per cent in Italy, as opposed to 1 per cent in Germany and 0.86 per cent in the Euro area (Table 2). Cumulating growth over time, these rates translate into very sizable differences: between 2000 and 2019, labour productivity increased only by 3 per cent in Italy, against 19 per cent in Germany and 16 per cent in the Euro area. Productivity growth in Italy was especially weak in the years leading up to the Global Financial Crisis. During the financial crisis and the ensuing recession, productivity per hour worked improved slightly in Italy and had a strong acceleration in Spain, thanks to a very strong reduction in hours worked, while it grew at a slower pace than before in the other countries. As a result, the Italian gap in productivity growth somewhat decreased. Over the period 2014-19, in Italy productivity grew on average at the same rate as in 2007-14, in contrast with Spain, where the acceleration experienced during the crisis came to a halt, and

with France, Germany and the Euro area, where productivity growth picked up relative to the previous period.

Table 2

Output growth decomposition (1)
(average annual percentage variations)

	real value added	labour productivity	hours worked per person employed	employment rate	share of working age population	total population
2000-2007						
Italy	1.16	0.06	-0.25	1.34	-0.44	0.45
Germany	1.57	1.58	-0.12	0.46	-0.27	-0.08
France	1.89	1.33	-0.20	0.03	0.01	0.71
Spain	3.35	0.39	-0.43	1.77	0.05	1.56
Euro area	2.02	1.10	-0.18	0.74	-0.13	0.49
2007-2014						
Italy	-1.14	0.22	-0.82	-0.85	-0.07	0.38
Germany	0.84	0.54	-0.54	1.15	-0.30	-0.00
France	0.58	0.58	-0.17	0.06	-0.39	0.51
Spain	-0.83	1.59	-0.09	-2.21	-0.50	0.38
Euro area	0.06	0.77	-0.49	-0.18	-0.31	0.27
2014-2019						
Italy	1.04	0.20	-0.07	1.49	-0.37	-0.20
Germany	1.59	0.83	-0.41	1.01	-0.36	0.51
France	1.55	0.72	0.00	1.00	-0.60	0.43
Spain	2.68	0.38	-0.16	2.36	-0.19	0.28
Euro area	1.89	0.66	-0.13	1.46	-0.38	0.28
2000-2019						
Italy	0.28	0.16	-0.41	0.57	-0.29	0.25
Germany	1.31	1.00	-0.35	0.86	-0.31	0.10
France	1.32	0.89	-0.14	0.30	-0.30	0.56
Spain	1.63	0.83	-0.23	0.46	-0.21	0.79
Euro area	1.27	0.86	-0.28	0.59	-0.26	0.35

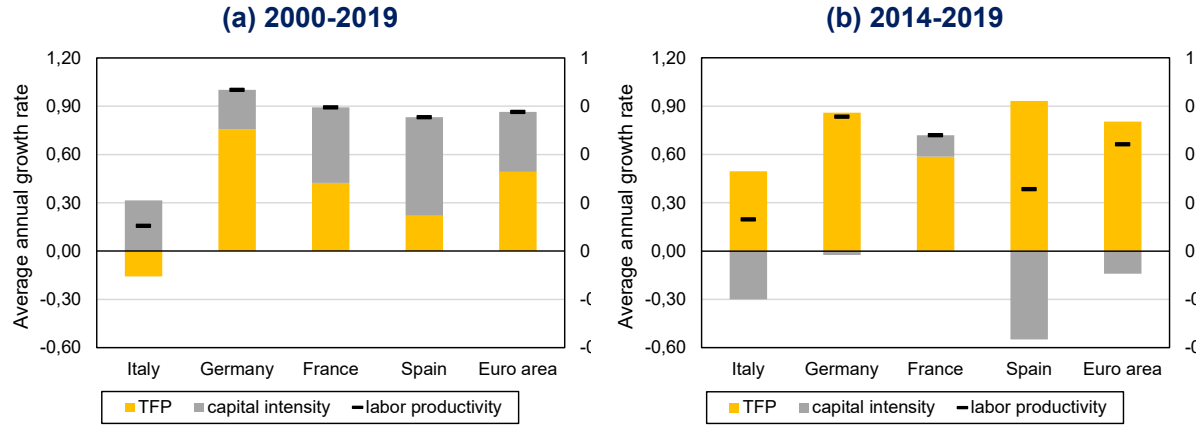
Source: own calculations on AMECO data. (1) Real gross value added excluding FISIM, total economy. Annual growth rates are calculated as log-differences. Average annual growth rates are calculated as arithmetic means of annual growth rates.

In order to dig deeper into the drivers of labour productivity growth, one can decompose it into two components: total factor productivity growth (TFP) and increases in capital intensity, i.e.

capital per hour worked.[10] Capital deepening occurred in all countries and in the Euro area between 2000 and 2019; although it was somewhat heterogeneous across the main EU countries, its yearly contribution to labour productivity growth in Italy was in line with the Euro area: 0.31 and 0.37 per cent, respectively, (Figure 5, panel a, and Table 3). The main cross-country differences, however, arise from TFP dynamics: in Italy, TFP growth was on average negative over the 2000-19 period, offsetting the positive contribution of capital deepening on labour productivity; conversely, in the other countries, TFP dynamics were positive and reinforced the effect of the increase in capital intensity.

Figure 5

Contributions to labour productivity growth - Total economic activities (1)
(percentage variations)



Source: calculations on AMECO data.
Annual growth rates are calculated as log-differences. Average annual growth rates are calculated as arithmetic means of annual growth rates.

The double-dip recession brought about structural changes in the Italian economy and triggered a productivity-enhancing resource reallocation towards more productive firms (Bugamelli et al., 2018). This can be seen by restricting the analysis to the years 2014-19 (Figure 5, panel b). During that period, Italy's TFP growth turned positive, albeit somewhat weaker than in the other major European economies.[11] This growth was the driver for positive labour productivity growth, despite the negative contribution of capital intensity. Capital accumulation dynamics were subdued in all major European countries, owing to the persistent negative effects on investment generated by the 2007-2013 recession. These dynamics, together with the increase in labour input since 2014, led to a decrease in capital intensity in the euro area as a whole and

[10] The decomposition equation implies that labor productivity growth can be expressed as the sum of two components: (a) TFP growth, and (b) growth in capital intensity, multiplied by the capital share of the economy (see Appendix 1). Variations in the latter component exclusively originate from changes in the quantity of capital available per hour worked, since TFP estimates in the AMECO database (which is used here for the growth accounting analysis) assume that the capital share is fixed and set at 0.35 (see Havik et al., 2014, page 10, note 5, also cited in the AMECO metadata, "Accuracy and reliability" section, at https://economy-finance.ec.europa.eu/system/files/2022-10/Reference%20Metadata%20AMECO_September%202022.pdf).
[11] Positive TFP growth in Italy has occurred also in the 2020-22 period.

in particular in Italy and Spain, curbing labour productivity growth. Section 4.2 will analyse more in detail the investment dynamics in the private sector after the Great Recession.

Table 3

Labour productivity decomposition – Total economic activities (1) *(average annual percentage variations)*			
	labour productivity	**TFP**	**capital intensity (2)**
2000-2007			
Italy	0.06	-0.26	0.32
Germany	1.58	1.01	0.57
France	1.33	0.79	0.54
Spain	0.39	-0.14	0.53
Euro area	1.10	0.66	0.44
2007-2014			
Italy	0.22	-0.53	0.75
Germany	0.54	0.43	0.11
France	0.58	-0.06	0.64
Spain	1.59	0.07	1.52
Euro area	0.77	0.11	0.67
2014-2019			
Italy	0.20	0.50	-0.30
Germany	0.83	0.86	-0.02
France	0.72	0.59	0.13
Spain	0.38	0.93	-0.55
Euro area	0.66	0.80	-0.14
2000-2019			
Italy	0.16	-0.16	0.31
Germany	1.00	0.76	0.24
France	0.89	0.42	0.47
Spain	0.83	0.22	0.61
Euro area	0.86	0.49	0.37

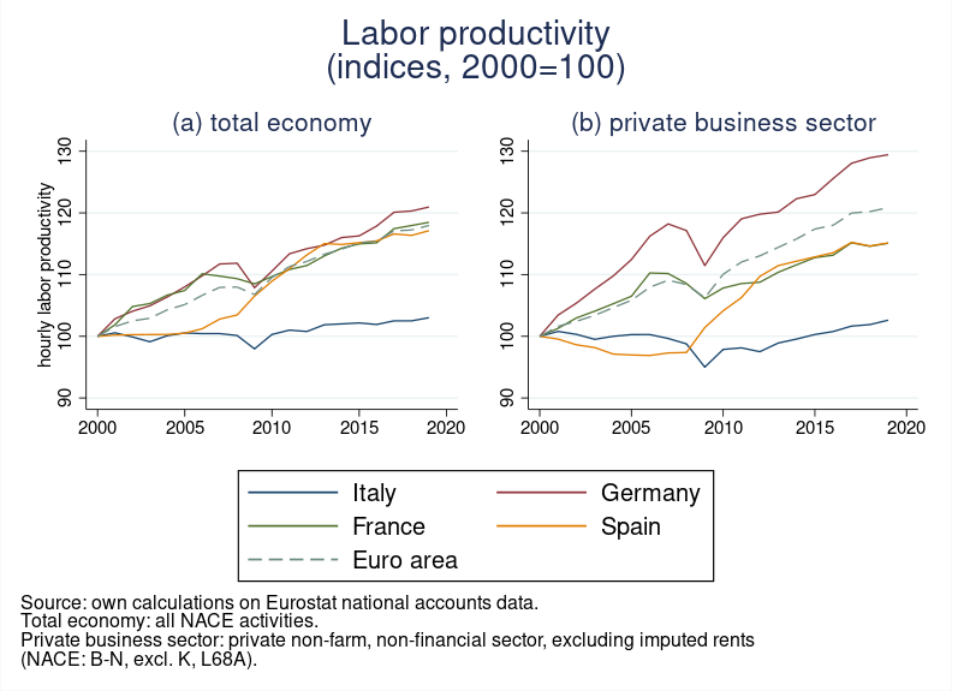
Source: own calculations on AMECO data. (1) Total economic activities. Annual growth rates are calculated as log-differences. Average annual growth rates are calculated as arithmetic means of annual growth rates. - (2) Capital deepening's contribution to growth is equal to the growth rate of capital intensity multiplied by the capital share, here set to 0.35 (see Appendix 1).

3. Productivity in the private sector and sectoral dynamics

The aggregate trends in labour productivity conceal large differences across sectors. In order to analyse such heterogeneity, we restrict our focus to the nonfarm, nonfinancial private sector, thus excluding nonmarket and public sector activities, as well as agricultural and financial

activities.[12] Trends in labour productivity performed similarly to the overall economy when looking at the whole 20-year period (Figure 6 and Table 4), whereas a pick-up in productivity growth in the private sector relative to the overall economy emerges in all countries but France when focusing on the sub-period 2014-19. Over the same period, cross-country differences in productivity trends were smaller in the business sector than in the overall economy (Figure 7).[13]

Figure 6



Source: own calculations on Eurostat national accounts data.
Total economy: all NACE activities.
Private business sector: private non-farm, non-financial sector, excluding imputed rents (NACE: B-N, excl. K, L68A).

[12] We also exclude imputed rents from the real estate sector. As a result, the private business sector here considered includes NACE classes B through N, excluding sections K (financial services) and L68A (imputed rents).

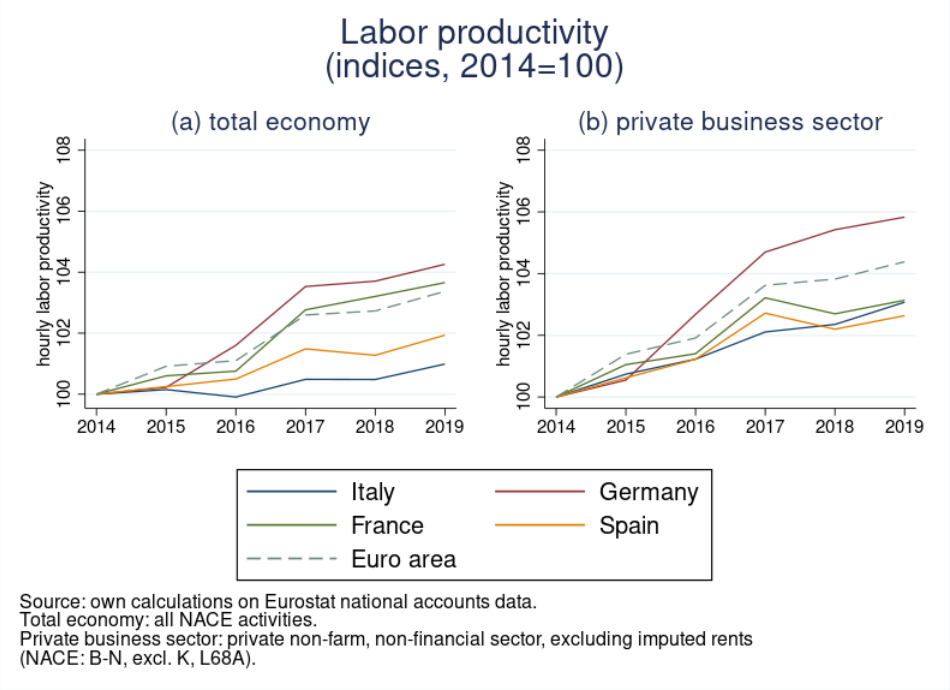
[13] This is especially due to larger cross-country differences in productivity trends in the public sector (NACE codes: O-Q). In Italy, the public sector gave a negative contribution to aggregate productivity growth in the 2014-2019 period, as its productivity steadily decreased over the years considered.

Table 4

Labour productivity decomposition – Private sector (1) *(average annual percentage variations)*			
	labour productivity	**TFP**	**capital intensity (2)**
2000-2007			
Italy	-0.05	-0.32	0.27
Germany	2.39	1.99	0.40
France	1.38	1.53	-0.15
Spain	-0.39	-	-
Euro area	1.24	-	-
2007-2014			
Italy	-0.01	-0.86	0.85
Germany	0.49	0.35	0.13
France	0.18	-0.05	0.23
Spain	2.03	-	-
Euro area	0.85	-	-
2014-2019			
Italy	0.61	0.95	-0.35
Germany	1.12	1.04	0.08
France	0.62	0.73	-0.11
Spain	0.52	-	-
Euro area	0.86	-	-
2000-2019			
Italy	0.14	-0.18	0.32
Germany	1.35	1.14	0.21
France	0.74	0.74	0.00
Spain	0.74	-	-
Euro area	1.00	-	-

Source: own calculations on Eurostat national accounts data. No data on capital stock by sector is available for Spain and the Euro area. (1) Private non-farm, non-financial sector, net of imputed rents (NACE categories: B-N, excl. K, L68A). Annual growth rates are calculated as log-differences. Average annual growth rates are calculated as arithmetic means of annual growth rates. - (2) Capital deepening's contribution to growth is equal to the growth rate of capital intensity multiplied by the capital share, here set to 0.35 (see Appendix 1).

Figure 7



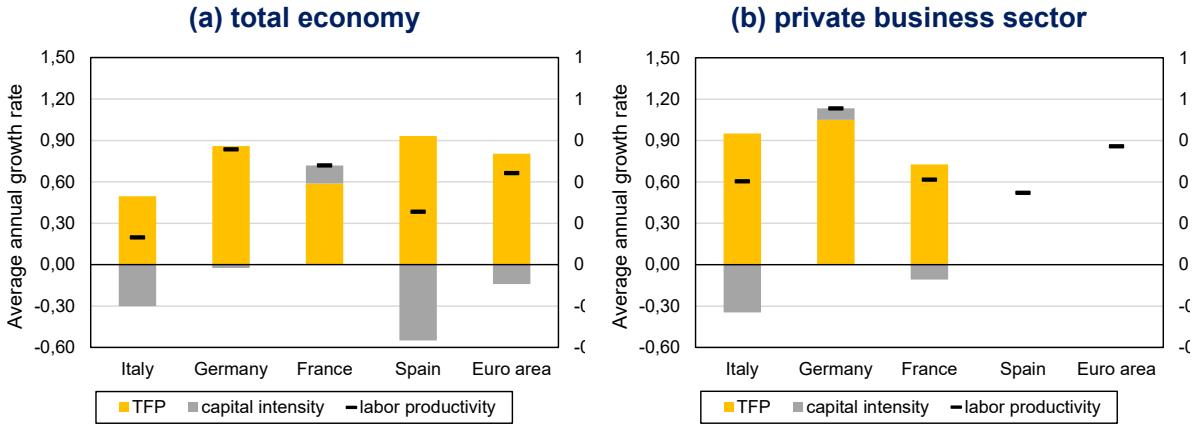
Source: own calculations on Eurostat national accounts data.
Total economy: all NACE activities.
Private business sector: private non-farm, non-financial sector, excluding imputed rents (NACE: B-N, excl. K, L68A).

In all countries,[14] the more positive productivity performance in the private sector, relative to the overall economy, after 2014 is due to the positive contribution of TFP growth, while capital intensity played either a limited (like in Germany or France) or a negative role (like in Italy). The extent of the decrease in capital intensity in Italy was similar between total economy and the business sector (Figure 8).

[14] Eurostat's national accounts data on capital stock by sector, which are necessary in order to estimate TFP for the private sector, are not available for Spain and the Euro area. The private sector's labor productivity decomposition into the contribution of TFP and capital intensity growth is therefore only available for Italy, Germany and France.

Figure 8

Contributions to labour productivity growth, 2014-2019 (1)
(percentage variations)

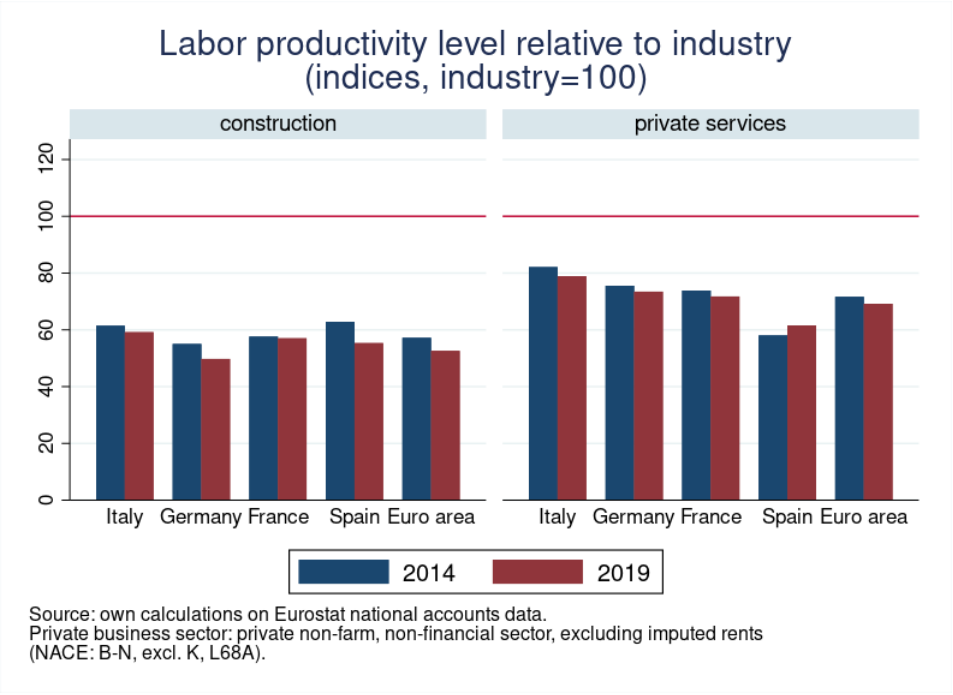


Source: own calculations on AMECO data (panel a) and Eurostat national accounts data (panel b). No data on capital stock by sector is available for Spain and the Euro area.
(1) Total economy: all NACE activities. Private business sector: private non-farm, non-financial sector, excluding of imputed rents (NACE: B-N, excl. K, L68A). Annual growth rates are calculated as log-differences. Average annual growth rates are calculated as arithmetic means of annual growth rates.

Even if labour productivity in the private sector since 2014 followed analogous trends in all countries, there are large sectoral differences, both within and across countries. Sectors differ both in their labour productivity level and in its growth paths. Figure 9 plots the sectoral labour productivity gap relative to industry, in 2014 and 2019. The industrial sector is the most productive in all countries; construction has the largest productivity gap. The extent of the gap between sectors varies across countries and has overall slightly widened over time.[15] Italy is the country with the smallest productivity gap across sectors (for services, labour productivity is about 20 per cent lower relative to industry, as opposed to a 30 per cent average gap in the Euro area).

[15] The only exception is the market services sector in Spain, whose productivity gap relative to the industrial sector decreased between 2014 and 2019, although its level is still high (services are about 40 per cent less productive than industry), when compared to the services-industry productivity gap registered in the other countries.

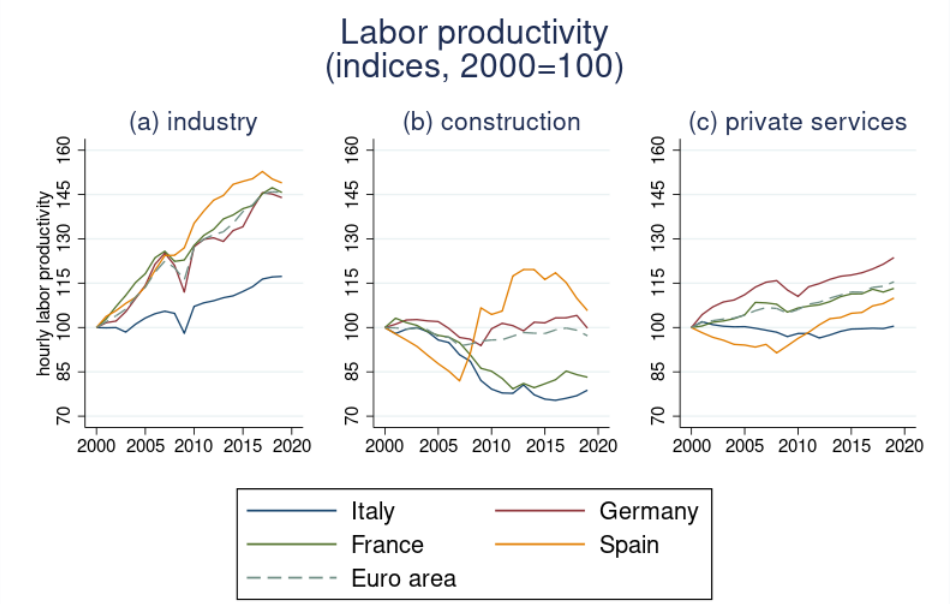
Figure 9



Source: own calculations on Eurostat national accounts data.
Private business sector: private non-farm, non-financial sector, excluding imputed rents (NACE: B-N, excl. K, L68A).

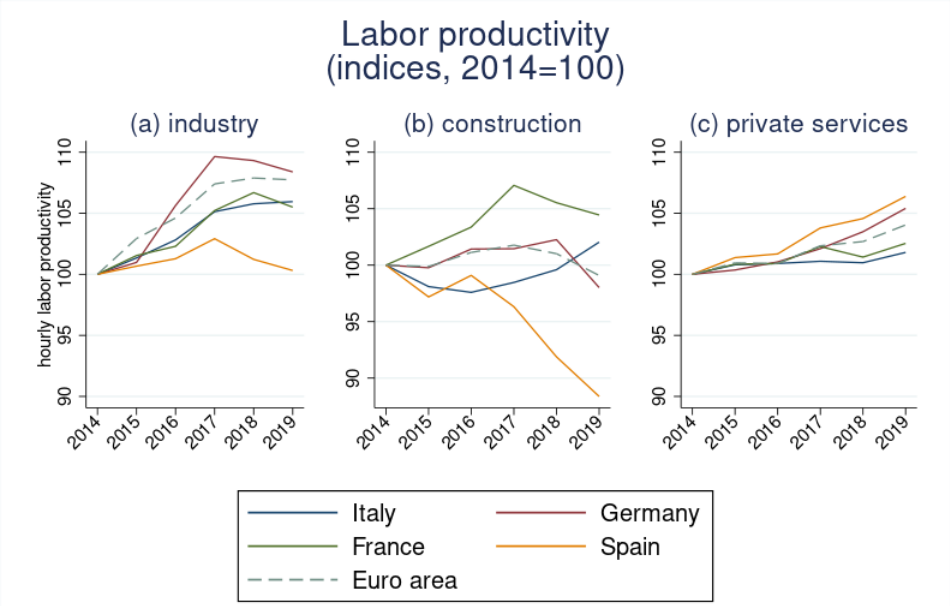
Figures 10 and 11 show sector productivity dynamics over the 2000-2019 and the 2014-19 period, respectively. Over the 2000-2019 period, Italy displayed the lowest cumulative growth in labour productivity in all sectors. Productivity in the industrial sector increased at faster rate but much less than in the comparison countries. Trends in productivity in the construction and services sectors are much more heterogeneous across countries. By 2019, labour productivity in construction had declined compared to the 2000 level in France and Italy, had remained stable in Germany and had slightly increased in Spain. Productivity in market services had increased (although less than in the industrial sector) in all countries except Italy, where it remained roughly stable at the 2000 level. Restricting the focus to the more recent years 2014-2019, in all countries except Spain, the industrial sector's productivity grew more than in the other sectors, although a generalized slowdown (or, in some cases, even negative growth rates) occurred since 2017. Italy's productivity growth in this sector was in line with that of France, and larger than Spain's (Table 5). A different picture emerges when looking at services, whose productivity growth was lower in Italy than the in the other countries, especially after 2016, thus making the sector a laggard both in the international comparison and relative to the Italian industrial sector.

Figure 10



Source: own calculations on Eurostat national accounts data.
Private business sector: private non-farm, non-financial sector, excluding imputed rents (NACE: B-N, excl. K, L68A).

Figure 11



Source: own calculations on Eurostat national accounts data.
Private business sector: private non-farm, non-financial sector, excluding imputed rents (NACE: B-N, excl. K, L68A).

Table 5

Average growth rate of labour productivity 2014-2019 (1) *(percentage points)*					
	Italy	**Germany**	**France**	**Spain**	**Euro area**
industry	1,16	1,62	1,07	0,06	1,49
construction	0,40	-0,36	0,87	-2,47	-0,18
market services (2)	0,36	1,02	0,50	1,24	0,79
private sector (3)	0,61	1,12	0,62	0,52	0,86

Source: own calculations on Eurostat national accounts data.
(1) Annual growth rates are calculated as log-differences. Average annual growth rates are calculated as arithmetic means of annual growth rates. - (2) NACE sectors G-N, excluding financial services (K) and imputed rents (L68A). - (3) NACE sectors B-N, excluding K, L68A.

Uneven growth, both within sector-across countries and within country-across sectors, is a recurring feature at all disaggregation levels. Figure 12 plots the average annual growth rate of sector productivity in the 2014-19 period, at the NACE 1-digit disaggregation level. Sector productivity growth rates are highly dispersed, especially between the industrial branches, in all countries considered. While Italy registers lower productivity growth rates in many sectors, the growth rate dispersion is comparable in magnitude to that of other countries.

Figure 12

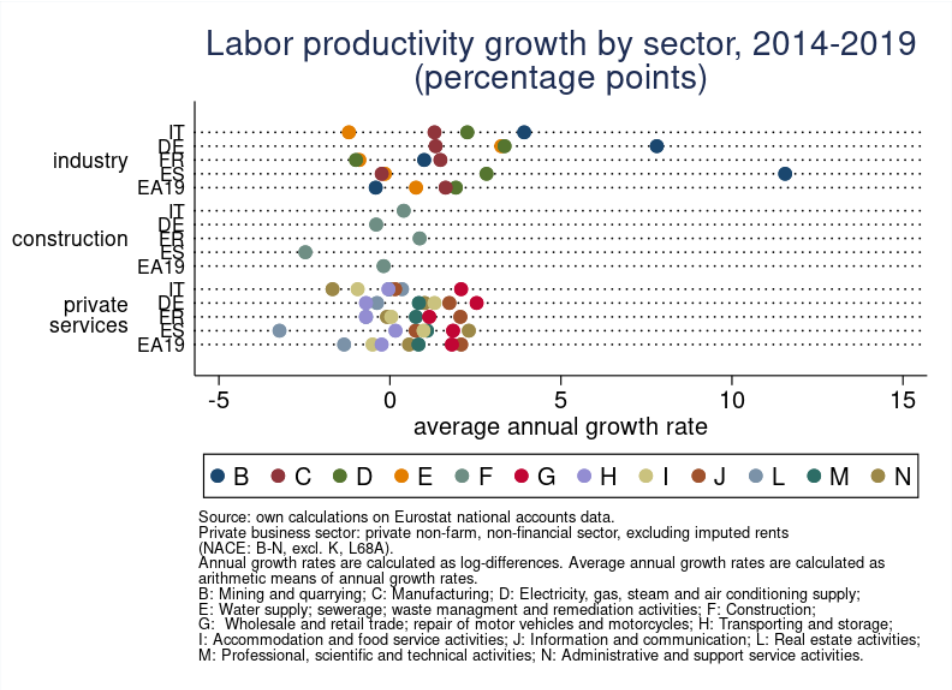
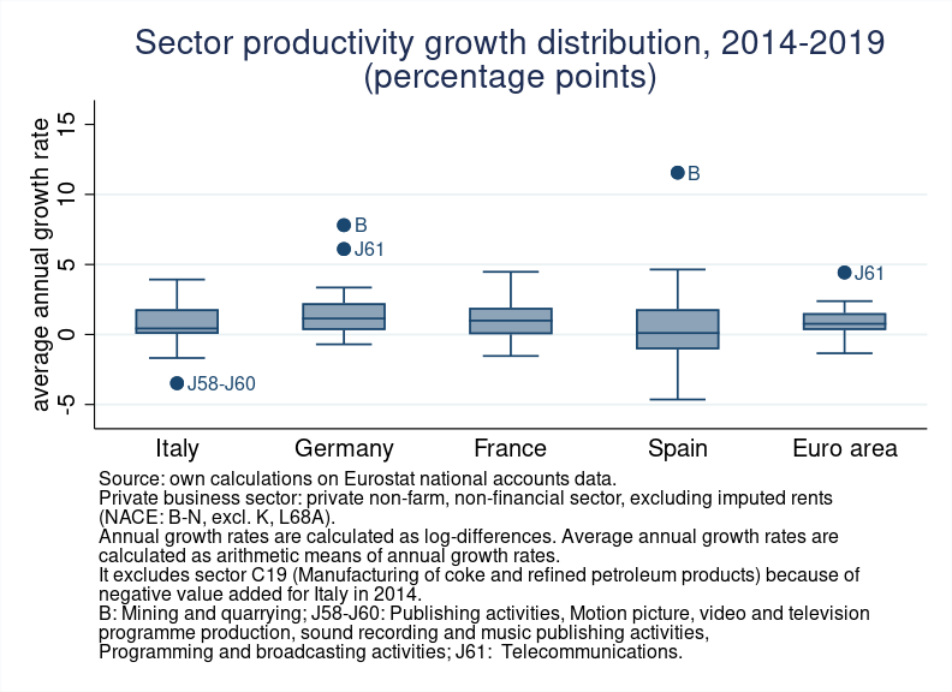


Figure 13 displays the distribution of the 2014-19 average productivity growth rate at the most disaggregated NACE levels available in national accounts data.[16] The evidence confirms that, although the median sector's growth in Italy was lower than in the other countries, the dispersion of productivity growth rates was similar across countries.

Figure 13



Although the general picture is one of weaker sectoral productivity growth – mainly in services –, there are a few sectors where Italy actually performs better than the comparison countries. Table 6 shows Italy's sectoral productivity growth over the period 2014-19 relative to productivity growth in the other countries. Italy exhibits the best performance in some manufacturing sectors.[17] Some of them have higher economic weight (both in terms of value added and hours worked) in Italy than in the other countries, as showed by the Balassa indices (which measure the weight of the sector in Italy, relative to its weight in the Euro area), and/or account for a sizable contribution to Italian exports (e.g. motor vehicles and transport equipment, as well as machinery and equipment). Other export-relevant sectors where Italy fares relatively well are the chemical and pharmaceutical sectors (C20 and C21), where the country performs better than Germany and Spain. Finally, among services, the Italian trade sector (G) has been exhibiting a sustained productivity growth since at least 2009 and performed better than in all other countries, except Germany. Overall, the sectors where Italy performed better than Germany, France and Spain account for 18 per cent of Italy's real value added (11 per cent of hours worked). Conversely, the sectors where Italy performed the worst account for

[16] Up to 2-digit NACE.
[17] Rubber, plastic and other non-metallic mineral products (C22_C23); machinery and equipment n.e.c. (C28), motor vehicles, trailers and semi-trailers and other transport equipment (C29_C30); furniture, other manufacturing and repair and installation of machinery and equipment (C31-C33).

23 per cent of value added (28 per cent of hours worked), including two sectors which play a crucial role in the recent economic evolution and digitalization process: information and communication (J) and administrative and support service (N) sectors.

In Italy, the extent to which a sector is exposed to international trade is correlated with its labour productivity dynamics: across sectors, productivity growth increases with the degree of trade intensity (defined as the share of exports over output; Figure 14). However, this result does not extend to all countries; while in France productivity has grown more in the tradable sectors (like in Italy), such a positive correlation between trade intensity and labour productivity growth is not detectable in Spain and Germany (Figure 15).

Table 6

Italy's performance in productivity growth relative to major EU countries and Euro area, 2014-2019

(percentage points; Balassa indices: EA=1)

	sector	Italy's productivity growth higher than:				Italy				
		Germany	France	Spain	Euro area	productivity growth (1)	hours worked share (2)	value added share (2)	Balassa index (3): hours worked	Balassa index (3): real value added
B	mining and quarrying		x		x	3.93	0.14	0.43	0.73	1.07
C10-C12	manufacture of food products; beverages and tobacco products		x	x	x	1.54	2.93	2.93	0.89	0.95
C13-C15	manufacture of textiles, wearing apparel, leather and related products			x		0.67	2.99	2.57	2.14	2.90
C16-C18	manufacture of wood, paper, printing and reproduction			x		1.23	1.64	1.53	1.08	1.17
C19 (4)	manufacture of coke and refined petroleum products	..	..	..	..	..	..	..	..	..
C20	manufacture of chemicals and chemical products	x		x	..	1.24	0.70	1.22	0.83	..
C21	manufacture of basic pharmaceutical products and pharmaceutical preparations	x		x	..	1.17	0.39	0.96	0.89	..
C22_C23	manufacture of rubber and plastic products and other non-metallic mineral products	x	x	x	x	2.52	2.11	2.35	1.10	1.19

Italy's performance in productivity growth relative to major EU countries and Euro area, 2014-2019

(percentage points; Balassa indices: EA=1)

	sector	Italy's productivity growth higher than:				Italy				Balassa index (3): real value added
		Germany	France	Spain	Euro area	productivity growth (1)	hours worked share (2)	value added share (2)	Balassa index (3): hours worked	
C24_C25	manufacture of basic metals and fabricated metal products, except machinery and equipment			x		0.12	4.12	4.11	1.25	1.31
C26	manufacture of computer, electronic and optical products				..	0.40	0.59	0.86	0.82	..
C27	manufacture of electrical equipment	x		x	x	2.10	0.93	1.15	0.96	0.92
C28	manufacture of machinery and equipment n.e.c.	x	x	x	..	0.47	2.93	3.84	1.29	..
C29_C30	manufacture of motor vehicles, trailers, semi-trailers and of other transport equipment	x	x	x	x	3.57	1.48	2.21	0.78	0.60
C31-C33	manufacture of furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment	x	x	x	..	1.16	2.76	2.32	1.14	..
D	electricity, gas, steam and air conditioning supply		x		x	2.26	0.51	2.59	0.72	0.92
E	water supply; sewerage, waste management and remediation activities					-1.20	1.33	1.65	1.18	1.13

Italy's performance in productivity growth relative to major EU countries and Euro area, 2014-2019

(percentage points; Balassa indices: EA=1)

	sector	Italy's productivity growth higher than:				Italy				Balassa index (3): real value added
		Germany	France	Spain	Euro area	productivity growth (1)	hours worked share (2)	value added share (2)	Balassa index (3): hours worked	
F	construction	x		x	x	0.40	9.77	6.83	0.95	0.88
G	wholesale and retail trade; repair of motor vehicles and motorcycles		x	x	x	2.08	23.82	18.92	1.04	1.10
H	transportation and storage	x	x		x	-0.04	7.89	8.81	0.99	1.18
I	accommodation and food service activities					-0.94	9.79	6.13	1.11	1.32
J58-J60	publishing, motion picture, video, television programme production; sound recording, programming and broadcasting activities					-3.48	0.59	0.88	0.61	0.54
J61	telecommunications					3.19	0.55	1.86	0.93	1.06
J62_J63	computer programming, consultancy, and information service activities			x		0.23	2.66	3.22	0.88	0.83
L (5)	real estate activities (net of imputed rents)	x	x	x	x	0.35	1.29	6.91	0.82	0.92
M69-M71	legal and accounting activities; activities of head offices; management consultancy activities; architectural and engineering					0.01	7.47	6.74	0.96	0.91

Italy's performance in productivity growth relative to major EU countries and Euro area, 2014-2019

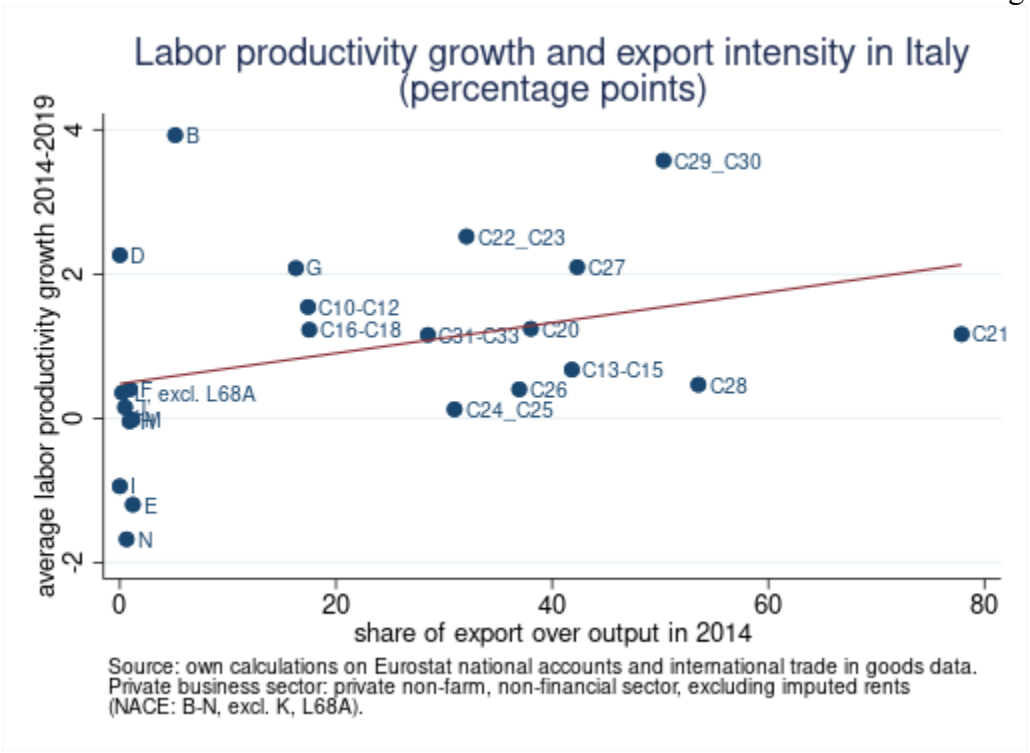
(percentage points; Balassa indices: EA=1)

		Italy's productivity growth higher than:				Italy				
	sector	Germany	France	Spain	Euro area	productivity growth (1)	hours worked share (2)	value added share (2)	Balassa index (3): hours worked	Balassa index (3): real value added
	activities; technical testing and analysis									
M72	scientific research and development			x		-0.82	0.64	1.65	0.67	1.18
M73-M75	advertising and market research; other professional, scientific and technical activities; veterinary activities	x				0.08	2.38	1.82	1.22	1.29
N	administrative and support service activities					-1.68	7.51	5.29	0.74	0.71

Source: own calculations on Eurostat national accounts data.

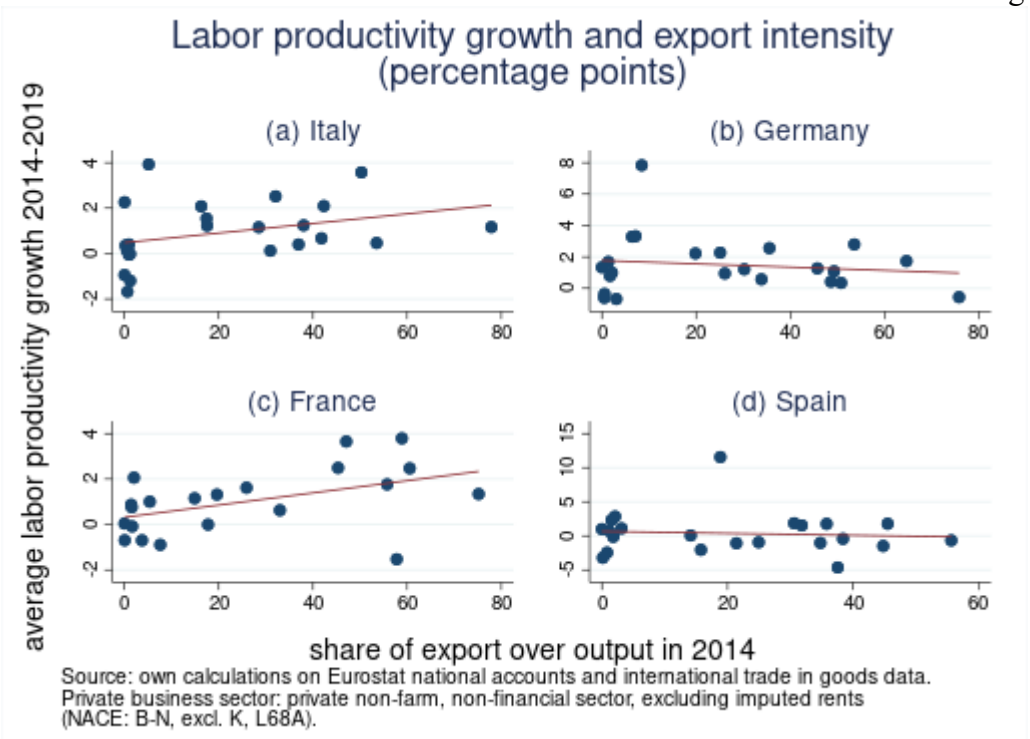
(1) Average annual growth rate. Annual growth rates are calculated as log-differences. Average annual growth rates are calculated as arithmetic means of annual growth rates. - (2) Average annual share relative to nonfarm, nonfinancial, business sector. - (3) Italy's share divided by Euro area's share. - (4) C19's value added is negative for Italy in 2014. The sector is therefore excluded.- (5) The real estate sector (L) excludes imputed rents (L68A).

Figure 14



Source: own calculations on Eurostat national accounts and international trade in goods data.
Private business sector: private non-farm, non-financial sector, excluding imputed rents (NACE: B-N, excl. K, L68A).

Figure 15



Source: own calculations on Eurostat national accounts and international trade in goods data.
Private business sector: private non-farm, non-financial sector, excluding imputed rents (NACE: B-N, excl. K, L68A).

4. Possible drivers of slow productivity growth in Italy

The evidence presented above shows that productivity growth is on average weaker in Italy than in the other Euro area countries, despite a decline in growth differentials since the end of the Great Recession. This evidence holds across sectors (with some exceptions) and at all levels of disaggregation, but Italy's underperformance is particularly striking in market services. However, even within each macro-sector, there is a large heterogeneity across sectors.

These facts, taken jointly, suggest a series of candidate drivers of aggregate productivity dynamics. To name a few, cross-country differentials in aggregate labour productivity growth may be linked to differences in sector composition, technology adoption, firm size, investment dynamics, and entry barriers. The following sections discuss evidence on the role of sector composition and investment dynamics, leaving the other factors to future work.

4.1. Sector composition[18]

In order to assess the role of structural features in explaining productivity growth differentials in the private sector across countries, it is useful to look at how a country's productivity growth performance would change, had it a different sectoral composition. Such counterfactuals exploit the fact that aggregate productivity, when value added is expressed at current or previous year's prices, can be expressed as the weighted average of sector productivities, where the weights are the labour input shares of the sectors, calculated in terms of hours worked.[19]

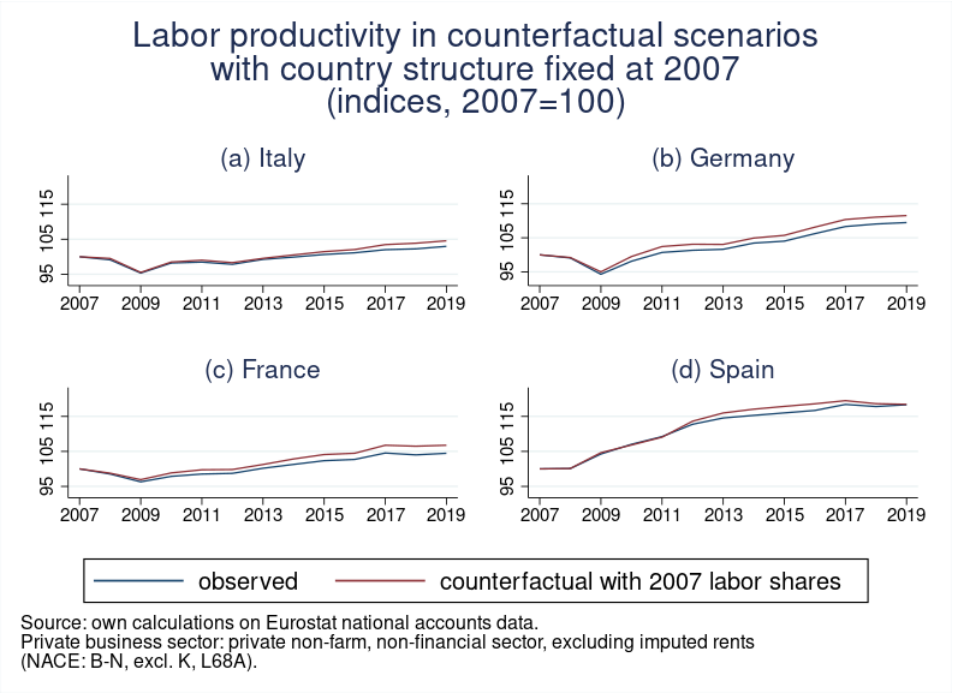
Although the sectoral composition is a slow moving structural feature of an economy, in all counterfactual scenarios we will fix the sector labour input shares at the 2007 or 2014 level, in order to clean the results from the effects of structural changes occurring over the period considered. Figure 16 provides an assessment of the role of structural change in each country over the period considered, by comparing the observed trend of each country with the counterfactual one. The results show that in all countries structural change had a negative, although small, effect, but cannot explain the cross country differences in productivity performance.[20] Previous evidence relative to the Great Recession period shows that employment grew more in low productivity activities (OECD, 2018), reflecting a decline in the manufacturing's employment share, as well as of the outsourcing of some service activities from manufacturing firms to business service firms (OECD, 2018). Our analysis confirms these results and documents that this structural change had a persistent negative impact on labour productivity dynamics up to 2019.

[18] National accounts data do not have data on value added and/or hours worked for some NACE 2-digit sectors for the Euro area as a whole. The international comparison in this section is therefore limited to Italy, Germany, France and Spain.

[19] The formal derivation of real aggregate productivity (in chain linked values) in counterfactual scenarios is presented in Appendix 2.

[20] Spain is an exception in this respect, since it appears that the negative effect on hourly labor productivity of structural change, emerging after 2012, was re-absorbed in 2019.

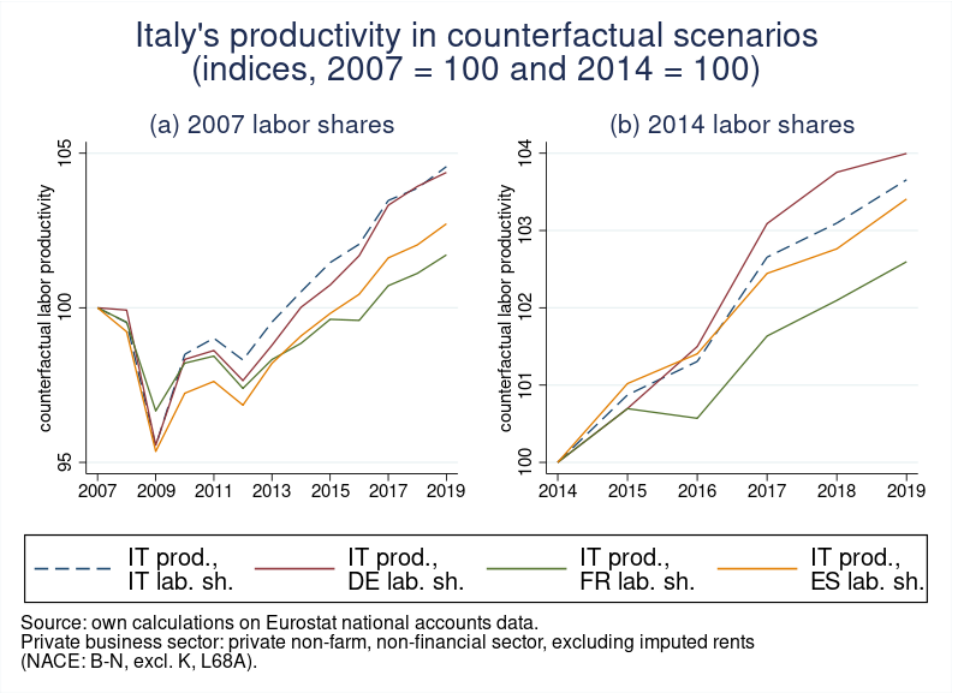
Figure 16



Source: own calculations on Eurostat national accounts data.
Private business sector: private non-farm, non-financial sector, excluding imputed rents (NACE: B-N, excl. K, L68A).

Provided that structural change in the years considered is small, we turn to the effects of the productive structure on Italy's performance. In particular, we want to establish whether at least part of the Italian weak productivity dynamics can be attributed to a penalizing productive structure relative to other countries. Figure 17 shows that this is not the case. Applying other countries' sectorial structures to Italy would not improve the country's performance in terms of labour productivity growth in the period 2007-2019 (Figure 17, panel a), while in the more recent period 2014-2019 a productive structure like the German one would have a positive, but limited, effect on Italian labour productivity: if Italy in 2019 had Germany's 2014 structure, the cumulative 2014-2019 productivity growth would have been about 4 per cent, in contrast with 3.7 per cent in the case in which Italy had held fixed its own 2014 sectoral labour structure (Figure 17, panel b).

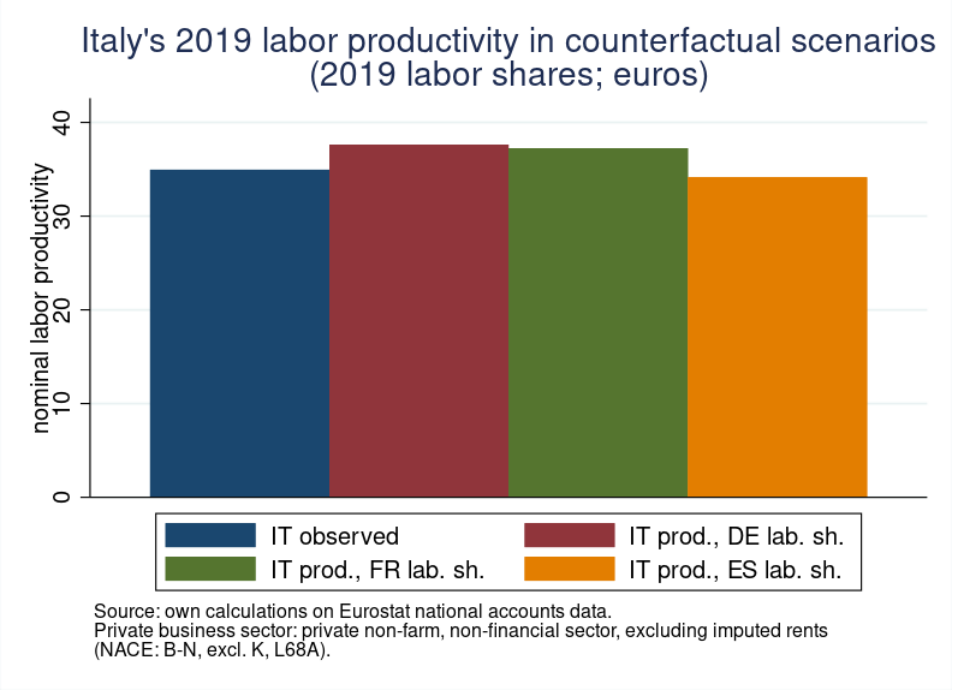
Figure 17



Source: own calculations on Eurostat national accounts data.
Private business sector: private non-farm, non-financial sector, excluding imputed rents (NACE: B-N, excl. K, L68A).

The counterfactual exercise presented above points to a very limited role for countries' sector structure in explaining cross-country differences in aggregate productivity growth. Despite the small effect on trends, however, productive structure may still have a role in determining differences in labour productivity levels across countries. Figure 18 shows the observed level of nominal labour productivity in Italy in 2019 and its value in three counterfactual scenarios, differing by the sectoral structures applied. In particular, the productivity levels in the scenarios are obtained using the other countries' 2019 labour input shares by sector. It emerges that productivity in Italy would have been 7.7 per cent (6.6) higher than observed if Italy had the German (French) structure in 2019; conversely, applying to Italy the Spanish structure, the private sector productivity level would have been about 2.3 per cent lower. This implies that with respect to Germany and France, the Italian productive structure is more tilted towards sectors with lower productivity levels.

Figure 18



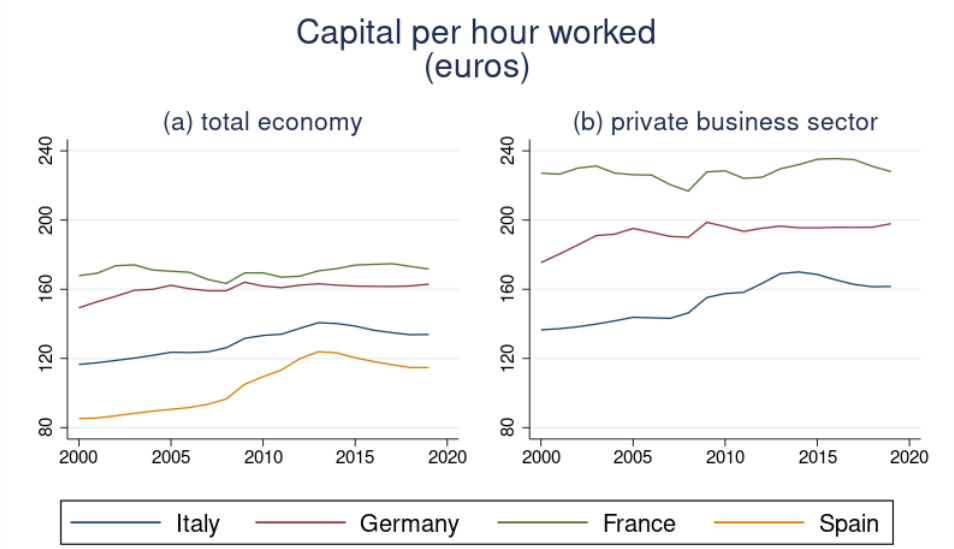
4.2. Investment[21]

Investment is widely regarded as essential to improving labour productivity. Among the different types of assets, intangibles, such as intellectual property products, are particularly relevant for productivity dynamics (OECD/APO, 2022). The growth accounting decomposition presented in Section 2 highlighted that, since the end of the financial crisis, capital deepening decreased in all countries: the growth of capital per hour worked slowed down in France, halted in Germany, and got negative in Italy and Spain, turning into a drag on labour productivity growth in the latter countries. This step change is particularly true for the private business sector (Figures 19 and 20), which also displays the largest cross-country differences in the amount of capital available per hour worked throughout the last twenty years.[22]

[21] National accounts data do not have data on investment for the Euro area as a whole. The international comparison in this section is therefore limited to Italy, Germany, France and Spain. Some disaggregation by type of assets (in particular, ICT and its components) is only available for Italy and France.

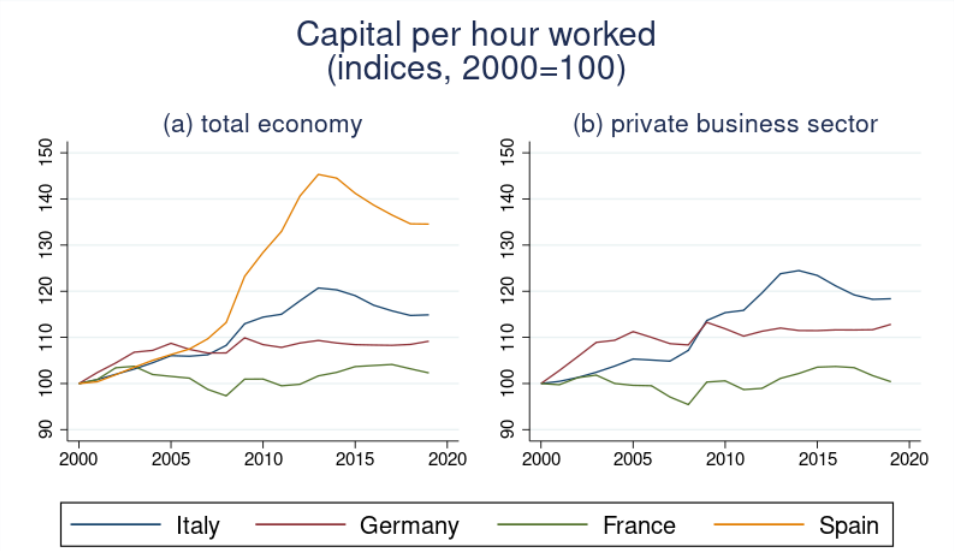
[22] As mentioned in Section 2, Eurostat national accounts data on capital stock by sector, which are necessary in order to construct measures of capital intensity for the private business sector, are not available for Spain.

Figure 19



Source: own calculations on Eurostat national accounts data.
Total economy: all NACE activities.
Private business sector: private non-farm, non-financial sector, excluding imputed rents (NACE: B-N, excl. K, L68A).
Capital in 2015 chain linked volumes.
No data on capital stock by sector are available for Spain.

Figure 20



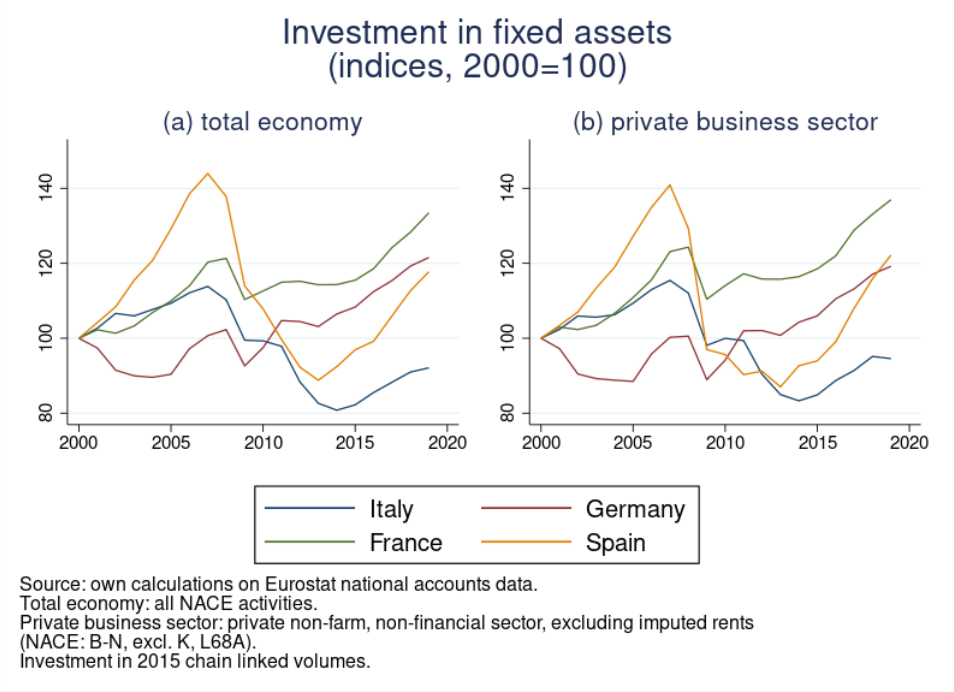
Source: own calculations on Eurostat national accounts data.
Total economy: all NACE activities.
Private business sector: private non-farm, non-financial sector, excluding imputed rents (NACE: B-N, excl. K, L68A).
Capital in 2015 chain linked volumes.
No data on capital stock by sector are available for Spain.

4.2.1. Investment dynamics

The global financial crisis and the Great Recession had negative effects on capital accumulation (Figure 21). In Spain and Italy, the effect of the crisis was particularly strong and persistent, as investment only slowly picked up after 2014. In Italy, investment in 2019 was still below its

2000 level. Conversely, in Germany and France, the negative effect of the crisis was more short-lived: investment fell sharply in 2009, but started to grow again soon after. These patterns are common to both the overall economic activities and the private sector.

Figure 21

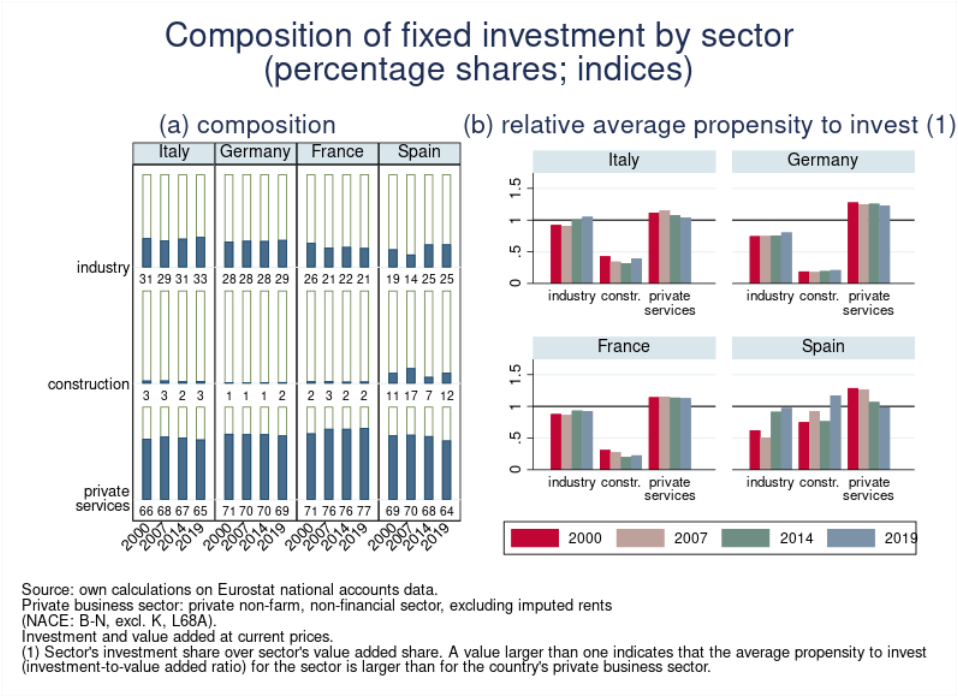


Source: own calculations on Eurostat national accounts data.
Total economy: all NACE activities.
Private business sector: private non-farm, non-financial sector, excluding imputed rents (NACE: B-N, excl. K, L68A).
Investment in 2015 chain linked volumes.

In all countries, a fraction ranging from two thirds to three quarters of investment in the private sector is accounted for by the service sector,[23] while the contribution of the construction sector to total investment in fixed assets is relatively minor (except in Spain; Figure 22, panel a). Sectoral shares of investment have remained roughly stable over time since at least 2007. The relevance of market services in investment composition reflects both the sector's weight in terms of value added, and – for some countries – higher sectoral propensity to invest, e.g. in Germany services are overrepresented in investment, relative to their share of value added (Figure 22, panel b). [24] In Italy, the 2019 investment shares of industry and market services were roughly in line with the sectors' value added weights, while the investment share of the construction sector stood well below its value added share.

[23] This share is smaller when one excludes the real estate sector (NACE sector L) from the analysis. In that case, the private services' share of total investment in fixed assets amounts to about 50 per cent throughout the period considered in all countries but France where it increased over time, reaching 61 per cent in 2019.
[24] To give a sense of the extent of phenomenon, in 2019 services accounted in Germany for 56 per cent of value added and 69 per cent of investment in fixed assets.

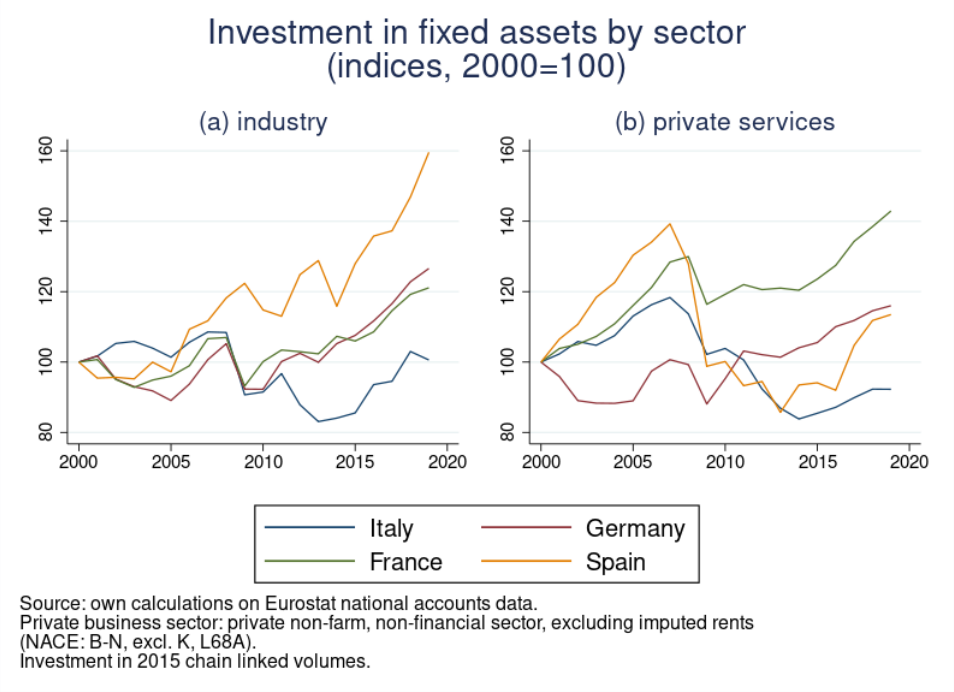
Figure 22



Source: own calculations on Eurostat national accounts data.
Private business sector: private non-farm, non-financial sector, excluding imputed rents (NACE: B-N, excl. K, L68A).
Investment and value added at current prices.
(1) Sector's investment share over sector's value added share. A value larger than one indicates that the average propensity to invest (investment-to-value added ratio) for the sector is larger than for the country's private business sector.

Sectors' investment trends differ substantially across countries and over time (Figure 23). The aggregate positive dynamics of investment observed since 2014 in all countries is the result of very different sectoral trends: between 2014 and 2019, investment cumulative growth was positive and sustained in the industrial sector, while it was much weaker in services (Table 7). In both sectors, Italy's investment dynamics were in line with those of Germany, where, however, the negative impact of the Great Recession had been milder and short-lived.

Figure 23



Source: own calculations on Eurostat national accounts data.
Private business sector: private non-farm, non-financial sector, excluding imputed rents (NACE: B-N, excl. K, L68A).
Investment in 2015 chain linked volumes.

Table 7

Average annual growth rate of investment in fixed assets (1) *(percentage points)*				
	Italy	**Germany**	**France**	**Spain**
		(a) industry		
2000-2007	1.17	0.10	0.92	1.58
2007-2014	-3.65	0.63	0.09	0.52
2014-2019	3.59	3.88	2.42	6.40
2000-2019	0.03	1.29	1.01	2.46
		(b) private services (2)		
2000-2007	2.41	0.10	3.57	4.73
2007-2014	-4.93	0.47	-0.92	-5.69
2014-2019	1.92	1.82	3.43	3.88
2000-2019	-0.42	0.69	1.88	0.67

Source: own calculations on Eurostat national accounts data. (1) Average annual growth rate of real investment in fixed assets. Investment at 2015 chain linked volumes. Annual growth rates are calculated as log-differences. Average annual growth rates are calculated as arithmetic means of annual growth rates. - (2) Private non-financial services, net of imputed rents (G-N, excl. K, L68A).

When looking at the years following the Great Recession within each macro-sector, a picture of large heterogeneity in investment dynamics emerges, both within and across countries (Table 8). Among services, investment grew more in Italy (relative to the other countries) in trade (G) and administrative and support service activities (N). These sectors jointly accounted for about 9 per cent of the private sector's investment and over 23 per cent of its value added in 2014

(about 13 and 38 per cent of the service branch's investment and value added, respectively). However, in the vast majority of service sectors, the country's investment growth performance was worse than in Germany, France and Spain. The sectors where Italy performed the worst among all countries considered account for about 48 per cent of private sector's investment and 23 per cent of its value added in 2014 (72 and 38 per cent of services' investment and value added, respectively).

Table 8

Italy's growth of investment in fixed assets, relative to major EU countries, 2014-2019

(percentage points)

sector		Italy			Italy's investment growth higher than		
		average investment growth rate (1)	share of investment in 2014 (2)	share of value added in 2014 (2)	Germany	France	Spain
B	mining and quarrying	-2.02	1.41	0.63	x		
C	manufacturing	3.78	23.42	25.46		x	
D	electricity, gas, steam and air conditioning supply	1.27	4.54	2.82			x
E	water supply; sewerage, waste management and remediation activities	10.88	1.40	1.63	x	x	x
F	construction	5.25	2.36	7.35			
G	wholesale and retail trade; repair of motor vehicles and motorcycles	7.46	5.97	18.51	x	x	x
H	transportation and storage	3.80	7.90	8.99		x	
I	accommodation and food service activities	1.26	1.69	6.04	x		
J	information and communication	0.54	7.73	5.91			
L (3)	real estate activities (net of imputed rents)	0.30	34.42	7.03			
M	professional, scientific and technical activities	-0.06	6.25	10.55			
N	administrative and support service activities	8.67	2.91	5.08	x	x	x

Source: own calculations on Eurostat national accounts data.

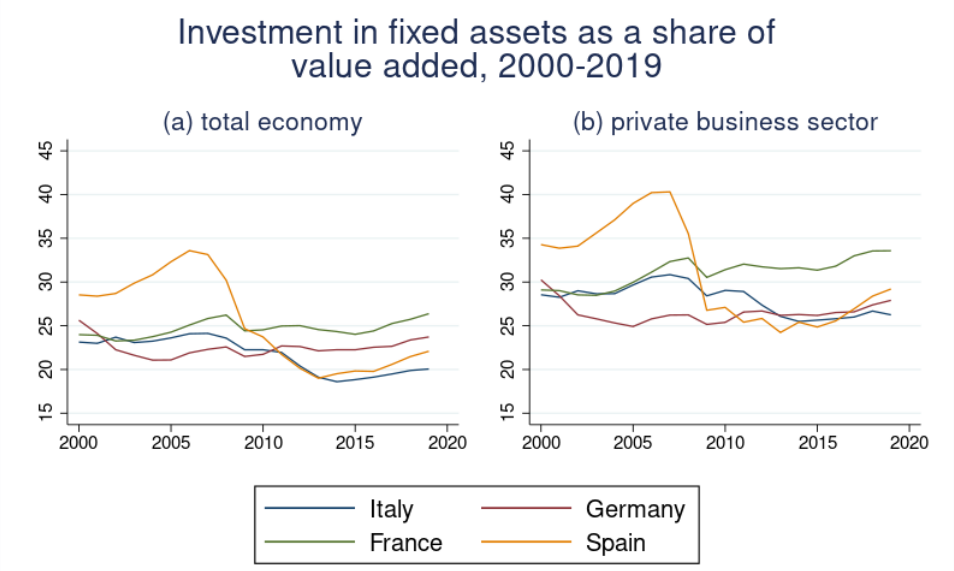
(1) Average annual growth rate of real investment in fixed assets. Investment at 2015 chain linked volumes. Annual growth rates are calculated as log-differences. Average annual growth rates are calculated as arithmetic means of annual growth rates. - (2) Investment and value added at current prices. - (3) The real estate sector (L) excludes imputed rents (L68A).

4.2.2. Average propensity to invest

As discussed above, the Great Recession and the sovereign debt crisis negatively impacted investment. The degree of persistence of the shock on investment is best seen by looking at the average propensity to invest, namely the share of value added destined to investment (Figure 24). Although in all countries a larger share of value added is devoted to investment in the private sector than in the total economy, the evolution of this ratio over time is common to the two aggregates.

In 2000, Italy, France and Germany had a similar share of investment over gross value added, both when looking at the entire economy and when focusing on the private sector, while Spain's ratio was higher in both sectors. In Germany, this share dropped sizably in the years up to 2005, and then remained roughly stable throughout the Great Recession (a slight increase has been occurring since the end of it). Conversely, in Italy and Spain, during the recession years, investment contracted more than output and the investment-to-value added ratio decreased drastically. In 2019 the indicator was still below its 2000 level, both in the overall economy and in the private sector. France is the country where investment grew the most between 2000 and 2019 (see section above) and the only country where the ratio between investment and value added was higher in 2019 than in 2000.

Figure 24

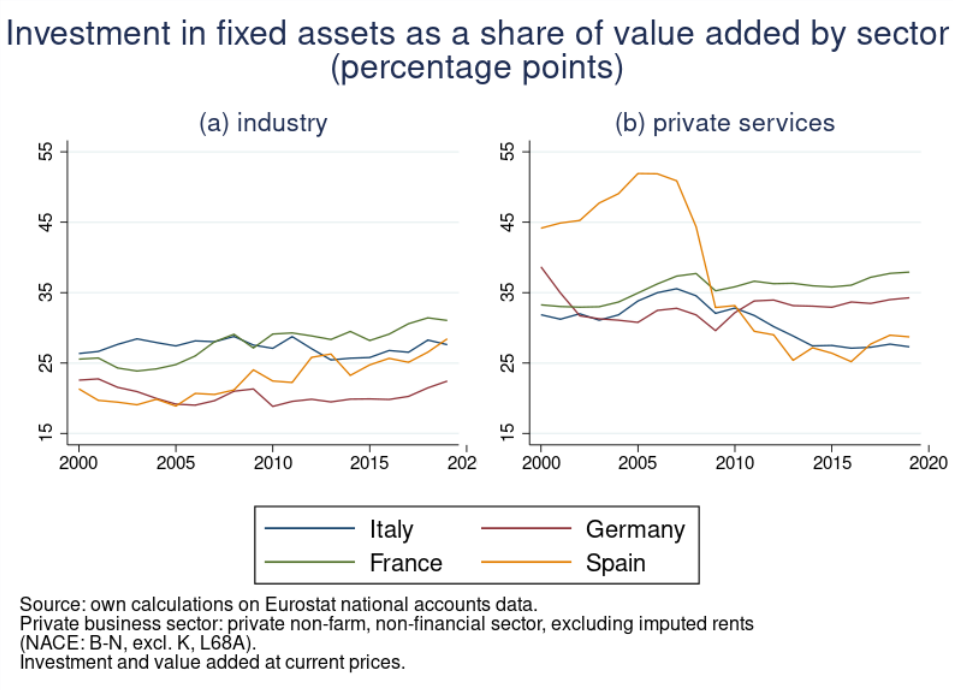


Source: own calculations on Eurostat national accounts data.
Total economy: all NACE activities.
Private business sector: private non-farm, non-financial sector, excluding imputed rents (NACE: B-N, excl. K, L68A).
Investment and value added at current prices.

In all countries, the share of value added devoted to investment was larger in services than in the industrial sector throughout most of the period 2000-2019 (Figure 25). In Italy and Spain, the Great Recession, however, affected disproportionally more the indicator in the service sector. In fact, in Italy the latter sector's investment-to-value added ratio declined considerably

since the 2007 financial crisis, and especially between 2011 and 2014. In the following years, investment as a share of value added remained constant in the service sector and slightly increased in the industrial one.[25] As of 2019, in Italy and Spain, this share was roughly the same for the industrial and the service sectors; in Germany and France, on the contrary, the service sector kept registering higher values of the indicator than the industrial sector.

Figure 25



Source: own calculations on Eurostat national accounts data.
Private business sector: private non-farm, non-financial sector, excluding imputed rents (NACE: B-N, excl. K, L68A).
Investment and value added at current prices.

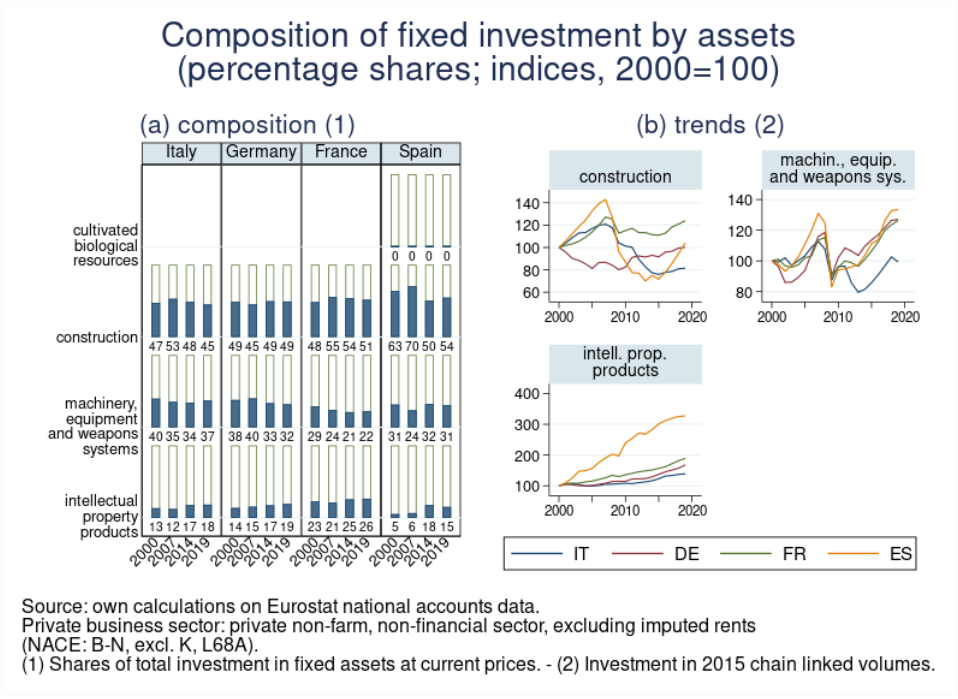
4.2.3. Composition and trends of investment by type of assets

The composition of private sector investment by asset type in Germany and Italy looks very similar (Figure 26, panel a): about half of investment in fixed assets is made of investment in construction, about one third is accounted for by investment in machinery and equipment and the remaining part is investment in intellectual property. Compared to Germany and Italy, France displays a smaller share of machinery and equipment and a higher share of intellectual property products; Spain has a lower intellectual property share and a much larger construction share.[26] Except for Spain, the share of construction over total investment in fixed assets has stayed roughly constant over time. In all countries, the weight of intellectual property products on total investment in fixed assets has been increasing over time. The Great Recession had different effects on the accumulation of different types of assets (Figure 26, panel b). In particular, in contrast with other types of assets, the recession did not stop the accumulation of intellectual property products in any country: investment in these assets increased throughout

[25] Net of the real estate sector, the share of investment over value added is lower in services than in the industrial sector in all countries, but the time trend is confirmed, although with smaller magnitude.
[26] The construction sector in Spain is much larger than in other countries. It accounts for 10.0 per cent of private sector's value added in 2019, as opposed to 6.8 in Italy, 7.2 in Germany, 9.3 in France.

the 2000-2019 period. In Italy, the level of investment in intangibles was about 40 per cent higher than in 2000, less than the other countries. Italy was the country where investment in construction and machinery was hit the most by the double-dip recession. By 2014, investment in machinery and equipment had returned to the 2000 level in all countries but Italy. Moreover, as of 2019, it was the only country where investment in construction was still below its 2000 level.

Figure 26



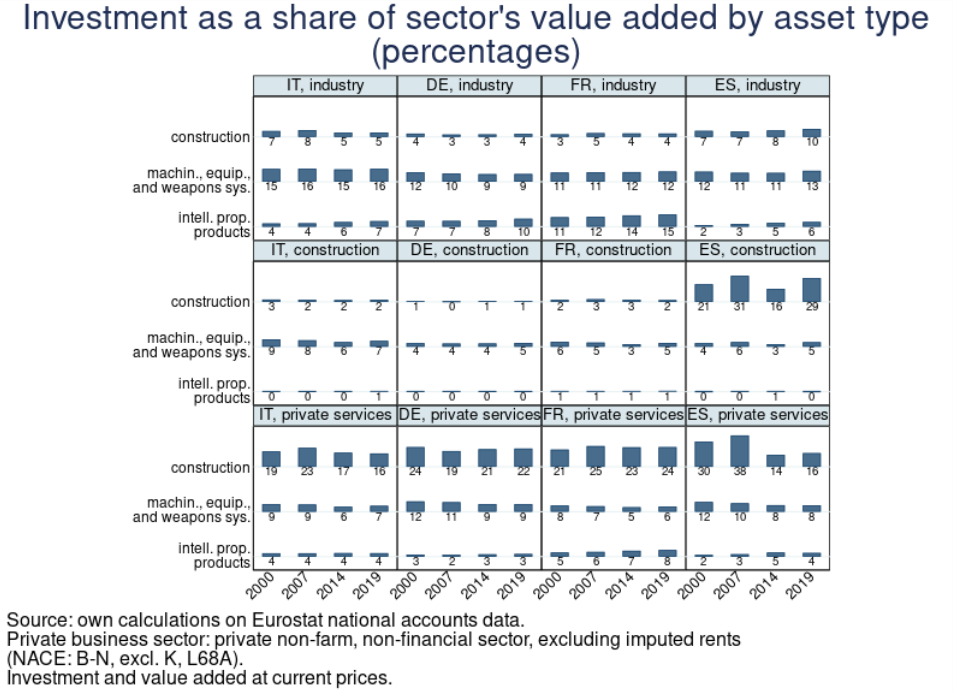
Source: own calculations on Eurostat national accounts data.
Private business sector: private non-farm, non-financial sector, excluding imputed rents (NACE: B-N, excl. K, L68A).
(1) Shares of total investment in fixed assets at current prices. - (2) Investment in 2015 chain linked volumes.

At the sectoral level, there are systematic differences in investment composition, but within each sector composition only changes slowly over time (Figure 27). Sectors differ by main type of asset (machinery and equipment for the industry and construction sectors;[27] construction for the market services sector), as well as by the relevance of investment in intellectual property products, whose weight is higher in the industry sector than in construction and services and it is the asset category where the most striking cross-country differences emerge. Investment in intellectual property products increased over time in all sectors, especially in the industrial one. In 2019, the share of value added devoted to this kind of investment in the industrial sector was about 7 per cent in Italy and 10 per cent in Germany and constituted 24 per cent of the overall investment in fixed assets in the sector in Italy and 43 in Germany. Conversely, in the service sector, investment in intangibles accounts for about the same share of value added in both countries, but its relative weight is larger in Italy (15 per cent, vis-à-vis 9 per cent in Germany in 2019). Intellectual property products play the largest role in France, both in terms of shares of value added and shares of overall investment in fixed assets: in France, in 2019 intangibles

[27] Also in this case, Spain is an exception, due to the large relevance of investment in construction performed by the construction sector itself.

constituted almost half of the investment in the industrial sector and over a fifth in the services sector, the highest shares for all sectors among all comparison countries.

Figure 27



Source: own calculations on Eurostat national accounts data.
Private business sector: private non-farm, non-financial sector, excluding imputed rents (NACE: B-N, excl. K, L68A).
Investment and value added at current prices.

5. Conclusions

The dynamics of labour productivity in Italy have been sluggish relative to other countries, even in a context of global slowdown in productivity growth. The weak performance of productivity growth in Italy, particularly in the years leading up to the Great Recession, has been the main cause of output growth differentials with the other major Euro area economies.

However, it's important to note that there have been some slightly positive developments in recent years. The period from 2014 to 2019 saw a modest increase in labour productivity growth, primarily driven by the business sector and due to TFP growth, as the cleansing effect of the recession played a role in reallocating resources toward more productive firms. This recovery, alongside a slowdown in other countries, led to narrowing of cross-country productivity growth gaps.

Among the several determinants of labour productivity growth identified in the literature, the present study focused on sector performance and capital accumulation.

In the private sector, productivity growth varies across sectors, with the industry sector outperforming market services in all countries. Notably, some manufacturing sectors in Italy, which are also significant in terms of labour and output shares, experienced the highest productivity growth among all countries considered during the 2014-2019 period. These sectors are often highly exposed to international trade. In contrast, productivity growth in services has

been stagnant in Italy over the 2000-2019 period. However, differences in the countries' sector composition play a very limited role in explaining cross-country differences in productivity growth, as the major differences lie in within-sector productivity growth rates.

Investment is widely regarded as essential to improving labour productivity. Among the different types of assets, intangibles, such as intellectual property products, are particularly relevant for productivity dynamics. The financial crisis and the Great Recession had a significant impact on investment in all countries, with investment in intellectual property products being the exception, steadily increasing throughout the 2000-2019 period. In Italy and Spain, investment took longer to recover. There are both cross-country and cross-sector differences in investment dynamics and in asset composition, although post-crisis investment dynamics were more favourable in the industrial sector in all countries but France, where the recovery was stronger in market services. Investment in intangible assets is closely related to innovation capabilities and is most relevant in the industrial sector. Cross-country differences in these types of assets favour France, where this kind of investment represents a very sizable share of overall investment in fixed assets.

In summary, Italy has faced challenges in terms of productivity growth, but the aggregate modest dynamics conceal a large sectoral heterogeneity. Recent improvements, particularly in certain manufacturing sectors highly exposed to international trade, provide some optimism. While investment was deeply impacted by the financial crisis and recession, it shows signs of recovery, especially in the industrial sector. Additionally, investment in intangibles, deeply linked to innovation capabilities and digitalization, has been growing even during the recession period. However, the relevance of such a kind of investment is in Italy still below what observed is in Germany and especially in France.

Appendix 1

The following expression holds for output:

$$Y_t = \frac{Y_t}{H_t} \cdot \frac{H_t}{L_t} \cdot \frac{L_t}{N_t} \cdot \frac{N_t}{P_t} \cdot P_t$$

where: Y_t = real output, H_t = hours worked, L_t = workers, N_t = working age population (15-64 years old), P_t = population. As a result: Y_t/ H_t = (hourly) labour productivity, H_t/ L_t = hours worked per worker, L_t/ N_t = employment rate, N_t/ P_t = share of working age population.

Taking logs and calculating the derivative of the above expression with respect to time (ignoring time subscript to limit notation burden), one can express the relationship in terms of growth rates, obtaining equation (1):

$$g_Y = g_{Y/H} + g_{H/L} + g_{L/N} + g_{N/P} + g_P \quad (1)$$

In order to further decompose the growth rate of labour productivity, assume a Hicks-neutral technology production function:

$$Y_t = A_t F(K_t, H_t)$$

Taking logs of the above expression and calculating its derivative with respect to time, one obtains:

$$g_Y = g_A + \frac{F_K}{F} \cdot \frac{dK}{dt} + \frac{F_H}{F} \cdot \frac{dH}{dt} = g_A + \frac{F_K K}{F} \cdot g_K + \frac{F_H H}{F} \cdot g_H$$
$$= g_A + \alpha g_K + \beta g_H$$

where α and β are the output elasticity with respect to capital and labour, respectively, and g_A is TFP growth.[28]

Under the assumption of perfect competition in factor markets,[29] $AF_K=r$ e $AF_H=w$, where r is the rate of return on capital (user cost = price at which the investor is indifferent between buying or renting the capital good) and w is hourly wage. Therefore, $\alpha=rK/Y$ is the capital share of income and $\beta=wH/Y$ is the labour share.

If one assumes constant returns to scale (which imply perfect competition in the final good market), $\alpha+\beta=1$. The above expression becomes:

$$g_Y = g_A + \alpha g_K + (1-\alpha) g_H$$
$$g_Y - g_H = g_A + \alpha(g_K - g_H)$$

[28] In the neoclassical growth model, TFP growth only measures the part of technological change that is not directly embedded in the inputs. In practice, TFP growth measures include all those elements which are not captured by measurements of productive inputs, such as: variations in organizational structures and other intangible investments, improvements in input quality and changes in the input quality composition, scale economies, externalities and business cycle effects (through cyclicality in the degree of capital utilization). See Timmer et al. (2010).

[29] Neoclassical growth models assume perfect competition in factor markets. This assumption implies that output elasticity with respect to capital (labor) equals the share of national income received by capital (labor). This equivalence is exploited in the estimation of output elasticities with respect to inputs by means of national accounts data.

$$g_{Y/H} = g_A + \alpha g_{K/H} \quad (2)$$

The last expression is equation (2).

Labour productivity growth can be therefore decomposed in: (a) a component depending on output elasticity with respect to capital (in turn equal to capital share) and capital deepening (growth of quantity of capital available per hour worked); (b) TFP growth.

Appendix 2

A. Nominal labour productivity and real productivity at previous year prices

When evaluated in nominal or previous year prices terms, aggregate value added can be expressed as the sum of sectoral value added:

$$Y_t^K = \sum_i Y_{it}^K \tag{1}$$

Where *i* denotes the sector and *t* denotes time. The above expression holds both when value added is evaluated at current prices (K=CP) and when it is evaluated at previous year prices (K=PYP).

By definition, (aggregate) labour productivity is:

$$\Phi_t = \frac{Y_t}{H_t} \tag{2}$$

Where Y_t is value added (at current or previous year prices) and H_t is hours worked.

For the case of nominal labour productivity and real productivity at previous year prices, substituting expression (1) into (2) and multiplying and dividing by sectoral hours worked H_{it}, yields:

$$\Phi_t^K = \frac{\sum_i Y_{it}^K}{H_t} = \sum_i \frac{Y_{it}^K}{H_{it}} \cdot \frac{H_{it}}{H_t} = \sum_i \varphi_{it}^K h_{it} \tag{3}$$

Where $\varphi_{it}^K = Y_{it}^K / H_{it}$ is sector *i*'s labour productivity (K=CP,PYP) and $h_{it} = H_{it}/H_t$ is the sector's weight in terms of hours worked.

Labour productivity at current or previous year prices can therefore be expressed as the weighted average of sectors' labour productivities.

B. Real labour productivity at chain linked values

According to the SEC2010 national accounts standards, real value added is calculated using chain linked indices.

The procedure entails a sequence of steps:

a. Construct a rolling basis quantity index for each two consecutive years of the series:

$$Q_{t,t-1} = \frac{Y_t^{PYP}}{Y_{t-1}^{CP}} \tag{4}$$

Where $Q_{t,t,1}$ is the quantity index between time *t-1* and *t*, Y_t^{PYP} is value added at time *t* evaluated at previous year prices, and Y_{t-1}^{CP} is value added at time *(t-1)* evaluated at current prices. Notice that both the numerator and the denominator are evaluated at *(t-1)* prices; this ensures that the index only captures changes in quantity between *(t-1)* and *t*.

b. Concatenate annual rolling basis indices in order to obtain the cumulative quantity index. The chain linked index between time *0* and time *t* is:

$$I_{t,0}^{C} = \prod_{j=1}^{t} Q_{j,j-1} = I_{t-1,0}^{C} Q_{t,t-1} \tag{5}$$

c. Set a reference year *b*, that will be the basis for the monetary valuation of real value added, and normalize the chain linked index by its value in the reference year:

$$I_{t,b} = \frac{I_{t,0}^{C}}{I_{b,0}^{C}} \tag{6}$$

d. Calculate real value added in chained linked volumes as the product of the normalized index and the reference year's nominal value added evaluated at current prices:

$$Y_t^{CL} = Y_b^{CP} I_{t,b} \tag{7}$$

In order to highlight how sectors' value added contribute to aggregate real value added, first substitute (6) and (5) into (7) to obtain:

$$Y_t^{CL} = Y_b^{CP} \frac{\prod_{j=1}^{t} Q_{j,j-1}}{\prod_{j=1}^{b} Q_{j,j-1}} \tag{8}$$

Notice that the aggregate rolling basis quantity index $Q_{j,j-1}$ can be expressed as a weighted average of sectors' indices. In fact, substituting (1) into the numerator of expression (4) and multiplying and dividing by Y_{ij-1}^{CP}, yields:

$$Q_{j,j-1} = \frac{\sum_i Y_{ij}^{PYP}}{Y_{j-1}^{CP}} = \sum_i \frac{Y_{ij}^{PYP}}{Y_{ij-1}^{CP}} \cdot \frac{Y_{ij-1}^{CP}}{Y_{j-1}^{CP}} = \sum_i Q_{i(j,j-1)} y_{ij-1}^{CP} \tag{9}$$

Which is the weighted average of sectors' chain linked indices, with weights equal to the sectors' share of previous year value added, evaluated at current prices ($y_{ij-1}^{CP} = Y_{ij-1}^{CP}/Y_{j-1}^{CP}$).

Using (1) and (9) in expression (8) for real value added implies that the latter can be rewritten as:

$$Y_t^{CL} = \sum_i Y_{ib}^{CP} \cdot \left\{ \frac{\prod_{j=1}^{t} \left[\sum_i Q_{i(j,j-i)} y_{ij-1}^{CP} \right]}{\prod_{j=1}^{b} \left[\sum_i Q_{i(j,j-i)} y_{ij-1}^{CP} \right]} \right\} \tag{10}$$

Expression (10) makes it clear that chain linked indices do not satisfy additivity: aggregate real value added is not the sum of sectors' real value added. Sector i's value added is indeed:

$$Y_{it}^{CL} = Y_{ib}^{CP} \left\{ \frac{\prod_{j=1}^{t} Q_{i(j,j-1)}}{\prod_{j=1}^{b} Q_{i(j,j-1)}} \right\} \tag{11}$$

Turning to productivity, aggregate real labour productivity is defined as:

$$\Phi_t^{CL} = \frac{Y_t^{CL}}{H_t} \tag{12}$$

Substituting expression (10) into (12), one gets:

$$\Phi_t^{CL} = \left\{ \frac{\prod_{j=1}^{t} \left[\sum_i Q_{i(j,j-i)} y_{ij-1}^{CP} \right]}{\prod_{j=1}^{b} \left[\sum_i Q_{i(j,j-i)} y_{ij-1}^{CP} \right]} \right\} \sum_i \frac{Y_{ib}^{CP}}{H_t} \tag{13}$$

Multiplying and dividing by H_{it}, equation (13) becomes:

$$\begin{aligned} \Phi_t^{CL} &= \left\{ \frac{\prod_{j=1}^{t} \left[\sum_i Q_{i(j,j-i)} y_{ij-1}^{CP} \right]}{\prod_{j=1}^{b} \left[\sum_i Q_{i(j,j-i)} y_{ij-1}^{CP} \right]} \right\} \sum_i \frac{Y_{ib}^{CP}}{H_{it}} \frac{H_{it}}{H_t} \\ &= \left\{ \frac{\prod_{j=1}^{t} \left[\sum_i Q_{i(j,j-i)} y_{ij-1}^{CP} \right]}{\prod_{j=1}^{b} \left[\sum_i Q_{i(j,j-i)} y_{ij-1}^{CP} \right]} \right\} \sum_i \frac{Y_{ib}^{CP}}{H_{it}} \, h_{it} \end{aligned} \tag{14}$$

From expression (11), sectoral real labour productivity is:

$$\varphi_{it}^{CL} = \frac{Y_{it}^{CL}}{H_{it}} = \frac{Y_{ib}^{CP}}{H_{it}} \left\{ \frac{\prod_{j=1}^{t} Q_{i(j,j-1)}}{\prod_{j=1}^{b} Q_{i(j,j-1)}} \right\} \tag{15}$$

The above expression implies:

$$\frac{Y_{ib}^{CP}}{H_{it}} = \varphi_{it}^{CL} \left\{ \frac{\prod_{j=1}^{t} Q_{i(j,j-1)}}{\prod_{j=1}^{b} Q_{i(j,j-1)}} \right\}^{-1} \tag{16}$$

Substituting (16) into (14), one obtains:

$$\Phi_t^{CL} = \left\{ \frac{\prod_{j=1}^{t} \left[\sum_i Q_{i(j,j-i)} y_{ij-1}^{CP} \right]}{\prod_{j=1}^{b} \left[\sum_i Q_{i(j,j-i)} y_{ij-1}^{CP} \right]} \right\} \sum_i \varphi_{it}^{CL} h_{it} \left\{ \frac{\prod_{j=1}^{t} Q_{i(j,j-1)}}{\prod_{j=1}^{b} Q_{i(j,j-1)}} \right\}^{-1} \tag{17}$$

Which can be rewritten as:

$$\Phi_t^{CL} = \sum_i \varphi_{it}^{CL} h_{it} \left\{ \prod_{j=1}^{t} \frac{\sum_i Q_{i(j,j-i)} y_{ij-1}^{CP}}{Q_{i(j,j-1)}} \right\} \left\{ \prod_{j=1}^{b} \frac{Q_{i(j,j-1)}}{\sum_i Q_{i(j,j-i)} y_{ij-1}^{CP}} \right\} \tag{18}$$

Therefore, when calculated in chained linked volumes, aggregate real labour productivity can be expressed as the weighted average of sectors' real labour productivity, but the weights are not simply the sectors' labour shares, as in the case of nominal productivity or real productivity calculated using (fixed) base year prices. In the case of real productivity calculated using chain linked indices, the labour share weights are corrected by two factors that take into account the concatenation and the choice of the reference year *b*.

C. Counterfactual real labour productivity

If we wanted to manipulate sectors' labour shares, e.g. in case we wanted to construct hypothetical scenarios where a country's sectoral composition (in terms of hours worked) is different from the observed one, it is most easily done by exploiting expression (3) for nominal productivity (or real productivity at previous year prices) and then convert it into real (chain linked) terms.

Using expression (3), counterfactual productivity (holding sectors' labour shares fixed to a given structure) is:

$$\overline{\Phi_t^K} = \sum_i \varphi_{it}^K \overline{h_\iota} \tag{19}$$

By using expression (2) and (19), counterfactual value added is:

$$\overline{Y_t^K} = \overline{\Phi_t^K} \cdot H_t = H_t \sum_i \varphi_{it}^K \overline{h_\iota} \tag{20}$$

One can use expression (20) to construct counterfactual value added both in current prices (K=CP) and in previous year prices (K=PYP). These counterfactual series can be then used to obtain a series of counterfactual real value added, by following the steps of the deflation procedure described above.

Finally, from the series of counterfactual real (chained linked) value added, one can calculate counterfactual real labour productivity:

$$\overline{\Phi_t^{CL}} = \frac{\overline{Y_t^{CL}}}{H_t} \tag{21}$$

As an alternative, we could have calculated the counterfactual value added in (20) holding not only labour shares, but also hours worked fixed:

$$\overline{\overline{Y_t^K}} = \overline{\Phi_t^K} \cdot \bar{H} = \bar{H} \sum_i \varphi_{it}^K \bar{h}_\iota \tag{22}$$

It turns out that the counterfactual labour productivity in (21) would be the same, regardless of the use of expressions (20) or (22).

To prove it, assume the use of expression (20) for counterfactual value added at current or previous year prices. Expression (4) implies:

$$Q_{t,t-1} = \frac{H_t \sum_i \varphi_{it}^{PYP} \bar{h}_\iota}{H_{t-1} \sum_i \varphi_{it-1}^{CP} \bar{h}_\iota} = \frac{H_t}{H_{t-1}} x_{t,t-1} \tag{23}$$

Where $x_{t,t-1}=\Sigma_i \varphi_{it}^{PYP} \bar{h}_i / \Sigma_i \varphi_{it-1}^{CP} \bar{h}_i$. Equations (5) and (6) become:

$$I_{t,0}^C = \frac{H_t}{H_0} \prod_{j=1}^{t} x_{j,j-1} \tag{24}$$

And

$$I_{t,b} = \frac{H_t}{H_b} \frac{\prod_{j=1}^{t} x_{j,j-1}}{\prod_{j=1}^{b} x_{j,j-1}} \tag{25}$$

Equations (25) and (20) imply that expression (7) becomes:

$$\begin{aligned} \overline{Y_t^{CL}} &= H_b \sum_i \varphi_{ib}^{CP} \bar{h}_\iota \cdot \frac{H_t}{H_b} \frac{\prod_{j=1}^{t} x_{j,j-1}}{\prod_{j=1}^{b} x_{j,j-1}} \\ &= H_t \frac{\prod_{j=1}^{t} x_{j,j-1}}{\prod_{j=1}^{b} x_{j,j-1}} \sum_i \varphi_{ib}^{CP} \bar{h}_\iota \end{aligned} \tag{26}$$

Finally, real labour productivity in (21) becomes:

$$\overline{\Phi_t^{CL}} = \frac{\overline{Y_t^{CL}}}{H_t} = \frac{\prod_{j=1}^{t} x_{j,j-1}}{\prod_{j=1}^{b} x_{j,j-1}} \sum_i \varphi_{ib}^{CP} \bar{h}_\iota \tag{27}$$

Which only depends on labour shares $\bar{h}_I$'s (both directly and through $x_{j,j-1}$), but not on the total level of hours worked, H_t.

Notice that if we wanted to construct counterfactual real labour productivity directly from expression (18), we would need to figure out which terms of the expression would be affected. The use of counterfactual labour shares would definitely affect (18) directly through h_{it}. It would also affect the expression indirectly through $Q_{i(j,j-1)}$. Adapting expressions (4) and (20) to a single sector *i*, $Q_{i(j,j-1)}$ can be written as:

$$Q_{i(j,j-1)} = \frac{Y_{ij}^{PYP}}{Y_{ij-1}^{CP}} = \frac{\varphi_{ij}^{PYP} H_{ij}}{\varphi_{ij-1}^{CP} H_{ij-1}} = \frac{\varphi_{ij}^{PYP} h_{ij} H_j}{\varphi_{ij-1}^{CP} h_{ij-1} H_{j-1}} = \frac{\varphi_{ij}^{PYP}}{\varphi_{ij-1}^{CP}} \cdot \frac{h_{ij}}{h_{ij-1}} \cdot \frac{H_j}{H_{j-1}} \tag{28}$$

From the above expression, it is evident that $Q_{i(j,j-1)}$ would be affected in counterfactual scenarios through the labour share $\bar{h}_I$ (as well as through the H_j/H_{j-1} ratio, in case counterfactuals are calculated using fixed hours worked, as in expression (22).

Additionally, expression (18) would be affected through the sector's share of value added y_{ij-1}^{CP}, since:

$$y_{ij-1}^{CP} = \frac{Y_{ij-1}^{CP}}{Y_{j-1}^{CP}} = \frac{\varphi_{ij-1}^{CP} H_{ij-1}}{\Phi_{j-1}^{CP} H_{j-1}} = \frac{\varphi_{ij-1}^{CP}}{\Phi_{j-1}^{CP}} h_{ij-1} \tag{29}$$

Finally, it can be showed that a sector's real labour productivity in chained linked volumes is not affected in counterfactual scenarios. To prove it, consider expression (15) for sector i's real labour productivity and use (28) to substitute for $Q_{i(j,j-1)}$:

$$\varphi_{it}^{CL} = \frac{Y_{it}^{CL}}{H_{it}} = \frac{Y_{ib}^{CP}}{H_{it}} \left\{ \frac{\prod_{j=1}^{t} Q_{i(j,j-1)}}{\prod_{j=1}^{b} Q_{i(j,j-1)}} \right\} = \frac{\varphi_{ib}^{CP} h_{ib} H_b}{h_{it} H_t} \left\{ \frac{\prod_{j=1}^{t} \frac{\varphi_{ij}^{PYP}}{\varphi_{ij-1}^{CP}} \cdot \frac{h_{ij}}{h_{ij-1}} \cdot \frac{H_j}{H_{j-1}}}{\prod_{j=1}^{b} \frac{\varphi_{ij}^{PYP}}{\varphi_{ij-1}^{CP}} \cdot \frac{h_{ij}}{h_{ij-1}} \cdot \frac{H_j}{H_{j-1}}} \right\} \tag{30}$$

Denoting $w_{i(j,j-1)}=\varphi_{ij}^{PYP}/\varphi_{ij-1}^{CP}$ and using the associative property of multiplication, it is possible to write the expression above as:

$$\varphi_{it}^{CL} = \frac{\varphi_{ib}^{CP} h_{ib} H_b}{h_{it} H_t} \left\{ \frac{\prod_{j=1}^{t} w_{i(j,j-1)}}{\prod_{j=1}^{b} w_{i(j,j-1)}} \cdot \frac{\prod_{j=1}^{t} \frac{h_{ij} H_j}{h_{ij-1} H_{j-1}}}{\prod_{j=1}^{b} \frac{h_{ij} H_j}{h_{ij-1} H_{j-1}}} \right\} \tag{31}$$

Notice that:

$$\prod_{j=1}^{t} \frac{h_{ij}H_j}{h_{ij-1}H_{j-1}} = \frac{h_{it}H_t}{h_{it-1}H_{t-1}} \cdot \frac{h_{it-1}H_{t-1}}{h_{it-2}H_{t-2}} \cdot \ldots \cdot \frac{h_{i1}H_1}{h_{i0}H_0} = \frac{h_{it}H_t}{h_{i0}H_0} \tag{32}$$

Hence, expression (31) reduces to:

$$\varphi_{it}^{CL} = \frac{\varphi_{ib}^{CP} h_{ib}H_b}{h_{it}H_t} \left\{ \frac{h_{it}H_t}{h_{ib}H_b} \cdot \frac{\prod_{j=1}^{t} w_{i(j,j-1)}}{\prod_{j=1}^{b} w_{i(j,j-1)}} \right\} = \varphi_{ib}^{CP} \left\{ \frac{\prod_{j=1}^{t} w_{i(j,j-1)}}{\prod_{j=1}^{b} w_{i(j,j-1)}} \right\} \tag{33}$$

Which does not depend on labour shares and is therefore the same both in the observed and counterfactual scenarios.

Therefore, if one would like to construct counterfactual aggregate real labour productivity in chained linked volumes directly from expression (18), it would be:

$$\overline{\Phi_t^{CL}} = \sum_i \varphi_{it}^{CL} \overline{h_\iota} \left\{ \prod_{j=1}^{t} \frac{\sum_i \bar{Q}_{i(j,j-i)} \bar{y}_{ij-1}^{CP}}{\bar{Q}_{i(j,j-1)}} \right\} \left\{ \prod_{j=1}^{b} \frac{\bar{Q}_{i(j,j-1)}}{\sum_i \bar{Q}_{i(j,j-i)} \bar{y}_{ij-1}^{CP}} \right\} \tag{34}$$

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