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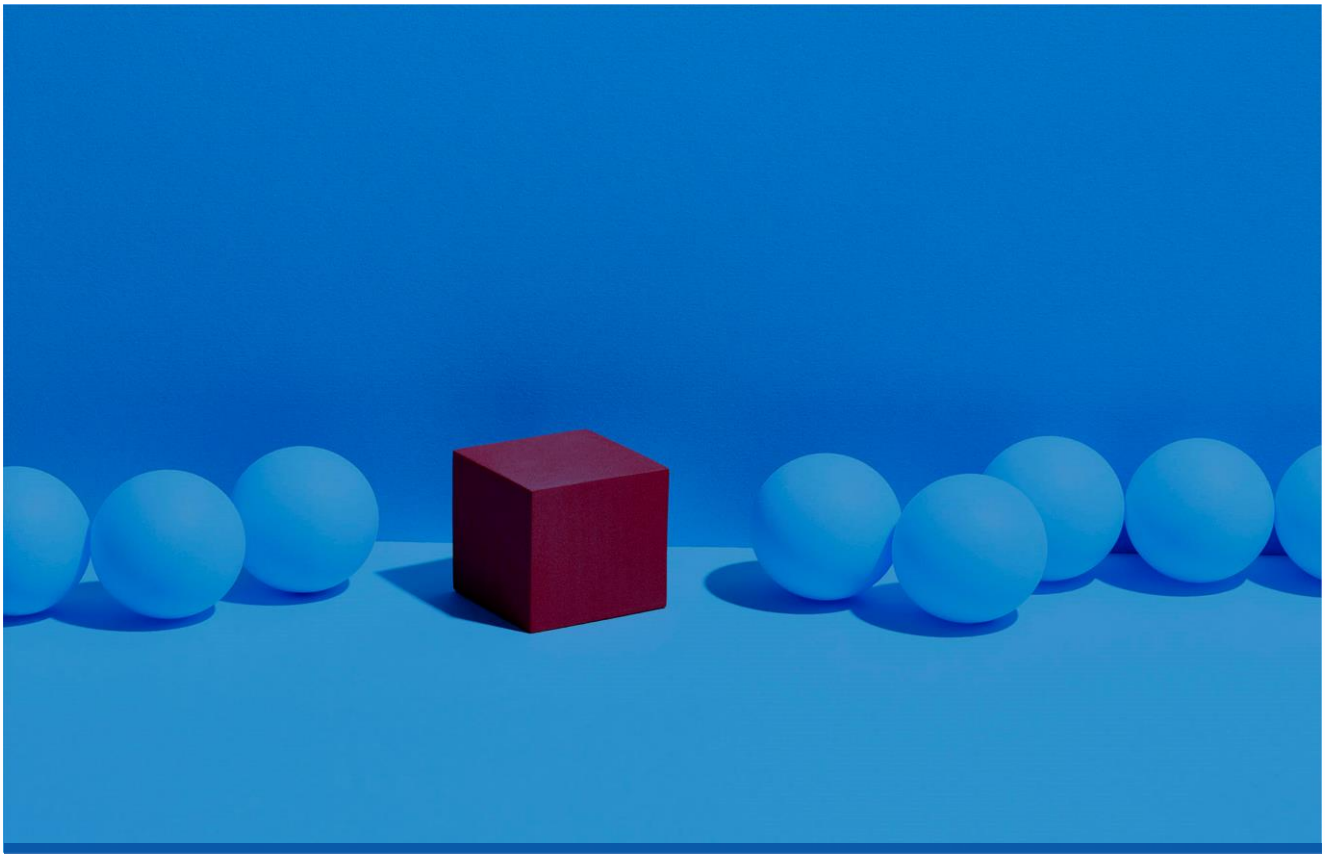
# IPR INTENSITY AND INDUSTRIAL DYNAMICS



August 2022

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# Acknowledgements

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# Executive Summary

Since 2013 the EUIPO, through the European Observatory on Infringements of Intellectual Property Rights, and the European Patent Office (EPO) have been conducting regular assessments of the intellectual property rights (IPR) intensity of EU industries. Those studies have quantified the contribution of IPR intensive industries in the EU economy in terms of employment, share of GDP and the EU external trade. The rich datasets produced for those studies are used in the present report to gain deeper insights into the dynamic evolution of EU industries in recent years, focusing on the possible associations between those dynamic changes and IPR intensity.

These analyses show that the use of IPR is becoming more widespread across the EU economy. The ownership of IPR is still highly concentrated within IPR intensive industries, especially in the case of patents and designs. However, the share of IPR attributable to non-IPR intensive industries has grown between 2004 and 2014. Many industries have grown in IPR intensity, but the intensity in non IPR-intensive industries has grown faster than that in in IPR-intensive ones.

IPR ownership has been traditionally thought to be concentrated in the manufacturing industries. Manufacturing is still responsible for a majority of patents and designs filings. However, the share of manufacturing in IPR filings has declined in recent years. Although manufacturing is still the biggest trade mark filing sector, its share represents only a third of 2010-2014 filings. Trade marks are by far the most versatile IPR, widely used across the whole EU economy.

In general, IPR-intensive industries are more productive than non-IPR-intensive ones. The productivity differences between those two groups of industries are higher in the case of services and trade sectors than in manufacturing. Moreover, with one exception of design-intensive manufacturing industries, the correlation between IPR intensity and productivity is positive. The negative relationship between intensity of design use and productivity in manufacturing could be an indication that design rights may be an especially important form of IP protection in more traditional and less productive industries. On the other hand, design-intensive manufacturing industries were characterised by the highest productivity growth among all IPR-intensive groupings in manufacturing between 2011 and 2017.

The analysis of the productivity dynamics indicates that IPR-intensive industries increase their productivity more rapidly than non-IPR intensive industries. The difference in productivity growth rates between IPR non-intensive and IPR-intensive industries is however smaller than in the productivity levels. In some industry groupings, such as the manufacturing and trade sectors, the productivity increase reflects an increase of value added coupled with a reduction in the number of employees.

Analysis of the business demography data indicates that the firm birth rates are in general lower in IPR-intensive industries than in non-IPR intensive ones in the manufacturing sector. On the other hand, IPR-intensive service industries are characterised by a higher firm birth rate than non-IPR intensive service industries. Moreover, whereas the correlation rate between firm birth rates and IPR intensity is in general weakly positive in service industries, it is negative in the case of manufacturing. This could indicate that there are relatively high barriers to entry in IPR-intensive manufacturing sectors.

These trends are also evidenced by the generally positive net business population growth in the service sector, which is higher in the case of IPR-intensive industries than in the non-IPR intensive ones. In manufacturing, IPR-intensive industries are characterised by negative net business population growth between 2013 and 2018—that is, the number of firms is declining. It contrasts, non-IPR intensive manufacturing industries have seen slightly positive rates of net business population growth. Survival rates do not seem to be affected by the IPR-intensity of industries to any significant degree.

Finally, the analysis of the rate of emergence of high-growth firms (HGF) leads to the conclusion that, between 2014 and 2018, HGF tended to appear more frequently among various groups of IPR-intensive industries than among non-IPR intensive ones. The rate of HGF emergence was highest among the patent-intensive industries in the manufacturing and services sectors.

The results confirm previous findings from academic research. Firms' innovation activity has been found to be important factor contributing to the increase of productivity. A higher innovation rate also increases the chance for exceptional performance. Since higher innovation is associated with higher IPR intensity, IPR intensive industries are in general more productive and are characterised by a higher share of high-growth firms.

Recent academic literature also investigates the relationship between intangible assets, including IPR, and market concentration. The results reported in the present study indicate that IPR intensity may lead to different industry dynamics in manufacturing and services. Higher IPR intensity may be associated with lower industry dynamism (i.e., fewer new firms) in the manufacturing sector but may signal higher industrial vitality and new market opportunities leading to higher entry rates in the service sector. Due to data and methodological limitations, those conjectures should be treated as preliminary, but they provide interesting perspectives for future research.

# 1 Introduction

Since 2013 the EUIPO, through the European Observatory on Infringements of Intellectual Property Rights, and the European Patent Office have conducted three EU-wide studies focusing on the use of intellectual property rights (IPR) in the EU economy.

By combining the information stored in IPR registries with demographic and financial information on IPR owners, those studies enabled, for the first time, a deeper analysis of the patterns of IPR usage by EU industries. The studies employed a transparent indicator that made it possible to compare IPR intensity between different industries, namely the number of filings per 1 000 employees. It allowed not only the calculation of IPR intensity in narrowly defined sectors of the EU economy, but also helped distinguish those industries that use IPR intensively from those that do not.

The combination of information stored in the IPR registries with demographic data of IPR system users and Eurostat statistics made it possible to calculate, for the first time, the contribution that IPR-intensive sectors make to the European economy. This was done in three successive studies in 2013, 2016 and 2019. These studies are referred to as 'industry-level IPR contribution studies.

However, the data gathered for those studies allow a much deeper analysis of the characteristics of IPR-intensive industries that distinguish them from industries that do not make intensive use of IPR. The main objective of the present report is to analyse possible differences between IPR-intensive and non-IPR-intensive sectors by comparing the values of several economic indices and their dynamic evolution. This report also explores possible associations between the economic indices and IPR intensity.

Section 2 describes the data and preparation methods. Section 3 is the core of the report. It begins with the evolution of IPR filings in the last 12 years and an analysis of the dynamic changes in the share of these filings that can be attributed to IPR-intensive and non-intensive industries and different sectors of the EU economy. Sections 3.3 and 3.4 explore the associations between IPR intensity and industries' productivity. Section 3.3 analyses the productivity differences between IPR-intensive and non-intensive sectors as well as correlations between productivity and IPR intensity. Section 3.4 takes a more dynamic look at the evolution of productivity indicators in two groups of industries, as well as the evolution of two indicators directly influencing productivity levels: value added and employment.

Section 3.5 compares IPR-intensive and non-intensive sectors through business demography indicators: changes in the number of firms and firm entry and exit rates. Section 3.6 compares the rate of emergence of high-growth firms in various types of IPR-intensive industries with those in non-IPR-intensive industries.

# 2 Data and methods

The research in this report is based on tabulations developed for successive reports on IPR-intensive industries and the economic performance of the European Union. These tabulations could be used almost without adaptation to analyse the productivity, value added, and employment indicators presented in Sections 3.3 and 3.4. In these cases, both IPR intensity and productivity indicators were derived from the same Eurostat Structural Business Statistics (SBS) data. The only adaptations necessary were caused by the differences in SBS data availability at 4-digit NACE[1] class level in different years. These adaptations are described in the Annex.

As the Eurostat data on business demography is less detailed than SBS statistics, it was not possible to use tabulations developed for reports on IPR-intensive industries and the economic performance of the European Union directly. Data preparation for the analyses in Section 3.5 therefore consisted of IPR data aggregation to the industry groupings that reflected Eurostat's schema for business demography statistics. Subsequently, IPR intensities were computed for these new industry groupings. IPR intensity status was determined using intensity thresholds corresponding to the 2013 study, namely: 3.16 trade marks per 1 000 employees, 1.61 designs per 1 000 employees and 0.69 patents per 1 000 employees. The distribution of IPR between IPR-intensive and non-intensive industries in the new groupings generally corresponds to that between IPR-intensive and non-intensive industries in the original classifications.

For all industry groups, IPR intensity was determined using data on filings between 2004 and 2008, corresponding to the 2013 study. The main rationale for this choice was the possibility of observing

[1] NACE (*nomenclature statistique des activités économiques dans la Communauté européenne*) is the standard classification of economic activity in the EU, maintained by Eurostat. The most granular level of aggregation used in the IP contribution studies is the class (also called the 4-digit level). Classes are in turn aggregated into groups (3-digit level) and divisions (2-digit level). The highest level of aggregation is the section, denoted by a letter.

developments within IPR-intensive and non-IPR-intensive industries over a longer period. Therefore, although there were some minor changes in the composition of the two groups of industries between the 2013 and 2019 studies, these were not considered[2].

For the various types of analysis in the present study, the IPR intensity data has been merged with Eurostat statistics. The Annex contains a detailed description of the Eurostat tables used in the report.

In principle, the analysis in the report covers the whole population of EU industries. As the entire population and not a sample of industries is used, the report does not involve inferential analysis or statistical generalisations. Therefore, no tests of statistical significance were conducted. The variability of outcomes within different groups of industries is, however, illustrated with box plots. In the box plot diagrams, the median is marked with a solid line, while the box shows the range between the 1st quartile (bottom of the box) and the 3rd quartile (top of the box). The vertical lines emanating from the box show the interquartile range (the difference between the 3rd and the 1st quartile) multiplied by 1.5, while the dots above and below these lines denote outlier observations. Box plots illustrate simple mean and medians with equal weight attached to each industry.

# 3 Descriptive analysis of data

## 3.1 Evolution of IPR filings in recent years

Figure 1 presents the evolution of filings for IPR protection by entities based in EU Member States between 2008 and 2020[3]. As the absolute number of applications is different for each IPR, for ease of comparison, the annual number of applications has been scaled to the number of applications filed in 2008 for each IPR under analysis.

[2] Out of 324 industries that were found to be IPR-intensive in 2013, 94 % (i.e. 304) were considered IPR-intensive in the 2019 report as well. 29 industries were not considered IPR-intensive in the 2013 report but were found to be IPR intensive in 2019. Note that the number of IPR-intensive industries differs from the number reported in 2013 due to adaptations made to accommodate differences in data availability between 2013 and 2019; see the Appendix for further details.

[3] If not otherwise stated, the EU corresponds to the EU28 as it existed prior to 31 January 2020.

The figure clearly shows that, until 2017, the growth rate of design and patent applications was tied to the evolution of GDP. The growth rate of trade mark filings by EU entities was, however, much faster. The number of trade mark applications never declined during this period, not even in the aftermath of the financial crisis after 2008. The number of trade mark applications filed in 2020 was 75 % higher than in 2008. In 2020, patent filings were 9.5 % higher and registered designs 2 % higher than in 2008[4].

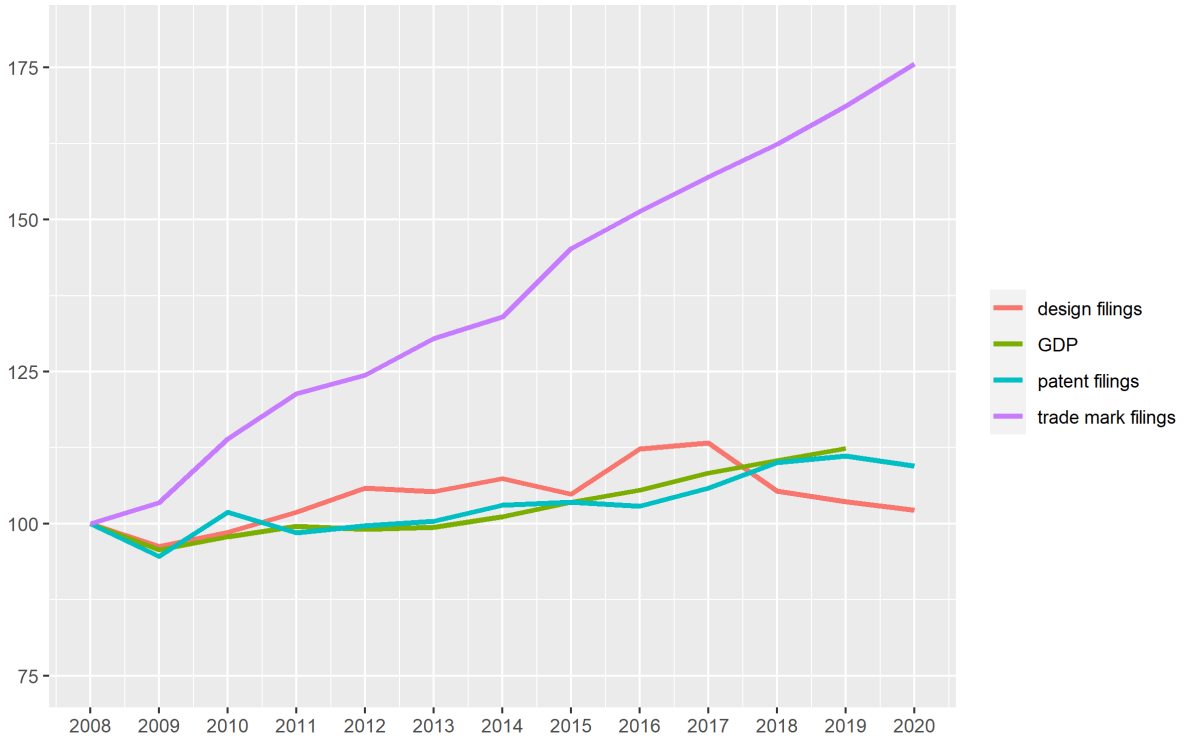


**Figure 1. Evolution of EU GDP and IPR filings by EU Member States between 2008 and 2020 (2008=100)**

Note: The figure shows the number of filings for each year compared to the 2008 level (2008=100) for each IP right. IPR filings data comprise filings by all entities based in the EU28 as of 30 January 2020.

## 3.2 Evolution of industry IPR intensities

The first step of the analysis was to investigate whether this growth in filing numbers was distributed equally among IPR-intensive and non-intensive industries. For this analysis, the data from two

[4] The separate report is planned to be published in 2022 to investigate recent trends in trade mark filings.

matching exercises conducted in 2013 and 2019 were compared ([5]). This data allows an analysis of the changes in IPR intensity from 2004 to 2008 and 2010 to 2014. For this purpose, the growth rate of intensity was calculated for each industry associated with patent, trade mark or design activity in both periods: 2004 to 2008, covered by the 2013 report, and 2010 to 2014, covered by the 2019 report[6].

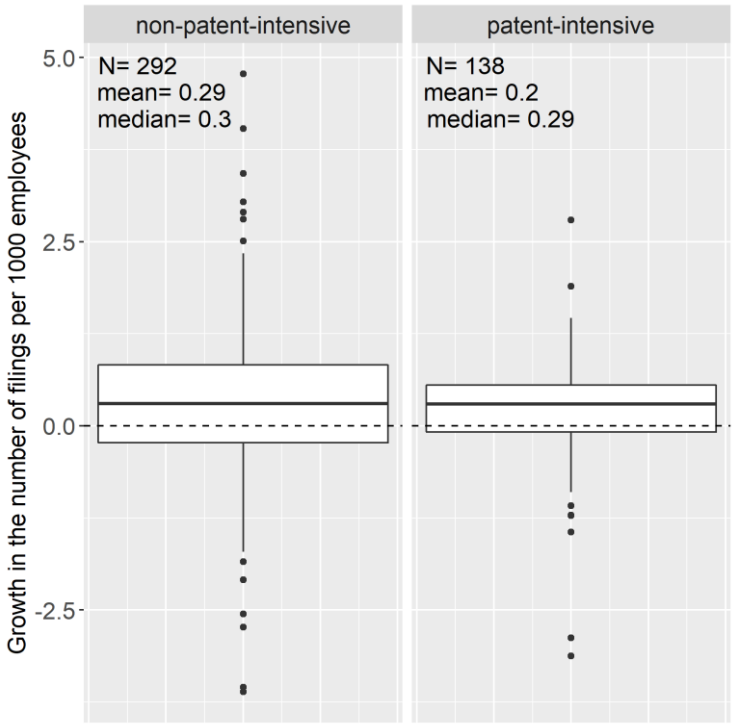


**Figure 2. Comparison of patent intensity growth rate for patent-intensive and non-intensive industries**

([5]) The recent trends in industry IPR intensities may be distorted by the repercussions of the COVID-19 pandemic, but the data under analysis does not cover this period.

([6]) The growth rate has been calculated as a difference of logarithms of mean value in patent, trade mark and design intensity, respectively, from 2004 to 2008 and 2010 to 2014.

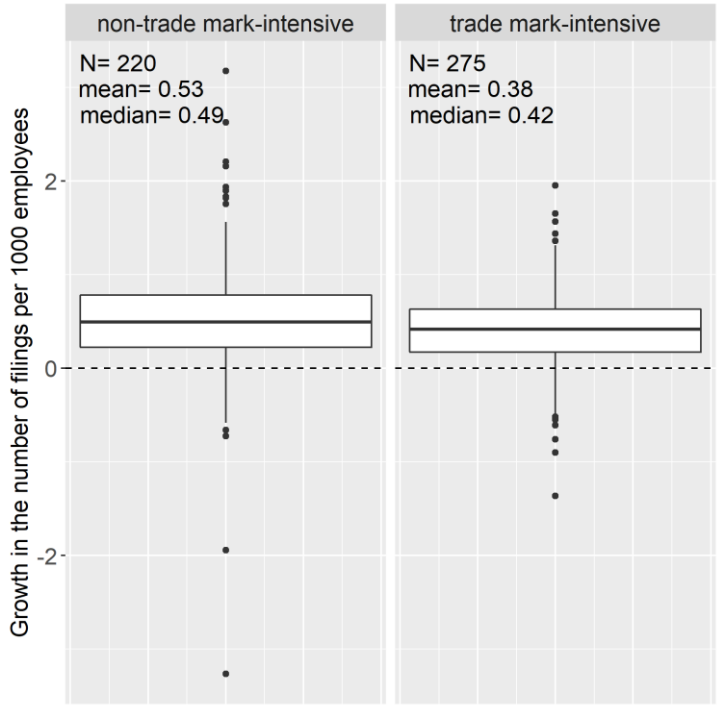


**Figure 3. Comparison of trade mark intensity growth rate for trade mark-intensive and non-intensive industries**

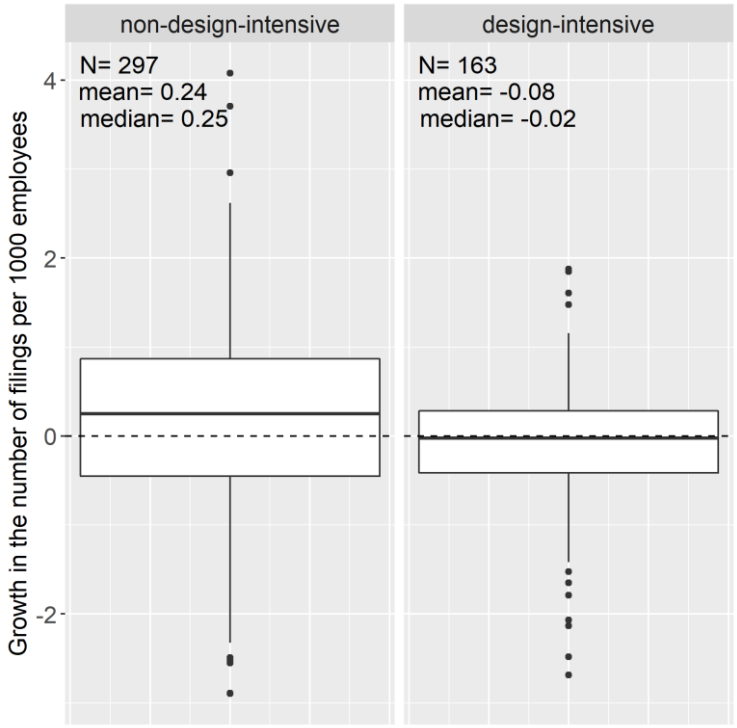


**Figure 4. Comparison of design intensity growth rate for design-intensive and non-intensive industries**

Note: Figures 2 through 4 present the distribution of the growth rates in the intensity of use of, respectively, patents, trade marks and designs in two periods, 2004 to 2008 and 2010 to 2014, for all NACE industries. The IPR intensity designation corresponds to the industry status calculated in the 2013 report.

Figures 2 through 4 show the distribution of IPR intensity growth rates within various groups of IPR-intensive industries compared with the group of industries that were not to use particular IPR intensively. The figures show the distribution (box plot) and information about the mean and median values of the patent, trade mark and design intensity growth rates. As can be seen in the box plots, IPR intensity grew more rapidly among the industries not found to be patent-, trade-mark- or design-intensive than in the industries that were found to be intensive users of those IPRs in the 2013 report. This difference is lowest in the case of patents, where the median growth rate is almost equal for patent-intensive and non-intensive industries, and the mean growth rate slightly higher for non-intensive industries. In the case of trade mark and design intensities, both mean and median growth rates for the non-intensive industries are higher than for the group of intensive industries. For design-intensive industries, the mean and median intensity growth rates were negative, which suggests that this group of industries filed relatively fewer applications in the second period.
This pattern of intensity growth results in shifts in the relative shares of IPRs applications that can be attributed to patent-, design- and trade-mark-intensive industries and to industries found not to intensively use these respective IPRs, as defined in the 2013 report.

Figure 5 shows that the distribution of all IPRs tends to be highly concentrated within IPR-intensive industries. This concentration was highest in the case of patents, where, from 2004 to 2008, patent-intensive industries were responsible for over 85 % of all patents filed. Design-intensive industries were associated with over 81 % of all designs filed within the same period. Trade marks are the IP right that seems most evenly distributed between intensive and non-intensive industries. Over 25 % of all the trade mark filings made between 2004 and 2008 were linked with industries that were found not to be trade-mark-intensive.

For all IPRs, the relative share of filings attributed to non-intensive industries from 2010 to 2014 is higher than from 2004 to 2008. This indicates that not only is the number of filings on the rise, but the use of IP rights is also becoming more widespread across the economy.

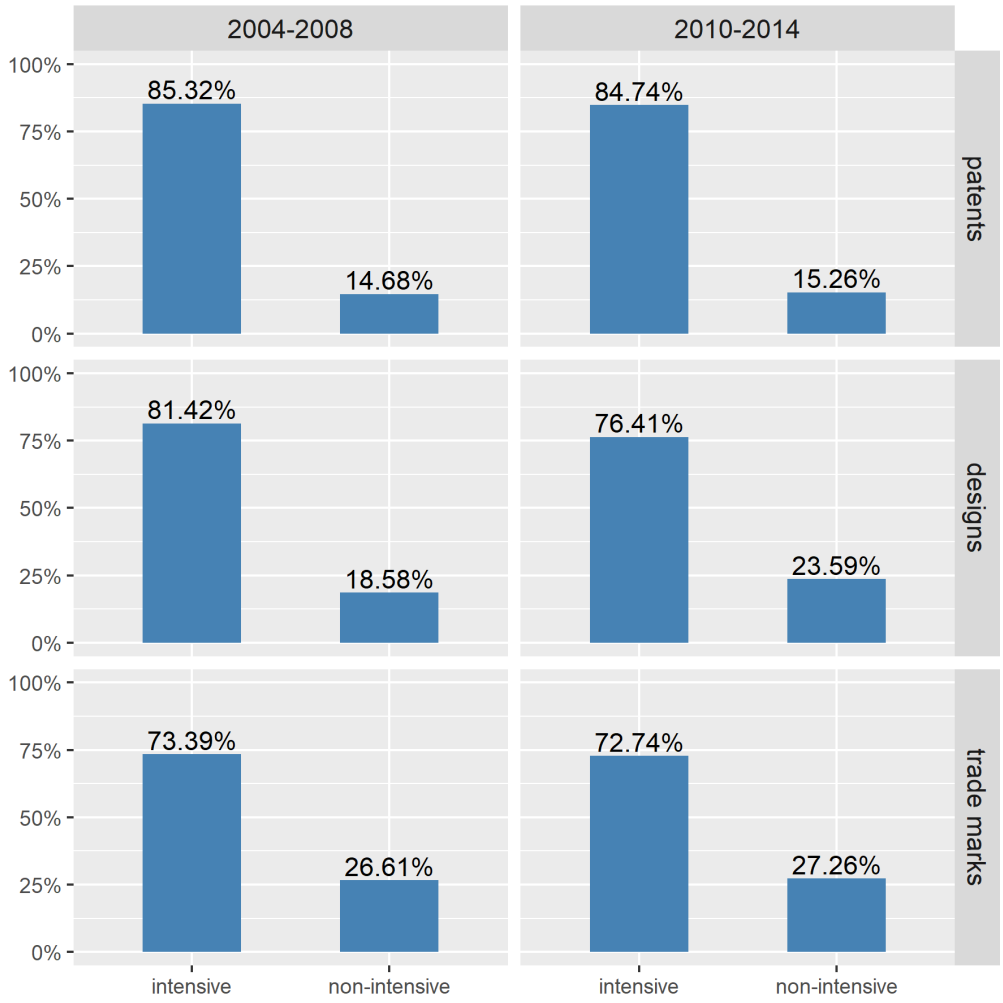


**Figure 5. Distribution of IP rights between IPR-intensive and non-intensive industries**

Note: the plots present the distribution of IPRs among the patent-, design- and trade-mark-intensive and non-intensive industries from 2004 to 2008 and from 2010 to 2014. The IPR intensity designation corresponds to the 2013 report (2004 to 2008).

Number of observations: patent-intensive (142), non-intensive (473); design-intensive (165), non-intensive (450); trade mark-intensive (279), non-intensive (336).

Figure 6 shows that the changes in the distribution of IPR also affect the spread of IPRs between various sectors of the EU economy. Traditionally, IPRs were thought to be the domain of manufacturing[7]. Figure 6 confirms the view that firms from the manufacturing sectors are dominant

([7]) In this report, the term 'manufacturing' refers to manufacturing, mining, electricity, gas, steam, air conditioning supply, water supply, sewerage, waste management and remediation activities.

filers of all IPRs. There are, however, important differences depending on the type of IPR. Whereas, for patents, firms representing manufacturing are responsible for over 70 % of all the filings, in the case of designs, manufacturing's share reaches 60 %. For trade marks, this sector accounts for approximately one third of filings. Firms representing services file approximately 18 % of patent applications and almost 30 % of trade marks. Entities active in the trade sector apply for approximately 25 % of designs and trade marks. From 2008 to 2010 and from 2010 to 2014, the share of IP rights associated with firms representing sectors other than manufacturing rose for all types of IPR.

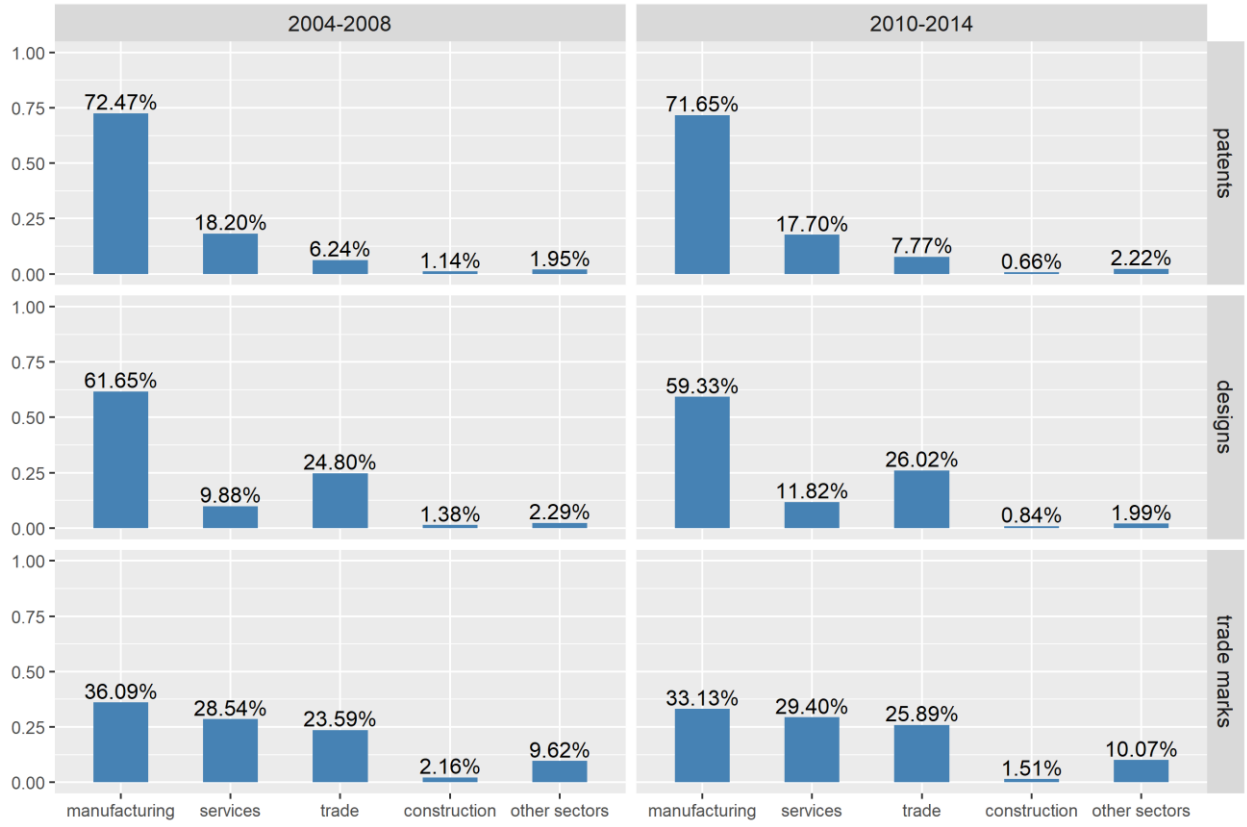


**Figure 6. Distribution of IP rights between the main sectors of the economy**

Note: the plots present the distribution of IPRs among various sectors of the EU economy in 2004 to 2008 and in 2010 to 2014.

Number of observations: manufacturing (262); services (121); trade (91); construction (22); other sectors (119).

These findings corroborate the recent academic literature, which argues that trade marks are a very versatile type of IPR, able to protect a much broader set of goods and services than patents or designs. Trade mark legislation does not stipulate strict requirements related to the novelty or

inventive step. Therefore, it may be particularly well suited to the needs of firms active in services (Schmoch and Gauch, 2009), cultural and creative industries (Castaldi, 2018), or to marketing products for which patent or design protection may not be available.

## 3.3 Productivity and IPR intensity

The IP Contribution studies show that IPR-intensive industries account for a higher share of GDP than of total employment. Those results suggest that IPR-intensive industries may be more productive (i.e. employees in those industries produce more value added than employees of non-IPR-intensive industries). This may be validated by analysing the Eurostat productivity statistics for IPR-intensive and non-intensive industries.

Figure 7 presents a series of box plots illustrating labour productivity for various industries, grouped by their IPR intensity status. The graphs show that, generally, IPR-intensive industries are more productive than their non-IPR-intensive counterparts. These differences are especially evident in the service and trade sectors. In the case of manufacturing, the only exception to this general pattern is the group of design-intensive industries, where mean productivity is lower than the mean productivity of non-IPR-intensive industries. In all other cases, both the mean and median values of labour productivity are higher for IPR-intensive than non-intensive industries.

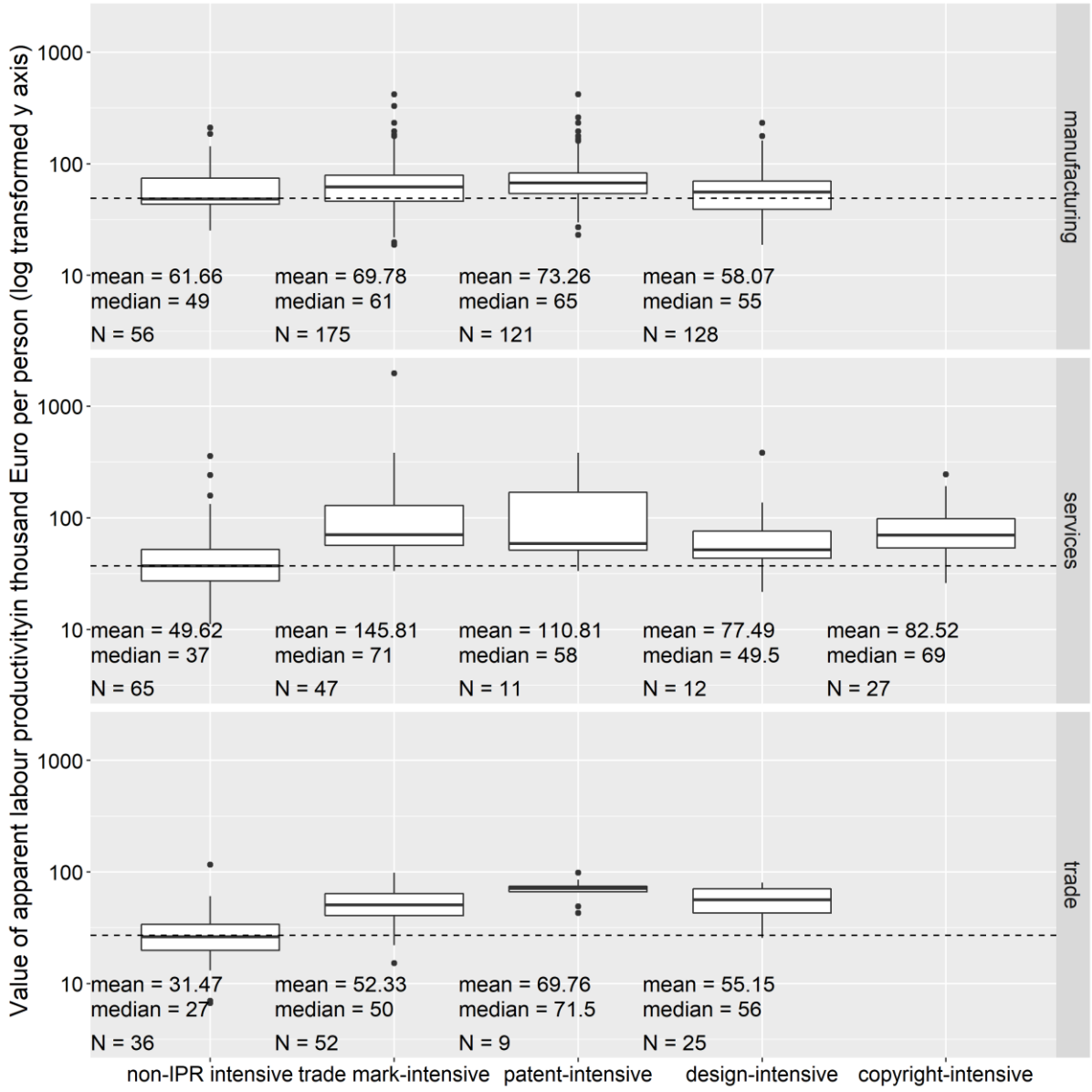


**Figure 7. Comparison of mean and median productivity in various groups of industries**

Note: The box plots illustrate the distribution of the productivity values (indicator V91110 – apparent labour productivity – gross value added per person employed) within various groups of industries in manufacturing, services and trade. Each data point represents the mean value of the annual productivity index for each individual industry calculated from 2011 to 2018. The text above each box plot shows the mean and median productivity values within the corresponding group of industries.

Figure 8 through Figure 10 illustrate correlations between the productivity of an industry and its degree of patent-, trade-mark- and design- intensity (by number of IP rights per 1 000 employees). In eight out of nine cases the correlation is positive, indicating that the more productive the sector, the more it relies on IPRs. The only outlier is the correlation between productivity and design intensity

in the manufacturing sector. The negative correlation suggests that design rights may be especially important for firms active in the traditional manufacturing industries with relatively lower productivity.

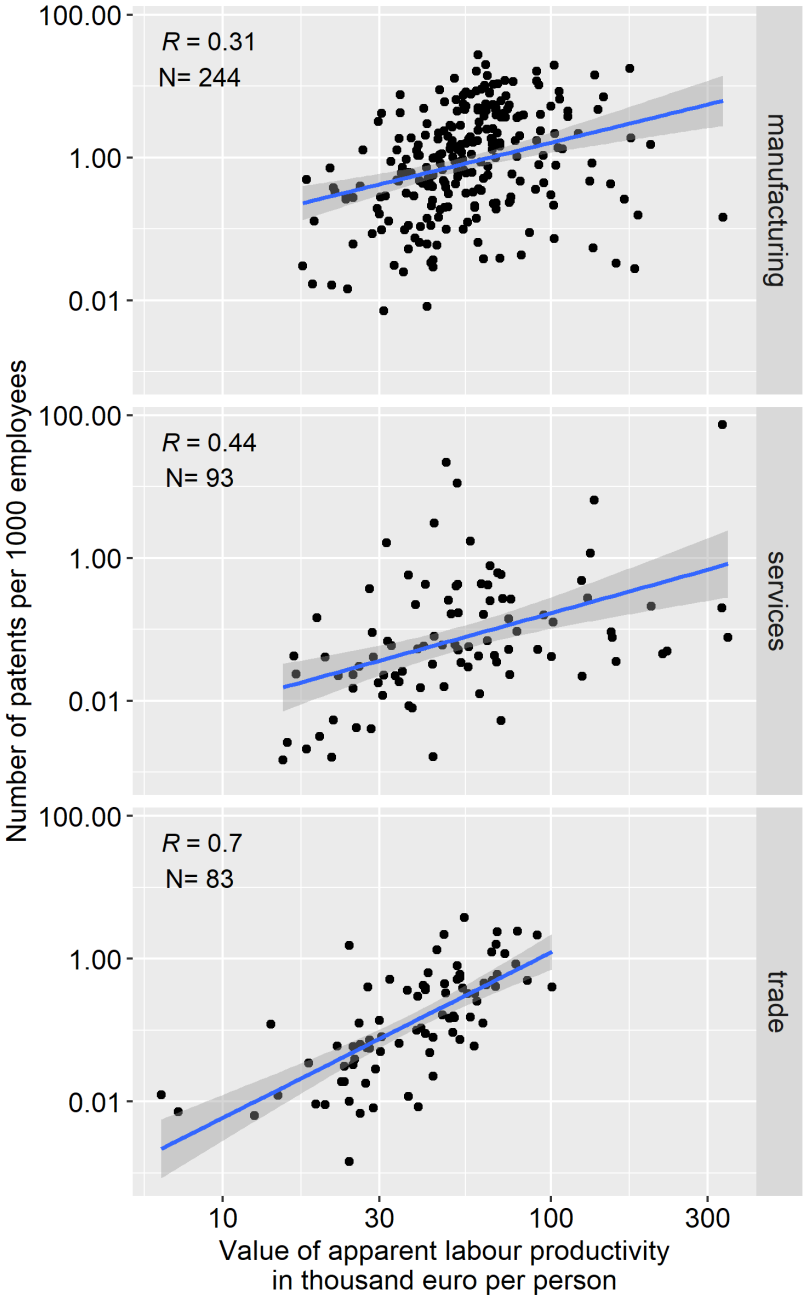


**Figure 8. Correlation between productivity and patent intensity**

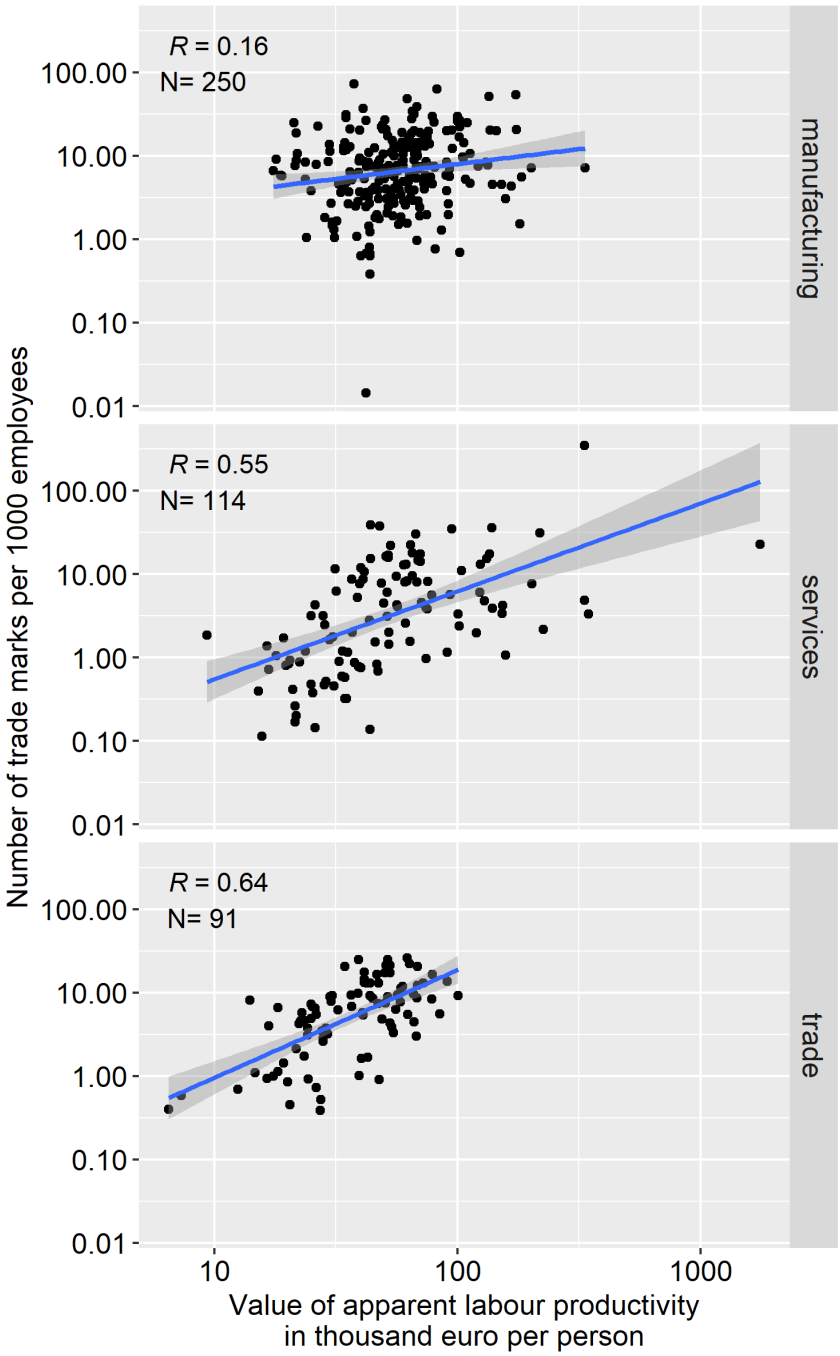


**Figure 9. Correlation between productivity and trade mark intensity**

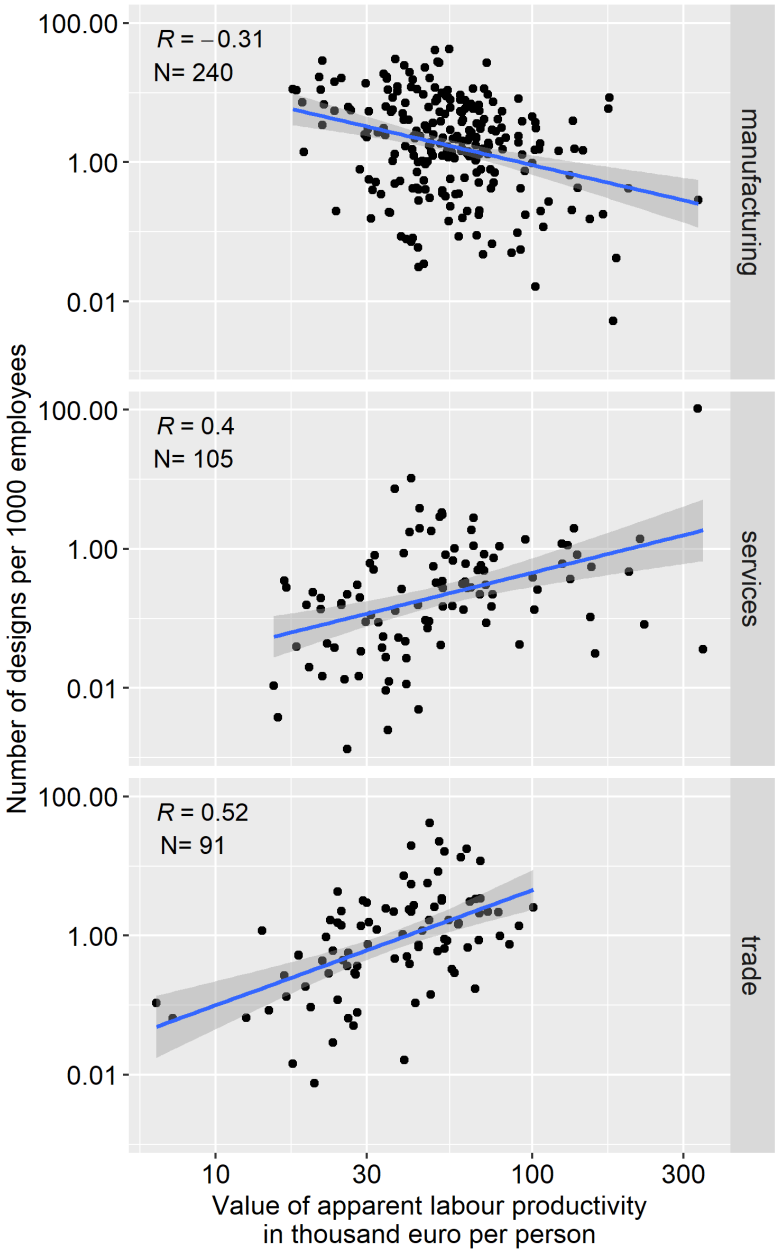


**Figure 10. Correlation between productivity and design intensity**

Note: the scatter plots compare the mean values of apparent labour productivity for each industry, calculated from 2011 to 2014, with its IPR intensity (respectively patent, trade mark and design intensities), calculated from 2010 to 2014. R represents the Pearson correlation coefficient between these two values.

## 3.4 Productivity growth

This section examines trends in productivity between 2011 and 2017, including whether this evolution differed between IPR-intensive and non-intensive industries. Figure 11 illustrates that, generally, the rates of productivity growth tend to be higher within the groups of IPR-intensive industries than within non-intensive industries. This difference is, however, not as pronounced as the differences in the productivity levels. The greatest difference is between non-IPR-intensive and design-intensive services. The median productivity growth of design-intensive services was almost twice as high as that of non-intensive services. The difference between the median productivity growth in these two groups of industries was 6 percentage points.

There are some exceptions to the general tendency towards higher productivity growth in IPR-intensive industries. The median productivity growth in patent-intensive services is lower than that in non-IPR-intensive services. Moreover, the mean and median of the industries grouped in the trade-mark-intensive services category are exactly the same as those of the non-IPR-intensive industries. However, the group of IPR-intensive service industries in which productivity grows only slightly faster than in non-IPR-intensive industries are characterised by relatively higher differences in productivity levels, as seen in Figure 7.

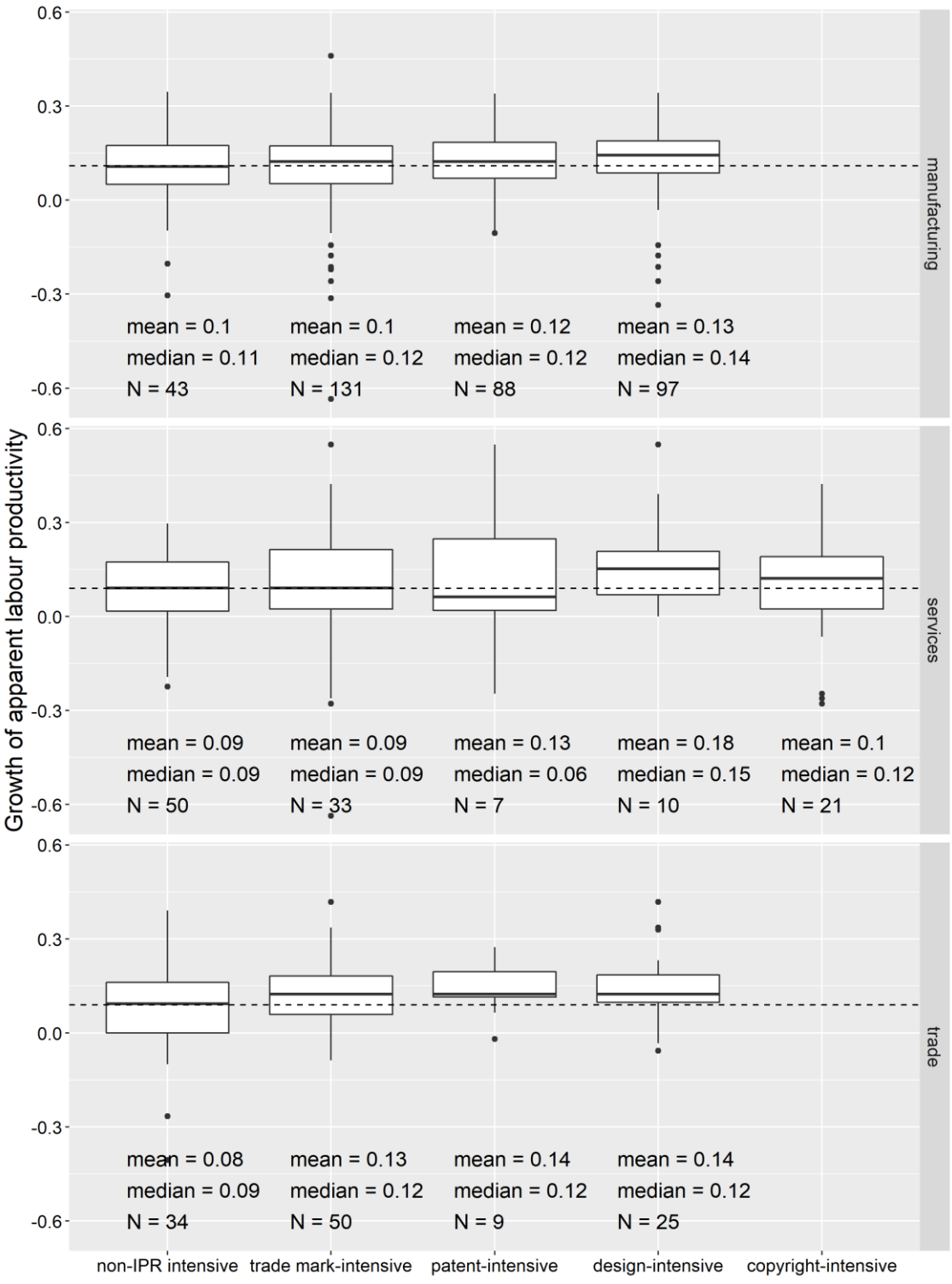


**Figure 11. Productivity growth rates for different groups of industries between 2011 and 2017**

Note: the box plots illustrate the distribution of productivity growth rates (indicator V91110 – apparent labour productivity – gross value added per person employed) within various groups of industries in manufacturing, services and trade. Each data point represents the index of productivity growth for each sector between 2011 and 2017, calculated as the differences in logs of the productivity levels.

There are two components that determine productivity changes – shifts in employment and changes in value added produced by an industry. Figure 12 presents an analysis of the changes in value added between 2011 and 2017. All industry groups increased their value added over the period. The growth of value added was fastest in the service sector. The value added growth in this sector was higher for trade-mark-, patent-, design- and copyright-intensive industries than in the groups of non-IPR-intensive industries.

The pattern is less clear for manufacturing and trade. The median value-added growth rate was lower in the group of trade mark-intensive and design-intensive industries than in non-intensive industries in both sectors. Additionally, the mean value added growth in the manufacturing sector was higher for non-IPR-intensive industries than in the group of trade-mark-intensive industries. In all other cases, however, the mean value added growth is higher in trade-mark-, patent-, design- and copyright-intensive industries than in the group of non-IPR-intensive industries.

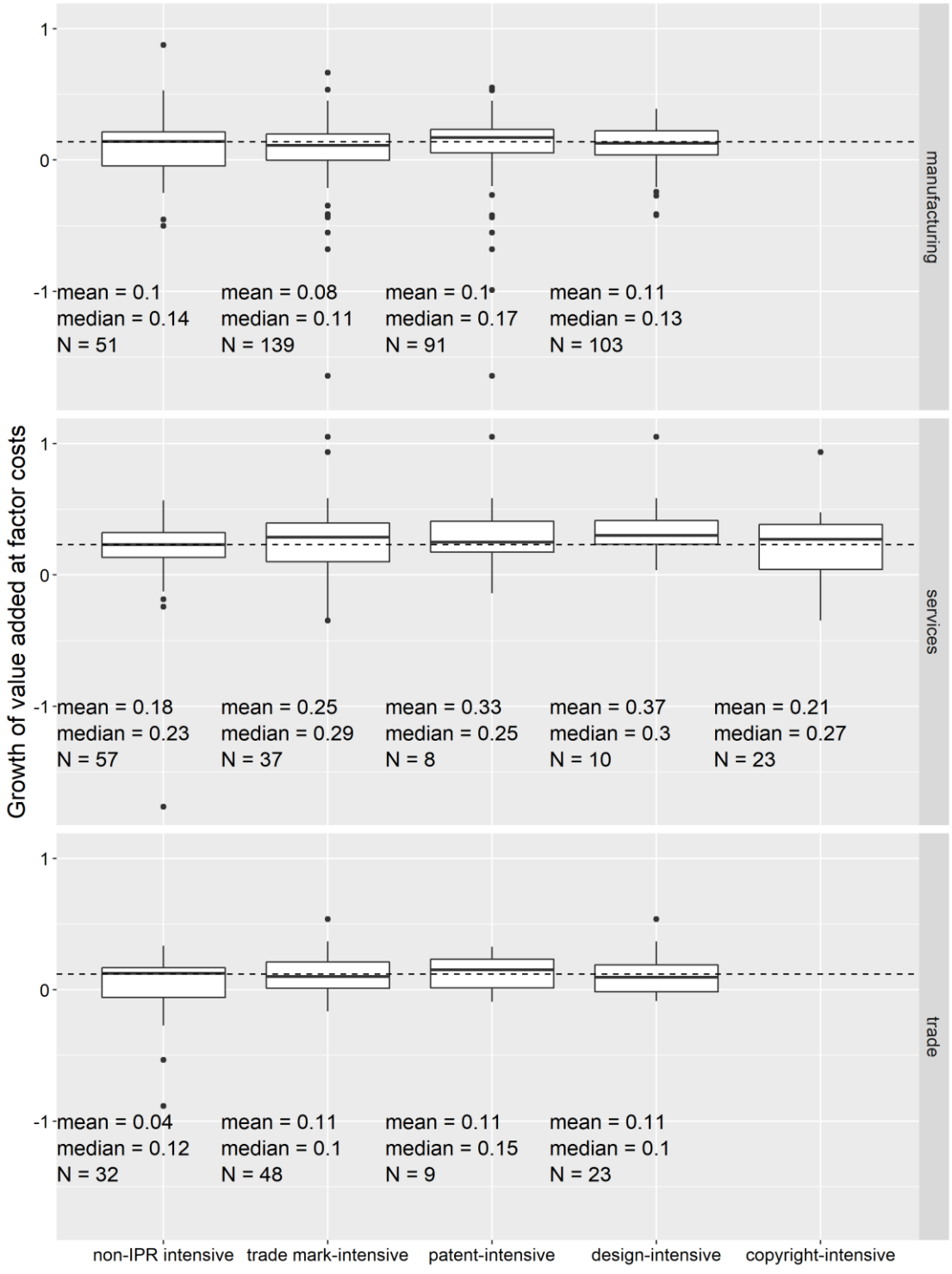


**Figure 12. Value added growth rates for different groups of industries between 2011 and 2017**

Note: the box plots illustrate the distribution of the value added growth rates (indicator V12150 – value added at factor cost – millions of euro) within various groups of industries in manufacturing, services and trade. Each data point represents the index of value added growth for each sector between 2011 and 2017, calculated as the differences in logs of the productivity level.

Figure 13 illustrates that the rates of employment growth are much lower than the growth of value added in all industry groups. In the manufacturing and trade sectors, median and/or mean employment growth rates are often negative. Moreover, in manufacturing, mean employment growth rates are lower in patent-, trade-mark- and design-intensive industries than in non-intensive industries. With the exception of patent-intensive industries, median job growth rates are also lower in the IPR-intensive industries than in industries that do not use IPR intensively. However, the differences in employment growth rates between IPR-intensive and non-intensive industries are rather small.

It is interesting to note that, whereas employment in manufacturing and trade is stagnant or declining, the mean and median employment growth rates in all groups of service industries are at 10 % or higher. Moreover, in all cases, the median and mean employment growth rates in trade-mark-, patent-, design- and copyright-intensive services exceed the median and mean growth rates of non-intensive industries in this sector of the economy. This indicates that the substantial share of innovations implemented in the service sector may be related to the introduction of new services that result in employment expansion. The growth in the number of persons employed is the highest in patent-intensive and design-intensive service industries, where both the median and mean growth rates exceed 20 %.

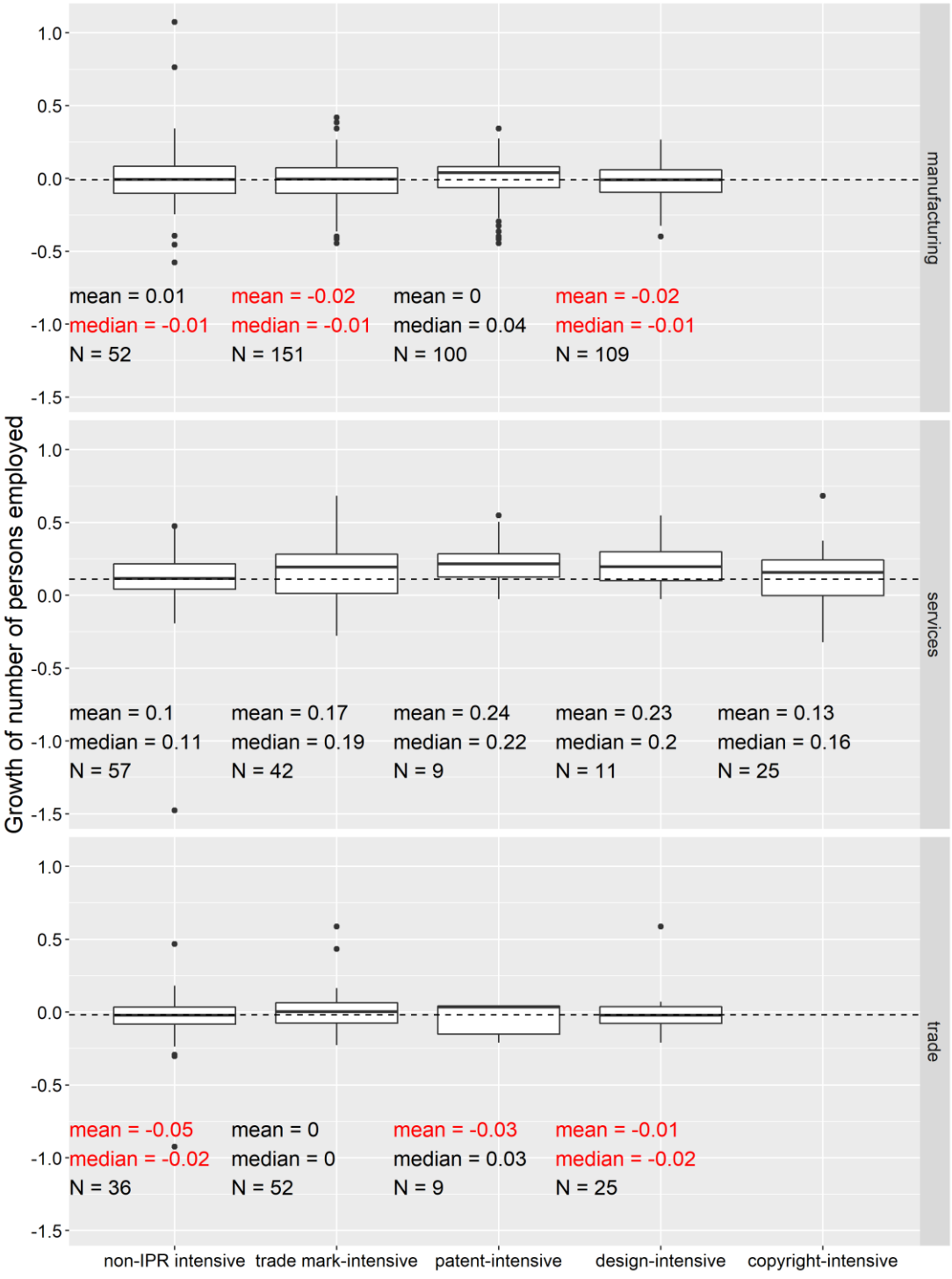


**Figure 13. Growth rates of number of persons employed for different groups of industries between 2011 and 2017**

Note: the box plots illustrate the distribution of the rates of growth of number of persons employed (indicator V16110 – persons employed – number) within various groups of industries in manufacturing, services and trade. Each data point represents the index of growth of number of persons employed in each sector between 2011 and 2017, calculated as the differences in logs of the productivity level.

## 3.5 Business demography

Data on the IPR intensity of European industries can be combined with business demography statistics to examine whether industry dynamism differs between groups of industries with different IPR intensity profiles.

Figure 14 shows that both the mean and median firm birth rate (i.e. the number of newly established firms divided by the total number of firms) is lower in the IPR-intensive industries group than in the group of non-IPR-intensive industries in the manufacturing sector. However, in the service sector, the birth rates are higher in any IPR-intensive industries' group than in the group of non-IPR-intensive industries. In the trade sector, the evidence is inconclusive, as the firm birth rate is much higher among trade-mark-intensive industries than among those that are non-IPR intensive, whereas the same indicator is slightly lower among design-intensive industries than in their non-IPR-intensive counterparts. Moreover, the number of observations in the trade sector group of industries is much lower than in manufacturing and services.

Figure 15 through Figure 17 show scatter plots and correlation rates between trade mark, patent and design intensities and firm birth rates in various sectors. In the case of all three IP rights, the correlation between IPR intensity and the firm birth rate is negative in the manufacturing sector. The absolute value of the correlation coefficient is highest for patent intensity, indicating a strong negative relationship between intensity of IPR use and the rate of entry of new firms. The value of this coefficient is lower in trade mark and design intensities.

However, the correlation coefficients between the IPR intensities and firm birth rates are positive in the services and trade sectors. The absolute value of the correlation coefficient is higher in trade industries than in services, while the correlation coefficient is relatively low, pointing to a weaker (but still positive) association between IPR intensity and firm birth rates.

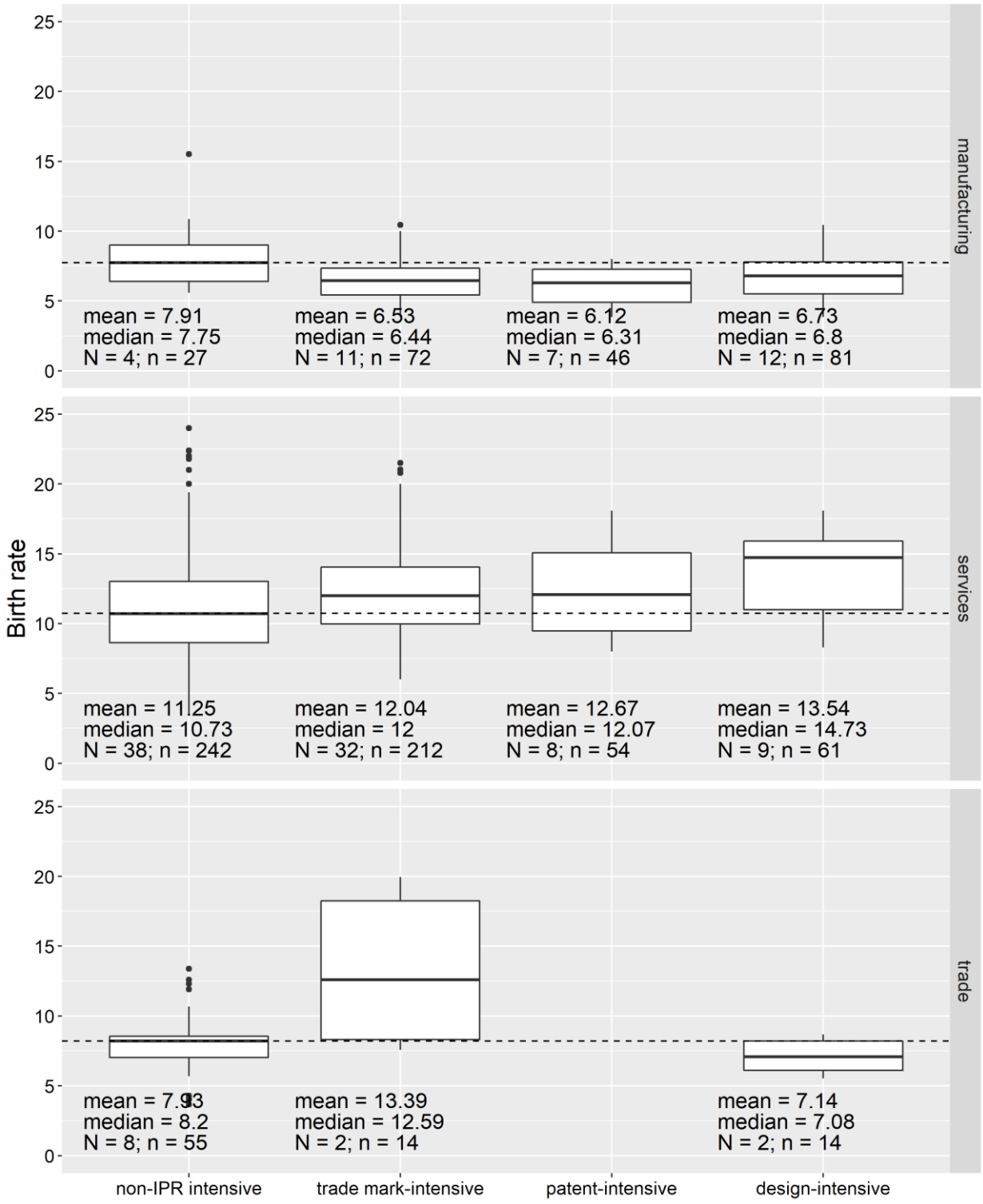


**Figure 14. Firm birth rates in different groups of industries**

Note: the box plots present the distribution, mean and median values of annual birth rates in various groups of industries in 2012 to 2018. The birth rate is defined as the number of enterprise births in the reference period (t) divided by the number of enterprises active in t (percentage). Source of data – Eurostat table bd_9bd_sz_cl_r2 'Business demography by size class (from 2004 onwards, NACE Rev. 2)'

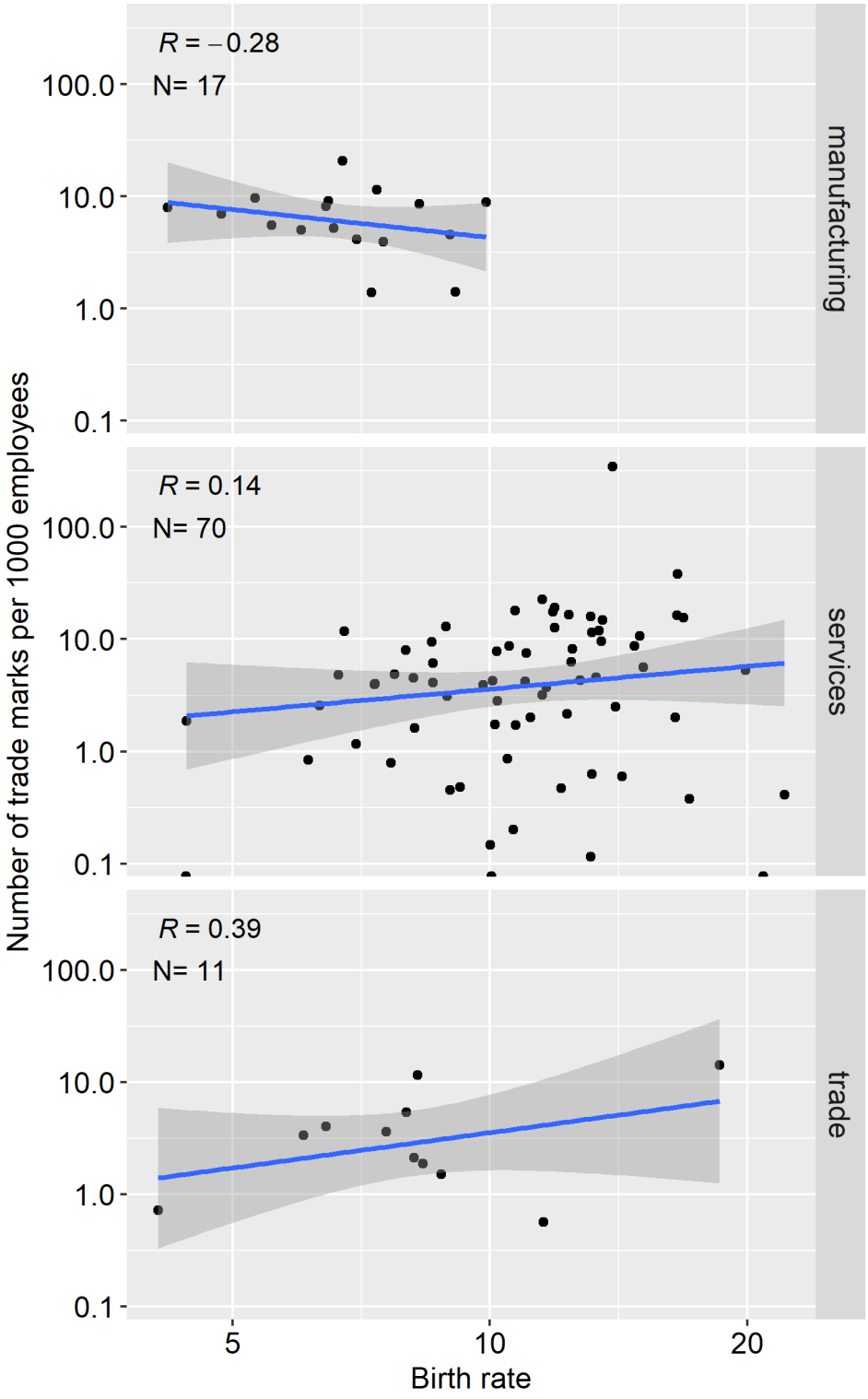


**Figure 15. Correlation between trade mark intensity and birth rate in different groups of industries**

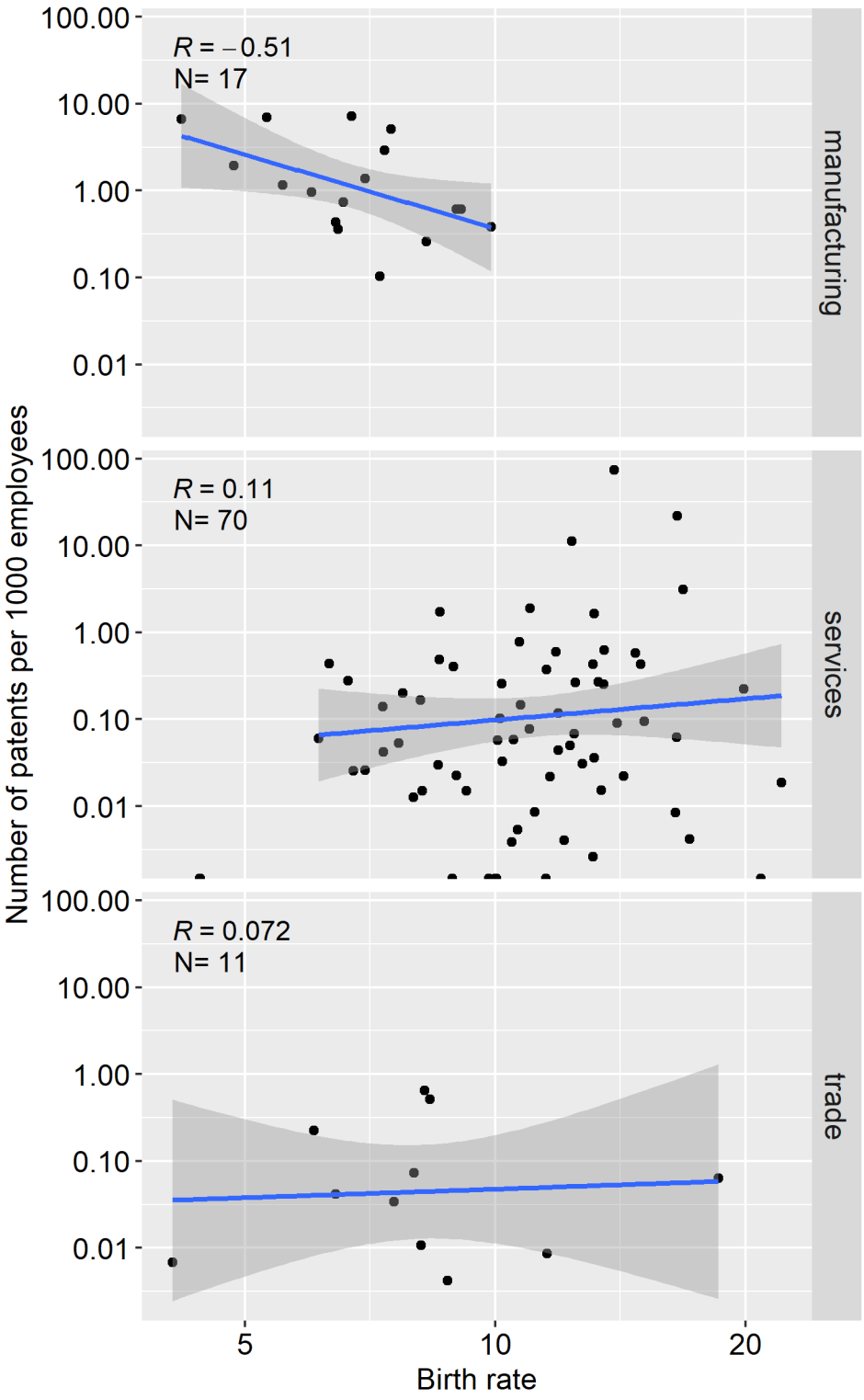


**Figure 16. Correlation between patent intensity and birth rate in different groups of industries**

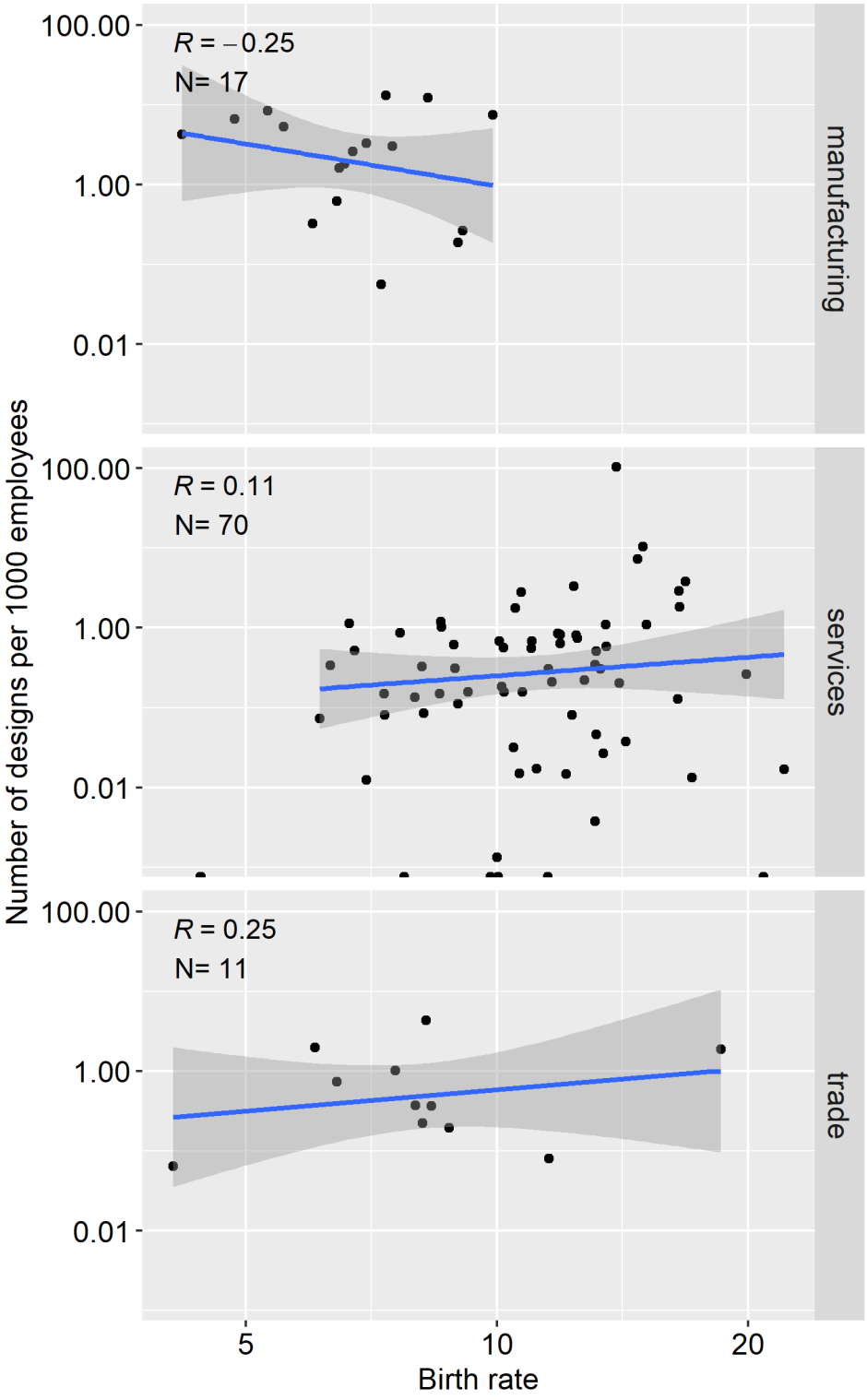


**Figure 17. Correlation between design intensity and birth rate in different groups of industries**

Note: the scatter plots present the relationship between the mean value of annual firm birth rates, calculated from 2010 to 2018 for each sector, and IPR intensity (respectively patent, trade mark and design intensities), calculated from 2010 to 2014.

Figure 18 presents another look at the number of firms active in European industries. The figure is based on the analysis of annual net business population growth rates, reflecting gross flows of firm births and exits. In trade-mark-, patent- and design-intensive manufacturing industries, the mean and median annual exit rate is higher than the firm birth rate, resulting in a reduction in the number of active firms. However, the net business population growth in the group of non-IPR-intensive manufacturing industries is positive, with more firms born than exiting the market. The net business population growth is positive across the board in the group of service industries. In this industry group, both the mean and the median values of net business population growth are higher for all the IPR-intensive industries' groups (trade mark, patent and design intensive) than in the group of non-IPR-intensive industries.

The picture is less clear in the trade sector. The mean and median net population growth rates in the group of non-IPR-intensive industries are negative, with more exits than births of new firms. Those indicators are very similar for the design-intensive industries, with the absolute value of the mean slightly higher and the median slightly lower than in non-IPR-intensive industries. However, both the mean and median net business population growth rate indicators are higher in trade mark-intensive industries than in non-IPR-intensive industries.

In summary, IPR-intensive service industries are experiencing a higher rate of net firm population growth than non-intensive service industries, while the number of IPR-intensive manufacturing firms is declining, with a mixed picture for the trade sector.

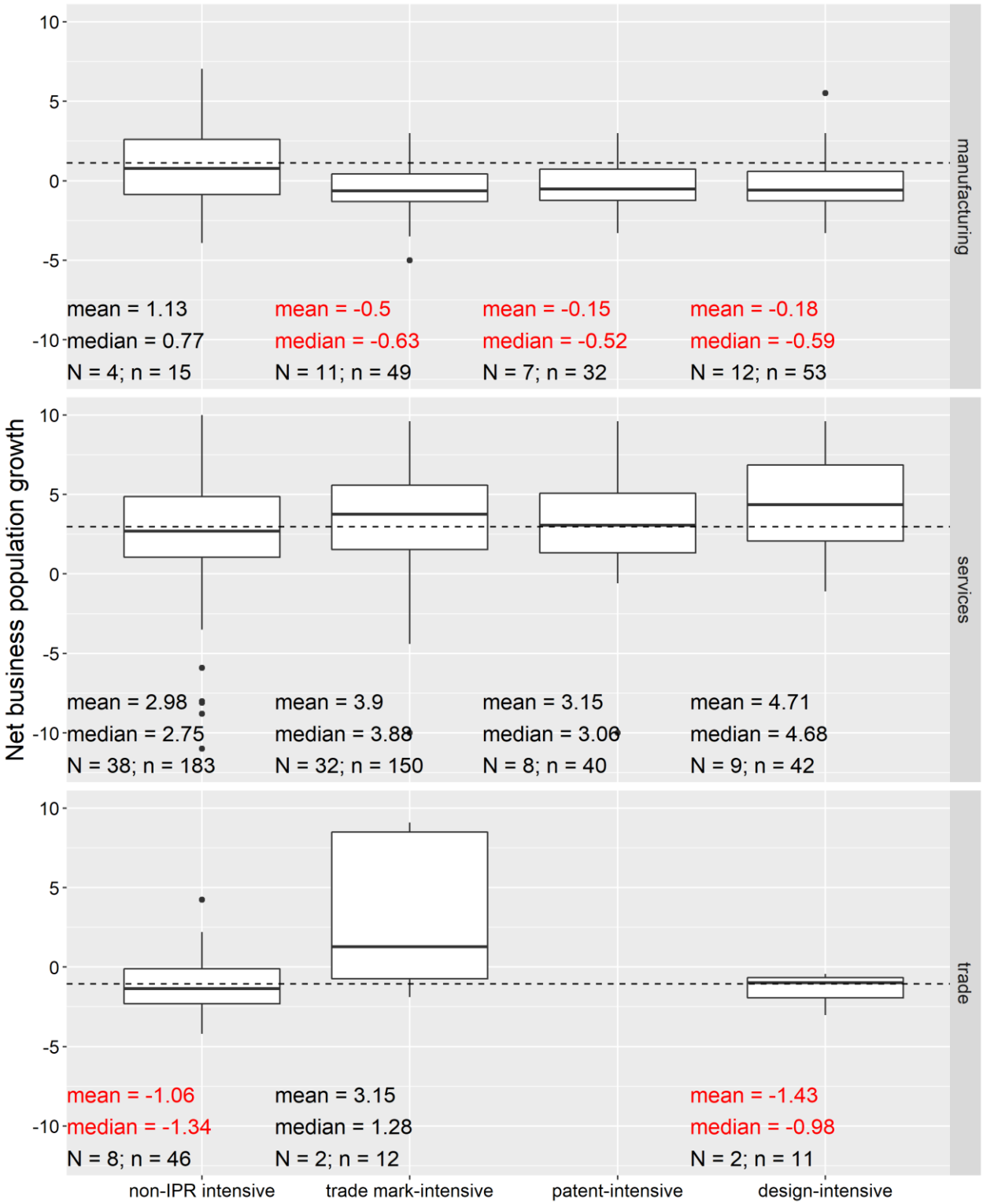


**Figure 18. Annual net business population growth in different groups of industries from 2013 to 2018**

Note: the box plots illustrate the distribution of the annual indices of net business population growth (indicator V97010 – Net business population growth – percentage) within various groups of industries in manufacturing, services and trade. Source of data – Eurostat table bd_9bd_sz_cl_r2 'Business demography by size class (from 2004 onwards, NACE Rev. 2)'.

Figure 19 shows that the differences in the survival rates are less pronounced than differences in the business population growth. Indicators of the survival rate (of firms born 3 years earlier) are similar in the various groups of IPR-intensive industries as in non-IPR-intensive industries in the manufacturing and services sectors. There are some differences in the trade sector, where the survival rate in trade mark-intensive industries is generally lower than in non-IPR-intensive industries, although the opposite is true for design-intensive industries. Moreover, the analysis of survival in the trade sector may be affected by the low number of observations.

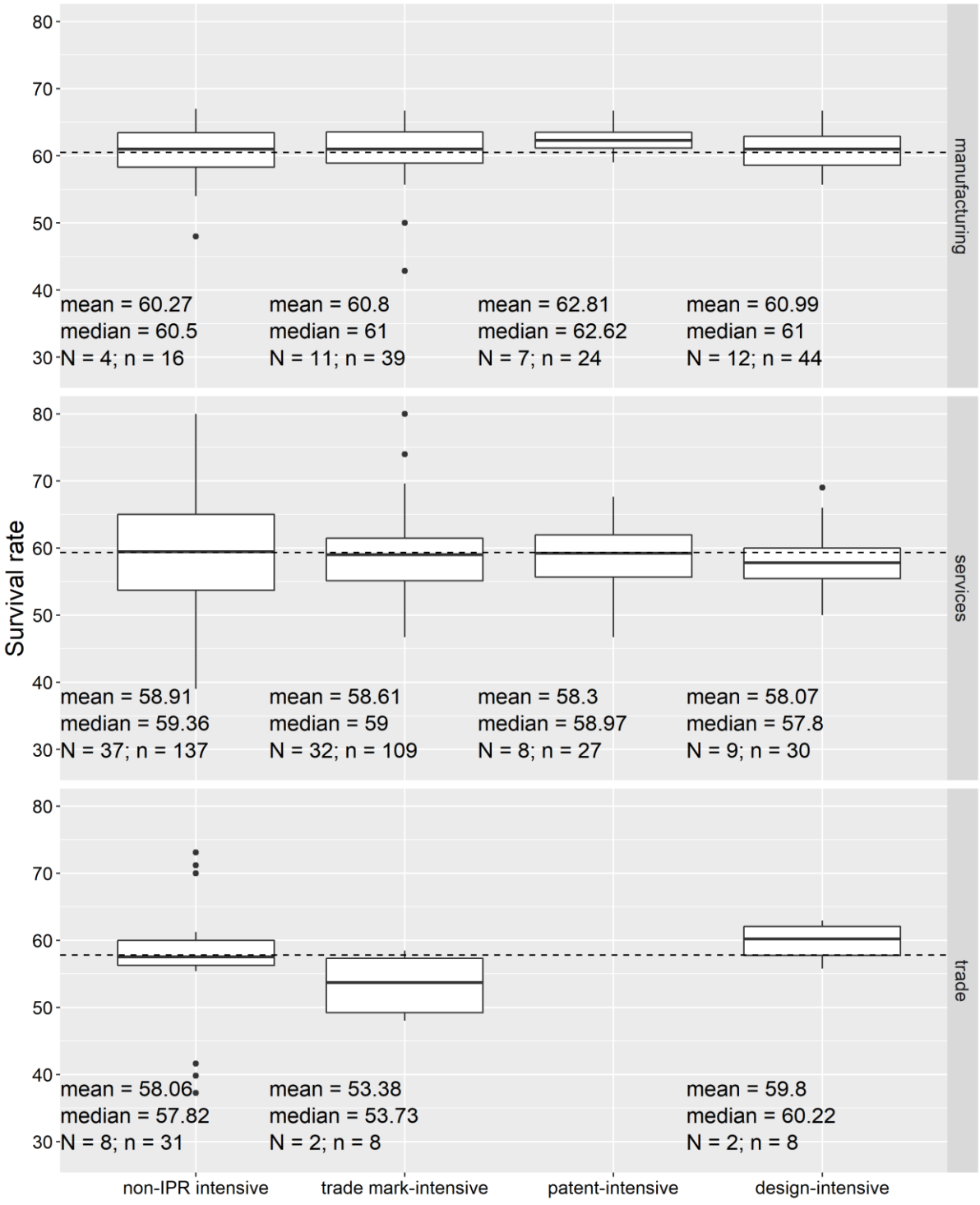


**Figure 19. Survival rate in different groups of industries**

Note: the box plots present the distribution, mean and median survival rates in various groups of industries from 2015 to 2018. Survival rate is defined as the number of enterprises born in t-3 that have survived to t, divided by the total number of enterprise births in t-3. Source of data – Eurostat table bd_9bd_sz_cl_r2 'Business demography by size class (from 2004 onwards, NACE Rev. 2)'

The business demographic processes described above translate into long-term tendencies as regards the number of firms active in various groups of industries. Figure 20 illustrates the changes in the number of firms active in the market between 2011 and 2017. As shown in the top panel, the number of firms active in the median manufacturing industry reduced, irrespective of IPR intensity. This reduction in the number of firms active in manufacturing industries was somewhat slower in the group of non-IPR-intensive industries than in the various groups of IPR-intensive industries.

Similarly, the number of firms active in the trade sector tended to diminish between 2011 and 2017. However, unlike the manufacturing sector, the pace of decline was more rapid in the group of non-IPR-intensive industries than in any group of IPR-intensive ones.

However, the number of firms in the services sector was characterised by relatively strong growth. The mean and median growth rate of the number of firms active in the IPR-intensive service industries is higher in various IPR-intensive groups than in the group of non-IPR-intensive industries.

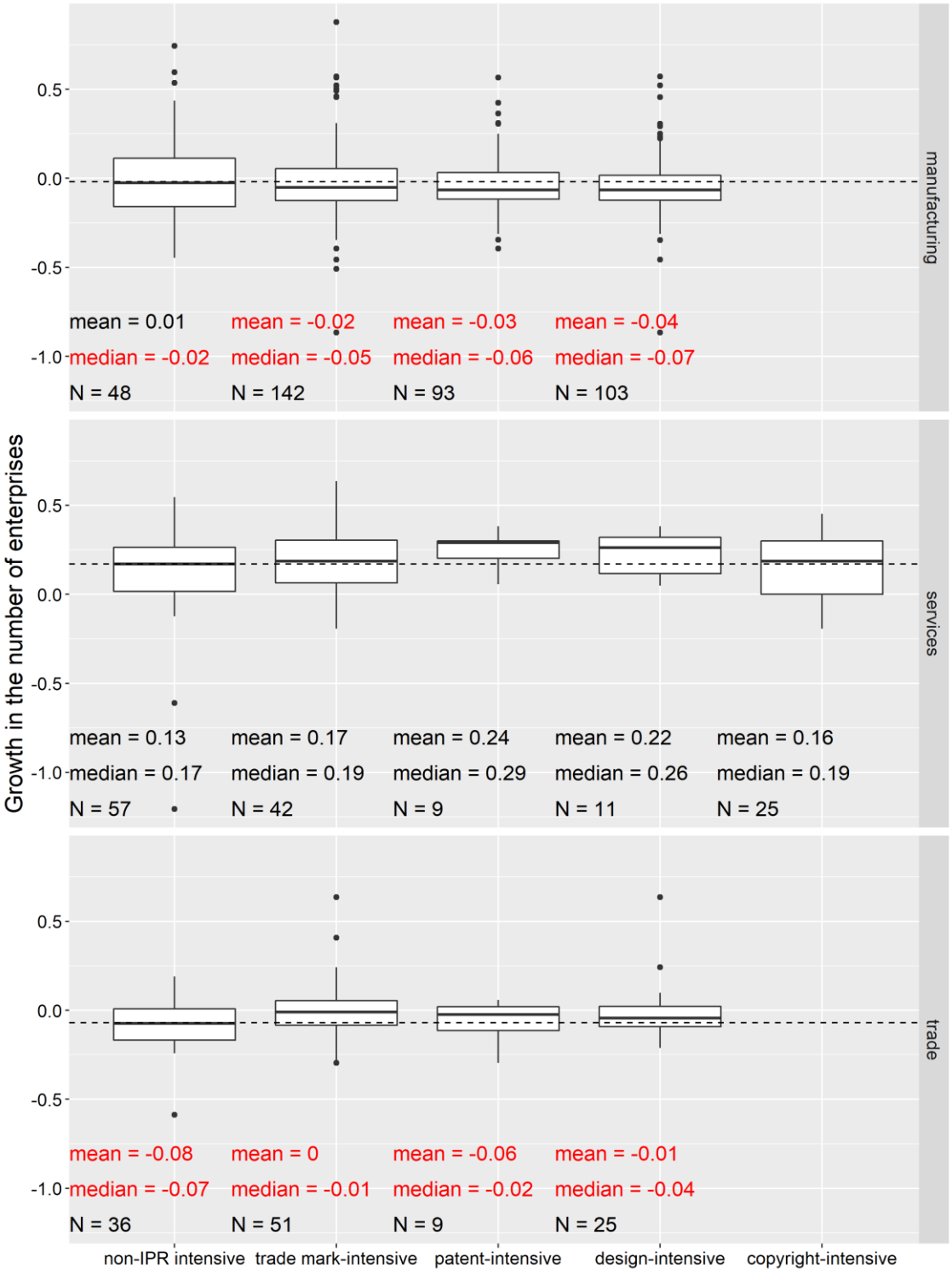


**Figure 20. Growth in the number of firms active in an industry between 2011 and 2017**

Note: the box plots illustrate the distribution of the rate of growth in the number of enterprises between 2011 and 2017 (indicator V11110 – number of enterprises) within various groups of industries in manufacturing, services and trade. Each data point represents the index of growth between 2011 and 2017, calculated as the differences in logs of the number of firms active in 2017 and 2011.

## 3.6 High-growth firms

Research has shown that a relatively small number of firms with exceptional growth play a vital role in innovation and employment creation in the economy. These firms often pave the way for subsequent industry growth and development (Bos and Stam, 2014). An earlier EUIPO/EPO study (EUIPO/EPO 2019b) showed that SMEs with prior IPR activities are more likely to experience a high turnover growth period than firms that were not IPR-active. Analysis of the frequency of emergence of high-growth firms (HGF[8]) in various industries provides another window for analysis of industrial dynamism.

Figure 21 illustrates that the share of HGF among firms with more than 10 employees is higher in every IPR-intensive industries group than in the group of firms not using IPR intensively. Across the manufacturing and services sectors the expected share of HGF is the highest among the patent-intensive industries. Within the manufacturing sector, mean and median HGF rates are very similar between the trade mark- and design-intensive industries, exceeding 9.5 % in both cases. In the services sector the mean and median shares of HGFs among the design-intensive industries are higher than among the trade mark-intensive industries. For both groups of industries, the mean HGF share is at least 0.5 percentage points higher than in non-IPR-intensive industries. This difference is even higher for the median HGF share, as it exceeds 1 percentage point when comparing non-IPR-intensive industries with any IPR-intensive industries group. Finally, the tendency for a relatively higher incidence of HGF in an industry (whether measured by the mean or the median value) is also confirmed for industries in the trade sector, where the difference between the trade-mark-intensive groups and the non-IPR-intensive industries group exceeds 2 percentage points, and for design-intensive industries it exceeds 1 percentage point.

([8]) High-growth firms are defined by the European Commission as firms that achieve an annual growth rate of employment of at least 10 % in three consecutive years.

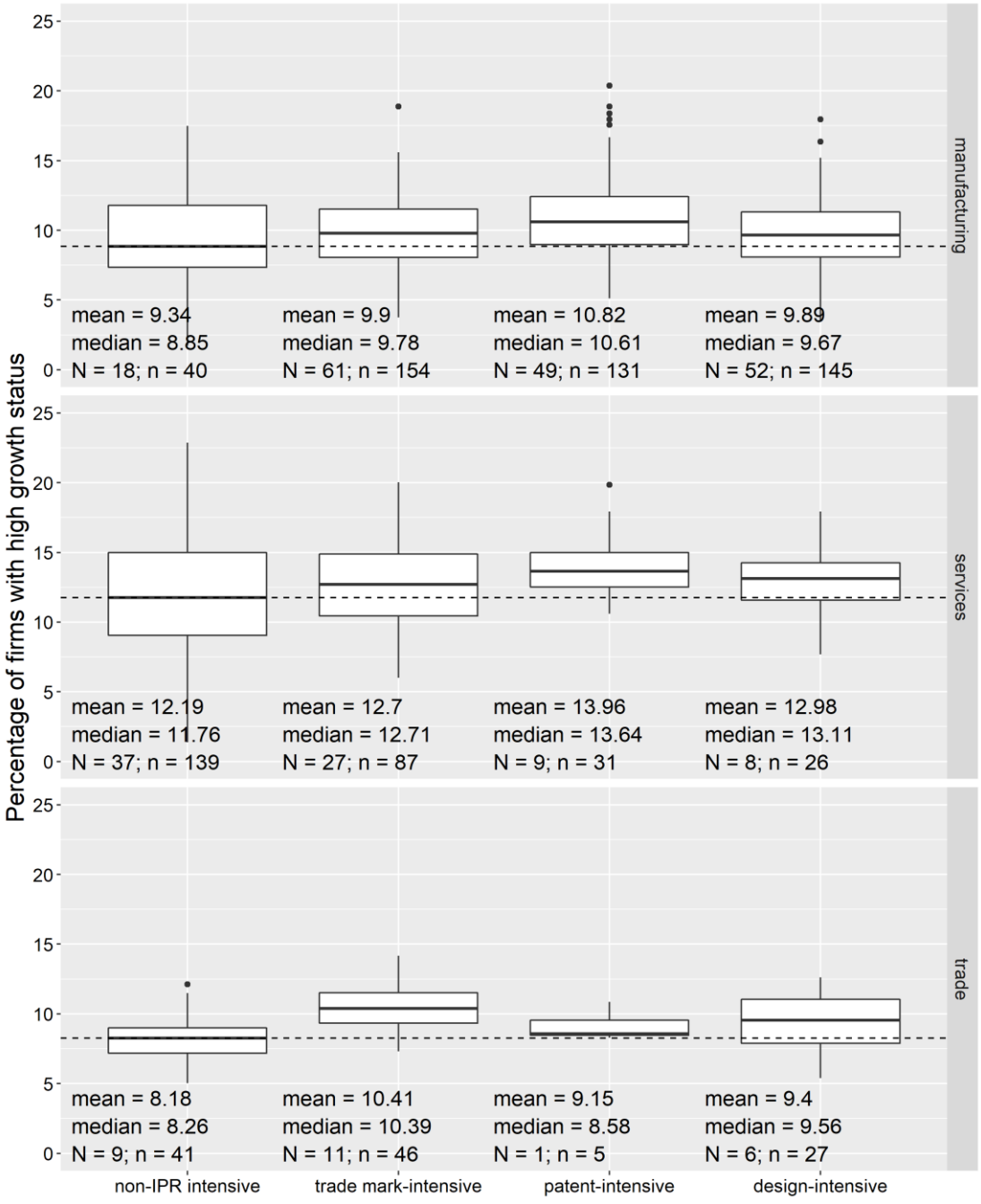


**Figure 21 Percentage of high-growth firms in industries between 2014 and 2018**

Note: the box plots present the share of high-growth firms in various groups of industries between 2014 and 2018. The indicator has been calculated based on the Eurostat table bd_9pm_r2 'High growth enterprises (growth by 10 % or more) and related employment by NACE Rev. 2'. Two indicators: 'High growth enterprises measured in employment (growth by 10% or more) – number' and 'Share of high growth enterprises measured in employment: number of high growth enterprises divided by the number of active enterprises with at least 10 employees – percentage' have been combined for the analysis. The definition of a high-growth was established by Commission implementing regulation (EU) No 439/2014 as a firm with at least 10 employees in the beginning of its growth period and an average annualised growth in its number of employees greater than 10 % per annum over a 3-year period.

# 4 Conclusions

The analysis of the filing patterns shows that, in general, the IPR intensity of the EU economy is rising. In patent and design filings, the rate of filing growth mirrors GDP growth. However, in trade mark filings, growth exceeds GDP growth. Whereas the manufacturing sector dominates patent and design filings, trade mark filings are much more evenly distributed across the EU economy, with services and trade accounting for over 50 % of filings. A more dynamic look at the filing patterns, comparing 2004 to 2008 with 2010 to 2014, indicates that sectors other than manufacturing are increasing their share of filings in all types of registered IPRs, with the pace of change highest in trade marks and designs and lower in patents. It is also interesting to note that industries found not to be IPR-intensive were increasing their IPR intensity more rapidly from 2004 to 2008 and 2010 to 2014 than IPR-intensive industries. This indicated a more widespread use of IP rights across the economy.

IPR-intensive industries are more productive than industries not using IPR intensively. The productivity difference is higher in services and trade than in manufacturing. In the latter sector, the mean value of productivity indicator in the design-intensive group of industries is lower than the value of the same indicator in the group of non-IPR-intensive industries. Moreover, with one exception (design-intensive manufacturing), there is a positive correlation between productivity and intensity of IPR use. The correlation coefficient is highest in trade and services and is relatively low in manufacturing. The negative relationship between productivity and intensity of design use in manufacturing could be an indication that design rights may be an especially important form of IP protection in more traditional, but also less productive industries.

In general, productivity growth between 2011 and 2017 tended to be higher in IPR-intensive industries than in industries not using IPR intensively. The differences in the productivity growth in the manufacturing and services sectors were minimal. Productivity growth was somewhat higher in design-intensive industries than in other types of IPR-intensive and non-intensive groups.

A look into the dynamic changes in value added and employment helps to untangle the differences in productivity growth. Whereas, in the manufacturing sector, the growth of value added was almost on a par in various groups of IPR-intensive and non-intensive industries, the mean employment growth in IPR-intensive industries was below that in non-IPR-intensive industries. However, the differences in the growth rates of value added and employment in the manufacturing sector were small.

The differences in value added and employment growth were more pronounced in the services sector, where the mean and median growth rates were higher in all groups of IPR-intensive industries than in non-intensive ones. A similar pattern emerged in trade industries, where mean values of value added, and employment growth were higher in all types of IPR-intensive industry groups than in the group of non-IPR-intensive industries. In a few cases, however, the median values of growth rates for IPR-intensive industries were slightly below the non-IPR-intensive industries' level.

Overall, the analysis of the dynamic productivity changes shows that IPR-intensive industries increase their productivity more rapidly than non-intensive industries. The difference in the growth rates is, however, relatively low, especially in the manufacturing sector. In the case of some groups of IPR industries, especially in the manufacturing and trade sectors, the productivity increase reflects an increase of value added coupled with a reduction in the number of employees. Finally, analysis of the rate of emergence of high-growth firms leads to the conclusion that, between 2014 and 2018, HGF tended to appear more frequently among the various groups of IPR-intensive industries than among non-intensive ones. The rate of HGF emergence was highest among the patent-intensive industries in the manufacturing and services sectors

# 5 Discussion

The results show higher productivity rates among IPR-intensive industries than among industries not using IPR intensively. This supports the dominant academic view that innovation is key to economic growth. It has been known for a long time that the differences in productivity levels between individual firms may be large, even if those firms are active in the same industry and are based in the same country or region (Nelson, 1981). Firms' innovation activity is one of the principal reasons explaining such differences. New innovative ideas provide blueprints for the rearrangement of raw materials and other inputs into improved products, providing more economic value. Innovation makes it possible to achieve higher economic value using the same number of inputs (Romer, 2019). Therefore, more intensive innovation among companies in an industry lifts that industry's productivity, either because it allows the firms to produce the same products using fewer resources (process innovation) or because it enables them to offer better, more valuable products (product innovation). Thanks to higher labour productivity, firms can offer their employees higher wages, as shown in previous joint EUIPO/EPO studies (EUIPO/EPO 2013; EUIPO/EPO 2016; EUIPO/EPO 2019a)

Recent academic debate on the role played by intangible assets, including IPR, in increasing market concentration is less conclusive. Haskel and Westlake (2017) argued that the highly scalable character of intangible assets promotes the emergence of large, relatively IPR-intensive firms. As discussed above, higher reliance on intellectual assets is associated with improvements in productivity. However, it is often also related to the higher market power of market leaders and increasing market concentration (Crouzet and Eberly, 2019, Autor et al. 2020). In markets where market leadership is based on highly scalable intangible assets, the prospects of smaller rivals are usually modest (Haskel and Westlake, 2017), which may discourage entrepreneurs from setting up new firms. Additionally, the Industrial Organisation literature sees brands and trade marks as a possible strategic tool for incumbents to discourage market entry (Lipczynski et al., 2005; Spulber, 2006).

However, the scalability of intangible assets may be exploited through licensing out valuable intangible assets rather than by relying on their own tangible resources for market entry and/or expansion. The option of licensing the intangible assets reduces the risks involved in market entry; therefore, the proliferation of IPR may contribute to higher, rather than lower, entry rates. There are also limits to the appropriability of intangible assets created by incumbents, which creates opportunities for spillovers. This may benefit other market players who can develop their business models around innovations not fully exploited by incumbents.

The present report contributes to that debate by pointing to the possibility that higher IPR intensity may be related to very different industry dynamics, depending on the sector. Higher IPR intensity seems to be associated with lower industry dynamism (in terms of entry of new firms) in the manufacturing sector. By contrast, in service industries, higher IPR intensity may signal industrial vitality and new market opportunities encouraging entrepreneurs to start new businesses. Due to the data and methodology constraints (see Section 6 below) these observations should be treated as preliminary and should be verified in the future with more rigorous analysis, controlling for other factors that may be correlated with both business dynamism and IPR intensity.

The present study provides additional evidence for a positive correlation between IPR activity and high growth. This is in line with the findings of the previous study of high-growth firms published by EUIPO and EPO (EUIPO/EPO 2019), which showed that IPR activity of a firm signals a higher likelihood of the firm achieving high growth in subsequent years. These findings support academic literature conjectures that innovative entry on the turbulent market, characterised by a high

innovation rate and higher IPR intensity, increases chances for exceptional growth (Audretsch, 1995; Bhide, 2003).

# 6 Data limitations and directions for future research

The present report facilitates the comparison of IPR-intensive industries with their non-IPR-intensive counterparts along several dimensions, capturing the similarities and differences between them. However, the methods of analysis used in this study have some limitations that restrict the set of conclusions that can be drawn. The most salient limitations are set out below, indicating potential future research activities that could be carried out to arrive at more robust conclusions about the phenomena under investigation.

Descriptive statistics is the main method of analysis employed in this report. It allows the illustration of differences between IPR-intensive and non-intensive industries. However, it does not prove the existence of a causal relationship between IPR intensity and those differences.

For instance, the finding of generally lower firm birth rates in the IPR-intensive manufacturing sector may be due to the existence of external factors, such as higher capital intensity required to operate in certain industries, which may be correlated with both general lower entry rates and higher IPR intensity. More sophisticated econometric methods may be employed in the future to disentangle the respective shares of the overall difference that can be attributed to IPR intensity rather than other economic phenomena. Therefore, the findings regarding the association between IPR intensity and industrial dynamics require deeper investigation. Based on the present research, it is possible to claim that indices based on IPR intensity may lead to different conclusions as regards industry dynamism, depending on whether manufacturing or service industries are analysed. Gaining an understanding of factors that may be the source of such differences requires more rigorous investigation.

The analysis in Section 3.5 shows that the number of firms active in a typical IPR-intensive manufacturing industry declined between 2013 and 2018. Over the same period, the number of firms active in a typical non-IPR-intensive industry increased. This may indicate rising market concentration in the typical IPR-intensive manufacturing industry. As discussed in Section 3.5, rising market concentration may be related to the higher productivity of market leaders, which in general, results in positive economic outcomes for consumers and economic growth. Rising concentration may also, however, be associated with higher markups and the rising market power of market

leaders, which may lead to economic inefficiencies and misallocation of resources (Covarrubias et al. 2020). Each of those possible phenomena leads to different policy prescriptions. Therefore, future research may further investigate the relationship between IPR intensity and market concentration. If this association is confirmed, the exact mechanism that leads to this outcome should be investigated.

The objective of the cyclical reports documenting the contribution of the IPR-intensive industries to the EU economy is to bring out the evidence of the IPR intensity of the EU industries at the most detailed level possible, ideally at 4-digit NACE industry codes. Some of the important indices extracted from Eurostat statistics, particularly those analysed in Sections 3.3 and 3.4, are available at the same level as IPR intensity aggregations published in the IP contribution studies. In those cases, the IPR intensity computations may be extracted directly from those reports. However, for some statistics, particularly those used in Sections 3.5 and 3.6, the level of detail available at Eurostat is lower. In those cases, it was necessary to aggregate IPR data and compute the IPR intensities at different (higher) aggregation levels than those available in the published reports. As a result, some 4-digit industries that were found to be IPR-intensive in previous reports may be aggregated within the wider industrial groupings that are not found to be IPR-intensive and vice versa. This may make it difficult to interpret the findings in the case of some concrete, narrowly defined industries. Additionally, in some industry groupings, the number of industries is relatively low, which increases the risks that the differences between non-IPR-intensive industries and some groups of IPR-intensive industries may be spurious. However, the findings regarding industrial dynamics are interesting enough to accept this limitation, with the caveat that they should be treated with caution and as a first step towards more thorough investigation. A possible remedy for future research may be to compute similar indicators from the census or equivalent comprehensive repositories of firm data, such as ORBIS. This should enable the indices to be brought to the required 4-digit level.

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# List of Figures

# Glossary

| | |
|---|---|
| EPO | European Patent Office |
| EUIPO | European Union Intellectual Property Office |
| HGF | High-growth firms |
| IPR | Intellectual Property Rights |
| NACE | Nomenclature Statistique des Activités Economiques dans la Communauté européenne – Statistical classification of economic activities in the European Community |
| SBS | Structural Business Statistics compiled by Eurostat |

# Annexes

## Annex A Adaptations due to missing SBS data

At the time of preparation of the first IP contribution study (2013), employment data was not available for several NACE classes. In those classes, it was decided to aggregate the IPR data to the group or division level. In particular, this was necessary for division 35 (electricity, gas, steam and air conditioning supply) and group 51.2 (freight air transport and space transport). However, for the report published in 2019 it was possible to obtain data on the class level for industries falling under group code 51.2. Due to the different granularity levels in the two reports, classes belonging to division 35 and group 51.2 had to be partially eliminated from the descriptive analysis, such as the changes in the IPR intensity. They are, however, included in the main part of the descriptive analysis based on SBS data. For this purpose, the IPR intensity status on the class level has been determined based on 2019 data.

The same situation concerns group 7.2 (mining of non-ferrous metal ores) for which data on employment on class level was not available for the 2019 report. Therefore, direct computation of the IPR intensity change has not been possible for this industry.

SBS data does not cover agriculture, forestry and fishing (NACE Section A), public administration (Section O) and non-market services such as education (Section P) and health (Section Q). Those industries were eliminated from most of the analysis, which is based on the SBS indicators. They are, however, included in the analysis of the evolution of the IPR intensity presented in Section 3.2.

## Annex B Sources of industrial statistics data

The productivity, value added, and employment analyses conducted in Sections 3.3 and 3.4 used Eurostat SBS data. SBS covers the 'business economy' (NACE Rev. 2 sections B to N and division 95) and describes the structure and performance of business sector in the EU. SBS statistics are available at a very detailed level. It provides indicators down to 4-digit classes, within four broad sectors of industry.[9]

Business demography statistics presented in Section 3.5 rely on Eurostat table bd_9bd_sz_cl_r2 – 'Business demography by size class (from 2004 onwards, NACE Rev. 2)'. This data covers a group of variables describing the characteristics and demography of the business population and provides indicators that allow an assessment of business dynamism.

Finally, the analysis of the emergence of high-growth firms in Section 3.6 was based on Eurostat table bd_9pm_r2 'High growth enterprises (growth by 10 % or more) and related employment by NACE Rev. 2'.

([9]) For the purpose of this report, SBS' 'industry' has been renamed 'manufacturing' to avoid confusion with the more general term 'industry' used to denote the lowest level of aggregation used in the IP contribution studies.

# IPR INTENSITY AND INDUSTRIAL DYNAMICS

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