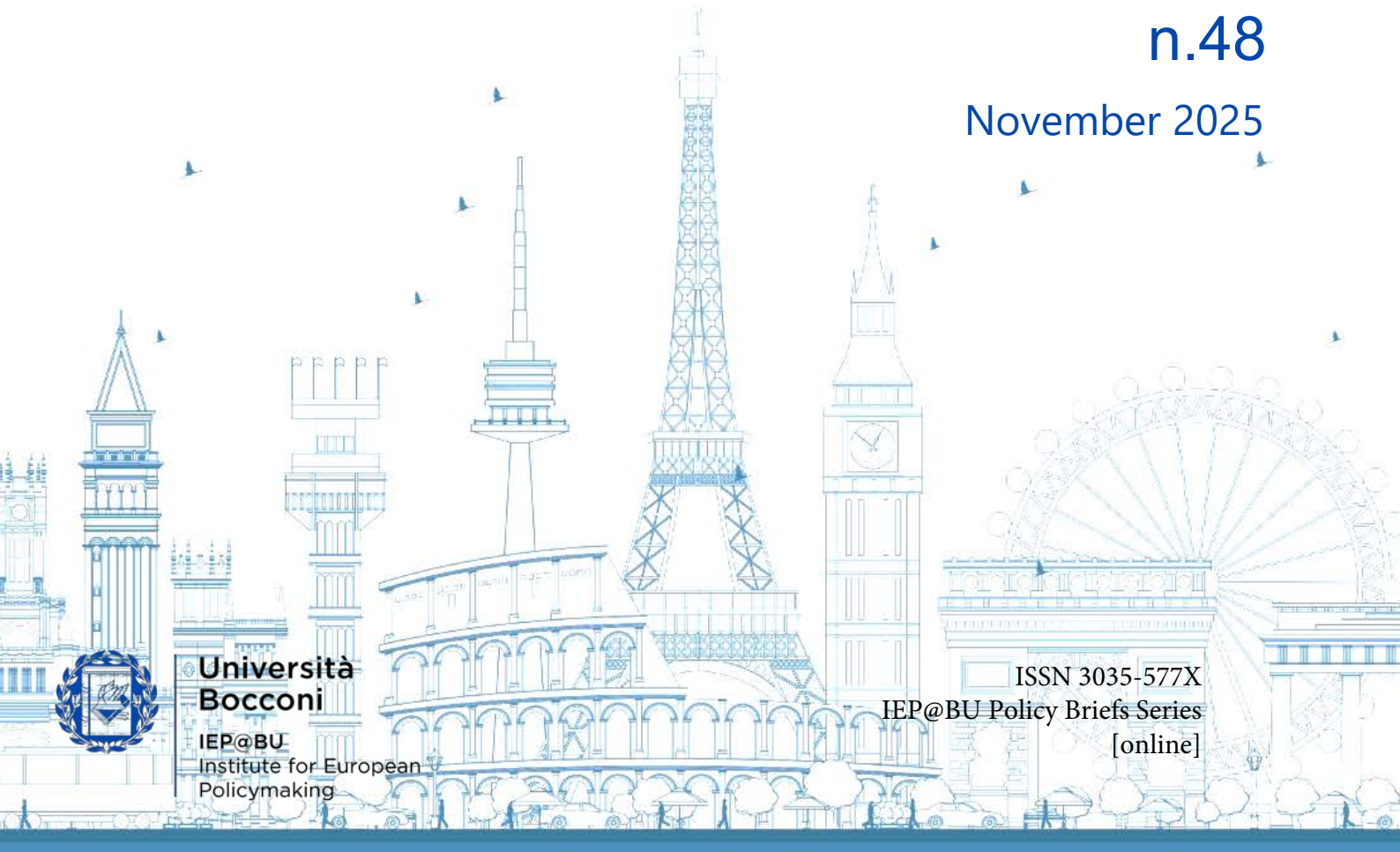
PRODUCTION AND INNOVATION IN THE AUTOMOTIVE INDUSTRY

A COMPARISON OF GERMANY AND ITALY

THOMAS **PULS,** ENNO **KOHLISCH,** OLIVER **KOPPEL**

IEP@BU Policy Brief
n.48

November 2025



Università Bocconi
IEP@BU
Institute for European Policymaking

ISSN 3035-577X
IEP@BU Policy Briefs Series
[online]

Executive Summary

The global automotive industry is undergoing a period of radical change. However, this is having very different effects on the various production locations. It is becoming apparent that this time around, all of the traditional Western European automotive countries will be on the losing side.

However, since the turn of the millennium, these countries have experienced very different developments, which is having a major impact on their positions in the current transformation.

This paper therefore aims to compare the situations of the automotive industries in Germany and Italy, which have pursued very different strategies since the turn of the millennium.

Particular focus is placed on comparing the research performance of the two countries, as measured in terms of transnational patent applications.

Without active research in the future-oriented fields of electrified powertrains and autonomous driving, it will be more than difficult to maintain the production location in the future.

Development of motor vehicle production in Germany and Italy

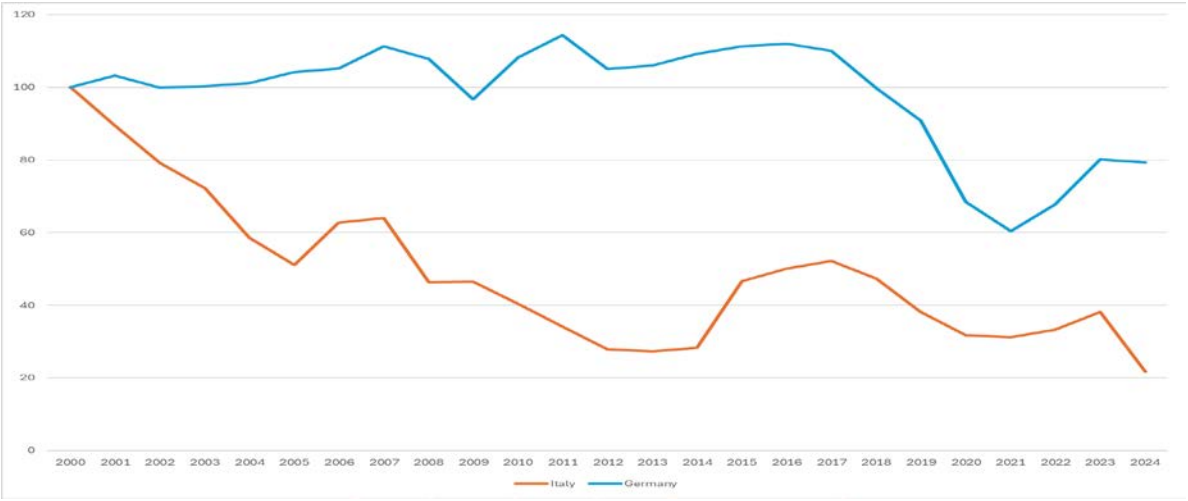
First, a comparison of the situation should be made, because even though Germany and Italy are considered traditional automotive countries with well-known brands, the development of vehicle production in the last 25 years has been very different in the two countries.

These developments are likely to be largely attributable to the very different business models of domestic vehicle manufacturers. These still shape the production level and the position of the locations in global competition today.

In Germany, the last major crisis in the automotive industry dates to 1993. It took a few years to overcome it, but after that a golden age began for the automotive industry in Germany, which lasted until 2017.

Then a noticeable downturn began, which was exacerbated by the pandemic. After the pandemic and supply chain disruptions, car production in Germany rose again by one million units and stabilized at around 4.1 million cars, which is around 20 per cent less than in 2000 (Figure 1).

Figure 1: Passenger Car production in Germany and Italy 2000=100



Source: OICA, 2025

In Italy, car production fell significantly shortly after the millennium. This trend continued until 2014, when a slight recovery set in. The massive slump in production in 2024, which was sharper than in the pandemic years, is striking. All in all, the number of passenger cars produced in Italy in 2024 was only 310,000 units - almost 80 per cent below the figure from the year 2000.

A comparison of the developments shows that German production was much more able to recover lost production volumes following external shocks such as the financial crisis or the pandemic. In Italy - as in France, for example - the recovery processes in the passenger car sector were much less pronounced.

The main explanation for this is probably that the car industry in Germany pursued a different business model to its competitors in France or Italy.

Global presence, dominance in premium cars, and the pursuit of technological leadership were the pillars of the successful model.

Italy's most important car manufacturer, on the other hand, focused more on volume models and the

European market. China was largely ignored as a sales market and the US market was actually only opened up as a sales market through the acquisition of a US manufacturer.

Attempts were made to position individual traditional brands in the premium segment, but today it has to be said that this attempt, apart from the famous Ferrari and Lamborghini brands, has failed.

At the end of this development, the Stellantis Group was formed, but this did not stop the loss of market share and production of the Italian brands as the recently announced temporary closures of Stellantis car factories show.

However, the German business model is now also coming under increasing pressure. New competitors in China, the shift towards electrified powertrains, increasing protectionism and the prolonged weakness of the European domestic market have now also led to overcapacity in car plants in Germany, which must be reduced.

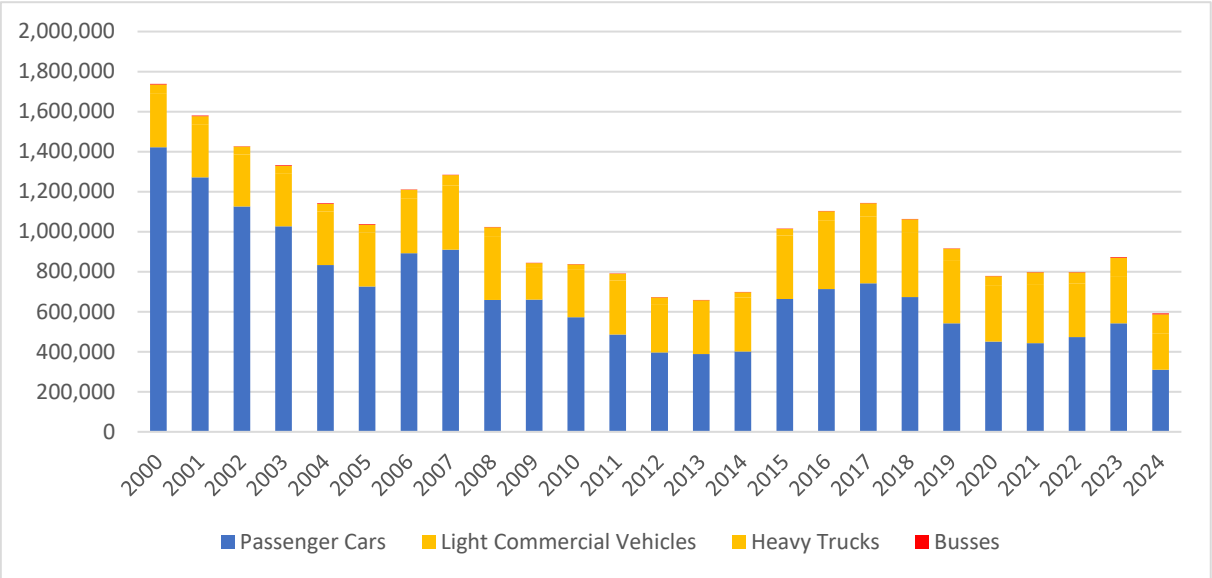
For the first time in over 30 years, the German public is therefore confronted with a crisis in the German car industry, although it is often ignored that the current upheavals are by no means limited to the German car industry.

This has led to many media outlets indulging in doomsday scenarios and questioning the business model that has been so successful to date.

The production of smaller vehicles and a greater focus on the domestic market are repeatedly cited by the German public as the most effective changes. An approach that is very similar to the strategy pursued by Italian manufacturers since the millennium.

However, it should also be noted that there was one stabilizing factor for the motor vehicle industry in Italy for a long time, and that was the commercial vehicle sector. If this is included in total Italian production, the decline is visibly less pronounced than if only passenger car production is considered (Figure 2).

Figure 2: Motor Vehicle Production in Italy between the years 2000 and 2024 by vehicle category



Source: OICA, 2025

Up to and including 2023, Italian commercial vehicle production was even higher than the comparable figure from the year 2000 but then slumped by a good 15 per cent according to figures from the International Automobile Industry Council (OICA) and was thus around 11 per cent below the figure from 2000.

The development of commercial vehicle production in Italy was so much better than in the passenger car sector that the share of commercial vehicles in total production in Italy rose from 18 per cent in 2000 to over 47 per cent in 2024.

In any case, it is worth noting that commercial vehicle production also experienced a drastic slump last year, causing the previous stabilizer to collapse.

With the recently announced takeover of IVECO by the Indian Tata Group, Italy also appears to be losing the control over its most prominent domestic manufacturer in the commercial vehicle sector to a foreign investor.

No comparative figures are available for Germany, as commercial vehicle production has not been reported for some time for data protection reasons. In any case, German commercial vehicle production is a long way from the relative importance of Italy.

Capacity utilization in Germany and Italy

The decline in production since the millennium has not yet been accompanied by corresponding capacity cuts in either country, which has resulted in the capacity utilization of various plants being far below what would be necessary for profitable operation.

As a rule of thumb, it can be said that the profitability threshold of an automotive plant is close to 80 per cent capacity utilization. According to an analysis commissioned by Automotive News (Inovev/Automobilwoche, 2025), the average capacity utilization of German plants in 2024 was 67 per cent.

It should be noted that this figure was noticeably influenced by the particularly poor capacity utilization of the two Ford plants in Saarlouis and Cologne. The former was already in the process of being shut down in 2024 and will be closed for good in November 2025. The main plant in Cologne underwent a fundamental model change, meaning that capacity utilization in 2025 is likely to be at least slightly better.

If these two plants are excluded from the calculation, capacity utilization at the German plants was around 75 per cent. However, even without Ford, there were still two plants with a capacity utilization of less than 40 per cent.

The Italian factories (including light commercial vehicles) achieved an average capacity utilization of 47% in 2024 (Inovev/Automobilwoche, 2025). Capacity utilization of less than 20 per cent is reported for two plants.

This means that the capacity utilization of Italian vehicle factories is once again well below the comparative figure for the pandemic years 2020 and 2021 and around 15 percentage points below the figure for 2023.

The year 2024 led to stagnating production figures in Germany and increased plant capacity utilization thanks to capacity reductions.

By contrast, the Italian sites reported production figures for last year that were last seen in the 1950s.

As a result, plant capacity utilisation fell to levels that threaten the existence of the companies. The question now is whether the production losses of recent years can be expected to be made up again.

In Germany, the answer from the OEM's is clear. The VW Group alone is planning to reduce capacity by 734,000 units over the next few years. In addition, the conversion of plants to electric cars is being driven forward. In 2024, 1.35 million electric vehicles were produced in Germany.

This was around a third of total production and the main driver of the production recovery since the pandemic. The production of pure internal combustion vehicles last year was at the level of the early 1960s.

We did not have any figures on the production of electric vehicles in Italy. However, there are various indications of low figures. For example, the fact that production of the Fiat 500e was temporarily suspended in 2024. Another indication of the structural weakness of Italian OEM with regard to electrified vehicles can be found in the patent statistics.

Patents are the most easily measurable indicator of research success and can therefore provide valuable information about the positioning of a location in relation to relevant future topics - in this case the electrified powertrain and autonomous driving.

For comparison: The development of the gross value added in the German and Italian automotive industries

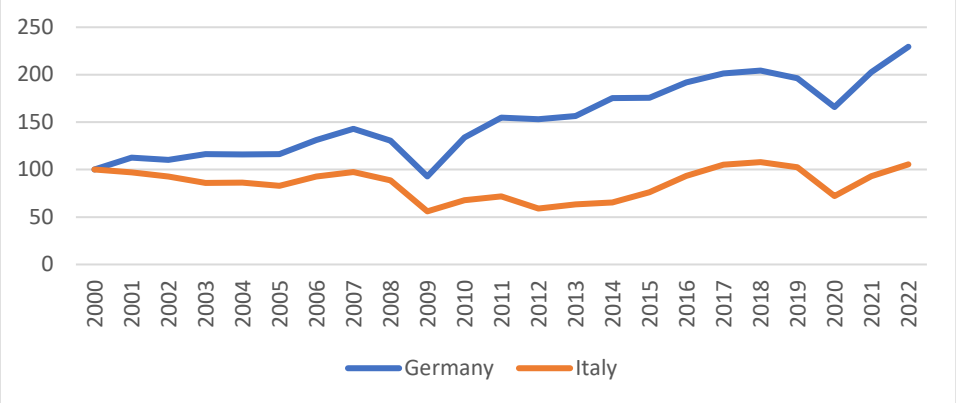
Pure unit figures can only reflect part of industrial development. They abstract from developments among suppliers. Furthermore, a shift toward higher-quality and therefore higher-priced vehicles would not be captured. For this reason, the analysis of unit numbers should also briefly consider the development of gross value added in the automotive industries of Germany and Italy at this point (Fig. 4).

Eurostat data, available up to 2022, measures the real gross value added in the automotive and shows that real output of this industry in Germany has more than doubled since 2000.

Similar to the analysis of unit sales, there were sharp declines during the financial crisis and in the period from 2018 to 2021, followed by significant recovery effects.

Fig. 4 Development of the gross value added in the German and Italian automotive industries

Chain linked volumes, index 2000=100



Source: Eurostat, 2025; own calculations

All in all, the gross value added of the German automotive industry has risen much more sharply than the number of vehicles produced.

One driver of this trend will be the increasing specialization in larger vehicle classes. The share of vehicle segments A to C (Mini, Small, Medium sized cars) in Germany fell from 46 percent in 2000 to 26 percent in 2022.

In Italy, too, there are similarities with the trend in unit sales. However, the declines measured in terms of gross value added are visibly smaller and the recovery phases are more pronounced. As a result, real gross value added in the automotive industry in Italy exceeded the 2000 figure again in 2017.

This could suggest that suppliers in Italy have performed better than vehicle manufacturers. In times of technological change, industrial research plays a key role in determining the future viability of an industry.

The research output of the German and Italian automotive industries will therefore be analyzed below, whereby it is also possible in principle to distinguish between the research performance of manufacturers and suppliers.

Patents are the most easily measurable indicator of research success and can therefore provide valuable information about the positioning of a location in relation to relevant future topics - in this case the electrified powertrain and autonomous driving.

In order to compare the patent activities of the automotive industry in the research locations of Germany and Italy, we draw on the IW patent database.

The IW patent database

The analysis was conducted using the IW patent database, which utilizes the data sources PATSTAT-GLOBAL, PATSTAT-EPRegister, and DPMAConnectPlus. The IW patent database thus contains all of the approximately 4.5 million patent families seeking protection for Germany or beyond since 1994, whether through an application to the German Patent and Trademark Office (DPMA), the European Patent Office (EPO), or the World Intellectual Property Organization (WIPO). This integrated approach allows the recording of both national and transnational patent families and, consequently, global patent activity.

The applicant module of the IW patent database contains all initial and current applicants since 1994.

Patent applications by legal entities are assigned at the level of individual companies/subsidiaries. Both the legal status of the patent applications and the information on the individual legal entities are continuously updated.

In addition to the industry, the latter also includes their control structure, including the global ultimate owner (final controlling shareholder or highest-level public corporation), profit motive, and, for legal entities with a profit motive, their size class.

Roughly 3,700 different applicants can be attributed to the vehicle industry, including manufacturers of motorcycles, tractors, excavators, military vehicles, etc..

The technology module of the IW patent database contains information on the technological areas

covered by the respective inventions. The evaluation is based on the so-called IPC symbols (International Patent Classification) cited in the patent applications, a hierarchically structured system with around 70,000 finely differentiated key codes at the lowest hierarchical level, the so-called IPC subgroups (WIPO, 2024).

39,400 of these IPC subgroups are cited by applicants from the vehicle industry, 30,600 of them can be characterized as vehicle related. These 30,600 subgroups can be assigned to specific technologies such as electrical powertrain, conventional powertrain, autonomous driving, etc. (see Koppel et al., 2018; Kohlisch et al., 2023 (the latter is German only)).

To ensure a meaningful comparison, this study considers transnational patent applications, specifically those seeking protection in multiple countries, including Germany.

This means that no country benefits from a so-called home bias in the analysis. Furthermore, a homogeneous quality standard is guaranteed, as all applicants considered must overcome the same high hurdles.

The analysis is carried out at the level of patent families, so that any double counting is ruled out. Due to the disclosure period for patent applications, 2022 represents the most recent complete year.

All patent data in this study are measured by the inventor's residence. Measuring them by the applicant's residence would entail a severe headquarter effect, in particular with regard to the Stellantis group.

For example, all Opel patents are nowadays applied for by PSA and thus attributed to France in the applicant's residence, whereas the inventor's residence reveals these patents as originating in Germany.

Due to the same kind of headquarter effect, Stellantis patents originating in Italian factories and R&D centers might be attributed to the Netherlands in an applicant's residence perspective, whereas the inventor's residence perspective as applied in this study attributes them to Italy.

The data set used in this study comprises the period from 2010 to 2022 and was compiled in September 2025.

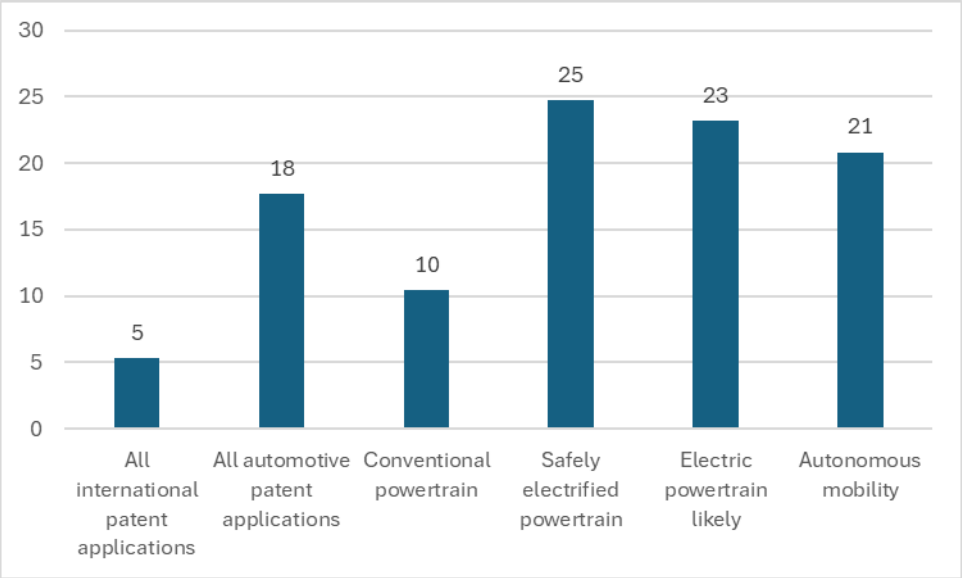
We measure the patent performance of the Italian and German vehicle industry as measured by the inventor's residence cited in the application, i.e. the vehicle industry's patent performance originating from the Italian and German research locations, respectively. In total, 270 (1,475) of these applicants from the vehicle industry exhibited patent activity in Italy (Germany). In the evaluation categories of applicant and inventor, a patent application is divided fractionally if there are several units of analysis.

Transnational automotive patent application by German and Italian Inventors

A breakdown of transnational patent activity in Germany and Italy by sector and technology field shows that the Italian automotive industry is comparatively poorly represented and can almost be described as nearly inactive in the relevant future fields like electric powertrain or autonomous mobility.

According to the data, for every transnational patent application filed by an Italian inventor, 5.4 applications are filed by inventors domiciled in Germany (Figure 3).

Figure 3: German patents for every patent submitted by an Italian inventor in 2022



Source: IW Patent Database, 2025

If we restrict ourselves to the automotive industry, this ratio changes dramatically. In the automotive industry, there are 18 patent applications by inventors living in Germany for each one by an Italian inventor.

This can mean one of two things. Either Germany has a considerable surplus of automotive patent applications or Italy's automotive industry is relatively weak in innovation. Closer examination shows that both statements are justified.

The automotive industry's share of all transnational patent applications by German inventors lies above 26 percent. In Italy this share is below 8 percent. The former indicates that Germany is very focused on the automotive industry in terms of innovation. The latter, on the other hand, shows that the Italian automotive industry was weak in terms of innovation, not only in comparison with its German competitors, but also in comparison with other industries in Italy.

This innovation weakness is very evident in the relevant future technologies, i.e. the electrified powertrain and autonomous mobility.

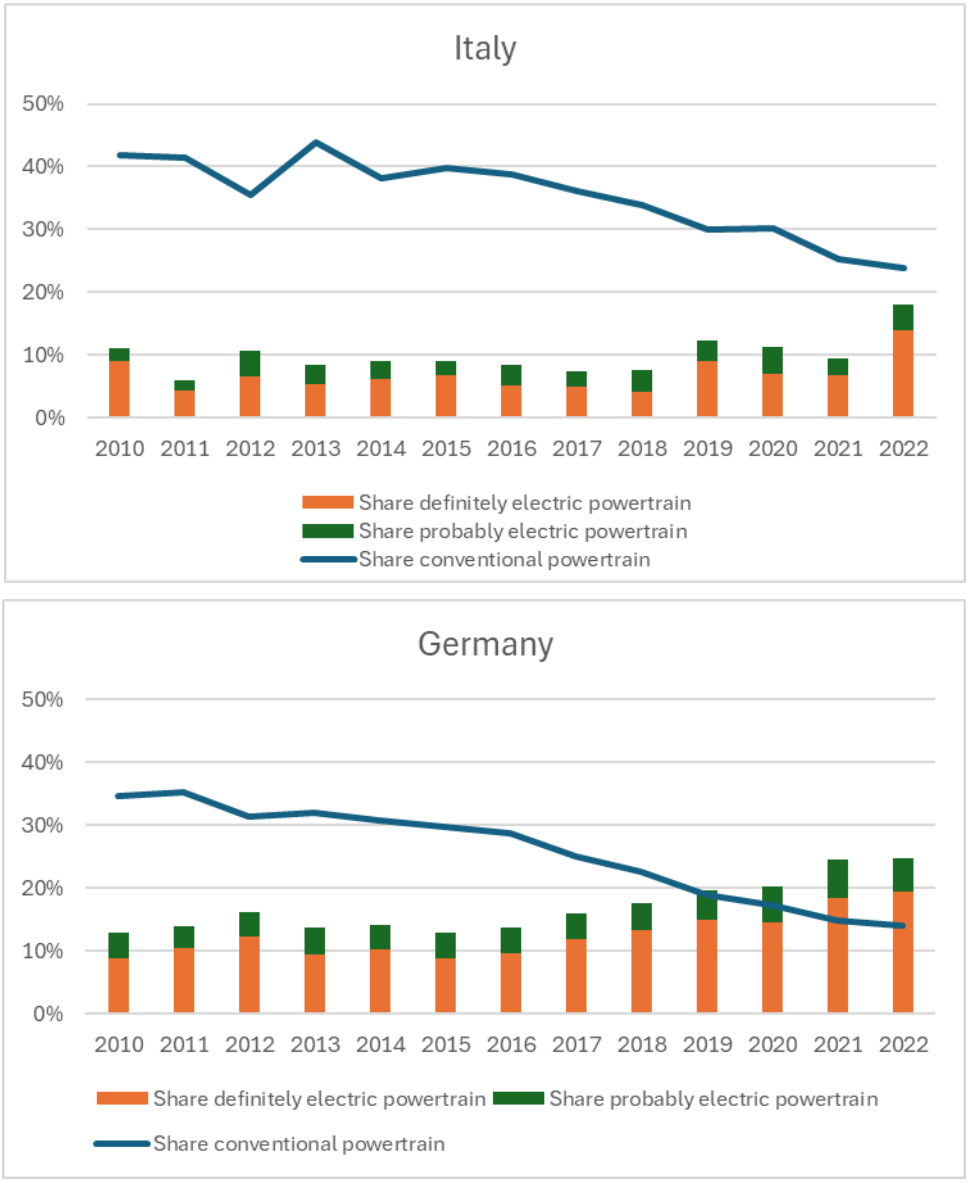
As a result, the ratio to the transnational patent activity of German inventors in the conventional powertrain is only 1:10. For innovations that can certainly be attributed to the electrified powertrain, such as batteries, high-voltage applications and the like, the ratio is 1:25. For patent applications that are highly likely to be attributed to the electrified powertrain, especially electric motors, there are 23 transnational patent applications by German inventors for every application by an inventor resident in Italy. The picture in the field of autonomous mobility is at the first glance slightly better from Italy's perspective.

The data thus shows a relative weakness of the Italian automotive industry in areas of innovation considered particularly promising for the future and a relative strength in conventional powertrains. This is a long-standing problem, as Figure 5 shows.

The share of patent applications for electric powertrains in all transnational automotive patents actually reached a historic high in Italy in 2024 after more than a decade of stagnation. However, it is still well below the share of conventional powertrains.

Figure 5: Different transformation paths in Germany and Italy

Shares of electrified and conventional powertrains in all transnational automotive patents – figures in per cent



Source: IW Patent Database, 2025

German inventors have steadily increased the share of electric powertrains since 2015. In 2024, it was 7 percentage points higher than in Italy. At the same time, research into conventional powertrains was scaled back more quickly than in Italy.

As a result, the share of patent applications for conventional powertrains in Germany is almost 10 percentage points below the comparable figure in Italy, and since 2019, more transnational patents have been filed for electric powertrains than for conventional ones. Germany is noticeably further ahead than Italy in this important transformation.

Who files transnational automobile patents in Italy?

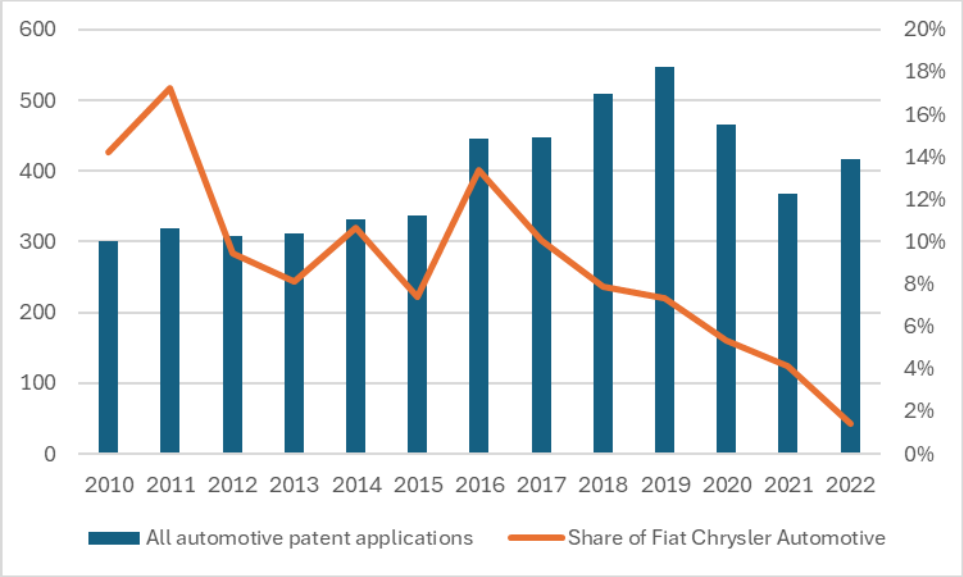
If the submitting companies are also taken into account, the findings become even more pronounced. There is a clear lack of innovation at Italy's largest OEM. The available data shows that Fiat Chrysler Automotive in particular, as the dominant vehicle manufacturer, has steadily reduced the number of its transnational patent applications over the last 15 years (Figure 6).

In 2021, the transnational patent applications of Italy's most important automotive group were a whopping 85 per cent below the comparable figure from 2010.

In 2024, most transnational automotive patents by Italian inventors were filed by Pirelli and Marelli. Brembo is also among the top five while FCA did not even make it into the top ten. FCA's weakness is also noticeable among Italian OEMs.

Ferrari was the most innovative OEM in terms of transnational automotive patents. Iveco also filed twice as many transnational patents as FCA.

Figure 6: Automotive Patents by Italian Inventors and the share of Fiat-Chrysler in percent



Source: IW Patent Database, 2025

It is evident that Italian inventors working for suppliers were able to fill the gap as the total number of transnational patent applications has remained stable despite the widespread withdrawal of the most important OEM.

However, considering that the global total number of transnational patent applications from the automotive industry has risen sharply since 2010, Italy has lost much of its importance as a centre for automotive research. This trend also applies to Germany, but is less pronounced, especially since 2018.

Unfortunately, there are currently signs that the German automotive industry is also responding to the decline in production with cuts in research spending. This is a dangerous trend in an industry that is in the midst of a technological transformation, as the developments in Italy show.

Policy recommendations

Although the German automotive industry is in a stronger position than most of its competitors, there is little reason to believe that it will be possible to regain the production lost since 2018. Capacity adjustments in Germany are therefore unavoidable.

German politicians should not attempt to hinder this process, even if it will lead to painful adjustments in some regions.

If the reduction is not carried out due to political pressure, the artificial overcapacity will lead to a permanent additional cost disadvantage that could trigger further losses. The task of policymakers is rather to support the necessary transformation and promote the transition of the affected workers to other industries.

Another important aspect is the promotion of research and the commitment to facilitating the introduction of new technologies.

The latter in particular is repeatedly proving to be a stumbling block in Europe. One example of this is autonomous driving, where German companies are at the forefront of technology, but are unable to sell their products in Europe and are therefore tending to relocate development to China.

In the field of electromobility, the German automotive industry primarily needs measures to stimulate demand. Sales of electric vehicles in Europe remain well below projections, leading to overcapacity in the construction of electric cars.

The key issue here is to expand the potential customer base, which is currently largely focused on homeowners with their own solar power systems. In order to appeal to other buyer groups, the charging infrastructure must be expanded and the pricing of charging electricity must be reconsidered. The success of electric cars in China can also be explained by the fact that the electricity costs for 100 kilometers of driving are only around one euro.

Italy's situation is very different from that of Germany. Viewed from the outside, Italian policy should focus primarily on existing strengths in the commercial vehicle and supplier sectors. Strengthening the country's position as a research location would also be crucial. According to our analysis, the Italian automotive industry has considerable deficits in this area compared to its competitors and other industries in Italy.

Sources

Eurostat, 2025, Gross value added and income by detailed industry [nama_10_a64], https://ec.europa.eu/eurostat/databrowser/view/nama_10_a64/default/table?lang=en [08.10.2025]

Inovev/Automobilwoche, 2025, 108 Fabriken – So ausgelastet sind die Autowerke in Europa, https://www.automobilwoche.de/automarktdaten/108-fabriken-so-ausgelastet-sind-autowerke-europa [03.09.2025]

Kohlisch, Enno / Koppel, Oliver / Küper, Malte / Puls, Thomas, 2023, Forschungsschwerpunkte der Kfz-Industrie am Standort Deutschland. Eine Auswertung auf Basis der IW-Patentdatenbank, in: IW-Trends, 50. Jg., Nr. 1/2023, S. 23-69

Koppel, Oliver / Puls, Thomas / Röben, Enno, 2018,Also IW-Report No. 34/18, Patent Performance of the German Vehicle Industry, https://www.iwkoeln.de/en/studies/oliver-koppel-thomas-puls-patent-performance-of-the-german-vehicle-industry.html [22.09.2025]

OICA – Organisation des Createurs d'Automobiles, 2025, Production Statistics, https://www.oica.net/category/production-statistics/2024-statistics/ [03.09.2025]

WIPO – World Intellectual Property Organization, 2024, International Patent Classification (IPC): An effective and easy-to-use system to classify and search patent documents, https://www.wipo.int/edocs/pubdocs/en/wipo-rn2022-7-en-international-patent-classification-ipc.pdf [22.09.2025]