Backward Linkages in the Hungarian Automotive Industry: Where Are the Links Concentrated?

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Abstract

Our paper is of descriptive nature and analyses the "connection points" of lead firms and suppliers in the automotive value chains. It relies on two types of methodologies: first, through the analysis of inverse input-output matrixes, it presents the local and international links of the Hungarian automotive industry and estimates, where (in which activities) local suppliers play an important role and from which countries the various inputs come. Second, through relying on company interviews, it presents a more nuanced picture about backward linkages in the Hungarian automotive industry. We conduct interviews with German and Japanese lead firms and foreign- and domestically-owned suppliers and thus our analysis is able to contrast the supplier policies of Western European and Japanese lead firms and the features of foreign- and domestically-owned suppliers.

Keywords: automotive industry, Hungary, supplier relations, input-output analysis

JEL Classification: F23, F61, L23, L62

1. Introduction

The automotive industry is of determining importance for the Hungarian economy. The industry evolved in the last thirty years in close connection with direct investments coming mainly from Germany and from other home countries of big automotive multinationals (Japan, and for automotive suppliers Western European countries, Korea, China, US etc.). Our paper has a closer look at the Hungarian automotive industry and shows the main characteristics of its supplier linkages. We rely on two methodological approaches: analysis of input-output tables and company interviews. According to our results, Hungary is highly integrated in automotive global value chains. However, this integration is different depending on the lead firm: German OEMS have different supplier linkages compared to Japanese ones. We show that the "averages" of these two different behaviours influence the evolution of the shares of value added in input-output tables.

This short paper is organised as follows. We present a brief overview of the literature and background on the Hungarian automotive industry, followed by the methodology. The next section contains the results of the input-output analysis, followed by the findings from the company interviews. The last section presents a summary of the paper.

2. The Hungarian automotive industry: a brief presentation and review of the literature

In a country with no car, just bus production during the more than 40 years of socialism, after the transition process started, Opel made the first automotive investment for engine production in 1990 as part of the regional strategy of GM in Europe (Bartlett and Seleny 1998). More importantly, the first assembly investment was made by the Japanese company, Suzuki by forming a joint venture firm, 'Magyar Suzuki Corporation' in 1991, followed by the German Audi in 1993 and Mercedes in 2008. Thus in 2020, of four original equipment manufacturers (OEMs), three firms are engaged in the vehicle assembly operation in the country and one of them produces engines as well, as its main activity. In addition, there are over 700 automotive suppliers in Hungary, both foreign-owned and Hungarian-owned. It is estimated that 175,800 jobs are created by the automotive industry, which is approximately 4% of the total employment of the country in 2017. Vehicle output has exceeded more than 400.000 units in 2018, representing more than one fifth of exports and one third of manufacturing production (HIPA 2018). Efficiency-seeking and export-platform foreign carmakers are attracted by low labour costs, flexible labour laws, good infrastructure, generous investment incentives and proximity to European markets.

In Hungary, expectations were high concerning the dynamising and growth impact of automotive investments and their positive impact on local companies mainly through backward linkages and spillovers. However, these expectations were not fulfilled: with some exceptions, local content originating from Hungarian suppliers has remained relatively low (Pavlínek et al., 2017), though company-level (Kazainé, 2013; Szalavetz, 2019) and macro-level (Sass-Szalavetz, 2013) analysis point to some upgrading over time.

3. Methodology

Our paper relies on a combined methodology. First, through the analysis of inverse input-output matrixes, we present the local and international links of the Hungarian automotive industry and estimate, where (in which activities) local suppliers play an important role and from which countries the various inputs used by the industry in Hungary come.

Second, we supplement the results of the above analysis with information gained from company interviews and one interview with the representative of HIPA (Hungarian Investment Promotion Agency) and one with JETRO. In these interviews, we try to assess and identify the various factors, which influence the choice of inputs (local or foreign, and if foreign, from which country sources), and we list the most important factors influencing the extent of reliance on local suppliers by multinational firms. Furthermore, we conducted three interviews with successful local (Hungarian-

controlled) suppliers and based on these sources of information as well as information from buyer firms, we determine the characteristics of successful local suppliers. Overall, we conducted interviews with German and Japanese lead firms and their local suppliers, both foreign-owned and Hungarian-owned. In our company sample, there are three Hungarian-owned supplier firms, two foreign-owned lead firms and three foreign-owned supplier firms. We supplemented the information gained from the company interviews with information from publicly available sources (newspaper articles, websites of the firms and balance sheets of the companies).

These two different methodological approaches supplement each other well and help us to overcome the well-known data problems and the problem originating from the lack of qualitative data on automotive lead firms and suppliers.

4. Results

Relying on the above mentioned two methodological approaches gave us a fuller picture about backward linkages in Hungary in the automotive industry.

4.1 Results of the data analysis

The input-output data bases offer indicators to measure the global value chain length and structure of the automobile industry (C29). We used the UIBE methodology, input-output tables and GVC indicators based on the WIOT database for our calculations. Characteristics of participation in global value chains are described by the participation rate, the production length and the position.

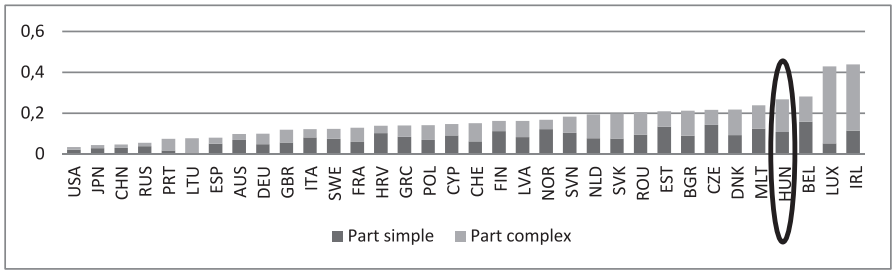
The participation index measures how much an industry is involved in its global value chain. The indicator is the sum of the backward and forward vertical specialisations; the former measured by the relative value added import to global export, while the domestic value added ratio in the global export indicates the weight of the forward participation.

The UIBE uses the Wang et al (2017) decomposition of gross output, who define the length of production as the average number of production stages between the primary inputs in a country/sector to final products in another country/sector: it is the average number of times that value-added created by the prime factors employed in the country/sector pair has been counted as gross output in the production process until it is embodied in final products. As a calculation it is the ratio of gross output to related value-added or final products. Its denominator is value-added or final products generated from a value chain, its nominator is cumulative gross output of the value chain. The total production length can be divided into backward and forward length, which characterises the industry as well as the country in an international comparison. The longer the production chain, the greater the number of backward and/or forward production stages. The different lengths indicate different positions of a country in the global value chain.

The position reflects the relative distance of a country-sector to the both ends of a value chain. The fewer production stages an industry has, the relatively more upstream the country-sector's position is in the particular global value chain. Hence the position index considers the length to both ends of the GVC, which means that production length and position are closely related.

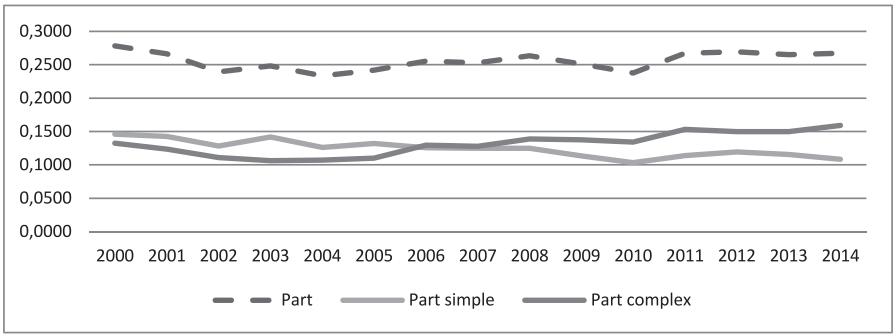
Concerning its participation index, the Hungarian automobile industry is highly involved in GVCs in international comparison (Figure 1), with the dominance of complex, multi-country value added chains. (In the case of complex GVCs, components cross borders more than once, while in the case of simple, only once.) This involvement is accompanied since 2004 with contacts with an increasing number of countries; and since 2007 multi-country trade is dominant (Figure 2).

Figure 1: Simple and complex participation indexes of the automobile industry (2014)



Source: calculated by UIBE

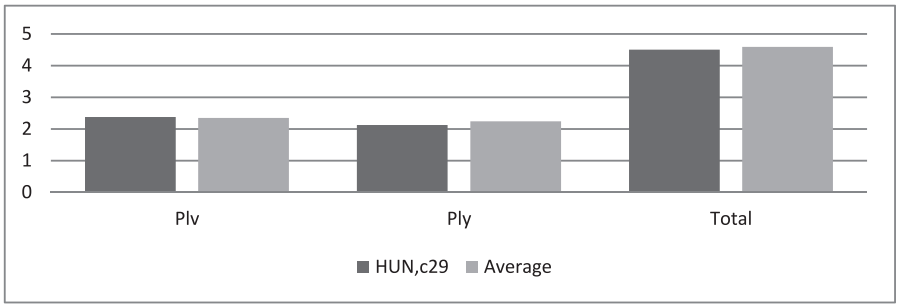
Figure 2: The participation index in Hungary 2000–2014



Source: calculated by UIBE

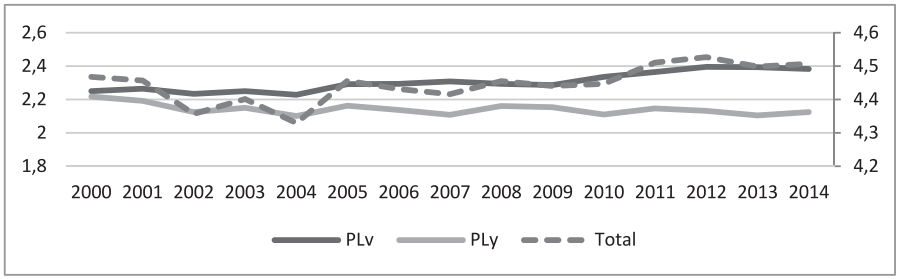
As far as the production length of the industry is concerned it is lower than the national average (Figure 3). Concerning the length with respect to backward linkages (Ply), it is shorter than either the forward linkage (Plv) length or the national average. In time (Figure 4) the total length (right axis) is basically stable between 2000 and 2014. However, its structure is changing (left axis): backward linkages have shrunk, and forward length has been extended. In international comparison, the Hungarian automobile industry is a bit longer than the average of other countries. However, other East-Central European automotive production chains are similarly long, likewise in China.

Figure 3: Forward, Backward and total production length in Hungary (2014)



Source: calculated by UIBE

Figure 4: Production length 2000–2014



Source: calculated by UIBE

A more detailed picture of the backward linkages of the automobile value chains can be obtained from the analysis of international input-output tables. (Table 1)

Table 1: Backward automobile value chains in terms of country and industry 2014 and 2000

2014			2000			2014			2000		
Country	Number	Value %	Country	Number	Value %	Industry	Number	Value %	Industry	Number	Value %
HUN	27	15,31	HUN	33	40,24	C28	24	21,99	C26	19	10,74
DEU	14	34,18	DEU	13	25,47	C29	22	28,20	C28	16	19,70
POL	10	4,09	AUT	8	5,45	C26	13	4,92	C29	13	27,73
AUT	8	3,92	ITA	8	2,88	C27	12	6,35	C27	9	8,06
CZE	7	3,89	JPN	5	2,52	C25	9	5,41	C24	7	2,69
FRA	7	2,60	FRA	4	2,31	C22	8	2,65	C22	4	2,86
ROW	7	2,90	GBR	4	1,49	C24	8	2,44	C25	4	5,30
ITA	6	3,59	USA	4	1,12	G46	8	3,54	C13-C15	3	0,57
JPN	5	1,69	ESP	3	0,99	M74_M75	5	1,16	G46	3	2,33

2014			2000			2014			2000		
Country	Number	Value %	Country	Number	Value %	Industry	Number	Value %	Industry	Number	Value %
NLD	5	1,07	POL	3	0,71	N	5	2,65	N	3	1,11
SVK	5	1,69	FIN	2	0,27	G45	3	0,62	C20	2	0,71
CHN	4	3,16	NLD	2	0,31	C20	2	0,43	C23	2	0,84
GBR	4	0,74	RUS	2	0,34	C23	2	0,56	C31-32	2	0,40
ROU	4	1,24	SVK	2	0,48	C31-32	2	0,31	F	2	0,42
USA	4	1,63	SWE	2	0,44	G47	2	0,39	A01	1	0,15
KOR	3	0,79	TWN	2	0,64	M69-70	2	0,85	C10-C12	1	0,14

Source: own calculation by WIOT

As far as the participating countries are concerned, the value chain is quite concentrated: 70% of the upstream automobile value added is produced by only eight countries. Most of them are neighbouring or geographically close economies. Hungarian and German companies contribute the most; Hungary has the highest score by the number of production stages, while both in absolute and relative terms the most values are added in Germany. Relatively high value added is imported from Italy and China, while Poland contributes with many stages though relatively little value added. However, in 2000, the value chain was even more concentrated: only three countries gave 70% of the upstream value added, with the leading role of Hungary. By 2014, Germany became dominant. In terms of the countries Czechia and Poland have the highest increase both in numbers and values. Italy has also achieved an upstream is the value chain, while the role of Japan fell back.

In terms of the industries, the value chain is also quite concentrated: 50% is produced by two, 60% by four industries. Most of the value added comes from the same, motor vehicle industry, while machinery and electric equipment give the most production stages. Further important contributions are provided by the manufacture of computer, electronic, metal, rubber and plastic products. In comparison with 2000, the concentration has increased, mainly due to the decrease of the relative contribution of the computer industry. In 2014, certain services appeared in the Hungarian automotive value chain (repair of motor vehicles and scientific and technical activities).

4.2 Results from company interviews

Our company interviews could supplement well the results of the data analysis. One important result is that input-output data conceal large differences between the individual data. With regards to automotive supply chain networks in Hungary, Magyar Suzuki employs 239 Tier-1 suppliers in Hungary (Interview, 18 December 2019). Mercedes is estimated to have over 110 suppliers in Hungary and Audi over forty (Interview, 18 October 2019). A clear difference can be identified between Magyar Suzuki and German OEMs in relation to local supplier networks. Due to the local content (LC) requirement of 50% (which had to be achieved by outside-EU companies in order that their products are treated as "EU-made" and thus freely traded in the EU), which Magyar Suzuki had to fulfill, the Japanese company has developed more

locally oriented supply chain networks by employing two strategies. The first strategy was to assist local firms (typically low technology level) to upgrade their technological capability to meet Magyar Suzuki's requirement. The second was to ask their suppliers in Japan to relocate into Hungary. Consequently, Suzuki could achieve a 50% local content requirement in 1995. In 2019, 27 locally owned firms supply Magyar Suzuki as a Tier-1 supplier (Interview 18 December 2019). In contrast, German OEMs do not have to fulfill this requirement (as Hungary was member of the same free trade area and later on higher level of economic integration as Germany). Consequently, German OEMs became to depend on foreign (typically German) Tier-1 suppliers in Hungary or imports from Germany. That is why we can find very low number (handful) locally-owned Hungarian companies, which could become Tier-1 suppliers for the German OEMs (Interview 18 October 2019). Indeed, Audi for example has no Tier-1 Hungarian-owned supplier. The Hungarian Audi affiliate has several hundreds of suppliers, of which around 40 are located in Hungary and around ten of these can be in Hungarian ownership. This is in line with our finding of the dominant role of German backward linkages in 2014 in the Hungarian automotive industry, based on the analysis of input-output tables, but this is mainly the result of the activities of German OEMs and not the Japanese one.

Furthermore, we can explain based on our company interviews, the increase in the share of German value added between 2000 and 2014: we suspect, this can be attributed to the appearance of the Hungarian Mercedes-subsidiary in 2012, which, as we saw, relies minimally on local and to a great extent on imported inputs. This can be partly attributed to the fact that Mercedes brought the production of an older model to Hungary, with existing suppliers linkages and networks and thus with very little room for recruiting new suppliers.

An interesting insight is gained on the suppliers of Suzuki from the interviews. There are two types of product contracts between Magyar Suzuki and their suppliers. First one is *drawing supplied method* (*taiyo-zu* in Japanese) that a supplier produces components according to drawing (blueprint) provided by an assembler (it can be considered as OEM arrangement in the GVC literature). Second type is *drawing approval method* (*shyonine-zu* in Japanese) that a supplier conducts a design of drawing and production of components according to basic specification provided by an assembler and receives the approval from the assembler (it can be considered as ODM agreement in the GVC literature) (see Takeishi and Fujimoto 2001). The former is used for general parts and the latter is used for functional parts. In general, local Hungarian suppliers produce general parts including sheet metal parts, pressed parts, resin parts that are bulky and ideal for a close location for assembling operation. On the other hand, multinational suppliers are engaged in the production of functional parts such as electric parts, lumps, and air-conditioning (Interview, 18 December 2019). In this context, large multinational corporations conduct R&D in their home country or regional headquarters and develop their functional parts. This is reinforcing our results from data analysis on the low level of R&D activities – however, by 2014; we could indicate a relatively significant increase in the share of these activities (Table 1), which again can be the result of such activities carried out by the Hungarian subsidiaries of OEMs. Indeed, the Hungarian

Audi subsidiary has a global mandate in the multinational firm for tribology-related R&D (Sass – Szavaletz, 2014).

As we showed, Magyar Suzuki plays an important role for enabling and keeping its Hungarian suppliers. With regards to development of general parts, Magyar Suzuki requests their suppliers to provide an improvement plan. At the first phase, process (production technology) upgrading is required. At the second phase, product development (designing of the product) is required. Suzuki's technical cooperation with their suppliers is conducted in the following three stages. At the first stage, Magyar Suzuki evaluates technical level of a supplier. At the second stage, if the supplier is interested in developing more complex parts, both Hungarian and Japanese staff members at Magyar Suzuki provide their advices to the firm. At the third stage, the supplier will be able to visit a firm that produces the same parts and learn production know-how in Japan (Interview, 18 December 2019). In this context, Magyar Suzuki enhances process and product development capabilities of local capital suppliers in Hungary and thus helps them to upgrade within value chains.

Foreign-owned suppliers presented important insights into their operation in Hungary. All had traditional links with automotive OEMs in their home countries, usually a long-term supplier relationship. They were encouraged by the OEM to follow them to Hungary, and in many cases product specificities justified setting up a local affiliate in Hungary, given the relatively high specific trade costs. However, all foreign-owned suppliers interviewed followed a diversification strategy: though they came to Hungary to supply their home partners, they were actively seeking new clients and partners, not only in Hungary, but also in other European (and in certain cases non-European) countries. Thus, though the home country headquarter was the most important decision-maker, the Hungarian subsidiaries acted quite independently in the majority of the cases when it came to finding new buyers. This is also true in terms of their local suppliers: they were trying hard to find Hungarian firms which are able to supply them in the required quantity and quality. However, as the results of the input-output analysis indicate (Table 1), they are not always successful in that, they complained about the capabilities of Hungarian suppliers. Another important common feature was the relative lack of R&D activities: in our interviewed cases this activity mainly remained in the home country, reinforcing the statement of Pavlínek et al. (2017) and our finding according to the analysis of input-output tables about the low (though somehow increasing) level of local R&D activity.

Taking interviews with successful Hungarian suppliers underlined certain important points, why the number and share of Hungarian suppliers is relatively low in the automotive industry. However, here we could certainly identify a selection bias: only successful local suppliers were welcoming our interview requests, thus we do not have information about the failures and other problematic cases. First of all, company size and capabilities matter: one of our interviewed company emphasized that it is able to supply Suzuki in the required amount, because it is large enough in terms of its capacities. Another supplier emphasized the importance of quality and meeting delivery times, as well as being able to increase productivity continuously and thus reduce costs and prices of supplies. Interestingly enough, one company emphasized that

supplying standardized products, while it is not beneficial from the upgrading point of view, it is more beneficial from the point of view of the company: it has to add less engineering and development activities, solve less numerous technical-technological problems and these capacities can be used elsewhere. This reinforces the dominance of manufacturing activities (and lack of various services) in local value-added, found by our analysis of the input-output tables (Table 1). Another supplier emphasized the importance of looking for niches when becoming suppliers to OEMs: there are many gaps, which foreign-owned companies deem too small and unprofitable to deal with – here comes the Hungarian company in the picture, which firm is specialized in this type of projects with 100 employees, of which 45 engineers. This case on the other hand may reinforce the still small but growing level of R&D in local value-added.

5. Conclusion

The automotive industry plays an increasingly significant role in the Hungarian economy. This is mainly due to the operation of four OEMs and the high level of involvement of Hungary in automotive global (or rather European) value chains. We showed, based on input-output tables, the high integration of Hungary in GVCs in international comparison. Furthermore, we showed the persistently low backward linkages, the decreased Hungarian value added share and the increased dominance of German value-added. Furthermore, while Hungary seems to be stuck in the bottom of the GVC smile curve through providing mainly manufacturing type value added, there is some increase in services value added over time. Based on our company interviews, we can present a more nuanced picture, according to which the information of input-output tables disguises large differences among OEMs operating in Hungary. The Japanese Suzuki relies significantly more on local (including Hungarian-owned) suppliers, than the German OEMS, especially the late arriving Mercedes. Furthermore, while Suzuki carries out no R&D in Hungary, here the German Audi may be responsible for the growth in this type of services value-added. Other such differences can be revealed by further investigations based on company interviews – which we continue further in the future. Furthermore, our preliminary results show how useful it can be to combine methodological approaches ("quantitative" and "qualitative") when analysing industry developments.

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References

[1] Bartlett, D. and Seleny, A. (1998). The Political Enforce of Liberalism: Bargaining, Institutions, and Auto Multinationals in Hungary. *International Studies Review*, 42(2) pp. 319-338.

[2] HIPA (2018). *Automotive Industry in Hungary*. Budapest: Hungarian Investment Promotion Agency. HIPA, Budapest.

[3] Kazainé Ónodi, A. (2013): Mosógéptől a kipufogó rendszerig: készségek és képességek – a Hajdu Zrt. esete. (From washing machine to In Ábel, I. and Czakó, E. (eds.). *Az exportsiker nyomában*, Alinea Kiadó, Budapest, pp. 155-168.

[4] Pavlínek, P.; Aláez-Aller, R.; Gil-Canaleta, C. and Ullibarri-Arce, M. (2017). Foreign Direct Investment and the development of the automotive industry in Eastern and Southern Europe. *ETUI Working Paper 2017.03.*ETUI Brussels.

[5] Sass M. and Szalavetz A. (2013). Crisis and upgrading: the case of the Hungarian automotive and electronics sectors*, Europe-Asia Studies*, 65 (3), pp. 489-507.

[6] Sass M. and Szalavetz A. (2014). R&D-based integration and upgrading in Hungary, *Acta Oeconomica*, 64: (Spec. Issue 1) pp. 153-180

[7] Szalavetz, A. (2019). Digitalisation, automation and upgrading in global value chains – factory economy actors versus lead companies, *Post-Communist Economies* 31(5), pp. 646-670.

[8] UIBE (2019). *GVC indicators* [online]. [cit.2020-02-26]. Available at: http://rigvc.uibe.edu.cn/english/D_E/database_database/index.htm

[9] Wang, Z, Wei, Sh., Yu, X. and Zhu, K. (2017). Characterizing Global Value Chains: Production Length and Upstreamness. *Working Paper No. 23261.* Cambridge: NBER National Bureau of Economic Research.

[10] WIOT (2016). *Statistics* [online]. [cit. 2020-02-26]. Available at: http://www.wiod.org/database/wiots16

Appendix – Acronyms

Acronym	Name	Acronym	Name
AUT	Austria	ITA	Italy
BEL	Belgium	JPN	Japan
BGR	Bulgaria	KOR	Korea
CHE	Switzerland	LTU	Lithuania
CHN	China	LUX	Luxembourg
CYP	Cyprus	LVA	Latvia
CZE	Czech Republic	MLT	Malta
DEU	Germany	NLD	Netherlands
DNK	Denmark	NOR	Norway
ESP	Spain	POL	Poland
EST	Estonia	PRT	Portugal
FIN	Finland	ROU	Romania
FRA	France	RUS	Russian Federation
GBR	United Kingdom	SVK	Slovakia
GRC	Greece	SVN	Slovenia
HRV	Croatia	SWE	Sweden
HUN	Hungary	TWN	Taiwan
IRL	Ireland		

Code	Industry
A01	Crop and animal production, hunting and related service activities
C10-C12	Manufacture of food products, beverages and tobacco products
C13-C15	Manufacture of textiles, wearing apparel and leather products
C16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
C17	Manufacture of paper and paper products
C19	Manufacture of coke and refined petroleum products
C20	Manufacture of chemicals and chemical products
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
C22	Manufacture of rubber and plastic products
C23	Manufacture of other non-metallic mineral products
C24	Manufacture of basic metals
C25	Manufacture of fabricated metal products, except machinery and equipment
C26	Manufacture of computer, electronic and optical products

C27	Manufacture of electrical equipment
C28	Manufacture of machinery and equipment n.e.c.
C29	Manufacture of motor vehicles, trailers and semi-trailers
C31_C32	Manufacture of furniture; other manufacturing
C33	Repair and installation of machinery and equipment
F	Construction
G45	Wholesale and retail trade and repair of motor vehicles and motorcycles
G46	Wholesale trade, except of motor vehicles and motorcycles
G47	Retail trade, except of motor vehicles and motorcycles
M69_M70	Legal and accounting activities; activities of head offices; management consultancy activities
M74_M75	Other professional, scientific and technical activities; veterinary activities
N	Administrative and support service activities