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The Impact of Economic Globalization on the Import Dependence and Product Innovativeness of Manufacturing Industry: a case study of France, Germany, Italy and Poland

Abstract: This study theoretically and analytically substantiates the authors' hypotheses regarding the impact of economic globalization on import dependence (the share of imports in production costs) and product innovativeness (the share of innovative products in the volume of realized industrial production) within the manufacturing industries of France, Germany, Italy and Poland. It is empirically proven that increased economic globalization leads to a rise in import dependence but a decline in product innovativeness in the manufacturing industries of the countries studied. Specifically, the analysis reveals a high direct correlation between the *de facto* economic globalization index and the share of imports in the intermediate consumption of most manufacturing divisions in the countries examined. Conversely, it is shown that a high inverse correlation exists between the *de facto* economic globalization index and the share of innovative products in the total realized industrial output of these countries' manufacturing industries. The study models changes in import dependence and product innovativeness when the economic globalization index increases by five points. The research is based on data for the manufacturing industries of Poland, Italy, France and Germany from 2000 to 2019.

Keywords: dependence; economic; globalization; import; manufacturing industry; production; product innovativeness

Received: 30 April 2025

Accepted: 17 September 2025

Suggested citation:

Ishchuk, S., Sozansky, L. (2025). The Impact of Economic Globalization on the Import Dependence and Product Innovativeness of Manufacturing Industry: a case study of France, Germany, Italy and Poland. *Prace Komisji Geografii Przemysłu Polskiego Towarzystwa Geograficznego* [Studies of the Industrial Geography Commission of the Polish Geographical Society], 39(4), 7–28. doi: <https://doi.org/10.24917/20801653.394.1>

INTRODUCTION

The impact of economic globalization on the manufacturing industry of various countries is a multifaceted and ambiguous phenomenon, with both positive and negative effects over different periods. On the one hand, economic globalization contributes to expanding

markets, increasing exports, lengthening global value chains while fostering specialization in the world economy, broadening the geographical scope of capital flows, encouraging technology transfer, creating new jobs in developing economies, and promoting better standards of corporate governance.

On the other hand, economic globalization can have a profoundly negative impact on the security and socioeconomic development of national economies, leading to economic processes such as monopolization of high-tech product markets, increased import dependence of national economies on high-tech goods and energy resources, the weakening or loss of a country's economic sovereignty, a deepening of social, innovative and technological gaps between developed and developing economies, increased labour migration and geopolitical tensions. These issues are particularly relevant in the context of ongoing global changes and economic globalization.

The manufacturing industries of Poland, Italy, France and Germany were chosen for this study. The selection of these countries is based on several factors: all are major EU economies, yet the industry in each country has unique characteristics, distinct specializations and operates at different levels of industrial and innovative development. A key argument for this selection was the substantial difference in the level of economic globalization (measured by the KOFEcGIdf index) among these economies. This allowed the authors to investigate whether the degree of economic globalization (openness or closedness to foreign trade) influences the qualitative indicators of the manufacturing industry.

The study period, from 2000 to 2019, was chosen because it encompassed the integration of Eastern European economies into the EU, which intensified economic globalization in the region. This period was also marked by the 2008 global financial crisis, the 2015 recession, and other global economic challenges. All these events, directly or indirectly, influenced economic globalization, which in turn was reflected in the indicators of import dependence and product innovativeness of manufacturing industries in these countries. The research's final year (2019) was dictated by the lack of more recent data available at the time of research.

The purpose of this research is to model the impact of economic globalization on the import dependence and product innovativeness of the manufacturing industries of Germany, France, Italy and Poland.

Research gaps. In most existing research on the problematic aspects of economic globalization's impact on industrial economic indicators, the following methodological peculiarities are observed. The scale of a country's economic globalization is not always determined by specific indicators (e.g. the economic globalization index). Instead, only superficial visual processes and changes that have occurred in a country's economy over a certain period are considered. In most cases, the starting point for the time period is the year a particular international agreement was signed. Using such an approach yields conditional results in assessing the impact of globalization on the economy.

In most existing studies, conclusions about the impact of economic globalization on industrial economic indicators are formed at the micro-level, analyzing the indicators of a certain number of firms or corporations, and the representativeness of the sample is often not calculated. This leads to contradictory conclusions. The results of the impact of economic globalization on the economy or a sector of a particular country are determined by analyzing the trends of absolute indicators, for example, the dynamics of exports/imports, production volumes, foreign investments, number of employees,

income, etc. Such an extremely important issue for a country's economic security, as the impact of economic globalization is, on the import dependence of manufacturing industries, remains completely overlooked by scholars.

The authors of this study faced the question of whether economic globalization contributes to increasing the innovativeness of a country's products or, on the contrary, decreases it. The answers to these questions can be ambiguous, as many countries hold the view that economic globalization can contribute to increasing the competitiveness of national industries by supplementing their production processes with imported technologies, resources, etc., thereby ensuring an increase in the innovativeness of industries' products. However, an objective answer to these questions can only be obtained from the results of in-depth empirical research, the main findings of which are presented in this article.

Thus, this study is the first to empirically establish correlations between economic globalization, expressed by the *de facto* economic globalization index, and the import dependence and product innovativeness of manufacturing industries of Germany, France, Italy and Poland. Furthermore, regression models have been built to determine how the import dependence and product innovativeness of manufacturing industries will change with a change in the *de facto* globalization index.

Structure of the research. The results presented in this article are structured into four main parts. The first part reviews the findings of existing studies that address issues of import dependence and innovativeness in the manufacturing industries of EU countries, with a focus on Germany, France, Italy and Poland, in the context of and under the influence of economic globalization. Based on this, the authors' hypotheses regarding the impact of economic globalization on the import dependence and innovativeness of manufacturing industries of those countries are formulated. The second part describes the methodological sequence by which the empirical study was conducted. The third presents proof of the authors' hypotheses through correlations between economic globalization and the import dependence and product innovativeness of the manufacturing industries of those countries while the fourth presents the results of modelling the import dependence and product innovativeness of their manufacturing industries through a change in the *de facto* economic globalization index.

LITERATURE REVIEW

This study's theoretical foundation and hypotheses were developed through the analysis of academic works on the impact of economic globalization, with a specific focus on the import dependence and innovativeness of manufacturing industries in EU countries. The influence of economic globalization on the import dependence and product innovativeness of manufacturing industries is multifaceted and can yield both positive and negative effects depending on the period, macroeconomic conditions or specific country.

However, academic papers clearly state that economic globalization can contribute to increasing the output of certain industrial products in EU countries, including Germany, Poland, France and Italy (Lurweg, Oelgemöller, Westermeier, 2010), and extending global value chains. At the same time, this process intensifies the specialization of countries in particular industrial products, goods or services (Dunford et al., 2013). While this model seems advantageous under conditions of global stability, recent events – the 2008 financial crisis, the economic consequences of COVID-19, global competition for

resources, geopolitical influences and the Russian-Ukrainian war – have created significant risks to the self-sufficiency of national industries in EU countries and have challenged the functionality of global value chains. For example, in recent years, an average of 51.7% of companies in surveyed EU countries have faced shortages of raw materials, intermediate goods and final products (Eurostat, 2025).

Economic globalization expands opportunities for the export of industrial goods but simultaneously increases the dependence of national economies on the import of intermediate consumption products (Păunică et al., 2018). While offshoring can reduce production costs and increase the profits and profitability of individual corporations, it also raises the risks of increased unemployment and a decline in innovativeness, as well as scientific and technological development in EU countries (Amighini, Rabellotti, 2003). As noted by World Trade (1999), “the structure of economic globalization is itself corporate protectionism because it is designed to protect corporations from the rules of democratic societies.” The extension of global value chains (GVCs) among EU countries, a result of economic globalization and integration, has negatively affected the Italian economy (Cresti et al., 2023). Italy is described as being “trapped into a downgrading path along GVCs,” and for over fourteen years, the country has recorded “an increasing labour dependence in the most strategic productive sectors as science-based and specialized supplier industries, and a lack of a clear forward penetration with stable and strategic partners.” The participation of countries in GVCs is distinctively asymmetric, with some, like Germany, assuming a dominant position, while others, such as Poland, show an upgrading path, and still more, like Italy, follow a downgrading path. Cresti, Dosi, Riccio (2023: 895) confirm “the strong ascending role of the Visegrad area... and the descending role of the southern one.”

Economic globalization, in addition to its positive aspects, is a key factor behind the significant increase in the dependence of national industries in EU countries, particularly Germany, France, Poland and Italy, on imported intermediate goods. For instance, German industry has seen a rise in imports of cheaper intermediate goods from partner countries outside the Eurozone, such as developing markets in Southeast Asia or neighbouring Central and Eastern European (CEE) countries (Stirboeck, 2006). Participation in GVCs has made Polish firms more reliant on imported intermediate goods which has, in turn, lowered their price markup and enhanced their competitiveness (Gradzewicz, Mućk, 2019). The Polish economy, like other CEE countries, shows significant import dependence for both domestic consumption and exports (Szpunar, Hagemeyer, 2019). In France, increased vertical specialization (the transfer of labour-intensive production stages abroad) has led to a reduction in the share of low-skilled workers in manufacturing industry, as firms have become more dependent on imported components (Strauss-Kahn, 2004).

Economic globalization also has a multifaceted impact on the innovative development of national industries in EU countries, specifically Germany, Poland, France and Italy. For example, it has a dual effect on innovation in the German manufacturing industry: it stimulates exports, which boosts income and innovation, but also forces firms to adapt to competition, potentially leading to production fragmentation (Herrigel, 2015). The German model of industrial production is undergoing changes due to globalization, as Herrigel (2015: 140) notes, “new products, technical innovations, competition among suppliers, new local rules, changes in currency values, opportunities caused by organizational learning and much more constantly destabilize the ordered practices that firms develop and create new problems with adaptation and management.” The

level of environmental uncertainty is so high that at any given moment, players lack a clear idea of the most optimal strategy to achieve their goals (Herrigel, 2015). Germany is a country where the pace of innovation is slowing, and its effectiveness as a driver of growth is decreasing (Naudé, Nagler, 2021). Furthermore, the productivity of German research is declining (Boeing, Hünermund, 2020), the number of German firms engaged in innovation is decreasing (Rammer, Schubert, 2018), and the profitability rates from research and development in German manufacturing are sharply falling (Lang, 2009).

The impact of economic globalization on the innovativeness of French industrial production is viewed from various perspectives. According to Aghion et al. (2020), “market size increase drives all firms to innovate more by increasing the innovation rents; yet by inducing more entry and thus more competition, it also discourages innovation by low productivity firms.” They also found that “a one percent expansion/contraction in export demand leads to 52 additional/fewer priority patents... in the French manufacturing sector.” Firms closest to the technological frontier increase innovation the most, while the combined effect can even be negative for the least productive. Erixon (2017) notes that “globalization has enabled firms to specialize and to increase the intensity of R&D, innovation and capital in their output.”

In the Italian economy, economic globalization has a positive impact on the innovativeness of firms that are larger, more productive and have a history of investing in innovation (Accetturo et al., 2014). The globalization and internationalization of the economy have also compelled Polish companies to implement innovative solutions (Grego-Planer, Glabiszewski, 2015). However, Poland simultaneously faces challenges such as low R&D expenditures by industrial enterprises, poor cooperation between business and academia, and a decreasing number of entities bringing innovations to the market. Gajda (2015) argues that “a change in assumptions about development is crucial for the innovativeness of Polish industry: from a development model based on the ability to imitate solutions developed in countries leading in innovation rankings, to a strategy of creating one’s own knowledge, which is the result of scientific research conducted in cooperation with industry.” The use of offshoring can negatively affect the socioeconomic efficiency of engineering and the economy in general, not only in developing countries but also in highly developed economies (Ishchuk, Sozansky, 2022).

Different approaches to economic globalization are rooted in fundamental theories. According to Ricardo’s theory of comparative advantage, countries gain an edge in international trade by focusing on producing goods with the lowest opportunity costs relative to other countries. This theory advocates for specialization within the world economy (Estevez 2022). In contrast, Keynes’s idea of “national self-sufficiency” suggests that every country should strive for economic independence to ensure its own development, producing all necessary goods and services whenever reasonable and convenient, and not ignoring its economic security in the pursuit of international trade. As Keynes (1933) wrote, “I sympathize, therefore, with those who would minimize, rather than with those who would maximize, economic entanglement between nations... But let goods be homespun whenever it is reasonably and conveniently possible, and, above all, let finance be primarily national.” Joseph Stiglitz, a Nobel laureate in economics, emphasizes that developed Western economies disproportionately benefit from economic globalization, which, conversely, deepens poverty in developing countries. He points out that “Western countries force poor countries to eliminate trade barriers,

while they themselves maintain them, preventing developing countries from exporting their agricultural products...” (Stiglitz, 2002).

While the reviewed and other works have made significant contributions to the complex issues of economic globalization, they were mostly conducted at the firm level. Their findings may therefore differ from the macroeconomic consequences of globalization on the import dependence and innovativeness of manufacturing industries in EU countries. For this reason, the empirical substantiation of the impact of economic globalization on the import dependence and product innovativeness of manufacturing industries remains an open question. Based on the review of academic literature and preliminary findings, the core hypotheses of this study are formulated as follows:

H1. Economic globalization increases the dependence of the manufacturing industries of Germany, France, Italy and Poland on the import of intermediate consumption products.

H2. Economic globalization reduces the innovativeness of the industrial products of Germany, France, Italy and Poland.

METHODOLOGY

The research goals and the verification of the formulated hypotheses were achieved through the following methodological sequence:

Stage 1: Analyzing the Globalization Index. The first stage of the research involved analyzing the level and dynamics of the *de facto* economic globalization index (KOFecGIdf) for the countries under review. The *de facto* index reflects the actual, rather than potential, international flow of goods, services and capital (KOF Globalization Index, 2022). This focus on factual data, such as the volume of international trade and foreign investments, distinguishes it from the *de jure* economic globalization index. The *de jure* index, by contrast, reflects the legal and institutional framework, including customs tariffs, trade agreements and investment restrictions, on the potential conditions for globalization. A higher KOFecGIdf value indicates a country's economy is more open to globalization and foreign trade, and vice versa. The index ranges from 1 to 100 and is based on a wide range of indicators covering foreign trade in goods and services, foreign investments, and economic restrictions. The primary objective of this stage was to identify the specific characteristics and trends of economic globalization in Germany, France, Italy and Poland.

Stage 2: Assessing Import Dependence and Innovativeness. The second stage involved analyzing the import dependence and product innovativeness of manufacturing industry as a whole, as well as for the 16 individual manufacturing divisions in Germany, France, Italy and Poland.

To calculate the import dependence for each division, the share of imported intermediate costs within the total for intermediate production was determined. This allowed for the calculation of the dependence of each of the 16 manufacturing divisions on imported intermediate costs. The data for this calculation were sourced from the input-output tables published by the OECD.Stat statistical database.

Product innovativeness was calculated as the share of innovative products in the total volume of realized industrial output, with data obtained from the Eurostat database.

A key objective of this stage was to determine the strength and nature of the relationship between economic globalization and:

- import dependence (the share of imports in costs) of manufacturing industry as a whole and across each of its 16 divisions;
- product innovativeness (the share of innovative products in total realized output) of the manufacturing industry as a whole and across its 16 divisions.

To establish these relationships, a simple correlation coefficient was calculated between KOFEcGIdf and both the import dependence and product innovativeness for the entire manufacturing industry and each of its 16 divisions.

Stage 3: Building Regression Models. At the third stage, single-factor regression models were used to determine the impact of economic globalization on product innovativeness and import dependence for manufacturing industry and its divisions. Mathematically, these models are represented by the following formulas:

$$I = b + ax \quad N = b + ax$$

where:

I – the share of imports in the costs of manufacturing industry;

N – the share of innovative products in the realized output of manufacturing industry;

b – the constant term;

x – KOFEcGIdf;

a – the regression coefficient.

These calculations resulted in single-factor regression models showing the influence of KOFEcGIdf on changes in:

- product innovativeness (the share of innovative products in realized output) for manufacturing industry as a whole and for each of the 16 divisions;
- import dependence (the share of imports in costs) for manufacturing industry as a whole and for each of its 16 divisions.

The statistical significance of these models was tested using standard indicators such as multiple R, R-square, adjusted R-square, standard error, t-statistic and P-value. Calculations were performed using the Statistica software package. The final conclusion about the statistical significance of each regression equation was based on the interpretation of its results, which involved substituting actual KOFEcGIdf values into the generated equation. The study utilized statistical data from the KOF Globalization Index 2023, Eurostat 2023, and OECD.Stat 2023.

RESULTS

The first stage of the study generated and processed the following data. According to the *de facto* economic globalization index rankings, smaller countries with low economic self-sufficiency are the most open to foreign trade liberalization. These nations typically focus on exporting a few key goods or services while being highly dependent on imports. Conversely, industrially developed economies tend to be more closed to trade liberalization.

As of 2019, the latest available data, the top spots in the *de facto* economic globalization index ranking of 204 countries were held by European nations like the Netherlands, Belgium, Ireland, Malta, Switzerland and Cyprus. In contrast, the countries most resistant to economic globalization included Romania, Italy, Poland and France. It is important to note that a country's level of economic openness is determined by individual factors

such as national strategies, economic potential and the terms of international agreements. For instance, despite its significant reliance on foreign trade, Czechia maintains a moderate level of economic openness, ranking 40th.

Economic globalization trends also vary by country, as demonstrated by the dynamics of the *de facto* index for the four EU countries studied from 2000–2019. In Germany, the index grew steadily, with a slight dip in 2009. Poland's globalization was characterized by two periods: rapid growth from 2002 to 2008, followed by a period of stable growth from 2010 to 2019. France and Italy showed trends similar to Germany's, with a relatively constant increase except for a decline in 2009. These trends indicate that global challenges, particularly the 2008 financial crisis, can lead to a temporary decrease in foreign trade liberalization.

Analysis of the relationship between Economic Globalization and the Import Dependence of the Manufacturing Industry. A correlation analysis was performed to examine the relationship between the *de facto* economic globalization index and the import dependence of manufacturing industries, measured by the share of imports in their production costs. The analysis, summarized in Table 1, yielded the following analytical conclusions.

Table 1. Pairwise correlation coefficient between the Index of Economic Globalization, *de facto* and the share of imports in the costs (intermediate consumption) of manufacturing industries

Total processing industry	Code NACE Rev.2	Poland	Italy	France	Germany
Manufacturing	C	0.94	0.89	0.97	0.89
Manufacture of food products; beverages and tobacco products	C10–12	0.89	0.84	0.95	0.89
Manufacture of textiles, wearing apparel, leather and related products	C13–15	0.76	0.90	0.95	0.71
Manufacture of wood, paper, printing and reproduction	C16–18	0.39	0.81	0.60	0.56
Manufacture of coke and refined petroleum products	C19	0.61	0.33	0.77	0.71
Manufacture of chemicals and chemical products	C20	0.90	0.79	0.97	0.88
Manufacture of basic pharmaceutical products and pharmaceutical preparations	C21	0.84	0.33	0.96	0.94
Manufacture of rubber and plastic products	C22	0.90	0.81	0.96	0.86
Manufacture of other non-metallic mineral products	C23	0.76	0.74	0.92	0.95
Manufacture of basic metals	C24	0.85	0.82	0.39	0.87
Manufacture of fabricated metal products, except machinery and equipment	C25	0.85	0.57	0.96	0.50
Manufacture of computer, electronic and optical products	C26	0.82	0.28	0.64	0.86
Manufacture of electrical equipment	C27	0.95	0.82	0.97	0.85

Manufacture of machinery and equipment n.e.c.	C28	0.94	0.88	0.97	0.90
Manufacture of motor vehicles, trailers and semi-trailers	C29	0.86	0.30	0.96	0.78
Manufacture of other transport equipment	C30	-0.03	0.26	0.81	0.60
Manufacture of furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment	C31-C33	0.76	0.85	0.96	0.87

Source: elaborated by the authors based on OECD.Stat (2022) and KOF Globalisation Index (2022)

There is a high (≈ 0.8) or very high (> 0.9) direct correlation between the Economic Globalisation Index, *de facto*, and the share of imports in the costs of the vast majority of manufacturing industries in Poland, Italy, France and Germany. In other words, the growth of economic globalisation, accompanied by liberalisation in foreign trade, had a high or very high impact on the growth of import dependence of the vast majority of manufacturing industries in the studied countries. This is an analytical justification for hypothesis H1, in particular, on the existence of a correlation between economic globalisation and import dependence of manufacturing industries.

Economic globalization did not contribute to strengthening the weak and strengthening the strong areas of national production, but on the contrary – weakened their production potential due to the increase in dependence on imports of intermediate consumption products. At the same time, the increase in import dependence occurred both in the products in which the studied countries traditionally had the highest potential for self-sufficiency, and in those areas of the processing industry that are developing. A clear example of this is a significant increase in the share of imports in the costs of the vast majority of processing industry products of all the countries considered and primarily Poland (Table 2). It is also appropriate to note that in Poland, the import dependence of the food industry (C10-12) – the sector with the greatest potential for self-sufficient functioning – almost doubled.

Table 2. Share of imports in the costs (intermediate consumption) of processing industry products [%]

Processing industry	Code NACE Rev.2	Poland		Italy		France		Germany	
		2000	2018	2000	2018	2000	2018	2000	2018
Manufacturing	C	27.02	37.72	20.54	26.43	27.69	34.46	24.15	31.93
Manufacture of food products; beverages and tobacco products	C10-12	10.13	19.32	11.18	15.82	11.39	16.98	17.79	23.9
Manufacture of textiles, wearing apparel, leather and related products	C13-15	41.21	45.89	15.58	21.63	28.78	36.07	29.59	33.19
Manufacture of wood, paper, printing and reproduction	C16-18	24.21	25.63	15.89	19.17	23.28	23.46	22.86	24.34
Manufacture of coke and refined petroleum products	C19	59.34	61.89	58.45	60.7	65.4	76.4	55.38	58.07

Manufacture of chemicals and chemical products	C20	30.53	45.97	26.15	33.81	25.67	33.2	25.01	38.55
Manufacture of basic pharmaceutical products and pharmaceutical preparations	C21	21.71	35.61	23.88	27.57	22.54	28.53	15.76	29.01
Manufacture of rubber and plastic products	C22	29.93	40.05	22.38	28.03	28.68	37.15	25.52	34.52
Manufacture of other non-metallic mineral products	C23	23.17	25.36	14.01	20.02	16.56	19.9	16.29	27.24
Manufacture of basic metals	C24	29.43	41.85	26.12	33.92	32.01	33.94	34.45	42.11
Manufacture of fabricated metal products, except machinery and equipment	C25	26.88	34.61	18.15	20.21	24.7	32.88	21.67	24.13
Manufacture of computer, electronic and optical products	C26	44.68	59.85	32.86	33.16	38.23	38.55	28.03	39.3
Manufacture of electrical equipment	C27	27.71	43.58	20.43	31.95	31.32	42.18	21.53	34.24
Manufacture of machinery and equipment n.e.c.	C28	27.66	42.00	17.06	22.77	28.5	36.73	20.85	28.75
Manufacture of motor vehicles, trailers and semi-trailers	C29	36.12	50.17	22.99	27.84	31.65	40.98	22.5	29.87
Manufacture of other transport equipmen	C30	40.74	42.23	22.99	28.57	38.85	46.23	32.94	37.55
Manufacture of furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment	C31-C33	28.87	34.39	16.41	22.94	22.48	32.74	20.97	30.53

Source: elaborated by the authors based on OECD.Stat (2022)

Similar trends were recorded in Italy, France and Germany, where a significant increase in import dependence was observed across low-tech (C10-C12, C13-C15, C16-C18, C31-C33), medium high-tech (C20, C27, C28, C29, C30), and high-tech industries (C21, C26). This classification of technological levels aligns with the Eurostat classifier (Eurostat, 2022). These sectors were traditionally considered economically self-sufficient in these countries and the marked rise in import dependence in the vast majority of these industries suggests that the expansion of specialization and the international division of labour in recent decades has weakened their economic autonomy. The logical expectation that economic globalization would strengthen and enhance the potential of national industries has, in most cases, failed to materialize.

Assessment of the relationship between the economic globalization index and the innovativeness of products in the processing industry of countries. Economic globalization

should potentially contribute to the growth of innovativeness of products and innovative development of the economies of all countries. The prerequisites for this should be exchange of experience, technologies, production processes between countries, unification of potential and innovative potential, and co-financing of these processes. However, the results of the empirical study showed that economic globalization had an ambiguous impact on the innovativeness of products in the vast majority of the studied countries. Thus, in Poland and Germany, the share of innovative products in the volume of products sold by the processing industry in 2018 compared to 2008, decreased by 4 p.p. and in France by 6 p.p. respectively. In contrast, in Italy this indicator increased by 4 p.p.

As a result of the correlation analysis, a high inverse correlation was found between the index of economic globalization, *de facto*, and the share of innovative products in the volume sold in the vast majority of manufacturing industries of the studied countries (Table 3). In other words, with the growth of economic globalization, there is a decrease in the innovativeness of manufacturing industry products and vice versa.

Table 3. Pairwise correlation coefficients between the index of economic globalization, *de facto*, and the share of innovative products in the volume of realized products of the processing industry

Processing industry	Code NACE Rev.2	Poland	Italy	France	Germany
Manufacturing	C	-0.92	0.00	-0.64	-0.74
Manufacture of food products; beverages and tobacco products	C10-12	-0.84	-0.40	-0.40	-0.51
Manufacture of textiles, wearing apparel, leather and related products	C13-15	0.12	0.50	-0.88	-0.74
Manufacture of wood, paper, printing and reproduction	C16-18	-0.48	-0.46	-0.69	-0.46
Manufacture of coke and refined petroleum products	C19	-0.75	-0.08	-0.81	-0.12
Manufacture of chemicals and chemical products	C20	-0.94	-0.67	-0.43	-0.41
Manufacture of basic pharmaceutical products and pharmaceutical preparations	C21	-0.58	-0.58	-0.56	0.56
Manufacture of rubber and plastic products	C22	-0.85	-0.14	-0.30	-0.20
Manufacture of other non-metallic mineral products	C23	-0.82	0.17	-0.02	-0.73
Manufacture of basic metals	C24	-0.74	0.67	-0.14	-0.82
Manufacture of fabricated metal products, except machinery and equipment	C25	0.84	-0.21	-0.49	-0.92
Manufacture of computer, electronic and optical products	C26	-0.65	0.19	-0.88	-0.68
Manufacture of electrical equipment	C27	-0.58	-0.67	-0.64	-0.72
Manufacture of machinery and equipment n.e.c.	C28	-0.83	-0.38	-0.47	-0.88
Manufacture of motor vehicles, trailers and semi-trailers	C29	-0.80	0.51	-0.79	-0.70
Manufacture of other transport equipment	C30	-0.19	-0.14	0.45	-0.17
Manufacture of furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment	C31-C33	-0.86	0.55	-0.56	-0.84

Source: elaborated by the authors based on Eurostat data (2022)

In particular, for example, the very high, negative (-0.92) value of the correlation coefficient for the processing industry as a whole (C) in Poland is a justification for the fact that the increase in foreign trade liberalization causes a decrease in the innovativeness of products of its processing industry. A high probability of a decrease in the innovativeness of products under the influence of economic globalization is also recorded in the food industry (C10-C12) – one of the basic and leading sectors of Poland and the vast majority of other industries of its processing industry.

The innovativeness of products of the vast majority of industries of the French and German processing industry, despite, *a priori*, significant competitive advantages (compared to the Polish industry), with the increase in economic globalization also decreases, albeit with a somewhat lower probability than in Poland. However, it is necessary to pay attention to the fact that in Germany the considered relationship for pharmaceutical production was medium and direct (positive). This is a sign that the growth of economic globalization has a positive effect on the innovativeness of its products.

Unlike Poland, France and Germany, the innovativeness of the products of the processing industry (C) of Italy did not depend on economic globalization (the correlation index is -0.00). Nevertheless, in 8 out of 16 industries of the Italian processing industry, a low or medium direct or inverse relationship between the mentioned indicators was recorded. In Italy, the growth of economic globalization causes a decrease in the innovativeness of the products of the chemical and pharmaceutical industries (C20, C21) but contributes to the growth of this indicator in the textile (C13-C15), metallurgical (C24) and automotive industries (C29).

Thus, summing up the results of the second stage of the research, we note, during 2000–2019, under the influence of economic globalization, import dependence increased and the innovativeness of the products of the processing industry of these countries decreased. Thus, under the influence of increasing economic globalization, the economic self-sufficiency and innovative potential of their industries significantly weakened. The changes considered also increased their specialization. All this is a sign of compliance with the policy of Ricardo's comparative advantages and/or is a consequence of the excessively high influence of TNCs in the world economy. As is known, TNCs primarily defend their financial interests, and with their activities they mostly weaken the interests of national economies and states (Ishchuk, Sozansky, 2022).

Results of the third stage of the study. The correlation analysis between the *de facto* economic globalization index and the import dependence and product innovativeness of the manufacturing industries in Poland, Italy, France and Germany has established an analytical foundation for quantifying their mutual influence. To achieve this, single-factor regression models were built to express the quantitative effect of the economic globalization index on changes in import dependence and product innovativeness across all manufacturing divisions (C) (see Table 4, Table 5).

All regression models reflecting the impact of $KOFecGIdf$ on the import dependence of the manufacturing industry and its divisions in the countries studied (Table 4) are statistically significant. For the vast majority of these models, the p-value an indicator of statistical significance for the influence of $KOFecGIdf$ on import dependence is extremely low (p-value < 0.001). This indicates that the probability of a random relationship between these indicators is minimal, confirming that the regression and the relationship it depicts are highly statistically significant.

The coefficient of determination (R-squared) shows the proportion of the dependent variable's variance explained by the regression model. For most models in Table 4, the R-squared value exceeds 0.80, indicating a high explanatory power. In other words, over 80% of the change in import dependence in most manufacturing divisions of the analyzed countries can be explained by a change in KOFEcGldf.

Similarly, all regression models reflecting the influence of KOFEcGldf on the product innovativeness of the manufacturing industry and its divisions (Table 6) are statistically significant. In all the regression equations shown in Table 5, the p-value is less than 0.05, confirming that the impact of KOFEcGldf on product innovativeness is statistically significant. For the majority of these models, the coefficient of determination (R-squared) exceeds 0.73.

Using the constructed regression equations, we modelled the change in these indicators assuming a 5-point increase in the economic globalization index (compared to the 2019 value). A 5-point increase was chosen for illustrative clarity.

According to the modelling results, the share of imports in the costs of all manufacturing divisions (C) in the countries would increase significantly. Specifically, a 5-point increase would raise the share of imports in manufacturing costs by 1.92 percentage points (p.p.) in Poland, 3.36 p.p. in Italy, 4.33 p.p. in France, and 3.48 p.p. in Germany (Table 5). This quantitatively validates the increase in manufacturing import dependence under the influence of economic globalization.

The modelling results also show that with a 5 p.p. increase in KOFEcGldf, the manufacturing divisions that would experience the highest increase in import dependence in Poland are the manufacture of basic metals (C24), electrical equipment (C27), chemicals and chemical products (C20), computer, electronic and optical products (C26), machinery and equipment n.e.c. (C28), motor vehicles, trailers and semi-trailers (C29), and basic pharmaceutical products and pharmaceutical preparations (C21). The import share in intermediate consumption would increase by 4.84 p.p. for the first sector, and by 2.04 to 2.69 p.p. for the others.

For the Italian manufacturing industry, a 5 p.p. increase in KOFEcGldf would lead to the largest increases in import dependence (from 3.23 p.p. to 6.37 p.p.) in the following sectors: manufacture of electrical equipment (C27), basic metals (C24), chemicals and chemical products (C20), furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment (C31-C33), and machinery and equipment n.e.c. (C28).

In the French manufacturing industry, a 5 p.p. increase in KOFEcGldf would result in the highest increases in import dependence (from 4.05 p.p. to 7.18 p.p.) in the manufacture of other transport equipment (C30), electrical equipment (C27), furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment (C31-C33), machinery and equipment n.e.c. (C28), fabricated metal products, except machinery and equipment (C25), motor vehicles, trailers and semi-trailers (C29), textiles, wearing apparel, leather and related products (C13-C15), coke and refined petroleum products (C19), and rubber and plastic products (C22).

In the German manufacturing industry, the largest increases in import dependence (from 4.02 p.p. to 5.6 p.p.) would be in the manufacture of chemicals and chemical products (C20), electrical equipment (C27), coke and refined petroleum products (C19), computer, electronic and optical products (C26), basic pharmaceutical products and pharmaceutical preparations (C21), other non-metallic mineral products (C24), and

furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment (C31-C33).

From these results, it is clear that a rising KOFEcGIdf has the highest impact on medium- and high-tech industries in Poland, France, Italy and Germany (specifically C26-C33, C20-C21, and C24-C25). However, the specific changes in import dependence vary across these countries, which can be attributed to differences in their initial KOFEcGIdf levels, the import dependence of individual sectors, organizational specifics, economic specialization, and the activity and nature of offshoring.

According to the modelling results, a 5 p.p. increase in KOFEcGIdf would also cause a significant decrease in the share of innovative products in the total output of the vast majority of manufacturing divisions in the analyzed countries (Table 6). This decline in product innovativeness would occur even in those industries considered traditional (with the highest potential for self-sufficiency and development) for these countries. In general, the largest decrease in innovativeness would happen in the same divisions where import dependence is projected to increase the most (see Table 4). However, the level of decrease in innovativeness across most divisions is significantly higher than the level of increase in their import dependence.

The practical value of these modelling results lies in their potential use for developing economic, social and foreign trade strategies. To determine how these indicators would change with a one-point increase in the globalization index, one can simply divide the modeling results by five. For example, a one-point increase in the globalization index would raise the share of imports in Poland's manufacturing costs by 0.38 p.p. ($1.92/5$). This provides a simple way to forecast changes in these indicators for any change in the globalization index.

In conclusion, the modelling results suggest that on the one hand, economic globalization has strengthened the influence of multinational corporations on the specialization and activities of national economies. On the other hand, governments have not taken sufficient measures to preserve and enhance economic self-sufficiency, innovation and socioeconomic development.

DISCUSSION

This study's first significant finding is the theoretical and analytical validation of a strong correlation between economic globalization and the import dependence and product innovativeness of manufacturing industries (C). We found a high direct correlation between KOFEcGIdf and the share of imports in the costs of the majority of manufacturing industries in Poland, Italy, France and Germany. In contrast, there is a high but inverse correlation between economic globalization and the innovativeness of products from these countries' manufacturing sectors. This provides empirical evidence that economic globalization not only increases the import dependence of national manufacturing industries but also reduces the innovativeness of their products. A crucial point is that this negative impact was proven for both highly developed economies (Germany, France and Italy) and the transitional economy of Poland.

Extending Prior Research. The second fundamental and practical result of this study is the quantitative measurement of economic globalization's impact on the level of import dependence and product innovativeness. This finding is a valuable contribution to the academic literature on economic globalization and provides a theoretical and

practical foundation for future research. It also empirically supports and extends the theoretical work of scholars such as Keynes, Stiglitz and Mazzucato. The study demonstrates that the negative consequences of globalization on economic self-sufficiency and innovativeness can occur not only in transitional economies like Poland but also in highly developed ones.

Policy Implications. The political implications of these findings are significant. The study shows that with increased economic globalization, countries experience greater industrial specialization, a rise in their manufacturing sectors' dependence on imported intermediate goods (and thus, the national economy as a whole), and a decline in product innovativeness. These issues are likely to become even more pronounced during periods of global crises. In response, governments, in collaboration with academia, business and civil society, must develop regulatory, organizational and economic tools some of which may be Keynesian and protectionist to mitigate the negative effects of economic globalization. These tools could include investing in and economically stimulating the development of national industries; controlling offshoring operations and production; regulating the economic influence of multinational corporations (MNCs) on national economies; while strengthening requirements for social, economic and environmental responsibility. Furthermore, it is crucial to address the problems of economic and social disparities in income and wages between countries. A failure to address these issues could lead to serious consequences for the social and economic well-being of Europe and the world.

Applied and Academic Contributions. The applied results of this study are centred on the use of the proposed regression equations. These allow for the determination of how import dependence and product innovativeness will change with a shift in the *de facto* economic globalization index. This provides an analytical tool for developing economic and industrial strategies, guiding investment decisions and formulating economic programs in the studied countries.

The academic contribution of this research lies in its empirical validation of the hypotheses regarding the link between economic globalization and import dependence and innovativeness. This serves as a theoretical contribution to economic theory and a practical foundation for expanding existing approaches and theories on economic globalization and its socioeconomic and industrial consequences.

CONCLUSION AND STUDY LIMITATION

This article presents the results of an investigation into the relationships between economic globalization, and the import dependence and product innovativeness of the manufacturing industries in Poland, Germany, Italy and France. The selection of these countries was deliberate, based on several key factors. At the time of the study, Germany ranked 36th in the economic globalization index, France was 59th, Poland 83rd and Italy 94th. This ranking suggests that, among these four nations, Germany's economy is the most open, while Italy's is the least. This provided a compelling question for the authors: do economies with different levels of openness show equally strong relationships between the economic globalization index, and the structural indicators of import dependence and innovativeness in their manufacturing sectors?

According to the study's findings, the negative impact of globalization on product innovativeness in Italy is relatively minor. This could be a result of the country's effective

protectionist policies and its relatively high economic self-sufficiency in the manufacture of machinery and equipment (C28), a sector that provides essential capital goods and tools to all other economic sectors. The logic is that if a country has its own machinery and equipment manufacturing base, it also has a higher innovative potential.

The study was conducted using data only from the 2000–2019 period, a limitation imposed by data availability at the time of the research. For future studies, it would be valuable to examine how the crises caused by COVID-19 and the Russian-Ukrainian war have affected the relationship between economic globalization, import dependence and product innovativeness in the manufacturing industries of the studied countries and the rest of the EU.

This article presents the main findings of the research, but a significant portion of the work (including raw data, analytical calculations and statistical characteristics) has been omitted to avoid overloading the text with appendices and tables. It is important to note that all the more than 100 regression equations in Tables 4 and 5 are statistically significant, a fact confirmed by the values of the correlation coefficient, p-value and coefficient of determination (R-squared).

The results of this study are confirmed for the analyzed countries, but it is not certain whether the hypotheses would hold for the manufacturing industries of other EU countries. It can be assumed that the findings are relevant for the majority of EU and Eastern European countries, but a definitive answer would require further research.

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Table 4. One-factor regression models of the impact of KOFECGldf on the change in the share of imports in the costs of the processing industry and their interpretation when KOFECGldf increases by five points

Processing industry	Code NACE Rev.2	Univariate regression equations								The magnitude of the influence of x on I (I simulated – I actual), percentage points			
		Poland		Italy		France		Germany					
		equations	p	equations	p	equations	p	equations	p				
Manufacturing	C	I = 10.85 + 0.386x	***	I = -15.15 + 0.672x	***	I = -26.71 + 0.866x	***	I = -21.79 + 0.696x	***	1.92	3.36	4.33	3.48
Manufacture of food products; beverages and tobacco products	C10-C12	I = -2.39 + 0.293x	***	I = -11.607 + 0.423x	***	I = -22.12 + 0.539x	***	I = -16.84 + 0.521x	***	1.47	2.11	2.69	2.60
Manufacture of textiles, wearing apparel, leather and related products	C13-C15	I = 29.78 + 0.237x	***	I = -13.56 + 0.547x	***	I = -25.85 + 0.865x	***	I = 5.00 + 0.342x	***	1.18	2.73	4.33	1.71
Manufacture of wood, paper, printing and reproduction	C16-C18	I = 21.28 + 0.0425x	*	I = -2.82 + 0.328x	***	I = 9.39 + 0.194x	*	I = 9.18 + 0.182x	*	0.21	1.64	0.97	0.91
Manufacture of coke and refined petroleum products	C19	I = 43.01 + 0.301x	*	I = 35.32 + 0.47x	*	I = 14.60 + 0.851x	***	I = -13.39 + 1.00x	***	1.50	2.37	4.26	4.99
Manufacture of chemicals and chemical products	C20	I = 8.91 + 0.508x	***	I = -17.03 + 0.809x	***	I = -19.67 + 0.731x	***	I = -48.90 + 1.120x	***	2.53	4.05	3.65	5.60
Manufacture of basic pharmaceutical products and pharmaceutical preparations	C21	I = 5.58 + 0.408x	***	I = 14.88 + 0.22x	*	I = -1582 + 0.618	***	I = -40.06 + 0.894	***	2.04	1.12	3.09	4.47
Manufacture of rubber and plastic products	C22	I = 17.51 + 0.304x	***	I = -0.845 + 0.427x	***	I = -27.87 + 0.901x	***	I = -25.19 + 0.756x	***	1.52	2.13	4.05	3.78
Manufacture of other non- -metallic mineral products	C23	I = 15.26 + 0.145x	***	I = -14.32 + 0.506x	***	I = -10.47 + 0.427x	***	I = -38.05 + 0.862x	***	0.73	2.53	2.13	4.31

Manufacture of basic metals	C24	I = 11.44 + 0.441x	***	I = -24.76 + 0.973x	***	I = 7.65 + 0.358x	*	I = -21.84 + 0.852x	***	4.84	4.86	1.79	4.26
Manufacture of fabricated metal products, except machinery and equipment	C25	I = 16.63 + 0.273x	***	I = 1.85 + 0.306x	*	I = -36.81 + 0.989x	***	I = 7.41 + 0.219x	*	1.36	1.53	4.94	1.10
Manufacture of computer, electronic and optical products	C26	I = 25.24 + 0.475x	***	I = 20.64 + 0.197x	*	I = -5.44 + 0.604x	*	I = -32.94 + 0.919x	***	2.37	0.98	3.02	4.60
Manufacture of electrical equipment	C27	I = 5.97 + 0.539x	***	I = -47.40 + 1.275x	***	I = -51.20 + 1.317x	***	I = -46.76 + 1.034x	***	2.69	6.37	6.58	5.17
Manufacture of machinery and equipment n.e.c.	C28	I = 10.37+0.448x	***	I = -17.52 + 0.646x	***	I = -35.11 + 1.005x	***	I = -21.06 + 0.638x	***	2.24	3.23	5.02	3.19
Manufacture of motor vehicles, trailers and semi-trailers	C29	I = 18.74+0.416x	***	I = 13.92 + 0.19x	*	I = -29.13 + 0.973	***	I = -12.58 + 0.528x	***	2.07	0.94	4.86	2.64
Manufacture of other transport equipment	C30	xx	-	I = 9.80 + 0.24x	*	I = -50.75 + 1.437x	***	I = -3.63+0.516x	*	**	1.18	7.18	2.58
Manufacture of furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment	C31-C33	I = 20.91 + 0.177x	***	I = -19.37 + 0.661x	***	I = -47.19+1.123x	***	I = -32.28 + 0.803x	***	0.88	3.30	5.61	4.02

Source: authors' calculations

I – the shares of imports in the costs of the processing industry

x – KOFEcGldf

xx – the influence of KOFEcGldf on the share is absent, very low, or the results of statistical testing and interpretation of the regression equation are unsatisfactory

p – p-value – a direct indicator of the statistical significance of the effect of KOFEcGldf (x) on import dependence (I), shows the probability that the relationship between variables is random. If this value is less than the established level of significance (0.05; 0.01 or 0.001), the relationship is considered reliable, i.e. statistically significant. “***” – p-value <0.001 (statistically extremely significant relationship)

* – p-value <0.05 (statistically significant relationship)

Table 5. One-factor regression models of the impact of KOFecGldf on the change in the share of innovative products in the realized production of the processing industry and their interpretation when KOFecGldf increases by five points

Processing industry	Code NACE Rev.2	Univariate regression equations										The magnitude of the influence of x on N (N simulated – N actual), percentage points			
		Poland		Italy		France		Germany							
		equations	p	equations	p	equations	p	equations	p	Poland	Italy	France	Germany		
Manufacturing	C	N = 41.321 + (-0.471x)	*	xx	xx	N = 75.58 + (-0.802x)	*	N = 82.12 + (-0.780x)	*	-2.35	**	-4.01	-3.90		
Manufacture of food products; beverages and tobacco products	C10–C12	N = 22.52 + (-0.278x)	*	N = 85.60 + (-1.24x)	*	N = 33.60 + -0.35x)	*	N = 79.56 + (-0.973x)	*	-1.39	-6.20	-1.77	-4.86		
Manufacture of textiles, wearing apparel, leather and related products	C13–C15	xx	xx	N = -40.29 + 0.954x	*	N = 160.58 + (-2.15x)	*	N = 145.12 + (-1.697x)	*	xx	4.77	-10.76	-8.48		
Manufacture of wood, paper, printing and reproduction	C16–C18	N = 21.85 + (-0.178x)	*	N = 50.12 + (-0.627x)	*	N = 51.13 + (-0.623x)	*	N = 68.10 + (-0.798x)	*	-0.89	-3.14	-3.11	-3.99		
Manufacture of coke and refined petroleum products	C19	xx	xx	**	xx	N = 240.72 + (-3.401x)	*	N = 34.95 + (-0.31x)	*	xx	xx	-17.00	-1.55		
Manufacture of chemicals and chemical products	C20	N = 43.20 + (-0.534x)	*	N = 130.9 + (-1.96x)	*	N = 53.86 + (-0.58x)	*	N = 50.08 + (-0.461x)	*	-2.67	-9.80	-2.89	-2.31		
Manufacture of basic pharmaceutical products and pharmaceutical preparations	C21	N = 33.86 + (-0.381x)	*	N = 46.21 + (-0.595x)	*	N = 90.42 + (-1.168x)	*	N = -46.89 + 0.876x	*	-1.91	-2.97	-5.84	4.38		
Manufacture of rubber and plastic products	C22	N = 44.40 + (-0.591x)	*	N = 26.00 + (-0.18x)	*	N = 64.03 + (-0.69x)	*	N = 32.43 + (-0.26x)	*	-2.95	-0.90	-3.46	-1.29		

Manufacture of other non-metallic mineral products	C23	N = 22.78 + (-0.258x)	*	N = 4.57 + 0.15x	*	xx	xx	N = 174.71 + (-2.191x)	*	-1.29	0.74	xx	-10.95
Manufacture of basic metals	C24	N = 23.4 + (-0.277x)	*	N = -51.01 + 0.978x	*	xx	xx	N = 87.07 + (-1.00x)	*	-1.38	4.89	xx	-4.99
Manufacture of fabricated metal products, except machinery and equipment	C25	N = 33.86 + (-0.421x)	*	N = 29.74 + (-0.33x)	*	N = 37.77 + (-0.419x)	*	N = 64.10 + (-0.756x)	*	2.11	-1.66	-2.09	-3.78
Manufacture of computer, electronic and optical products	C26	xx	xx	N = 4.37 + 0.40x	*	N = 170.63 + (-2.068x)	*	N = 198.10 + (-2.159x)	*	xx	1.99	-10.34	-10.80
Manufacture of electrical equipment	C27	N = 62.92 + 9 (-0.65x)	*	N = 78.49 + (-0.921x)	*	N = 100.54 + (-1.21x)	*	N = 136.90 + (-1.431x)	*	-3.24	-4.61	-6.06	-7.15
Manufacture of machinery and equipment n.e.c.	C28	N = 37.9 + (-0.347x)	*	N = 82.31 + (-0.98x)	*	N = 64.99 + (-0.65x)	*	N = 195.66 + (-2.324x)	*	-1.73	-4.90	-3.26	-11.62
Manufacture of motor vehicles, trailers and semi-trailers	C29	N = 32.40 + (-0.14x)	*	N = -164.67 + 3.18x	*	N = 302.83 + (-3.95x)	*	N = 116.38 + (-0.89x)	*	-0.70	15.92	-19.73	-4.43
Manufacture of other transport equipment	C30	N = 36.20 + (-0.22x)	*	N = 52.50 + (-0.48x)	*	N = 67.18 + 1.42x	*	N = 116.38 + (-1.12x)	*	-1.11	-2.41	7.10	-5.58
Manufacture of furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment	C31-C33	N = 61.89 + (-0.842x)	*	N = -26.67 + 0.729x	*	N = 39.65 + (-0.420x)	*	N = 171.72 + (-2.099x)	*	-4.21	3.64	-2.10	-10.50

Source: authors' calculations

N – the share of innovative products in the sold products of manufacturing industries

x – KOFecGldf

xx – the influence of KOFecGldf on the share is absent, very low, or the results of statistical testing and interpretation of the regression equation are unsatisfactory

p – p-value – a direct indicator of the statistical significance of the impact of KOFecGldf (x) on product innovation (N), shows the probability that the relationship between variables is random. If this value is less than the established significance level (0.05; 0.01 or 0.001), the relationship is considered reliable, i.e. statistically significant

* – p-value <0.05 (statistically significant relationship)