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ORIGINAL PAPER

GROSS VALUE ADDED MULTIPLIERS IN THE ECONOMIES OF GERMANY, POLAND AND SLOVAKIA: A COMPARATIVE INPUT-OUTPUT ANALYSIS

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K e y w o r d s: gross value added multiplier, input-output analysis, Leontief inverse matrix, direct and residual effects, interindustry linkages.

A b s t r a c t

The purpose of the study is to compare gross value added (GVA) multiplier effects across economic activities in Germany, Poland and Slovakia and to identify common sectoral regularities and country-specific differences in their composition. Using OECD national input-output tables for 2012 and 2022, the standard Miller–Blair GVA multiplier is decomposed into direct and residual effects. The results show that total multiplier values are relatively similar across the three economies, whereas their composition differs much more clearly. Education, computer programming, health and public administration consistently record some of the highest multipliers and high direct value-added intensity. Motor vehicles and electronics show a contrasting pattern: Poland and especially Slovakia combine lower direct GVA coefficients with higher residual shares than Germany. These manufacturing differences are visible in both observed years. Compared with previously estimated output multipliers, the findings show that stronger gross-production propagation does not necessarily imply a stronger value-added effect, which is relevant for sectoral and industrial-policy assessment.

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MNOŻNIKI WARTOŚCI DODANEJ BRUTTO W GOSPODARKACH NIEMIEC, POLSKI I SŁOWACJI: PORÓWNAWCZA ANALIZA INPUT-OUTPUT

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Słowa kluczowe: mnożnik wartości dodanej brutto, analiza input-output, macierz odwrotna Leontiefa, efekty bezpośrednie i rezydualne, powiązania międzybranżowe.

Abstrakt

Celem badania jest porównanie efektów mnożnikowych wartości dodanej brutto (WDB) w rodzajach działalności gospodarczej Niemiec, Polski i Słowacji oraz identyfikacja wspólnych prawidłowości sektorowych i różnic krajowych w strukturze tych efektów. Na podstawie narodowych tablic input-output OECD za lata 2012 i 2022 standardowy mnożnik WDB Millera i Blaira rozłożono na efekt bezpośredni i rezydualny. Wyniki wskazują, że łączne wartości mnożników są w trzech gospodarkach stosunkowo zbliżone, natomiast ich struktura różni się znacznie wyraźniej. Edukacja, usługi informatyczne, ochrona zdrowia i administracja publiczna konsekwentnie osiągają jedne z najwyższych mnożników oraz wysoką bezpośrednią intensywność wartości dodanej. Odmienny wzorzec występuje w produkcji pojazdów samochodowych i elektroniki: Polska, a szczególnie Słowacja, łączą niższe bezpośrednie współczynniki WDB z wyższymi udziałami efektu rezydualnego niż Niemcy. Różnice te są widoczne w obu badanych latach. Zestawienie z wcześniej oszacowanymi mnożnikami produkcji pokazuje, że silniejsza propagacja produkcji brutto nie musi oznaczać silniejszego efektu wartości dodanej, co ma znaczenie dla oceny sektorowej i polityki przemysłowej.

Introduction

Input-output multipliers are widely used to trace how changes in final demand propagate through production systems. A strong gross-output response, however, does not necessarily imply an equally strong value-added effect. Output multipliers accumulate the production requirements generated through successive rounds of intermediate transactions, whereas GVA multipliers measure the value added generated by that response. Distinguishing these two dimensions is therefore essential when sectoral multipliers are used to compare production structures or to inform industrial and structural policy (Miller & Blair, 2022; Oosterhaven & Stelder, 2002).

This distinction is particularly relevant for Germany, Poland and Slovakia. The three economies are closely connected through the EU single market and Central European production networks, especially in the automotive, machinery and electronics industries, but differ substantially in size, openness and sectoral specialisation. Germany combines a diversified manufacturing base with a broad producer-service sector; Poland combines a strong industrial base

with an expanding service economy; Slovakia is a small open economy strongly specialised in automotive production. Their comparison therefore makes it possible to examine how similar final-demand impulses translate into value added under different production structures (Timmer *et al.*, 2015; Grodzicki & Skrzypek, 2020; Sozanskyy, 2026).

The object of the study is the formation of gross value added multiplier effects across economic activities in the production systems of Germany, Poland and Slovakia. The central analytical question is whether stronger gross-output propagation is accompanied by a stronger GVA effect and how that effect is divided between its direct and residual components across activities. Accordingly, the purpose of the study is to identify and compare GVA multiplier effects across economic activities in the three economies and to reveal common sectoral regularities and country-specific differences in both their level and composition.

To achieve this purpose, the following tasks are addressed: to calculate activity-level GVA multipliers using harmonised OECD input-output tables and the standard Miller–Blair formulation; to separate each multiplier into direct and residual value-added effects; to identify recurring sectoral regularities and country-specific differences in multiplier levels and composition; and to compare the sectoral configuration observed in 2022 with that in 2012 and with the previously estimated output multipliers for the same three economies.

The analytical contribution of the study is to place GVA and output multipliers for the same activities and economies on a common comparative basis. This distinguishes three dimensions that are often conflated: the scale of gross-output propagation, the total GVA generated per unit of final demand, and the direct–residual composition of that GVA effect.

The remainder of the article is organised as follows. The literature review outlines the conceptual and empirical background of GVA multiplier analysis and identifies the research gap. The data and methodology section describe the OECD input-output tables and the calculation procedure. The results section presents the comparative findings for Germany, Poland and Slovakia. The conclusions summarise the main regularities and their implications.

Literature review

The distinction between gross-output propagation and value-added generation follows directly from the input-output framework developed by Leontief (1936, 1941). The Leontief inverse measures the total production requirements generated by final demand, while value-added coefficients convert those requirements into the income created along the production process (Miller & Blair, 2022; ten Raa, 2005). The continuing development and empirical reach of this framework are reviewed by Dietzenbacher *et al.* (2013). This distinction matters because repeated

intermediate transactions can make an activity appear important in gross-output terms without producing an equally strong value-added effect.

Empirical research confirms that sectoral positions can change when the focus moves from output to value added. Material- and input-intensive activities may record high output multipliers, whereas labour- and knowledge-intensive services often display stronger value-added effects (Cassar, 2015; Backinezos *et al.*, 2020). Oosterhaven and Stelder (2002) show why gross measures can overstate sectoral importance when intermediate transactions are repeatedly counted. European applications to ICT and transportation further demonstrate the usefulness of separating direct and subsequent contributions to value added and employment (Keček *et al.*, 2016; Vukić *et al.*, 2021). Recent work on uncertainty in multiplier estimates also cautions against interpreting small numerical differences as mechanically precise sectoral rankings (Stehrer *et al.*, 2024).

The distinction becomes still more important in internationally fragmented production. Large gross production and trade flows may coexist with a relatively small share of value added at a particular stage of the chain (Koopman *et al.*, 2014). This is especially relevant in Central Europe, where Germany, Poland and Slovakia participate in common automotive, machinery and electronics networks but occupy different functional positions within them (Timmer *et al.*, 2015; Grodzicki & Skrzypek, 2020). Research on functional specialisation further shows that the location of design, engineering and other higher-value functions matters for the value added generated directly within production activities (Stöllinger, 2021).

A previous study of the same three economies found markedly higher output multipliers in several Polish and Slovak manufacturing activities than in their German counterparts (Sozanskyy, 2026). This raises the key empirical issue addressed here: whether stronger gross-production propagation is accompanied by a stronger GVA effect and whether the composition of that effect differs across the three production systems. Existing studies do not provide a harmonised activity-level comparison of GVA multipliers for Germany, Poland and Slovakia for two observation years using the same classification and calculation procedure. The present study addresses this gap.

Data and methodology

The empirical base consists of the OECD 2025 national Input-Output Tables for Germany, Poland and Slovakia for 2012 and 2022. The tables are valued at basic prices and distinguish fifty activities according to ISIC Rev. 4. The same classification and data source are used for all three countries. Mining of metal ores (B07) has zero recorded output in Germany and therefore has no reportable GVA multiplier. Activity T (activities of households as employers) is excluded from country averages because it records no intermediate consumption in the

OECD tables; its direct GVA coefficient and multiplier are therefore both 1.000 and its residual effect is 0.000 in all three countries and both years. Including it would add no information on intersectoral differences.

For each activity j, the GVA multiplier is calculated according to the standard Miller–Blair formulation (Miller & Blair, 2022; Eurostat, 2008):

$$M_j^{\mathrm{GVA}} = \sum_{i=1}^{n} v_i \; l_{ij}, \qquad \left(\mathbf{M}^{\mathrm{GVA}}\right)' = \mathbf{v}'\mathbf{L} \tag{1}$$

where:

v_i – is the direct GVA coefficient of supplying activity i,
l_{ij} – is element (i, j) of the Leontief inverse,
M_j^{GVA} – is the total GVA generated in the production system by one unit of final demand for the output of activity j.

The calculations use the total Leontief inverse published with the OECD tables, consistently with the earlier output-multiplier analysis of the same economies (Sozanskyy, 2026).

To distinguish the value added created in the activity receiving the final-demand impulse from the value added associated with subsequent production rounds, the multiplier is decomposed as follows:

$$\mathrm{DVE}_j = v_j, \qquad \mathrm{RVE}_j = M_j^{\mathrm{GVA}} - v_j \tag{2}$$

where:

DVE_j – is the direct value-added effect,
RVE_j – is the residual value-added effect.

The direct effect equals the activity's direct GVA coefficient. The residual effect is the remainder of the multiplier generated in subsequent production rounds and includes later-round value added both in supplying activities and in the activity itself. It is therefore interpreted as the subsequent-round component of the GVA effect rather than as a measure of supplier linkages alone. The percentage shares reported below are calculated relative to the total multiplier, and country averages are unweighted means across reportable activities. The analysis uses the open static Leontief model; induced household-consumption effects are not included.

Results

The results are interpreted in two successive stages. The first concerns the level and sectoral ordering of GVA multipliers; the second concerns the way in which the total GVA effect is divided between direct and residual components. The analysis begins with activity-level estimates because country averages

alone can conceal important sectoral similarities and differences. It then checks whether the sectoral pattern observed in 2022 was also visible in 2012 and only afterwards summarises the country averages. Table 1 presents the activity-level multipliers and their components for 2022; the corresponding 2012 values are reported in Appendix 1.

Table 1

Gross value added multipliers and their decomposition into direct and residual effects in Germany, Poland and Slovakia, 2022

Economic activity	Code	Germany			Poland			Slovakia		
		M	Effect		M	Effect		M	Effect	
			Direct	Residual		Direct	Residual		Direct	Residual
1	2	3	4	5	6	7	8	9	10	11
Agriculture, hunting and related service activities	A01	0.962	0.478	0.484	0.962	0.355	0.606	0.924	0.320	0.604
Forestry and logging	A02	0.959	0.526	0.433	0.977	0.445	0.533	0.976	0.600	0.376
Fishing and aquaculture	A03	0.934	0.509	0.424	0.938	0.514	0.423	0.912	0.516	0.396
Mining of coal and lignite	B05	0.986	0.870	0.116	0.990	0.900	0.090	0.930	0.437	0.493
Extraction of crude petroleum and natural gas	B06	0.941	0.357	0.584	0.943	0.338	0.605	0.967	0.705	0.262
Mining of metal ores	B07	–	–	–	0.953	0.531	0.423	0.928	0.444	0.484
Other mining and quarrying	B08	0.933	0.410	0.524	0.928	0.338	0.590	0.896	0.198	0.698
Mining support service activities	B09	0.962	0.579	0.383	0.948	0.462	0.486	0.940	0.403	0.536
Manufacture of food products, beverages and tobacco products	C10T12	0.956	0.213	0.744	0.960	0.173	0.788	0.925	0.229	0.696
Textiles, wearing apparel, leather and related products	C13T15	0.944	0.323	0.621	0.965	0.360	0.605	0.933	0.361	0.572
Manufacture of wood and wood products	C16	0.949	0.295	0.654	0.976	0.312	0.664	0.954	0.295	0.659
Manufacture of paper and paper products; printing	C17_18	0.938	0.261	0.677	0.955	0.265	0.690	0.916	0.195	0.721
Manufacture of coke and refined petroleum products	C19	0.912	0.105	0.807	0.938	0.214	0.723	0.847	0.211	0.636
Manufacture of chemicals and chemical products	C20	0.940	0.258	0.682	0.954	0.199	0.755	0.910	0.161	0.750
Manufacture of basic pharmaceutical products	C21	0.957	0.446	0.511	0.964	0.409	0.555	0.956	0.443	0.514
Manufacture of rubber and plastic products	C22	0.941	0.319	0.622	0.958	0.271	0.687	0.920	0.255	0.665
Manufacture of other non-metallic mineral products	C23	0.930	0.332	0.598	0.943	0.284	0.659	0.915	0.268	0.647
Basic iron and steel	C24A	0.855	0.161	0.694	0.941	0.160	0.781	0.916	0.217	0.699
Manufacture of non-ferrous and precious metals	C24B	0.785	0.133	0.652	0.953	0.183	0.770	0.918	0.166	0.752

Economic activity	Code	Germany			Poland			Slovakia		
		M	Effect		M	Effect		M	Effect	
			Direct	Residual		Direct	Residual		Direct	Residual
1	2	3	4	5	6	7	8	9	10	11
Manufacture of fabricated metal products	C25	0.930	0.360	0.571	0.961	0.324	0.636	0.941	0.303	0.638
Manufacture of computers, electronic and optical products	C26	0.961	0.462	0.499	0.951	0.208	0.743	0.919	0.108	0.811
Manufacture of electrical equipment	C27	0.939	0.353	0.587	0.947	0.229	0.718	0.927	0.200	0.727
Manufacture of machinery and equipment n.e.c.	C28	0.944	0.366	0.578	0.956	0.322	0.635	0.931	0.208	0.723
Manufacture of motor vehicles, trailers and semi-trailers	C29	0.938	0.314	0.624	0.933	0.186	0.747	0.906	0.105	0.801
Building of ships and boats	C301	0.932	0.187	0.744	0.950	0.249	0.701	0.939	0.321	0.618
Manufacture of other transport equipment	C302T309	0.950	0.341	0.609	0.951	0.239	0.713	0.931	0.229	0.702
Manufacture of furniture; repair and installation of machinery and equipment	C31T33	0.949	0.412	0.538	0.955	0.371	0.584	0.937	0.348	0.589
Electricity, gas, steam and air conditioning supply	D	0.966	0.350	0.616	0.968	0.357	0.611	0.885	0.031	0.854
Water supply; sewerage; waste management	E	0.955	0.423	0.532	0.959	0.448	0.510	0.945	0.473	0.472
Construction	F	0.958	0.408	0.550	0.954	0.295	0.659	0.953	0.408	0.546
Wholesale and retail trade; repair of motor vehicles	G	0.965	0.540	0.425	0.964	0.578	0.386	0.954	0.544	0.409
Land and pipeline transport	H49	0.927	0.437	0.490	0.874	0.322	0.552	0.896	0.433	0.463
Water transport	H50	0.960	0.385	0.575	0.953	0.252	0.701	0.977	0.749	0.228
Air transport	H51	0.950	0.247	0.703	0.949	0.199	0.750	0.912	0.145	0.767
Warehousing and support activities for transportation	H52	0.949	0.318	0.631	0.936	0.359	0.578	0.937	0.382	0.555
Postal and courier activities	H53	0.964	0.367	0.596	0.958	0.531	0.427	0.938	0.422	0.516
Accommodation and food service activities	I	0.957	0.443	0.514	0.971	0.491	0.480	0.949	0.579	0.371
Publishing, audiovisual and broadcasting activities	J58T60	0.965	0.419	0.546	0.968	0.462	0.506	0.952	0.441	0.511
Telecommunications	J61	0.958	0.330	0.628	0.966	0.503	0.462	0.964	0.556	0.408
Computer programming and information services	J62_63	0.980	0.534	0.445	0.985	0.571	0.414	0.970	0.537	0.433
Financial and insurance activities	K	0.968	0.432	0.536	0.982	0.672	0.310	0.969	0.489	0.479
Real estate activities	L	0.980	0.721	0.259	0.970	0.508	0.462	0.981	0.740	0.241

Economic activity	Code	Germany			Poland			Slovakia		
		M	Effect		M	Effect		M	Effect	
			Direct	Residual		Direct	Residual		Direct	Residual
1	2	3	4	5	6	7	8	9	10	11
Professional, scientific and technical activities	M	0.972	0.513	0.459	0.970	0.524	0.446	0.961	0.500	0.461
Administrative and support service activities	N	0.969	0.546	0.423	0.965	0.513	0.453	0.950	0.431	0.519
Public administration and defence; compulsory social security	O	0.971	0.627	0.344	0.978	0.724	0.254	0.968	0.672	0.296
Education	P	0.983	0.759	0.223	0.986	0.789	0.197	0.977	0.777	0.200
Human health and social work activities	Q	0.976	0.663	0.313	0.973	0.574	0.398	0.969	0.644	0.325
Arts, sports, entertainment and recreation	R	0.968	0.521	0.447	0.964	0.439	0.524	0.944	0.336	0.608
Other service activities	S	0.975	0.642	0.332	0.969	0.563	0.406	0.960	0.608	0.353
Activities of households as employers	T	1.000	1.000	0.000	1.000	1.000	0.000	1.000	1.000	0.000
Average (excluding activity T)	—	0.949	0.417	0.532	0.957	0.398	0.559	0.937	0.391	0.547

Note: direct and residual effects add to the multiplier. Germany reports zero gross output for mining of metal ores (B07), so no GVA multiplier is calculated for this activity. The reported values for German basic iron and steel (C24A) and non-ferrous and precious metals (C24B) should therefore be interpreted with caution. The means in the final row omit activity T and use only activities with reported values. M denotes the gross value added multiplier; the direct and residual effects sum to M.

Source: author's calculations based on the OECD Input-Output Tables (OECD, 2025) for 2022.

Across the three economies, several activities consistently record some of the highest GVA multiplier values. Education and computer programming and information services are among the highest-valued activities in all three countries. Human health and social work and public administration also record comparatively high multipliers, while real estate and financial services belong to this group in most cases. The recurrence of these activities is more informative than small differences in their exact rank and points to a common sectoral pattern across the three economies.

Several activities also recur among the lowest GVA multiplier values. Land and pipeline transport, coke and refined petroleum products, other mining and quarrying, other non-metallic mineral products and motor vehicles record comparatively low values in at least two of the three economies. German basic metals are additional low-value cases, although their position is affected by the B07 data limitation noted under Table 1. Most remaining activities cluster around intermediate values, including construction, trade, telecommunications,

professional services and much of manufacturing. These positions describe multiplier levels and should not be interpreted as a ranking of overall economic importance.

The same broad sectoral pattern is visible in 2012. Computer programming and information services, real estate, professional services, public administration and education again record some of the highest multiplier values in most countries, while petroleum refining, basic metals and other mining are again among the lowest. Individual positions nevertheless change, and several energy-related activities move more markedly between the two observations. The earlier year therefore indicates a broadly persistent sectoral ordering without implying an invariant ranking.

Against this sectoral background, the country averages are remarkably close. In 2022 the average GVA multiplier is 0.949 in Germany, 0.957 in Poland and 0.937 in Slovakia, compared with 0.955, 0.939 and 0.925 in 2012. The averages therefore reveal no strong cross-country hierarchy in the total GVA effect. The more informative differences concern the way that effect is divided between the activity receiving the final-demand impulse and subsequent production rounds. Table 2 reports this direct–residual composition for 2022, while Appendix 2 gives the corresponding shares for 2012.

Table 2

Shares of the direct and residual effects in the gross value added multiplier in Germany, Poland and Slovakia, 2022 (%)

Economic activity	Code	Germany		Poland		Slovakia	
		Direct	Residual	Direct	Residual	Direct	Residual
1	2	3	4	5	6	7	8
Agriculture, hunting and related services	A01	49.7	50.3	36.9	63.1	34.6	65.4
Forestry and logging	A02	54.9	45.1	45.5	54.5	61.5	38.5
Fishing and aquaculture	A03	54.6	45.4	54.9	45.1	56.6	43.4
Mining of coal and lignite	B05	88.2	11.8	90.9	9.1	47.0	53.0
Extraction of crude petroleum and natural gas	B06	37.9	62.1	35.9	64.1	72.9	27.1
Mining of metal ores	B07	—	—	55.7	44.3	47.8	52.2
Other mining and quarrying	B08	43.9	56.1	36.4	63.6	22.1	77.9
Mining support service activities	B09	60.2	39.8	48.7	51.3	42.9	57.1
Food products, beverages and tobacco	C10T12	22.2	77.8	18.0	82.0	24.8	75.2
Textiles, apparel, leather and related products	C13T15	34.2	65.8	37.3	62.7	38.6	61.4
Manufacture of wood and wood products	C16	31.1	68.9	31.9	68.1	30.9	69.1
Manufacture of paper and paper products; printing	C17_18	27.8	72.2	27.7	72.3	21.3	78.7

Economic activity	Code	Germany		Poland		Slovakia	
		Direct	Residual	Direct	Residual	Direct	Residual
1	2	3	4	5	6	7	8
Manufacture of coke and refined petroleum products	C19	11.5	88.5	22.9	77.1	24.9	75.1
Manufacture of chemicals and chemical products	C20	27.5	72.5	20.9	79.1	17.6	82.4
Pharmaceutical products	C21	46.6	53.4	42.4	57.6	46.3	53.7
Rubber and plastic products	C22	33.9	66.1	28.3	71.7	27.7	72.3
Other non-metallic mineral products	C23	35.7	64.3	30.1	69.9	29.3	70.7
Basic iron and steel	C24A	18.8	81.2	17.0	83.0	23.7	76.3
Non-ferrous and precious metals	C24B	16.9	83.1	19.2	80.8	18.1	81.9
Fabricated metal products	C25	38.6	61.4	33.8	66.2	32.2	67.8
Computer, electronic and optical products	C26	48.1	51.9	21.8	78.2	11.7	88.3
Electrical equipment	C27	37.6	62.4	24.2	75.8	21.6	78.4
Machinery and equipment n.e.c.	C28	38.8	61.2	33.6	66.4	22.3	77.7
Motor vehicles, trailers and semi-trailers	C29	33.5	66.5	19.9	80.1	11.5	88.5
Building of ships and boats	C301	20.1	79.9	26.2	73.8	34.2	65.8
Manufacture of other transport equipment	C302T309	35.9	64.1	25.1	74.9	24.6	75.4
Furniture; repair and installation of machinery	C31T33	43.4	56.6	38.8	61.2	37.1	62.9
Electricity, gas, steam and air conditioning	D	36.2	63.8	36.9	63.1	3.5	96.5
Water supply; sewerage; waste management	E	44.3	55.7	46.8	53.2	50.1	49.9
Construction	F	42.6	57.4	31.0	69.0	42.7	57.3
Wholesale and retail trade; motor vehicle repair	G	56.0	44.0	60.0	40.0	57.1	42.9
Land and pipeline transport	H49	47.2	52.8	36.9	63.1	48.4	51.6
Water transport	H50	40.1	59.9	26.5	73.5	76.7	23.3
Air transport	H51	26.0	74.0	20.9	79.1	15.9	84.1
Warehousing and support for transportation	H52	33.5	66.5	38.3	61.7	40.8	59.2
Postal and courier activities	H53	38.1	61.9	55.4	44.6	45.0	55.0
Accommodation and food service activities	I	46.3	53.7	50.6	49.4	60.9	39.1
Publishing, audiovisual and broadcasting activities	J58T60	43.4	56.6	47.7	52.3	46.3	53.7
Telecommunications	J61	34.4	65.6	52.1	47.9	57.7	42.3
Computer programming and information services	J62_63	54.5	45.5	57.9	42.1	55.4	44.6
Financial and insurance activities	K	44.7	55.3	68.5	31.5	50.5	49.5

Economic activity	Code	Germany		Poland		Slovakia	
		Direct	Residual	Direct	Residual	Direct	Residual
1	2	3	4	5	6	7	8
Real estate activities	L	73.6	26.4	52.4	47.6	75.4	24.6
Professional, scientific and technical activities	M	52.8	47.2	54.0	46.0	52.0	48.0
Administrative and support service activities	N	56.3	43.7	53.1	46.9	45.4	54.6
Public administration and defence	O	64.6	35.4	74.0	26.0	69.4	30.6
Education	P	77.3	22.7	80.1	19.9	79.6	20.4
Health and social work activities	Q	67.9	32.1	59.1	40.9	66.4	33.6
Arts, entertainment and recreation	R	53.8	46.2	45.6	54.4	35.6	64.4
Other service activities	S	65.9	34.1	58.1	41.9	63.3	36.7
Households as employers	T	100.0	0.0	100.0	0.0	100.0	0.0

Note: the two shares add to 100%. Mining of metal ores (B07) is omitted from the German percentage breakdown owing to zero recorded output.
Source: author's calculations based on the OECD Input-Output Tables (OECD, 2025) for 2022.

Once the multiplier is decomposed, the cross-country contrasts become clearer. The average residual share increased between 2012 and 2022 from 55.6% to 56.4% in Germany, from 56.0% to 58.6% in Poland and from 55.1% to 58.7% in Slovakia. In 2022 the direct component is especially high in education, public administration, health and several other services, whereas the residual component is much larger in a number of manufacturing activities. The decomposition therefore shifts attention from small differences in the total multiplier to differences in direct value-added intensity and in the share of the effect associated with subsequent production rounds.

The contrast is particularly visible in motor vehicles and in computers, electronic and optical products. In motor vehicle manufacturing the GVA multiplier is 0.938 in Germany, 0.933 in Poland and 0.906 in Slovakia, while the direct effect is 0.314, 0.186 and 0.105, respectively. The residual share consequently rises from 66.5% in Germany to 80.1% in Poland and 88.5% in Slovakia. In computers and electronics the multipliers are again relatively close – 0.961, 0.951 and 0.919 – but the direct effect falls from 0.462 in Germany to 0.208 in Poland and 0.108 in Slovakia. The main difference between the three production systems in these activities therefore lies in direct value-added intensity rather than in the total GVA multiplier.

The comparison with the output multipliers previously estimated for the same economies sharpens this interpretation. In motor vehicles, the output multiplier rises from 2.615 in Germany to 3.175 in Poland and 3.882 in Slovakia; in computers and electronics it rises from 2.155 to 3.084 and 3.770 (Sozanskyy, 2026). The much smaller cross-country differences in the GVA multiplier show

that a stronger gross-production response does not automatically translate into a larger value-added effect. Output propagation and value-added creation therefore describe different dimensions of the same production response.

The 2012 comparison shows which of these differences are persistent. In Slovak motor vehicles the direct GVA coefficient changed only from 0.102 in 2012 to 0.105 in 2022, and in computers and electronics from 0.109 to 0.108; the corresponding residual shares remained close to 89% in both years. Larger changes are observed in Slovak machinery and electrical equipment, where the direct component declined and the residual share increased. In Poland, changes in the selected manufacturing activities are more moderate, while in Germany the direct coefficient of motor vehicles increased from 0.287 to 0.314 and the residual share fell from 69.7% to 66.5%.

Energy-related activities change more strongly between the two observed years. In Slovakia, the direct GVA coefficient of electricity supply fell from 0.202 in 2012 to 0.031 in 2022, while the residual share rose from 76.0% to 96.5%. In coke and refined petroleum products, the direct coefficient increased from 0.107 to 0.214 in Poland and from 0.101 to 0.211 in Slovakia, with a corresponding decline in the residual share. These changes distinguish the energy activities from the more persistent manufacturing contrasts described above.

Figures 1 and 2 summarise the two main dimensions of the comparison. Figure 1 shows the average direct and residual effects in 2012 and 2022, while Figure 2 compares the residual share of selected activities in 2022.

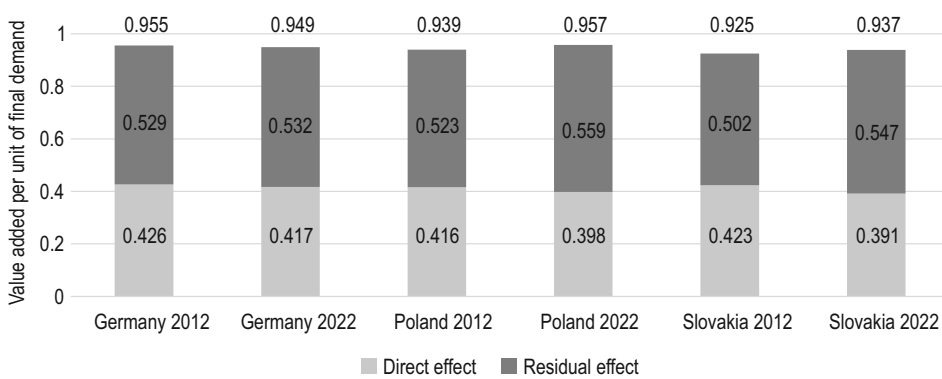


Fig. 1. Average direct and residual effects in Germany, Poland and Slovakia, 2012 and 2022
Source: author's calculations based on the OECD Input-Output Tables (OECD, 2025).

Figure 2 highlights the contrast between selected manufacturing and service activities. In motor vehicles and computers/electronics the residual share is substantially higher in Poland and Slovakia than in Germany, whereas the differences are smaller in trade, public administration and education. This confirms that the composition of the GVA effect depends on both the activity and the production system in which it operates.

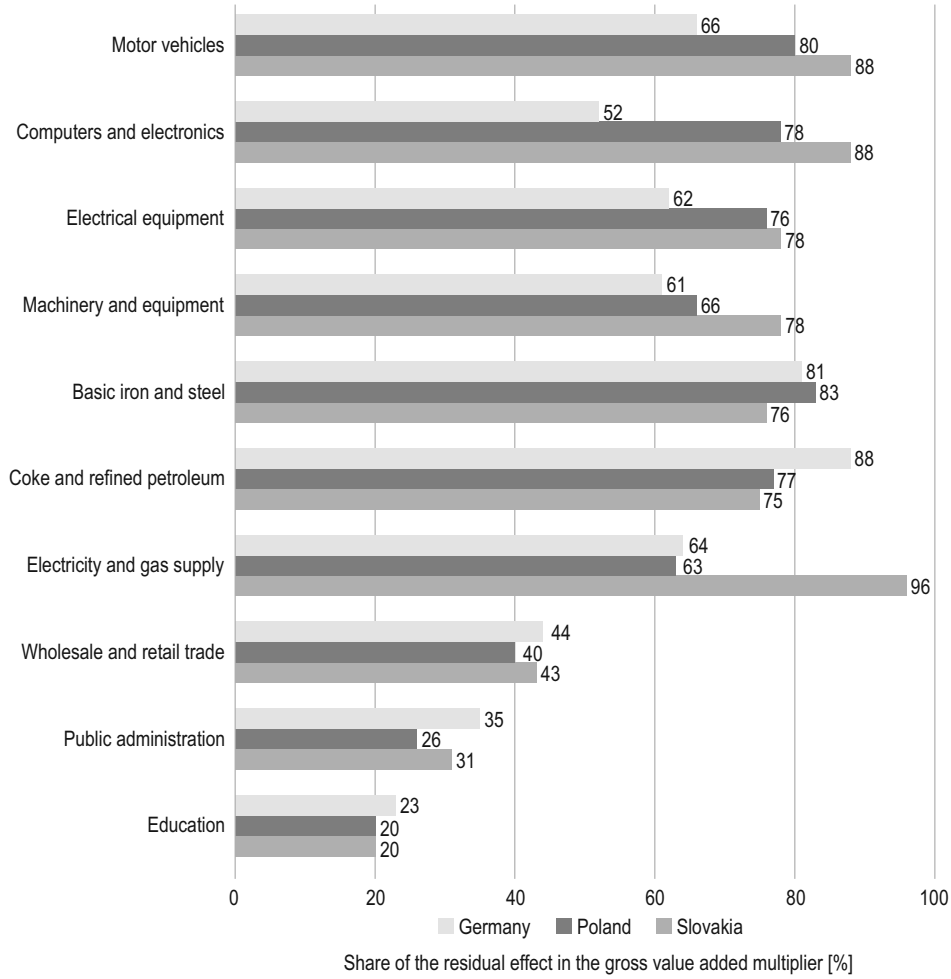


Fig. 2. Share of the residual effect in the gross value added multiplier of selected economic activities, 2022

Source: author's calculations based on the OECD Input-Output Tables (OECD, 2025).

In summary, the three economies display a broadly similar sectoral profile: several of the same activities record some of the highest and lowest GVA multiplier values, and this broad ordering is also visible in 2012. Country averages remain close and therefore provide only limited differentiation between the three production systems. The clearer contrasts emerge after decomposition: motor vehicles and computers/electronics in Poland and especially Slovakia combine relatively low direct GVA coefficients with high residual shares, whereas Germany generates a larger part of the effect directly in these activities. Read together with the previously estimated output multipliers, the results show that strong

propagation of gross production does not necessarily imply a proportionally stronger value-added effect. This is the central economic result of the comparison and provides the basis for the policy implications discussed below.

Conclusions

The study identifies a broadly shared sectoral profile of GVA multiplier levels in Germany, Poland and Slovakia, together with substantially larger differences in the composition of those effects. Education, computer programming and information services, health and public administration repeatedly record some of the highest multiplier values, whereas petroleum refining, land transport, other mining and several manufacturing activities are more often among the lowest. Country averages remain relatively close, so the most informative cross-country differences arise in the direct and residual components rather than in the total multiplier alone.

The most pronounced differences are found in motor vehicles and computers/electronics. Poland and especially Slovakia combine comparatively low direct GVA coefficients with high residual shares, whereas Germany generates a larger part of the total effect directly in the activity receiving the demand impulse. The comparison with output multipliers shows that the stronger gross-production response observed in Polish and Slovak manufacturing does not translate into a larger GVA multiplier. Output propagation and value-added creation should therefore be assessed jointly rather than treated as equivalent indicators.

The findings have two practical implications for industrial and structural policy. First, a high output multiplier should not be used on its own as a criterion of sectoral priority: strong propagation of gross production may coexist with a similar total GVA multiplier but a much lower direct GVA coefficient. Output propagation and value-added formation should therefore be assessed jointly when the objective is to identify sectors that combine strong interindustry effects with substantial value creation.

Second, the results for motor vehicles and electronics in Poland and especially Slovakia point to the relevance of functional upgrading. Where the direct GVA coefficient is low, policies that strengthen design, engineering, R&D, software, testing and other higher-value functions are more directly related to increasing value-added intensity than an expansion of production volumes alone (Stöllinger, 2021). At the same time, the comparatively high GVA multipliers of several service activities should not be interpreted mechanically as a ranking of policy priorities; employment, productivity, strategic functions and other objectives also matter.

A natural continuation of the study is to separate the GVA multiplier into domestic and total components in order to identify how much of the multiplier

effect is generated within the reporting economy and how much is associated with imported intermediate inputs. This domestic – total decomposition is the principal direction for further research.

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Appendix 1. Gross value added multipliers and their decomposition into direct and residual effects in Germany, Poland and Slovakia, 2012

Economic activity	Code	Germany			Poland			Slovakia		
		M	Effect		M	Effect		M	Effect	
			Direct	Residual		Direct	Residual		Direct	Residual
1	2	3	4	5	6	7	8	9	10	11
Agriculture, hunting and related service activities	A01	0.952	0.415	0.537	0.926	0.347	0.580	0.915	0.373	0.542
Forestry and logging	A02	0.977	0.573	0.404	0.977	0.555	0.422	0.981	0.670	0.311
Fishing and aquaculture	A03	0.950	0.492	0.458	0.883	0.453	0.430	0.895	0.362	0.533
Mining of coal and lignite	B05	0.974	0.685	0.289	0.966	0.634	0.332	0.865	0.267	0.598
Extraction of crude petroleum and natural gas	B06	0.942	0.435	0.507	0.947	0.585	0.362	0.808	0.159	0.649
Mining of metal ores	B07	—	—	—	0.952	0.589	0.363	0.863	0.312	0.551
Other mining and quarrying	B08	0.888	0.364	0.524	0.915	0.347	0.568	0.830	0.145	0.685
Mining support service activities	B09	0.931	0.450	0.480	0.918	0.444	0.474	0.887	0.432	0.454
Manufacture of food products, beverages and tobacco products	C10T12	0.957	0.220	0.737	0.937	0.195	0.742	0.934	0.273	0.661
Textiles, wearing apparel, leather and related products	C13T15	0.950	0.325	0.625	0.953	0.387	0.566	0.940	0.422	0.519
Manufacture of wood and wood products	C16	0.959	0.264	0.695	0.953	0.332	0.621	0.965	0.401	0.564
Manufacture of paper and paper products; printing	C17_18	0.952	0.310	0.642	0.949	0.304	0.645	0.926	0.283	0.643
Manufacture of coke and refined petroleum products	C19	0.893	0.112	0.781	0.794	0.107	0.686	0.699	0.101	0.598
Manufacture of chemicals and chemical products	C20	0.950	0.301	0.649	0.928	0.229	0.699	0.867	0.139	0.728
Manufacture of basic pharmaceutical products	C21	0.967	0.504	0.462	0.955	0.384	0.571	0.942	0.430	0.513
Manufacture of rubber and plastic products	C22	0.951	0.345	0.606	0.940	0.283	0.657	0.917	0.283	0.634
Manufacture of other non-metallic mineral products	C23	0.910	0.355	0.555	0.926	0.314	0.612	0.887	0.331	0.556
Basic iron and steel	C24A	0.899	0.212	0.687	0.890	0.149	0.740	0.842	0.170	0.672
Manufacture of non-ferrous and precious metals	C24B	0.916	0.173	0.743	0.898	0.160	0.738	0.877	0.335	0.542
Manufacture of fabricated metal products	C25	0.962	0.405	0.558	0.945	0.344	0.601	0.944	0.421	0.523

Economic activity	Code	Germany			Poland			Slovakia		
		M	Effect		M	Effect		M	Effect	
			Direct	Residual		Direct	Residual		Direct	Residual
1	2	3	4	5	6	7	8	9	10	11
Manufacture of computers, electronic and optical products	C26	0.965	0.460	0.505	0.936	0.195	0.741	0.912	0.109	0.803
Manufacture of electrical equipment	C27	0.952	0.384	0.568	0.932	0.235	0.697	0.925	0.255	0.670
Manufacture of machinery and equipment n.e.c.	C28	0.957	0.377	0.580	0.943	0.337	0.606	0.929	0.296	0.632
Manufacture of motor vehicles, trailers and semi-trailers	C29	0.947	0.287	0.660	0.926	0.193	0.733	0.909	0.102	0.807
Building of ships and boats	C301	0.958	0.234	0.724	0.939	0.252	0.687	0.935	0.230	0.705
Manufacture of other transport equipment	C302T309	0.963	0.333	0.630	0.947	0.315	0.632	0.928	0.326	0.602
Manufacture of furniture; repair and installation of machinery and equipment	C31T33	0.956	0.422	0.533	0.947	0.428	0.519	0.943	0.363	0.580
Electricity, gas, steam and air conditioning supply	D	0.964	0.336	0.628	0.939	0.420	0.519	0.843	0.202	0.641
Water supply; sewerage; waste management	E	0.965	0.464	0.501	0.940	0.495	0.445	0.958	0.620	0.338
Construction	F	0.954	0.408	0.545	0.934	0.355	0.580	0.969	0.547	0.422
Wholesale and retail trade; repair of motor vehicles	G	0.967	0.549	0.418	0.960	0.633	0.326	0.959	0.561	0.398
Land and pipeline transport	H49	0.945	0.462	0.484	0.847	0.418	0.429	0.894	0.441	0.453
Water transport	H50	0.947	0.229	0.718	0.945	0.401	0.543	0.962	0.691	0.271
Air transport	H51	0.935	0.206	0.729	0.927	0.261	0.666	0.915	0.358	0.557
Warehousing and support activities for transportation	H52	0.943	0.358	0.585	0.928	0.414	0.514	0.928	0.364	0.564
Postal and courier activities	H53	0.950	0.390	0.560	0.968	0.718	0.250	0.966	0.472	0.494
Accommodation and food service activities	I	0.970	0.487	0.483	0.954	0.430	0.524	0.956	0.624	0.333
Publishing, audiovisual and broadcasting activities	J58T60	0.966	0.449	0.518	0.963	0.457	0.506	0.969	0.562	0.407
Telecommunications	J61	0.972	0.415	0.558	0.949	0.388	0.562	0.979	0.561	0.418
Computer programming and information services	J62_63	0.987	0.577	0.410	0.975	0.530	0.445	0.982	0.670	0.312
Financial and insurance activities	K	0.973	0.490	0.482	0.952	0.555	0.396	0.983	0.534	0.449
Real estate activities	L	0.984	0.745	0.239	0.966	0.626	0.340	0.977	0.699	0.279
Professional, scientific and technical activities	M	0.976	0.545	0.430	0.969	0.538	0.431	0.978	0.654	0.324

Economic activity	Code	Germany			Poland			Slovakia		
		M	Effect		M	Effect		M	Effect	
			Direct	Residual		Direct	Residual		Direct	Residual
1	2	3	4	5	6	7	8	9	10	11
Administrative and support service activities	N	0.975	0.566	0.409	0.955	0.537	0.418	0.974	0.656	0.317
Public administration and defence; compulsory social security	O	0.973	0.655	0.318	0.972	0.765	0.207	0.974	0.703	0.271
Education	P	0.987	0.774	0.213	0.980	0.747	0.233	0.968	0.739	0.230
Human health and social work activities	Q	0.978	0.683	0.295	0.965	0.565	0.400	0.956	0.630	0.327
Arts, sports, entertainment and recreation	R	0.973	0.568	0.404	0.964	0.489	0.474	0.992	0.794	0.198
Other service activities	S	0.979	0.656	0.323	0.958	0.544	0.414	0.965	0.643	0.322
Activities of households as employers	T	1.000	1.000	0.000	1.000	1.000	0.000	1.000	1.000	0.000
Average (excluding activity T)	—	0.955	0.426	0.529	0.939	0.416	0.523	0.925	0.423	0.502

Note: direct and residual effects add to the multiplier. Germany has no reportable coefficient for mining of metal ores (B07) because recorded output is zero. The means in the final row omit activity T and use only activities with reported values. M denotes the gross value added multiplier; the direct and residual effects sum to M.

Source: author's calculations based on the OECD Input-Output Tables (OECD, 2025) for 2012.

Appendix 2. Shares of the direct and residual effects in the gross value added multiplier in Germany, Poland and Slovakia, 2012 (%)

Economic activity	Code	Germany		Poland		Slovakia	
		Direct	Residual	Direct	Residual	Direct	Residual
1	2	3	4	5	6	7	8
Agriculture, hunting and related services	A01	43.6	56.4	37.4	62.6	40.7	59.3
Forestry and logging	A02	58.6	41.4	56.8	43.2	68.3	31.7
Fishing and aquaculture	A03	51.8	48.2	51.3	48.7	40.4	59.6
Mining of coal and lignite	B05	70.3	29.7	65.7	34.3	30.9	69.1
Extraction of crude petroleum and natural gas	B06	46.2	53.8	61.8	38.2	19.7	80.3
Mining of metal ores	B07	—	—	61.9	38.1	36.1	63.9
Other mining and quarrying	B08	41.0	59.0	37.9	62.1	17.5	82.5
Mining support service activities	B09	48.4	51.6	48.4	51.6	48.8	51.2
Food products, beverages and tobacco	C10T12	23.0	77.0	20.8	79.2	29.2	70.8
Textiles, apparel, leather and related products	C13T15	34.2	65.8	40.6	59.4	44.8	55.2
Manufacture of wood and wood products	C16	27.5	72.5	34.8	65.2	41.6	58.4
Manufacture of paper and paper products; printing	C17_18	32.6	67.4	32.0	68.0	30.6	69.4
Manufacture of coke and refined petroleum products	C19	12.5	87.5	13.5	86.5	14.4	85.6
Manufacture of chemicals and chemical products	C20	31.7	68.3	24.7	75.3	16.0	84.0
Pharmaceutical products	C21	52.2	47.8	40.2	59.8	45.6	54.4
Rubber and plastic products	C22	36.3	63.7	30.1	69.9	30.9	69.1
Other non-metallic mineral products	C23	39.0	61.0	33.9	66.1	37.3	62.7
Basic iron and steel	C24A	23.6	76.4	16.8	83.2	20.2	79.8
Non-ferrous and precious metals	C24B	18.9	81.1	17.8	82.2	38.2	61.8
Fabricated metal products	C25	42.0	58.0	36.4	63.6	44.6	55.4
Computer, electronic and optical products	C26	47.7	52.3	20.8	79.2	11.9	88.1
Electrical equipment	C27	40.4	59.6	25.2	74.8	27.5	72.5
Machinery and equipment n.e.c.	C28	39.4	60.6	35.7	64.3	31.9	68.1
Motor vehicles, trailers and semi-trailers	C29	30.3	69.7	20.9	79.1	11.2	88.8
Building of ships and boats	C301	24.5	75.5	26.8	73.2	24.6	75.4
Manufacture of other transport equipment	C302T309	34.6	65.4	33.3	66.7	35.1	64.9

Economic activity	Code	Germany		Poland		Slovakia	
		Direct	Residual	Direct	Residual	Direct	Residual
1	2	3	4	5	6	7	8
Furniture; repair and installation of machinery	C31T33	44.2	55.8	45.2	54.8	38.5	61.5
Electricity, gas, steam and air conditioning	D	34.9	65.1	44.7	55.3	24.0	76.0
Water supply; sewerage; waste management	E	48.1	51.9	52.7	47.3	64.7	35.3
Construction	F	42.8	57.2	38.0	62.0	56.5	43.5
Wholesale and retail trade; motor vehicle repair	G	56.8	43.2	66.0	34.0	58.5	41.5
Land and pipeline transport	H49	48.8	51.2	49.4	50.6	49.3	50.7
Water transport	H50	24.1	75.9	42.5	57.5	71.8	28.2
Air transport	H51	22.1	77.9	28.2	71.8	39.2	60.8
Warehousing and support for transportation	H52	38.0	62.0	44.6	55.4	39.2	60.8
Postal and courier activities	H53	41.1	58.9	74.1	25.9	48.8	51.2
Accommodation and food service activities	I	50.3	49.7	45.1	54.9	65.2	34.8
Publishing, audiovisual and broadcasting activities	J58T60	46.4	53.6	47.5	52.5	58.0	42.0
Telecommunications	J61	42.6	57.4	40.8	59.2	57.3	42.7
Computer programming and information services	J62_63	58.5	41.5	54.4	45.6	68.2	31.8
Financial and insurance activities	K	50.4	49.6	58.4	41.6	54.3	45.7
Real estate activities	L	75.7	24.3	64.8	35.2	71.5	28.5
Professional, scientific and technical activities	M	55.9	44.1	55.5	44.5	66.9	33.1
Administrative and support service activities	N	58.0	42.0	56.2	43.8	67.4	32.6
Public administration and defence	O	67.3	32.7	78.7	21.3	72.2	27.8
Education	P	78.4	21.6	76.3	23.7	76.3	23.7
Health and social work activities	Q	69.8	30.2	58.6	41.4	65.8	34.2
Arts, entertainment and recreation	R	58.4	41.6	50.8	49.2	80.0	20.0
Other service activities	S	67.0	33.0	56.8	43.2	66.6	33.4
Households as employers	T	100.0	0.0	100.0	0.0	100.0	0.0

Note: the two shares add to 100%. Mining of metal ores (B07) is omitted from the German percentage breakdown owing to zero recorded output.

Source: author's calculations based on the OECD Input-Output Tables (OECD, 2025) for 2012.