CPAG Research Report

Technology Diffusion through Trade within the EU

How goods, services and supply chains carry know-how — and why parts of Europe are starting to fall behind.

PERIOD COVERED
1995 – 2025

DATA SOURCES
OECD TiVA · ILO

FOCUS
EU-27 + Romania, Czechia, Hungary, Poland

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How goods, services and supply chains carry know-how —and why parts of Europe are starting to fall behind.

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EXECUTIVE SUMMARY

The overlapping shocks of the post-2019 period have produced a striking three-layered productivity growth pattern within the European Union: frontier economies grew in tandem with the world frontier (CAGR 0.6% and 0.5% respectively), non-frontier economies expanded at barely half that rate (CAGR 0.3%), while Central and Eastern European economies maintained significantly higher growth rates consistent with the advantage-of-backwardness mechanism theorised by Acemoglu et al. (2026). While the existing literature has documented the productivity-enhancing effects of trade openness and GVC participation in normal times, it has paid limited attention to how structural shifts in the composition and directionality of trade flows — rather than their volume alone — affect the technology diffusion capacity of individual economies under conditions of systemic shock. Exploiting bilateral trade data from the OECD TiVA database matched with ILO labour productivity statistics over 1995–2022, we address this gap by decomposing the technology diffusion capacity of intra-EU and extra-EU trade flows by productivity tiers of trading partners. This decomposition — novel in distinguishing the exogenous productivity effect of partner countries from the endogenous trade volume choices of individual member states — allows us to identify absorptive capacity responses to global trade shocks separately from partner-driven spillover effects. We document a systematic post-2019 reorientation of EU trade toward middle-productivity partners within the bloc, alongside a concurrent downgrading of extra-EU trade relationships away from high-productivity destinations. a mechanism largely overlooked in the existing productivity slowdown literature, which has focused primarily on demand deficiency, financialization, and the measurement of intangible capital. Our results carry direct implications for the design of value chain integration strategies and policies aimed at strengthening absorptive capacity across EU member states.

AT A GLANCE

Main findings

1 In 1995-2019 EU frontier, EU non frontier and world frontier grew in tandem, with the world frontier remaining 22% ahead of the EU frontier on average. After 2019 productivity growth halved globally; EU and world frontiers decelerated in tandem. EU non-frontier growth fell to half the frontier rate.

2 In 1995-2019 ECE countries confirmed the advantage-of-backwardness mechanism: Countries with the largest productivity gaps grew fastest. After 2019 ECE countries give evidence of a productivity threshold at approximately 50% of frontier productivity, beyond which the advantage of technological backwardness diminishes or disappears. Czechia's and EU non-frontier's underperformance is telling suggesting either a shrinking technology gap or an inability to absorb frontier technologies, particularly in AI and ICT.

3 Three-tier productivity structure emerged post-2019. After overlapping shocks, EU productivity split into three distinct layers: the EU frontier growing in line with the world frontier (CAGR 0.6% vs 0.5%), the EU non-frontier growing at half that rate (CAGR 0.3%), and ECE countries growing significantly faster (Romania 2.7%, Poland 2.3%).

4 The advantage of technological backwardness holds — but only up to a threshold. Romania, Poland, and Hungary confirmed Acemoglu et al.'s (2026) prediction: the larger the productivity gap relative to the frontier, the faster the growth. However, this advantage appears to vanish at around 50% of EU frontier productivity, beyond which catching-up stalls or reverses.

5 Czechia may have crossed the backwardness threshold. At 38% of EU frontier productivity, Czechia's growth rate converged to the frontier rate — suggesting it has entered a zone where the technology diffusion benefit diminishes, despite not yet reaching frontier levels.

6 EU non-frontier is caught in a competitiveness trap. With average productivity at half the EU frontier, EU non-frontier countries grew at only half the frontier's rate post-2019. This is attributed either to a productivity gap too narrow to sustain easy technology absorption, or to frontier technologies (particularly AI and ICT) being inappropriate for their institutional and skill contexts.

7 EU trade shifted structurally toward intermediates and intra-EU sourcing post-2019. The share of final goods in both exports and imports declined across all groups, reflecting deeper GVC embeddedness. Additionally, the EU frontier's share of imports from within the EU jumped from 54% to 60%, signalling a deliberate supply chain regionalisation driven by post-pandemic de-risking.

8 The EU frontier is downgrading its OECD trade partner quality. After 2019, EU frontier countries shifted exports away from high-productivity OECD partners toward lower-productivity ones, while maintaining ties only with the very top (world frontier). This trade partner downgrading reduces exposure to the productivity spillovers historically associated with high-standard markets.

9 Within EU, trade is polarising toward middle-productivity and ultra-high-productivity partners. Across all country groups, the share of trade with "high"-productivity EU partners collapsed (by ~10–20 percentage points), redistributed toward the "middle" tier and outliers (Luxembourg, Ireland). This reflects both value chain restructuring and a comfort-zone dynamic where countries gravitate toward peers.

10 ECE countries are deepening intra-regional trade while increasing cheap-input sourcing from outside EU. All four ECE countries reduced trade with low-productivity EU partners and expanded ties with middle-tier EU partners — each other and newer EU members — indicating an emerging CEE sub-regional economy. Simultaneously, OECD imports became increasingly concentrated in low-productivity partners (reaching 48–60% of OECD imports), reflecting cost-driven supply chain strategies.

11 Romania and Poland are emerging as a digital services corridor within ECE. Both countries lead ECE in IT export shares, particularly to non-EU markets (Romania at 9%, Poland at 6% of ROW exports). This signals endogenous capability building beyond traditional assembly — their most promising long-run comparative advantage.

12 Hungary is the most structurally vulnerable ECE economy. Its FDI-driven assembly model has exhausted its convergence potential: the productivity gap with OECD trading partners stalled after 2012, services exports remain the weakest of the four (27% in 2022), and IT export presence is minimal. Without structural diversification, the model faces a ceiling with no clear escape route.

The process of innovation and diffusion is one in which new ideas are combined with insights from others. Trade thus affects technology by determining the distribution from which producers draw their insights. Yan Bai et al (2024) showed that a country has incentives either to subsidize imports from places that improve the quality of learning at Home; or lower its export tax to another country if a) higher productivity in that country is good for the Home, and b) more exports to that country improve the quality of learning and, in turn, the country's technology. Acemoglu et al (2026) showed that there is a "technological advantage to being backward", in that economies that are behind the world frontier can improve their technology faster by adopting technologies from the frontier than those at the frontier, which typically have to advance through new inventions and innovations. In their framework in the long-term equilibrium all countries settle into the same growth rate as the world technology frontier. The reason is that growing faster than the frontier would lower the technology gap and technology improvement world be harder to accomplish, while growing slower than the frontier would increase the technology backwardness, which in turn would ease the adoption of ideas and technology from the frontier.

However, some of the world frontier technology might be inappropriate for the laggards. A foundational insight in development economics is that technologies are not neutral — they are embedded in specific factor endowments, institutional environments, and skill ecosystems. The idea that countries with different factor endowments will use different technologies was first formalized by Atkinson and Stiglitz (1969), who thus gave rise to a tradition on "appropriate technology." Several factors determining the appropriate technology were studied, the endowment of capital by Basu and Weil (1998), the labour skill mix by Acemoglu and Zilibotti (2001). Caselli and Coleman (2006) find evidence in support of the idea that skilled labor-abundant richer countries choose technologies better suited to skilled workers, and these technologies are not ideal for places that are more abundant in unskilled workers. Technologies also require institutional and physical infrastructure complements. Röller and Waverman (2001) demonstrated that telecommunications technology only generates returns above a network externality threshold — meaning early adopters in thin markets gain little. Djankov et al. (2002) and the World Bank Doing Business literature show that institutional infrastructure — contract enforcement, property rights, standards bodies — is a necessary complement to many industrial technologies. Rodrik (2007, One Economics, Many Recipes) synthesized this into the concept of "second-best institutions": the optimal technology for a given economy depends not on best-practice global standards but on what complements the local institutional environment. Importing first-best technology into second-best institutions often yields worse outcomes than more modest, locally adapted techniques. Any of the above impediments can slowdown the adoption of frontier technology putting a brake on the growth of laggards and offsetting the technology advantage of being backward.

The technology diffusion in EU was studied empirically in ECIPE (2024). The results point to 1/the stronger diffusion capacity of Western and Nordic EU countries, 2/ the absorption of advance technology in manufacturing and services by Middle Europe and Central and Eastern Europe,

3/the economic divide between Nordic/Western countries and CEE linked to their differing capacities for diffusing knowledge and technology, 4/the growing digital divide between Nordic and CEE countries, which not only risks deepening economic inequalities and undermining competitiveness but also threatens to drive skilled workers away from less digitally advanced regions.

We analyse the changes in productivity, trade and technology backwardness of EU member states, separately for the EU frontier (the 3 most productive countries in each year[1]), the non-frontier countries (EU member states not in frontier and not outliers) and ECE countries (Romania, Czechia, Hungary and Poland). Considering that technology is embodied in the country's productivity[2] we measure technology backwardness for each EU member state by the gap between its own productivity and the productivity of its trading partners from EU and outside EU. We compared the evolutions between 1995-2019 and 2019-2022.

METHODOLOGY

Data and methodology

The analysis is based on 1/the OECD tiva data set covering 1995-2022 consisting of the bilateral trade of each EU member state with countries in EU and countries outside EU included in the OECD data set and 2/ countries ILO productivity (USD per person in 2015 prices) for 1995-2025. By matching these two data sets we can compute for each EU member state the productivity of the whole set of exporting partners and the productivity of the whole set of importing partners, separately for the trade within EU and outside EU called OECD. These productivities are computed as weighted averages of the productivity of export/import partners with the weights representing the share of each partner in total export/import of the given EU member state.

$Prod_{ct}^{EU,ex}=\sum_{i=1}^{27} prod^{EU}{}_{it} w_{it}$, where $w_{it} = \frac{ex_{cit}}{ex_{ct}}$ (1)

$Prod_{ct}^{EU,im}=\sum_{i=1}^{27} prod^{EU}{}_{it} w_{it}$, where $w_{it} = \frac{im_{cit}}{im_{ct}}$ (2)

[1] Excluding the super productive outliers Luxembourg and Ireland from 2015, with productivity exceeding the EU frontier by more than 1.4 times about at par with world frontier.

[2] Surinach et al (2009) found empirical support for the link between innovation and productivity. WIPO Report (2026) using patent citations, scientific references, and reuse of breakthrough inventions showed that technological knowledge flows have economic impact and that there is a clear link between international knowledge spillovers and improvements in worker productivity, industry performance, and national income. Developing economies particularly benefit by adopting and adapting knowledge from more advanced countries, which helps narrow productivity gaps and accelerate economic development. The most common way technological knowledge spreads is through goods that embody new technologies. Consumers access embedded innovations through their purchases while companies use imported machinery, components and materials as inputs for their own production. The report notes that knowledge now diffuses faster than ever yet remains highly concentrated among a small group of advanced economies, with Western Europe among the dominant hubs.

$Prod_{ct}^{OECD,ex}=\sum_{i=1}^{54} prod^{OECD}{}_{it} w_{it}$, where $w_{it} = \frac{ex_{cit}}{ex_{ct}}$ (3)

$Prod_{ct}^{OECD,im}=\sum_{i=1}^{54} prod^{OECD}{}_{it} w_{it}$, where $w_{it} = \frac{im_{cit}}{im_{ct}}$ (4)

where

t, represents the year of the period 1995-2022,

27 trade partners from EU member

54 trade partners from outside EU, out of which 16 OECD members[3].

$prod^{EU}{}_{it}$ is the productivity of trade partner i from EU in year t,

$prod^{OECD}{}_{it}$ is the productivity of trade partner i from OECD in year t,

$prod_{ct}^{EU,ex}$ is the productivity of export partners from EU of EU member state c,

$prod_{ct}^{EU,im}$ is the productivity of import partners from EU of EU member state c,

$prod_{ct}^{OECD,ex}$ is the productivity of export partners from OECD of EU member state c,

$prod_{ct}^{OECD,im}$ is the productivity of import partners from OECD of EU member state c,

im_{cit} represents gross imports from EU member state c to trade partner i in year t,

ex_{cit} represents gross exports of EU member state c to trade partner i in year t,

im_{ct} is the total gross imports of EU member state c

ex_{ct} is the total gross exports of EU member state c.

Productivity gap of the EU frontier	Productivity gap of EU non frontier
$gap^{EU\ fr,\ exEU}{}_t=\frac{\sum_{c=1}^{3} prod_{ct}^{EU}}{3} - \frac{\sum_{c=1}^{3} prod_{ct}^{EU,ex}}{3}$	$gap^{EU\ non\ fr,\ exEU}{}_t=\frac{\sum_{c=1}^{24} prod_{ct}^{EU}}{24} - \frac{\sum_{c=1}^{24} prod_{ct}^{EU,ex}}{24}$
$gap^{EU\ fr,\ imEU}{}_t=\frac{\sum_{c=1}^{3} prod_{ct}^{EU}}{3} - \frac{\sum_{c=1}^{3} prod_{ct}^{EU,im}}{3}$	$gap^{EU\ non\ fr,\ imEU}{}_t=\frac{\sum_{c=1}^{24} prod_{ct}^{EU}}{24} - \frac{\sum_{c=1}^{24} prod_{ct}^{EU,im}}{24}$
$gap^{EU\ fr,\ exOECD}{}_t=\frac{\sum_{c=1}^{3} prod_{ct}^{EU}}{3} - \frac{\sum_{c=1}^{3} prod_{ct}^{OECD,ex}}{3}$	$gap^{EU\ non\ fr,\ exOECD}{}_t=\frac{\sum_{c=1}^{24} prod_{ct}^{EU}}{24} - \frac{\sum_{c=1}^{24} prod_{ct}^{OECD,ex}}{24}$
$gap^{EU\ fr,\ imOECD}{}_t=\frac{\sum_{c=1}^{3} prod_{ct}^{EU}}{3} - \frac{\sum_{c=1}^{3} prod_{ct}^{OECD,im}}{3}$	$gap^{EU\ non\ fr,\ imOECD}{}_t=\frac{\sum_{c=1}^{24} prod_{ct}^{EU}}{24} - \frac{\sum_{c=1}^{24} prod_{ct}^{OECD,im}}{24}$

[3] The OECD set includes 54 countries outside EU. 16 are OECD members- Australia, Canada, Chile, Colombia, Costa Rica, Iceland, Israel, Japan, Korea, Mexico, Norway, New Zeeland, Switzerland, Turkiye, United Kingdom and United States of America. 38 are non-OECD members - Angola, Argentina, Bangladesh, Belarus, Brasil, Brunei Darussalam, Cambodia, Cameroon, China, Democratic Republic of Congo, Cote d'Ivoire, Egypt, Hong Kong, India, Indonesia, Jordan, Kazakhstan, Lao People's Democratic Republic, Malayisia, Mexico, Morocco, Myanmar, Nigeria, Pakistan, Peru, Philippines, Russia, Sao Tome and Principe, Saudi Arabia, Senegal, Singapore, South Africa, Chinese Taipei, Thailand, Tunisia, Ukraine, United Arab Emirates, Vietnam.

Productivity gap of an EU member state
$gap^{C,exEU}_t=prod^{EU}_{ct}-prod^{EU,ex}_{ct}$; $gap^{C,imEU}_t=prod^{EU}_{ct}-prod^{EU,im}_{ct}$; $gap^{C,exOECD}_t=prod^{EU}_{ct}-prod^{OECD,ex}_{ct}$; $gap^{C,imOECD}_t=prod^{EU}_{ct}-prod^{OECD,im}_{ct}$; where c ϵ {Bg, Ro, Cz, Hu, Pl, At, Be, Cy, Dk, Ee, Es, Fr, Fi, Ge, Gr, Hr, Ie, It, Lv, Lt, Lu, Mt, Nl, Pt, Si, Sk, Se}

For each EU member state four productivity gaps are computed for measuring the difference between own productivity on the one hand and the productivity of its export/import trading partners from EU and OECD.

The productivity of export/import partners of EU frontier and EU non-frontier in each year is the simple average of the productivity of export/import of the EU member states belonging to EU frontier and EU non frontier. The analysis focuses on EU frontier, non EU frontier and ECE region including Romania, Czechia, Hungary and Poland.

The paper has three parts. The first past presents the productivity dynamics within EU, separately for EU frontier, EU non-frontier and ECE countries before and after 2019. The second part shows the evolution of the trade in EU by the geography of trading partners, that is the trade among EU member states and the trade of EU member states with outside EU trade partners included in OECD tiva data base. The third part presents the productivity gap between on the one hand EU frontier, EU non frontier and ECE and on the other hand the productivity of their trading partners within EU and outside EU before and after 2019, in an attempt to find out differentiating elements which after 2019 favoured technology diffusion in the EU frontier but not in the EU non-frontier.

SECTION 1

Productivity dynamics

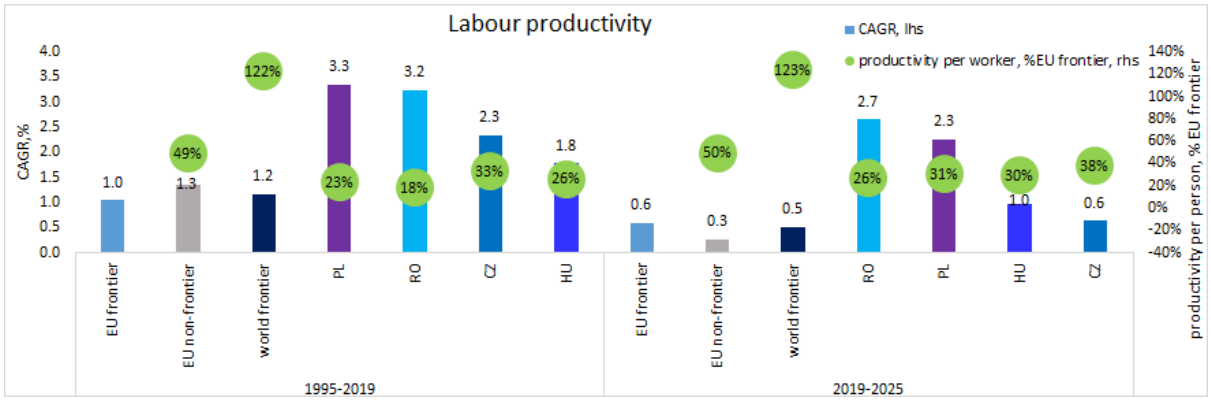
The cumulative annual growth rate of productivity in EU during 1995-2019 was close to that of the world frontier[4] (1.2% in OECD countries where productivity exceeded the productivity of EU frontier) in both EU frontier (1%) and EU-non frontier (1.3%). The productivity in ECE countries with a consistent productivity backwardness compared to the world and EU frontier grew faster as the model in Acemoglu et al (2026) would predict (Fig. 1). Romania and Poland with the largest productivity backwardness compared to the productivity of EU frontier (15% and 23% respectively) grew fastest (CAGR 3.2% and 3.3% respectively).

[4]The productivity of world frontier in each year is the average productivity of the OECD countries outside EU more productive than the EU frontier in that year.

In 1995-2019 compared to the EU frontier average annual productivity, the world frontier average annual productivity was 22% ahead, EU non-frontier's average productivity was half (49%), while in ECE the average annual productivity ranged between 18% in Romania and 33% in Czechia.

After 2019, during the period 2019-2025, the productivity of the whole world slowed down sharply. The annual growth rates halved compared to 1995-2019. The EU frontier (CAGR 0.6%) grew in tandem with world frontier (CAGR 0.5%). But the EU non-frontier evolved twice slower (CAGR 0.3%). In ECE the growth rates also slowed down, but except for Czechia, the growth rates of productivity were higher than in the frontiers. The largest growth rates were registered in Romania (CAGR 2.7%) and Poland (CAGR 2.3%), where the average productivity of 2019-2025 was 26% and 31% respectively of the EU frontier. In Hungary the productivity increased slower (CAGR 1%) and the average productivity of the period was 30% of the EU frontier.

Fig. 1

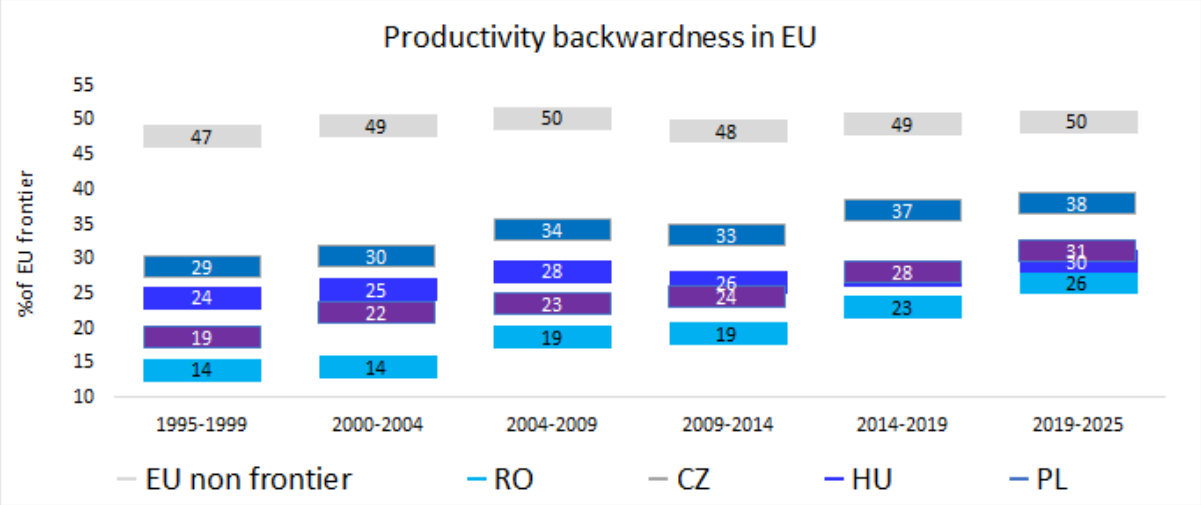


Source: ILO statistic on labour productivity, 2025

The cases of Romania, Poland and Hungary confirm the existence of the advantage of being a technological laggard theorised by Acemoglu et al (2026). These countries grew faster than the frontiers and still have the potential to grow faster in the future, their productivity levels being below the threshold when the advantage of technological backwardness disappears (Fig. 2). The fact that in Czechia the productivity grew by the same rate as the frontier might indicate that its productivity (at 38% of the EU frontier) hit a threshold beyond which the advantage of being a technological laggard diminishes. That hypothesis is confirmed by the EU non-frontier. For this group of EU countries, with average productivity at half of the EU frontier, the annual growth rate of productivity was half of the frontier, perhaps either because the technological backwardness was smaller and the technology diffusion from outside became more difficult or that the technology from the frontier (mainly in AI, ICT domain) became inappropriate and therefore could not be absorbed. Thus, it turns out that the smaller the productivity gap to the frontier the larger the productivity dynamics gap to the frontier. The threshold productivity level beyond which productivity growth remains behind the frontier growth it seems to be 50% of the frontier productivity.

We ask the question whether the technology diffusion embodied in the evolution of export and import partners productivity triggered the slowdown.

Fig. 2



Source: ILO statistic on labour productivity, 2025

SECTION 2

EU's trade

The trade within EU and with OECD covers around 95-96% of total EU trade. During the whole period (Table 1)

- Exports were larger than imports
- Trade within EU was larger than the trade with OECD.
- Up to 2019 the share of within EU exports and imports declined in favour of OECD trade, but after 2019 a reversal happened in case of exports.
- The share of final goods in total traded goods declined over time from 49% in 1995 to 43% in 2022 of exported goods and from 44% in 1995 to 37% in 2022 of imported goods.
- The geographic mix of final goods trade shares became more equilibrated. The share of exported final goods within EU declined from 51% to 45% in 2022, while the share of imported final goods within EU declined from 60% in 1995 to 54% in 2022. This evidence proves that EU member states become more integrated in European value chains and traded among themselves more intermediate goods. The final goods were traded more with outside EU.

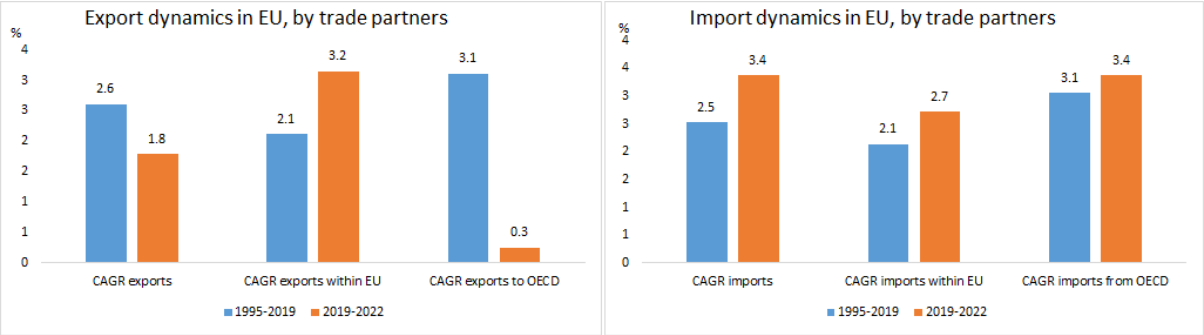
Table 1 EU trade, by geography of trade partners

	1995			2019			2022		
	World bn USD 2015 price	Of which, %		World bn USD 2015 price	Of which,%		World bn USD 2015 price	Of which,%	
		Within EU	OECD		Within EU	OECD		Within EU	OECD
Total									
Export	3256	55	40	6040	49	45	6369	51	43
Import	3064	58	38	5577	53	43	6160	52	43
Final goods									
Export	1584	51	42	2757	42	48	2749	45	46
%total	49%			45%			43%		
Import	1350	60	38	2181	54	43	2281	54	43
%total	44%			39%			37%		

Source: OECD tiva database

The trade as a means of technology diffusion for EU had a buoyant expansion amid persistent structural changes over the last thirty years (Fig. 3). Exports and imports increased by 2.6%/2.5% y-o-y on average in 1995-2019 and by 1.8% y-o-y the exports and 3.4% y-o-y the imports in 2019-2022 (Fig. 1). There's a clear asymmetry between exports and imports in the 2019–2022 period — imports accelerated broadly, while exports to OECD partners nearly stalled. Intra-EU trade strengthened on both sides, possibly reflecting supply chain reorientation or regionalization trends post-COVID. The near-zero OECD export growth (0.3%) likely reflects disruptions from the pandemic, global demand shifts, and possibly early effects of geopolitical tensions post-2022.

Fig. 3



Note: CAGR based on values in USD 2015 prices

Source: OECD tiva dataset

2.1 EU frontier's trade

The share of EU frontier trade declined sharply from 23% the exports and 21% the imports in 1995 to 10% in 2019 and 11% in 2022 both inside and outside EU trade (Table 2). With this contraction its capacity to diffuse technology among its trading partners withered.

Although the share of exports to OECD increased up to 2019 (from 40% in 1995 to 44% in 2019) and stay still thereafter, more than half of the exports were sent to EU (55% in 1995 and 52% in 2022). In case of imports almost no changes in the geographical mix occurred and the biased towards EU was more pronounced than in case of exports all over the period (60% of total imports were received from EU and 37% from OECD). The pre-2020 baseline was shrinking for 25 years. CAGRs of -0.8% over a 25-year period for the most productive EU economies is striking. It suggests even frontier countries faced structural export headwinds — likely reflecting their already-high market maturity, euro appreciation effects, and gradual offshoring of production stages.

Table 2 EU frontier trade by geography of trade partners and share in EU trade

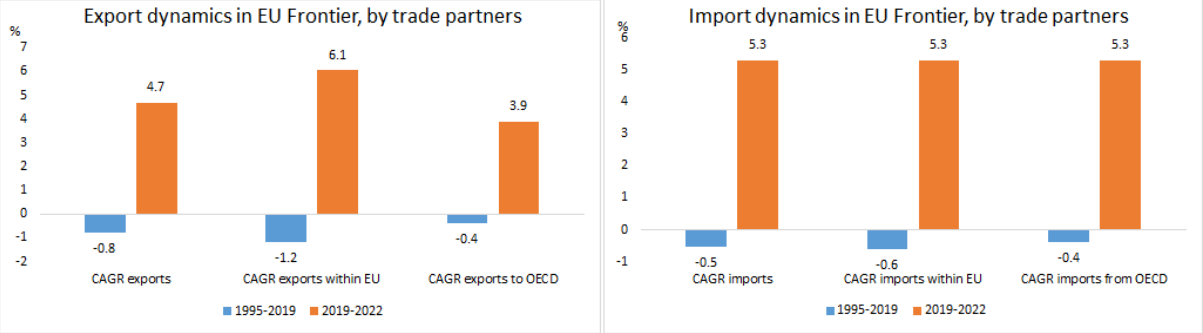
	1995			2019			2022		
	World bn USD 2015 prices	of which, %		World bn USD 2015 prices	of which,%		World bn USD 2015 prices	of which,%	
		Within EU	OECD		Within EU	OECD		Within EU	OECD
exports	745	55	40	618	50	44	709	52	43
imports	655	61	35	575	60	37	641	60	37
	Share of EU frontier in EU trade by partners, %								
	World	Within EU	OECD	World	Within EU	OECD	World	Within EU	OECD
%EU export	23	23	23	10	10	10	11	11	11
%EU import	21	22	20	10	12	9	11	13	9

Source: OECD tiva database

Trade exploded after 2019, both exports and imports, the exports towards EU faster (CAGR 6.1%) than the exports to OECD (3.9%), the imports at the same rate (CAGR 5.3%) regardless the geography (Fig. 4). These evolutions were the opposite compared to 1995-2019, when both exports to and imports from OECD (CAGR -0.4%) declined less than the trade with EU (CAGR -1.2% of exports, CAGR -0.6% of imports). The EU Frontier shows a striking pattern — long-run stagnation followed by a sharp post-2019 rebound, especially in intra-EU trade on export side and imports regardless the geography. This may reflect these countries capitalizing on supply chain reshoring or increased demand for high-value goods.

Imports grew slightly faster than exports in case of OECD trade, while the opposite was true for within EU trade. The OECD gap is the most notable — frontier countries pulled significantly more from OECD partners than they sent. This may reflect demand for high-value intermediate inputs from non-EU advanced economies.

Fig. 4



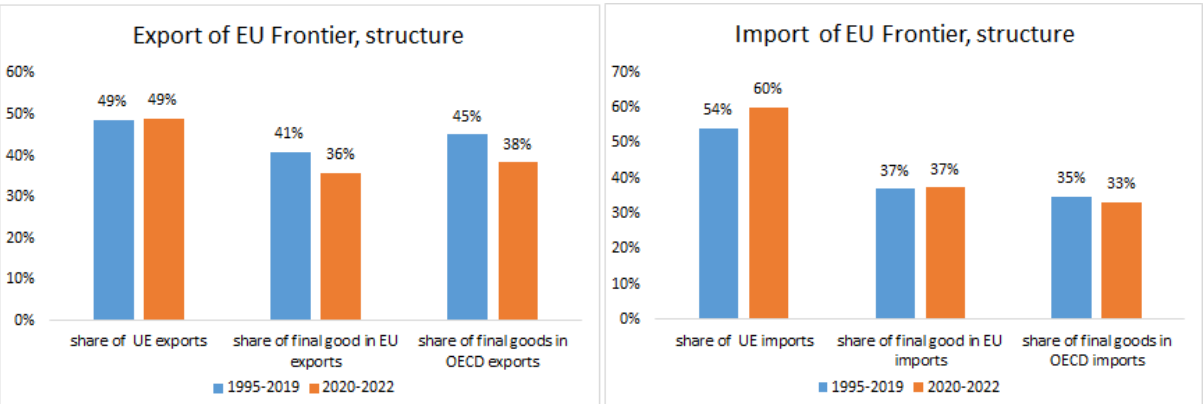
Note: CAGR based on values in USD 2015 prices

Source: OECD tiva dataset

After 2019 the EU countries are sourcing more from each other (relative to sourcing from outside the EU) but not sending proportionally more to each other on the export side. The share of EU exports remained unchanged at 49% in both periods, while the share of EU imports increased from 54% before 2019 to 60% after 2019. The most likely explanation is a defensive restructuring of supply chains — EU firms replacing extra-EU suppliers with EU ones, driven by risk, policy, or cost factors — while export market geography remains largely unchanged. The import side adjusts faster than the export side because procurement decisions can be made unilaterally, while export market share depends on foreign buyer behavior.

The proportion of final goods changed consistently in case of exports, declining regardless the geography, to 36% from 41% in EU exports and to 38% from 43% in outside EU exports (Fig. 5). This tendency is an indication for a more vertical specialization in EU, a good that previously crossed one border now crosses two or three, with each crossing generating an intermediate goods export. This change in production structure might be caused by reshoring of intermediate from outside EU determined by supply chain de-risking and friend-shoring dynamic. EU frontier countries are importing more intermediate goods than final goods from both within EU (63% of total imports oriented to EU) and outside EU (67% of the total imports oriented outside EU).

Fig. 5

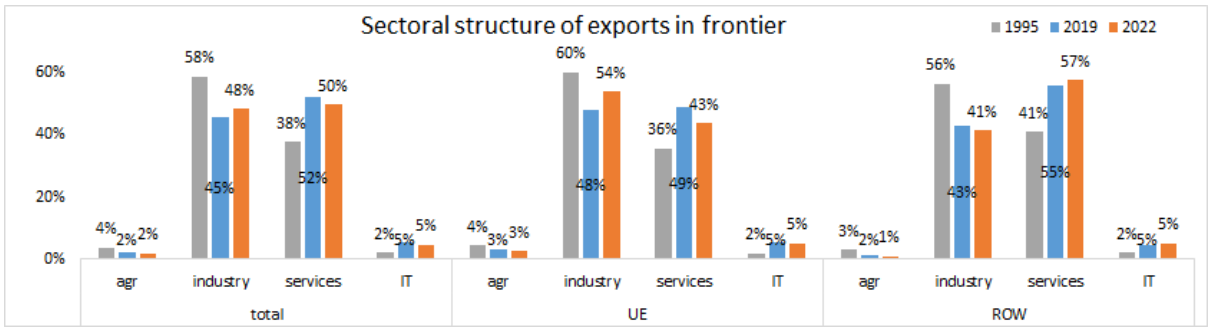


Note: CAGR based on values in USD 2015 prices

Source: OECD tiva dataset

The sectoral change of import and exports changed slightly over the years. Up to 2019 there was a significant deindustrialisation of exports, the share of exported industrial products declined from 58% in 1995 to 44% in 2019 (Fig. 6). After 2019 a reversal of the trend is noticeable the share of exported industrial good increased to 44%. This tendency was supported by the changes in the exports oriented within EU, which was stronger than the opposite change occurring in the export oriented towards OECD world, where the share of exported industrial products slightly declined after 2019. Services have become the dominant export sector — and are stronger toward ROW. Services rose from ~38–41% in 1995 to ~50–57% by 2019–2022. Crucially, the ROW services share (57%) is higher than for EU exports (43%), meaning frontier countries export more sophisticated or globally competitive services outside the bloc — financial services, consulting, IP licensing, and similar. Industry fell sharply long-term but rebounded in 2022 within the EU. Industrial exports dropped from ~56–60% in 1995 to ~41–48% by 2019, then partially recovered by 2022 — especially in EU-directed trade (48%→54%). This mirrors the post-COVID goods demand rebound and likely reflects energy-intensive industrial goods flowing within Europe's supply chains. IT exports emerged and stabilised at 5% — a modest but real structural shift. IT went from 2% in 1995 to 5% by 2019 and held there in 2022, consistently across all destinations. While still a small share, this is a meaningful departure from zero — and stands in stark contrast to the non-frontier group where IT remains at 0–3%. IT imports increased as well symmetrically inside and outside EU.

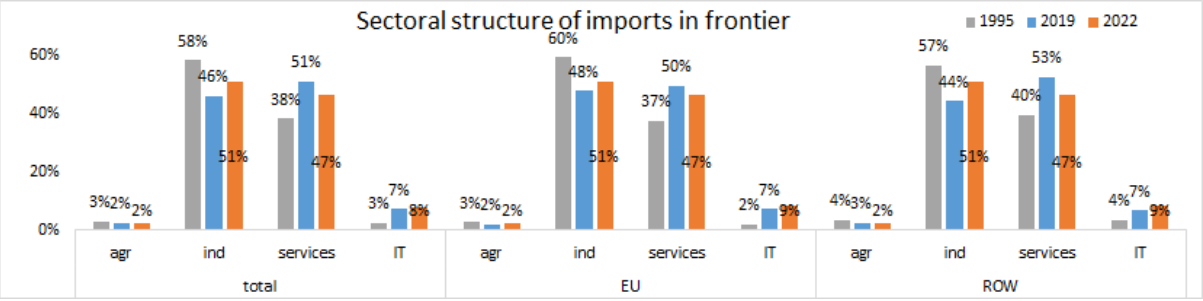
Fig. 6



Source: OECD tiva dataset

The same structural changes registered the imports (Fig. 7). The difference is that the share of imported industrial products increased regardless the geography after 2019. The share of exported industrial products increased to 50% in 2022 from 47% in 2019 in EU exports and to 47 from 42% in exports towards OECD world.

Fig. 7



Source: OECD tiva dataset

The overall picture that emerges for EU frontier is that of repositioning as upstream, services- and intermediate-goods specialists deeply embedded in European value chains — rather than final goods exporters. The frontier is services- and intermediate-goods-led, with emerging but limited digital exports. These 3 economies have undergone a genuine structural transformation since 1995: from industry-dominant to services-dominant, with a small but real IT footprint. Their global reach is stronger in services (especially ROW), while industrial exports remain EU-centric. Post-2020 volume surge masks a compositional paradox. Despite being the most productive EU economies, frontier countries are also exporting fewer final goods over time. They are not the final assemblers — they are the upstream, high-value-added specialists supplying components, services and IP into European and global value chains. This is a sophisticated position, but it implies dependence on downstream partners to complete the value chain.

Import deepening within the EU signals supply chain regionalisation. The rise in EU import share (54%→60%) combined with stable final goods import composition suggests frontier countries are deliberately sourcing more from regional partners — likely a strategic response to post-pandemic supply chain vulnerabilities and geopolitical de-risking.

2.2 EU non frontier's trade

The trade of EU non frontier is a consistent part of the EU trade, the exports increased from 76% in 1995 to 80% in 2019 and declined to 78% in 2022, while imports continuously increased from 78% in 1995 to 80% in 2019 and 81% in 2022 (Table 3). By geography of trading partners, the share of EU non frontier increased for imports and exports within EU and remained unchanged for exports to OECD. Overall, the capacity of EU non frontier to diffusing technology among its technological laggard trading partners increased, unlike for the EU frontier.

The exports followed the same pattern as in EU frontier, the share of export within EU declining over time but remaining the majority of exports. Unlike in EU frontier where the geographical mix of imports was stable and biased towards EU, the imports in EU non-frontier followed the same pattern of exports, the share of imports to OECD increased at the expense of the imports from EU.

Both imports and exports had almost the same geographical mix in 2022. Compared to 2019 the share of OECD exports declined at the level of the share of OECD imports.

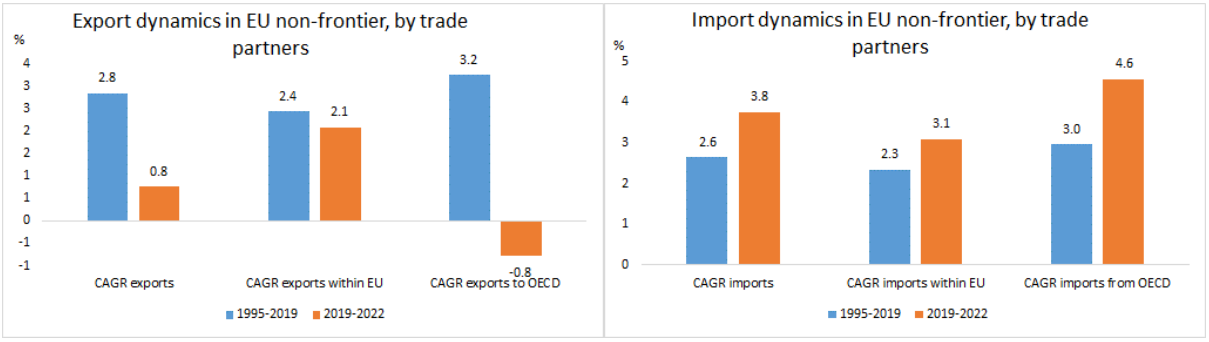
Table 3 EU non frontier trade, by geography of trade partners

	1995			2019			2022		
	World bn USD 2015 prices	of which, %		World bn USD 2015 prices	of which, %		World bn USD 2015 prices	of which, %	
		Within EU	OECD		Within EU	OECD		Within EU	OECD
export	2483	55	40	4861	50	44	4972	52	42
import	2389	57	39	4471	53	42	4994	52	43
	Share of EU frontier in EU trade, by partners, %								
	World	Within EU	OECD	World	Within EU	OECD	World	Within EU	OECD
%EU export	76	76	76	80	82	79	78	80	76
%EU import	78	77	80	80	80	78	81	81	81

Source: OECD tiva database

The total exports of EU non-frontier slowed down after 2019 (Fig. 8) due to the contraction of exports to OECD. On the contrary, imports accelerated, faster the imports from OECD (CAGR 4.6%) than the imports within EU (CAGR 3.1%). But this is a defensive dynamic — they are growing within the protected EU market while retreating globally.

Fig. 8



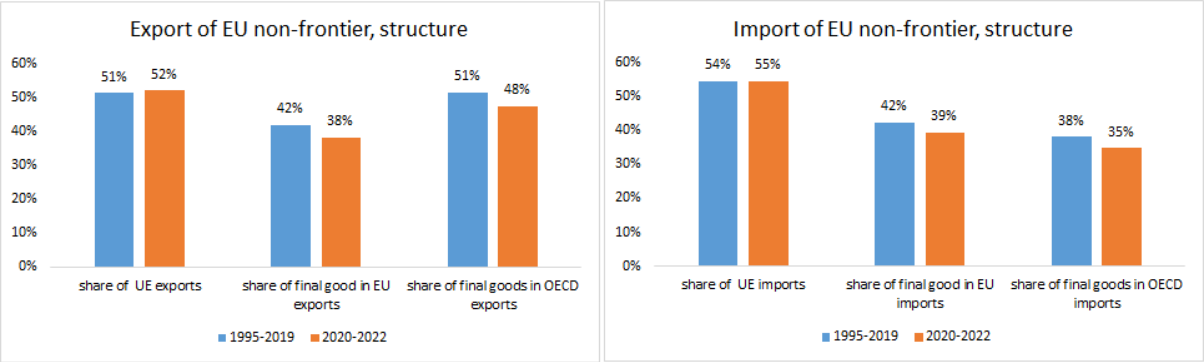
Note: CAGR based on values in USD 2015 prices

Source: OECD tiva dataset

The share of exports/imports from EU was relatively stable over the whole period, and represented more than half of the exports/imports (Fig. 9). The share of exported/imported final goods declined after 2019. The share of imported final goods from OECD world remained lower than the share of exported final goods towards OECD world. The non EU frontier have more equilibrated export/import within EU, and outside EU there is a bias towards exports of final goods and imports of intermediate goods. Both exports and imports are shifting toward intermediates simultaneously. Final goods shares are falling on both the export and import side, by roughly 3–4 pp each. This is a dual intermediate-goods deepening: non-frontier countries are both producing

and consuming more components and semi-finished goods — consistent with deeper GVC embeddedness as assembly or processing nodes. Geographic concentration is entrenched — over 50% of both exports and imports stay within the EU. The EU share of exports (51%→52%) and imports (54%→55%) is stable and dominant. These economies show no sign of geographic diversification. Their trade is structurally EU-dependent, which limits exposure to faster-growing non-EU markets. Non-frontier countries export more final goods to OECD than frontier do. The OECD final goods export share for non-frontier (48%) is higher than for frontier (38%). This seems counterintuitive but reflects that non-frontier countries still export more traditional finished industrial goods globally, while frontier countries have moved upstream into intermediates and services.

Fig. 9

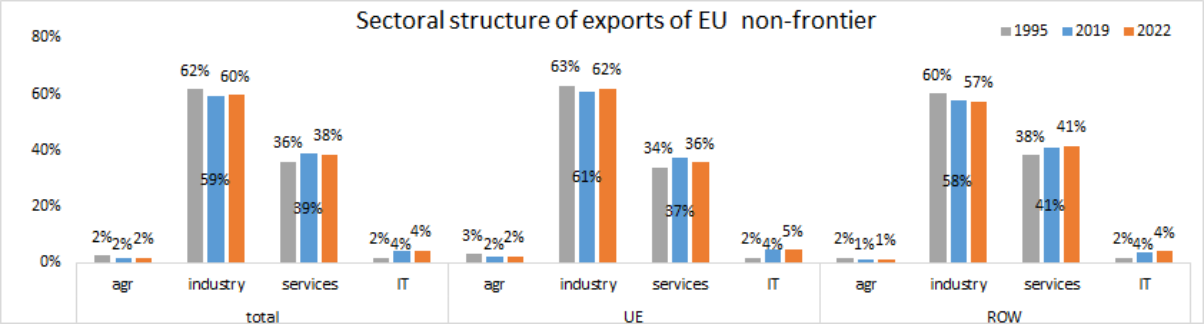


Note: CAGR based on values in USD 2015 prices

Source: OECD tiva dataset

The sectoral distribution of exports and imports of EU non-frontier have similar trends of EU frontier exports, namely after strong deindustrialisation up to 2019 followed a reindustrialisation both within and outside EU (Fig. 10). Industry is overwhelmingly dominant and barely moving — structural rigidity. Industry accounts for 57–63% of exports across all destinations in 2022, down only marginally from 60–63% in 1995. Unlike the frontier where industry fell from 58% to 45–48%, non-frontier countries have not meaningfully deindustrialised their export base. They remain locked in traditional industrial exports. Services growth is slow and stalled — the great divergence from frontier. Services rose modestly from 34–38% in 1995 to 37–40% in 2022. Compare this to the frontier where services surged to 50–57%. Non-frontier countries have not undergone the services transformation that defines frontier economies. Their services exports are growing but at a pace far too slow to close the gap. IT doubled but remains marginal at 4%. IT exports grew from 2% (1995) to 4% (2019–2022) — a doubling in relative terms, consistent across all destinations. This is a positive sign but still well below what would be needed for a genuine digital transition. At 4%, IT remains a rounding error in the export mix.

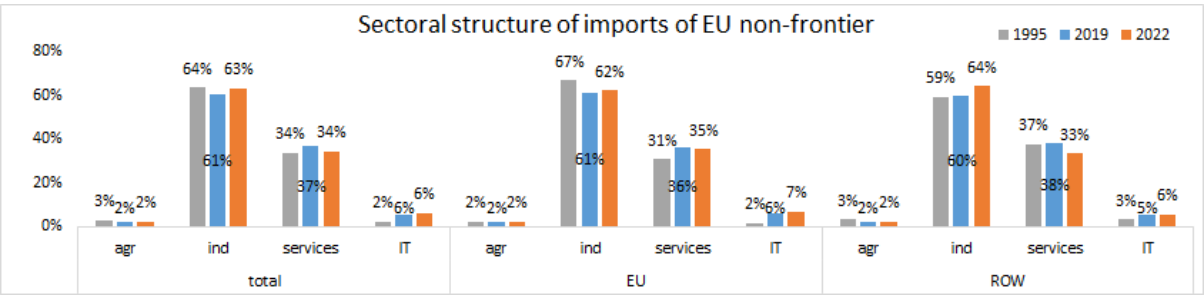
Fig. 10



Source: OECD tiva dataset

In total imports industry dominates at 64% in 1995, dipping to 61% in 2019, then recovering to 63% in 2022 (Fig. 11). Services are stable at 34% across 2019 and 2022, up from 34% in 1995 — remarkably little change. Agriculture is negligible (2–3%). IT grew modestly from 2% to 6%. In EU imports industry is very high — 67% in 1995, 61% in 2019, 62% in 2022. Services grew from 31% to 36% and then 35%. Agriculture minimal (2%). IT rose to 7% — the highest IT import share across all breakdowns, suggesting non-frontier EU countries are sourcing more digital services and technology from within the EU. In ROW imports industry actually increased from 59% to 60% and then 64% — the opposite trend to most CEE countries. Services fell from 37% to 38% and then 33%. IT at 3–6%.

Fig. 11



Source: OECD tiva dataset

2.3 EU Frontier vs. EU non frontier

Volume vs productivity paradox. The non-frontier group is 7× larger in export volume than the frontier, and built a surplus 9× bigger in absolute terms by 2019 (+$389 bn vs +$44 bn in 2015 prices). But the situation reversed in 2022, when EU non frontier registered deficit and EU frontier continued with surplus (-$22bn vs. $38bn). The frontier economies are the most productive per capita but are not the EU's trade volume engines — the EU non-frontier countries carry the bulk of EU's international trade weight.

A tale of two transitions. Frontier economies have undergone a genuine structural shift: services rose from ~38% to ~50–57% of exports, industry fell from ~58% to ~48%. ROW services exports

are the frontier's defining advantage. At 57% of ROW exports, frontier economies are exporting services to non-EU markets at a rate far exceeding the non-frontier 22 (41%). This reflects the globally competitive service sectors of economies like the Netherlands (financial services, logistics), Ireland (tech and pharma services), Denmark (shipping, design), and Sweden (business services, software). This is where the real productivity and value-added advantage is concentrated. Non-frontier has barely moved: industry remains at ~59–63%, services only crept from ~36% to ~39%. The structural transformation gap is the defining difference between the two groups. The non frontier is caught in an industrial middle trap. It is too industrialised to benefit from the services- and knowledge-led growth of frontier economies, yet not competitive enough globally to grow their industrial exports beyond the EU's protected market. The combination of stagnant total export growth, declining OECD export CAGR, and surging imports paints a picture of eroding external competitiveness. The IT asymmetry is the most structurally telling signal. IT imports (6–7%) are nearly double IT exports (4%). These countries are consumers — not producers — of the digital economy. Without a reversal of this gap, they will remain technology-dependent on both frontier EU economies and non-EU suppliers, with limited ability to capture the value added from digitalisation.

Both groups show the same pattern — services peaked in 2019 and retreated slightly by 2022, with industry partially recovering. This is a COVID and energy crisis effect operating symmetrically across both groups, not a structural reversal. The direction of travel remains toward services. The EU services export gap is telling, EU frontier economies export 43% services to EU partners vs 36% for non-frontier — a 7-point gap. Within the integrated EU single market, frontier economies have built more service-intensive intra-EU trade relationships, reflecting their deeper specialisation in financial, business, and knowledge-intensive services.

Post-2019 dynamics reveal a structural vulnerability, not a recovery. The near-flat export CAGR contrasted with sharply rising import CAGR is not a transitory shock — it reflects underlying weaknesses in export capacity. The non-frontier group is absorbing the post-COVID demand rebound primarily through imports, not export-led growth, which has worrying implications for their current account positions and long-run convergence with frontier economies.

Post-2020 dynamics reversed the long-run pattern. Before 2020, non-frontier' trade expanded while frontier' trade was contracting. After 2020, frontier dramatically outperformed on export CAGRs (4.7% vs 0.8% total; 3.9% vs -0.8% OECD). Crucially, non-frontier OECD export CAGR actually fell post-2020 — the only negative shift in the dataset — signalling a global competitiveness problem precisely when frontier accelerated.

Both groups are shifting toward intermediates — but for different reasons. Final goods shares fell in both groups on both export and import sides. For the frontier, this reflects upstream specialisation in high-value components and services. For non-frontier, it likely reflects deeper embeddedness as lower-stage assemblers and processors in GVCs — a less advantageous position.

IT is marginally stronger in frontier (5%) vs non-frontier (4%). Surprisingly small difference given the income gap. This reinforces the finding that ECE countries like Romania (9%) and Poland (6%) are punching above their weight in IT exports relative to much richer EU economies. Frontier re-shored imports; non-frontier did not. The frontier's EU import share jumped from 54% to 60% post-2020 — a deliberate regionalisation signal. Non-frontier stayed flat at 54–55%. This suggests frontier economies actively restructured supply chains toward EU partners, while non-frontier maintained their pre-existing sourcing patterns.

The weak performance of the non-frontier group after 2019 was mirrored by status change from net exporter to net importer. The frontier's superiority is in productivity and structural composition, not in trade volume but in balance.

The sharpest divergence is the post-2019 OECD export CAGR: frontier jumped to 3.2% while non-frontier actually fell to -0.8%. This single metric captures the global competitiveness gap most clearly — when the world reopened, frontier economies seized export opportunities outside the EU while non-frontier retreated into the single market.

The frontier vs non-frontier comparison reveals two distinct economic models coexisting within the EU:

The frontier model — represented by the 3 most productive economies — is characterised by services-led export growth, global competitiveness in non-EU markets, and rapid structural transformation. These economies are actively deindustrialising their export mix and replacing it with high-value services.

The non-frontier model — the 22 mid-tier EU economies — remains anchored in industrial exports with only modest services growth. Their structural inertia is not necessarily a failure — it reflects genuine industrial comparative advantage — but the 22-point services gap with frontier economies (38% vs 50% in 2022 total exports) suggests they are not keeping pace with the structural shift that defines the EU's most productive members.

The most important implication is for ECE countries: the convergence target is moving. If ECE is converging toward the non-frontier 22 model — stable industry, modest services — it may be converging toward a model that is itself falling behind the frontier. True long-term convergence requires catching not just the non-frontier 22 but the frontier itself — which means building globally competitive services exports, not just matching non-frontier industrial shares. Romania's IT niche and Poland's regional hub ambitions are steps in the right direction, but the frontier's 57% ROW services share remains a distant target.

2.4 ECE's trade

The region's trade developed fast up to 2019. The share in EU exports rose from 4% in 1995 to 10% in 2019 and 2022 (Table 4). The share of imports increased from 4% in 1995 to 10% in 2019 and 11% in 2022. The contribution of the region in total export within EU was higher than its contribution in the total export of EU with OECD (by 60% in 1995, 2.1 times in 2019 and 2 times in 2022). The same situation was in the case of imports, but the contribution of the region in total imports within EU exceeded its contribution in total imports of EU from OECD by smaller magnitudes (40% in 1995, 54% in 2019 and 34% in 2022). The region transformed from an equilibrated trader in 1995 into net exporter in 2019 (with exception of Romania) becoming a net importer in 2022 due to Romania and Hungary.

Table 4 ECE trade, by geography of trade partners

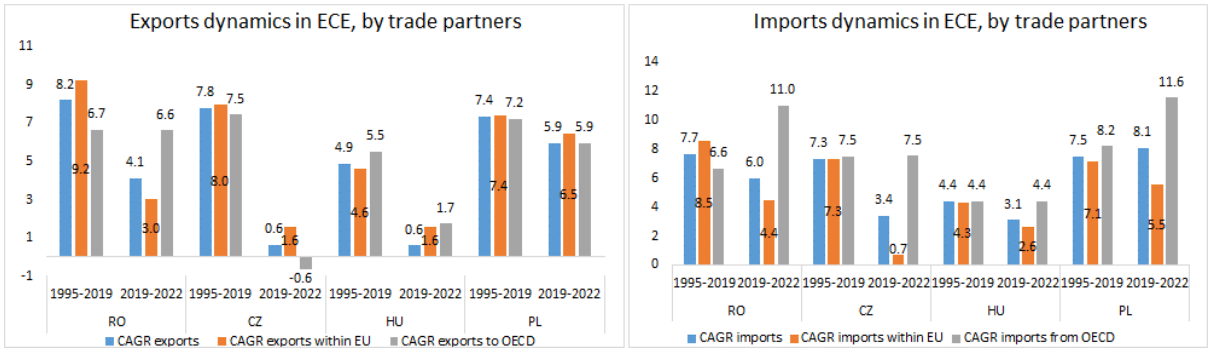
	USD bn	1995			2019			2022		
		World Bn USD 2915 prices	of which, %		World Bn USD 2015 prices	of which,%		World Bn USD 2015 prices	of which,%	
			Within EU	OECD		Within EU	OECD		Within EU	OECD
RO	export	12	52	38	82	65	27	93	63	29
	import	16	57	34	92	69	27	109	66	31
CZ	export	25	66	29	150	69	27	153	71	26
	import	25	66	31	136	66	32	151	61	36
HU	export	36	70	25	112	66	29	114	65	30
	import	39	72	26	109	71	26	120	70	27
PL	export	47	65	30	257	66	29	305	67	29
	import	42	63	34	237	58	40	300	54	44
ECE	export	120	65	29	602	67	28	666	67	28
	import	121	66	31	575	64	33	679	60	37
		Share of ECE in EU trade, by partners,%								
		World	Within EU	OECD	World	Within EU	OECD	World	Within EU	OECD
%EU export		4	4	3	10	14	6	10	14	7
%EU import		4	4	3	10	12	8	11	13	10

Source: OECD tiva database

- All four countries decelerated their export and import growth in 2019–2022 (excepting Poland's imports) relative to the long-run 1995–2019 average. This likely reflects the post-COVID trade rebound (Fig. 12).
- Romania (RO) export growth halved CAGR in 2019–2022 (4.1%), below its long-run rate (8.2%), and its import CAGR remained high (CAGR 6% in 2019-2022 vs. 7.7% in 1995-2019)— the second highest among the four countries, suggesting strong domestic demand or supply-chain restocking.

- Czechia's trade slowed down the most, exports almost stalled (CAGR 0.6% vs 7.8% in 1995-2019), while the growth of imports halved in 2019-2022.
- Hungary (HU) had relatively modest export growth (CAGR 0.6% in 2019–2022 vs. 4.9% in 1995-2019), but rather resilient import growth (CAGR 3.1% in 2019-2022 vs. 4.4% in 1995-2019).
- Poland (PL) showed more moderate deceleration in exports and slight acceleration in imports, with figures above EU benchmarks.
- Overall, the ECE was growing trade faster than the EU non-frontier but slower than the EU frontier in case of exports.

Fig. 12



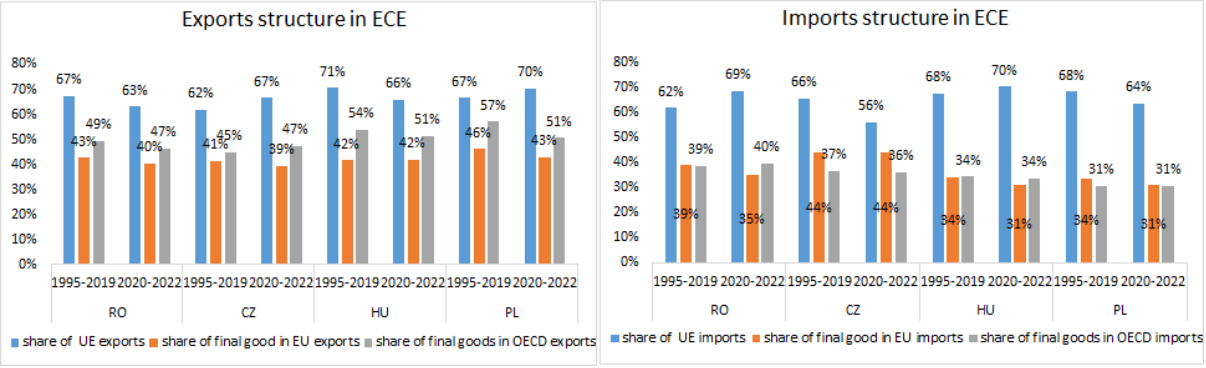
Source: OECD tiva dataset

EU market dominance is high but slightly declining in ECE trading. The share of exports going to the EU dropped modestly in 2020–2022 vs. 1995–2019 for most countries (e.g., RO from 67% to 63%, HU from 71% to 66%), suggesting mild trade diversification beyond the EU (Fig. 13). The share of final goods in EU exports is rising in most countries (e.g., PL: 46% to 57%, CZ: 41% to 45%), pointing to a gradual upgrade in export sophistication — these economies are moving up value chains.

On the import side, the EU share is also high (56–70%) but relatively stable, while the share of final goods in imports has been flat or slightly declining, suggesting continued reliance on intermediate goods (components, machinery) for manufacturing. Hungary consistently shows the highest EU trade shares (71% exports, 68% imports), reflecting deep integration into EU industrial supply chains — particularly automotive and electronics.

The overall picture reveals a dynamic, deepening trade integration in ECE economies, and a gradual shift toward higher-value final goods in exports.

Fig. 13

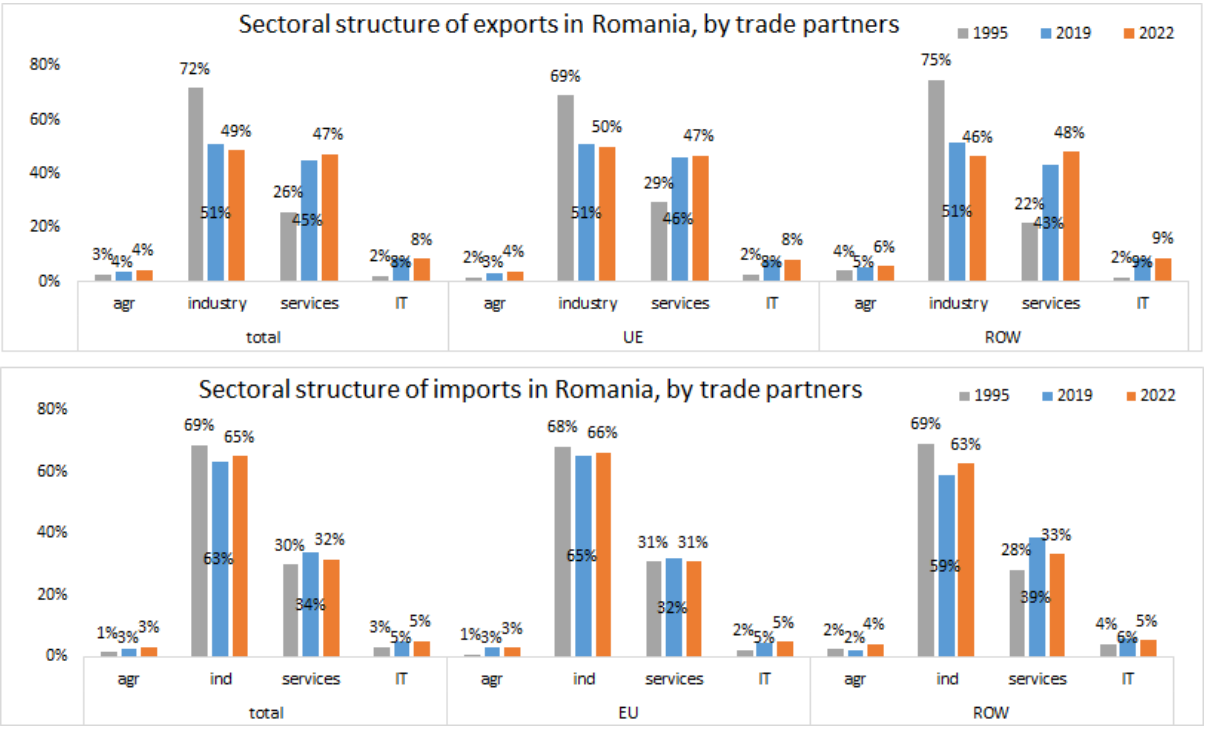


Source: OECD tiva dataset

Romania

In total Romanian exports industry dominates but is declining — from 72% in 1995 to 49% and then 47% (Fig. 14). Services have grown substantially, from 26% to 51% and 45%. Agriculture remains marginal (3–5%). IT is a small but emerging category at 8%. EU exports have a similar pattern — industry fell from 69% to around 47–50%, while services rose from 23% to roughly 46–51%. IT is negligible at 2%. In Rest of World (ROW) exports industry is even more dominant, peaking at 75% in 1995 and still at 48% in 2022. Services are lower than in EU trade (22–43%). IT reaches 9%, the highest of all breakdowns — suggesting Romania's IT exports are more oriented toward non-EU markets than EU ones.

Fig. 14



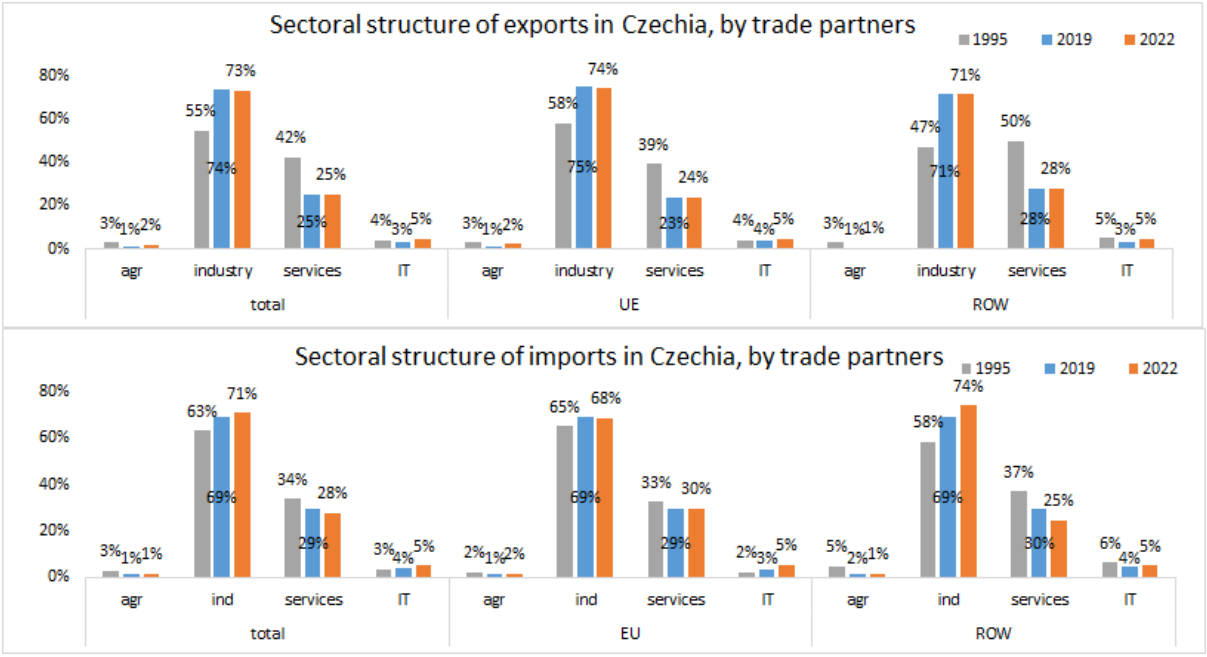
Source: OECD tiva dataset

In total Romanian imports (Fig. 15) industry also dominates imports (55–69%), though it has decreased over time. Services imports grew from 19% to 34% and then 32%. Agriculture is minimal (1–3%). IT imports are 3–5%. In EU imports industry imports from the EU are very high and stable (65–68%). Services are lower (31–32%). Agriculture stays at 1–3%. In ROW imports services imports are relatively high (28–39%), reflecting global service sourcing. Industry from ROW fell from 69% to 63%, while IT is 4–5%.

Key findings:

- Deindustrialisation trend — Industry's share in both exports and imports has fallen significantly since 1995, replaced by services.
- Services rise — Services grew strongly on both the export and import side, reflecting Romania's integration into the modern service economy.
- IT as a niche export — Romania shows a growing IT export capability, especially to non-EU markets (9% in ROW exports).
- EU vs ROW — Romania's trade with the EU is more services-balanced, while ROW trade remains more industry-heavy.
- Import dependency — The high and persistent industry share in imports (especially from the EU) suggests Romania relies heavily on manufactured goods from EU partners.

Fig. 15



Source: OECD tiva dataset

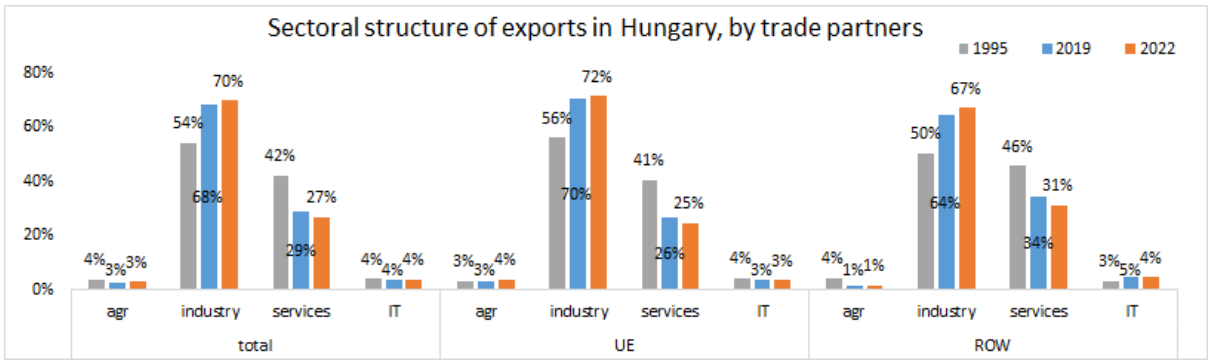
Czechia

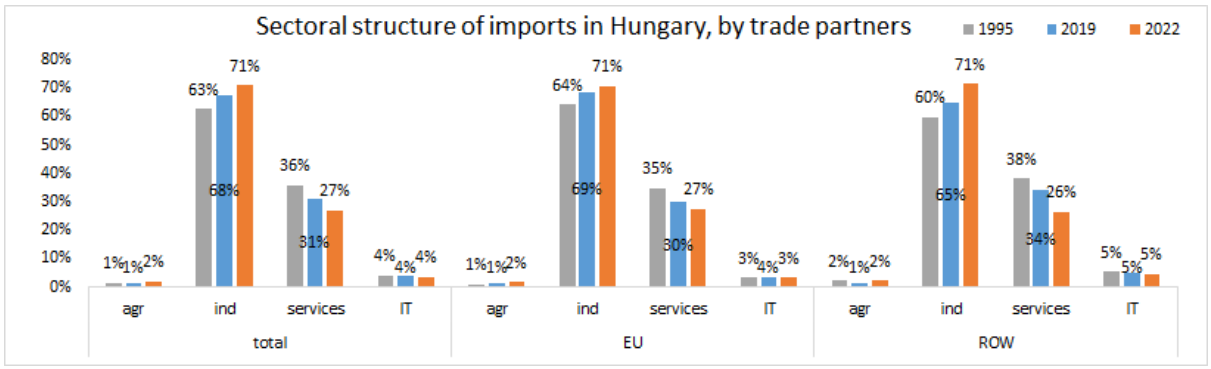
In Czechia total exports are dominated by industry— 73% in 1995, declining to 55% and 42% by 2022 (Fig.15). Services grew from 25% to 74% — a dramatic shift. Agriculture is tiny (3–4%). IT is

5%. In EU exports industry was 74% in 1995, dropping to 58% and 39%. Services surged to 75% in 2019 and 28% in 2022 — the 2022 dip is notable and may reflect post-pandemic restructuring. IT at 5%. In ROW exports industry remains stronger here (47–71%), similar to Romania's pattern. Services are more moderate (28–50%). IT reaches 5%, consistent across breakdowns.

Industry dominates Czech imports too (63–71%) but the dominance is declining. Services grew from 29% to 34% and then 28%. Agriculture 3–5%, IT 4–5%. In EU imports industry is very high and stable (65–68%). Services modest at 28–33%. Agriculture 2–5%. In ROW imports industry fell from 74% to 58%. Services are higher at 30–37%, reflecting global service sourcing. IT 4–6%.

Fig. 16





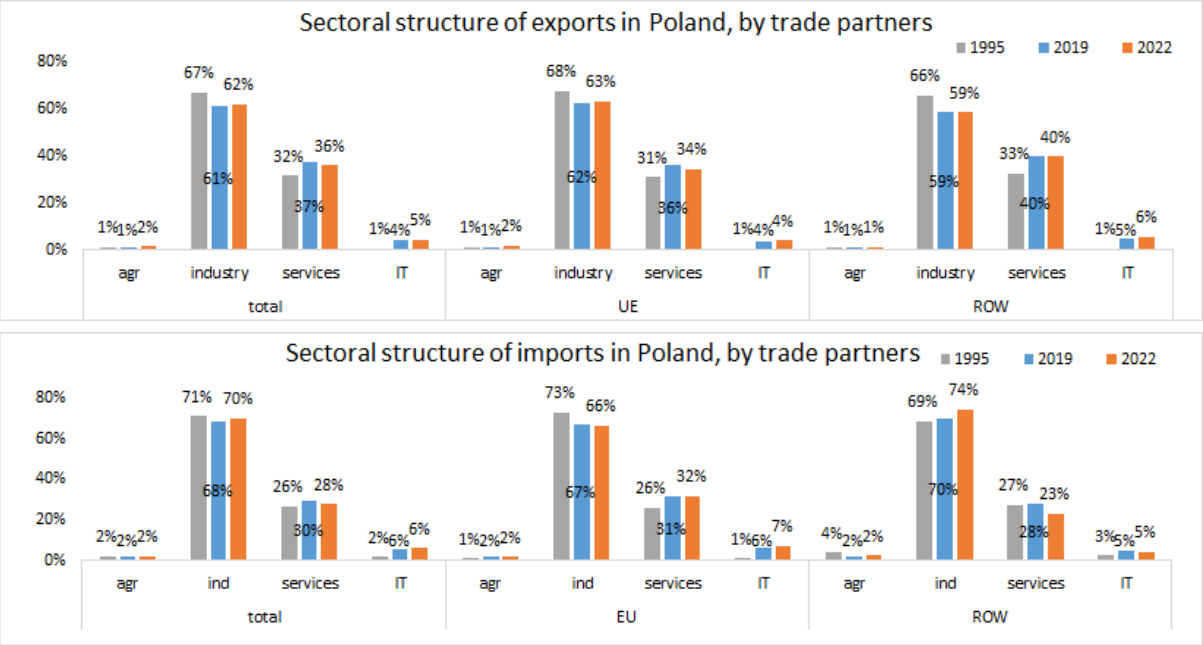
Source: OECD tiva dataset

Hungary

In Hungary in total exports industry peaked at 70% in 2019, up from 54% in 1995, then slightly down to 42% in 2022 — unlike Romania and Czechia, Hungary saw an industry re-strengthening through 2019 before declining (Fig. 16). Services grew from 42% to 68% and then 27%. IT is 4%. In EU exports industry rose from 56% to 72% in 2019, then fell to 41%. Services mirror this — high in 1995 (70%) and 2022 (25%), with a dip in 2019. This suggests a structural shift back toward manufacturing for EU markets in 2019, possibly driven by automotive FDI. In ROW exports industry is dominant (50–67%), services more moderate (31–64%). IT is only 3–4%, lower than Romania and Czechia.

In total Hungarian imports industry imports are high and rising — 63% in 1995 to 71% in 2022. Services declined from 36% to 27%. IT stable at 2%. In EU imports industry is very high (64–71%), services declining (27–35%). Mirrors the export-side manufacturing dependency. In ROW imports industry also high (60–71%), services moderate (26–38%), IT 5%.

Fig. 17



Source: OECD tiva dataset

Poland

In Poland in total exports industry fell from 67% to 62% and 37% — a sharp drop by 2022 (Fig. 17). Services grew strongly from 32% to 61% and then 36%. IT jumped to 5–6%, the second highest after Romania. Agriculture is slightly more visible at 1–2%. In EU exports industry declined from 68% to 63% and 36%. Services rose from 31% to 62% and 34%. IT at 5% — consistent. In ROW exports industry held higher (59–66%) but fell to 40% by 2022. Services grew from 33% to 59% and then 40%. IT reached 6% in ROW, matching Romania's strength in non-EU digital exports.

Polish total imports are dominated by industry at 68–71%, services modest at 26–30%. IT 2%. Agriculture 2–3%. Very stable structure, little change over time. In EU imports industry high (66–73%), services low (26–32%). Minimal agriculture. Highly stable. In ROW imports industry fell from 74% to 69% and then 28% — a dramatic drop by 2022, the sharpest among all four countries. Services from ROW surged to 70% in 2022. IT at 3–5%.

Table 5 ECE Synthesis

Dimension	Romania	Czechia	Hungary	Poland
Industry exports 2022	47%	42%	42%	37%
Services exports 2022	45%	~42%	27%	36–61%*
IT exports (ROW)	9%	5%	3–4%	6%
Industry imports 2022	55%	71%	71%	70%
ROW import shift	Moderate	Moderate	Moderate	**Strong**
Agri visibility	Slightly higher	Negligible	Negligible	Slightly higher

Poland is deindustrialising fastest on the export side — industry exports fell to just 37% by 2022, the lowest of all four countries, with services filling the gap (Table 5). Poland's ROW import structure shifted dramatically — industry imports from non-EU sources collapsed to 28% while services surged to 70% in 2022. This is the most extreme structural shift observed across all four countries and warrants attention — it may reflect rerouting of supply chains post-COVID or data classification changes.

Poland and Romania lead in IT exports, both reaching 6–9% in ROW trade, confirming Central-Eastern Europe's emergence as a digital services hub for global markets.

Hungary remains the outlier — weakest services exports, strongest manufacturing import dependency, least IT export presence — consistent with its role as a pure assembly/manufacturing FDI destination.

All four countries share the same EU import pattern — heavily industry-dominated (66–73%), reflecting deep integration into EU value chains with little variation.
A clear ECE digital corridor emerges: Romania and Poland are building comparative advantages in IT/services exports, especially to non-EU markets, while Czechia follows, and Hungary lags behind.

Agriculture remains marginal in all four, though Romania and Poland show slightly more presence — consistent with their larger agricultural sectors relative to Czechia and Hungary. The data reveals that the ECE countries have followed diverging paths of integration into the global economy since 1995, despite starting from similar post-communist baselines.

Model 1 — The Assembly Hub (Hungary, Czechia)

Hungary and Czechia attracted massive FDI in manufacturing — automotive (Audi, Škoda, Suzuki), electronics (Samsung, Foxconn) — which locked their trade structures into industry-heavy export and import profiles. Their imports remain overwhelmingly industrial (70–71%) because assembly hubs need to import components to re-export finished goods. This is a processing trade model —

efficient but structurally dependent on foreign multinationals and vulnerable to supply chain shocks. Czechia is gradually escaping this model through services growth. Hungary shows no such escape — its services exports are the weakest of all four (27% in 2022), suggesting it remains deeply embedded in the assembly paradigm with limited structural diversification.

Model 2 — The Emerging Digital Economy (Romania, Poland)

Romania and Poland are evolving toward a hybrid model — retaining significant industrial exports while building genuine strength in services and IT. Both lead in IT exports to non-EU (ROW) markets at 6–9%, which is strategically significant because: It signals endogenous capability building, not just foreign assembly, while non-EU IT exports suggest global competitiveness, not just proximity advantage within the EU, pointing to a growing skilled workforce in tech and outsourcing. Romania's 9% IT share in ROW exports is particularly notable for an economy of its size and income level.

The EU Dependency Question

All four countries share a structural vulnerability — their imports are overwhelmingly sourced from the EU (66–73% industrial), meaning they are deeply embedded in EU supply chains with limited supplier diversification. This creates 1/exposure to EU economic cycles — a slowdown in Germany hits all four simultaneously, 2/limited bargaining power in trade relationships, 3/risk concentration — COVID and the energy crisis demonstrated how fragile this integration can be Poland's dramatic collapse in ROW industrial imports to 28% in 2022 (from 74% in 1995) may actually reflect an attempt to reshore or re-EU-source supply chains after pandemic disruptions — a strategic, if involuntary, realignment.

The Services Surge — Structural or Statistical?

The rise of services across all four countries raises an important interpretive caution. Some of this may reflect: 1/reclassification effects — how transport, financial, and digital services are categorised has changed, 2/Post-2008 restructuring — the financial crisis accelerated the shift away from manufacturing, 3/Genuine tertiarisation — the real growth of business process outsourcing, finance, and tourism. The truth is likely a combination of all three, and the 2022 data often shows a partial reversal, suggesting services shares in 2019 may have been partly cyclical or statistical.

Strategic Implications

- For Romania and Poland: The IT and services trajectory is their most promising long-term comparative advantage. Investing in education, digital infrastructure, and reducing brain drain will determine whether this advantage compounds or stalls.

- For Hungary: The over-reliance on foreign manufacturing assembly is a strategic risk. Without diversification into services and digital sectors, Hungary is one major corporate relocation decision away from a structural trade shock.
- For Czechia: It sits between both models — historically manufacturing-heavy but rapidly servicefying. Its challenge is managing the social costs of deindustrialisation while capturing the gains from services growth.
- For the CEE region as a whole: The emergence of a digital services corridor — with Romania and Poland as its anchors — represents the most significant structural shift since EU accession. If sustained, it could rebalance CEE's role in the European economy from low-cost assembler to mid-tier knowledge economy.

SECTION 3

Technology diffusion

We assess the power of technology diffusion embodied in trade through the productivity of export and import partners differentiated by geography -partners located within EU and outside EU- and by the object of trade (final and intermediate goods). For a given EU country the change in the productivity of its exports and imports partners has two drivers the change of the trading partners' own productivity and the changes in the volumes of trade with these trading partners. No EU country engaged in international trade can control the evolution of the productivity in their trading partners but can choose their trading partners and decide the trade flows with each of them. To bring into light these decisions over time the trading partners were distributed into several groups depending on their productivity related to the EU frontier productivity as shown in table below. The trading partners within EU were divided into five tiers: "Low" tier with productivity below 30% of EU frontier, "middle" tier with productivity between 30% and 60% of the EU frontier, "high" tier with productivity between 60% and below EU frontier, the EU frontier itself and the outliers well above EU frontier productivity. The trading partners within OECD were distributed in a similar way into 4 tiers, "low" with productivity below 30% of EU frontier, "middle" with productivity

between 30% and 60% of EU productivity, "high" with productivity between 60% and 100% of EU frontier and world frontier with productivity above EU frontier.

Table 6 Distribution of EU trade by productivity of trading partners

	tiers	definition	EU exports to EU, by receiving country productivity		EU imports from EU, by sending country productivity	
			1995-2019	2019-2022	1995-2019	2019-2022
Within EU trading partners	**low**	productivity<30% of EU frontier	9%	11%	9%	11%
	middle	30%≤productivity< 60% of EU frontier	10%	10%	8%	10%
	high	60%≤productivity< EU frontier	66%	61%	67%	61%
	EU frontier	productivity=EU frontier	13%	11%	13%	10%
	Super high, outliers	productivity>1.4x EU frontier	2%	7%	3%	9%
	Total, tr USD		2.1	3.6	2.1	3.6
			EU exports to OECD, by receiving country productivity		EU imports from OECD, by sending country productivity	
			1995-2019	2019-2022	1995-2019	2019-2022
OECD partners	**low**	productivity<30% of EU frontier	31%	35%	34%	41%
	middle	30%≤productivity< 60% of EU frontier	5%	8%	5%	7%
	high	60%≤productivity≤ EU frontier	30%	26%	29%	24%
	world frontier	productivity>EU frontier	34%	31%	31%	29%
	Total, tr USD		1.8	3	1.6	2.8

Note: OECD partners are the countries in the OECD data base excepting EU members.

Source: OECD tiva dataset

Two thirds of the within EU trade was between "high" productivity EU countries, 13% between EU frontier and 2% between outliers (Luxembourg and Ireland since 2015) in 1995 and 2019 (Table 6). The rest of the trade was among "low" productivity (9%) and "middle" productivity (10%) countries. The share of export sent, and import received was almost identical for each tier, excepting "middle" productivity tier which received 10% of the EU exports and sent 8% of EU imports. After 2019 the share of trade at extremes increased, namely of "low" productivity tier and outliers, both net importers.

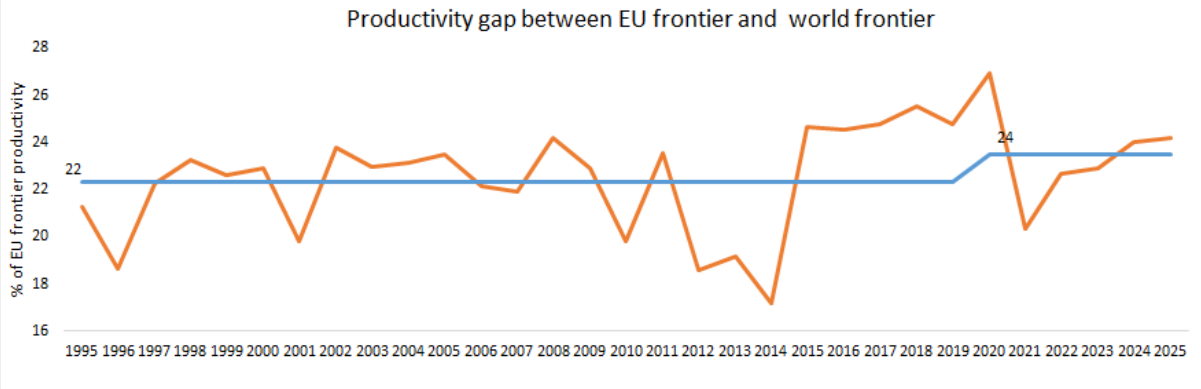
The trade of EU with OECD shows that "middle" productivity countries are few in OECD, while the "low", "high" and world frontier groups had comparable size in 1995-2019. The share of imports received from EU was lower than the share of exports sent to EU by 3 percentage points in case of "low" productivity group. The same difference was registered by world frontier, but in this case the share of imports received from EU was higher than the share of exports sent to EU. The world frontier absorbed more EU exports than EU absorbed world frontier exports. After 2019 the share

of EU trade with "low" and "middle" productivity OECD countries increased, but only the "low" productivity countries absorbed more EU exports than EU absorbed their own exports.

3.1 Technology diffusion in EU frontier

EU frontier productivity was lower than the world frontier on average by 22% lower in 1995-2019 and 24% in 2019-2025 (Fig. 18). There was considerable fluctuation around the averages, especially after the great recession when EU frontier got closer to the world frontier and after 2015 when the reverse happened and after covid pandemic which again diminished the productivity gap for several years.

Fig. 18



Note: world frontier includes countries included in OECD tiva dataset outside EU with productivity exceeding the productivity of EU frontier.

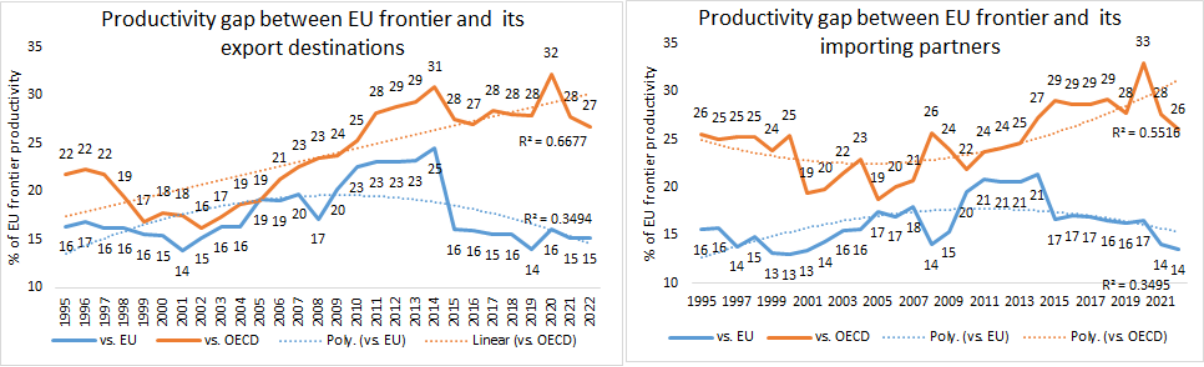
Source: ILO, OECD tiva dataset

3.1.1 Productivity gap with trading partners

The productivity of EU frontier exceeded the productivity of its trading partners regardless their geography (Fig. 19). The productivity gap to EU frontier productivity ratio (measured as the ratio in the EU frontier productivity of the difference between the productivity in EU frontier and the productivity in its trading partners) versus the trading partners from OECD increased over time and was by 27% of the EU frontier productivity in 2022. On the contrary, the productivity gap to EU frontier productivity ratio versus trading partners in EU declined abruptly in 2015 and stabilised afterwards at about 15%-17% of the EU frontier productivity. Over the whole period the EU frontier productivity exceeded the productivity of its trading partners from OECD by more than the productivity of its trading partners from EU. Applying the implications of Acemoglu et al (2026), it appears that the technology diffusion capacity of EU frontier is more favourable towards OECD trading partners where the technology gap is larger and increasing. The technology gap

between EU frontier and its trading partners from EU is smaller and declining possibly making the absorption of technology from EU frontier more difficult. How the EU frontier's choice of trading partners and the volumes of trade with them is reflecting this hypothesis?

Fig. 19



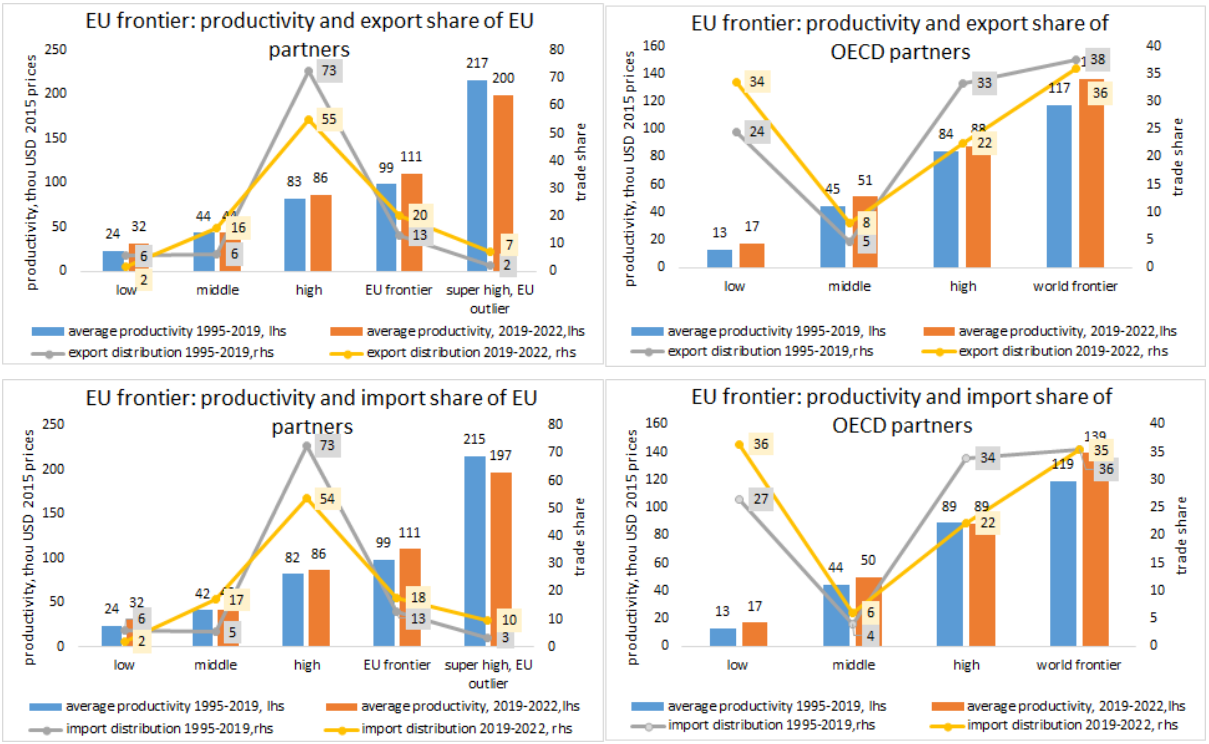
Source: OECD tiva dataset

3.1.2 Change in trade distribution

The most striking pattern of the trade with EU partners is the dramatic redistribution of export and import shares toward peers in EU frontier, outliers and "middle" productivity partners : the collapse of "high" productivity tier export/import share by almost 20 percentage points was absorbed by the "middle" tier rising from 6% to 16%, EU frontier rising from 13% to 20% in exports and from 13% to 18% in imports and the "outlier" group (with highest productivity, ~217k USD) rising from 1% to 7% in exports and from 3% to 10 % in imports. The "low" tier lost from 6% to 2% exports and imports (Fig. 20).

This means the EU frontier shifted trade away from its most and moderately-high productive EU partners simultaneously toward middle-tier ones — a downward reorientation within the EU network and toward the highest productivity ones (peers and outliers) equivalent to an upward reorientation within the EU network. EU frontier countries choosing to trade consistently more with "middle" tier from EU with productivity at 40% of their own productivity and to trade less with "high" tier with productivity at 77% of their own productivity expand their technology diffusion capacity for "middle" tier and shrank it for "high" tier which otherwise would anyway would benefit the least, their productivity backwardness being higher than the threshold level (50%), the level below which the advantage of being technological backward seem to diminish. The genuine gainer is the "middle" tier towards which the potential for technology diffusion from EU frontier intensified.

Fig. 20



Source: OECD tiva dataset

The change in the trade with OECD partners shows a single downward orientation of OECD network arguably more concerning: "Low" productivity OECD partners saw export share surge from 24% → 34% and import share from 27% → 36% — the largest jump, "World frontier" (highest productivity, ~115-116k USD) held relatively stable: exports 36% → 38%, imports 35% → 36% — essentially flat, "High" productivity lost share: exports 33% → 22%, imports 34% → 22%, "Middle" remained modest but stable.

So, within OECD trade, the EU frontier is substituting away from high-productivity partners toward low and in a lesser extent middle-productivity ones, while maintaining ties only with the very top (world frontier).

The EU frontier is losing traction with sophisticated, high-standard markets replacing those flows with lower-productivity destinations that are less demanding in OECD, unlike in EU where a dual redistribution takes place from high toward middle and the highest. The OECD pattern could reflect loss of quality competitiveness, supply chain disruptions, or geopolitical realignment (post-2019/COVID/Ukraine effects). The EU pattern indicates more diversification, on the one hand, integration in value chains with cheaper partners and on the other hand the upgrade of links with the most sophisticated ones.

The change in the distribution of trade volumes occurred when the average productivity of partner groups themselves rose between periods, meaning the EU frontier isn't trading with less productive countries in absolute terms — but it is trading relatively more with the lower tiers of an increasingly productive world. The gap between where trade is flowing and where the most productive partners sit is widening. In addition, the 2019-2022 window captures COVID disruptions and the early Ukraine war shock, which may have mechanically redirected trade, and therefore some of the changes could be transitory rather than structural.

Nevertheless, compared to the overall EU trade distribution, the EU frontier still shows a trade partner upgrading pattern in OECD external trade relationships toward world frontier and a concentration of trade with peers away from low tier in EU trade (Table 7). If these persist beyond the shock period, EU frontier will maintain its export sophistication and its exposure to the productivity spillovers that come from trading with high-performing partners.

Table 7 Deviation of distribution of EU frontier trade from distribution of EU trade

EU groups	EU frontier exports to EU, by receiving country productivity		EU frontier imports from EU, by sending country productivity		OECD groups	EU frontier exports to OECD, by receiving country productivity		EU frontier imports from OECD, by sending country productivity	
	1995-2019	2019-2022	1995-2019	2019-2022		1995-2019	2019-2022	1995-2019	2019-2022
Low	-3	-9	-3	-10	Low	-6	-1	-8	-4
Middle	-4	5	-3	7	Middle	-1	0	-1	-1
High	7	-6	5	-7	High	3	-4	5	-2
EU frontier	0	9	0	8	World frontier	3	5	4	7
Super high/ outliers	0	0	1	1					

Source: OECD tiva dataset

Synthesis — Four Cross-Cutting Findings

1. The High-Productivity flight Effect

Across all trade partners, the "high" tier's share collapsed in 2019–2022 — reaching 55% in both EU export and import. EU frontier countries are gravitating toward the EU's most productive partners and least productive ones, avoiding the middle. This reflects the diversification of EU integration trough both quality and proximity sorted trade and coordination of value chains with low productive partners.

2. The Polarisation of OECD Trade

Both OECD charts show the same pattern — low and middle tiers gaining share, high losing. This global value chain polarisation means EU frontier economies are simultaneously engaging with the world's most and least productive economies, bypassing the intermediate OECD tier. This has structural implications for which countries benefit from CEE's trade growth.

3. Productivity is Rising at Every Tier

The bars consistently show higher productivity in 2019–2022 than 1995–2019 at every tier. This means EU frontier countries are not just trading more with productive partners — they are trading with increasingly productive versions of those partners. This creates a compounding productivity spillover effect through trade.

4. Symmetry Between Exports and Imports

The near-identical patterns between export charts and import charts suggest that EU frontier countries' trade is deeply integrated and reciprocal — they buy from and sell to the same partner tiers in roughly the same proportions. This reduces trade imbalance risk but also means structural shocks propagate symmetrically in both directions.

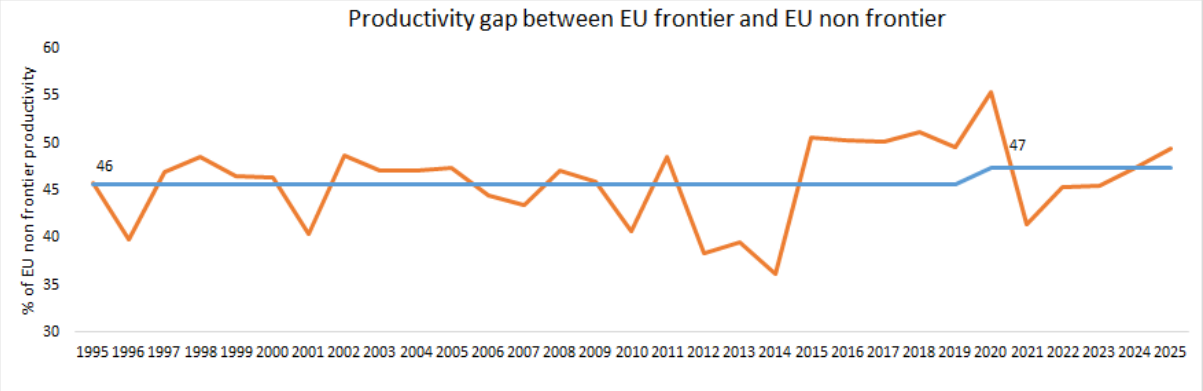
Strategic Implication

EU frontier countries are downgrading their trade partners' quality over time globally and partially in EU. Due to diversification the risk of growing dependence on a narrow set of high-productivity EU partners is avoided. Meanwhile, the OECD polarisation strategy — cheap inputs from low-tier, technology from high-tier — is efficient but vulnerable to geopolitical disruption at either end of the value chain.

3.2 Technology diffusion in EU non-frontier

The productivity of EU non frontier was lower than the EU frontier on average by 46% in 1995-2019 and 47% in 2020-2025 (Fig. 21). Significant lower gap up to 35% was registered during the EU debt crisis, while widener gap around 50% was registered in 2015-2019.

Fig. 21



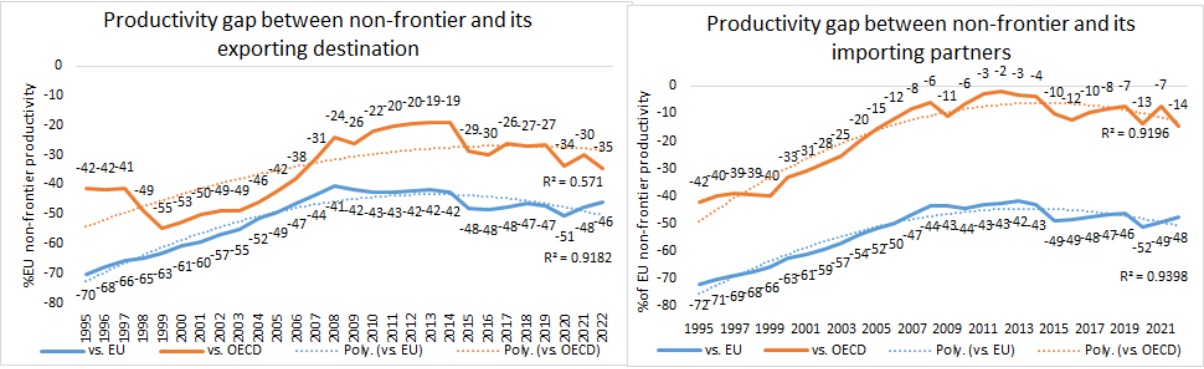
Source: OECD tiva dataset, ILO

3.2.1 Productivity gap with trading partners

The productivity of EU non-frontier although converged towards the productivity of its trading partners remained below it all over the period (Fig. 22). The productivity gap to EU non-frontier productivity ratio (measured as the share in the EU non-frontier productivity of the difference between the productivity in EU non-frontier and the productivity in its trading partners) is narrower for OECD partners than for EU partners. The gap is narrower for import OECD partner than for export OECD partners, and about the same size for both import and export EU partners. The gap with EU partners followed a narrowing path from −70% in 1995 to around −42–46% by the mid-2000s and then stabilized. Although the EU non-frontier remained substantially less productive than its EU partners, the productivity gap approached the threshold level which rendered the technology diffusing more difficult and the catching-up process stalled after the great recession.

With OECD import partners the productivity gap narrowed gradually and almost closed during 2010-2013 but widened again up to -14% in 2022. The productivity gap with both OECD import and export partners had an inverted U shape pattern: the gap with OECD export partners improved sharply from −42% in 1995 to about −19% around 2010–2014 and widened back to −35% by 2022, while the gap with OECD import partners narrowed even more from -42% in 1995 to -2%– -3% around 2010-2014 and widened back to -14% in 2022. These evolutions suggest that EU non-frontier was gradually losing competitiveness relative to their OECD trading partners. With the productivity gaps too small, beyond the threshold of technology diffusion slowdown, the absorption of technology from their OECD trading partners became difficult. With EU partners the productivity gap is still large enough, below the threshold of technology diffusion slowdown, so that the EU non frontier can still absorb technology from them and enjoy the advantage of a technological laggard.

Fig. 22



Source: OECD tiva dataset

3.2.2 Change in trade distribution

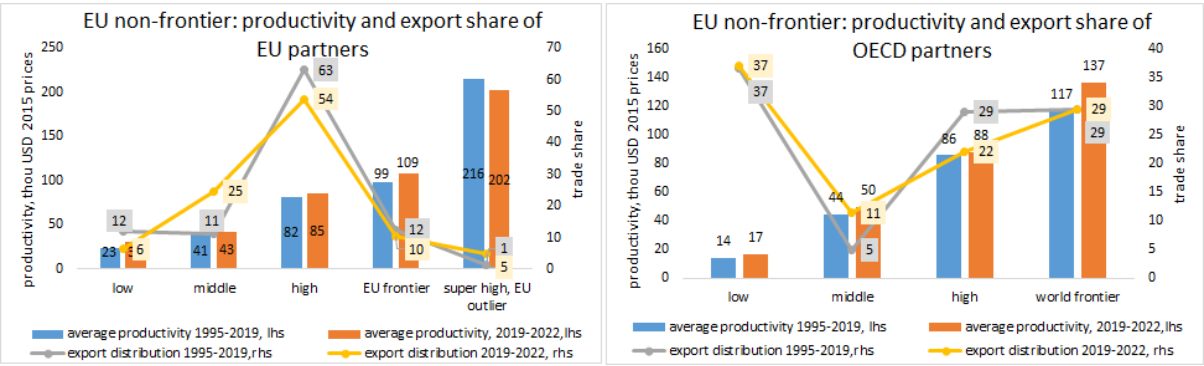
Exports to EU Partners (Fig. 23)

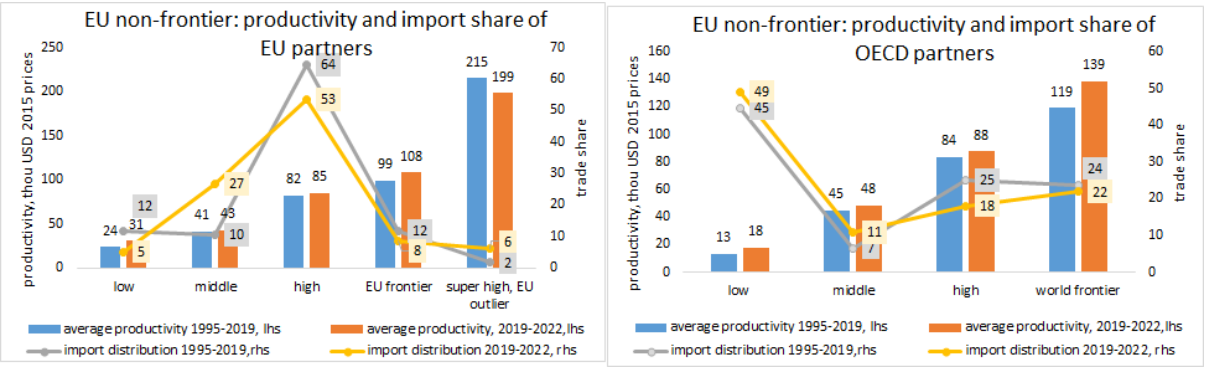
Productivity of partners: Rises from 23k (low) to 216k (outlier), very similar range to frontier countries. Modest productivity increases between periods at each tier.

Export distribution shift: the large decline of dominant "High" tier from 63% to 54%, compensated by the striking jump of "Middle" from 11% to 25%, "Frontier" declined from 12% to 10% and "Low" from 12% to 6% "outlier" increased from 1% to 5%.

Interpretation: The flight away from "high" tier mirrors the frontier pattern, but the apparent rise in "low" tier exports and super high is notable — EU non-frontier countries may be maintaining or expanding trade links with less productive EU members (e.g. newer Eastern EU entrants) while also concentrating on super high-productivity partners.

Fig. 23





Source: OECD tiva dataset

Exports to EU partners (Fig, 23) Exports toward high-productivity EU partners declined from 63% (1995–2019) to 54% (2019–2022), Exports toward frontier EU partners increased from 10% to 12%, Exports toward outliers increased from 1% to 5%. Low and middle tier shares also increased slightly. Non-frontier EU states are actually diversifying away from high-tier partners and redistributing exports toward both the very top (frontier, outliers) and lower tiers. The shift toward outliers (Luxembourg, Ireland) is notable — possibly reflecting growing financial/services integration. However, the high-tier share remains dominant.

Exports to OECD Partners (Fig. 23)

Productivity of partners: 14k to 115–137k, standard range.

Low-tier: stable at 37%, EU non-frontier EU maintains a large share of exports to least productive OECD partners, Middle-tier: increased from 5% to 11% — a shift toward moderately productive OECD partners, High-tier: declined from 29% to 22% — retreat from demanding high-productivity markets, World frontier: stable at 29%

Interpretation: mild downgrading within OECD trade — EU non-frontier is retreating from high-productivity OECD partners and compensating by expanding into middle-tier ones, while relationships with world frontier partners hold steady. Combined with the EU trade and the widening productivity gaps, this reinforces the competitiveness trap narrative: EU non-frontier is gradually gravitating toward less demanding trade relationships rather than upgrading toward more productive ones.

Imports from EU Partners (Fig. 23)

Productivity of partners: 24k to 215k, stable across periods.

Import distribution shift: the large increased of Middle" from 10% to 27% and the smaller expansion of outliers from 2% to 6% is compensated by the declined of the other tiers, "High" tier from 64% to 53%, "Frontier" from 12% to 8%, "Low" from 12% to 5%".

Interpretation: non-frontier EU countries are massively concentrating imports from middle-and super productivity EU partners, pulling away from all other tiers. This is even more pronounced than in frontier countries, suggesting the EU core is tightening its internal sourcing around the middle and super productive economies.

Imports from OECD Partners

Productivity of partners: 13k to 117–139k.

Import distribution shift: the rise of "Low" tier from 45% to 49% and "Middle" tier from 7% to 11% compensated by the decline of "High" tier from 25% to 18% and "World frontier" from 24% to 22%.

Interpretation: EU non-frontier countries are sourcing more from low and middle productivity OECD partners — as EU frontier does with OECD imports. This likely reflects offshoring of lower-value production to cheaper OECD economies (e.g. Mexico, Turkey), consistent with Western European firms' long-standing cost arbitrage strategies.

Table 8 Non-Frontier vs Frontier — Direct Comparison, 1995-2019 vs 2020-2022

Dimension	EU frontier	EU non-frontier
EU export concentration still in "high"	73→55%	63→54%
EU import concentration in still "high"	73→54%	64→53%
EU "low" tier export share	6→2%	12→6%
EU "low" tier import share	6→2%	12→5%
OECD "low" tier export share	Rising (24→34%)	Flat (37→37%)
OECD "low" tier import share	Rising (27→36%)	Rising (45→49%)
Outlier tier rise	3x export/import	3x import, 5x export
Middle tier in OECD	the thinnest	also the thinnest

Main cross cutting findings

1	Both groups converge on high-productivity EU partners. The "high" tier concentration trend is universal — both frontier and non-frontier are gravitating toward the EU's high productive economies.
2	EU non-frontier countries offshore more aggressively. The 45–49% low-productivity OECD import share for non-frontier countries dwarfs the frontier equivalent, confirming that Western European economies are the primary drivers of global offshoring — sourcing cheap inputs from low-productivity OECD partners at scale.
3	The outlier tier is rising. This suggests that extreme productivity outliers — Luxemburg and Ireland — are becoming more relevant as trade partners within EU possibly due to reshoring pressures or geopolitical decoupling.
4	The middle remain thin in OECD and reached about one quarter in EU. In OECD trade, the middle productivity tier is gaining share but remain thin. This is a structural feature of modern trade, not a cyclical one — global value chains are bypassing medium-productivity partners in favour of either cost efficiency (low) or technological sophistication (high).
5	The middle tier crowds out low and high tiers in EU frontier and non- EU frontier too. Several possible explanations exist.

1/the comfort zone hypothesis applicable to EU non-frontier according to which countries gravitate toward partners whose productivity level is closest to their own. Trading with highly productive partners creates competitive pressure they struggle to meet, while very low productivity partners offer limited market size and sophistication. Middle-tier partners represent a "sweet spot" of manageable competition and adequate demand — essentially trading with peers rather than leaders or laggards.

2/The global financial crisis and subsequent European debt crisis may have severed established trade relationships with both high-productivity partners (too demanding, credit-constrained) and low-productivity ones (too risky, insufficient demand). Middle-tier partners — often more resilient emerging economies or mid-range EU members — may have offered more stable and accessible trade relationships during the restructuring period.

3/The post-2021 energy crisis hit non-frontier EU states particularly hard. This may have on the one hand forced retreat from low-productivity partners whose trade was only viable under low energy/transport costs and on the other rendered difficult to compete in high-productivity markets requiring quality investments they could no longer afford. The only commercially viable space given the constrained cost structure remained the middle tier.

Because the middle-tier concentration of the EU trade and the middle-low tier concentration of OECD trade, much above of the EU trade distribution (Table 9), reduce exposure to the competitive and technological pressures that drive productivity catch-up, it might lock non-frontier EU states into a permanently lower productivity trajectory, which is a genuine policy concern.

Table 9 Deviation of distribution of EU non frontier trade from distribution of EU trade

EU groups	EU non frontier exports to receiving country productivity		EU non frontier imports from EU, by sending country productivity		OECD groups	EU non frontier exports to OECD, by receiving country productivity		EU non frontier imports from OECD, by sending country productivity	
	1995-2019	2019-2022	1995-2019	2019-2022		1995-2019	2019-2022	1995-2019	2019-2022
Low	3	-4	3	-6	Low	6	2	10	9
Middle	1	14	2	17	Middle	0	3	1	4
High	-3	-7	-3	-7	High	-1	-4	-4	-6
EU frontier	-1	0	-1	-1	World frontier	-5	-1	-8	-7
outliers	-1	-2	-1	-2					

Source: OECD tiva dataset

Strategic Implication

EU non-frontier countries —European countries except EU frontier and outliers — are pursuing a dual sourcing strategy: tightening integration with the EU's most productive economies for high-value trade, while simultaneously offshoring lower-value activity to cheap OECD partners. This is a mature, optimised trade structure. The risk is that over-concentration in high-productivity EU partners creates systemic fragility — as the 2022 energy crisis demonstrated, when the core sneezes, the entire network catches cold.

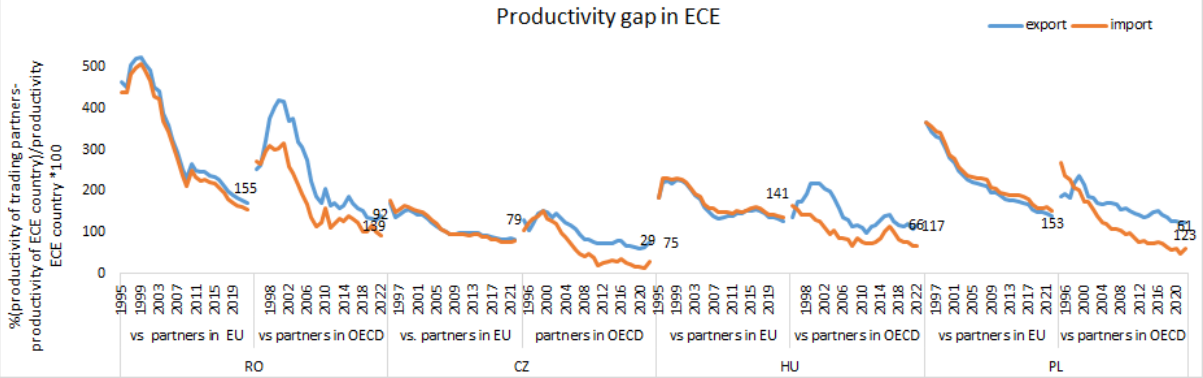
3.3 Technology diffusion in ECE

The four ECE countries belonged to "low" productivity tier in 1995. Beginning with 2000 Czechia entered in the "middle" productivity tier, Poland followed in 2019 and Hungary in 2022. Romania remained in the "low" productivity tier up to 2022.

3.3.1 Productivity gap with trading partners

There were several common features of the productivity gap convergence in all ECE countries: 1/the productivity gap (measured as the share in ECE country's productivity of the difference between the productivity of trading partners and the productivity of ECE country) narrowed over time, 2/the evolution of productivity gap with EU export partners was perfectly in sync with the EU import partners but not for OECD partners, 3/the productivity gap closed faster with OECD partners than for EU. The speed of the productivity gap convergence was different (Fig. 24). Judging upon the productivity gap, Romania has the largest technology backwardness against both EU and OECD trading partners, and therefore the best positioned to absorb technology from outside, especially from EU.

Fig. 24



Source: OECD tiva dataset

ROMANIA

Romania's productivity gap vs. EU partners, 450% of the Romanian productivity in 1995, by far the largest starting point, converged rapidly and consistently to 155% by the end of the period. Export and import lines track very closely together throughout. The productivity gap vs. OECD partners started moderately high (250% for import, 270% for export), then surged dramatically around 1991–2001 to above 400% for exports and 300% for imports— likely reflecting EU accession preparation shock and trade reorientation, narrowed strongly to 92% for imports and 139% for exports in 2022. The productivity gap for exports from 2022 showed a slight deterioration compared to 2019, suggesting that the pandemic and energy crisis hit Romania harder than its OECD export partners.

Overall Romania profile: Largest starting gap, strongest convergence trend, but fragile — the OECD export gap re-widening in 2022 signals vulnerability.

CZECHIA

Czechia's productivity gap vs EU partners started around 177%, converged steadily to 84% for exports and 79% imports — the smallest EU productivity gap of all four by end of period. The productivity gap vs. OECD partners started at 128 for exports and 105% for imports in 1995 and

converged to 75% for exports and 29% for imports, the smallest OECD gap of all four by wide margin. The gap maintained higher for EU partners than OECD partners, and higher for export partners than import partners. Overall, the evolutions show a very balanced convergence in case of Eu partners and a remarkably steady convergence with no major disruptions in case of OECD partners.

Overall Czechia profile: The most advanced convergence story — smallest gaps on both EU and OECD dimensions, stable trajectory. Closest to its trading partners' productivity levels.

HUNGARY

Hungary's productivity gap vs. EU partners: Started around 180%, improved to 75% — strong convergence. But the path was volatile — notable deterioration around 2008–2012 (GFC period) and again post-2019. Export and import lines diverge more than in other countries, with imports consistently showing a smaller gap than exports. The productivity gap vs OECD partners started at 136% for exports and 166% for imports -250%, recovered to 140% — but convergence stalled after 2012. The gap has been essentially flat or slightly widening since then — a convergence trap. Export and import lines track closely but both plateaued.

Overall Hungary profile: Strong early convergence followed by stagnation — the productivity gap stopped closing after 2012, consistent with Hungary's structural over-reliance on FDI-driven assembly without building endogenous productivity capabilities.

POLAND

Poland's productivity gap vs. EU partners started around 370%, converged to 140% for exports and 150% for imports — steady convergence since 2004 EU accession, with export and import lines tracking closely. The productivity gap vs. OECD partners: Started moderately at 190% for exports and 270 for imports, deteriorated the productivity gap for exports to 240% in 1999, recovered strongly to 66% for imports and 123% for exports — the second best OECD convergence after Czechia. Export line slightly better than import line in recent years.

Overall Poland profile: Volatile early history but strong sustained convergence since EU accession, particularly with OECD partners. Second best performer after Czechia.

Table 10 Productivity convergence in ECE

Country	EU gap, 2022		OECD gap, 2022		Convergence quality
	export	import	export	import	
Romania	171%	155%	139%	92%	strong but fragile
Czechia	84%	79%	75%	29%	stable and deep
Hungary	128%	135%	117%	66%	Good EU, stalled OECD

Poland	139%	153%	123%	61%	Strong, second to Czechia

Cross-Cutting Findings

1. All four have converged substantially since 1995

Despite starting from very large gaps — Romania at -450%, Poland and Hungary near -200–250% — all four have made significant progress. EU integration is clearly the primary driver, with the most rapid convergence occurring in the years immediately following EU accession (2004 for CZ, HU, PL; 2007 for RO).

2. Export and import lines track almost identically

In nearly all cases, the productivity gap measured through export partners and import partners moves in lockstep. This means ECE countries trade with similarly productive partners on both sides — there is no systematic tendency to export to more productive partners than they import from, or vice versa. Trade is horizontally integrated in terms of partner quality.

3. Czechia has genuinely escaped the productivity gap

At -29% vs OECD partners and -79% vs EU partners, Czechia is approaching parity with its trading partners. This is a remarkable achievement and reflects genuine productivity convergence, not just structural change.

4. Hungary has hit a convergence ceiling

Hungary's OECD gap stalled at around 130% after 2012 and shows no further improvement. This is the most alarming signal in the entire dataset — it suggests Hungary's FDI-driven growth model has exhausted its convergence potential without building the endogenous capabilities needed to keep closing the gap.

5. Romania's 2022 re-widening is a warning

After two decades of convergence, Romania's OECD productivity gap widened again post-2019. This could reflect the disproportionate impact of energy prices, supply chain disruptions, or simply that Romania's trading partners recovered faster from COVID. Either way it breaks the convergence trend and deserves monitoring.

6. Poland's early volatility masks strong fundamentals

The dramatic early deterioration in Poland's gaps (around 1999–2001) was severe but temporary. Since EU accession, Poland has converged consistently and is now second only to Czechia on OECD gap closure. Its large domestic market provides a buffer that the other three lack.

7. The UE gap is generally harder to close than the OECD gap

For Romania and Hungary especially, the UE productivity gap remains significantly larger than the OECD gap. This makes sense because EU trade exposes ECE states to the most demanding possible benchmark precisely because of deep integration, geographic proximity and value chain embeddedness — while OECD trade involves a more heterogeneous and less extreme productivity distribution of partners. The larger EU gap is therefore not necessarily a sign of weakness but

rather a reflection of how deeply and asymmetrically ECE economies are integrated into the EU's most productive core.

Strategic Interpretation

The productivity gap chart is ultimately a convergence story with a warning embedded in it. Three of the four countries are converging — but at very different speeds and with different fragilities:

Czechia has largely solved the convergence problem and now faces the challenge of transitioning to a genuinely high-productivity economy rather than just catching up
Poland is on a strong trajectory, and its size gives it resilience — it is the most likely to follow Czechia's path
Romania has made enormous progress, but the 2022 re-widening suggests it has not yet secured its convergence — it remains one shock away from losing ground
Hungary is the most concerning — convergence has stalled, the assembly model is exhausted, and without structural reform the gap may start widening again

The deepest lesson from these developments is that EU accession was necessary but not sufficient for productivity convergence. The countries that built endogenous capabilities — Czechia through services and technology, Poland through market depth and regional hub status — are pulling ahead. Those that relied primarily on foreign manufacturing investment — Hungary above all — are hitting a ceiling. Romania's IT niche may be its escape route, but only if it scales.

3.3.2 ECE's trade distribution

The main changes in the trade distribution within EU in 2019-2022 compared to 1995-2019 by productivity tiers in each ECE countries are as follows (Fig. 25)

Exports from EU

ROMANIA

In Romania's EU trade "high" tier dominates at 67% in 1995–2019, declining slightly to 65% in 2019–2022, "EU frontier" fell from 12% to 5%, Low" fell from 13% to 8%. The tiers with increased shares were "middle" from 8% to 19% and "outlier" from 0% to 2%.

Interpretation: Romania is redistributing exports away from high/frontier/low toward middle/outliers productivity EU partners — a slight downgrading of export destination quality, possibly reflecting new trade links with newer EU members

CZECHIA

In Czechia's exports "High" tier is dominant at 68% falling to 62%, "Low" declined from 18% to 6% the most dramatic shift across all countries, outliers declined from 4% to 2%, "middle" increased from 8% to 24%, "Frontier" stay stable at 6%. Very similar evolution as in Romania with downgrading pattern toward middle tier.

HUNGARY

In Hungary's exports "High" tier at 69% is falling to 60% the sharpest decline as in Poland, "Frontier" fell marginally from 5% to 6%, "Low" declined from 13% to 9%, "Middle" increased from 11% to 23% and "outliers" doubled from 1% to 2% but remained marginal.

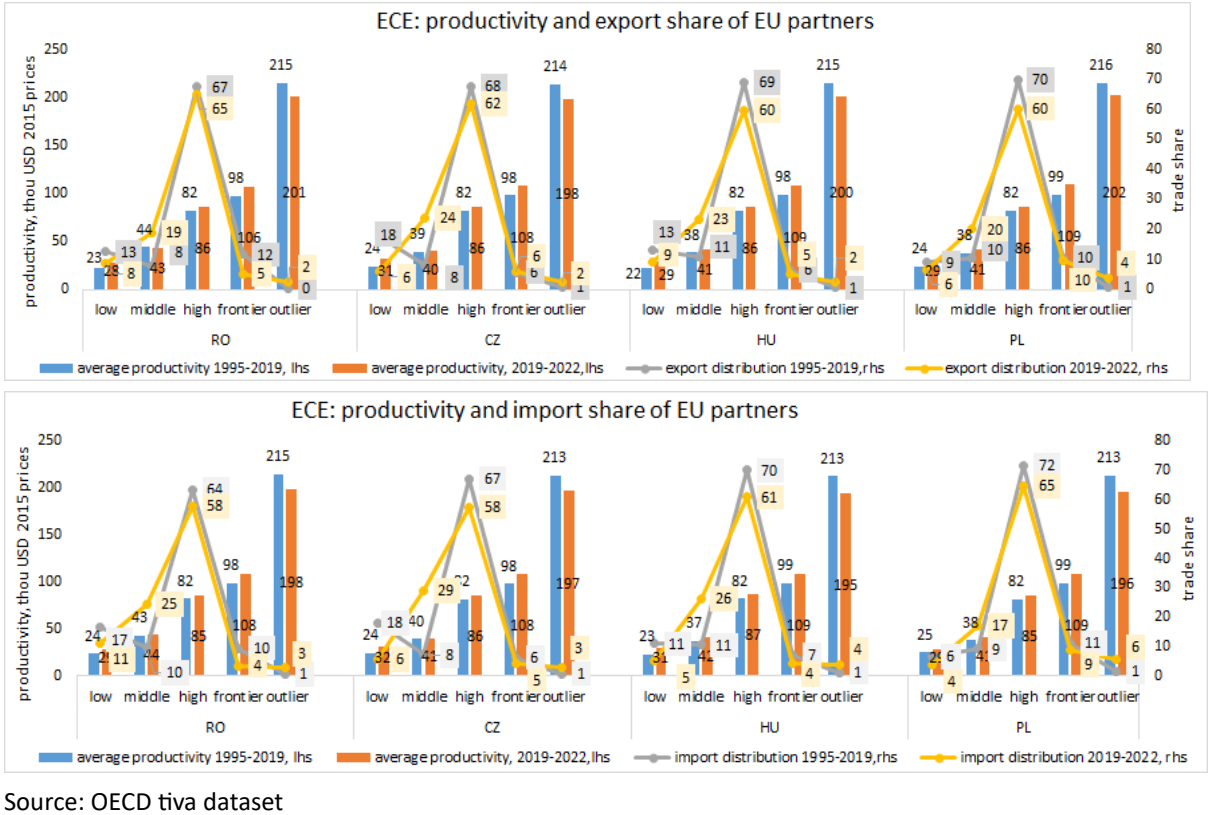
Interpretation: Hungary shows the most aggressive reorientation from high to middle productivity EU partners — possibly reflecting new supply chain links with Eastern EU members or rerouting through lower-cost EU economies

POLAND

In Poland's exports "High" tier at 70% falling to 60% as sharp fall as in Hungary, "Low" declined from 9% to 6%, "middle" from 10% to 41% —surged dramatically, "Frontier" stable at 10% and "outlier" increasing from 1% to 4% but negligible.

Interpretation: Poland is the same as Hungary, the high tier is substituted by middle-tier surge alongside with increasing share of super high productivity outliers— suggesting it is building export relationships with a broader range of EU partners, not just the middle productive.

Fig. 25



Source: OECD tiva dataset

Import from EU partners (Fig. 25)

ROMANIA

In Romania's imports "high" tier, "frontier" and "low" tiers had a moderate decline, the first from 64% to 58%, the second from 10% to 4% and the third from 17% to 11%. The other two tiers gained importance in the total imports, the "middle" from 10% to 25% and "outlier" from 1% to 3%.

Interpretation: Romania is downgrading its sourcing from "high" and "frontier" to "middle" productivity EU partners on the import side too — consistent with its export pattern, suggesting deepening trade with newer, less productive EU members

CZECHIA

In Czechia's imports the decline of "high" tier from 67% to 58% and of "low" from 18% to 6% was compensated by the rise of "middle" tier from 8% to 29%. The frontier and outliers together did not change their weight.

Interpretation: Czechia shows the most dramatic middle tier import surge — possibly reflecting sourcing from Eastern EU members for intermediate goods in its manufacturing chains

HUNGARY

In Hungary's import pattern is similar to Czechia, the declining "high" tier from 70% to 61% and "low" tier from 11% to 5% was substituted by the rising "middle" tier from 11% to 26%

Interpretation: Hungary's symmetry between export and import where middle-tier surges at the expense of high and low tiers contraction indicates that both selling to and buying from middle-productivity EU partners happened at increasing rates, consistent with its role as a regional assembly hub connecting Western EU manufacturers with Eastern EU suppliers.

POLAND

In Poland's imports as in Hungary's imports the falling "high" tier from72% to 65% and "low" tier from 6% to 4% are replaced by the rising "middle" tier from 9% to 17%. What is specific to Poland is that frontier tier declining from 11% to 9% is replaced by outliers increasing from 1% to 6%.

Interpretation: Poland again stands out with a massive middle-tier import and outlier surge. This likely reflects Poland's dual development as a regional trade hub, sourcing from mid-productivity EU partners across a wide range of sectors and as a new competitor in super high productive sector.

Table 11 The features of closing the productivity gap with trade partners in ECE

Dimension	Romania	Czechia	Hungary	Poland
"High" tier exports in 2019–2022	65%	62%	60%	60%
Low tier export decline	small (-5pp)	moderate (-12pp)	small (-4pp)	small (-3pp)
Middle tier export surge in 2020-2022 vs 1995-2019	moderate (+11pp)	large (+16pp)	moderate (+12pp)	moderate (+10%)
"High" tier imports 2019–2022	58%	58%	61%	65%
Low tier import decline in 2020-2022 vs 1995-2019	small (-6pp)	moderate (-12pp)	small (-6pp)	small (-2pp)
Middle tier import surge in 2020-2022 vs 1995-2019	Moderate (+15pp)	sharp (+21pp)	moderate (15pp)	small (8%)

Cross-Cutting Findings

1. Universal expansion of "frontier" and "outlier" tiers

All four countries show "frontier" and "outlier" EU partner shares increasing on both export and import sides. The ultra-productive EU economies are becoming more interested to ECE trade flows — possibly as ECE countries mature and become more competitive with upgraded productivity.

2. The "low" tier decline is a new ECE-internal dynamic

The fall in trade with low-productivity EU partners — strongest in Czechia on imports and exports— likely reflects deepening intra-CEE trade as Romania, Bulgaria, Slovakia, and the Baltic states become more integrated, and their productivity is catching up. ECE countries are increasingly trading with each other, not just with Western Europe.

3. "Middle" tier explosion is ubiquitous

The surge in middle-tier partners on both imports and exports suggests the region is becoming integrated in European value chains.

4. "High" tier still dominates but is losing ground

Despite the shifts, the "high" tier remains the single largest partner group for all four countries on both sides of trade — at 58–65%, much above of the EU trade distribution (Table 12).. The structural gravity of Germany, France, and the Netherlands remains overwhelming, but is slowly weakening as ECE intra-regional trade deepens.

Table 12 Deviation of distribution of ECE trade from distribution of within EU trade

EU groups	RO exports to EU, by receiving country productivity		RO imports from EU, by sending country productivity		CZ exports to EU, by receiving country productivity		CZ imports from EU, by sending country productivity	
	1995-2019	2019-2022	1995-2019	2019-2022	1995-2019	2019-2022	1995-2019	2019-2022
Low	4	-2	8	0	9	-5	9	-6
Middle	-2	9	1	15	-2	13	-1	19
High	2	4	-4	-3	2	1	0	-3
EU frontier	-1	-6	-4	-6	-7	-5	-7	-5
outliers	-2	-5	-2	-6	-2	-5	-2	-6
	HU exports to EU, by receiving country productivity		HU imports from EU, by sending country productivity		PL exports to EU, by receiving country productivity		PL imports from EU, by sending country productivity	
	1995-2019	2019-2022	1995-2019	2019-2022	1995-2019	2019-2022	1995-2019	2019-2022
Low	4	-2	2	-6	0	-4	-2	-7
Middle	1	13	2	17	0	10	1	7
High	3	-1	3	0	4	-1	4	4
EU frontier	-7	-6	-6	-6	-3	-1	-2	-1
outliers	-2	-5	-1	-5	-2	-3	-1	-3

Source: OECD tiva dataset

Strategic Implication

The ECE countries are undergoing a dual reorientation — maintaining their core trade ties with high-productivity Western EU economies while simultaneously building new links with lower and middle productivity EU partners, i.e. each other and newer EU members. This intra-CEE trade deepening, if sustained, points toward the emergence of a more self-sufficient CEE sub-regional economy within the broader EU — less dependent on the Western European core and more mutually interconnected.

Exports to OECD Partners (Fig. 26)

ROMANIA

In Romania's exports although "low" tier is declining from 43% to 38% it remains the largest single share. "high" tier is declining as well from 28% to 21%. These contractions are compensated by the expansion of "middle" tier from 6% to 19%. "World frontier" is relatively stable (24% in 1995-2019 and 23% in 2020-2022).

Interpretation: Romania is concentrating its OECD export destinations towards the middle tier—shifting away from low and high tiers. This is a mixed structural signal for Romania regarding its quality of OECD exports.

CZECHIA

In Czechia's exports "low" tier remain essentially flat at 39%, "middle" increased from 5% to 12%, "high" declined from 30% to 23%, and "world frontier" remained flat at 26%.

Interpretation: Czechia substitutes the high productivity with low productivity OECD exports confirming that Czechia is downgrading export partner quality outside the EU.

HUNGARY

In Hungary's exports "low" tier increase from 31% to 41%, "middle" tier increased from 5% to 10% and "high" tier declined from 30% to 21%, "world frontier" essentially flat at 29–30%.

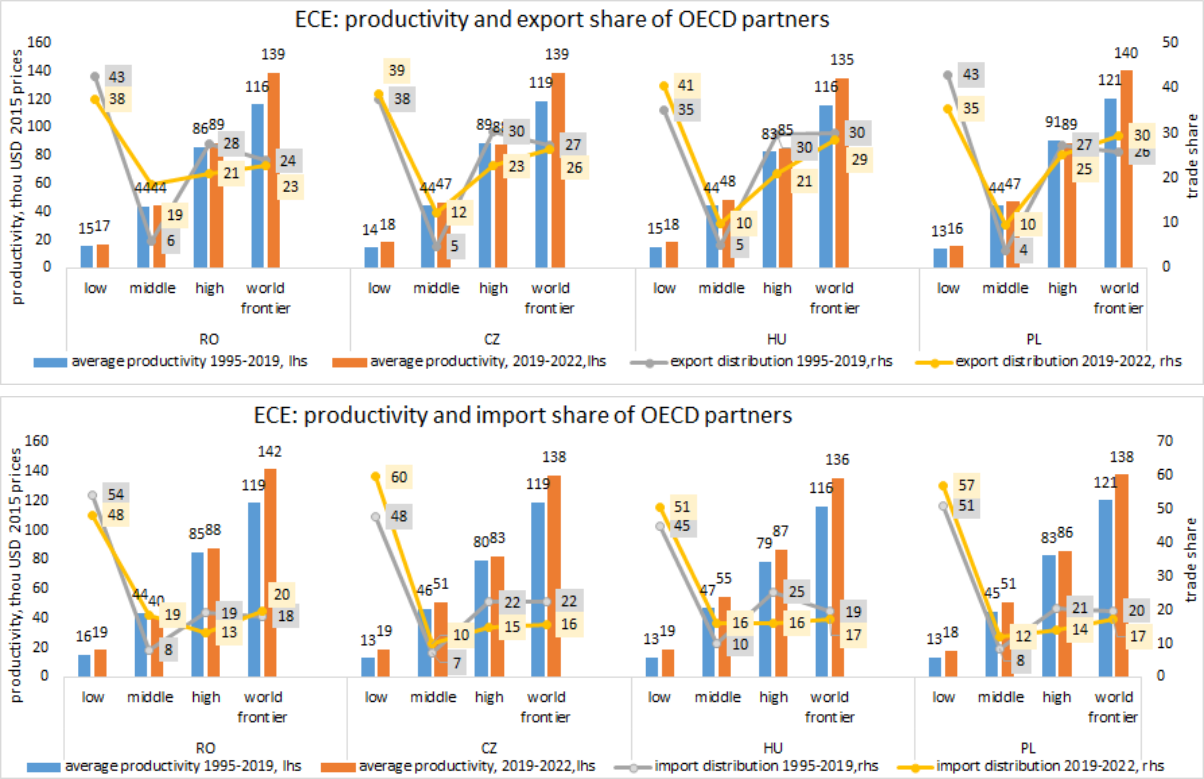
Interpretation: Nearly identical to Czechia — Hungary substitutes the high productivity with middle and low productivity OECD exports.

POLAND

In Poland's exports "low" fell from 43% to 35%, "middle" increased from 4% to 10%, "high" declined from 27% to 25%, "world frontier" increased from 26% to 30%.

Interpretation: Poland is upgrading its OECD export quality from low to middle and from high to frontier.

Fig. 26



Source: OECD tiva dataset

Imports from OECD Partners (Fig. 26)

ROMANIA

In Romania's imports "low" tier fell from 54% to 48% — still dominant and very high, "middle" increased from 8% to 19%, "high" declined from 19 to 13%, "world frontier" rose modestly from 18% to 20%.

Interpretation: Romania sources heavily from low-productivity OECD partners — the highest low-tier import share of all four. The middle tier increased. This suggests Romania is cheap-input dependent in its non-EU sourcing, with limited upgrading toward high-productivity OECD suppliers.

CZECHIA

In Czechia's imports "low" tier rose significantly from 48% to 60%, the highest of all four, "middle" fell from 7% to 10%, "high" fell from 22% to 15%, "world frontier" fell from 22% to 16%.

Interpretation: Czechia shows the most extreme "low" tier import surge — 60% of OECD imports from low-productivity partners in 2019–2022. This likely reflects sourcing from lower-cost non-EU OECD members (Turkey, Mexico, Eastern European non-EU) for manufacturing inputs, consistent with its assembly hub model.

HUNGARY

In Hungary's imports "low" tier rose from 45% to 51%, "middle" increased from 10% to 16%, "high" fell from 19% to 17% — essentially flat.

Interpretation: Similar to Czechia — heavy "low"-tier import dependence rising, "middle" on the upward as well. Hungary is deepening its cheap-input sourcing strategy from non-EU OECD partners.

POLAND

In Poland's imports "low" tier rose from 51% to 57% — highest "low" tier import share after Czechia, "middle" increased from 8% to 12%, "high" declined from 21% to 14%, "world frontier" fell from 20% to 17%.

Interpretation: Poland mirrors the pattern — rising low-tier and middle.

Table 13 Integrated Four-Country OECD Summary

Dimension	period	Romania	Czechia	Hungary	Poland
"low" export share	2019–22	38%	38%	35%	43%
"Middle" export expansion, share difference	2020-2022 vs 1995-2019	Sharp +13pp	moderate +7pp	moderate +5pp	moderate +6pp
"High" + "world frontier" export loss, share difference	2020-2022 vs 1995-2019	Moderate -5pp	Strong -13pp	Strong -11pp	Strong -10pp
"low" import share	2019–22	48%	60%	51%	57%
"Middle" import expansion, share difference	2020-2022 vs 1995-2019	Sharp +11pp	small +3pp	moderate +6pp	small +4pp
"High" import loss, share difference	2020-2022 vs 1995-2019	Declining -6pp	Declining -7pp	declining -9pp	declining -7pp
"World frontier" imports trend, share difference	2020-2022 vs 1995-2019	Rising +2pp	Declining -6pp	Declining -2pp	Declining -3pp

Full Integration — EU + OECD Trade, All Four Countries

Romania

EU trade: Moderate "low" tier fall, "high" tier still dominant, some downgrading

OECD exports: Upgrading toward "medium" from the dominant "low" (38%)—positive signal, but the decline of "high" negative signal

OECD imports: Heavy "low" tier dependence (48%), limited "high" tier sourcing

Profile: A transitional economy — upgrading export destinations selectively while remaining cheap-input dependent on the import side. IT export strength to ROW markets is its clearest comparative advantage.

Czechia

EU trade: Sharp "medium" tier surges on both sides — deepening intra-CEE links

OECD exports: downgrade from "high" to "middle"

OECD imports: 60% "low" tier — the most aggressive cheap-input sourcing of all four

Profile: A sophisticated assembly hub — sourcing cheap inputs globally, exporting to high-productivity partners, deeply embedded in EU manufacturing chains. Highly efficient but structurally exposed.

Hungary

EU trade: Sharp "medium" tier surge, symmetrical import pattern

OECD exports: Strong "high" collapse, gains in "low" and middle

OECD imports: Heavy "low" tier dependence (51%), rising

Profile: The purest assembly hub — buying cheap, selling to high-productivity markets, with the weakest services and IT export presence. Most vulnerable to supply chain disruption and FDI withdrawal.

Poland

EU trade: Unique "middle" tier explosion— emerging regional hub

OECD exports: "low" collapse, world frontier gains

OECD imports: Very high "low" tier (57%), rising; "high" and world frontier collapsing

Profile: The most complex and hybrid economy — combining assembly hub characteristics with regional hub ambitions, strongest domestic market, and leading IT export presence alongside Romania.

Compared to the overall trade EU distribution with OECD, ECE countries are more exposed towards low and middle tiers, except Poland's imports which is in line with the average EU trade distribution (Table 14).

Table 14 Deviation of distribution of ECE trade with OECD from distribution of EU trade with OECD

OECD groups	RO exports to OECD, by receiving country productivity		RO imports from OECD, by sending country productivity		CZ exports to OECD, by receiving country productivity		CZ imports from OECD, by sending country productivity	
	1995-2019	2019-2022	1995-2019	2019-2022	1995-2019	2019-2022	1995-2019	2019-2022
Low	12	3	20	8	7	4	13	19
Middle	1	10	3	12	0	4	2	3
High	-2	-5	-10	-11	0	-3	-7	-9
World frontier	-10	-8	-13	-9	-7	-5	-9	-13
	HU exports to OECD, by receiving country productivity		HU imports from OECD, by sending country productivity		PL exports to OECD, by receiving country productivity		PL imports from OECD, by sending country productivity	
	1995-2019	2019-2022	1995-2019	2019-2022	1995-2019	2019-2022	1995-2019	2019-2022
Low	5	6	11	10	12	1	17	16
Middle	0	2	5	9	-1	1	3	5
High	0	-5	-3	-8	-3	-1	-8	-10
world frontier	-4	-2	-12	-12	-8	-1	-12	-12

Source: OECD tiva dataset

SYNTHESIS

FINAL SYNTHESIS

Strategic Synthesis — The ECE Trade Transformation

The universal middle increase is the defining trend. Across all four countries, in both EU and OECD trade, on both export and import sides — the middle productivity tier got stronger from low basis. This is not a country-specific phenomenon but a structural feature of how global value chains are reorganising in the post-2019 world.

Two Forces Driving This Simultaneously

FORCE 1

Upward Pull

ECE countries are trading away from low productivity partners as their own capabilities improve and EU integration deepens.

FORCE 2

Downward Push

Cheap input sourcing from low-productivity partners outside EU is intensifying as cost pressures and supply chain diversification accelerate post-COVID in Czechia and Hungary, but not in Romania and Poland.

The Result: Two Asymmetric Trade Structures

WITHIN EU

V-shaped

Concentrated at middle productivity

OUTSIDE EU

L-shaped

Concentrated on low productivity

THE BIG TAKEAWAY

This dual structure maximises efficiency but creates fragility.

Geopolitical disruption at the low end (sanctions, trade wars) or recession at the high end (German slowdown) hits ECE economies with only a middle-tier buffer to absorb the shock.

CEE exporters are becoming slightly more productive internally but are trading down in partner quality — exporting less to the world's most productive economies. Since exposure to high-productivity partners is itself a driver of productivity growth (the learning-by-exporting effect), this reorientation could slow future convergence for these economies.

ANNEX

Table 1 Trade with goods, bn USD current prices

	EU Frontier		EU non frontier		Romania		Czechia		Hungary		Poland	
World	export	import	export	import	export	import	export	import	export	import	export	import
1995	479.4	420.6	1595.6	1535.8	7.9	9.8	15.6	16.0	23.1	24.8	29.8	27.0
2019	667.0	620.1	5243.8	4824.1	88.9	98.9	161.6	147.1	120.7	117.7	277.4	256.5
2022	875.9	829.1	6141.2	6168.1	115.1	134.6	189.1	185.8	140.5	148.1	377.2	369.9
1995	261.7	256.2	870.3	879.7	3.0	5.6	10.4	10.6	16.3	17.9	19.4	16.9
2019	335.5	369.6	2616.8	2578.9	24.4	68.2	111.7	96.9	80.2	83.8	183.8	148.5
2022	452.1	498.6	3200.5	3231.2	33.1	88.4	134.9	114.1	91.9	104.1	252.7	199.5
1995	190.3	145.4	641.1	599.4	3.0	3.4	4.6	5.0	5.9	6.3	8.8	9.2
2019	296.1	230.1	2309.5	2025.7	24.4	27.1	43.9	46.6	35.2	31.1	81.7	103.0
2022	375.6	310.3	2591.4	2650.2	33.1	41.4	48.3	67.1	42.4	39.6	107.8	163.4

Source: OECD TIVA data base

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