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Production disintegration and integration of Central Europe into global markets

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Abstract

Central Europe, which includes countries that either already joined the EU or are to accede the EU in the near future, offers an interesting case to examine network trade. The accession process has been crucial to the emergence of conditions friendly to production fragmentation, i.e., well-functioning services blocs indispensable to linking production blocs and duty-free access to a Single Market. Has Central Europe become part of production and distribution networks?

In order to examine this trade, we develop an eclectic approach. Using the Standard International Trade Classification, Rev. 2, we identify parts and final products falling into three networks (automotive, information technology and furniture) and calculate various indices assessing the extent to which trade is two-way and involves processing and assembly operations.

The analysis provides strong empirical support to the conclusion that Central Europe has become integrated into global, mostly EU-based networks of production and distribution. Network-related trade has experienced a very strong growth and undergone three important changes: processing and increased specialization in production of parts have increasingly replaced simple assembly operations; the CEEC-10 network firms, operating through mostly EU-based networks of production and distribution, have begun expanding beyond EU markets; and by 1999 CEEC-10 has moved from the status of a net importer to that of a net exporter of network products and parts.

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But not all countries have moved at the same pace. The largest recipients of FDI in the 1990s–Hungary, the Czech Republic and most recently Slovakia–have also experienced the fastest growth in network trade.

JEL classification: F1; F14; F15; F19

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1. Introduction

The combination of technology and business friendly and efficient services environment has spurred a new global division of labor. Its trademark is–to borrow an apt phrase from Feenstra (1998)–integration of trade and disintegration of production in the global economy. Internationalization or disintegration of production has been taking place within vertically integrated manufacturing industries, with, for instance, electronic semi-conductors, tuners, valves, etc., assembled or processed in low-wage countries to be fed into further processing or for final sales. Main industries involved in this trade include automobiles, television and radio receivers, sewing machines, office equipment, electrical machinery, power and machine tools, typewriters, cameras and watches (USITC, 1996). FDI (foreign direct investment) and MNCs (multinational corporations) have been the driving forces of this trade through establishing production capacities and linking them to international supply chains.

Central European transition economies (hereafter CEEC-10[1]) offer a very interesting case to study fragmentation or disintegration-induced trade or, as it is sometimes called, intra-product trade (Kierzkowski, 2001), as it shows with laser-like clarity the indispensable conditions for participating in this new division of labor. Until 1989–1990, they have all been, with the possible exception of Slovenia, outside the direct reach of foreign business. In 1991–1993 they all opened to foreign investments; they all signed the Europe Association Agreements over 1991–1996 that de facto launched the long accession process, which resulted in EU membership for all but two of them as of May 1, 2004.[2]

In order to become eligible for accession to the EU, they had to remove, albeit gradually, barriers to their trade with the EU including behind-the-border measures and they had to introduce trade facilitating measures including among others reforms of customs administration as well other reforms to converge to the acquis communautaire. Taken together, these measures have contributed to the emergence of well-functioning services blocs and business friendly environment, which are a necessary condition, though not a sufficient one, to participate in fragmentation-induced division of labor.[3]

Furthermore, in addition to duty-free access to EU markets that went into effect for most industrial products almost immediately following the signing of a European Association Agreement, another attraction was the emergence of a single free trade area for industrial products. In response to complications created by the emergence of a network of overlapping free trade areas (FTAs) and the need

[1] CEEC-10 comprise Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

[2] Bulgaria and Romania await accession, which is tentatively scheduled for 2007.

[3] Bloc services are crucial to linking various fragments of production process located in different geographical locations (Jones & Kierzkowski 1990, 2001). But so is trade facilitation environment, i.e., good transportation, business friendly and efficient customs, and thereby low transaction costs.

to harmonize rules of origin among European members of EU-inspired FTAs, the EU launched Pan-European cumulation project. Its objectives were twofold; harmonization of the pace of duty-removal on industrial products and "regionalization" of the rules of origin through a system of diagonal cumulation (WTO, 1997). The European Cumulation Agreement, which went into effect on January 1, 1997, has bonded CEEC-10 and European Economic Area countries through a system of diagonal cumulation allowing imports in these countries to be treated as local inputs. The shift to duty free trade in industrial products was accelerated and a single European trading bloc was fully in place on January 1, 2002.

As a result of these measures, CEEC-10 have become attractive to both efficiency-seeking and market access-seeking MNCs. The availability of cheap skilled labor force combined with geographical proximity has been a magnet for MNCs. Many of them have decided to move fragments of their production process there at early stages of transition from central planning. Countries that moved fast with adopting structural reforms have been very successful. Hungary first then followed by the Czech Republic, Estonia and other countries have received FDI inflows accounting for more than one-fourth of their annual domestic investments. Firms with foreign participation have been the levers of their impressive export expansion in the second half of the 1990s.

The objective of this paper, however, is more modest. It is not our intention to identify links between production fragmentation and FDI inflows or trace them to MNCs operating in these countries, although they deserve a thorough analysis. The main focus of this paper is to assess the size and dynamics of this trade. The question addressed here is how much rather than why, although links to FDI and MNCs are empirically straightforward.

The paper is organized as follows. Section 2 discusses methodological issues related to estimating the impact of production disintegration on trade. Section 3 discusses developments in size, direction and dynamics of trade in networks' products and parts. Section 4 takes a closer look at the changing patterns of trade across networks. Section 5 seeks to answer more detailed questions about the extent and intensity of processing and assembly operations across networks. Section 6 answers a question which countries among CEEC-10 are the major players. The last section concludes.

2. Approach to estimating trade driven by intra-product specialization

Despite the apparent growing significance of intra-product trade, there have been few attempts to assess empirically the scope of foreign trade that can be directly attributed to production fragmentation. Some analysts suggest using OPT (outward processing trade) statistics to estimate trade in industrial networks (Rojec & Jaklic, 2002). While undoubtedly they provide insights into outsourcing, these are of little use for trade with CEEC-10, as they cover mainly processing related to products facing restrictive access to EU markets. This has applied only to few products, most notably clothing, traded with CEEC-10, but not to others driving the emerging division of labor fueled by production disintegration.

Others use intra-industry trade (IIT)–as measured by the well-known Grubel-Lloyd index[4]–to estimate the growth of trade due to fragmentation (Kierzkowski, 1998, 2001). While the IIT clearly includes

[4] The GL index of intra-industry trade between two partners is usually expressed as: $GL=1-\sum[|X_i-M_i|/\sum(X_i+M_i)]$, where X and M are exports of a country and imports by a partner correspondingly of product i. The index suffers from two problems: aggregation and aggregate trade imbalances.

fragmentation-related trade, it also captures a large portion of trade that may have little to do with production sharing or fragmentation (Jones & Kierzkowski, 2004). IIT tends to be high among countries that are similar in terms of their endowments and incomes and that have smaller thresholds of the minimum efficient scale of production (more firms and greater variety supported by the market).[5] Consumer preferences rather than globalization of production shape a significant portion of trade in, for instance, motor vehicles between the EU and the United States.

Undoubtedly, fragmentation-driven trade accounts for a considerable and probably growing portion of ITT. The empirically observed positive correlation between multinational activity and IIT would clearly point in this direction (Markusen, 1998). But it would be difficult to estimate the share of this trade in IIT. The distinction between horizontal and vertical intra-industry trade–the latter involves exchange of similar goods of different quality, whereas the former comprises exchange of similar goods that are not differentiated in terms of quality–does little to solve the problem. Products subject to mutual exchanges often enter different market niches, although in some cases lower quality products may be imported for processing.[6] It seems that the index of horizontal trade specialization (HTS), which is a slightly modified version of the Grubel-Lloyd index, applied to selected product groups offers a better measure of trade due to production sharing and fragmentation. But it also fails to capture exchanges generated by cross-border networks of production and distribution, although this index may be effectively used to assess the existence of two-way links within narrowly defined production networks.

The weakness of Yeats' (2001) approach consisting of using parts defined as such in SITC is that the SITC does not do a good job in distinguishing between assembled goods and parts. Parts are limited to those identified within machinery and transport equipment group (SITC 7). This approach leaves outside the analysis a number of processed inputs. Examples abound. Parts of piston engines (SITC. 7139) are covered but not internal combustion engines for cars (SITC. 732). It also leaves out almost the whole electronic sector. For instance, diodes and semi-conductors (7763), electronic microcircuits (7764), monitors and TV tubes (7761), etc., used increasingly in a vast array of consumer products are omitted.

Taking into account the finding that trade in parts concentrate in a small group of sectors,[7] we focus our analysis on three sectors of manufacturing. These are information technology (office equipment; telecommunication equipment, electronics), motor vehicles, and furniture. Both information technology (IT) and automotive sectors are at the very core of the division of labor driven by dividing up production process and moving its parts to economies with friendly trade facilitating environment.

The empirical evidence suggests that MNCs dominate automotive and IT sectors. Suppliers in these sectors tend to be either subsidiaries of MNCs or operate in outsourcing within MNC networks of manufacturing and distribution. Therefore, we shall refer to them as production and marketing networks.

Although furniture is not a classic area of production fragmentation, it has been included for three reasons. First, it possesses characteristics of global networking. As far as final products are concerned, furniture producers in operate as suppliers to large, usually international, retailers (e.g., Ikea) turning out product according to their detailed specifications. Branded retailers often take care of providing parts and components. Assembly is its major feature. However, producers of parts operate within supply chains,

[5] Technological factors may lower the minimum efficient scale of production and thus allow the market support more firms and greater variety (Hufbauer, 1970).

[6] For instance, Aturupane, Djankov, and Hoekman (1997) find that vertical intra-industry trade accounted for 80–90% of total IIT of CEEC with the EU. It would be impossible to estimate what proportion was further processed in the EU.

[7] This is also confirmed by our earlier empirical analysis of CEEC trade. See Kaminski and Ng (2001).

which implies production fragmentation. In brief, CEEC-10 suppliers, if they wanted to export, had to become part of EU-based networks of marketing. Second, for some CEEC-10, it has been a very important foreign currency earner accounting for between 6% and 10% of manufactured exports. Last but not least, the developments in furniture-related trade shed light on not only on the pace of industrial restructuring captured by the extent to which imports of parts from the EU are replaced either by domestic or regional CEEC-10 suppliers but also on trade effects of production disintegration.

Appendix Table 1 identifies SITC. Rev 2 categories for parts and final products of these three production and distribution networks that are used in our estimates.[8] The portion of trade identified as network trade is then subject to a more detailed, eclectic analysis seeking to assess the extent to which this is indeed a two-way trade involving processing. We examine the following indices: imports of parts and components as percent of network exports of both final products and parts (referred to as network import intensity); the earlier mentioned HTS; share of parts in total network exports and imports and developments in their trade in parts.

3. CEEC-10 network trade: size, directions and dynamics

The participation in a division of labor based on fragmentation of the production process involves two-directional transborder flows. Parts brought to a country are processed and shipped to a location in another country for further processing. However, shifting of production activity to another country may lead over time to the fall in imports of input-parts, as suppliers may move their operations as well in order to be physically closer to their final user or take advantage of cheaper skilled labor. As the international experience shows, this happens quite often. For instance, the VW-owned Skoda factory in the Czech Republic has led to the emergence of extensive local backward linkages with both local suppliers and foreign firms (USDS, 2003). Furthermore, local suppliers go beyond local users finding new outside markets often in neighboring countries. In consequence, exports of parts may go up. While raw trade data used here do not allow capture subtleties, they shed in their aggregates light on general tendencies.

Table 1 offers preliminary insights into the dynamics and significance of network trade in CEEC-10 integration into global economy. First, spectacular overall expansion in 1995–1999 continued at even a slightly stronger rate in 1999–2002, the CEEC-10 share in total world network exports increasing from 1.0% in 1995 to 3.3% in 2002 and imports from 1.6% to 2.6% over the same period.[9] Its share in CEEC-10 manufactured (excluding chemicals) exports increased from 19% in 1995 to 39% in 2002 and in imports from 25% to 31%. Simultaneously, CEEC-10 have moved from the status of a net importer to that of a net exporter of network products and parts already in 1999.

[8] The problem is that the SITC Rev. 2 system falls well short of allowing precise estimates of foreign trade activity within a network. Leaving aside standard weaknesses of foreign trade statistics, the problem is that it does not allow to distinguish among various uses of a part. For instance, piston engines (7132) include a whole array of engines for cars, trucks, tractors, works trucks and armored vehicles. Parts (7139) include not only parts for piston engines (7132) but also parts used in production of engines for boats (7133). In consequence, one may overestimate the trade generated by a given production network.

[9] In terms of value, exports were in 1999 around 150% above their level in 1995, and imports 55%. The increase between 1999 and 2002 was smaller, yet sizable—77% and 45% respectively.

Table 1
Network trade of CEEC-10 in global context in 1995, 1999 and 2002 (in percent and billion of US dollars)

	1995					1999					2002				
	CEEC	EU	CIS	ROW	TOT.	CEEC	EU	CIS	ROW	TOT.	CEEC	EU	CIS	ROW	TOT.
Share in CEEC-10 trade	9.6	72.2	6.0	12.1	100	7.1	78.6	1.7	12.6	100	9.0	77.2	1.9	11.9	100
Share of CEEC-10 in network trade turnover	9.6	7.1	15.0	0.3	1.5	7.1	12.7	6.7	0.4	2.0	9.0	18.2	5.4	0.6	3.0
Exports (bill. US$)	1.4	7.6	1.3	1.5	11.7	2.1	23.9	0.6	2.8	29.4	4.2	41.0	1.5	5.3	52.0
Imports (bill. US$)	1.4	12.7	0.4	2.6	18.4	2.1	21.7	0.4	4.4	28.6	4.2	31.0	0.3	5.7	41.3
Exports as % of imports	100	59	304	58	63	100	110	171	64	103	100	132	507	93	126

Due to the missing data, 1996 data are used for Bulgaria and CIS countries. Total network products include automotive, IT and furniture networks. CIS denotes Commonwealth of Independent States and ROW stands for rest of the world. EU trade turnover excludes intra-EU trade.
Source: based on world import data from UN COMTRADE Statistics.

Second, there has been change in terms of CEEC-10 presence in external markets and their significance as an outlet for external suppliers. CEEC-10 importance as the EU's partner has been steadily growing. The share in EU network turnover, excluding intra-EU trade, increased from 7% in 1995 to 13% in 1999 and 18% in 2002. So did their participation in networks in the ROW (rest of the world), where their share in ROW trade has experienced steady growth, with its value in 1999 and 2002, 42% over 1995 and 1999 respectively.

Third, intra-CEEC trade in network products and parts has followed not an unexpected pattern over time. It relatively contracted between 1995 and 1999, mainly because of falling trade in automotive products and parts between the Czech and Slovak Republics following the dissolution of former Czechoslovakia in 1992. The share of intra-CEEC network trade in their aggregate network trade turnover stood in 1999 at 73% and in 2002 at 94% of its level in 1995. The 1999–2002 witnessed strong growth, with its value doubling.

Last but not least, 'old connections' from the defunct CMEA (Council for Mutual Economic Assistance), i.e., former Soviet republics now grouped in CIS (Commonwealth of Independent States), turned out to be inconsequential to allow CIS participate in this emerging division of labor, as a network two-way trade is yet to emerge in their trade patterns. CIS have switched to other markets mostly for network final products, and so have CEEC-10 for both network parts and products. The share of CEEC-10 in their trade contracted more than half from 15% in 1995 to 7% in 1999 and 5% in 2002. Had CEEC-10 exports not picked up in 2002, the fall would have been much deeper, as CEEC-10 imports fell in both 1999 and 2002. In consequence, this is mostly a one-way trade, with the CEEC-10 exporting mainly network final products to the CIS. The share of CIS in aggregate CEEC-10 network slightly increased from 1.7% in 199 to 1.9% in 2002, mainly thanks to Czech exports of cars.

4. Evolving significance of networks: the rise of IT network and the decline of furniture network

The relative importance of network trade in CEEC-10 trade has greatly increased, with the value of their network products and parts exports rising almost five-fold and imports three-fold between 1995 and 2002. Networks products and parts have been the fastest growing items in both exports and imports, with their share in manufactured (excluding chemicals) exports increasing from 19% in 1995 to 39% in 2002

Table 2
Share of networks in network trade and in manufactures in 1995 and 2002 (in percent and million of US dollars)

Networks	Share in total network				Share in manufactures (chemicals excluded)			
	Exports		Imports		Exports		Imports	
	1995	2002	1995	2002	1995	2002	1995	2002
Automotive	54%	53%	51%	50%	14%	22%	16%	17%
Electronic	17%	33%	44%	46%	4%	10%	8%	12%
Furniture	29%	14%	6%	4%	6%	6%	2%	2%
Total (in million of US$)	11,664	51,964	15,692	46,940	24%	39%	25%	31%
Memorandum	(in million of US dollars)							
Other parts	3868	8011	4050	9188	6.5%	6.0%	6.2%	6.5%

Source: based on world import data from UN COMTRADE Statistics.

and in imports from 25% to 31% (Table 2).[10] Simultaneously, trade in 'other parts,' i.e., SITC. Seven categories identified there as parts and not specified in networks' parts have lagged behind. Their share in aggregate exports of networks and other parts fell from 25% in 1995 to 13% in 2002, whereas this share in imports declined from 21% to 16% over the same period.

Trade in networks products and parts grew faster than world network trade: the share of CEEC-10 in world exports of IT products and parts increased from 0.3% in 1995 to 2.2% in 2002 and in imports from 1% to 2%; their share in automotive exports grew from 1.2% to 3.7% and in imports from 1.9% to 3.3%; and their share in world exports of furniture rose from 7% to 11% and in imports from 2.3% to 3%. Taking into account that the share of total CEEC-10 exports in world exports was 1.8% in 1995 and 2.6% in 2002, CEEC-10 had revealed comparative advantage in furniture and acquired it in automotive network products and parts by 1999. As for IT network products, CEEC-10 share was in 2002 still below their share in total world exports.

But in line with global trends, trade in IT network products has displayed very strong dynamics. The share of IT network in CEEC-10 network exports in 2002 was 16 percentage points higher and in imports 12 percentage higher than in 1995 (Table 2). This increase has occurred almost exclusively at the expense of furniture network trade, as their share in network exports plunged 15 percentage points and in imports 2 percentage points between 1995 and 2002. Despite this precipitous decline, furniture products and parts have retained their share in both exports and imports of manufactures (chemicals excluded). The share of IT products and parts in manufactured exports increased 2.5 times, while that of automotive network increased 50%. This increase merely allowed it maintaining the same share of network exports and imports in 2002 as it had in 1995.

5. Is it really trade triggered by production disintegration?

Neither exports nor imports of network products provide a definite proof that this is indeed a two-way, intra-product trade, i.e., involving processing or assembling operation. They may import and export only final goods, and processing and assembly may take place only within individual CEEC-10 or, at best,

[10] The share of manufactures excluding chemicals in CEEC-10 exports increased from 65% in 1995 to 75% in 2002. Their average annual growth rate in terms of value was 14% in 1995–2002.

across CEEC-10 economies. Since fragmentation of production implies shipping parts and components across border as well as final products, the task is to capture the intensity of this process. One has to look at other indices.

One way of addressing this issue is to look at the values of HTS (horizontal trade specialization) index and imports of parts as percent of network exports of both final products and parts. Values of the HTS, based on modified Grubbel-Lloyd index,[11] range from zero to unity—zero indicates either exports or imports in covered product categories, whereas unity points to a full-fledged two-way trade across all product categories in a given network and major trading partner. The developments in imports as percent of network exports of final products and parts, referred to as network import intensity, provide indication of further processing and assembly operations. Intuitively, one would expect that if its value declines high over time, then imports are processed, value is added and exported–at prices exceeding significantly the costs of imported parts–taking either the form of parts or final products. This is not a perfect measure, though. Its weakness is that parts can be used for final products that are sold domestically. One has to take into account other measures such as revealed regional advantage in imports of parts calculated as the share of country's imports of parts in CEEC-10 imports to its share in total regional imports.

Table 3 reports the values of both network import intensity and HTS indices for each network and a trading partner as well as provides some other information shedding light on features of network trade. Let us briefly discuss each network beginning with the automotive network. It still towers over other networks, although the IT network–as argued above–increasingly challenges its dominant position. Exports of automotive network accounted in 2002 for 22% of CEEC-10 total manufactured goods exports. Its import intensity has been on the decline since 1995 falling below 100 in 2002. This indicates that the value of total automotive exports has exceeded the value of imported automotive parts. The relative decline in CEEC-10 import intensity vis-à-vis the EU has been a major driver of this change. This is no surprise, as the EU has accounted for around 80% of total CEEC-10 sales (including intra-CEEC exports) of this network. The share of parts in automotive network exports to the EU increased whereas it fell to other destinations including intra-CEEC-10 exports. But despite the falling share of parts in total automotive network intra-CEEC-10 trade, the intensity of intra-CEEC automotive network trade remains high, with the purchases of automobiles significantly expanding. This combined with the fall in the share of the EU in total network exports seems to suggest that automobiles manufactured in CEEC-10 by MNCs have replaced to some extent those previously imported and manufactured in the EU.[12]

Together with the fall in import parts intensities of network exports, the fact that the value of HST index has been close to unity for both intra-CEEC trade and trade with the EU clearly indicates a two-way trade. More important, it also suggests that production disintegration has indeed been a major factor driving this trade, as the expansion in exports of both final products and parts accompanied the increase in imports of parts indicating processing, with exports taking the form of either the parts or final products.

As noted earlier, the IT network has been a 'sunrise' network. It has recorded that largest increase in terms of its share in exports of manufactured goods, with the value of its exports in 2002 more than eight

[11] It is calculated as: $HTS_i=1-(|E_{ij}-M_{ij}|)/(E_{ij}+M_{ij})$ where E_{ij} and M_{ij} are the country's exports and imports of i products to/from the country or market j respectively.

[12] All major players of the world automotive industry are now present in CEEC-10. See USDS (2003).

Table 3
CEEC-10 trade in automotive, IT and furniture networks in 1995, 1999 and 2002 (in billion of US dollars and percent)

		Motor vehicles			IT network			Furniture			Total networks		
		1995	1999	2002	1995	1999	2002	1995	1999	2002	1995	1999	2002
Imports of parts as percent of network exports	CEEC	96	101	89	83	80	67	79	100	90	94	98	84
	EU	176	111	72	168	133	127	40	29	23	146	104	75
	CIS	37	46	25	15	18	18	2	11	11	29	36	22
	Total	125	118	75	211	211	227	43	34	30	138	128	101
Exports as percent of manufactured exports	CEEC	13.0	16.3	17.9	3.5	4.0	7.5	1.9	2.9	3.7	18.5	23.1	29.1
	EU	9.3	19.9	22.2	3.3	10.0	13.8	6.6	6.1	5.9	19.3	36.1	41.8
	CIS	17.3	13.4	19.5	5.0	4.7	6.8	8.5	6.8	3.9	30.7	25.0	30.1
	Total	10.6	18.2	20.4	3.4	9.5	12.9	5.6	5.5	5.3	19.5	33.3	38.6
Share in exports of CEEC-10 (in percent)	CEEC	15.1	9.0	9.4	12.8	4.2	6.3	4.3	5.3	7.5	11.6	7.0	8.1
	EU	57.7	81.8	79.0	64.9	78.8	78.1	78.1	83.3	80.0	64.7	81.2	78.8
	CIS	11.2	2.1	3.4	10.2	1.4	1.9	10.4	3.5	2.6	10.8	2.2	2.8
	ROW	16.0	7.1	8.2	12.1	15.6	13.7	7.2	7.9	9.9	12.9	9.6	10.3
(billion of US$)	Total	6.3	16.1	27.5	2.0	8.4	17.3	3.3	4.9	7.2	11.7	29.4	52.0
Share in imports of CEEC-10 (in percent)	CEEC	10.2	8.4	9.2	2.8	3.2	4.7	13.8	18.6	27.2	7.2	6.6	7.9
	EU	72.3	75.9	79.1	57.3	62.1	47.2	78.1	72.5	62.5	64.2	66.6	58.7
	CIS	3.7	1.1	0.7	0.4	0.1	0.2	0.2	0.4	0.8	2.0	0.6	0.4
	ROW	13.8	14.6	11.0	39.5	34.6	47.9	7.9	8.5	9.5	26.6	26.2	33.0
(billion of US$)	Total	7.9	17.0	23.4	6.9	14.0	21.7	0.9	1.4	1.9	15.7	32.4	46.9
Share of parts in network imports from (in percent)	CEEC	63.7	61.1	52.4	47.0	23.1	30.9	12.5	32.7	40.8	55.2	49.7	44.8
	EU	43.2	57.2	47.4	44.4	47.6	51.0	35.9	46.3	50.7	43.1	53.3	48.6
	CIS	32.8	41.2	41.9	61.9	55.9	62.6	22.2	45.8	34.3	35.0	42.5	44.6
	Total	42.8	57.2	47.6	40.8	47.2	50.8	32.8	43.6	46.7	41.3	52.3	49.0
Share of parts in network exports to (in percent)	CEEC	56.0	60.1	49.1	42.9	36.1	43.4	13.7	33.8	43.2	49.1	52.7	46.9
	EU	38.4	50.1	56.3	74.0	41.3	23.4	23.6	41.5	44.8	39.5	46.2	43.8
	CIS	36.7	48.7	29.1	48.5	42.7	36.3	6.5	16.1	23.9	30.3	38.6	30.0
	Total	42.7	51.0	54.3	66.2	37.1	27.9	20.5	38.1	41.7	40.4	44.9	43.8
Horizontal trade specialization index	CEEC	0.92	0.99	0.91	0.86	0.89	0.97	0.92	0.98	0.98	0.91	0.98	0.93
	EU	0.78	0.99	0.92	0.53	0.93	0.74	0.42	0.41	0.34	0.86	0.95	0.80
	CIS	0.58	0.70	0.29	0.21	0.24	0.19	0.01	0.07	0.15	0.40	0.49	0.25

Source: based on world import data from UN COMTRADE Statistics.

times above their value in 1995. Its share in manufactured exports almost quadrupled over the 1995–2002 period. The value of IT exports in 2002 was two times higher than in 1999 and that of IT imports 2.8 times higher. Leaving aside dynamics, there are other signs suggesting the entry of CEEC-10-based firms into global IT networks and their growing specialization in the assembly of final IT products. Consider that the increase in import intensity from 211 in 1999 to 227 in 2002 has been first accompanied by a very fast growth in exports of both parts and final products and, second, this has been due to expanding imports of parts from the ROW. This is the only network with ROW firms supplying more products and parts than firms from the EU.

Another feature of the CEEC-10 IT trade is that firms from CEEC-10 appear to be increasingly specializing in processing or assembly operations of final IT products destined for EU consumers. Consider first that between 1995 and 2002 the share of final products in IT exports to the EU dramatically increased from 26% to 64%, while the share of parts in imports from the EU increased from 50% to 53%.

Second, the decline in 1999–2002 of a two-way IT trade with the EU as captured by the fall in the value of HST in 2002 as compared with that in 1999 points to the change in specialization profiles, with the EU specializing in parts and CEEC-10 in final products. The expansion in exports of final products has accompanied the increase in imports of parts. The EU has provided about half of all IT parts imported by CEEC-10 and took 78% of network exports and 65% of CEEC-10 network parts exports in 2002.

Turning to a 'sunset' network, i.e., furniture, it has three distinguishing features. First, as noted earlier, its overall economic weight has been on the decline, although its trade has almost kept pace with the growth in trade in manufactures, with its share only slightly declining in 1995–2002.

Second, the earlier reliance on furniture parts imported from the EU and other suppliers, which has been relatively low in comparison with other networks, has continued to fall. Import intensity fell overall from 40% in 1995 to 30% in 2002, with the import intensity of trade with the EU having had been responsible for this contraction. Its decline has been accompanied by the increase in the share of parts in total furniture network exports to the EU. The shift to parts in overall furniture network exports continued in trade with other markets as well indicating the growing presence of CEEC-10 firms in furniture supply chains.

Last but not least, intra-CEEC-10 trade in furniture has become more regionally oriented than that in any other network and its two-way intensity has remained very high, with the value of HST almost equal to unity in both 1999 and 2002.

It appears the CEEC-10 network firms have begun expanding beyond EU markets, although most of them probably operate through mostly EU-based networks of production and distribution. EU markets have driven trade across three networks since the start of transition in CEEC-10 and continues to do so. However, the 1999–2002 period has witnessed the reversal of trends observed before 1999. The share of the EU in CEEC-10 networks' exports and imports fell between 1999 and 2002. The only exception was CEEC-10 imports of automotive parts, which increased from 72% in 1995 to 76% in 1999 and 79% in 2002. This was not sufficient to compensate for the fall in other networks' imports of parts, as the share of the EU fell from 53% in 1999 to 49% in 2002. The contraction in the share of the EU in CEEC-10 total networks' exports was slightly steeper from 87% in 1999 to 79% in 2002 and in imports from 67% to 59%.

Distinguishing between parts and final products does not change the overall picture of the slight shift away from the EU, but it sheds light on distinctive geographical patterns within networks. Exports of motor vehicles to CEEC-10 and ROW have significantly increased—the share of the former increased 50% from 8% in 1999 to 12% in 2002 and of the latter from 10% to 14% (Table 4). It appears that MNCs use increasingly capacities established in CEEC-10 to manufacture for exports not only to the EU but also to other markets. This observation probably applies also to parts as well: the share of their sales to both CEEC-10 and the EU fell in total exports of automotive parts while that of the ROW significantly increased.[13]

Except for the automotive network, CEEC-10 producers in other networks appear to rely increasingly on parts provided by suppliers from CEEC-10 countries. Their share in both IT and furniture networks' imports significantly expanded between 1999 and 2002. More than one fourth of furniture parts and 6% of IT parts imported by CEEC-10 came from this source in 2002 up from 14% and 2% in 1999. One

[13] This may be due to a growing 'global reach' of firms operating in CEEC-10. Consider, for instance, that car-parts suppliers engaged in manufacturing in the Czech Republic represent 45% of the Top 100 European automotive component suppliers and 40% of the Top 100 World suppliers. These firms operate globally (USDS, 2003).

Table 4
Geographical patterns in CEEC-10 network trade in parts and final products in 1995, 1999 and 2002 (in percent)

		Share of CEEC-10 in				Share of the EU in				Share of the ROW in			
		Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports
		Parts		Final products		Parts		Final products		Parts		Final products	
Automotive	1995	19.7	11.9	11.6	7.0	57.7	78.9	62.0	73.1	22.6	9.2	26.4	19.9
	1999	10.6	10.5	7.3	8.0	81.8	79.7	83.2	72.6	7.6	9.8	9.5	19.4
	2002	8.5	9.7	10.5	12.0	79.0	83.2	75.6	79.1	12.5	7.1	13.9	8.9
IT	1995	8.3	4.2	21.7	5.1	72.6	73.9	49.9	68.8	19.1	21.9	28.4	26.1
	1999	4.1	2.1	4.3	4.1	87.7	70.3	73.6	80.7	8.2	27.6	22.1	15.2
	2002	9.7	5.5	4.9	9.1	65.3	63.1	83.1	71.8	25.0	31.4	12.0	19.1
Furniture	1995	2.9	6.4	4.6	15.8	90.0	87.0	75.0	76.3	7.1	6.6	20.4	7.9
	1999	4.7	14.1	5.6	19.6	90.6	80.0	78.8	74.8	4.7	5.9	15.6	5.6
	2002	7.8	26.9	7.3	29.6	86.0	66.2	75.6	63.8	6.2	6.9	17.1	6.6

Source: own calculations based on world import data from UN COMTRADE Statistics.

suspects that lower research and development content in furniture parts explains the difference between the intensity of 'regional CEEC' engagement. Whatever the reason, this change certainly indicates a healthy shift towards more complex and higher value-added activity in CEEC-10.

But this growth of importance intra-CEEC-10 network trade is not limited to parts but also extends to final products. The share of intra-CEEC-10 imports in furniture imports was 30% in 2002 and that in IT final imports increased from 4% in 1999 to 9% in 2002.

The IT network appears to be most outward-oriented, i.e., going beyond regional pan-European arrangements. The share of the ROW, both as suppliers and buyers, is significantly higher than in furniture or automotive networks. Trade in IT parts with ROW has grown faster than with the EU or intra-CEEC-10 trade, as the share of ROW increased both in CEEC-10 exports and imports. The parts of the 'information technology' networks had driven foreign trade of highly developed countries—exports of office machinery displayed the fastest annual growth of 15.9% over 1978–1995, followed by telecommunications growing at 11.5% over this period (Yeats, 1998). CEEC-10 appear to have hit the same path.

6. Variation within CEEC-10 in network trade: moving at the same direction but at a different pace

An interesting question concerns the variation among CEEC-10 in terms of participating in the new division of labor driven by production disintegration. The aggregate trade data say little about individual countries. Three countries–the Czech Republic, Hungary and Poland–have shaped CEEC-10 overall trade performance. Over the past decade, each of them has accounted for at least 20% of total CEEC-10 exports and imports and they jointly have been responsible for around two thirds of the total trade turnover. Czech Republic and Hungary have experienced the strongest growth in network trade over the 1995–2002 period, and their performance had hugely impacted CEEC-10 overall performance.

Yet, except for Bulgaria and Latvia, CEEC-10 have been moving in the same direction, albeit at a different pace. But even Bulgaria's and Latvia's networks' exports, despite the contraction in the share of network trade in manufactured exports, were in 2002 almost 50% above their value in 1999 (Table 5).

Table 5
Share of network exports and imports in manufactured (excluding chemicals) exports and imports in 1995, 1999 and 2002 and the change in value of network exports and imports

	Share in exports			Share in imports			Memo: value of network exports and imports			
	1995	1999	2002	1995	1999	2002	Index, 1999	Index, 2002	Index 1999	Index 2002
							1995=100	1999=100	1995=100	1999=100
Bulgaria	9.3	7.2	6.5	20.0	28.5	25.9	74	146	226	139
Czech R.	18.1	27.8	42.8	23.7	25.8	34.2	214	254	133	204
Estonia	31.7	35.2	36.1	32.5	29.6	30.7	197	162	150	157
Hungary	21.4	55.0	55.0	24.3	40.2	43.2	725	138	383	142
Latvia	17.9	12.6	13.5	25.4	27.2	27.7	90	146	197	143
Lithuania	22.4	19.6	28.1	27.0	23.6	29.9	122	273	138	214
Poland	21.2	29.6	35.1	22.5	32.5	30.6	187	187	252	112
Romania	13.8	12.5	15.3	15.2	16.5	19.7	107	207	138	210
Slovak R.	14.6	32.9	36.6	25.0	32.4	33.8	301	163	205	160
Slovenia	26.6	30.6	31.5	33.8	34.2	31.0	118	123	118	95

Source: UN COMTRADE Statistics.

The extent to which CEEC-10 have become integrated into global markets through networks varies considerably across networks. In order to capture the patterns of specialization among CEEC-10, we have calculated their respective ratio of a share in networks, exports of parts and goods and imports of parts to their respective shares in CEEC-10 total exports and imports of parts. This is an equivalent of an export specialization index, called thereafter a Regional Trade Specialization Index (RTCI).[14] Table 6 reports their values in 1995, 1999 and 2002.

In addition, in order to account for the possible use of parts in processing and assembling operations for domestic markets, we have calculated a similar index-ratio of a share in networks' parts imports to a country's share in CEEC-10 total imports.[15] As above, if the value is above unity, this may suggest revealed specialization in assembly and processing operations. The cases where the values of regional import specialization ratio are above unity while the values of RTSI below unity are marked in italic in Table 6. The discrepancy exists only for few cases: Poland in automotive network in 1999 and 2002, Hungary in furniture in 1995 and 2002, and Latvia and Lithuania both in 1995. Production for domestic use may explain the lack of revealed regional "advantage" of Hungary and Poland in respective networks. Weaknesses in trade statistics probably explain discrepancies for Latvia and Lithuania.

What is the respective countries' specialization within networks? Bulgaria is not part of the picture. But neither are Latvia, Lithuania and Romania. Romania used to specialize in furniture in 1995–1999 but no longer in 2002. So did Latvia and Lithuania in furniture.[16] Estonia lost its revealed regional advantage in IT products, but retained it in furniture in 1995, 1999 and 2002. The Czech Republic and Hungary specialize in both automotive and IT network trade, Slovakia in automotive products, and

[14] It differs from the ESI in two respects. First, RTCI measures country's specialization in CEEC-10 export offer rather than in a selected market. Second, it takes the sum of exports and imports of parts. The value of RTCI equal of above unity suggests specialization among CEEC-10 whereas the values below unity its absence, i.e., specialization in other groups of products.

[15] Depending on a network, parts account for between 40% and 60% of CEEC-10 aggregate network trade.

[16] Lithuania specializes in exports of furniture but its exports use little imported inputs. As a result, with the value of RTC is below unity, its engagement does not qualify as a network-type engagement.

Table 6
Values of regional trade specialization index for network trade in 1995, 1999 and 2002

	Automotive			IT-network			Furniture		
	1995	1999	2002	1995	1999	2002	1995	1999	2002
Bulgaria	0.48	0.50	0.43	0.48	0.44	0.38	0.27	0.33	0.40
Czech Republic	*1.22*	*1.12*	*1.34*	*1.28*	0.65	*1.29*	0.73	0.88	0.80
Estonia	*1.07*	0.41	0.52	*2.12*	*1.39*	0.98	*1.19*	*1.04*	*1.07*
Hungary	0.83	*1.37*	*1.17*	*1.14*	*2.22*	*2.04*	*0.60*	0.65	*0.60*
Latvia	0.59	0.28	0.31	0.55	0.37	0.29	*0.71*	0.67	0.73
Lithuania	*1.21*	0.44	0.68	1.37	0.55	0.47	*0.77*	0.67	0.81
Poland	0.89	*0.93*	*0.96*	0.96	0.90	0.67	*1.38*	*1.43*	*1.50*
Romania	0.50	0.22	0.34	0.60	0.56	0.56	*1.65*	*1.07*	0.94
Slovak Republic	0.83	*1.32*	*1.25*	0.82	0.55	0.46	0.62	0.56	0.89
Slovenia	*2.03*	*1.32*	*1.07*	0.74	0.48	0.37	*1.51*	*1.79*	*1.75*

In italic are RTSI for which a country has a revealed specialization in imports of parts.
Source: own calculations based on the UN COMTRADE database.

Slovenia in both automotive and furniture networks. So does Poland, albeit–as mentioned above–with a caveat. Automotive firms operating in Poland appear to be integral parts of global automotive networks, but final products (and possibly parts as well) are sold domestically. Given its relatively large internal market, this is not surprising.

Engagement in total network trade of two countries–Czech Republic and Hungary–stands out pointing to the importance of FDI and geographical location. Hungary experienced the largest increase in network-related exports and imports in 1995–1999, with its share in CEEC-10 trade rising from 14% to 32%. It was also the largest recipient of FDI per capita among CEEC-10 each year over 1990–1996 except in 1994. Czech spectacular rise came in 1999–2002, with its share in CEEC-10 networks' exports rising from 18% to 27% mainly thanks to the spectacular rise of IT network exports.[17] Czech Republic was the largest recipient of FDI per capita among CEEC-10 in 1999–2001 and the second largest after Slovenia in 2002.

7. Conclusion

Network trade has been the driving force of CEEC-10 integration into global markets. The nature of this trade has undergone four significant changes. First, there has been a shift from the dominance of simple assembly operations to processing and local production of parts. The shift appears to have fully taken place in the furniture and automotive networks and is underway in the IT network. Second, the CEEC-10 network firms, operating through mostly EU-based networks of production and distribution, have begun expanding beyond EU markets. Third, by 1999 CEEC-10 has moved from the status of a net importer to that of a net exporter of network products and parts. Last but not least, while automotive

[17] The value of Czech IT exports increased 35 times from US$80 million in 1996 to US$2.5 billion in 2002 with the value of imports of parts and components tripling to US$1.4 billion. Hungarian exports of IT products increased in terms value 10 fold between 1995 and 1999.

network still towers over other networks accounting for around one-fifth of CEEC-10 manufactured exports excluding chemicals, the IT network trade is increasingly challenging its dominant position.

While we have not examined the link between the FDI and network trade, their positive impact seems to be ubiquitous. FDI inflows have been behind network trade in all CEEC-10 economies. Two largest recipients–the Czech Republic and Hungary–have been also the best performers. When making generalizations, one should take into account geographical proximity and the EU accession. The latter in particular has contributed to liberalization and, thereby, to attracting efficiency- and EU market access-seeking FDI.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.iref.2004.12.008.

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