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Deindustrialisation and reindustrialisation patterns in V4 countries – industry 4.0 as a way forward?

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ABSTRACT

This contribution aims at: (i) mapping the deindustrialisation and reindustrialisation tendencies over the economic history of the Visegrad countries (Czechia, Hungary, Poland and Slovakia, henceforth, V4) since 1918 to 2022 by creating a cadastre of applied policy measures and evaluating their effectiveness; (ii) exploring whether the economic mentality of V4 countries allows current reindustrialisation policies to be effectively geared towards Industry 4.0? In order to understand the key features of industrialisation process in the V4s, a broad literature overview places emphasis on the economic characteristics of the region. It is also important to analyse the correlation between industrial policy in the XXth century and the new tendencies at the turn of the millennium by examining whether the current industrial policy mixes are serving economic resilience or grounding critical instability as a form of middle-income trap. Finally, it draws lessons for general- and V4-specific industrial policy in time of Industry 4.0.

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Industrialisation; industrial policy; Industry 4.0; V4 countries; development

1. Introduction

In the light of the past 30–40 years of developed countries, many suspected that industrial policy had been banished from the map of economic governance. Being in the throes of polycrisis (e.g. tipping inflation, COVID-19, worsening productivity dynamics, gaping inequalities, demographic problems, natural disasters and climate change, sovereign debt crisis, migration crisis, war etc.) economists and policy practitioners had to realise that the exploitation of the potential benefits of digitalisation and Industry 4.0 (Kovacs, 2018) calls for dedicated industrial policies. However, today's industrial policy can be built on better foundations if we know its past, even just in relation to a historical region.

In the last three decades, the main objective of economic history research was to compare the Western and Eastern European countries in terms of their economic

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performance. Most of these studies gave an overview about the development of certain sectors, such as agriculture, industry, and trade by highlighting the strongholds and weaknesses of each' country's national economy. Industrialisation as the main driver of technological renewal and policy measures affecting its effectiveness in the Visegrad countries (Czechia, Hungary, Poland and Slovakia) were not among the key objectives of research activities. From a bird's eye view, this article tries to analyse the impacts of industrialisation/deindustrialisation process in V4 countries by placing emphasis on the outcomes of successful industrial policy strategies.

As far as our methodological considerations are concerned, the article builds a verbal model based on quantitative and qualitative data and information obtained from publicly available databases (e.g. CompNet, UNIDO, Eurostat, OECD, World Bank, etc.) and indexes (e.g. UNIDO Competitive Industrial Performance Index, Global Index of Economic Mentality) by relying on a systemic literature review. Due to space limitations, it was not our aim to provide a detailed historical overview of all the specifics but to give a bird's eye view. As for the definitions of the key terms, although industrial policy is often understood as a mix of policies aiming at stimulating the growth and competitiveness of manufacturing industry, our article refers to industrial policy as a cavalcade of tools and regulations that are to foster (or to prevent) structural changes when qualitatively new socio-economic systemic configuration emerges. It considers deindustrialisation as the organic process of which along the industry-weighted economy is becoming ever-more service-oriented. By reindustrialisation the article means the intention of as well as the actions initiated by governments through which the weight of manufacturing in the economy begins to grow again. Of course, by now, the world economy and the industrial intertwining within it have become so interconnected and complex whereby disentangling the effects of industrial policy measures has become ever more cumbersome. Still, a kind of picture can be given of large patterns and co-movements at the level of policy intentions and macro-outcomes.

The article is organised as follows. Section 2 deciphers the economic history of industrialisation patterns in V4s since 1918 to 2022.[1] To this end, Section 2.1 looks at the three Central and Eastern European countries, Czechoslovakia, Hungary, and Poland during the period 1918–1945, Section 2.2 addresses the period of 1945–1989. Section 2.3 and 2.4 highlight the consequences of the deindustrialisation process after the regime change of the early 1990s and the beginning of a new wave of reindustrialisation after 2010. In order to better understand the features of these processes, Section 3 offers a policy cadastre of industrial upgrading in all four countries as an important added value to the current literature, while Section 4 explores whether the current approaches to Industry 4.0 chosen (bottom-up, top-down) emerged in an autochthonous way by examining whether V4s' socio-economic and path-dependent mentality is suitable for the bottom-up and thus more sustainable development of Industry 4.0 or rather just to grounding critical instability. Section 5 concludes with some important lessons for industrial policy in general and for V4s alike.

2. Economic history of industrialisation patterns in V4

2.1. Industrialisation in Czechoslovakia, Hungary and Poland (1918–1945)

The dismemberment of previous Empires in Central and Eastern Europe (Tsarist Russia and the Austro-Hungarian Monarchy) accompanied by post-war settlements and frontier changes in Central and Eastern Europe after World War I, changed substantially the conditions of industrial development in the region. The majority of countries suffered from a general scarcity of basic commodities and raw materials. In the autumn of 1918, the dissolution of the Dual Monarchy, as a large and an efficient economic unit further exacerbated post-war difficulties because it severely limited access to markets and resources for industrial firms both within and beyond the 1914 borders (Teichova, 1985, pp. 222–227).

As a result of Paris Peace Conference, six new entities were created in Central and Eastern Europe. Border changes also exerted influence on industrial development. Another major problem was that the length of customs frontiers increased to 6–7,000 km. With the dissolution of the former Habsburg Empire, seven new customs areas emerged in the region. Between 1919 and 1924, the Central and Eastern European countries withdrew into isolation and most of them adopted prohibitive measures in trade (customs tariffs) in order to protect their domestic markets (Szávai, 2009a, p. 114).

Aldcroft and Morewood analyse the key features of industrial strategies pursued by each country in the region between 1918 and 1939. They stress that economic modernisation programmes gave priority to industry at the expense of agriculture throughout the whole period. Industrial development in Czechoslovakia, Hungary and Poland was driven by the force of nationalism. The main policies adopted in the years 1918–1939 may be classified as follows: protection and trade regulation; state assistance in various forms and increasing state intervention. Industry was also supported with many privileges and incentives, including exemption from taxes, cheap factory sites, subsidised railway rates, maximum fuel prices, exemption from customs duties on imported raw materials and equipment, and specific assistance was provided to encourage the development of certain sectors, especially light industrial branches (e.g. textiles) (Aldcroft & Morewood, 1995a, pp. 29–36). The main problem was that industry did not keep pace with the technical changes and methods of the modern era. Apart from Czechoslovakia, the region's industry was hardly affected by Western developments in business organisation, rationalisation, and new methods of production (Aldcroft & Morewood, 1995b, pp. 76–82).

Thanks to the successful economic stabilisation in the mid-1920s, all three countries experienced a quick recovery up until 1929. Estimates for the generation of national product in industry show that industrial output grew by 32% in Czechoslovakia and by 22% in Hungary between 1925 and 1929. In the years 1926–1928, Polish industry also expanded very rapidly by around 40%; however, industrial output in 1929 reached only 91% of the pre-war level (Radice, 1985).

The vigorous growth of industrial production came to halt in all three countries during the Great Depression (1929–1933). In the most depressed years, 1932–1933, industrial output declined by 42% in Poland, 30% in Czechoslovakia and 5% in Hungary (e.g. the index of manufacturing output between 1929 and 1939 shrunk by 2.9% in

Table 1. Indices of manufacturing output, 1929–39 (1913 = 100).

	1929	1938	% change
Czechoslovakia	140	136	−2.9
Hungary	112	128	14.3
Poland	86	105	22.0

Source: Berend and Ranki (1974), pp. 299–300.

Czechoslovakia, see Table 1). The most depressed branches of industry were metals and engineering, and the least affected foodstuffs and chemicals (Radice, 1985, p. 50).

To ease economic recovery, industrial policy was driven by major investment programmes launched by the Hungarian and Polish governments in the second half of the 1930s. In Hungary, the Győr Programme was launched on 12 March 1938, which wanted to invest 1,000 million pengő in armaments. Its main objective was to modernise the armed forces and military infrastructure in the country. The Five-Year Rearmament Programme resulted in an economic boom before the outbreak of World War II. In 1939, the volume of industrial production was 22% above the 1938 level (Dombrady et al., 2016, p. 143). Military considerations played crucial role by adopting the Four-Year Investment Plan in Poland between 1936 and 1940. It focused on establishing the 'Central Industrial Region', the triangle bounded by Warsaw, Cracow and Lvov) as major industrial region concentrating on the development of heavy industry and military equipment away from the country's frontiers. The ambitious project absorbed 50% of public investments in 1939 and amounted to 2,000 million złoty (Ranki & Tomaszewski, 1986, pp. 41–48).

Despite the efforts to foster industrial development in all three countries, structural modernisation did not take place even at the end of the 1930s. Based on literature overview there were several constraints on industrial expansion. According to Aldcroft and Morewood, state policy tended to support unproductive and non-economic investments during the interwar years. They argue that the majority of investments went into residential constructions and later to defence-related industrial activities. Additionally, state's financial resources were limited and could not replace the role of foreign capital when international money markets dried up in the 1930s. Finally, the direction of investment within the industry itself could not promote rapid development. State incentives and assistance focused on developing light industrial branches, such as textiles, food processing, where the growth of potential was low, whereas insufficient attention was given to the most modern dynamic sectors (e.g. chemicals, telecommunications and the motor industry). Import substitution could be achieved in textiles due to the low domestic purchasing power and the shortage of capital, which coupled with unskilled labour force. Protection of the domestic market favoured to build up a self-sufficient economy in the least cost activities. Despite the greater encouragement given to heavy industry in the second half of the 1930s, markets for the products were limited by the depth of demand at home, and the lack of competitive advantage on the international market. Industrial structure remained static, and all three countries preserved their traditional dual structures, with many small-scale inefficient firms competing with a few modern large-scale enterprises (Aldcroft & Morewood, 1995c, pp. 181–187).

Other authors argue the general shortage of skilled labour, which was a crucial factor limiting manufacturing growth in a period, when European industry still relied on craft

production methods (Teichova, 1988, pp. 21–22). Eckstein emphasised the decline in capital investment, especially after 1929, which increased the technological gap vis-à-vis Western Europe (Eckstein, 1955, p. 220). Whereas Western Europe was characterised by a structural modernisation in their economies accompanied by technological renewal during the interwar period, Central and Eastern Europe preserved its traditional industrial branches. First, industrial development could not absorb the excess of rural population in the agriculture; therefore, the occupational distribution of the labour force remained almost unchanged in all three countries. Second, due to the low level of domestic accumulation coupled with the general shortage of capital, the agrarian sector was not able to generate substantial income surplus to the industry, which would have served as a domestic demand for its further expansion. Third, as a result of budget constraints, domestic demand for capital and consumer goods rose only modestly during the interwar years. Finally, the autarkic tendencies pursued by each country of the region together with the lack of adjustment to the changed circumstances in the world economy contributed to the backwardness of Central and Eastern Europe (Berend & Ranki, 1976, pp. 435–439).

In the years 1938–1945, Central and Eastern Europe became a part of the German Grossraumwirtschaft (large area economy). Practically, the whole region was tied to the Third Reich by signing bilateral trade agreements, which served the war needs of the Third Reich (Radice, 1986, pp. 299–308). The Nazi war economy gave a further boost to industrial expansion. Consequently, wartime industrial expansion was characterised by placing emphasis on the development of mining and metal industries as well as machinery and armaments.

By the end of the Second World War, Hungary and Poland suffered serious losses both in national wealth and human lives. The majority of new industrial capacities, built up during the war years, were destroyed completely, although Czechoslovakia, especially the Czech areas were less affected by immediate war losses (Berend & Ranki, 1977, pp. -159–161).

2.2. Industrialisation á la command economies (1945–1989)

An important factor that determined the fate of Central and Eastern Europe between 1945 and 1989 was that the whole region was subordinated to the Soviet empire. The USSR also dismantled complete factories and industrial equipment from the defeated countries as war booty, which hindered the post-war economic recovery. Besides the acute shortage of labour force, industrial plants had to face a general scarcity of raw materials, components, and repair facilities, which hindered the shift from war to peacetime production. As a result of these factors, in the spring of 1945 industrial output declined by about two-thirds in Hungary and dropped to 19% in Poland and fell by 50% in Czechoslovakia of the pre-war level (Berend & Ranki, 1977, p. 160; Landau & Tomaszewski, 1985, p. 197; Teichova, 1988, p. 117).

To mitigate the harmful impacts of economic dislocations and ease recovery, the state assumed a pivotal role in the immediate post-war years. Klein et al. stress that all three countries pursued autarkic industrialisation policies with extensive planning (Klein et al., 2017, p. 79). In the course of a relatively short period (1945–1948), the elements of mixed economies were abolished completely. By the end of 1948 all industrial assets were

nationalised, and the institutional framework of a centrally planned economy was also built up. In parallel with the nationalisation process, the Two-Year Plan in Czechoslovakia (1946–1948) and the Three-Year Plans both in Hungary and Poland (1947–1949) contributed to switch to a Soviet command economy (Domonkos, 2019, pp. 68–95).

At the end of the 1940s, all three countries copied obediently the Soviet type of forced industrialisation, which encompassed the massive diversion of resources from agriculture to industry. As Aldcroft and Morewood rightly note that the initiation of the first Five-Year Plans (in the Polish case a further year was added) served the rapid development of heavy industry (sector A), which enjoyed priority over light consumer industries (sector B). The bulk of investments concentrated on mining, metallurgy, and engineering (Aldcroft & Morewood, 1995d, p. 107). Other sectors, such as agriculture, light industry and services were neglected completely.

Due to forced industrialisation, the traditionally low rates of capital accumulation, which were about 5–6% un the interwar period, thus achieved 22–30% in the first half of the 1950s. By annihilating the market, the countries of Central and Eastern Europe entered a period of 'primitive accumulation' (Berend, 1996, p. 78).

The problems of the command economy with its rigid steering mechanism became clearly visible in mid-1950s; therefore, the highly irrational targets of investment plans had to revise completely. At the beginning of the 1960s, there was generally no rural labour reservoir, which was essential for industry to achieve fast economic growth. Machinery and equipment had become technologically backward, adversely impacting production levels. There was the recognition that extensive growth needed to be replaced by intensive factors of growth to utilise inputs more efficiently. Improving production methods through technological innovation, higher-quality management and organisation to minimise waste were the most important elements of economic reforms, which strived to improve productivity and efficiency of the centrally planned economy (Aldcroft & Morewood, 1995d, pp. 113–114). Although enterprises were given greater autonomy in carrying out investments, and compulsory targets were not broken down at the micro level, large state-owned monopolies ignored market signals. They were not pushed to compete by the market. The losses of these enterprises were compensated by the state.

According to Klein et al. from 1950s onwards Central and Eastern Europe was characterised by a fast economic growth, which was based on forced industrialisation. Industrial output recovered to pre-1939 levels by 1950 and expanded rapidly up to the mid-1970s. In Czechoslovakia, Hungary and Poland, industrial value added measured in constant prices doubled during the 1950s and tripled over the period 1950–1970. Industrialisation reached its peak in the 1970s, when industry and construction employed over 40% of the workforce, whereas the proportion of agricultural employment was less than half compared to the 1945 level. In all three countries, industry remained the largest sector of the economy until the end of the 1980s (Klein et al., 2017, p. 80).

The year 1973 was a watershed in the world economy, which forced the most developed countries to restructure their economies and adjust them to the challenges brought by the new wave of technological revolution. As Berend rightly notes that the depression of the mid-1970s was a structural crisis. Whereas the leading Western economies responded adequately to the challenges brought by the depression of the 1970s by phasing out energy-wasteful industrial branches, including iron and metallurgy and

Table 2. Gross industrial output in Czechoslovakia, Hungary, and Poland (1976–1980 and 1981–1985, %).

	1976–1980	1981–1985
Czechoslovakia	4.7	2.7
Hungary	3.4	2.2
Poland	4.7	0.4

gross value of output at constant prices
Source: United Nations (1987) p. 113.

placed emphasis on innovation and technological renewal, Central and Eastern Europe could not keep up with the revolutionary advanced technologies. Contrary to the Western economies, Czechoslovakia, Hungary, and Poland preserved their old-fashioned technologies and economic structures, based on heavy industrial branches, such as coal mining, iron production and metallurgy (Berend, 2009). The rigid and bureaucratic command economy was driven by forced industrialisation, but innovation and technological development were completely neglected. Because 'unlimited' and unutilised labour reserves were depleted in the 1960s, therefore, the policy of extensive import-substituting industrialisation was not sustainable (Berend, 1996).

The energy shocks in 1973 and 1979 exerted negative influences on the industrial development of the region. The main problem was that all three countries did not respond adequately to the oil crisis because instead of applying energy-saving methods, the majority of investments were concentrated on heavy industrial branches, which had to be fed largely by imports. Practically, all three countries were not able to build-up modern export sectors. State socialist governments reacted belatedly to the changed international economic environment in the 1970s (Domonkos, 2023).

The turn of the 1970s to 1980s were devastating for Hungary and Poland. To maintain fast-growth policy, the Hungarian and Polish governments did not hesitate to seek credits from Western countries and banks. The short-sighted policy pursued by communist leaderships led to dramatic consequences because increasing balance of payments deficits could be offset by obtaining new loans. This process resulted in severe indebtedness in both countries; however, Czechoslovakia was an exception because it did not borrow extensively during the 1970s. Servicing debt seriously hindered any adjustment and significantly weakened investment possibilities (Domonkos, 2023).

Table 2 indicates that in the 1980s, gross industrial output started to slow down in all three countries of the region. Since the rigid and bureaucratic mechanisms of the command economy was not overhauled and any move towards modernising obsolete production structure was postponed, the technological gap further increased between the three countries and Western Europe. Austerity, introduced both in Hungary and Poland in the 1980s, did not promote the structural renewal of old-fashioned industrial branches. The international competitiveness of the Czechoslovak industry also deteriorated, which coupled with declining growth rates and productivity (Csaba, 1982, p. 121).

By the end of 1989, the deepening structural crisis was accompanied by internal and external disequilibrium. All these factors undermined the fast-growth industrialisation strategies of the command economies and finally contributed to the collapse of state socialism in Central and Eastern Europe.

2.3. Encoded deindustrialisation (1990–2010)

After the decades of socialism proving to navigate towards a dead end in terms of real and, more importantly, sustainable socio-economic development; the regime changes of the early 1990s in the V4 countries paved the way for a potentially fruitful and long-standing democratic development that breeds reasonable capitalist modernisation. That time coincided with the emergence of a new techno-economic paradigm in the developed economies of Europe, namely that of the rise of the new information and telecommunication-based (ICT) and service sector-oriented economic development path by resulting in knowledge economies. In other words, by the time the Polish socialist economist, a member of the central committee of the communist Polish United Workers' Party, Oskar Lange could have been right, the socialist system had gone through an implosion due to its inherent problems.[2]

As regards industrial policy engineering, V4 countries' economic governances realised that the pushed industrialisation was going nowhere. After 1990, two intertwined tendencies were in tandem: 1) encoded deindustrialisation; 2) softened industrial policy with broadened macrotargets. On the one hand, with the ICT revolution of the early 1970s (Kovacs, 2011; Perez, 2010), services started to contribute ever more to economic growth, as compared to that of the manufacturing sector in both developed and developing countries, by representing a sort of encoded deindustrialisation across the board. This trend did also reach Visegrad countries.[3] On the other hand, after the regime changes, post-socialist V4 countries started to be inclined with the idea of supporting broad-based transformative forces by cultivating competitiveness and employment via softened and more horizontal industrial policies (including various privatisation methods resulting in different patterns of demand for R&D and innovation in V4 countries).[4]

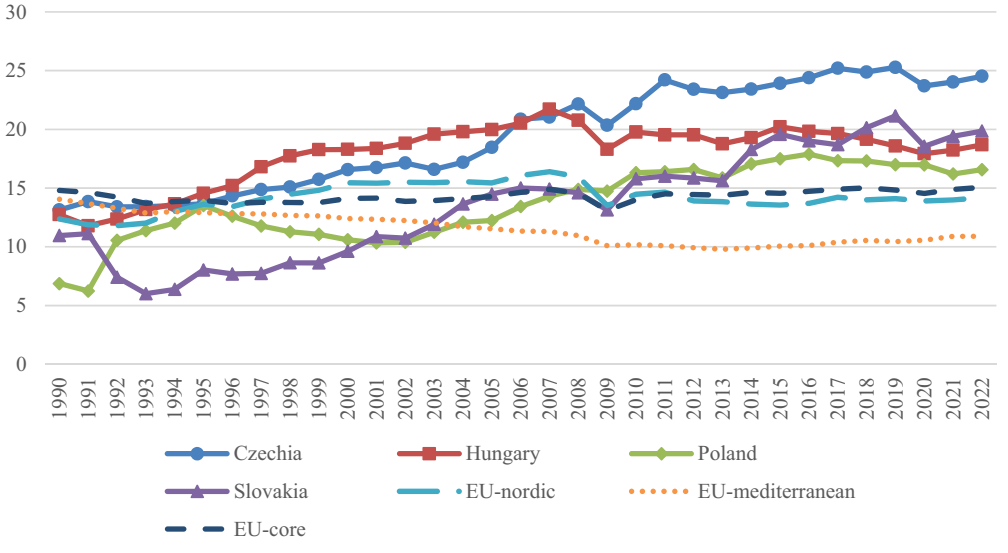

Figure 1. Manufacturing value added (% of GDP, 1990–2022). Note: EU-nordic countries consist of Denmark, Sweden and Finland; EU-core countries are Germany, France, the Netherlands and Austria; while EU-mediterranean countries cover Portugal, Italy, Spain, Greece and Cyprus. Source: UNIDO, Competitive Industrial Performance Index.

• **Czechia**: On the one hand, and despite being a traditionally more industrialised economy relative to other V4 countries[5] (i.e. in 1990, the manufacturing value added in terms of GDP % was close to that of the Nordic EU countries and was just slightly below that of the average of the EU-core countries, what is more, since 1995, the Czechian values have been being well beyond even the EU-core ones, see Figure 1), the Czechian employment in services sector within the total employment soared mainly after 1992 by growing up until the 2008 crisis (was 46.5% in 1992, 55% in 2007).[6]

Another catalysing force behind the rise of services sector was the fact that the government started to prefer subsidising job creation in regions affected heavily by the transformation (i.e. suppression of mining activities in regions like Ostrava, Karviná, Frýdek Místek etc).[7] As a corollary, during the so-called 'Czechian miracle', a period between 1990 and 1996, unemployment remained low by cementing the social trust necessitated by further economic policy changes later on. Thus, the Czechian industrial policy was subsidy-oriented in a more horizontal fashion[8] with the key priorities of supporting businesses in industry and industrial services (e.g. offering training programmes for SMEs to integrate into supplier networks in electronics and automotive areas[9]); restructuring of the industrial production base; increasing the competitiveness of industrial production; and developing human resources. It took a few years after the introduction of an excessively generous investment scheme for greenfield international investors to put the Czechian industrial performance on an ameliorating trend by closing the gap with Hungary and even transcending that level from the midst of 2000s. At the same time, the Czech industrial policy was also pervaded by conscious selectiveness[10] either in a form of creating industrial zones (which policy measure was abandoned by 2010; however, by magnetising a large number of firms, this policy tool contributed to the reduction of unemployment thereafter[11]) or when building on and promoting the further development of existing automotive industry via foreign capital involvement.[12]

• **Hungary**: The Hungarian industrial policy was formed in the crossfire of two processes: the impact of inherited industrial (non-competitive) structures resulting in path-dependent development had to be dealt with together with the spatial shaping effect of inflowing foreign direct investments (FDI). To the latter, Hungary attracted one of the highest volumes of FDI among V4s.[13] Its industrial policy (led by the Ministry of Industry and Trade in the early 1990s, then by the Ministry of Industry, Trade and Tourism until 1998) focused on dismantling large corporate structure, supporting firms' modernisation and R&D activities and related investments, it also served the objective of opening up the country via stabilisation, liberalisation, privatisation by making the country more and more popular for foreign capital. By 1997, foreign capital accounted 33% of the Hungarian GDP, by 2007, that number rose to 52%, while the Czechian (48%), Slovakian (32%) and the Polish (25%) were lower.[14] In this way, the FDI-led industrial investments counterbalanced the transformation crisis as the manufacturing value added exceeded even that of the Czechian values essentially until the 2008 turmoil (*Figure X*).[15] Deindustrialisation as a form of expanding service orientation did also start after the regime change since the employment in services within the total employment rose from 40% to 45% of 1990 over 65% by 2010. What is more, however, that type of reindustrialisation tendency seemed to have suffered from a sort of runaway phenomena since an FDI-dependent growth model emerged proving to be a Janus-faced process (i.e. FDI concentrated merely in automotive sector [Mercedes, Audi] just like in Czechia [Volkswagen] and Slovakia [KIA]).[16] After 2010,

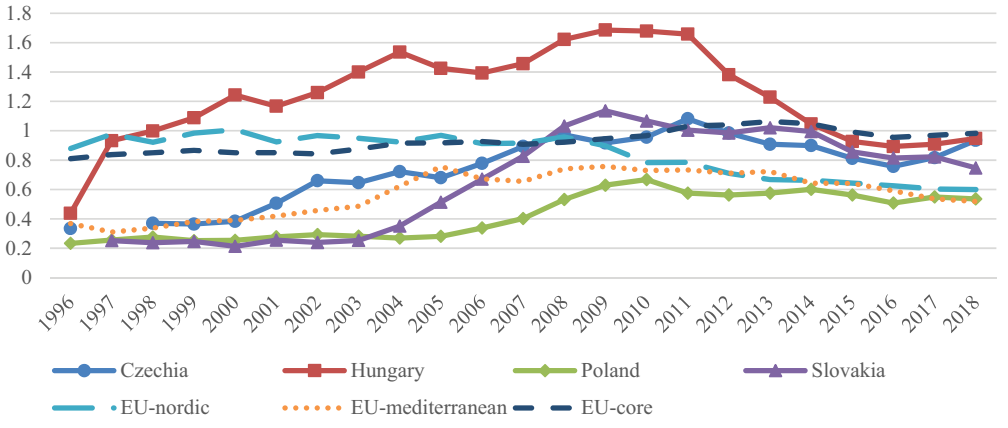

Figure 2. Revealed comparative advantage index of high-tech industries exports. Note: The Revealed Comparative Advantage (RCA) index measures the importance of a sector in the export bundle of a country with respect to the importance of that sector in worldwide export flows. Following the OECD classification high-technology is referred to industries such as aircraft, computing machinery, communication equipment. Source: ComProd database from CompNet (2024).

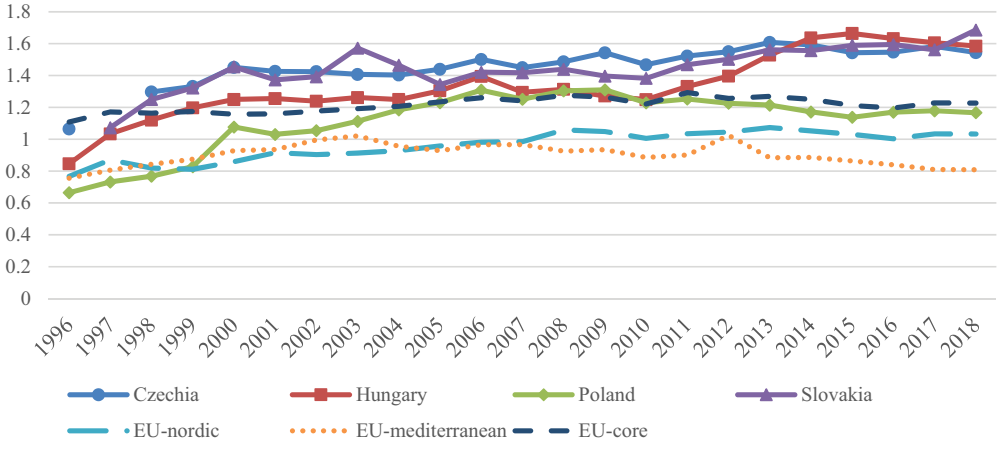

Figure 3. Revealed comparative advantage index of medium high-tech exports. Note: The Revealed Comparative Advantage (RCA) index measures the importance of a sector in the export bundle of a country with respect to the importance of that sector in worldwide export flows. Following the OECD classification medium–high technology is referred to industries such as electrical machinery, motor vehicles and chemicals. Source: ComProd database from CompNet (2024).

foreign capital started to fly away to a larger extent than in Czechia or Slovakia by lessening the technology content of the Hungarian export (see Figure 2).[17] It implies that the Hungarian industrial policy was preferring mainly multinationals while leaving behind the domestic middle (SMEs) ones to become more competitive via innovating as well as producing more and more medium high-tech exports (Figure 3). Export-oriented but at the same time mainly one-sided FDI-driven growth (i.e. as Figure 4 depicts, relative export density indicator became ever more higher after 2010 by implying relatively larger

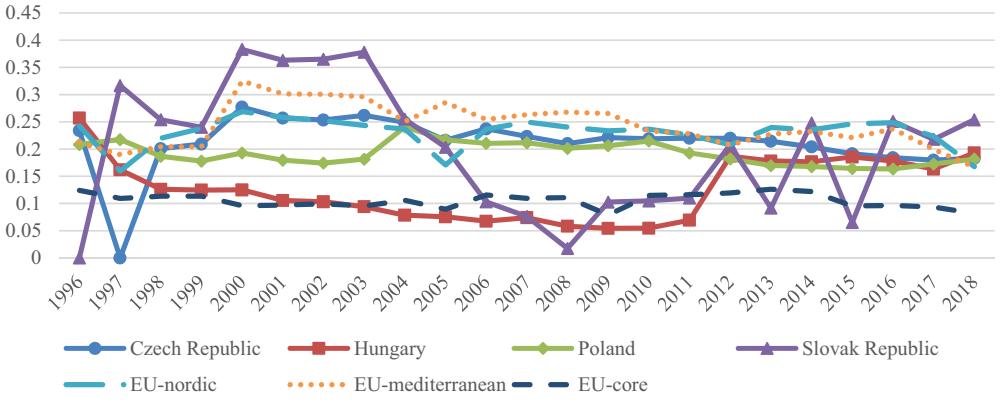

Figure 4. Relative export density. Note: relative export density is a networked-based indicator for the relative specialisation of a country's exports. A country's specialisation on the single-product level, defined as the export share of this product, is compared to the specialisation of the exporter' s trade partners and competitors, where the latter are defined as a trade partner's third-party import and export partners. Source: ComProd database from CompNet.

concentration as a way it did in Slovakia as well) paradigm with all its shortcomings (e.g. it engenders the lack of a critical mass of strong and internationally highly competitive domestic companies that affects negatively even the service sector's outlooks, siphons away agile workers from other sectors, conserves low-wages based competitiveness, etc.) represents an encoded critical instability by grounding the middle-income trap phenomena based on low level of industrial as well as services sophistication. The potential of knowledge-based industries (such as pharmaceutical, health biotechnology, new materials, etc.) and that of knowledge-based services is relatively low by feeding back to the middle-income trap.[18]

• **Poland**: At the dawn of the economic transformation of the early 1990s, the Polish economic model was still centred on agriculture, i.e. its manufacturing value added was low relative to other V4s (see Figure 1). If one takes into account that between 1991 and 2010, the share of workers in agriculture within the total employment decreased from 25% to 13% (but in the early 2020s it was still 4–5% points higher than in other V4 countries), Polish industrial policy tried to pursue some co-ordination with the aim at modernising certain industries. However, the fact that its manufacturing value added started to diverge from the V4 trajectory with 1995 until 2010 suggests that the industrial policy toolkit and narrative were sometimes rather ill-based and impromptu (i.e. industrial policymakers announced the sectors seeming to be promising without dedicating financial backing to their development or pushing the modernisation of non-competitive sectors like coal mining).[19] The Polish industrial policy mix encompassed tax allowances for foreign companies like FIAT, while was geared towards the neoliberal fashion of structural change (i.e. eliminating a number of subsidies as well as tax exemptions, privatisation of state-owned enterprises, regulating the financial sector to pursue prudent credit offerings, supporting SMEs etc.).[20] What is more, since it was attentive to spatial discrepancies being further aggravated by restructuring, it contributed to the creation of Special Economic Zones in 1994 for regions suffering the most to attract investors.[21] Still,

a more diversified economic growth pattern could emerge due to the inflowing FDI, which was the highest volume among V4s, not preferring primarily the manufacturing sector but mainly services (Kornecki, 2006). Deindustrialisation via servitisation took place along which the share of workers in services (within total employment) rose from 42% of 1991 to 56% of 2010. Consequently, industrial development was not pervaded by ever more impressive productivity increases and the export performance was conserved at by far the lowest level among V4 countries (e.g. see the RCA index of high-tech and medium high-tech exports, Figures 2 and 3). Let us add immediately that (i) with the benefit of hindsight, the moderated industrial development being coupled with large internal market acted as a solid driver of surpassing growth rates (i.e. in 1991–2008, the average annual real GDP growth rate was 4.6%) by leading to the doubling of the Polish GDP over 25 years from the regime change; (ii) such more diversified growth model did not come with more even distribution of wealth, on the contrary, even though Poland rationalised its regional institutional architecture (i.e. giving more autonomy to regions) the high degree of concentration and anti-rural nature of the inflowing foreign direct capital was still observable (e.g. North-East area was preferred over eastern districts, such as Mazowieckie area, that have been suffering from lower investment, lower income and less opportunity for sustained employment).[22] Still, the international competitiveness of the Polish industry was on an improving trend from the mid of 1990s to 2010, while the Hungarian inflexion point (turning onto a decline) came sooner with 2008 (Figure 5).

- **Slovakia**: After the regime change, the Slovak economy was suffering from the inherited burdens of the earlier era's industrial approach (i.e. interventionist governmental activity with the aim at boosting certain sectors via financial support to selected companies), while efforts were also made to follow the footsteps of the European Union's industrial policy.[23] Economic restructuring took place meaning that a sort of deindustrialisation happened, mainly in rural areas, while workers were ever more absorbed by the expanding services sector (or manufacturing sector going through 'servitization',[24] i.e. adding services to product portfolios) (e.g. the share of employment in services within total employment increased by nearly a third from the value of 46.5% of

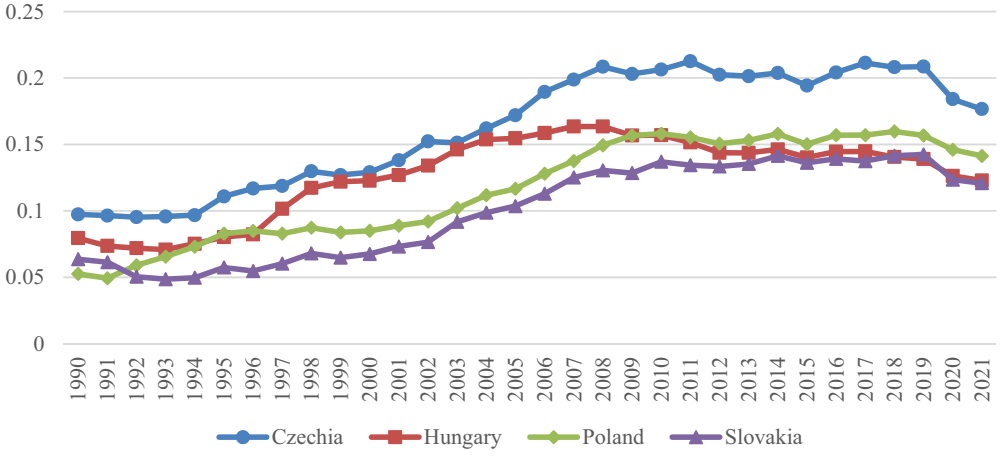

Figure 5. Competitive industrial performance index (1990–2021). Source: UNIDO (2023).

1990 to 58.5% of 2010 whereby services value added in percentage of GDP grew up to 60%). Unfortunately, an unbalanced development path was already in the cards due to historical socio-economic configuration by resulting in increasing wealth and income inequalities and the emergence of 'culture of dependence' from the welfare state.[25] After the regime change and the implemented shock therapy, the Slovak economic policy engineering based the country's growth concept on corruption and crony capitalism (i.e. questionable privatisation decisions; supporting industry at the expense of external indebtedness, etc.) whereby the level of inflowing foreign capital between 1994 and 1998, as compared to Hungary, was reluctant up until the consolidation era led by economic reforms of the early 2000s. Still, the Slovakian industrial policy was equipped with the idea of remaining implicit thereby industrial economic restructuring resulted in relatively more equal spatial development as compared to other V4 countries since it emphasised competitiveness-enhancement rather than sheer industrial development (i.e. GINI remained one of the lowest ones among V4 countries[26]; the number of small industrial companies rose while the share of the larger ones declined by implying that the Slovak industrial policy focused on turning towards smaller players especially during the 2000s).[27] What is more, as it is discernible on Figure 4, the Slovak economic transformation resulted in an improving relative export density up until the early 2010s, then it was propped up to heights that are typical for the Mediterranean (peripheral) countries (i.e. Slovakia become the stronghold of automotive sector via the presence of VW, PSA, Kia, Jaguar-Land Rover).[28] It indicates that, just like in case of Hungary, the Slovakian industrial performance was not dominated by a socio-economic mentality that would have cultivated a healthier export diversification strategy, so its manufacturing activities tended to avoid elevated levels of sophistication.

After the socialist period – which was characterised by the *pattern that insufficient capital endowment had to be offset by overburdening the state in embarking on forced and ultimately internationally uncompetitive industrialisation, which was compounded by non-negligible shortage of skilled labour* (especially in Hungary and Poland) – in the period 1990–2010, V4 industrial policies were shaped by and large the *entrenched neoliberalism*[29] applied. The course of transformation put V4 countries on an *inertia path* in the sense that it necessitated the attraction of more and more foreign capital (especially in Hungary and Poland as being the highly indebted V4s by the early 1990s) to go beyond the under-capitalised nature inherited from socialism, so the market-friendly mentality in its foundations did not originate from within and organically, but was born out of necessity with all of its shortcomings (distorted FDI-dependence, etc.). At the level of numerical and growth-oriented surface, one may conclude that 20 years of transition until 2010 was merely enough for Hungary to become a relative loser among post-socialist countries if for no other reason than it produced some quantitative GDP growth; nevertheless, those per capita rates were way below that of the OECD average (1.7%) by implying the reappearance of 'primitive accumulation' of the previous eras in a somewhat different form; was enough for Czechia to reach out a non-lagging country of which economic growth at least kept pace with the OECD average; while that time was well enough for Poland and Slovakia to become successful countries simply because they came closer to the OECD average. A more nuanced view is given if one looks at the period 2010–2022 as well.

2.4. Reindustrialisation in the vortex of industry 4.0 (2010–2022)

It is worthwhile to explore whether the growth models of V4 countries were underpinned by industrial policy in (i) tailoring the economies towards Industry 4.0[30]; (ii) supporting the evolvement of more complex industrial export products; (iii) establishing more fertile grounds for servitization; or (iv) generating less income disparities to stabilise social trust as a precondition of political stability, hence that of structural reforms and industrial policy for structural change. A *virtuous circle* is more likely to emerge once there is already a trend of exported products becoming more complex being coupled with non-negligible servitization, because it is a better basis for I4.0-focused industrial policy if and only the society has enough trust in the government, a factor which is significantly influenced by inequalities.[31] Otherwise, critical instability may arise, i.e. a vicious circle, which is more likely to lead to the failure of any kind of industrial policy, and what is more, to the middle-income trap.

- Czechia:
  - **Tailoring towards I40**: A conscious I4.0 development started in 2015 with the programme Průmysl 4.0 based on a bottom up as well as multidisciplinary approach (designing the strategy was organic by the active involvement of key stakeholders). Key policy measures and support programmes are as follows: funds available from already existing operational and subsidy programmes especially for micro, small and medium enterprises, shaping education system towards technical skills (Education 4.0). There has been a strong improvement in the number of firms carrying out product innovations, and business process innovations.[32] Against this background, the key weaknesses and threats to Industry 4.0 are crystal-clear such as the lack of unequivocal model for financing the transition, ICT and high-speed Internet-penetration-related regional discrepancies, unresolved cybersecurity triggering risk averse mentality.
  - **Complexity of export products:** In the period 2010–2022, the Czechian industrial policy was fully in line with the European reindustrialisation priorities (stipulated in Europe2020), while following its own route of supporting both the larger companies operating in key businesses and SMEs to breed the networking effect (e.g. direct supports for larger players started to diminish however they still got a perceptible level of discount on corporate income tax later on).[33] State support was maintained in certain sectors considered as vital ones from the viewpoint of the Czechian economic development. Due to such policy approach pervaded by I40-awareness, Czechian firms are to increase their investments in I40 technologies while they were able to increase the complexity of their products and export portfolio.[34] To the latter, according to Observatory of Economic Complexity, by 2021, Czechia had the 7th most complex economy out of 131 countries ranked by the Economic Complexity Index (ECI). In 2021, albeit the top exported goods are still cars and motor vehicles, the country has become the world leader in exporting non-optical microscopes, what is more, it was the 13th largest exporter in the world of the highly complex electric soldering equipment (furthermore, machine-tools as well as machinery and mechanical appliances are of key complex exported goods).

- **Servitization**: Beyond the fact that the economy has become ever more service-oriented (services value added reached 58% of GDP by 2021, the top services have also become more sophisticated, such as other transport; personal travel; miscellaneous business, professional, and technical services; business travel; and air transport. As for service innovation, European Service Innovation Scoreboard 2023 reported that Czechia performs the best among V4 countries (It ranks in the middle third of the ranking in terms of wider framework conditions, while ranks in the upper third in terms of service innovation outputs).[35]
- **Inequalities**: Importantly, along the course of such industrial policymaking, the Czechian economy was able to stabilise the income inequality tendency up to 2010 (i.e. GINI was stagnating), then it could even improve by grounding political trust as well until the demolishing impact of COVID-19 (recently it has again started to improving).[36] It implies that there is a room for manoeuvre in risky and challenging I40 development in Czechia by overcoming automotive-sector dependency as well.

- Hungary:
  - **Tailoring towards I40**: Following a bottom-up and multidisciplinary approach, Hungary developed its own Industry 4.0 National Technology Platform programme based primarily on public financing with the aim at reindustrialising the national economy. Since the main objectives are rather bold (foster acceleration of innovation in fields of cybersecurity, promote the readiness of the national economy for I4.0), the key measures are not well developed yet either: involving stakeholders to reach out more efficient knowledge sharing via Industry 4.0 INFO@HAND application, establishment of three research centres with virtual and physical demonstrative abilities (e.g. SmartFactory which is a cyber-physical production and logistics pilot system). The Hungarian I4.0 development has also been supported by the more concrete industrial programme, the so-called Irinyi Plan (2016) which is to initiate an innovation-driven economic growth model for Hungary through reindustrialisation (i.e. increasing the weight of industry within GDP).[37] That plan already suggested that automotive industry will face a gargantuan change in 10–15 years, thus the country is now to promote automation and battery production in a more dedicated way than ever before (i.e. with substantial government support) to much of our consternation since electric vehicle battery production is a highly resource-intensive sector (i.e. water, energy, workforce) the needs of which Hungary cannot meet satisfactorily.[38] Let us add immediately, the Hungarian U-turn (Kornai, 2015) after 2010 made the bottom-up approach rather deceptive. All in all, from the midst of 2010s, due to a more interventionist governance acting in a more like antidemocratic fashion by triggering uncertainties, there has been a deteriorating trend in terms of government support for R&D, sales of innovative product and in patent application alike.[39] Consequently, the Hungarian I4.0 strategy and deployment seem to be merely a pseudo-bottom-up approach.
  - **Complexity of export products:** By 2021, among 131 countries ranked, Hungary has become the 35th in total exports, while it was the 14th most complex economy

according to ECI. The top exported goods covered cars; motor vehicles; parts and accessories; electric batteries, video displays, and packaged medicaments. The most complex products exported were as follows: instruments and apparatus for physical and chemical analysis; metal-pickling preparations; fluxes for soldering, brazing; measuring and checking instruments.

- **Servitization**: The share of services within GDP has been being way below than that of other V4 countries by hovering around 56%. As for services export, the top services exported by Hungary in 2020 were miscellaneous business, professional, and technical services, other transport, personal travel, royalties and licence fees, and air transport. As for service innovation based on Service Innovation Scoreboard, basically, Hungary was ranked in the middle third of countries regarding wider framework conditions as well as service innovation outputs, while it took the lower third with respect to service innovation inputs.
- **Inequalities**: income inequalities were mainly stagnating up to early 2010s when they started to deteriorating along the course of the Hungarian reindustrialisation. Trust in government remained relatively resilient up to COVID-19, then it turned into a worsening trend.[40] Such trajectory can be seen as ominous signs for sustainable political trust necessary to carry out further I40-related measures that are of paramount importance in a country that has been facing a perceptible declining trend in manufacturing value added (see Figure 1), while there have been improving trajectories in other V4 countries in the period 2010–2022.[41]

- Poland:
  - **Tailoring towards I40**: An Industry 4.0-aware development plan (Morawiecki Plan – Future Industry Platform) came to the forefront in 2016 by building on the dialogue with industrial players (bottom up) and being financially backed by the Polish state which will be supplemented by private financing as well over the long term. The key measures are as follows: awareness raising campaigns, sharing knowledge over Industry 4.0, offering virtual and physical demonstrations, export assistance for Polish enterprises, regulatory changes to simplify the establishment of businesses, consultancy services, introduction of tax breaks and the Estonian CIT (i.e. opportunity for firms to postpone their tax payment on reinvested profits in order to liberate innovation in products and services) etc. One of the most perceptible objectives to Industry 4.0 development is the relatively low awareness and involvement of SMEs, while there is an impression of the wider public that direct/indirect support of I4.0 transition affects adversely market competition. The number of Polish firms basing their production on automation or computer-controlled production lines has been increasing since 2005, what is more, there have been strong improvements in the number of firms providing ICT trainings, the volume of government support for R&D and innovation, and in the share of business process innovation.[42,43]
  - **Complexity of export products:** By 2021, out of 131 countries ranked, Poland has become the 28th most complex economy according to ECI. The top Polish export

products (with ancillary services) are as follows: motor vehicles; parts and accessories; electric batteries; seats; other furniture; and video displays. As for the highest complexity products that are exported from Poland are as follows: electric (electrically heated gas) soldering, brazing, welding machines and apparatus; metal-pickling preparations; fluxes, etc., for soldering, brazing; welding powders; hand-operated spanners and wrenches; and polyamides in primary forms.

- **Servitization**: After Hungary, Poland has the second lowest share of services value added within national GDP (56.8%). As for services export, the followings were in the top in 2020: other transport; miscellaneous business, professional, and technical services; personal travel; business travel, and construction abroad. As for service innovation, Polish companies were relatively badly barded with service innovation by being in the lower third of wider framework conditions, that of service innovation inputs/outputs in the ranking of the European Service Innovation Scoreboard. Since then, Poland has become the leader of the shared service centre industry in Europe.
- **Inequalities**: After a short stalemate around 2010, Poland could put its economy on an increasingly more equal distribution path since GINI coefficient started to decline significantly until nowadays (GINI value of 33.2 of 2010 was replaced by 28.8 by 2020), which, in principle, better establishes social trust. People's trust in government increased after 2015 up to 2020 when it sharply declined by representing one of the worst trust levels across the OECD countries due to the perceivable incapability of government to address effectively the COVID-19 crisis (i.e. Poland suffered from the highest excess death rate in the EU).

- Slovakia:
  - **Tailoring towards I40**: In 2016, the Slovak economic governance established the Smart Industry Platform in an effort to enhance digitalisation of Slovak industrial SMEs via public financing (based on already-existing Operation Programmes, European funds while seeking out new ways of funding). Smart Specialisation programme was also created for the period 2021–2027 with a number of priorities including 'Innovative Industry for the 21st century'[44] thereby the government is to put more focus on automation and robotisation of industrial production under the confines of Industry 4.0; on boosting processing of raw materials and semi-finished products into higher value-added products; on progressive technologies and materials; on increasing energy efficiency in the economy. While there has been an upward trend in terms of manufacturing value added by reaching the second highest share across the V4 countries, Slovak businesses recognises more and more that higher standard education and vocational programmes are of essence to meet the I40-related human capital requirements (i.e. long-term low-skilled unemployment has been being by far the highest in Slovakia among V4 countries).[45] Moreover, in 2022, the government introduced a super subscription for investment in I4.0 (i.e. assets that are directly associated with I40 are subject to super depreciation).[46]
  - **Complexity of export products:** Slovakia is the 16th most complex economy according to the ECI. Its top export products are as follows: cars; motor vehicles; parts and accessories; video displays; broadcasting equipment; and rubber tires. The exported products (potentially servitized) with the highest complexity are as

follows: electric (electrically heated gas) soldering, brazing, welding machines and apparatus; machine-tools; machinery for working rubber or plastics or for the manufacture of products; screws, bolts, nuts, coach screws, screw hooks, rivets, cotters, cotter-pins, washers; parts and accessories suited for use only/mainly with machines. Slovakia has therefore relative strengths in medium- and high-tech goods exports, while there has been lowering sales of innovative products since 2016 and the collaborative efforts of innovative SMEs with others have also declined since 2022.[47]

- **Servitization**: Slovak socio-economic innovation ecosystem has been consisting of a GDP-producing services sector at a level of 58% mainly since 2010, hence the country has the highest share of services value added as compared to other V4 countries. The top services exported by Slovakian firms are as follows: other transport; miscellaneous business, professional, and technical services; personal travel; telecommunications services; and construction abroad. As for services innovation, although Slovakia was in the middle third of countries analysed in terms of wider framework conditions for service innovation in the midst of 2010s, it was quite impressively outstanding with its first position in service innovation output.
- **Inequalities**: Slovakia could dampen income inequality even more since 2010 by becoming a country with the lowest GINI coefficient by 2020 among V4s. Importantly, despite the seemingly trust-enhancing GINI trend (which is rather deceptive), there has been a great deal of problems with social quality in Slovakia (i.e. shortcomings in social inclusion, marginalised Roma population etc.)[48] by resulting in lowering trust in the ruling cabinet as well as resulting in a society which is more and more open to illiberal socioeconomic structures.[49] Still, being in the EU and EMU provides strong institutional checks and balances in reining in those voices. This leads to the conclusion that region-specific, that is to say, differentiated industry 4.0 policy is required in Slovakia due to the major socio-regional disparities.

3. Policy cadastre of industrial upgrading in V4s

If one takes a mere glimpse on what kind of industrial policy concepts were observed in the reviewed periods (1918–1945, 1945–1989, 1990–2010, and 2010–2022), it can be stated that the dogma of very specific and forced industrial protection and development was replaced with the regime change of the early 1990s by a more vague but more horizontal industrial policy, which was in the first half of the 2010s finally replaced by a still even blur concept of reindustrialisation under the auspicious of Industry 4.0.

Table 3 illustrates the industrial policy instruments and their achievements/deficiencies in Czechoslovakia, Hungary, and Poland between 1918 and 1989 and after 1990 in the Visegrad countries. Industrial strategies during the interwar period involved the traditional elements of protectionism, to build up the basis of import substitution. As a result of Great Depression, the increasing role of the state was accompanied by the spread of cartels, which became an effective instrument of each government policy. By the late of 1930s, they accounted for 40% of Hungary's industrial production, 66% of the Polish and most of the Czech (Berend & Ranki, 1974, p. 141; Teichova, 1988, pp. 44–46). Teichova

Table 3. Industrial policy instruments and results in the period 1918–2022.

Period	Country	Policy instruments	Results
1918–1945	Czechoslovakia Hungary Poland	Protection of domestic markets (import substitution) and trade regulation by high customs tariffs (30–50%) compared to pre-war level. State assistance and incentives (exemption from taxes and from customs duties). Cartelisation in the 1930s.	Major investment programmes in *Hungary* and *Poland* at the end of the 1930s (e.g. The Győr Programme in Hungary and the Four-Year Investment Programme in Poland). Some successful examples in modern productivity-enhancing technologies in *Czechoslovakia* and *Hungary*. To encourage light industrial branches at the expense of modern sectors of the economy.
1945–1989	Czechoslovakia Hungary Poland	Retaining the instruments of the centralised war economy. From 1948 the abolition of mixed economy and forced industrialisation strategy within the command economy. Detailed compulsory plan indicators and material plans for each economic entity. CMEA as a forum of economic and trade cooperation among its member states	Fast growth of domestic capital accumulation as a result of forced industrialisation in the 1950s. Monocular focus on industrial development (e.g. heavy industry at the expense of other sectors of the economy). Overstrained investments, low level of efficiency and productivity. Lack of profitability and market incentives. Acute shortage of qualified labour force and raw materials. General shortage of consumer goods. Reform attempts in the second half of the 1960s but were halted in early 1970s.
1990–2010	Czechia Hungary Poland Slovakia	privatisation, subsidising job creation in lagging behind regions, training programmes, generous investment scheme, creating industrial zones, FDI-attractive tax regime privatisation, subsidising firms, FDI-attractive tax regime and allowances privatisation, tailoring financial sector to pursue prudent credit offerings, supporting SMEs, creating special economic zones, allowances for foreign companies privatisation, selective financial support, broad based competitiveness programmes	largest MVA by 2010 among V4s, largest relative export density, highest medium high-tech exports FDI-dependence, lowest relative export density declining relative export density, lowest revealed comparative advantage index of medium as well as high high-tech exports uncertain FDI, converging to V4s in terms of MVA, improving relative export density
2010–2020	Czechia Hungary Poland Slovakia	Průmysl 4.0, bottom-up and multidisciplinary, funds, Education 4.0 Industry 4.0 National Technology Platform, Smart Factory, pilots, favouring electric vehicle battery production, industry 4.0 prizes Future Industry Platform, dialogue, awareness campaigns, demonstrative projects, tax breaks, Estonian CIT Smart Industry Platform, supporting SMEs, super subscription for I4.0 investments,	increasing number of firms with product innovations, with business process innovations, expanding product complexity and servitization, stabilised inequalities declining R&D support, stagnating then slightly declining MVA, weakening competitive industry performance, stagnating relative export density, worsening revealed comparative advantage index of high high-tech exports, growing inequalities increasing number of firms offering ICT trainings, intensifying business process innovations, stagnating service innovations spectacularly increasing competitive industry performance, education-demand mismatch, highest service value added, decreasing inequalities

Source: own compilation by the authors.

stresses that cartels aimed at controlling markets by fixing prices and allocating production quotas among members. They restricted free competition by regulating trade conditions and encouraged industrial concentration, especially in heavy industry. Many of these cartels were international in scope during the 1930s, and Germany used them to exert influence on Central and Eastern Europe both economically and politically (Teichova, 1989, pp. 960–961).

According to relevant data, despite the slow pace of industrialisation, Czechoslovakia and Hungary recorded some examples of implementation of modern productivity-enhancing technologies. The Bata Shoe Company, established in Zlín in 1924 started to apply modern mass production techniques in the mid-1920s and became a world leader in 1928. By 1938 the Czechoslovak firm employed 65,000 workers (including 23,000 abroad) and produced 50 million pairs of shoes. The other successful example was the Škoda works of Mladá Boleslaw in 1925, which focused on car manufacturing and production of armaments. With its branches and purchases of existing companies across the region it employed 37,000 workers in the 1930s (Turnock, 2005, pp. 203–204). In Hungary, electrical and mechanical engineering industries were able to retain their competitiveness in the world market. From 1922 onwards, radio sets were produced by the United Incandescent and Electrical Co. and its output rose significantly. Otto Bláthy's patient for galvanometer in 1923 gained similar success. The Ganz Works produced diesel motor-powered locomotives and sea-ships (Kaposi, 2002, pp. 293–294). Nevertheless, these successes were not capable of offsetting the shortcomings of industrial strategies during the interwar years.

As Table 3 indicates that the instruments of the centralised war economy, such as fixed prices and wages together with the allocation of resources, including both material inputs and investment were retained even after World War II. From 1947 onwards, Stalin issued instructions to the Communist parties in the region to speed up sovietisation, which encompassed the abolition of private property and the elements of mixed economy. By the end of 1948, all three countries followed the industrial policy that of the Stalinist model in the 1930s. The programme of forced industrialisation had to realise within the framework of the rigid and bureaucratic mechanism of command economy. Brus described that system as a 'centralised model', according to which the central plan embraced the whole level of detailed outputs and inputs in the economy. The structure of the plans was strictly hierarchical, plans of lower level were formally subordinated segments of the corresponding plans at the higher level (Brus, 1986, p. 12). The plans gave detailed instructions about the investment and spending of companies. The Planning Office was responsible for preparing material plans, which were used by relevant ministries and other branches of the central administration to order the yearly and quarterly distribution of materials. All plan indicators were compulsory for each economic entity, including industrial firms and state companies and any deviation from the central plan without acceptable reason was punished harshly (Berend, 1996 –76;, pp. 75; Berend, 2006, pp. 157–164).

Due to monocular focus on heavy industrial development and defence considerations, other sectors of the economy (agriculture, infrastructure and services) were neglected completely. What counted was quantity, and in particular, attaining the norms prescribed by the central planners for each industrial branch, while economies of scale, profitability,

and marketability did not play any role. One of the weaknesses of the Stalinist command economy was that investments were not adequately prepared and dispensed with the necessary technical documentation, which resulted in a great and ever-increasing number of projects being left unfinished in all three countries (Berend, 1996, p. 81). Most factories piled up huge stocks of unsaleable products, light industry barely developed, and the production of consumer goods stagnated or even declined (Szávai, 2009b, p. 153). The low level of productivity and efficiency could be explained on the one hand by the wasting of materials, energy, and labour, and by high production costs on the other (Szakács, 1999, pp. 253–254).

The scarcity of agricultural and consumer goods was a general feature of the Stalinist central planning. Kornai notes that shortage became a permanent and a chronic phenomenon of the socialist regime, which embraced all sectors of the economy (Kornai, 1992). Although reform attempts in the second half of the 1960s wanted to overhaul the deficiencies of the command economy, by improving the levels of productivity and efficiency, large industrial enterprises were not able to compete in world markets and their losses were continuously compensated by the state budget. Because orthodox communists gathered strength within the Communist Parties of the region, all radical reform measures were halted in early 1970s.

Over the period 1949–1991, CMEA served as the economic cooperation of the Soviet bloc countries. It operated as a closed and protected regional market, which was isolated from the world economy. Although several cooperative industrial projects were launched within the organisation and the percentage of traded machinery produced cooperatively rose from 20% to 40% in the years 1970–1980, this kind of cooperation served only for letting individual countries produce different products for bloc-wide selling (Berend, 2006, p. 168). Additionally, the bulk of industrial products could only be sold on CMEA market due their low levels of quality. According to one estimate, slightly fewer than one-fifth of goods manufactured during the 1970s could claim to meet global standards and quality in Hungary (Romsics, 1999, p. 352).

The structural crisis in mid-1970s, further exacerbated the internal and external problems of Czechoslovakia, Hungary and Poland. The main problem was that instead of adjusting to the changed circumstances in the world economy, all three countries preserved their obsolete industrial sectors and production structure. To maintain fast growth, they relied heavily on Western capital and technology imports, therefore intra-trade within CMEA started to decline significantly. The short-sighted policy of the communist regimes led to a dramatic backlash, which resulted in balance of payments crisis and increasing indebtedness in the 1980s.

Between 1990 and the early 2010s, V4 industrial policies have become ever more blurred by dissolving in a variety of horizontal policy areas such as science and technology, innovation and trade policies. After the regime change of V4 countries in the early 1990s, the sequence of deindustrialisation and a more or less conscious reindustrialisation pattern emerged up to the early 2020s. We have followed an untrodden trap (by looking at the nature of I4.0 programmes, the growing complexity of export performance, servitization tendencies as well as how political trust-enhancing or undermining inequalities emerged across the board) in examining whether industrial policy approaches served as a driver of the complex development of I4.0 in V4s or whether there have been significant path dependencies given by the economic history of the countries analysed.

It can be concluded that what we have seen so far is that Industry 4.0 awareness has been being present in V4s mainly from 2015 to 16, and the related industrial policy approaches are sought to be bottom-up and multidisciplinary[50] with the exception of Slovakia (where it is a rather top-down).

The question that rightly arises here is whether V4s are predestined for organic as well as successful Industry 4.0 transformation by their own social mentality, which was formed in a secular way during the vortex of the various periods of economic history?

4. Economic mentality and V4s in time of industry 4.0

In an effort to decipher whether the approaches (bottom-up, top-down) chosen emerged in an autochthonous way, we look at the economic mentality of V4 countries. Examining economic mentality may also feed back to the economic historical background and its potential continuity in one way or another.

Technological advancement is based on innovativeness of an economy which is not an exogenous endowment, rather it can be explained by the institutional characteristic of the country, in other words with the complexity of economic relations. Consequently, industrial policy shall not be just a task for the policy-makers, it relies heavily on the development of social relations too. For this reason, it is instructive to look at whether V4 countries have an economic mentality which is suitable for the bottom-up and thus more sustainable development of Industry 4.0. To this end, we use the so-called Global Index of Economic Mentality (Czegledi et al., 2021), which is to capture the extent to which citizens

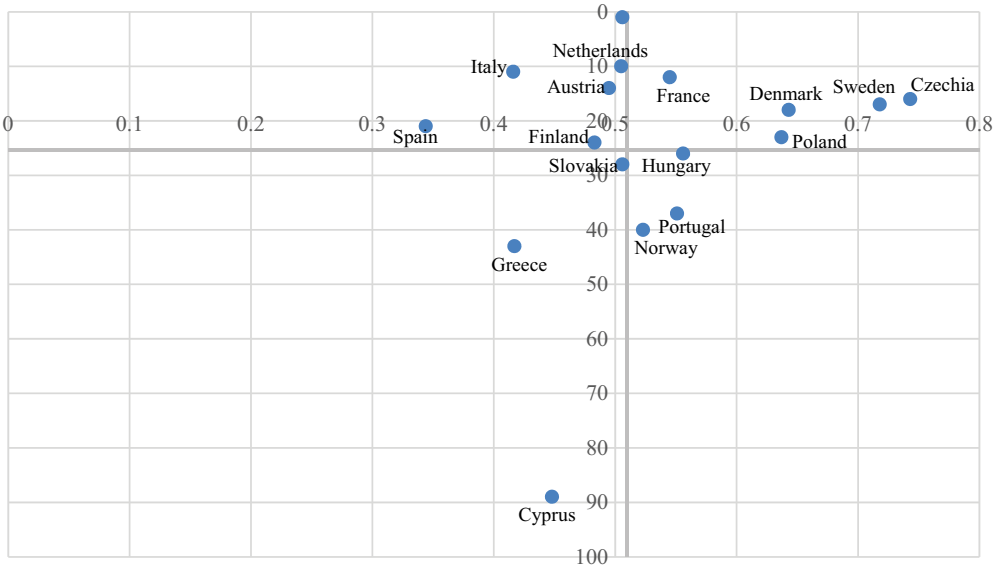

Figure 6. Nexus between economic mentality and competitive industrial performance. Note: The horizontal axis refers to economic mentality captured by GIEM values derived from Czegledi et al. (2021) (i.e. higher values refer to greater market-orientation), while vertical axis represents Competitive Industrial Performance Index 2022 developed by UNIDO (i.e. higher values represent more competitive industrial sectors). Intersection represents the averages. Source: own compilation.

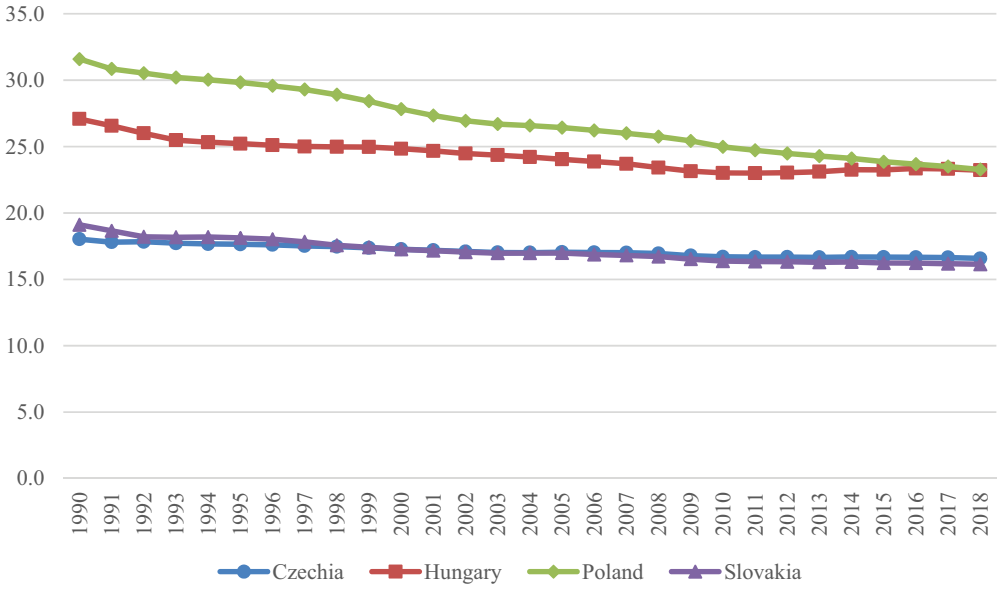

Figure 7. Dynamic general equilibrium model-based (DGE) estimates of informal output (% of official GDP). Source: World Bank (2024).

prioritise private initiative, free competition, and personal responsibility, as opposed to a more interventionist as well as paternalist (supportive) government with greater government income redistribution.

Figure 6 sheds some light on the fact that higher competitive industrial performance – which benchmarks the ability of countries to produce and export manufactured goods competitively – tends to be associated with a more market-oriented social behaviour that grounds bottom-up approaches to emerge as the cases of Czechia and Poland demonstrate; while Hungary and Slovakia can be considered as countries where I4.0-aware reindustrialisation happens in a more top-down manner.

Poland, Hungary and Slovakia have GIEM values closer to the average, while the Czechia has a higher-than-average value being associated with a higher industrial performance as well. The lower GIEM may also mean that there may be a greater receptivity to top-down solutions, paternalism (not-market oriented competition), and more populist policies, especially in Hungary and Poland.[51] As a result, we cannot hope for a sustainable, organic, and widely applied I4.0 based on the efficiency improvement mechanism of market competition.

It is hardly by chance that informality, which captures the extent of preferring not-market oriented mentality, has been the largest ones in Hungary and Poland among V4 countries (Figure 7). In this respect, Slovakia can be considered as an exception, where, with a lower GIEM, none of this was observable if for no other reason than its political leadership once was committed to becoming a full member of the EU as well as the EMU proving the country's internal commitment to market integration, which until now has effectively countered illiberal and anti-democratic voices.

A clear sign of the not so well-functioning innovation ecosystem in V4 countries, especially in case of Hungary and Poland, is the strikingly high amount of remittances sent home by expatriated workers[52] (i.e. after the EU-accession, remittances received in percentage of GDP exceeded 2.8% in 2006 in Poland, while the Hungarian volume rose then even further by reaching 3.2% of the GDP in 2015–2016).[53] In short, expatriation, as a cause of excessive labour shortage, is a key driving force behind higher employment rates that are by no means implying that some V4 countries would have an outstanding market-oriented economic mentality, a factor to be reckoned with when pursuing I4.0. Unsurprisingly, Hungary and Poland have been the least converging V4 countries to the European Union in the period 2000–2022. In Czechia, the real GDP per capita was at 50% of the EU average in 2000, the closest share among V4 countries, while Hungary was at 35%, Poland at 28%, and Slovakia at 34%. By 2022, these values were respectively: 64%, 49%, 50% and 56%. All this transpires that V4s, including the slowest converging Hungary being susceptible to middle-income trap,[54] would be better off if they immediately strived for Industry 5.0 (i.e. human-centred and inclusiveness-enhancing Industry 4.0),[55] rather than pushing for Industry 4.0, which is focused on increasing technology-focused and productivity dynamics at all costs.

5. Conclusion

We provided economic-history backed evidence that industrial policy – usually considered as a *faux pas* or at least a taboo topic – has been being alive (but not evenly well) in Visegrad countries. The pattern of industrialisation, deindustrialisation and reindustrialisation has been a logical repercussion of V4 economic history. The reviewed and analysed history of more than a century-long industrial policy, with the newly compiled cadastre of policy measures, provides at least six important lessons both about general industrial policy engineering and V4-specific ones in the era of Industry 4.0.

First, at the end of the day, industrial policy is a cavalcade of tools and regulations that are to foster (or to prevent) structural changes when qualitatively new socio-economic systemic configuration emerges. Industrial policy nowadays is therefore an important cog in the resilience-building machine via economic policy and can be a mean towards a post-growth world economy advocated by the well-known degrowth literature.[56] Thus, economic systems have evolutive development, which can be very well illustrated through the economic history of the Visegrad countries. Economic governance is therefore on a safer footing if considers industrial policy as a sphere going for moving-targets, thus its content and tools shall dynamically change over time by its very nature. Our policy cadastre *per se* conveys that heterogeneity is above all, thus differentiated industrial policy is a must. What also follows from this understanding is that manufacturing is not the only sector that can be in the focus of industrial policy.

Second, the most important lesson for today is that results can be achieved with a modern production structure, an industrial policy that acquires and maintains a market and listens to and values expertise. An underlying requirement of this is accepting that not capitalism but innovism is to be cherished and pursued – instead of promoting the sheer accumulation of classical capital in V4s, which was not a feasible

option during socialism either, market-tested betterment shall be excelled by focusing on human capital and the idea-generation power of the entire innovation ecosystem as a stove of any kind of I4.0 development.

Third, socialism left behind nothing but fossilised economic systems (incapable of innovating) in case of V4 countries, the course of transformation at the expense of deindustrialisation paved the way towards establishing innovation ecosystems being more capable of converging to other developed EU countries, while the latter phase of reindustrialisation due to the structural change-triggering power of Industry 4.0 and digitalisation requires an even more holistic industrial policy to become both the creature and the architect of our time. A game-changer and more responsible industrial policy approach is a *de rigueur* aspect in V4 countries to cultivate competitiveness, inclusive growth by not depleting but appreciating natural resources (i.e. a more responsible industrial policy is sought to act as a mean towards post-growth/degrowth development by transforming the middle-income trap into an opportunity[57]).

Fourth, industrial policy is instructive enough once it has a long-term framework, but the horizon of its measures is predominantly short run, in other words, impulsiveness is of key importance to avoid a cultural adoption to subsidies and then preventing counter-incentivising firms.

Fifth, V4s characterised by labour shortages would be better off if they did not strive for Industry 4.0, which focuses on technology and productivity, but instead moved towards the concept of Industry 5.0, which includes human-centred and inclusive development.

Sixth, and most importantly, in economies with high FDI-exposure coupled with substantial labour shortages, which is not unknown in the industrialisation economic history of V4s, (even if they have a low GIEM value, i.e. their social sensitivity is greater than pursuing profits and respecting market competition above all else), Industry 4.0 transformation depends predominantly on the decisions of foreign multinationals (or at least relies heavily on significant government support by leading potentially to the overload of the states, especially in Hungary), which are forced to increase robotisation/automation.[58] This kind of Industry 4.0 development can remain limited and in the long run can adversely affect the social fabric of the given economy and its political stability alike. While in Czechia, there is a room for manoeuvre in risky and challenging I4.0 development by overcoming automotive-sector dependency[59] via reindustrialisation; in case of Hungary, an economic historical path-dependency can be contoured: just as the socialist economy seeking forced industrialisation was on the breathing machine of foreign capital, so today the economy embarking on the path of essentially forced reindustrialisation is on the excessive dependence on foreign capital as well (of course, with the difference that decisions related to FDI are made abroad, and the government has little room to influence them). While in the case of Poland, politics still have the potential to derail and undermine even a relatively instructive industrial policy striving to promote sustainable Industry 4.0, Slovakia showcased that being in a club (EU, EMU) may immunise politics to diverge from taking advantage from a healthy but more differentiated I4.0 development. In other words, the perspectives of industrial policies for sustained I4.0 development as

an opportunity to avoiding or overcoming middle development trap in V4s is at nothing but the mercy of politics.

Notes

1. When addressing industry, the article mostly refers to manufacturing because of the availability of that type of data.
2. Lange outlined in the 1960s that the development of modern computer technology would enable the smooth operation of the planned economy.
3. Service sector is responsible for the most share of GDP (approx. 50–70%) as well as for the greatest share of the labour force (more than 50%) in developed countries. Moreover, the border between services sector and manufacturing sectors has become rather blurred.
4. See: Radosevic (1999).
5. See: Křibíková et al. (2017).
6. See: World Bank Development Indicators.
7. See: Banerjee (1995).
8. Right after the regime change, different ministries were established being dedicated one way or another to industrial policy: Ministry of Industry, Ministry of Construction Industry, and Ministry of Mechanical Engineering and Electrical Engineering.
9. Malinkska and Martin (2002) showed that the programme stimulated higher Czechian SMEs' involvement.
10. For those businesses that are operating in prosperous and promising fields, as the 2005 ex ante evaluation report revealed. See. https://www.mpo.cz/assets/dokumenty/26522/27633/304082/priloha001.doc Accessed on: 17.01.2024
11. See: https://www.statista.com/statistics/1228506/unemployment-rate-in-czechia-by-regions/ Accessed on: 17.01.2024
12. See: Pavlínek (2008).
13. The privatisation process helped as a driver of inflowing capital, see: Mihalyi (2001).
14. See: Barta (2005).
15. There has been virtually no break in the FDI-centric growth model (i.e. growth based on serious transnational presence) since the beginning of the nineties, what is more, its character has only further hardened over the years from the political and economic side in which EU enlargement and the industrial policy and development ideology that comes with Europeanization (pursue EU-compatible and generous development/support policies that strengthen the competitive situation) had an indispensable role. See: Vukov (2019).
16. For a more comprehensive account on FDI-dependent growth paradigm, see: Nölke and Vliegenthart (2009), Farkas (2016).
17. It was also reflected in the stagnating innovation performance of Hungary. See: Kovacs (2021).
18. See: Kouli and Müller (2024).
19. See: Karbownik (1997).
20. See: Bratkowski et al. (1995).
21. They are still quite attractive, see: https://invest-in-poland.eu/special-economic-zones-in-poland/ Accessed on: 17.01.2024
22. See: Chidlow and Young (2008), Hryniewick (2017).
23. 'Action Programme to Strengthen Competitiveness of European Industry' (Council Decision No. 96/413/EC). The new type of industrial policy approach was adopted by the Slovak government in 1999 ("Work-out of Industrial Policy of the European Union to the Conditions of the Slovak Republic ").
24. See: Fontagné and Harrison (2017).

25. See Stenning et al. (2010) for more on the culture of dependence in Central and Eastern European countries.
26. See: Milanovic (2001).
27. See: Lehocký and Rusnák (2016) or the Commission Opinion (2004). What is more, Slovakia somewhat stands out from the CEE region (including V4), as there has been a relatively lower level of income inequality coupled with a lower level of income concentration (e.g. neither the capital share of income nor the labour share of income dominates). World Bank's GINI indices exemplify this as well as Ranaldi and Milanovic (2020).
28. The share of cars, electronic consumer goods and machines within export was doubled during 1995 and 2012 by reaching 53.2%. See (Becker & Lesay, 2019).:
29. See: Bohle and Greskovits (2012).
30. 2011 was the year when the term Industry 4.0 was used first time in the Hanover industry technology fair in Germany. Public search interest has risen 140 times since then, while 50,000 research papers were published on the topic in 2021 alone. For more on Industry 4.0, see: Kovacs (2019).
31. For more comprehensive account on the relationship between trust and inequalities, see: Bobzien (2023).
32. See: European Innovation Scoreboard 2023.
33. See: https://www.vlada.cz/assets/evropske-zalezitosti/dokumenty/130516_Strategie-pusobeni-CR-v-EU_2.pdf Accessed on: 17.01.2024
34. See: National Industry Centre (2022).
35. See: https://ec.europa.eu/docsroom/documents/5702/attachments/2/translations/en/renditions/native Accessed on: 17.01.2024
36. Data are available at: https://data.oecd.org/gga/trust-in-government.htm Furthermore, see: https://www.indexmundi.com/facts/czech-republic/indicator/SI.POV.GINI Accessed on: 17.01.2024. As for the relatively stable course of political trust in Czechia, see: Kołczyńska (2020, p. 802).
37. For the period 2021–2027, the so-called *Smart Specialization Strategy* formulates the role of reindustrialisation as a mean of increasing the efficiency of supply chains, applying new cutting-edge technologies and increasing the proportion of high value-added production.
38. See: Éltető (2023).
39. See: European Innovation Scoreboard 2023.
40. See: https://data.oecd.org/gga/trust-in-government.htm
41. See: https://ec.europa.eu/eurostat/databrowser/view/TESSI190__custom_6967786/default/table?lang=en Accessed on: 17.01.2024
42. See: Królikowski et al. (2021). Gyimesi (2021) and European Innovation Scoreboard 2023.
43. During and after the outbreak of Covid-19, only the Polish manufacturing production of the V4 was able to continue to grow, while the Czech, Hungarian and Slovak values almost fell to the 2015 level. See: https://data.oecd.org/industry/industrial-production.htm 17.01.2024
44. See: https://s3platform.jrc.ec.europa.eu/region-page-test/-/regions/SK Accessed on: 17.01.2024
45. See: Grenčíková et al. (2021).
46. See: https://commission.europa.eu/system/files/2022–06/2022-slovakia-stability-programme_en.pdf Accessed on: 17.01.2024.
47. See: European Innovation Scoreboard 2023.
48. See: European Commission (2022), Friedrich Ebert Stiftung (2023).
49. See: Novakova (2020).
50. See: Shadikhodjaev (2018).
51. For Hungary and Poland, see: Everett (2021), Győrffy (2022).
52. IMD Talent Report 2022 recurrently confirmed that V4 countries are inclined to be exporter of talents (i.e. in the ranking, the V4 positions were as follows for 2022: Czechia (28), Hungary (44), Poland (50) and Slovakia (48)), which is implied by the salient employment rate

indicating that labour shortage is there to stay to be addressed (automation, robotisation etc.), as Astrov (2019) showed.

53. See: https://data.worldbank.org/indicator/BX.TRF.PWKR.DT.GD.ZS?locations=SK-CZ-HU-PL-EU Accessed on: 17.01.2024
54. See more on middle income/middle development trap in case of Hungary: Darvas (2020), Pellényi (2020), Csath (2022), Szigetvári and Túry (2022).
55. See: https://research-and-innovation.ec.europa.eu/research-area/industrial-research-and-innovation/industry-50_en Accessed on: 17.01.2024
56. See: d'Alisa et al. (2016), Georgescu-Roegen (2020) or Paech (2011).
57. Degrowth is based on the sustainable reduction of production and consumption, through which human well-being can be increased, more just property and income conditions can be built, and ecological conditions can be improved.
58. See more on the surpassing robotisation levels of V4s in: Fernandez-Macias et al. (2020).
59. For more on why the large share of manufacturing and automotive in the Czech Republic weighs negatively on the risks, see: IMF (2022).

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References

Aldcroft, D. H., & Morewood, S. (1995a). Coping with depression in Eastern Europe. In D. H. Aldcroft & S. Morewood (Eds.), *Economic change in Eastern Europe since 1918* (pp. 164–194). Edward Elgar Publishing Limited.

Aldcroft, D. H., & Morewood, S. (1995b). Inflation, reconstruction and stabilisation. In D. H. Aldcroft & S. Morewood (Eds.), *Economic change in Eastern Europe since 1918* (pp. 22–43). Edward Elgar Publishing Limited.

Aldcroft, D. H., & Morewood, S. (1995c). A new start under socialism in the 1950s and 1960s. In D. H. Aldcroft & S. Morewood (Eds.), *Economic change in Eastern Europe since 1918* (pp. 105–128). Edward Elgar Publishing Limited.

Aldcroft, D. H., & Morewood, S. (1995d). Policies to combat depression. In D. H. Aldcroft & S. Morewood (Eds.), *Economic change in Eastern Europe since 1918* (pp. 58–86). Edward Elgar Publishing Limited.

Astrov, V. (2019, September). Labour market trends in Visegrad countries: Implications for Austria. *Wiiw Policy Notes and Reports*, (33), 1–26.

Banerjee, B. (1995). The transformation path in the Czechia. In M. Marrese, M. S. Lutz, T. Saavalainen, V. Koen, B. Banerjee, & T. Krueger (Eds.), *Road maps of the transition. The Baltics, the Czechia, Hungary, and Russia*. https://doi.org/10.5089/9781557755193.084

Barta, G. (2005). The role of foreign direct investment in the spatial restructuring of Hungarian industry. In G. Barta, É. G. Fekete, I. Kukorelli, & J. Timár (Eds.), Hungarian spaces and places: Patterns of Transition. *Centre for regional studies, Pécs* (pp. 143–160). Centre for Regional Studies of the Hungarian Academy of Sciences.

Becker, J. – Lesay, I. (2019). Slovakia's Development Model: Contours, Vulnerabilities and Strategic Alternatives. *Journal of Contemporary Central and Eastern Europe*, *27*(2–3), 139–154. https://doi.org/10.1080/25739638.2019.1692521

Berend, I. T. (1996). *Central and Eastern Europe, 1944–1993. Detour from periphery to the periphery*. Cambridge University Press.

Berend, I. T. (2006). *An economic history of twentieth-century Europe. Economic regimes from laissez-faire to globalization*. Cambridge University Press.

Berend, I. T. (2009). *From the Soviet Bloc to the European Union. The economic and social transformation of Central and Eastern Europe since 1973*. Cambridge University Press.

Berend, I. T., & Ranki, G. (1974). *Hungary: A century of economic development*. David and Charles.

Berend, I. T., & Ranki, G. (1976). *Közép- és Kelet-Európa gazdasági fejlődése a 19-20. században (economic and social development of East Central Europe in the 19th and 20th centuries)*. Közgazdasági és Jogi Könyvkiadó.

Berend, I. T., & Ranki, G. (1977). *East Central Europe in the 19th and 20th centuries*. Akadémiai.

Bobzien, L. (2023, July). Income inequality and political trust: Do fairness perceptions matter? *Social Indicators Research*, *169*(1–2), 505–528. https://doi.org/10.1007/s11205-023-03168-9

Bohle, D., & Greskovits, B. (2012). *Capitalist diversity on Europe's periphery* (1st ed., pp. 304). Cornell University Press.

Bratkowski, A. S. – Dąbrowski, M. – Antczak, M. – Łuczyński, M. – Połomski, K. (1995, July). *Fiscal policy in Poland under transition*. Center for Social & Economic Research.

Brus, W. (1986). 1950 to 1953: The peak of stalinism. In M. C. Kaser & E. A. Radice (Eds.), *The economic history of Eastern Europe, 1919–1975* (Vol. III, pp. 22–24). Clarendon Press.

Chidlow, A. – Young, S. (2008). Regional determinants of FDI distribution in Poland. William Davidson Institute Working Paper Number 943 November.

Commission Opinion. (2004): Slovakia. European Commission. Retrieved January 17, 2024, from https://eur-lex.europa.eu/EN/legal-content/summary/3_slovakia.html

CompNet. (2024). ComProd Database. The Competitiveness Research Network. Retrieved January 17, 2024, from https://www.comp-net.org/data/9th-vintage/

Csaba, L. (1982). Industrial Structural Policy in Czechoslovakia, 1970-1985. *Economics of Planning*, *18* (3), 114–142. https://doi.org/10.1007/bf00623120

Csath, M. (2022). Hungary is threatened not by the middle-income trap but by the medium development trap. *KÖZ-GAZDASÁG*, *17*(1), 127–159. https://doi.org/10.14267/RETP2022.01.09

Czegledi, P. – Lips, B. – Newland, C. (2021). The economic mentality of nations. *Cato Journal*, *41*(3). https://doi.org/10.36009/CJ.41.3.10

d'Alisa, G., Demaria, F., & Kallis, G. (2016). *Degrowth: Handbuch für eine neue Ära. Das unverzichtbare Nachschlagewerk zur Postwachstumsdebatte*. oekom.

Darvas, Z. (2020). *Relocating production from China to Central Europe? Not so fast!*. Bruegel. 20 August 2020.

Dombrady, L., Germuska, P., Kovacs, G. P., & Kovacs, V. (2016). *A magyar hadiipar története. a kezdetektől napjainkig 1880–2015 (The history of the Hungarian armaments industry. From 1880 to 2015)*. Zrínyi Könyvkiadó.

Domonkos, E. (2019). *Közép- és Kelet-Európa gazdaságtörténete 1945 és 1989 között. A szovjet megszállás és a sztálinista tervgazdálkodás kiépülése (Economic history of Central and Eastern Europe between 1945 and 1953. Soviet occupation and the creation of centrally planned economy)*. Aposztróf.

Domonkos, E. (2023). The impacts of the 1973 and 1979 oil crisis on Central and Eastern European countries. *Gradus*, *10*(1), 1–8. https://doi.org/10.47833/2023.1.ECO.005

Eckstein, A. (1955). *National income and capital formation in Hungary, 1900–1950*. Bowes & Bowes.

Éltető, A. (2023, June). Aspects of electric vehicle battery production in Hungary. ELKH KRTK, Institute of World Economics. Working Paper Nr. 271.

European Commission. (2022). 2022 Country Report – Slovakia. European Commission, Brussels. Retrieved January 17, 2024, from https://commission.europa.eu/system/files/2022-05/2022-european-semester-country-report-slovakia_en.pdf.

Everett, J. (2021). Combatting Illiberalism in the heart of Europe: Lessons from Slovakia. *FORUM, Social Sciences Review*, *22*(5), 107–123.

Farkas, B. (2016). *Models of capitalism in the European Union. Post-crisis perspectives*. Palgrave Macmillan. https://doi.org/10.1057/978-1-137-60057-8

Fernandez-Macias, E. – Klenert, D. – Antón, J.-I. (2020). Don't blame it on the machines: Robots and employment in Europe. VoxEU.org. Retrieved January 17, 2024, from https://cepr.org/voxeu/columns/dont-blame-it-machines-robots-and-employment-europe

Fontagné, L. – Harrison, A. (2017). *The Factor-free Economy. Outsourcing, servitization, and the future of industry*. Oxford University Press.

Friedrich Ebert Stiftung. (2023). Industrial policy for a new growth model. Country briefing Slovakia. Vienna Institute for International Economic Studies. Retrieved January 17, 2024, from https://library.fes.de/pdf-files/bueros/budapest/20284.pdf

Georgescu-Roegen, N. (2020). *La Décroissance – Entropie - Ecologie – Economie*. Sang Terre.

Grenčíková, A. – Kordoš, M. – Bartek, J. – Berkovič, V. (2021). The impact of the industry 4.0 concept on Slovak business sustainability within the issue of the pandemic outbreak. *Sustainability*, *13*(9). Article No: 4975. https://doi.org/10.3390/su13094975

Gyimesi, Á. (2021). National industry 4.0 platforms in the Visegrad 4 countries – a comparison with the Frontrunner Digital Economies in Europe. *Studia Universitatis Babeş-Bolyai Oeconomica, Sciendo*, *66*(3), 21–39. https://doi.org/10.2478/subboec-2021-0012

Győrffy, D. (2022). Populism and authoritarianism in the EU: What is the role of the euro? *European Politics and Society*, 1–21. https://doi.org/10.1080/23745118.2022.2148916

Hryniewick, M. (2017). The activity and functioning of enterprises with foreign capital in Poland. *Studia z Polityki Publicznej*, *4*(2), 81–101. https://doi.org/10.33119/KSzPP.2017.2.4

IMF. (2022). *Czech Republic*. IMF Country Report No. 22/23, IMF, Washington. Retrieved January 17, 2024, from https://www.imf.org/-/media/Files/Publications/CR/2022/English/1CZEEA2022001.ashx

Kaposi, Z. (2002). *Magyarország gazdaságtörténete 1700–2000 (Economic history of Hungary, 1700–2000)*. Dialóg-Campus.

Karbownik, A. (1997). Górnictwo wegla kamiennego w Polsce. Ocena stanu aktualnego (Coal Mining in Poland. Assessment of the Current State). In H. Bochniarz, and S. Krajewski (Eds.), *Sektorowe programy restrukturyzacji i prywatyzacji majatku panstwowego (Sector Restructuring Programmes and Privatisation of State-owned Enterprises)* (pp. 88–100). Task Team for Structural Policy in Poland.

Klein, A., Schulze, M. S., & Vonyó, T. (2017). How peripheral was the periphery? Industrialization in East Central Europe since 1870. In K. H. O'Rourke & J. G. Williamson (Eds.), *The spread of modern industry to the periphery since 1871* (pp. 63–90). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780198753643.001.0001

Kołczyńska, M. (2020). The economy and governance as determinants of political trust in Europe: An analysis of the European Values Study and World Values Survey, 1990–2019. *Czech Sociological Review*, *56*(6), 791–833. https://doi.org/10.13060/csr.2020.051

Kornai, J. (1992). *The socialist system: The political economy of communism*. Oxford University Press.

Kornai, J. (2015). Hungary's U-turn: Retreating from democracy. *Journal of Democracy*, *26*(3), 34–48. https://doi.org/10.1353/jod.2015.0046

Kornecki, L. (2006). Foreign direct investment (FDI) in the Polish Economy: A comparison with central and Eastern Europe (CEE) countries. *Problems and Perspectives in Management*, *4*(3), 5–14.

Kouli, Y., & Müller, U. (2024). *The Middle-income Trap in Central and Eastern Europe – causes, consequences and strategies in Post-Communist Countries*. Berghahn Books.

Kovacs, O. (2011). Policies in support of service innovation. An INNO-Grips policy brief by ICEG European center. Principal author: Olivér Kovács.

Kovacs, O. (2018). The dark corners of industry 4.0 – grounding economic governance 2.0. *Technology in Society*, *55*(3), 140–145. https://doi.org/10.1016/j.techsoc.2018.07.009

Kovacs, O. (2019). Big IFs in productivity-enhancing industry 4.0. *Social Sciences*, *8*(2), 37. Industry 4.0 Implication for Economy and Society. https://doi.org/10.3390/socsci8020037

Kovacs, O. (2021). The Hungarian Eurology – the road to perdition? *Post-Communist Economies*, *33* (4), 435–457. https://doi.org/10.1080/14631377.2020.1745558

Křibíková, P. – Tichá, M. & Poczatková, B. (2017). Organizational structures changes as business reaction to economic reforms (the case of the Czechia). "The EUrASEANs. *Journal on Global Socio-Economic Dynamics*, *4*(5), 19–27. https://doi.org/10.35678/2539-5645.4(5).2017.19-27

Królikowski, T. – Bałasz, B. – Ubowska, A. (2021). Dynamics of changes in Poland in the light of the industry 4.0. *Procedia Computer Science*, *192*(192), 4128–4137. https://doi.org/10.1016/j.procs.2021.09.188

Landau, Z., & Tomaszewski, J. (1985). *The Polish economy in the Twentieth Century*. Croom Helm.

Lehocký, F., & Rusnák, J. (2016). Regional specialization and geographic concentration: Experiences from Slovak industry. *Miscellanea Geographica – Regional Studies on Development*, *20*(3), 5–13. https://doi.org/10.1515/mgrsd-2016-0011

Malinkska, J., & Martin, S. (2002). Czech supplier development programme in electronics and automotive. Retrieved January 17, 2024, from http://www3.weforum.org/docs/Manufacturing_Our_Future_2016/Case_Study_13.pdf

Mihalyi, P. (2001). Foreign direct investment in Hungary – the post-communist privatisation story re-considered. *Acta Oeconomica*, *51*(1), 107–129. https://doi.org/10.1556/AOecon.51.2000-2001.1.5

Milanovic, B. (2001). Inequality during the transition: Why did it increase? In S. M. Nsouli – O. Havrylyshyn (Eds.), *A decade of transition. Achievements and challenges* (p. 281). IMF. https://doi.org/10.5089/9781589060135.072

National Industry Centre. (2022). Czech Industry Analysis 2/2020. Retrieved January 17, 2024, from https://aktualne.cvut.cz/en/reports/20220606-czech-industry-analysis-2022-smart-industry-40-technologies-help-in-the-crisis

Nölke, A., & Vliegenthart, A. (2009). Enlarging the varieties of capitalism: The emergence of dependent market economies in east Central Europe. *World Politics*, *61*(4), 670–702. https://doi.org/10.1017/S0043887109990098

Novakova, Z. R. (2020). The curious case of Slovakia. Regime preferences thirty years after the velvet revolution. *International Journal of Social Quality*, *10*(2), 1–19. https://doi.org/10.3167/IJSQ.2020.100203

Paech, N. (2011). *Befreiung vom Überfluss. Auf dem Weg zum Postwachstumsökonomie*. oekom.

Pavlínek, P. (2008). *A successful transformation? Restructuring of the Czech automobile industry*. Physica Verlag, Springer. https://doi.org/10.1007/978-3-7908-2040-9

Pellényi, G. (2020). The role of Central and Eastern Europe in global value chains: Evidence from occupation-level employment data. European Commission, Economic Brief No. 062,

Perez, C. (2010). Technological Revolutions and Techno-Economic Paradigms. *Cambridge Journal of Economics*, *34*(1), 185–202. https://doi.org/10.1093/cje/bep051

Radice, E. A. (1985). General characteristics of the region between the wars. In M. C. Kaser & E. A. Radice (Eds.), *The economic history of Eastern Europe 1919–1975* (Vol. I, pp. 23–65). Clarendon Press.

Radice, E. A. (1986). The German economic programme in Eastern Europe. In M. C. Kaser & E. A. Radice (Eds.), *The economic history of Eastern Europe 1919–1975* (Vol. II, pp. 299–308). Clarendon Press.

Radosevic, S. (1999, December). Transformation of science & technology systems into systems of innovation in Central and Eastern Europe: The emerging patterns and determinants. *Structural Change and Economic Dynamics*, *10*(3–4), 277–320. https://doi.org/10.1016/S0954-349X(99)00016-8

Ranaldi, M., & Milanovic, B. (2020). Capitalist systems and income inequality. *Stone Center Working Paper* No. 25.

Ranki, G., & Tomaszewski, J. (1986). The role of the State in industry, banking and trade. In M. C. Kaser & E. A. Radice (Eds.), *The economic history of eastern europe 1919–1975* (Vol. II, pp. 3–48). Clarendon Press.

Romsics, I. (1999). *Hungary in the Twentieth Century*. Corvina Publishing.

Shadikhodjaev, S. (Ed). (2018). *Industrial policy and the World Trade Organization. Between legal constraints and flexibilities*. Cambridge University Press. https://doi.org/10.1017/9781316535172

Stenning, A. – Smith, A. – Rochovská, A. & Swiatek, D. (2010). *Domesticating Neo-liberalism: Spaces of economic practice and social reproduction in post-socialist cities*. Wiley Blackwell.

Szakács, S. (1999). *Gazdaságtörténet (Economic history)*. BKE-Számalk.

Szávai, F. (2009a). A Horthy-korszak gazdasági élete 1920-1945 (The economic life of the Horthy Era from 1920 to 1945). In L. Gulyás (Ed.), *A modern magyar gazdaság története. Széchenyitől a Széchenyi tervig (the contemporary economic history of Hungary. From Széchenyi to the Széchenyi plan)* (pp. 113–125). JATE Press.

Szávai, F. (2009b). A szocialista korszak gazdasági élete, 1945–1990 (Economic life of the Socialist Era, 1945–1990). In L. Gulyás (Ed.), *A modern magyar gazdaság története. Széchenyitől a Széchenyi tervig (the contemporary economic history of Hungary. From széchenyi to the Széchenyi plan)* (pp. 147–161). JATE Press.

Szigetvári, T., & Túry, G. (2022). Can they get out of the middle-income technology trap? State strategies in Hungary and Türkiye in promoting automotive investments. IWE Working Papers No. 269, Institute for World Economics - Centre for Economic and Regional Studies.

Teichova, A. (1985). Industry. In M. C. Kaser & E. A. Radice (Eds.), *The economic history of eastern europe 1919–1975* (Vol. I, pp. 222–323). Clarendon Press.

Teichova, A. (1988). *The Czechoslovak economy 1918–1980*. Routledge.

Teichova, A. (1989). East-central and south-east Europe, 1919–1939. In P. Mathias & S. Pollard (Eds.), *The Cambridge economic history of Europe. The industrial economies: The development of economic and social policies* (Vol. VIII, pp. 887–983). Cambridge University Press.

Turnock, D. (2005). *The economy of East-Central Europe, 1815–1989. Stages of transformation in a peripheral region*. Routledge.

UNIDO. (2023): Competitive industrial performance index, Retrieved January 17, 2024, from https://stat.unido.org/cip/

United Nations. (1987). World Economic Survey 1987. Current Trends and Policies in the World Economy. Department of International Economic and Social Affairs, United Nations, p. 113.

Vukov, V. (2019). More Catholic than the Pope? Europeanisation, industrial policy and transnationalised capitalism in Eastern Europe. *Journal of European Public Policy*, *27*(10), 1546–1564. https://doi.org/10.1080/13501763.2019.1684976

World Bank. (2024). The World Bank – World development indicators. World Bank, Retrieved January 17, 2024, from https://datatopics.worldbank.org/world-development-indicators/.