A termelési hálózatok jelentősége a globális versenyképesség tükrében - a magyar vállalatok integrálódása szempontjából

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Final research report

The aim of our four-year research project was to analyze the competitiveness of the Hungarian economy in terms of the so-called mesoeconomics, which can be placed between the macroeconomic approach (using macro-level data) and the microeconomic approach, which examines the behavioral characteristics of companies. Within this, our research focused on two main areas: on the one hand, on the structure and segmentation of the business sector, along several dimensions: company size, ownership structure (domestic vs. foreign), economic branch, various financial indicators etc. and their consequences on productivity and competitiveness, also in international comparison. On the other hand, we aimed to analyze the position of the Hungarian firms in international trade and Global Value Chains. By combining economics, network science and statistics we apply an interdisciplinary approach in our methodology. We concluded a more accurate relative position of Hungarian firms revealing those small- and medium enterprises that are currently hidden from the official statistics because they are participating in the GVCs indirectly. By making several modifications and adjustments on the toolbox of classical graph theory, we could identify the relevant cluster for the Hungarian economy in the network of trade in value-added. That segment includes the EU member states (mainly from EU15) besides the USA, China, and Japan. Hungary is clearly part of the East-Asian value chain of electronics products, as well as the Western European automotive industry.

In both topics we planed to make analyses in internation context.

Both research goals were fully met. In the framework of the project, we published 8 scientific articles, reports and book-chapters, including 4 in English (one is forthcoming). In addition, we participated in several conferences and scientific events, where we discussed our research results with the (inter)national scientific community. All publications and conference presentations indicated that the research was supported by National Research, Development and Innovation Office.

In the following, we summarize our research results and dissemination in accordance with the structure of the research plan.

Work package 1: The distribution and performance of the Hungarian corporate sector by size and ownership (foreign vs. domestic), in European comparison

Regarding to firms size distribution and labour productivity we analysed basicaly theree dimensions of this topic.

- the position and development of medium sized firms in Hungary between 2000-2016,
- the role of foreign owned firms in wage development in Hungary in EU-wide comparison,
- the firms size distribution of Central-Eastern Europeen countries (CEE) compared to other EU regions with special regard to its consequences to labour productity differences.

In the first phase of the research we focused on the role of *medium-sized firms* in the Hungarian economy. In the book chapter published in the Social Report 2018, we started from the widely shared statement in the literature that larger enterprises have higher labour productivity than smaller ones. In the first publication we have chosen a specific issue of this topic, namely the positon and development of *medium sized* firms in Hungary betweec 2000-2016. Our starting point was that although companys' movement, corporate transformations, the birth and cease of operation of companies, are a natural part of market competition The group of middle sized firms are generally considered to be more stable than micro and small firms.

Furthermore, medium-sized companies could also be a source of expansion for the large enterprise category as long as they manage to grow.

We examined what movements took place in the group of Hungarian private-owned medium-sized companies (with 50-249 employees) between 2000 and 2016. How much of these firms which operated in 2000, could grow and become a large company; how much of them stagnated or even narrowed or ceased to exist; and what corporate financial indicators can be attributed to different categories of companies.

Our research results in this term rather were rather mediocre. The research pointed to a significant drop-out of medium-sized companies until 2016 that were already operated in 2000. Out of the 3,350 companies investigated, 1,800 ceased operation by 2016. The remaining 1,500 companies, 900 have shrunk, about 600 into small companies and more than 300 into micro companies. Of the latter, 170 companies operated in 2016 with zero or one employee. Of the 3,350 in 2000, only 50 companies were able to move up and become large firm until 2016, and there were further 300 companies that albeit remained in the medium-sized category but were able to grow in the last one and a half decade. The disappearance or contraction of medium-sized companies was almost continuous, so it cannot be linked to any economic events or shocks. Among the firms ceased or shrank between 2000 and 2016, there were firms which already existed before the economic transition and were privatized to domestic private owners, as well as companies established during the 1990s.

The results of the study pointed to an important negative phenomenon of the Hungarian economy and the firm size structure. As there are relatively few large companies in Hungary, medium-sized companies would have to create a stable foundation and a secure pillar of the economy, which they were apparently unable to fulfill in the first one and a half decade.

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In the article, published by the Külgazdaság in Volume 2019/9-10 we investigated the role of foreign owned enterprises in value added of the competitive sector, productivity and wage convergence between 2008-2016. The research was based on the Eurostat SBS (Structural Business Statistics database, FATS-08) and compared the Hungarian data with EU-wide indicators.

The article examines the statement often made by politicians and experts that the structural problems and low productivity of the Hungarian economy are also explained by the fact that multinational companies bring low value-added activities to the Hungarian economy, which only aims to take advantage of low wages. The results of the research showed that it was these foreign companies, called pejorative "assembly plants", that made a decisive contribution to the improvement of the Hungarian macroeconomic indicators (production, employment, wage growth) in the examined period, 2008–2016. Foreign-owned companies produce more than half of the total value added generated by the Hungarian corporate sector and about 30 percent of Hungarian GDP, and their share has been constantly growing. The productivity of foreign companies in Hungary is three times the average of domestic firms, and their average wage level is 2.4 times that of domestic firms.

More importantly, between 2008 and 2016, foreign-owned companies made a decisive contribution to the Hungarian wage convergence, as they implemented larger than average wage increase, while the wage increase of domestic firms lagged far behind the average wage increase of the entire corporate sector. The calculations indicated that without foreign companies, there would have been essentially no wage convergence in the V4 countries, and especially in Hungary, between 2008 and 2016. The higher wage levels of foreign companies also reflect the remuneration of a more skilled workforce. In addition to the attractiveness of higher wages, foreign companies achieve this by training. Through corporate training, foreign companies gain a labor market advantage that domestic firms rarely enjoy.

In any case, the main problem of the Hungarian economy is not that foreign companies do not bring the production phases that create the highest added value to Hungary, i.e. that Hungary would be an "assembly plant" based on a relatively low wage level. Low wages - at least until recently - supported the chances of survival of domestic firms and, conversely, the wage level in Hungary was determined by the low level of productivity of domestic firms.

Éva Palócz published an essay in this topic in Portfolio with the title: "Az „összeszerelő üzem" hamis mítosza" (The false myth of the "assembly plant"). In that case NKFIH support was not indicated because it didn't belong to the scientific but the popular output of the project. The article aroused considerable interest and many renowned researchers reflected on the article.

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An article in English written by Éva Palócz with István János Tóth at Springer Publishing House is expected to be published at the end of 2021. The article examines the question, listed in our work plan, of how the firm size distribution (FSD) of the Central and Eastern European EU member states, including Hungary in particular, developed between 2010 and 2018 in EU comparison.

The major conclusion of the chapter was that firm size distribution is only one dimension of economic performance and productivity levels. There are also strong country-specific characteristics that influence economic growth, regardless of the size structure of firms. All countries have a heterogeneous corporate sector, and each corporate size category has its significance.

Nevertheless, our research has shown that the firm size distribution has some significance. Countries with higher average firm size tend to have higher than average productivity. Therefore, in the CEE group, the lower average firm size is one of the factors leading to lower labor productivity. However, FSD is not necessarily the cause of low or around average productivity levels but instead reflects the overall state of the corporate sector. Firms' size structure and labor productivity might be traced back to common roots: institutional, behavioral, cultural, and other factors. More importantly, in the CEE, particularly large differences in labor productivity between firm size categories indicate the presence of a dual economy. In Hungary, Slovakia, the Czech Republic, and Romania, the dominant presence of large foreign-owned companies strongly determines the relatively high productivity of large companies.

The data also showed that domestically-owned small businesses were unable to keep up with high productivity foreign firms in most CEE countries. The key to increasing macroeconomic productivity and creating a more balanced firm size distribution in these economies is therefore the improvement in productivity of micro, small, and medium-sized enterprises which have a higher share in employment than average for EU-countries. However, the CEE group is not homogeneous in this respect, either. In the Baltic countries, firm size distribution is more balanced and productivity differences are smaller than in the V4 and Romania.

Although there are no statistics available yet on the structural shifts in the business sector during the Covid-19 crisis, empirical evidence suggest that large corporations have been more resilient to the crisis, which might push the average firm size up. At the same time, we know that the micro and small business sector, which has been most exposed to the negative effects of the Covid crisis, is flexible: failing businesses can be replaced by new ones. Therefore, the Covid crisis presumably did not have a significant impact on the company size structure. However, medium-sized companies (50-249 people), whose employment share fell in most CEE countries before the crisis, may find themselves in a difficult position, as they are not as flexible as small businesses and do not have as strong market positions as large companies.

Work package 2: Features of trade in value added and reappraisal of export performance of Hungarian companies

Together with Czechia and Slovakia, Hungary has one of the highest shares of gross export in its GDP in the world. However, according to the latest trade in value-added statistics, the domestic value-added in the Hungarian gross export is only around 40%, which is the lowest among the Visegrad countries and it is also very moderated compared to the EU average. This suggests that the Hungarian economy is backward integrated into the global value chains, as it strongly relies on foreign inputs.

It is mainly the German economy which supplies the most foreign value-added to Hungary through the machinery and the automotive industry. It is also one of the highest importers of Hungarian value-added

export (also through the same other industries). No doubt that the Hungarian trade in value-added heavily depends on the German economy, although there are other segments of our transactions of value-added. The electrical industry is firmly linked to the Chinese partners on the imported inputs side, and the regional bilateral relations are also strong.

These peculiarities were revealed during the early stage of the desk research, when the team acquired the multiregional input-output tables from Eora[1]. The database was digitalised, and several functions were written to analyse the role of Hungary in global value chains. AFter investigating the time series it was concluded that the position of Hungarian enterprises in the GVC's is rather ambiguous. The ratio of domestic value-added in the gross export (DVAX) has been declining since the 2000s, and today the Hungarian DVAX indicator is the lowest among the Visegrad countries right after Slovakia. However, the decline of the DVAX values is not a region-specific process, as the international share of labour began to accelerate in the 1990s and gradually became fragmented in the 2000s. That was the golden period of modern globalisation, which significantly moderated after the Millennium. Thus, more and more producers entered to the global value chain, therefore the share of domestic value added decreased in most of the countries.

The fact that the share of value-added in gross export is not always necessary a concern of national competitiveness. Throughout the research Czechia and Romania received special attention, because these two competitors of the Hungarian economy have some more favourable characteristics in the global value chains. It was found at the very beginning that the size of the local market positively correlates with some GVC indicators. By analysing the national company data purchased from Coface, it was discovered that the large domestic market contributes to the development of some large national companies that can also penetrate to the international market, and beside the domestic one, they are able to supply other markets as well. Although sometimes a considerable amount of FDI is also involved, these firms can become a global player, too. The vehicle industry a good example in the Czech Republic (Skoda) or Romania (Dacia), because these companies have a large domestic market, while they also have an ample share on the international market.

As the aforementioned companies have a long history in their home country, the supplier network is also at disposal for the main producers, and this also generates domestic value-added. At the same time, Hungarian exporters still rely more on foreign inputs, which can be derived to the low productivity of the Hungarian suppliers. In Hungary, the foreign owned companies have much higher productivity compared to the domestic firms, and it is also true, if these local enterprises are matched with those regional foreign suppliers through which the Hungarian exporters procure their inputs.

Nevertheless, if we turn our attention to the local supplier network, Hungary has a clear favourable progress. The measure of indirectly exported value-added is an indicator of how local producers can indirectly participate in the global trade by contributing inputs to those companies that have direct exports. This ratio is permanently increasing in the Czech Republic and Hungary, while it is constant in Poland and moderately decreasing in Slovakia. In case of the latter one could assume that the indirect exporters became direct exporters by time, however it is not likely, because the Slovakian DVAX/gross export values contradicts to that. A probable explanation is that the Slovakian local suppliers had been substituted by foreign firms. At the same time, the Czech firms could keep their position, while the status of the Hungarian suppliers is not that robust. In 2005 when Hungary lost a part of its wage competitiveness due to the fast increase in the unit labour costs, some companies could also lose their position, which they acquired back later in a decade.

During that research phase we focused on those Hungarian companies, that are indirectly participating in the global value chains. That layer is completely hidden from the official statistics, due to the fact that sometimes the suppliers are not aware of who the final consumers are. Indirect exporters are not reporting any exporting activities to the authorities, and many times they do not even directly export anything, thus

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[1] As it was already mentioned in the interim reports, due to the unexpected and unforeseenable rise in the price we were unable to purchase the international company database from ORBIS. Therefore, we utilised other sources of data, that were more aggregated compared to the one in the research proposal.

they do not have any export revenue in their income statement. The only existing way to detect and trace the role of these indirect exporters in the global value chains is through the international input-output tables, albeit these data are often very aggregated. Case studies scrutinised during the literature review suggested that the main indirect exporters are usually small- and medium size enterprises (SMEs). This assumption was relied on the relatively (compared to large companies) unfavourable returns to scale levels and other factors of the SMEs, which constrain their possibilities to export directly (lack of management commitment, insufficient financial background, limited production capacity etc.).

The existing methodologies are not appropriate to investigate the aforementioned issue, because the lack of suitable data. Therefore, a new process was developed which made possible to analyse the importance of Hungarian firms by size in the global value chains. For that, we utilised the database of the National Tax and Customs Office (NAV) and the Hungarian symmetric input-output table published by the Central Statistics Office.

The main feature of the applied method that it links the NAV database of balance sheets, income statements and the input-output table. To that it takes advantage of the so called RAS method which is applied in situations when the structure of input-output matrix is known for a previous year, and in the next year only the elements on the sides are available. By the RAS method one can estimate the elements within the matrix, assuming that there are no significant structural changes compared to the previous year (this is a very plausible assumption). In our case the input-output structure of the Hungarian economy by company size was unknown, however the aggregated IO table (by industry) was known, just as the side elements of the detailed matrix. The latter was simple given by the total number which was allocated by sizes based on the NAV database.

This method has some congestions and to bypass we took some plausible assumptions:

•   Neither the CSO, nor the NAV datasets contain information about the intra-industrial trade by company size. Therefore, it was assumed that the structure of transactions within the economy is similar to the structure of the aggregated IO data.

•   Export data is available by size from the NAV database, however the import is also required to fill out the IO table. The only source concerning the imports by firm size is provided by the CSO, but it covers merchandise trade only, thus data on trade in services are not available. After reviewing the international literature and statistics we concluded that the structure of trade in services is assumed to be similar to the structure of trade in goods. By that, data on the import use by company size could be produced.

•   Due to the required computitional time required for the estimation algorithm, we concluded that only the 3 main sectors shall be covered, that is agriculture, manufacturing and services.

An optimisation algorithm was run to get the matrix elements by the RAS method. The produced detailed matrix was within 2% error margin of the aggregated version, thus the estimation was successful. As the IO table was available by company size for the three main sectors, we could calculate the GVC indicators for the SMEs and the large companies.

The results showed that the Hungarian SMEs are integrated into the global value chains in more or less the same degree as the large companies. The difference is that the major part exported value-added of the SME sector is indirect, that is, the most products and services of the SMEs are built into other products of direct exporters. Despite of that the trade in value-added of small and medium sized enterprises is only the third of the amount exported by large companies.

An interesting outcome is that DVAX value of the SMEs is larger than in case of the large companies. In other words, the export of SMEs contains higher value-added (direct and indirect) compared to those firms that employ more than 250 employees. However, this is not surprising, as the value-added produced by the SMEs is twice as more than their export, while it is only half for the large firms, because their export is much larger. This reiterates the findings that were introduced in the first section; the largest exporters in Hungary mostly rely in foreign inputs, while the mostly use the domestic resources.

To filter the effect of the different export volumes, one can adjust the indices by using the output as the deflator. This presents how much of the value-added created (direct and indirect) is for export. In the agricultural sector the SMEs export only 8%, while the large companies have 56%. This distribution is similar in every sector. The conclusion is that most SMEs are trading with other small companies, and the majority of value-added by this sector is consumed by residents. At the same time, most transactions done by larger firms are conducted with another large firm, especially if the product will be exported.

The main conclusion of that work package is that the export of Hungary has two faces. Large companies (most probably with foreign ownership) give the largest part of our export. Some local SMEs could integrate into this value chain and by that they are also indirectly participating in the GVC. However, the number of these SMEs are very low, as most small companies are supplying domestic demand, and most economic transactions are done with other SMEs. The domestic supply of the large companies in Hungary is arguably increasing, but the dependency on foreign inputs is still high, for which the low productivity of the SME sector is responsible (see work package 1).

WP3: The integration of Hungarian companies into Eastern-European value chains

Analysing regional value chains requires a complex approach, because the multiregional input-output tables usually cover at least 60 countries around the world. This means that one shall segment the global network by regions in order to have more specific inferences. That approach is widely applied in the literature, and some recent studies argued that global value chain are more fragmented as they were previously thought to be. Local connections are truly important, albeit links to biggest actors of the world economy (like China, Germany, and the USA etc.) bear particular significance on both demand and supply side.

The application of network science in the analysis of global value chains was already promoted in the proposal. GVCs are traditionally studied through the toolbox of mathematical economics, namely by input-output methods. Nevertheless, there are other methods available to perform analysis in a different point of view. The utilisation of graph theory in the GVC research is a relatively new aspect. It is based on the realisation that the transaction matrix of intermediate goods and services in the input-output tables is equivalent to the adjacency matrix in graph theory.

Still, network science has not achieved significant results in global value chain analysis, mainly because these networks were extremely dense, and the methodology applied on that field are developed for network with much less connections (mainly for social network analysis). The input-output tables form a complete graph (in which every node has an edge connecting it every other nodes)[2]. The complete graph is a peculiarity of input-output tables, which constraints the applicability of classical network theory methodology, thus the demand for pruning the network usually emerges. In that case an algorithm finds and eliminates those edges that have very little effect on the characteristics of the network. The algorithm assumes that the edges (trade links) are substitutable, which is not plausible in economic point of view. Therefore, pruning the network of global value chains is not recommended at all, because it deletes existing trade relations that are certainly optimal, and their substitutability is not ensured on the short run.

Segmentation is a popular method in network analysis. These tools create subnetworks within a graph, and they are quite similar to those that are applied in multivariate statistics. In the GVC framework these procedures also have limited useability, because due to the specificities of these models the segmentations usually happen along the nodes with the highest weights. Thus, the world is segmented along the two largest exporters, suggesting that the two largest and most important countries or industries are completely separable, albeit the most intensive trade is most probable happens between these two countries.

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[2] Complete IO tables are not common, because those links that are considered as insignificant are simply neglected (see for example the WIOD database). At the same time, there are datasets (like the Eora dataset which is utilised in the research) that are fully complete.

In this work package an alternative segmentation method was proposed which ensures that the country (or industry) in question remains in focus. In that bottom-up approach the network is built around the initial node which secures that only those vertices will be included in the network that are important for the node in focus and to every other member of the network. This is an important aspect of the segmentation methodology, because classical clustering methods build the partitions around the largest nodes, that is around the largest economies with the highest export volumes. In that case smaller countries (measured by GDP) are generally neglected by the clustering algorithms, as though they were satellite suppliers/users of the largest exporter/importer.

By applying that methodology one can grow the relevant network around any node. In that particular case we tested if the value chain of Hungary is truly regional. Based on the results it can be concluded that the geographical coverage of the graph is not limited to Eastern-Europe. Furthermore, Hungarian firms are more related to German, Austrian, French and Italian companies than to Slovakian or Czech enterprises (considering both direct and indirect flows of value-added). In addition, the network is not limited to Europe only, because it also includes China, Japan, Russia, and the USA.

As a control we have checked the networks of other Visegrád countries and Romania. Poland, Slovakia and Romania have a very similar one to Hungary, but the Czech Republic is very distinct, as it has links to Nordic countries (to which Hungary does not), and has significant partnership with Southern economies, like Greece or Cyprus. The following figure presents the network revealed by our algorithm:
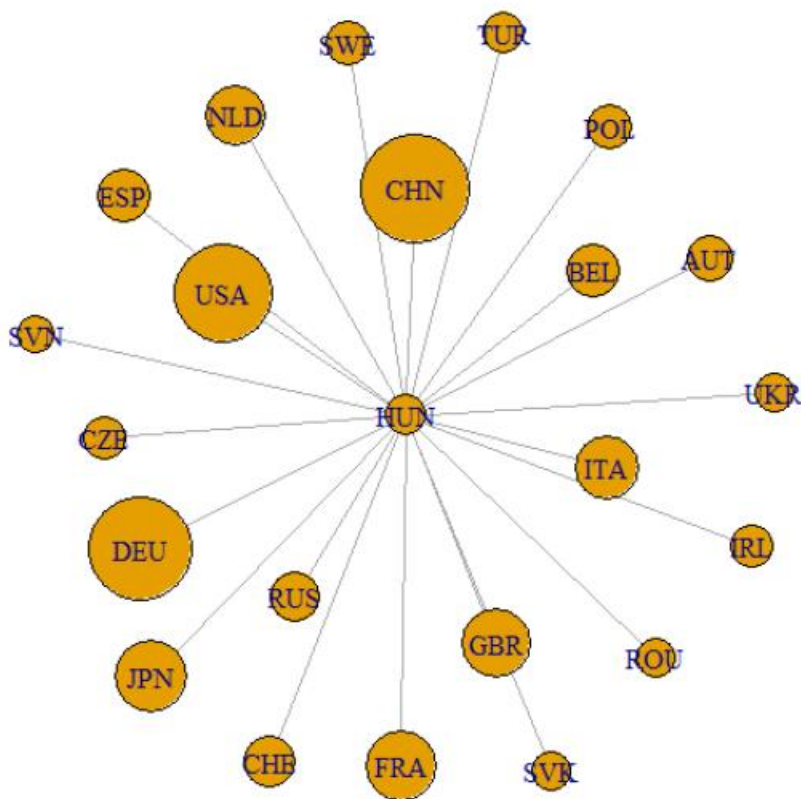
The network above covers 90% of the Hungarian export of value-added (direct and indirect as well). For the sake of simplicity, those edges that are not connected to Hungary were pruned. An interesting finding is that all other Visegrad countries as well as Romania has a more diversified network than Hungary. Germany is one of the main partners everywhere, however its weight in the Hungarian network is well above the average. Therefore, the Hungarian value-added network is highly concentrated compared to other countries. That is not necessarily a concern, however it also means that the dependency in the Hungarian network on other countries is higher than the average. This reiterates our findings in the second world

package (WP2). The largest value-added exporters mostly rely on foreign inputs (with high German and Chinese value-added in it) and depend less on the domestic market.

Another aspect of the value-added networks is that they can be made dynamic. This step is necessary in order to evaluate the position of the companies in it. To reveal the flow in the value-added network, one should turn to the classical methods of input-output analysis. One flaw of network science is that when it comes to time series it only investigates the changes of edge weights, which will not determine the flow of value-added in the network. The method applied is also known as the structural decomposition analysis (SDA), and it can disaggregate the route of the value-added (direct and indirect together).

That toolbox can manage direct and indirect trade links. The letter is also known as the "first round", which is country that the value-added "visits" before arriving its destination. The "second round" countries are evidently those two countries that are importing value-added from the base country and from each other before supplying the value-added to its destination country.

In this phase we have chosen one trade relation to be analysed: the path between Hungary and Germany's export. It was calculated that the value-added produced by Hungarian companies can "visits" almost all European countries before arriving to Germany (there is also a direct path between the two countries, which is obviously not investigated here) and going to export to another economy. Besides that, among the top 30 intermediary countries 26 are in Europe, and only 4 are out of the continent: Russia, China, Japan and the USA.

Analysing value-added flows are a bit over-aggregated, therefore we limited the analysis to the Hungarian motor vehicle industry. The highest value-added flow between Hungary and Germany is of course the direct one. Besides that, the "first round" flows are dominated by Austria, Czechia and Slovakia in Europe and the USA, Japan, China, South-Korea from the group of non-European countries. According to the industrial decomposition, the Hungarian motor vehicle industry supplies value-added to mostly other vehicle sectors, however trade relations were also found with electronic, machinery or chemical industries. We also examined the same in case of the Visegrád countries and found that the first-round partners are more or less the same in the automotive industry.

It was a surprising research result that the Hungarian automotive industry, whose output occupies one of the best positions in Hungary, is not well situated in the GVCs in terms of both ranking (place of the link in the chain) and its share in the total value added. The two indicators are, of course, interrelated. The longer the value chain and the further down a supplier is placed in the chain, the smaller its share in the value added of the entire production chain.

In fact, the share of value-added produced by the domestic automotive companies is initially quite low compared to the chemical industry. In case of the latter 3-4% share after the first round is common, while it is usually below 2% in the vehicle industry. In other words, the share of Hungarian value-added produced by automotive suppliers diminishes much faster than the share of Hungarian value-added produced by the chemical industry. However, it must be noted that the volume of the latter is much lower. One cause behind this can be the difference in productivities between the two industries.

WP 4: Synthesis and conclusions – significance of the project in macro-economic context

Hungary is well integrated into GVC-s but with a weak position

Our research has clearly demonstrated that Hungary is well integrated into the global value chains, however its position is generally weak. The exported domestic value-added into the final demand or into export of the partner countries is very low compared to other European countries. Compared to Hungary, Czechia and Poland could achieve a more advanced spot in the value chains. The reason behind this is that the average Hungarian participant in the value chains is heavily dependent on import, that is, the participation of Hungary in the GVCs is backward. This carries a lot of risks due to the dependency on foreign inputs. However, the distribution of import dependency in the Hungarian manufacturing industry is far not even, one of the largest sectors (by employees or output), the automotive sector produces one of the lowest value-added per gross export ratio.

This overdependence on imports caused by backward integration slips uncertainty into the macroeconomic conditions. If a country is very close to one of the ends of value chain, especially if the domestic market is small, it leads to a high volume of foreign trade (export, import or both). Direct value-added exporters tend have a local supplier network in the background, that is, not always those firms are exporting which are importing (if they do it means the lack of local suppliers). The greatest challenge arises when the country is exposed to high foreign *exchange risks*. In case of devaluation of the national currency, the importers suffer losses, while the exporters gain extra profit. If the exporter shared this profit with the importer, the loss of importers could be reduced, however based on our regular survey among the manufacturing industry this is not the typical case in Hungary. Undoubtedly, the devaluation of the domestic currency is more favorable for smaller domestic companies, operating with lower import rate, but this doesn't bring sustainable benefits, on which it is dangerous to rely.

The strength of the position of the businesses of a country in value chains and the rate of value-added affect also the ability to enforce prices. Macro-level gains or losses from changes in Term of Trade (ToT) are an important point of reference in assessing the position of businesses in international value chains.If the terms of trade improve (the price index of exports is above that of imports), real domestic income increases by more than real GDP, permitting higher growth in real domestic expenditure than implied by the change in domestic production itself; a deterioration in the terms of trade imply the opposite. Since several new member states of the EU achieved significant gains in their ToT, the convergence in terms of per capita real domestic income was steeper than what is indicated by per capita GPP within the EU. Hungary's convergence is well below its potential in both respects, but the lag behind the potential output is larger regarding per capita real income than per capita production.

Unbalanced distribution of participation in GVCs

Regarding the situation of companies of different sizes, we found that the participation of Hungarian small and even medium-sized enterprises in the value chain is rather limited. This finding is in line with the results of other research carried out within the framework of the project, which showed that the productivity gap between companies of different sizes, compared to the national average, is particularly large in Hungary. This gap is larger than the EU average and also exceeds that of many regional competitors. Thus, the productivity disadvantage of Hungarian micro and small enterprises is extremely high compared to the national average. This may explain their low participation in GVCs.

However, our study based on detailed NAV data and on interviews also pointed out that while the average participation of domestic SMEs in global value chains is low, there are particularly productive SMEs that are successfully (either directly or indirectly) integrated into value chains. This shows that behind the average low productivity of Hungarian micro-and small enterprises there are large differences among different types of firms. The group of SMEs is also heterogeneous, with average productivity reduced by the almost non-viable companies that are only able to stay afloat through low wages and often tax evasion (e.g., undeclared or fictitious minimum wage employment). The export intensity of SMEs is also varied; about half of the small companies do not export directly at all, while there is a narrow segment that exports

a significant part of its production. This segment of small businesses is also able to engage in global value chains, as it requires the same capabilities as export activity. Productivity and export capacity are closely linked, as only companies with a good productivity indicator can be competitive in the international market.

However, the vast majority of domestic SMEs (and especially micro-enterprises) produce only for the domestic market, even in tradeable sectors. Obviously, there is competition in this market as well, but not as fierce as in the global market, especially between companies supplying local markets.

Growth poles and macroeconomic conclusions

According to our literature review, most value chain analyses covering Hungary study the automotive industry. This is mostly because it produces one of the largest outputs and employs a considerable share of the labour force. However, our study showed that the domestic and international multiplier effect of the local vehicle industry is quite low compared to other (smaller) industries. It must be noted it is not a Hungarian peculiarity, as similar multipliers were found in the region.

Our analysis found that in the Hungarian automotive industry the value-added (direct and indirect) share in the export of partner country (for example the Hungarian value-added content in an Italian export to France) is below 2% on average. At the same time, it is between 5-8% in the chemical and electronic industry. This suggests that in case of the latter two sectors the importance of the domestic supplier network in the value chain is much higher. It also assumes better relative position in the GVCs. It is also not marginal that the share of domestic value-added in gross exports in these industries is about 40-50% which is significantly higher than in the automotive industry where it is only about 20-30%. Thus, the automotive sector is one of the largest employers in Hungary, however the chemical (including the pharmaceutical companies) and the electronical industries are potentially more appropriate to be called as growth poles of the economy.

Politicians and experts often complain that large multinational companies are deploying relatively low value-added segments of value chains in Hungary. This is partly true, as our research has also shown, although other benefits such as better jobs and significantly higher than average wages have to be considered. And higher wages are also a kind of compulsion for small companies operating with particularly low wages, thus accelerating the renewal of the sector. On the other hand, the allocation considerations of multinational corporations can be little influenced by economic policy, at most through the selection of foreign corporations wishing to establish in Hungary, which it apparently does not do.

The deep integration into the value chains has its own opportunities, though. Participation in value chains requires continuous innovation from producers and only companies capable of technological advancement can enter and remain in value chains. It is therefore a watershed between small businesses capable of development and other SMEs, as in the case of exports. Thus, while striving to get as many SMEs as possible to participate in GVCs, the real goal is for more SMEs which share the values needed to be able to export and participate in GVCs. And this also poses a challenge to the macroeconomic environment, by creating transparent, predictable and fair economic conditions and improving the quality of education and training.

Consequences of Covid-19

The pandemics has shown the bottlenecks of the global value chains. One must reconsider the dependency structure within the GVCs, because the past year proved that any link regardless of its size or role can be a potential bottleneck threat to the whole production chain. Dependency on raw-materials, parts and accessories or logistics can cause hiatus in the production somewhere else in the world and a few weeks of production halt is detectable in the GDP. Of course, a lot depends on the nature of the product (countries lack of raw materials cannot substitute import), however a stronger local supplier network can reduce the risks a bit.

The possible stronger reliance on local supplier can even raise the chances of domestic firms to get involved in GVCs. However, the Covid crisis caused severe damages in the entire business sector in all countries but a number of short time analyses and sporadic information suggest that small businesses have been hit harder by the economic downturn than large corporates. Today, it is still an open question whether progressive

companies in Hungary were more resilient to the crisis, or there was a certain type of counter-selection in which less transparent companies were in a better position.

Dissemination: publications and presentations

Publications

2021

Tóth, István János - Palócz, Éva (2021): Firm size, productivity, EU-funds, and corruption. In: Emerging European Economies after the Pandemic: Gone with the Wind. Mátyás, László (ed), *Springer Publishing House. In the Series: Contributions to Economics.* Chapter 3. Forthcoming. The first subchapter in the book about the correlation between firm size distribution and productivity was written by Eva Palócz.

Vakhal, P. (2021): The analysis of global value chains by tools of graph theory. PhD dissertation draft. Budapesti Corvinus Egyetem. Budapest. pp. 178. The development of the new method and the complete analysis, presented briefly in WP 3, constitute the fundament of the PhD dissertation of Peter Vakhal for which he received the maximum points on the workshop preceding the final discussion, which will take place during the autumn semester:

2020

Czakó, E., & Vakhal, P. (2020). Hungary in Global Value Chains. In X. Chen (Ed.), CEE Countries in Europe: Toward Center or Periphery in Global Value Chains (pp. 104–110). China-CEE Institute. https://china-cee.eu/wp-content/uploads/2020/11/PDF2019Project3.pdf

Vakhal, Péter (2020). Magyar kis- és középvállalkozások a globális értékláncokban. Külgazdaság, 64(5–6), 30–59. https://doi.org/10.47630/KULG.2020.64.5-6.30 https://kulgazdasag.eu/article/1444

Vakhal, Péter (2020): Possible alteration of global value chains in the CEE region. In: The Restart of European Economy and Its Impact on Central and Eastern Europe. Palócz, É. (ed). Kopint-Tárki and China CEE Institute. pp. 29-37. https://china-cee.eu/wp-content/uploads/2021/03/newbook_restart_2march2021.pdf.

2019

Palócz, Éva (2019): Adalékok a külföldi vállalatok magyarországi szerepének a megítéléséhez. Külgazdaság LXIII. évf. 2019/9-10. pp 39-64. https://kulgazdasag.eu/cikk/2019/adalekok-a-kulfoldi-vallalatok-magyarorszagi-szerepenek-a-megitelesehez

Oblath, Gábor (2019) Külkereskedelmi cserearányok, bruttó hazai reáljövedelem és bruttó hazai termék: változások és szintek nemzetközi összehasonlításban. Kopint-Tárki Műhelytanulmányok, No. 54.

2018

Palócz, Éva – Vakhal, Péter (2018): Mi lett velük: egy kiterjesztett esettanulmány tanulságai a középvállalati réteg sorsának alakulásáról 2000-2016 között. in: Társadalmi Riport 2018. Tárki Zrt. ISSN 1216-6561. https://www.tarki.hu/sites/default/files/trip2018/203-216_Palocz-Vakhal_kozepvallalatok.pdf

Conference presentations

Vakhal, P. (2021, June 21). Magyarország elhelyezkedése az értékláncokban – egy gráfelméleti megközelítés. Globális Értékláncok Mérési Lehetőségei section. Innováció, digitális transzformáció és a válságból való kilábalás útjai conference, Győr. The presentation introduces an innovative alteration of graph theory that offers a new way to analyse cluster in global value chains. It also maps the segment of Hungary.

Erzsébet Czakó, Éva Palócz and Peter Vakhal (6 September 2019): Participation in the round table at the 57th Conference of the Association of Hungarian Economists (MKT), where the future of global value chains in term of the competitiveness of the Hungarian economy was the discussed

Vakhal, P. (2019, December 14). Accounting Global Value Chains and competitiveness: A challenge for official statistics. 45th EIBA Annual Conference 2019, Leeds. The presentation reviews the current accounting practices of official statistics to register global value chains. It argues that the current process became inappropriate by time because of the new forms of trade and multinational corporate operation.

Vakhal, P. (15 November 2018): Presentation at the conference of the European Research Institutes of Business Cycle (AIECE) his working paper "Sources of growth – production functions of European automotive industry: A micro approach". In that publication he applied panel econometrics to prove that in automotive value chain in Eastern Europe firms can increase their output by increasing their workforce, while in the EU15 members, capital investments have much higher importance.

Vakhal, P. (2018, November 21). A termelési tényezők szerepe az európai járműipari értékláncban. Magyar Tudomány Ünnepe – Nemzetköziesedés és fenntarthatóság konferencia, Budapest. The paper evaluates the role of production factors in the European automotive industry and reveals that the highest return to scale is on labour force in the CEE region, which is due to the large difference in productivity between the EU15 and EU13.

Vakhal, P. (2018, November 14). Hol helyezkedik el Magyarország a regionális beszállítói láncban? A Magyar Logisztikai, Beszerzési és Készletezési Társaság 26. kongresszusa, Siófok. The presentation reviews the position of Hungary in the automotive parts supply chain. It argued that Slovakia ha a centered position, while Hungary rather plays a marginal role compared to Czechia. Hungary strongly linked to Germany, however the links with regional countries are rather weak compared to the link to Germany.

Vakhal, P. (2018, March 7). Competitiveness from official statistical data – what do we really know? Competitiveness of Firms and Locations in the Digital Age, Budapest. The presentation presents how the widely used indicators of competitiveness is biased by globalisation. It argued that the competitiveness of the region is rather lower, while it is most probably higher in the EU15.

Vakhal, P. (11 November 2017): Presentation at the conference of the European Research Institutes of Business Cycle (AIECE) his working paper "Possible extensions of SNA data collection for better TiVA statistics". In this presentation he has shown how changes in global trade affected the data collection of SNA data, and how much bias can be generated by the new forms of trade.