

Drivers of productivity differences in the Hungarian manufacturing sector 2014–2017

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Earlier research proved the existence of multilayer dualities within the Hungarian Economy. Based on these findings, this paper examines the driving forces of productivity differences comparing two groups in Hungarian manufacturing sector: locally owned and foreign-owned companies. The cluster analysis and the panel regression based on financial data of 1725 firms for the period 2014 to 2017 revealed that, while crucial driving forces may match, their direction and importance differ considerably. While foreign companies have an apparent advantage in productivity, their increase in export ratio correlates with lower efficiency; in contrast, export intensity boosts the efficiency of the locally owned companies. While the proportion of highly trained workforce correlates with productivity, this effect appears to be weaker in foreign-owned companies, which signals inefficient use of intellectual resources. These results raise questions regarding the efficacy of the current Hungarian economic policy of promoting foreign investments (FDIs).

Keywords: competitiveness, TFP, ownership, export, wage level

1. Introduction

International statistics show a considerable difference among the productivity levels of different countries, and within countries across industries, company size, and ownership types. Usually, locally owned entities are less productive than foreign-owned ones, particularly in emerging countries. Such productivity lag hampers inter-firm cooperation and the convergence of countries – a fundamental goal of the European Union.

Understanding the drivers of productivity differences may help to find appropriate economic development policy measures, increasing the efficiency of firms, and boosting GDP growth. After a short literature review, this paper focuses on comparing differences in drivers of productivity across various groups of Hungarian manufacturing firms for the years 2014–2017.

2. Literature review

There is an extensive and diverse literature concerning the differences in business productivity. Results underscore that productivity disparities across countries are mostly due to inequalities in access to resources like technology and human knowledge. Besides that, different levels of managerial skills also have a considerable role in both inter- and intranational productivity differences (Bloom et al. 2010, 2012a, 2012b). Within countries or industries, these differences also depend on the

level of development of the economy. Syverson (2010) states that in China and India, the most productive ten percent of the business sector may perform four or five times better than the rest of the economy. In comparison, in the USA, there is only a ninety percent difference between these two groups

Duality is not a new problem, as it is inherent in foreign direct investments (FDIs). It inevitably occurs when investments from more developed countries take place in less developed regions (McMillan–Rodrik 2011). Halpern et al. (2015) highlight that during or after the transitions in the Central and Eastern European (CEE) countries, productivity growth stemmed from the expansion of the private economy, the increased investment activity of foreigners, the breakdown of trade barriers, and thereby boosted exports and imports.

Expanding FDI has deepened duality in CEE. Subsidiaries of foreign companies adapted their structures developed elsewhere within a short period; that is, as Dyker (2004) emphasises, the workforce had the capacity for internalisation in terms of education, social, and ethical standards. In addition to utilising existing capabilities, capital, investments into technology and equipment was also needed, but systems, including management techniques, had to be adapted too to realise productivity benefits. However, this process caused an increase in duality rather than any convergence.

The lack or the limitations of convergence appeared on several fronts. For example, foreign-owned firms created significant exports and intensive imports. Nevertheless, their impact on productivity and growth remained localised; it manifested only within the group of privatised firms or greenfield investments. However, based on Majcen et al. (2009) and Vukšić (2016), they had little or no impact or spillover effects on locally owned firms, or sometimes they even had apparent negative consequences.

Researchers could not identify any convergence on productivity between locally and foreign-owned firms in ten CEE countries over the period between 1995 and 2014, either at country level or the level of most industries. (Table 1) Although the productivity gap has somewhat narrowed, this was mainly due to significant productivity increases in some countries, especially the Baltic States, while Bulgaria lagged behind during this period. Nițoia and Pocheab (2016) underline that meanwhile, significant divergences have emerged across sectors.

Table 1 GDP per capita in purchasing power parity (EU 27 (without UK) average=100)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Bulgaria	44	46	47	46	47	48	49	50	51	53
Czechia	84	84	83	85	87	88	88	90	91	92
Estonia	66	72	75	77	79	77	77	79	82	84
Latvia	53	58	61	63	64	65	65	67	69	69
Lithuania	61	66	71	74	76	75	76	79	81	82
Hungary	66	67	66	68	69	70	68	69	71	73
Poland	63	66	68	68	68	69	69	70	71	73
Slovakia	76	76	77	78	78	78	73	72	73	74

Source: Eurostat-FATS (2020b)

Foreign companies bring benefits to the host countries; however, their presence in the region is mostly due to the lower wage level. Trends in employment in developed European countries between 1993 and 2010 showed that employment increases in host countries occurred in outsourceable activities with medium wage demand, such as machine operators and assembly activities. Cost advantage was the primary driving force behind this restructuring, and these trends led to a stiffening of the division of manufacturing activities across countries. This phenomenon is reflected in longer-term variations in economic development (GDP), wage differentials, and lack of convergence. In the dual-economy structure, insufficient convergence may also originate from foreign subsidiaries exercising full process control in their business model.

Based on Goos et al. (2014), within the locally owned companies, more complex reasons restrict cooperation with foreigners and the ability to catch-up by themselves. Primary factors include the available amount of capital, business size, and the quality of the management.

The lack of convergence is apparent beyond the field of corporate productivity, according to Hungarian researchers, like Kotosz and Lengyel (2018). The V4 countries (Slovakia, Czech Republic, Poland, and Hungary) did not show convergence in GDP per capita between 2000 and 2014. However, some post-crisis convergence appeared due to the slowdown in the developed regions. The causal relationship between FDI and economic development could not be confirmed for the V4 countries. Instead, the squeeze-out effect of multinational companies on the domestic market is likely to gain importance.

While FDI does not lead to a higher level of development in V4 countries, the relative level of development affects their ability to attract capital. The economic model based on FDI was distorted, and the policy of supporting foreigners was not coupled with the strengthening of domestic companies. Gál and Juhász (2016) underline that this phenomenon was particularly real in Hungary, and least valid in Poland, where the internationalisation of Polish companies was an explicit economic policy objective.

In the division of production activities within the European Union, the weight of manufacturing in the ten post-socialist countries almost doubled after 2000, rising from 5.5% to 10.6% by 2016 (Nagy et al. 2019). This growth is a consequence of the intensive FDI and indicates the main direction of the division of activities within the EU. Regional FDI activity mainly covers low value-added, labour-intensive activities based on the cheap workforce. This group of countries emerged into assembling locations, while higher value-added activities tend still to concentrate on more developed countries. This division reproduces a centre-periphery relationship. Obviously, beyond the natural interests of countries, there may be fundamental reasons for this, which are rooted in the low productivity, weak innovation, reduced knowledge level, and poor management skills in these peripheral countries. Late arrivals would find it difficult to obtain positions even if they had no fundamental disadvantages.

Koppány (2017) highlights that foreign investments in Hungary are mainly export-oriented, using imported materials for creating an export. The growth effect derives mostly from the increase in volume, as the value-adding of exports is mostly low. Companies of the automotive industry are at the forefront of the group of firms following this scheme.

In the manufacturing sector dominated by foreign companies (manufacturing of vehicles, computers and optical products), the value-added content is the lowest among all sectors, according to the input-output tables. Besides these sectors, very few rely on domestic suppliers, while electronics is ranked first based on import activity, and automotive industry achieves the third or fourth position. During recent years, the positive effect of economic growth has been accompanied by an increase in risk in the economic structure. Duality was maintained and strengthened. The domestic corporate sector did not strengthen, and the “sectoral portfolio” of the manufacturing industry did not improve. Economic stability requires diversification, competing domestic and foreign companies, and a risk-reducing sectoral structure.

Research shows that multilayer duality characterises the Hungarian economy (Reszegi–Juhász 2014, Juhász–Reszegi, 2017). A sample of more than 4000 non-financial private firms showed that neither the foreign-owned nor locally owned firms form homogeneous groups themselves. To separate firms using different kinds of technology, we created groups based on whether the given firm paid an average wage higher than what its sub-industry did. For instance, low-wage foreign companies performing usually simple, low-added value tasks had low productivity and performed no better in efficiency than locally-owned counterparts. In contrast, locally owned firms with significant export sales (at least 25 percent of the total sales) showed significantly higher efficiency than the other part of the sub-sample. Foreign firms with high technical equipment level (PP&E/capita) and a high wage (paying over 70–80 percent above the average) could be statistically linked to extraordinary productivity.

Financial statement data do not explain the vast differences within other groups of firms; factors like management skills or innovation level seem to play a role – this requires further research. Ten case studies by Ábel and Czakó (eds. 2013) on export intensive Hungarian companies supported this idea. It became clear that the knowledge and experience of the owners and the top management have a strong influence on the export orientation and the strategy of these firms. These suggest that, in order to be competitive, a company has to be efficient, profitable, and able to learn market and technology; thus, a simple governmental export incentive will not be enough for substantial uplift.

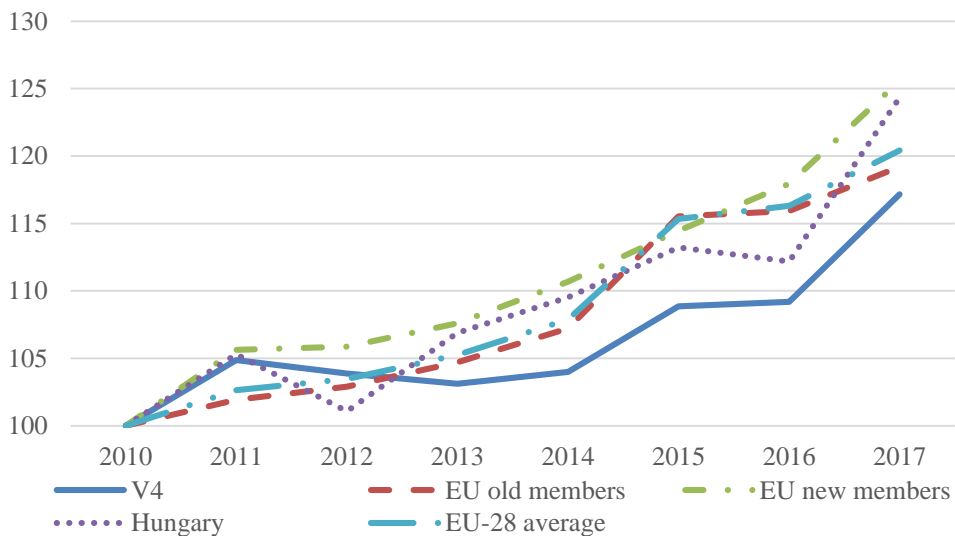
Due to the different dualities existing in parallel with each other, the competitiveness of firms cannot be enhanced by a general, uniform economic policy. (Chikán et al. 2018) To uncover the main drivers behind the differences and identify possible roads leading to convergence, a more complex multidimensional approach is required.

3. Productivity differences across the EU

During recent years, the productivity of V4 country firms has grown in par with their counterparts in the EU (Figure 1). This trend practically implies a lack of convergence, as closing the gap would require a considerably faster development of V4 than the average of old EU members.

Can we expect the investment of foreign firms to help this process? Seemingly, yes, as based on the data from Eurostat-FATS, foreign firms achieve a higher added value per employee level in any EU member country (Figure 2). Though when considering the historical development path, the hope fades. In 2017, the performance fallback of the locally owned companies in old member states was higher than in 2010 by almost 7 percentage points. While the same lag in the new member states decreased by 5 percentage points, the local firms still did not reach 56 percent of the foreign-owned performance. So, a considerable convergence is nowhere to see. On top of that, Hungary produced a far more unfavourable ratio of 35 percent, and the value even decreased by 1.5 percentage points over the years considered.

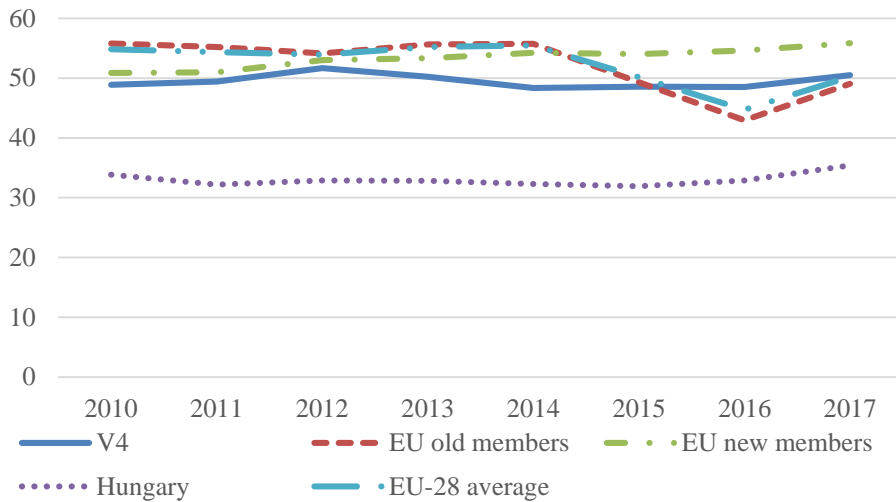
Figure 1 Productivity* of firms by regions (2010=100)



*Gross value added per person employed, thousand euro

Source: Eurostat-FATS (2020a)

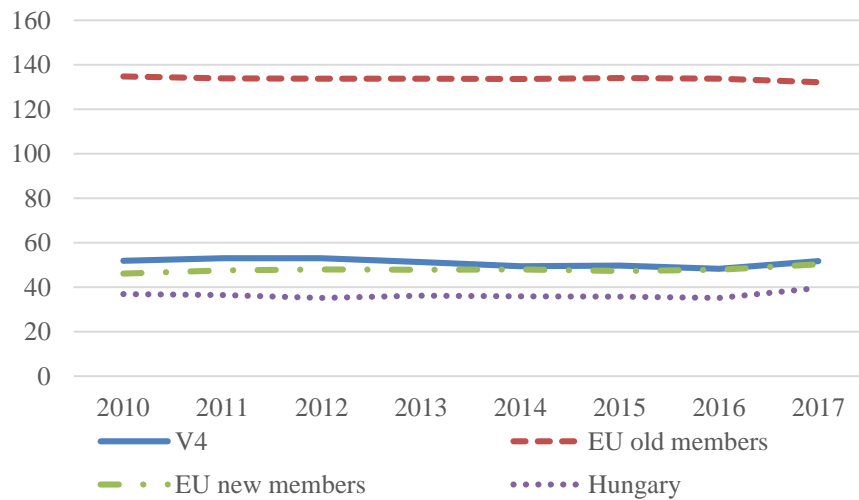
Figure 2 Productivity of locally owned firms as a percentage of that of foreign-owned companies in the same country (%)



Source: Eurostat-FATS (2020a)

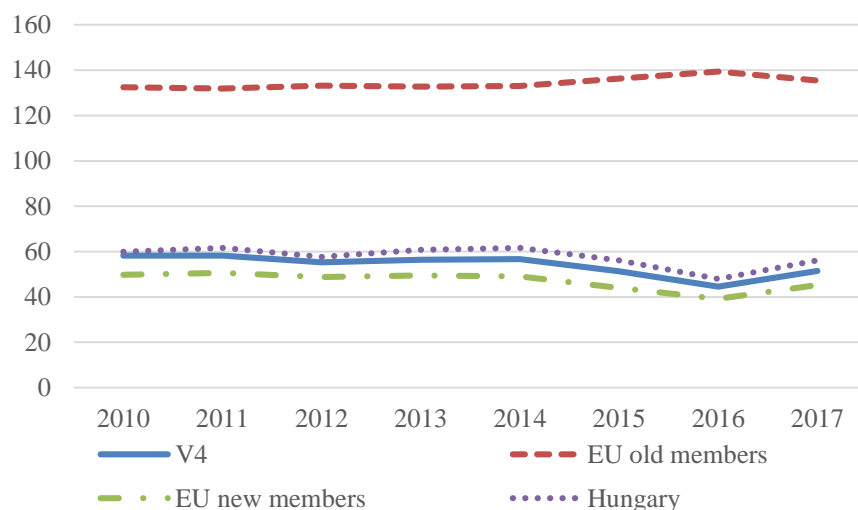
There could be many causes explaining the higher performance of the foreign-owned firms. International business activity usually favours bigger size and higher efficiency, while the average locally owned firms are in a far smaller size range.

Figure 3 Productivity of the locally owned firms as a percentage of that of the locally owned companies in the EU (%)



Source: Eurostat-FATS (2020a)

Figure 4 Productivity of the foreign-owned firms as a percentage of that of the foreign-owned companies in the EU (%)



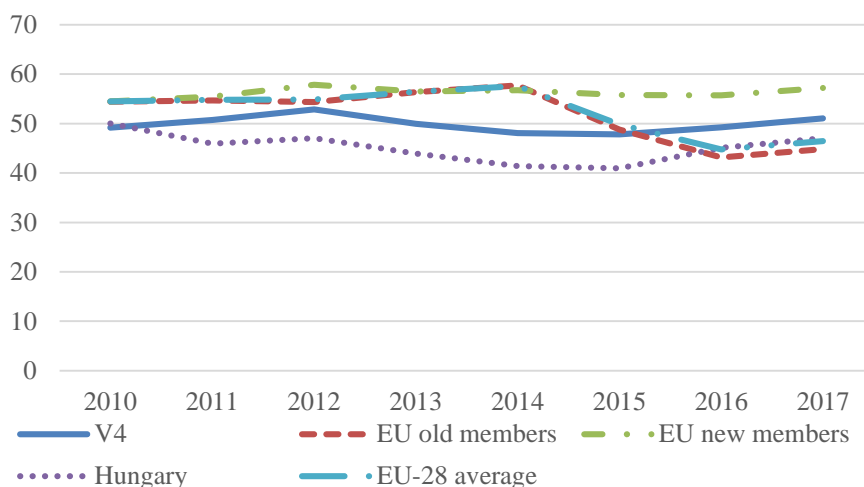
Source: Eurostat-FATS (2020a)

Due to this difference, when contrasting the efficiency rates to the EU average, we should separate the companies on ownership to avoid distortions caused by the complex structuring of the countries (Figures 3 and 4). As for the locally owned firms, new EU members have shown some closing-up to the old members' level. Statistics on foreign-owned companies show a similar picture but with a small deterioration. It is only the average of the new members that got closer to the average of the old ones, but there was no considerable closing-up, neither for locally nor for foreign-owned companies.

When we only focus on the manufacturing industry, the specific research area of this paper, the trends are no different. (Figure 5) During the period 2010 to 2017, locally owned companies experienced a worsening position, typically, compared to foreign-owned companies. Those were only the average of the V4 and the new members that have shown some improvement, while Hungarian firms have a slightly more significant lag. Once again, generally, we see no trace of measurable convergence in any of the groups.

Without any doubt, the growing number of foreign companies and their increasing role in employment has boosted the average productivity of the receiving countries. At the same time, the productivity of foreign companies lags behind the EU average most likely due to the role foreign companies play in the international supply chains. The low added value content of their production may explain why they show little or no positive effect in host countries during the period 2010–2017. The productivity of foreign firms in CEE countries (EU new members) has grown to a lesser extent than their locally owned counterparts and their Western-European counterparts. The gap between a locally owned firm in new and old Member States has slightly narrowed while that between the foreign-owned firms in those two regions instead extended. (See Figures 3 and 4)

Figure 5 Productivity of locally owned firms as a percentage of that of foreign-owned companies in the same country in the manufacturing industry (%)



Source: Eurostat-FATS (2020a)

Thus, the inelasticity of the role these foreign-owned firms play in the global division of labour hampers any closing-up of the host countries. For instance, even if the economy of a less developed country consisted of such foreign-owned firms entirely, the national average productivity would appear to be only 50–60 percent of the developed countries.

Locally owned companies do not show a secure sign of considerable improvement potential either. Their productivity lag is so massive that it makes the opportunities offered by the export markets and the cooperation opportunities with multinationals nearly unreachable.

The presence of the foreign companies is not disadvantageous, of course, but the convergence also calls for successful locally owned entities. However, the question remains: what do locally owned firms that promote catching-up look like.

4. The performance of the Hungarian manufacturing industry

Dramatic differences appear in the workforce efficiency across firms in Hungary (just like in other CEE countries). Our research aims at identifying the key factors that influence the level of added value and those that could support convergence to the Western countries.

4.1. Dataset and methodology

Our database covers the financial statements of privately held Hungarian manufacturing companies with at least ten employees and continuous operation from 2014 to 2017 that published non-simplified financial reports and reported positive equity in each of the years. Companies that went through restructuring, liquidation, or mergers were excluded.

We winsorised the raw data by replacing outliers with the 2nd and 98th percentile, respectively. The Bisnode company provided a dataset extended with details on employment. We also clarified the ownership background of each entity to categorise them as locally or foreign-owned considering their majority shareholder.

With the kind allowance of the Ministry of the National Economy, we were also able to use details for the 2016 wage survey of the Hungarian Central Statistical Office. This survey covered 50 percent of our sample and allowed for estimating the educational breakdown of the employees for the firms in the database. To do so, we created 40 subsamples based on added value/employee, return on investment, and total factor productivity and used the average percentage of employees with higher education for those subgroups from the survey for all companies in our sample belonging to that subgroup.

Based on the data from the financial statements we performed a cluster analysis on return on investment (EBITDA/Invested capital=ROIC), labour productivity (added value/employee), and total factor productivity (TFP). Each of the firms was also categorised on the average wage paid compared to that of the average in their sub-industry. This information allowed us to separate companies with more advanced technology calling for a more trained workforce that usually implies a salary payment higher than sub-industry average. The data collected was organised into a panel.

Table 2 The economic importance of the sample
(Total sample/Total of the Manufacturing industry in Hungary)

Year	N	Sales	Export	Added value	Employment
2014	1725	76.66%	74.78%	67.40%	41.60%
2015	1725	78.13%	75.99%	66.97%	43.39%
2016	1725	80.13%	78.92%	70.73%	43.62%
2017	1725	79.53%	79.02%	74.26%	42.94%

Source: based on KSH (2019a, 2019b)

Table 3 The structure of the sample

	N	Proportion
Foreign-owned (F)	853	49.45%
Locally owned (L)	872	50.55%
Low wage (L)	959	55.59%
High wage (H)	766	44.41%
F low wage (FL)	350	20.29%
F high wage (FH)	503	29.16%
L low wage (LL)	609	35.30%
L high wage (LH)	263	15.25%
Sample total	1725	100.00%

Source: own construction

We performed all analyses on four data subsets. We created separate groups for locally owned low-wage (LL), high wage (LH), and foreign-owned low wage (FL), and high wage (FH) entities.

We have also sent out questionnaires to top managers of the manufacturing companies to gain a picture on management attitudes and methods applied. The 197 replies collected helped us to describe further each sub-category of wages, ownership, and performance.

Our sample includes a considerably important set of firms in the Hungarian economy (Table 2). As we have seen from the data of FATS (Eurostat-FATS 2020) and an earlier paper on the Hungarian manufacturing industry (Juhász and Reszegi, 2017) two of the main drivers of the inter-firm differences are the ownership and the relative wage level compared to the sub-industry average. Table 3 presents the breakdown of the sample in these dimensions.

4.2. Most important results

To get a deep understanding of the productivity differences across Hungarian manufacturing firm, we performed a two-step analysis. First, we used panel regressions on the financial statement of the firms to see how specific factors influence total factor productivity (TFP). Next, we used management questionnaires to investigate how top performers differ in management aims and style from laggards. This way, we could identify differences even in factors not included in the classic accounting statements.

When we examined the differences in TFP across the wage-ownership groups defined, it became clear that the ownership background alone explains the productivity differences only partly. Foreign companies have a nearly 30 percent advantage over their locally-owned counterparts, though this gap showed a modest decrease over time. We may see an even more differentiated picture if also considering the relative wage level (Table 4).

Table 4 Differences in TFP across wage and ownership groups*

	2014	2015	2016	2017	Change in TFP (%)	N
Foreign-owned (F)	11.52	11.54	11.55	11.56	4.5	853
Locally-owned (L)	11.22	11.26	11.27	11.29	6.8	872
LL	11.10	11.14	11.16	11.19	8.5	609
LH	11.51	11.53	11.54	11.54	2.7	263
FL	11.27	11.27	11.27	11.31	4.2	350
FH	11.69	11.74	11.75	11.74	4.8	503
Total	11.37	11.40	11.41	11.43	5.7	1725

*Paired group differences are significant at 1 percent in each year.

Source: own construction

Lower than average productivity goes hand-in-hand with low wage level (LL, FL). While still being better, foreign companies lost some of their advantages as the gap between the two groups decreased from 17 to 12 percent thanks to the improvement of the local firms. This increase could be partly the result of the pressure coming from the increasing wage level in the economy, calling for efficiency improvement.

It is important to note that local high wage companies perform much better than the foreign low-wage FL group, so it is not generally true that foreign companies are more efficient than locally owned ones. This misconception comes from the overwhelming advantage of the FH cluster that performs as much as 20 percent above the LH companies. Sadly, the local high wage firms have achieved the lowest improvement over time.

To understand what factors drive the differences in TFPs, we built panel regressions including fundamental ratios, spatial data, and information on sub-industries. As productivity is often linked to the level of the quality of the workforce, education information was added. Given that the percentage of employees with secondary education was very similar across groups, the rate of the employees with higher-level education grew against primary education only. Due to this strong connection, we could only use one of these ratios in our panel regression. Thus, we included the deviation of the company group rate for higher education employees from the industry average.

Table 5 shows the results of our initial linear panel regressions. As a point of reference for the dummy variables, we used the 2014 performance of firms with less than 50 employees and without any export that are headquartered in the capital (Budapest) and were active in one of the thirteen sub-industries without dummies.

Our base model controls for the environmental effects at a relatively low corrected R squared. Based on the panel of 1725 firms, export intensity and TFP are positively interrelated. It seems that the level of technical equipment (PP&E and Intangibles per employee) plays little role in efficiency contradictory to popular belief. Still, investment intensity was significant, either because more efficient firms spent more on new equipment as they can afford it, or as more up-to-date equipment supports efficiency.

It is important to note that the significant effect of sub-industries disappeared once the level of education was added while explanatory power of the model was boosted. We found a robust connection between the level of education of the human resource and the efficiency of the company. This link might be explained by the type of tasks the firm performed, the intensity of innovation and the level of technology used at the given companies.

Table 5 Results of the panel regressions

Dependent variable: TFP	Base run	Education added	Locally owned	Foreign-owned
Corrected R squared	0.09	0.49	0.49	0.47
Constant	11.181	11.408	11.393	11.638
Export below 25% of Sales	0.188	0.083*	x	x
Export 25-50%	0.196	0.120	0.071*	x
Export 50-75%	0.227	0.118	x	-0.098*
Export 75-100%	0.225	0.128	0.139	-0.153
Number of employees 50-249	x	X	0.049*	x
Number of employees above 250	x	X	x	x
Vehicles	x	X	x	x
Metalwork	x	X	x	x
Machinery	x	X	x	x
Rubber	-0.080*	X	x	x
Computers	x	X	x	x
Electric equipment	x	X	x	x
Food	-0.090	X	-0.050*	x
Central Hungary	-0.098*	X	x	x
Northern Hungary	-0.278	-0.097	x	-0.100*
Northern Great Plain	-0.219	-0.107	x	x
Southern Great Plain	-0.186	-0.077	x	x
Central Transdanubia	x	X	x	x
Western Transdanubia	-0.143	-0.052*	x	x
Southern Transdanubia	-0.330	-0.172	-0.162	-0.119
Year 2015	0.044	0.036	0.043	0.028*
Year 2016	0.053	0.050	0.060	0.040
Year 2017	0.069	0.070	0.087	0.055
(PP&E+Intangibles)/employee (M HUF)	0.003	-0.006	-0.007	-0.006
Investments/Invested assets_	0.524	0.258	0.259	0.261
Rate of employees with higher education		0.054	0.060	0.047

Unmarked variables are significant at 1 percent. X marks tested variables that proved not to be significant. * Significant at 5 percent.

Source: own construction

When assessing locally and foreign-owned entities separately (Table 5, last two columns), the models showed some surprising results while the explanatory power did not fall. These results are the following.

(1) Export intensity goes hand-in-hand with efficiency only in the case of the locally owned firms. The productivity of the local firms increased together with their export intensity.

(2) Higher export intensity for the foreign-owned companies was linked to lower efficiency. This decrease could not be due to a weaker level of management. Instead, it relates to the type of activity (most likely mass production for the supply chain of the parent company) leads to lower profitability.

(3) The TFP growth of the foreign-owned firms was less than that of the locally owned counterparts in each of the surveyed years. The increasing local wage level put the locally owned firms under severe efficiency pressure. At the same time, the future of foreign companies depends on the performance of the whole supply chain and not solely on the performance of the Hungarian branch. This result also supports

the idea that just because of the presence of foreign-owned firms, we should not expect the dynamisation of the economy. That change will only happen if foreign-owned companies switch to products with higher added value.

Table 6 Results of the panel regressions for ownership and wage level groups

Dependent variable: TFP	Locally- owned Low wage	Foreign- owned Low wage	Locally- owned High wage	Foreign- owned High wage
Corrected R squared	0.44	0.40	0.49	0.45
Constant	11.348	11.587	11.670	11.838
Export below 25% of Sales	0.087*	x	-0.094*	x
Export 25-50%	0.130	x	x	x
Export 50-75%	0.143	x	-0.089*	-0.142
Export 75-100%	0.222	-0.101*	x	-0.149
Number of employees 50-249	x	x	x	-0.138
Number of employees above 250	x	x	x	-0.160
Vehicles	x	x	-0.126*	-0.123*
Metalworks	x	x	x	-0.070*
Machinery	x	x	x	x
Rubber	x	x	x	x
Computers	x	x	x	x
Electric equipment	x	x	0.197*	x
Food	x	x	x	x
Central Hungary	x	x	x	x
Northern Hungary	x	x	-0.168*	x
Northern Great Plain	x	x	-0.099*	x
Southern Great Plain	x	x	-0.099*	x
Central Transdanubia	x	x	x	x
Western Transdanubia	x	x	-0.097*	x
Southern Transdanubia	-0.137	x	-0.209	-0.145
Year 2015	0.046	x	x	0.055
Year 2016	0.062	x	x	0.070
Year 2017	0.102	0.056	x	0.059
(PP&E+Intangibles)/employee (M HUF)	-0.008	-0.012	-0.007	-0.005
Investments/Invested assets_	0.203	0.196*	0.291	0.305
Rate of employees with higher education	0.067	0.056	0.045	0.039

Unmarked variables are significant at 1 percent. X marks tested variables that proved not to be significant. * Significant at 5 percent.

Source: own construction

(4) It is shocking to see the vast difference in the coefficient of the level of education. While the efficiency of the foreign-owned firms is undoubtedly higher, it is hard to interpret that a higher ratio of well-educated employees couples with lower productivity improvement. Why do foreign-owned firms not use well-trained workforce as efficiently as locally owned companies?

As a next step, we estimated the regressions for each of the four ownership-wage groups separately (Table 6). Based on the result, we may add some additional essential findings.

(5) Higher export is coupled with higher TFP level only in the locally-owned low wage firm group. For the foreign-owned low wage and the locally owned high

wage groups, export is negatively correlated with TFP. However, what is most surprising is that in the most efficient foreign high wage entities, high export intensity is coupled with a TFP fallback that is even bigger in extent than that for the foreign low wage firms. This disrupting effect could be a sign of the inferior position of these firms in the global supply chains.

(6) While the vehicle manufacturing industry is usually considered to raise the general efficiency level in emerging countries, our results show that in Hungary, this industry actually underperforms the other manufacturing sectors in TFP among companies with higher wage or higher technology level.

(7) The coefficients suggest that the efficiency of the locally owned high wage firms only stagnated during the four years analysed. In other words, the best local firms that are meant to contribute heavily to closing the efficiency gap failed to improve. The only group that shows significant efficiency improvement is the locally owned low wage firms – this can be attributed to increasing pressure due to the general wage level increase they experienced during the surveyed years.

(8) An increase in the ratio of employees with higher education contributes most to higher efficiency in the locally owned low wage LL group, where the higher education rate is the lowest. The education effect is diminishing across the groups when the TFP level is increasing. This incident could be an outcome that the more efficient companies hire too many high-educated employees or use them in positions that do not require that high level of education. Our data show that the FH group employs 71.9 percent of labour with secondary education in positions that do not require any particular pre-knowledge. This bias occurs (45.6 percent) even within the LH group.

While most of the factors that are generally considered as influencers of productivity ended up without any significance in several cases, equations could only explain less than half of the variance in TFP. So, it became clear that we would have to look for additional information sources to get a better explanation. As a first step, we run a k-means clustering process to find three groups of firms of similar size (Table 7).

Table 7 Total factor productivity (TFP) cluster centres

	2014	2015	2016	2017	Change in TFP (%)	N
TFP1	10.80	10.82	10.86	10.90	10.0	518
TFP2	11.39	11.41	11.41	11.42	3.0	848
TFP3	12.14	12.21	12.21	12.21	7.0	359

Source: own construction

The centres of TFP clusters (Table 7) show vast differences among firms. The productivity of the third cluster is almost 130 percent higher than that of the first one and also exceeds that of the second cluster by 80 percent. (Due to the equation, estimated percentage differences are equal to absolute differences in TFP.)

During the four years examined, there were no major changes in these. Nominal efficiency improvements amounted to 3 to 10 percent while inflation and exchange rate effects are of similar size. (Consumer prices climbed by 2.76 percent,

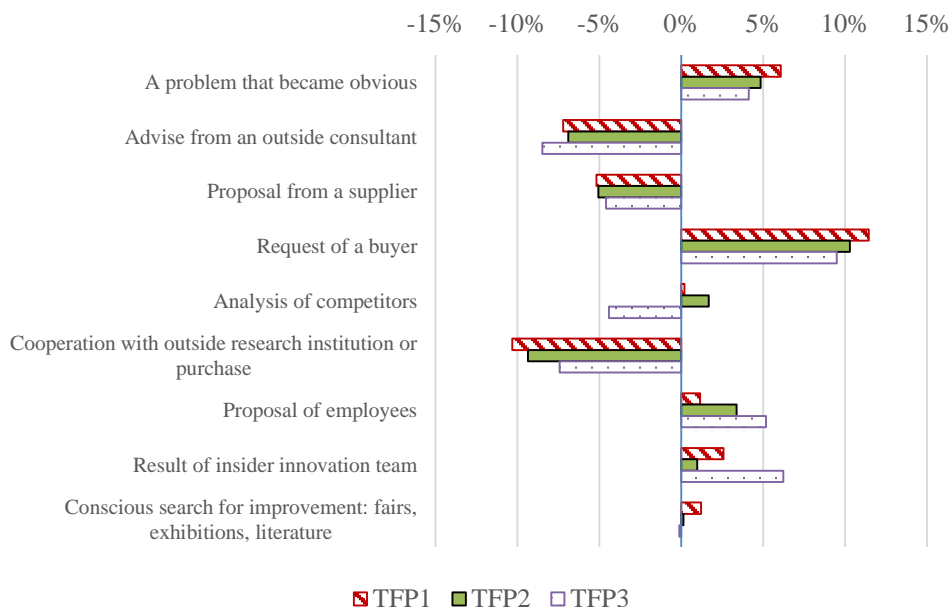
industrial prices rose by 0.63, manufacturing prices grew by 1.13 percent. Export prices went up by 0.18 percent, while import prices fell by 1.74 percent. The euro-HUF exchange rate showed a 1.5 percent fall; KSH, 2020a, 2020b)

As a next step, we asked top managers of firms belonging into one of these TFP clusters about their management style, toolset, and goals to see how TFP3 (top-performer) cluster is different from the other two. (Figure 6) Respondents from the most efficient firm cluster signalled a more than average importance to the initiatives of a development team within the firm and proposals from colleagues when it came to innovations.

Manages stated that buyer request was the most dominant source of innovation. The cooperation with outside research institutions played the least important role. It is interesting to note that the most efficient group (TFP3) paid the least attention to competitors as these companies might be already the best in their sector.

When asked to highlight the most critical success event of the company, top managers mostly voted for introducing a product that subsequently made up more than five percent of sales. (Figure 7) It was only in the group TFP3 that creating an innovative team played a particular role. The group with the lowest productivity gave particular weight to improvements in efficiency, turning into a supplier of a multinational company, and increasing their share in the domestic market.

Figure 6 Factors promoting change and innovation during the last three years (questionnaire responses)*

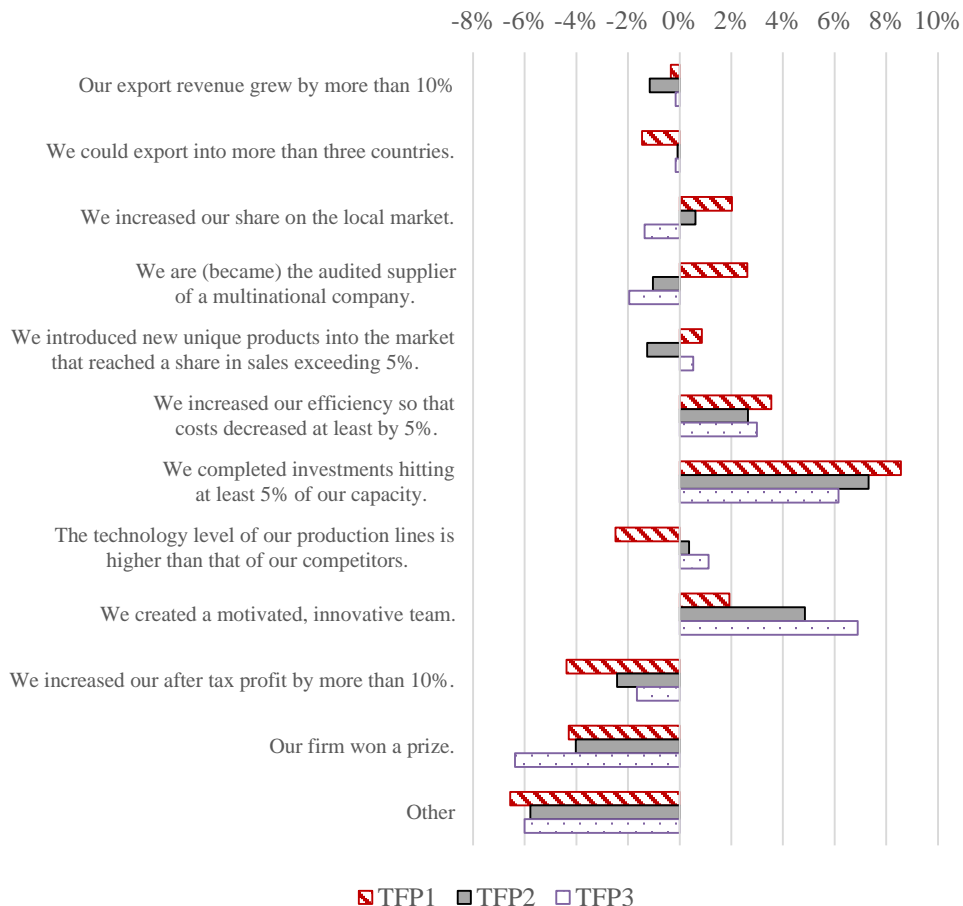


*Altogether there were ten options offered of which a maximum of five should have been chosen. For those selected items, the importance was measured on a 1 to 10 Likert scale. The figure shows the deviation from the average for the importance weighted frequency of each answer.

Source: own construction

The growing shortage of labour boosted the importance of human resource. When asked on HR policy (Figure 8), top managers gave a high weight to statements like “We aim at improving labour efficiency”, “Skills and abilities of our employees contribute seriously to competitiveness”, and “Keeping our professionals is a critical issue in what corporate culture plays an important role”. The most efficient TFP3 group put a more prominent weight than the other two groups on continuously developing the skills of their colleagues, and providing training to achieve that. While training sessions were organised at 61.3 percent of the firms in TFP3, this rate was only 43.0 percent in TFP2 and just 18.5 in TFP1. This extreme difference could be the result of not only managers not considering development essential but also of employees at firms performing such simple tasks that education had little chance to pay off.

Figure 7 The most critical success events the last three years*

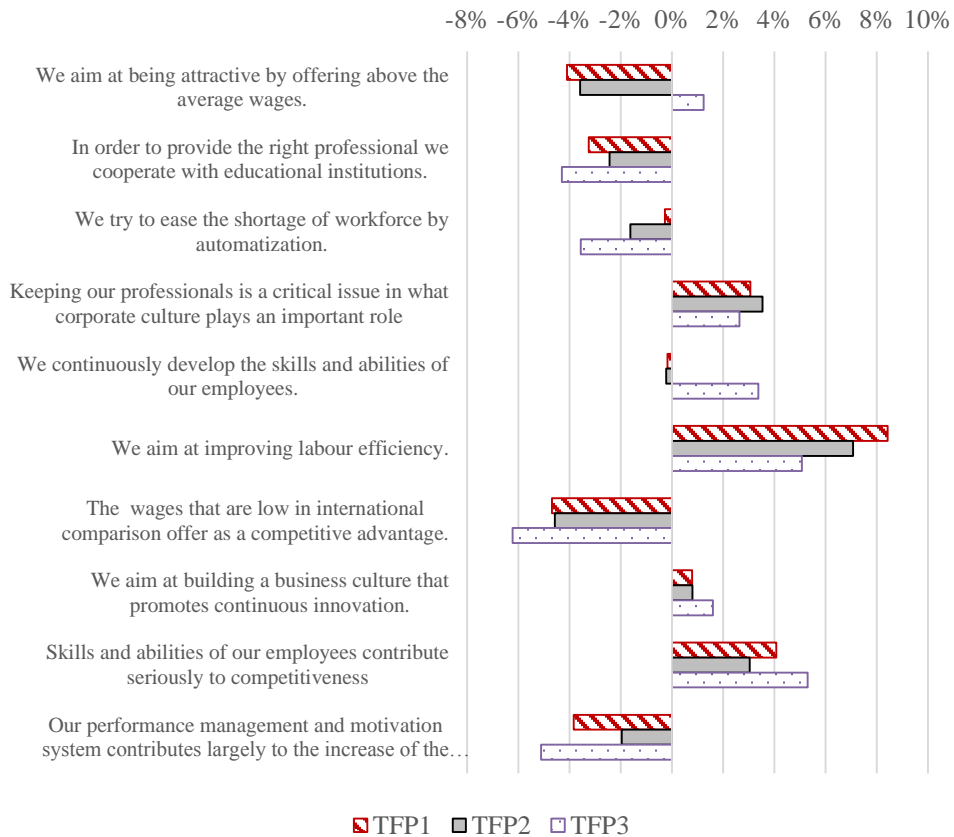


*Altogether there were twelve options offered of which a maximum of five should have been chosen. For those selected items, the importance was measured on a 1 to 10 Likert scale. The figure shows the deviation from the average for the importance weighted frequency of each answer.

Source: own construction

It is also in group TFP3 that the importance of getting human resource by higher than industry average wages is above the average. The other two groups had this with a lower than average importance only that may also be the result of the fact that with lower productivity, it is tough to cover the dynamically increasing wages.

Figure 8 The essential traits of human resource management*



*Altogether there were ten options offered of which a maximum of five should have been chosen. For those selected items, the importance was measured on a 1 to 10 Likert scale. The figure shows the deviation from the average for the importance weighted frequency of each answer.
Source: own construction

The most efficient TFP3 group overweighed answers linked to skills and abilities and excellent and innovative teams. Other clusters instead focus on requests from the buyers, the demand of the local (national) market, and issues that come to light by themselves. When we checked for the employment structure, we found a more significant rate of employees with higher education and a lower rate for those with primary education in the TFP groups with higher efficiency (Table 8).

Table 8 The educational structure of employees across TFP clusters (%)

Level of Education	TFP1	TFP2	TFP3	Average of the Manufacturing Industry
Primary	21.4	17.5	11.9	17.6
Secondary	68.0	67.3	64.5	67.0
Higher	10.6	15.2	23.6	15.4

Source: own construction

More trained human resource has a higher chance to be innovative, more capable of learning and of performing high added value tasks. So, these results show again that the educational structure could have an effect on efficiency. These differences also appear in the wage level. In 2017, an average employee earned 680 euro per month in TFP1 cluster, 942 in the TFP2 cluster and 1,329 in the most efficient TFP3 cluster (1 euro equalled 310 HUF that time).

5. Summary and policy recommendations

Our paper investigated productivity differences across Hungarian manufacturing firms. Based on a sample of 1725 firms, we showed that productivity differences spring out of a wide range of different factors. Still, these effects are different in size and direction for various subsets of firms surveyed, which confirms the earlier identified existence of multilayer duality in the Hungarian economy. Our analysis focused on relative wage level and ownership background of firms with full accounting report published, continuous operation, and positive equity during the period 2014–2017, and identified numerous unique connections.

For the locally owned firms with lower than subindustry average wage (LL), low productivity appears to be linked to a low employee educational level and weak strategic position, in other words, to their disadvantaged role in the supply chain. As for the foreign-owned low wage (FL) companies, those seemed to focus on profit-seeking as the main driving force for their operation seemed to be the low local wage level. The tasks the Hungarian branches performed did not require a high level of training, and thus, no matter what quality the management was, it was not possible to reach a high level of added value.

Theoretically, the locally owned high wage (LH) firms could be the main drivers for the convergence of the national economy to the EU. However, these firms stagnated and showed a weakening position compared to the other three groups in the surveyed period. The foreign-owned high wage firms (FH) had a positive impact on national income. However, their future profitability and growth depend on the supply chain they belong to rather than the progress of the local economy. FH firms showed a slow improvement in efficiency during the surveyed years that might be the result of structural changes or the increase of the share of low added value tasks in their operation while maintaining a higher than average wage level. This latter explanation is supported by the fact that lower TFP accompanied higher export intensity in the FH group.

To sum up, the period 2014–2017 was far from being a success for economic convergence to Western countries. The foreign-owned firms in Hungary had a far lower average efficiency than in old EU member states. On top of that, foreign-owned firms paying a lower than sub-industry average wage were even worse in TFP than their high wage-paying locally owned counterparts. This lag is why policymakers should put more emphasises on carefully selecting what kind of FDI should receive state subsidies. It seems that promoting the growth best performing locally owned firms could have a more prominent boosting effect on the Hungarian economy.

Our panel regressions could not confirm that, as widely believed, the growing export intensity coupled with increasing efficiency in the Hungarian manufacturing industry in surveyed years. It was only valid in case of the low-wage paying locally owned firms. This phenomenon calls for a more careful review of the transfer pricing techniques of the foreign-owned firms, as it is hard to believe that the local market offers higher profitability than export.

Also, we could not find evidence that the vehicle manufacturing firms were more efficient than other sub-industries, that is another widely-quoted misbelief. That is why there is limited justification in offering particular governmental support for developing this sector, particularly if that leads to an overdependence of the local economy on car production as experienced during the period examined.

Further, results do not confirm that the level of technical equipment (PP&E/employee) would correlate with higher efficiency. This result may question the justification of the state subsidies provided during the years of analysis for companies to invest in machinery used in production.

The paper exemplifies that various groups of firms exist that use different business models and thus have heterogeneous drivers of efficiency. This divergence calls for a differentiated economic policy that targets various groups with tailor-made programs to enhance the performance of the firms.

Based on management questionnaires, we concluded that the firms with high TFP built on competitive and profitable products using innovation and motivated, well-trained staff. Hence, the policymakers may want to consider offering subsidies towards innovation, improvement of management techniques, and employing a highly trained workforce.

The need for such programs is highlighted by the fact that during the years analysed, it was particularly the locally-owned firms with more advanced technology and higher wage level that faced difficulties when improving performance.

Besides the coronavirus crisis, the main challenge the Hungarian economic policy faces in 2020 is how to support companies to get out of the trap of performing low added value tasks at low wage level, and renew themselves to cope with the intense wage pressure. Policymakers should focus on motivating the foreign-owned low wage firms to increase their added value while offering a boost to the locally owned high wage firms to develop further. These steps require an increasing amount of well-trained workforce.

At the same time, it is time to realise that the traditional general support of foreign direct investment in Hungary will not promote convergence, and recent political steps that lowered the number of students in higher education further

undermine the convergency process. We also see the government welcoming an increasing number of poorly trained employees from Eastern countries meant to replace well-trained Hungarian professionals who have left to work in Western countries to earn better wages. These tendencies in the labour market give little hope for closing the development gap in the foreseeable future, and call for immediate action from the side of the government.

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