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EXAMINATION OF THE PERFORMANCE OF FOOD INDUSTRY ENTERPRISES BETWEEN 2010 AND 2021

Péter FÖLDI[1], Anett PARÁDI-DOLGOS[2], Tibor BAREITH[3]
[1]Budapest Business School, 1055 Budapest, Markó u. 29-31. Hungary
[2]Hungarian University of Agriculture and Life Sciences, 7400 Kaposvár, Guba Sándor u. 40. Hungary
[3]Centre for Economic and Regional Studies, 1097 Budapest, Tóth Kálmán u. 4. Hungary

ABSTRACT

In the case of any state, the success of its corporate sector is a cardinal question for its national economy. Consequently, the issue of profitability of the corporate sector has always attracted considerable attention from experts dedicated to understanding successful economic functioning. Regarding academic research priorities, it is essential to identify the identifiable factors, mechanisms of action and trends that are important for the success of corporate growth. In the light of previous studies on the performance of the Hungarian food sector, the above findings are also confirmed, and the main focus of this research is to analyse the factors that play a significant role in stimulating the profitability of the Hungarian food industry. The relevant research period is mainly the period before, during and after the coronavirus epidemic.
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INTRODUCTION

The economy, and in particular the food industry, is one of the main pillars of society, since it is the sector that provides the basis for meeting one of the most important human needs, namely physiological needs. If we have a look at the role each domestic industry plays in the national economy, we can say that the share of the food industry in Hungary is around 3.2% of domestic workers were employed in the food industry, while food industry development accounted for around 2.7% of investments in the national economy. The sector accounted for 8.8% of export performance (*KSH*, 2020). Although the food industry was not spared by the outbreak of the coronavirus, which shook its stability and set back its previous performance indicators, we can still talk about one of the most important sectors.

The fact that profitability has remained substantially unchanged since the beginning of the new millennium and the fact that the food industry is a major export sector, further increase the importance of the food industry in the national economy (*Tóth et al.* 2019). It is therefore highly justified to analyse the food sector in order to obtain a more accurate picture of its importance, and for this purpose it is essential

to understand the factors that significantly determine and influence profitability. To this end, the so-called GMM estimator of *Arellano* & *Bond* (1991) can be applied, which uses dynamic panel data to understand the conditions and most important factors affecting the sector.

After a brief presentation of the domestic situation of the sector, we will review the main factors that determine the profitability of food businesses as noted in the literature. Agricultural and food industries are particularly strong in the fruit and meat sectors, which are still the flagships of the Hungarian food industry (*Nagy et al.* 2021). In terms of competitiveness, Hungary needs to make use of subsidies and development measures as these enterprises can only rely on them in the event of a possible adverse period. It cannot be said that the food enterprises are capital strong, except for 1 or 2 enterprises. Therefore, the number of subsidies and developments cannot be neglected. The stability of businesses has a significant impact not only on the functioning of the economy, but also on the domestic supply of basic needs (*Madari*, 2021). The more significant the businesses at the centre of the issue are considered, the more important it is to understand the reasons that make these businesses successful and profitable. In the context of research focusing on this sector, it is also important to point out that the corporate structure of the Hungarian food industry differs significantly from firms in other EU Member States (*Nagyné*, 2004). Thus, it is a competitive factor that is important to examine in order to determine how to improve the evolution of corporate profits (*Eklund & Lappi*, 2019).

The integration of infotechnology within the sector is significant (over 50%), but the application of more advanced high-tech solutions is less widespread. Typical examples are the use of enterprise management systems or artificial intelligence-based services and cloud services (*Debrenti & Herdon*, 2021). With these challenges in mind, it is of paramount importance to build on the foundations of a strong historical tradition, with a sufficiently stable vision and innovation potential, and with future development directions and opportunities. We will only make small references to these. Hungarian food industry operators must therefore keep their revenue generation ambitions focused on the above.

We were curious as to whether the companies engaged in export sales are more effective and profitable than their peers who only sell domestically. In the case of food industry enterprises, it is questionable how much they can spend on investments, developments and R&D without using subsidies. We wanted to see how true the previous studies on profit persistence were and what the results of our current research are for food businesses. We also examined the effectiveness of the 10 largest companies compared to other competitors.

Research background on the performance of the Hungarian food industry

In international terms, the main 'markets' for research and studies based on the analysis of structural and firm-specific factors are those countries whose industry is highly developed and whose role in the national economy is also important. This is particularly important if the industry of particular importance has the potential to have an above-average impact on shaping the future direction and development potential of the national economy. Typical issues might be the relationship between

concentration and profitability within a given industry, or barriers to entry. These are, of course, important factors in both the intensity of competition in an industry and the strategic underpinnings of corporate success, but it is important to add that in the digital world these competencies, which have a major impact on competitiveness, are worth thinking about explicitly (*Karagiannopoulos et al.* 2005). Previous research found a number of links between concentration and profitability (*Kwak & Kim*, 2020; *Hui et al.* 2019; *Al Arif & Awwaliyah*, 2019), and also highlights that success is a key issue in terms of the ability of an organisation to generate continuously improving returns from its efficient operations. The importance of the role of firm-specific factors has been a focus area for a number of studies, and these have consistently supported the importance of success and profitability (*Vijayakumar*, 2011; *Seelanatha*, 2011; *Zainudin et al.* 2018; *Li & Islam*, 2019).

Research on the success of food businesses in Hungary often emphasises that market orientation is a necessary element of success from a marketing perspective (*Kiss et al.* 2020). However, the importance of each perspective does not end there - there is also the question of what success means for the given business (*Szanyi-Gyenes & Almási*, 2021). Another similar performance evaluation aspect is the operation of the company's various activities and processes and the significance of the management culture within the company (*Nagy et al.* 2020). The level of digitalisation is also a frequently raised issue, especially in the context of marketing and market orientation which has already been mentioned (*Berezvai et. al.*, 2019). Profitability is one of the most important indicators of business performance, and profit is a key driver of market competition. The level of market competition in an industry can be characterised by profit persistence that shows the rate at which the profits of market participants profit to equilibrium (average yield).

MATERIALS AND METHODS

In our model we estimate the profit persistence of Hungarian food industry and firm control variables. In addition to theoretical considerations, available data played an important role in the choice of explanatory variables.

The data used in this research was taken from the CREFOPORT company database. The analysis was based on a sample of Hungarian small, medium and large food companies which were operating between 2010 and 2021. The analysis excluded companies for which no financial data were available. The database contains 23,823 items for the observation period, with a total of 3,268 food companies in the sample. When selecting the companies, it was important to ensure that the companies selected covered the whole range of SMEs in Hungary and that the conclusions and recommendations that were drawn could be used to improve the industry. The focus of our analysis is on ROA, which is the ratio of profit after tax to total assets. We used the natural logarithm of turnover as a control variable for plant size, proxy variables for long (long-term liabilities/balance sheet total) and short (current assets/short-term liabilities) risk for risk, and the 3-year rolling standard deviation of the ROA ratio as a third risk measure. This is detailed in *Table 1*. A further variable included is tender activity, i.e. whether the firm had had a winning tender in a given year, measured by a dummy variable. We show two independent variables to control for industry effects.

The number of firms indicates how many firms were operating in the given industry and year, and the logarithm of industry turnover controls for industry size through industry turnover.

A standard approach in profit persistence examinations can be considered to be dynamic panel models which provide the most accurate estimates to our current knowledge (*Hirsch*, 2017). The dynamic model uses the GMM estimator system defined by *Arellano and Bond* (1991).

The outlined model used in our analysis can be expressed as follows (1):

$$\pi_{i,t} = \sum_j \alpha_j(X_{j,i,t}) + \lambda\pi'_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

Where $\varepsilon_{i,t} = \eta_i + \nu_{i,t}$. The Arellano-Bond GMM estimation is based on the first difference of the equation, which allows to eliminate time-independent firm-specific (η_i) effects (*Hirsch & Gschwandtner*, 2013). Firm- and industry-specific variables (X_j), that can explain the profit persistence of firms can be included in the model. The Arellano-Bond GMM estimation is based on the first difference of the equation, which allows to eliminate time-independent firm-specific (ηi) effects (*Hirsch & Gschwandtner*, 2013). Firm- and industry-specific variables (X_j) that can explain the profit persistence of firms can be included in the model. The GMM estimation can be considered consistent if there is no second-order autocorrelation in the error factors and the instruments are appropriate. The lagged dependent variable is endogenous, all other variables in the model are exogenous (*Hirsch & Gschwandtner*, 2013).

The Blundell-Bond estimator assumes that there is no autocorrelation between individual error factors, and it is necessary for the panel effect to be independent of the first difference of the first observation of the dependent variable for it to work properly. Similarly to the Arellano-Bond estimator, the Blundell-Bond works well when we have many observations and the time parameter is finite (large N, small T type sample).

The bottom and top one percent of the distribution of variables were trimmed because of the outliers. The database certainly contains human errors, there are several steps to fill in the database with data, and then problems can occur during queries. For this reason, a percentage 'truncation' of the data is justified. Treatment was taken where necessary.

Return on assets (ROA) was used as a dependent variable to measure corporate profitability. ROA is the return on assets, profit after taxation, divided by total assets.

The model includes a total of 9 dependent variables, 6 of which measure firm-specific effects and 3 of which measure industry-specific effects. The variable for export sales is a binary variable, which takes a value of 1 if the company had export sales in the year in question. It will not be so specific for SMEs, as this form of sales will be true for large firms (see descriptive statistics in *Table 1*).

The control variable regarding tender activity is a dummy variable, similar to export sales, and has a value of 1 if the company has drawn at least 1 HUF of tender funds. Tendering activity can be critical for a company. If a company has accessed tender funding, we can assume that there are investments and ideas for the future (*Kis-Tóth & Vígh*, 2013). It is important not to confuse the access to tender funding

with tender activity, as not all tenders will be winning tenders, the variable in the model only considers winning tenders.

Table 1: Descriptive statistics for food businesses from 2010 to 2021

Variable	N	Mean	p50	SD	Min	Max
ROA_w	23823	0.060	0.043	0.221	-0.946	0.710
tender_dummy	23823	0.928	1	0.259	0	1
export_dummy	23823	0.130	0	0.337	0	1
number of firms	23823	2206.662	2276	167.113	1756	2358
ln_revenue	23823	18.349	18.370	2.393	11.798	24.011
short risk	23823	5.919	1.683	17.097	0.094	137.837
long risk	23823	0.086	0	0.154	0	0.739
ln_industry revenue	23823	28.757	28.722	0.153	28.472	29.035
top10_share	23823	0.280	0.276	0.013	0.262	0.305
ROA_sd3	19473	0.108	0.054	0.151	0.001	0.917

The number of firms variable shows how many firms were active in the food industry in a given year. In the case of this variable, only the number of SMEs included in our database was considered. One condition for perfect competition is that there is an infinite number of sellers and buyers in the market. Based on this assumption, the expansion of the supply side will worsen profitability, while the exit of firms will improve profitability due to a loosening of competition in the market.

The development of turnover is influenced by a number of factors such as the company's customer policy. This is a theoretical assumption that in our analysis turnover is a representation of the size of the company, and due to economies of scale, larger companies can operate more cost-efficiently and thus, they will be more profitable, ex ante anyway.

A total of three variables were used to measure risk. This is due to the economic rationale that higher returns can be achieved by taking more risk. Short-term risk is the ratio of current assets to current liabilities, i.e. they show the liquidity position of the company. In contrast, long risk can be interpreted as leverage: long-term liabilities divided by total assets. Our third risk indicator shows the 3-year rolling standard deviation of profitability (ROA). By using the standard deviation of profitability, we can incorporate a risk indicator into the model that does not directly use the financial statement data.

Industry revenue and market share of the top 10 highest revenue companies (top10_share) are exogenous industry variables in the model. The mechanism of action of industry revenue is the same as the number of firms variable, but in this case, we have the assumption that all firms are equal, the size of revenue determines market power. According to our assumption, higher industry revenue reduces competition. However, this effect can only prevail if, in the meantime, market shares do not exhibit significant spikes. The top10_share is intended to measure this phenomenon, if the top 10 firms can increase their market share, it is expected to reduce the industry average profitability. The big players are skimming the market.

Profit persistence research is mostly carried out using econometric estimations, which are usually made using AR1, OLS or GMM methods. However, Markov chains take a different approach to measure. Markov chains can be used to examine the probabilities that a given companies will move to a more profitable or less profitable groups. To evaluate the results, we can take into account the values of mobility, which we can look at in general. On the other hand, from the perspective of the effects used for our research. Furthermore, econometric estimators usually measure profit using continuous variables (usually ROA), whereas Markov chains work with discrete values.

The companies in the sample were divided into quintiles and then into deciles, based on the profitability (ROA) ranking. Each group is labelled from 1 to 5(10), where 1 is the least profitable group and 5(10) is the group which contains the companies with the highest profitability. The output of the Markov chains is a transition probability matrix, which represents the probabilities of which firms move into a given group (either up or down). The diagonal of the matrix is the most important from the point of view of profit persistence, and the closer its value is to 1, the higher its profit persistence is, i.e. the profit share does not change much from year to year, so everyone stays in their own group. As a result, profit is „sticky".

Markov chains are modelled by the probability of the transition of the profit rate of firms between two points in time. This transition probability is calculated with respect to the proportion of firms in the current profitability group. We then use the resulting transition probability matrix to estimate the probability of transitions between profitability groups.

We consider it important to note that the estimated probabilities will only be unbiased if the process of generating the data is constant and if the sample size is sufficiently large.

RESULTS AND DISCUSSION

When presenting the results, the Markov chain results are presented first, followed by the dynamic panel estimates.

Markov chain analysis

The estimates presented in our article are for the food manufacturing sector and the results are presented in *Table 2* and *Table 3*.

Table 2: Transition probability matrices (food industry)

ROA	(1)	(2)	(3)	(4)	(5)	P_j
(1)	**45,56**	19,29	11,86	10,58	12,71	100
(2)	19,23	**44,78**	20,9	9,96	5,14	100
(3)	10,99	20,87	**39,12**	20,68	8,34	100
(4)	9,20	10,64	21,55	**40,40**	18,21	100
(5)	10,92	6,00	9,08	23,18	**50,82**	100
P_j	18,5	20,5	20,93	21,24	18,84	100

Table 3: Transition probability matrices (food industry)

ROA	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	Pj
(1)	**31,69**	14,05	6,69	6,87	4,93	5,6	5,78	6,02	7,12	11,25	100
(2)	14,09	**31,31**	14,67	9,62	6,86	6,17	5,21	4,31	3,56	4,2	100
(3)	8,48	13,09	**31,7**	17,45	9,5	6,79	4,8	3,39	2,57	2,23	100
(4)	6,82	10,03	16,01	**24,31**	15,61	9,98	7,21	4,55	3,46	2,03	100
(5)	4,94	7,05	8,82	15,92	**23,88**	15,2	9,45	7	4,41	3,31	100
(6)	4,67	5,31	7,11	9,83	15,53	**23,61**	15,14	9,83	5,65	3,31	100
(7)	3,96	5,14	5,87	6,51	9,89	17,03	**22,32**	15,37	9,45	4,45	100
(8)	4,58	4,72	4,33	4,58	6,28	9,93	18,11	**24,98**	15,34	7,16	100
(9)	6,3	4,5	3,05	3,45	4,4	6,55	9,7	18,64	**28,29**	15,14	100
(10)	6,87	4,18	2,15	3,33	3,38	3,7	6,44	11,21	23,34	**35,41**	100
Pj	8,76	9,73	10,17	10,34	10,25	10,67	10,59	10,65	10,27	8,57	100

The transition probability matrix in *Table 2* shows the results for 5 groups and *Table 3* shows the results for 10 groups. In the first table, all diagonal values are above 0.4, in the second all diagonal values are above 0.2. There is always, and in every industry, some probability of profit persistence. The question is not this, but what that probability is, and to which extent profit persistence exists. The highest probabilities are found at the lower and upper end of the profitability groups, indicating that poor and good performers have higher profit persistence. Poor performers find it difficult to break out of this state, while high performers are more likely to remain in the more profitable group. The Markov chain analysis does not give a complete picture of the nature of market competition, but there are signs that suggest that the market is not perfect.

Dynamic panel models

In order to evaluate the model describing the profitability of the firms, the GMM (Generalized Method of Moments) method was used with the Arellano-Bond method. After the estimation was to test the suitability of the instruments, which was carried out with the Sargan test. The p-value of the Sargan's test should be higher than 0.05. The results of the diagnostic tests of our first-difference regression model are shown in *Table 4*. The first- and second-order autocorrelation tests also showed no significant results which means that there is no autocorrelation between the differential residual variables. In the case of the Blundell-Bond model, we can test for second-order autocorrelation, and here the model did not show any problems either. These results suggest that the models meet the requirements for diagnostic tests and are likely to be good estimators of firm profitability.

The purpose of the Blundell-Bond estimation procedure is to check the robustness of the Arellano-Bond model results. The interpretation of the results is based on the Arellano-Bond model, and if the results of the Blundell-Bond model contradict the main model, this is indicated.

The focus of our study is profit persistence, this effect is captured by the coefficient of the first lag of the ROA indicator, the coefficient is significant, its value

is 0.267. The results confirm the Markov chain results, the Hungarian food SME sector is not described as perfectly competitive. According to relevant literature, profit persistence in the food industry is generally lower than in the manufacturing industry, but persistence around zero is rare. *Hirsch and Gschwandtner* (2013) measured an abnormal profit persistence between 0.1 and 0.3 in their research on five European countries, while they found profit persistence above 0.3 in their research on the whole economy. In their research, *Molnár et al.* (2021) they found values between 0.11 and 0.34. However, in their study of 3 European countries, *Hirsch et al.* (2020) found results between 0.4 and 0.65.

The results show that higher turnover increases the profitability of the company. Regarding risk, a rise in short risk increases profit. In our case, this means that an improvement in the liquidity position has a positive effect on ROA.

The coefficient of long-term risk is negative, so an increase in the share of long-term liabilities will worsen profitability. This suggests that the profitability of financed investments and projects is lower than the interest paid after external capital. The variable, measuring the dispersion of the profit rate (ROA_sd3), is inversely related to profitability, i.e. profitability decreases with increasing volatility. This is contrary to our expectations and confirms the return-risk paradox theory which states that the relationship between return and risk is not positive after all. Similar results on the risk-return relationship were found e.g. by *Lőrincz* (2007); *Miskolczi* (2017); *Bélyácz & Daubner*, (2021).

Table 4: Results of the dynamic panel estimation

	Arellano-Bond		Blundell-Bond	
	ROA		ROA	
L.ROA	0.267***	(0.021)	0.271***	(0.020)
tender_dummy	0,005	(0.006)	0,015	(0.015)
export_dummy	-0.074***	(0.005)	-0.017*	(0.010)
number of firms	-0.000**	(0.000)	-0.000***	(0.000)
ln_revenue	0.017***	(0.001)	0.048***	(0.005)
short risk	0.000***	(0.000)	0.001***	(0.000)
long risk	-0.130***	(0.009)	-0.119***	(0.018)
ln_industry revenue	0.002	(0.011)	-0.107***	(0.015)
top10_share	-0.274	(0.197)	-0.290*	(0.163)
ROA_sd3	-0.245***	(0.026)	-0.225***	(0.044)
Constant	-0,124	(0.292)	2.476***	(0.414)
Observations	19069		19069	
Number of id	3268		3268	
ar2p	0.679		0.737	
hansenp	0.34		-	

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

(In the case of Arellano-Bond model there are standard faults, in the case of Blundell-Bond there are WC robustness standard errors).

There is no statistically verifiable link between the use of grant funding and profitability. However, export activity has a surprisingly negative impact on profitability. This is presumably due to the fact that production costs have increased more than the income from export sales. In addition, it is not negligible that higher transport costs, in addition to rising production costs, may also be behind the fall in profitability. Export sales are also affected by exchange rates.

In the case of industry variables, there is a visible difference between the Arellano-Bond and Blundell-Bond models. In the case of the number of firms variable, the two models are still consistent, i.e. the increase of the number of firms reduces profits, which confirms that profitability decreases as the supply side increases. Conversely, when industry revenue is used instead of the number of firms, this effect is only confirmed by the Blundell-Bond model, with no relationship in the case of the Arellano-Bond estimation. The situation with regard to the top 10 market share is similar, we expect that the increase in this variable reduces profit, which is the case according to the Blundell-Bond model, but according to the Arellano-Bond estimation procedure it has no effect on profit.

CONCLUSIONS

The food industry has undergone a major transformation over the past two decades. In this study, we have analysed the competitive situation of the Hungarian food industry through a model which is suitable for measuring market competition. In the food industry sector, the profit persistence effect is present, i.e. the industry is characterized by imperfect competition.

Our studies have confirmed that firms engaged in export sales are less profitable in this industry, as other studies have also concluded (*Grazzi*, 2011; *Ju & Yu*, 2015; *Gaigné et al.* 2017). Unfortunately, what may contribute to this is the drastic increase in production and transportation costs. Thus, at the moment this industry is facing this problem. It is uncertain when the situation in the industry will stabilize, which is not helped by inflation or the current situation. Similarly to the situation in agriculture, subsidies would be needed here, too, in order to normalise the situation in the long term, which would help to meet everyone's needs.

It is the next factor why food SMEs need support, and that is the existence of investments, development and R&D. According to the model, long risk is negative, i.e. long-term debt reduces profit, so businesses will not borrow to finance their investments, there will be no investment, no development, and the sector will not be competitive. Long-term debt will push firms into a loss-making direction, therefore, food firms will not take long-term loans, this is why the role of subsidies in the system is important (*Bakucs et al.* 2014; *Singh et al.* 2021; *Mokgomo et al.* 2022). According to other arguments, only firms that sell for export can be competitive, which increases profitability (*Fischer & Schonberg*, 2007). In contrast, in the Hungarian food industry, we have discovered that exports reduce profitability. According to *Herczeg et al.* (2020), the higher the ROA value is, the higher the export revenue of the firm on average will be. According to *Kazainé* (2016), export performance does not depend on the ownership composition, a firm with Hunga-rian ownership can be just as likely to be successful as a mainly foreign-owned firm.

We have found that firms with a better liquidity position are more profitable, so those without liquidity problems are stable and more profitable.

Based on the long-risk analysis, we have drawn the conclusion that taking a long-term loan reduces profitability. If the company is not able to do so, there will be no investments and the Hungarian food industry will be at a competitive disadvantage in the medium to long term without innovation. This is an area that needs to be developed in the case of food businesses. The range of subsidies is not negligible in this case as a possible alternative which is more favourable than taking out a long-term loan in this case. In the case of a long-term loan, the enterprise must take risks, whereas if it decides to use the subsidy, it must only decide on its effective use. The conditions for taking out a grant are slightly tougher, but in the long run it can generate more income for the company.

Our research shows that there is profit persistence which is considered average for manufacturing and higher for agriculture.

When we examined industry revenue, we found that the more firms there are, the lower the profits become, as increasing competition leads to decreasing profits. When examining the Blundell-Bond model, we only obtained significant values.
In the case of top10_share, it is also significant only for the Bundell-Bond model, if the top10 takes a larger share of industry revenue, profitability in the industry decreases, the big players take the profits, and eventually small firms go bankrupt.

For the risk number ROA_sd3_w, the higher the risk is, the lower the profit is. All theories say that as risk-taking increases, profit increases (ex ante), but in our study it is the other way around.

In the case of our research, it would be timeless to say that a business that sells abroad is certainly more effective and profitable than its counterparts that sell domestically. This would work in a perfectly competitive world with the exception that there is no exchange rate differential. If we look back to the passed years, there are pitfalls then and now as well. We do not need to have an outstanding balance in a foreign currency in order to experience this, as it is sufficient to sell within the community or outside the community in another currency. When, so to speak, there is not so much impact on the world economy, then this would not even be perceptible, but one bad decision by the government, the EU or the world economy is enough, and investors sound the alarm that we should get rid of the currency of the given country, which brings with it the weakening of the currency of the given country, which then has an impact on the exchange rate in both the short and long term. To stabilize this, the central bank can take steps to normalize the situation.

When COVID19 arrived, it was similar to when a financial crisis started after the bankruptcy of a particular credit institution. At the beginning, no one here knew who and what to expect, whether the business would be able to continue its activities, or if it was completely impossible. Back to the exchange rate differential, which fluctuated quite a bit during this time. There was a company that preferred to withdraw its money from the bank and deposit it in the company's foreign currency treasury, in order to realize only a minimal loss after the transaction. Unfortunately, there are not many options regarding the exchange rate, since we either realize a profit or a loss after a given transaction. We do not realize anything in the event that

the counter value of our account is transferred on the same day. In our studies, what contributes to the decrease in the profitability of export sales is the constantly increasing production and transportation costs. We cannot cover the production and delivery costs even with a fixed contract, since the service company can think of one thing and raise the price to us, but we cannot raise to the foreign partner, so we will lose the extra income, so to speak, and will realize a loss, or break even. Unfortunately, none of them are favourable.

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Corresponding author:

Péter FÖLDI
Budapest Business School
1055 Budapest, Markó u. 29-31. Hungary
e-mail: foldi.peter@uni-bge.hu