ON THE INVESTMENT ATTRACTIVENESS OF UKRAINIAN COMPANIES

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EUROPEAN JOURNAL OF BUSINESS SCIENCE AND TECHNOLOGY

Volume 8 Issue 1
ISSN 2694-7161
www.ejobsat.com

ABSTRACT

The geographical location of Ukraine provides a multitude of possibilities for successful investment activity. There are rich natural resources, a fertile soil and a qualified low-cost labour force. On the other hand, investors have to deal with historical ties to the Soviet Union, corruption, and political instability exacerbated by occupation of part of the territory by Russia. This paper deals with the possibility of identifying the investment attractiveness of the particular sectors in Ukraine by the level of concentration measured by the Herfindahl-Hirschman index. Accounting data of companies taken from the Orbis database are evaluated by ABC analysis and the general linear model. The results point to significant dependency of variables representing investment attractiveness on the Herfindahl-Hirschman index, where deviations are explained by sectoral specifics.

KEY WORDS

ABC analysis, Herfindahl-Hirschman index, investment attractiveness, Ukrainian companies and sectors

JEL CODES

C21, F21

1 INTRODUCTION

A deep understanding of a nation's investment attractiveness and the accompanying inherent risks possessed by companies is very important in improving the success rate of investment processes and the resulting effects on the investment market. The right indicators or metrics are needed for analysis and decision-making by potential investors, who must be convinced of the feasibility of their investment in order to be successful. At present, there is no unified view of the methodological approaches to this type of analysis and evaluation of investment attrac-

VESELÁ, Natálie, RODCHENKO, Volodymyr, and HAMPEL, David. 2022. On the Investment Attractiveness of Ukrainian Companies. *European Journal of Business Science and Technology,* 8 (1): 54–71. ISSN 2694-7161, DOI 10.11118/ejobsat.2022.001.

tiveness. Searching for appropriate approach is motivated by business needs and provides another basis for further research in this direction. Such a single view can be developed, in detail, for each market segment, while factoring in the relative effects on other segments.

According to Pylypenko (2009), approaches to assessing the investment attractiveness of companies can be divided into three groups with respect to the relationship to the source of information. First, there are methods based on expert evaluations; then further methods based on statistical information and calculations; and thirdly, combined methods. Blank (2001) looks at investment attractiveness in terms of the company's financial position. He considers suitable characteristics for evaluating the investment attractiveness of companies to be those derived from indicators such as sales volumes, use of assets and their efficiency, financial stability, liquidity, and solvency.

Gaidutskiy (2004) requires that the comparative method cover the following elements of the investment process: comparison of investment objects, comparison of investors and comparison of factors of investment attractiveness. According to Chernysh (2013), a high-quality system of indicators for assessing investment attractiveness must consider the following circumstances: a limited number of indices directly influencing investment decisions; the calculation of indicators from public accounting and statistical data, the minimum use of internal information; the possibility of carrying out a rating assessment of the company's activities over time (as well as in relation to other economic entities).

Ukraine has the investment potential to realize good gains in growing sectors. Being a large, fertile and resource-rich country with a relatively low-cost labour force. The factor of low-cost labour is however considered overrated and mitigated by poor management of low productivity, see Kharlamova (2014). Ukraine is a very specific country with limited availability of information, and this fact represents the risk portion of investors' facts to consider before taking investment action. A comprehensive survey of positive and negative aspects affecting DFI investment in Ukraine in 2010–2017 is given by Furdychko and Pikhotska (2018). This survey maps the development of FDI over time in detail and gives a good overview of the major social economic and political factors.

The negative phenomena affecting DFI in Ukraine include massive oligarchism (Pleines, 2016), unfair competition, clientelism and the vulnerability of businesses through raider attacks just to name a few. Foreigners do not want to invest money in Ukraine, because they have no confidence in a stable and predictable law enforcement environment. Due to the difficult conditions for investment and business development, investors tend not to pay any attention to Ukraine when it comes to thinking about where to invest their money and choose less regulated and more predictable environments.

In Serhieieva (2015) the dynamics of investment attractiveness and DFI investment in Ukraine in 2008–2015 are investigated and internal DFI structure is analysed. The most important factor affecting the business climate is considered to be the "Ukrainian mental mind set" and measures to act on this are suggested. Apart from these socio-psychological reasons, geopolitical instability, poor legislation and economic uncertainty also negatively impact the investment climate in Ukraine.

In order to assist potential investors with the investment decision-making process, an assessment of regional investment attractivity was developed by Kharlamova (2014). This mathematically grounded methodology tries to capture the effect of regional factors on inward FDI. The method is based on the long-term detailed investment monitoring of 26 Ukrainian regions and their subsequent multi-stage rating assessment. Integral outputs yield rating indicators for investment potential (IP), investment risks (IR) and investment activity (IA) for each of these 26 Ukrainian regions. For marketing purposes IP-IR, IP-IA matrixes are assembled. enabling an analysis of the distribution of the regions by investment attractiveness. Lastly, the regions are graphically plotted on a 2D graph of investment activity versus investment attractiveness. This arrangement allows us to classify the regions according to investment

efficiency and construct analogue variants to BSG (IA versus IP) and DPB (investment attractiveness versus IP) matrixes. The major novelty of this approach is the ability to encompass territorial investment marketing.

Comprehensive analysis of the investment climate in Ukraine is engaged in by Krupka and Bachinskiy (2014). In his work, the author examines possible directions for improving methods for evaluating companies, in order to attract new investments through greater transparency. It recommends estimating the investment attractiveness of companies using a thorough analysis of the economic activity of the company: property relations, capital turnover, profitability and financial stability, liquidity, and market activity. Krupka and Bachinskiy (2014) also propose an index of investment attractiveness. In Malko (2015) the essence of categories such as "investment climate" and "investment attractiveness" is examined. The factors which influence the formation of a state's investment climate are identified. The investment attractiveness of Ukraine at its present stage of development is evaluated.

The aim of this paper is to assess the effect of business concentration on the investment attractiveness of selected sectors of the Ukraine economy. For detailed insight, the ABC method will be employed and a comparison with corresponding sectors of the Romanian economy will be made.

2 THEORETICAL BACKGROUND

The relationship between concentration within a sector and investment attractiveness and hence the volume of investment in the sector is not straightforward. In this section, we will lay out the theoretical links between the economic phenomena linking concentration and investment attractiveness and further illustrate them using results from other papers relevant to the Ukrainian economy.

We first focus on the effects of sector concentration on the efficiency of companies and the form of competition in the market, and hence on the competitiveness of companies. Higher concentration in a sector results in potentially higher production efficiency of certain companies, which implies a competitive advantage and will ultimately shape the type of competition in the market. An increase in concentration in a sector can affect different economic levels: production within an enterprise, the enterprise itself, the industrial sector. It will have an impact on regions across the country, but the most important impact will be on the competitiveness of the enterprise itself as a major component of the whole economy.

In the current difficult economic conditions, enterprises may lack a clear strategy regarding financial and economic targets and criteria, but the key will still be to keep up with the times, to update technology, innovate and set investment strategies correctly and in a timely manner. As Ratnayake (1999) writes, many enterprises in Ukraine have found themselves struggling to survive in market conditions. The only way to survive was to integrate with other businesses and corporations. Under the conditions of Ukraine's unstable and developing economy, holdings began to form that allowed the original smaller enterprises to exist at all due to the greater efficiency given by higher concentration. According to Rastvortseva et al. (2012), the increasing concentration of business activities in a region creates the conditions for the emergence of the agglomeration effect: the economic benefits of enterprises arising due to the positive effect from the higher scale of production.

Rodchenko (2013) examines asymmetries between regions, including differential industrial concentration, and their impact on the development of cities and urban complexes. The author concludes that regional asymmetries cause mainly negative consequences and require state regulation of asymmetries in the socio-economic development of regions. As part of the study, a model for managing the socio-economic development of cities was developed.

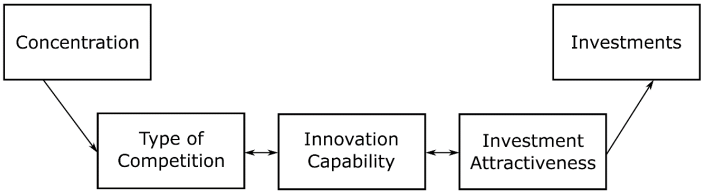

Fig. 1: Scheme of link between concentration of the sector and investment attractiveness of the sector resulting in investments to the sector

The productivity of firms increases with increasing levels of concentration, see Cieślik et al. (2018). According to Aritenang (2021), it can be observed that a higher level of concentration of companies in the market increases the competitiveness of larger companies, and this is especially true for foreign-invested companies.

Efficiency and profitability of production, as well as increasing its volume, effective management with elements of innovation, and (foreign) investment under conditions of market competition are the basis for increasing the profitability of the enterprise, which will lead to its further growth and may overall lead to a change in the market structure. Aleskerova and Fedoryshyna (2018) point out that enterprises operating at full capacity and increasing the production of high-quality products are competitive mainly due to the financing of innovation. Aritenang (2021) argues that, in addition to the size of a firm, investment and innovation also lead to an increase in its competitiveness. Ilyash et al. (2018) demonstrate the dependence of the efficiency or competitiveness of enterprises on the development of the innovative potential of Ukrainian industry and concludes at the industry level that the level of efficiency in an industry depends on its level of innovation. According to Cordano and Zevallos (2021) investment depends on competitiveness and vice versa. The investment climate is a source of competitiveness.

A paper by Malyutin and Sokolov (2012) addresses competitiveness at the national level. The authors conclude that Ukraine has low investment attractiveness, resulting in low competitiveness. For stable healthy economic growth it is very important to solve the problem of increasing investment by introducing effective incentives through the tax system (tax rate reduction, tax exemptions). Ilyash et al. (2018) deal with the relationship between the index of competitiveness and the index of innovation at a national level and empirically prove direct dependency.

On the basis of the above, we can conclude that concentration, innovation and investment are essential factors in ensuring the competitiveness of firms and the efficiency of entire industries. Concentration and increasing competitiveness also create a positive investment climate that stimulates investment attraction. It follows that industry concentration and the investment it generates are interlinked. The cited articles confirm that also in Ukraine, increasing sector concentration increases the efficiency of the market as a whole and the competitiveness of the individual business entity. In addition to concentration, investment (especially foreign investment) and innovation are competitiveness factors.

The relationship between the categories discussed can be expressed through the scheme in Fig. 1. The degree of concentration of an industry will be reflected in the differences in competitiveness between companies and consequently in the type of competition in a given market. Among other things, the size and profitability of firms is influenced by the innovation potential of firms. Taken together, this shapes the investment attractiveness of individual companies and thus of the sector as a whole, which determines the volume of investment. Our subject of interest is the causal link between sector concentration and investment attractiveness, hence the use of unidirectional arrows in Fig. 1; however, it would also be possible to explain the reverse causality from investment volume to sector concentration.

3 METHODOLOGY AND DATA

The required accounting data for companies are obtained from the Orbis database of Bureau van Dijk. Specifically, we use total assets, profitability, solvency ratio, liquidity ratio, value added and ROA. We deal with companies with prevailing activities in sectors NACE 1 Crop and animal production, hunting and related service activities; 10 Manufacture of food products; 21 Manufacture of basic pharmaceutical products and pharmaceutical preparations; 28 Manufacture of machinery and equipment; 35 Electricity, gas, steam and air conditioning supply. The sectors analysed were selected regarding information on the sectors of the Ukrainian economy according to the governmental UkraineInvest organization, which presents Energy, Manufacturing, Agritech and Innovations as the dominant sectors of the Ukrainian economy, see UkraineInvest (2020). A further important fact is that for the remaining sectors, the Orbis database contains relatively many more empty items than for the sectors analysed. This will lead to a distortion of results in the case of the joint analysis of all Ukrainian sectors. The analysis is carried out for the years 2009–2016, and except for Ukraine we will also deal with Romania as an EU member with roughly similar characteristics to Ukraine. Concentration of the sector is measured by the Herfindahl-Hirschman index (HHI), which is calculated as the sum of squared shares of the companies. Total assets are used for this purpose.

In addition to analysis based on the total dataset, we provide an ABC analysis based on total assets which divide companies of particular explored sectors into categories A, B and C, which account for 80, 15 and 5% of cumulative total assets. ABC analysis is traditionally used for different purposes (typically for inventory management), but in our case it can help to distinguish among variously "important" companies and their properties. A general discussion is given for example in Ultsch and Lötsch (2015). We follow the approach of Lapshyn and Kuznichenko (2017), who estimated the socio-economic state of regions of Ukraine using the Gini coefficient and ABC-XYZ analysis; also Pawełek et al. (2017) may be mentioned, where ABC analysis is used in corporate bankruptcy prediction.

The general linear model is employed to assess dependencies between characteristics which can serve as investment attractiveness and HHI accompanied by factors (country, sector, year, ABC group). A total of 240 observations (a combination of two countries, seven years, five sectors and three ABC groups) were used to estimate the individual regression models; in the case of the regression for group A only, 80 observations were used. Based on these regressions, predictions for combinations of countries and sectors are formed to show the results graphically. All calculations were performed in the MATLAB R2019b computational system and Genstat 19 software, the significance level was set at 0.05.

4 RESULTS

General linear models were estimated for particular investment attractiveness measures. Complete estimates are placed in Appendix. An analysis of variance for the entire dataset is presented in Tab. 1. Note that for gross profit many values for Romania are missing, which distorts results. For this reason, gross profit was assessed using Ukraine data only. HHI is assessed by F-test as a significant variable in all cases (line HHI F). The statistical significance of accompanying factors is also evaluated. The sector denoted as NACE is always significant. The country × sector interaction is significant except Value added, which means that this variable is determined by sector, not by country. HHI is also assessed by t-test, where the result

Tab. 1: Analysis of variance and HHI parameter assessment for particular models of investment attractiveness characteristics based on total dataset. Except sign of HHI parameter estimate, p-values are tabulated. Gross profit is available for Ukraine only, so factor country and interaction Country × NACE are not used here.

Factor	Liquidity	Profit	ROA	Solvency	Value added
HHI par. sign	−	+	+	+	−
HHI t	0.227	0.373	0.047	0.006	0.059
HHI F	<0.001	<0.001	<0.001	<0.001	<0.001
Country	0.028	×	0.198	<0.001	0.719
Year	0.044	0.811	<0.001	0.998	0.520
NACE	<0.001	<0.001	<0.001	<0.001	<0.001
ABC group	<0.001	<0.001	0.010	0.930	<0.001
Country × NACE	<0.001	×	<0.001	<0.001	0.417

Tab. 2: Analysis of variance and HHI parameter assessment for particular models of investment attractiveness characteristics based only on ABC group A. Except sign of HHI parameter estimate, p-values are tabulated. Gross profit is available for Ukraine only, so factor country and interaction Country × NACE are not used here.

Factor	Liquidity	Profit	ROA	Solvency	Value added
HHI par. sign	−	+	−	−	−
HHI t	0.010	0.001	0.022	0.821	0.527
HHI F	<0.001	<0.001	<0.001	0.012	<0.001
Country	0.625	×	0.438	0.171	1.000
Year	0.128	0.123	0.179	0.914	0.029
NACE	<0.001	<0.001	<0.001	<0.001	<0.001
Country × NACE	<0.001	×	<0.001	<0.001	0.341

can be interpreted as significance of HHI after elimination of other factors. This is true for ROA and Solvency ratio, where HHI has a positive effect.

An analogical analysis was provided for ABC group A only, which should cover the key companies in the given sectors, see Tab. 2. Results are similar to those for the entire dataset, the main result – significance of HHI – remains. There is a change in HHI significance after elimination of the other variables, where Liquidity ratio and ROA are affected negatively and Gross profit positively.

Predictions of country × sector interaction, which can serve as adjusted effects combinations, were calculated. This can be depicted based on HHI to illustrate the dependency. The case of liquidity and solvency ratios is presented in Fig. 1. Direct dependency on HHI is visible for both the entire dataset and for group A only.

The reason for a visible deviation in the level of liquidity of Ukrainian companies in the sector NACE 1 Crop and animal production may be the absence of a land market in Ukraine and insufficient regulation of the system of relations concerning land use. The result is a relatively low share of fixed assets, and thus high values of coefficients, taking into account elements of short-term assets. This is reflected in companies' balance sheets through a higher share of assets involved in one turnover cycle and a relatively smaller share of fixed assets, the creation of which is associated with longer-term investments, which become riskier due to the unsatisfied land market.

In the case of important companies from group A, there is also visible a lag between Romanian companies from the pharmaceutical industry and the remaining companies. Large companies in the pharmaceutical industry are the companies that usually secure the production of the most mass-produced drugs. Marginality is significantly increased with these drugs. The reasoning is as follows: drug development costs are generally of a conditionally constant nature, and as sales increase (which

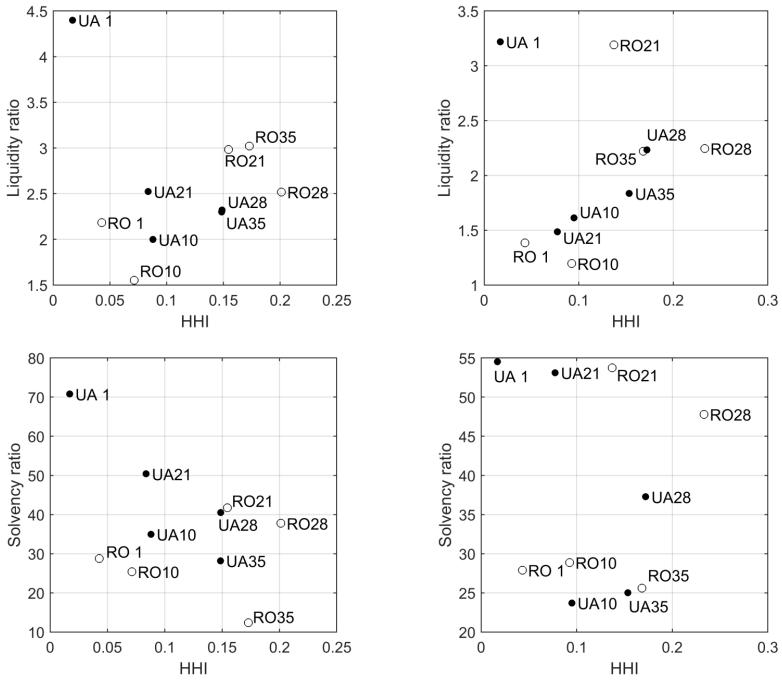

Fig. 2: Scatter plots of predicted Liquidity and Solvency ratios with relation to HHI prediction based on total dataset (left-hand graphs) and based only on ABC group A (right-hand graphs). RO means Romania, UA Ukraine and the number denotes the sector.

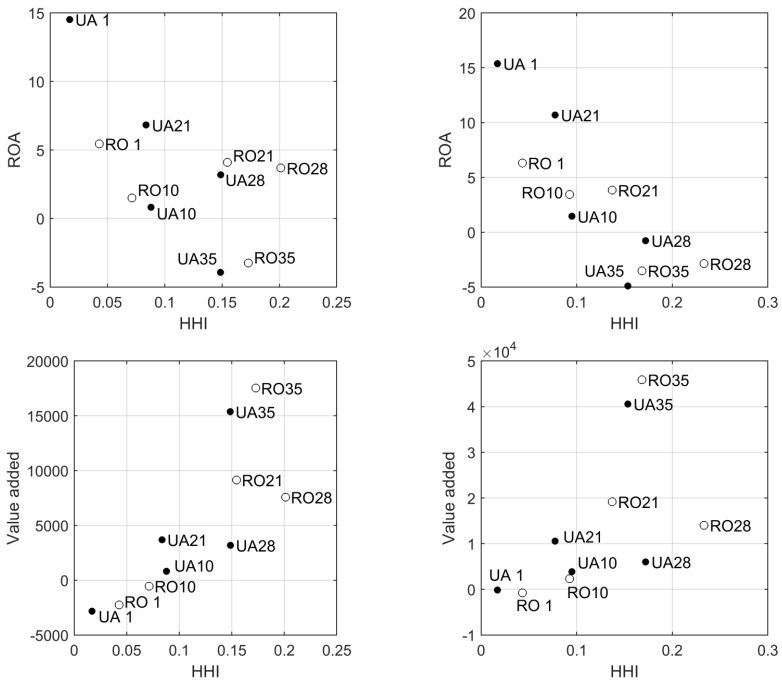

Fig. 3: Scatter plots of predicted ROA and Value added with relation to HHI prediction based on total dataset (left graphs) and based only on ABC group A (right graphs). RO means Romania, UA Ukraine and the number denotes sector.

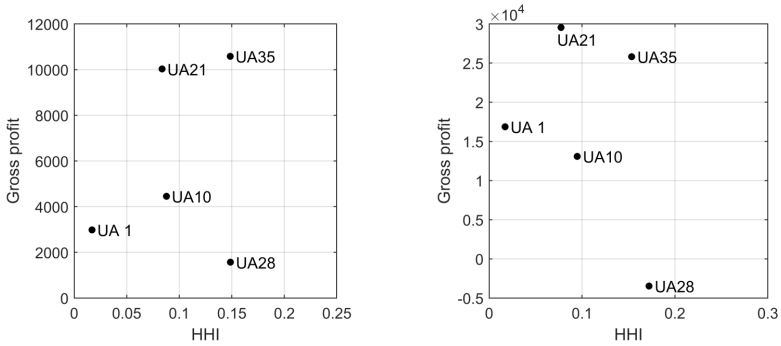

Fig. 4: Scatter plots of predicted Gross profit with relation to HHI prediction based on total dataset (left graph) and based only on ABC group A (right graph). UA means Ukraine and the number denotes the sector.

is typical of bulk drugs), their margins increase significantly.

In the case of the solvency ratio (see Fig. 2), for all companies the situation is unclear. When we focus on group A only, we can see a similar picture as for the liquidity ratio. The differences in the values of liquidity and solvency ratios for Ukraine and Romania lie in the peculiarities of the distribution of the company's owners and the aggressiveness of the asset financing policy (at the expense of equity or borrowed capital). In Romania, the main revenues come from well-known large companies, which do not require large investments in development and production. Increased solvency in Ukraine suggests that the pharmaceutical sector is owned by the state or foreign residents.

In Fig. 3 there are illustrated relations of HHI and ROA or value-added characteristics. Visible indirect dependency in the case of ROA can be explained in the case of NACE 28 Manufacture of machinery and equipment sector. As far as engineering companies are concerned, it can be stated that Ukrainian industry was generally focused on the markets of the CIS countries. Changes in relations with Russia and redirection to other markets, including the European market, have led to some companies entering a state of crisis. This was especially acute in large companies. Small- and medium-sized enterprises were able to redirect quickly. Large companies could not survive the break-up of historical links quickly and painlessly. They suffer losses due to differences in technological standards and other difficulties in integrating into European chains. In addition, the negative situation in the main sales markets of the engineering industry significantly worsened the performance of large companies in Romania and Ukraine.

The extreme case, negative ROA, is visible for NACE 35 Electricity, gas, and steam sector. The negative values of relative profit indicators, and thus the return on assets, are explained by the peculiarities of state regulation and subsidies of companies providing these services, namely state regulation of tariffs. On the other hand, the high level of wear and tear on the networks available to these companies causes them to increase their operating costs, which also affects the creation of a negative ROA.

Value added seems to be directly dependent on HHI, see Fig. 3, bottom graphs. There is a visible lag between NACE 35 Electricity, gas, and steam sector and the remaining companies. The value added of this sector is higher due to the relatively higher level of capital consumption (utilities, production facilities, etc.) and as a result of the relatively large volumes of depreciation. It can also be noted that the level of wages in this sector is usually slightly higher, which also contributes to a higher level of value added.

Unfortunately, the Orbis database includes Gross profit values for Ukraine companies, but not for Romania ones. In Fig. 4 we show the relationship between gross profit and HHI, which seems not to be systematic. Similarly to the ROA case, large companies from the NACE 28 Manufacture of machinery and equipment

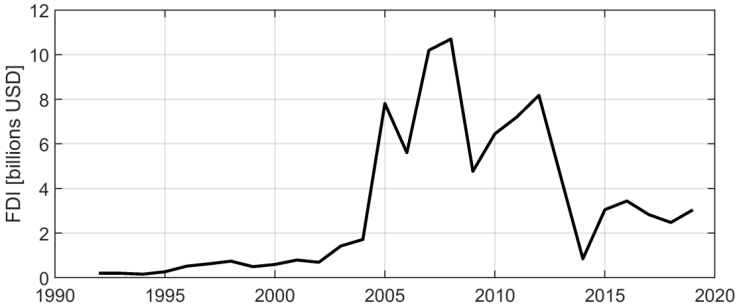

Fig. 5: Development of foreign direct investment in Ukraine (excluding occupied territories). Source: State Statistics Service of Ukraine

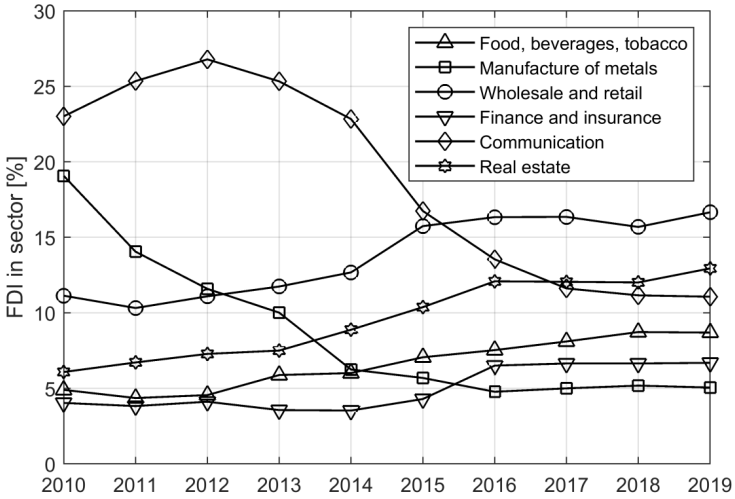

Fig. 6: Development of foreign direct investment in Ukraine (excluding occupied territories) sectors (the six sectors with the largest share were selected). Source: State Statistics Service of Ukraine

sector show worse average results than when all companies are involved. The reason is the change in the structure of the engineering market in Ukraine, the division of the USSR market from perestroika, the negative impact on eastern Ukraine due to the military conflict. Large enterprises which were part of the engineering complex in the USSR, which was the only economic complex, suffered in this.

An extremely serious problem, which without doubt affects foreign investment in Ukraine, is the territories currently occupied by Russia or by forces allied with Russia: the Autonomous Republic of Crimea, the city of Sevastopol, the regions of Donetsk and Luhansk. The occupation of these territories in 2014 led to a sharp decline in foreign investment, see Fig. 5, which has not been fully offset yet. Also, the distribution of FDI seems to be affected by this situation, see Fig. 6. Apart from long-term trends, changes are visible after 2014. The proportion of FDI distribution in particular sectors can be affected not only by attractiveness of the sector, but also by newly increasing risks, which can result for example in higher investment in the Wholesale and retail sector. It can be said that since 2016, the distribution of investment between sectors has been more or less stable. Unfortunately, this period is already outside the scope of the data analysed by us.

5 CONCLUSIONS

Based on the analysis performed, we can conclude that the level of concentration of the sector measured by HHI is a significant factor for determining key characteristics of investment attractiveness. Of course, sectoral specifics in the country should be taken into account, because deviations from visible dependencies exist. Moreover, application of ABC analysis enables assessment of the main companies' specifics, as discussed for the NACE 28 Manufacture of machinery and equipment sector.

For stronger results, it will be necessary to analyse more sectors in more countries, the limiting factor here will be the availability of data. For further analysis of the Ukrainian economy, it will also be important to separate the occupied areas from the areas fully controlled by the Ukrainian government. These topics will be the subject of our further research.

6 ACKNOWLEDGEMENT

Supported by the grant No. PEF_DP_2019039 of the Internal Grant Agency PEF MENDELU.

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8 DETAILED RESULTS OF REGRESSION MODELS

In the case of including complete data, models are of the form

$$\begin{aligned} Y = \ & \text{Constant} + \text{HHI} + \text{Country} + \\ & + \text{Year} + \text{NACE} + \text{ABC} + \\ & + \text{Country.NACE}, \end{aligned}$$

where for Y we gradually set Liquidity, Profit, ROA, Solvency and Value added (for Profit, the model is estimated for Ukraine only). Parameters for factors are differences compared with the reference level Country Romania, Year 2009, NACE 1 and ABC group A.

8.1 Liquidity

Tab. 3: Estimates of parameters

Parameter	Estimate	s.e.	T	p-value
Constant	1.552	0.215	7.23	<0.001
HHI	−2.1	1.74	−1.21	0.227
Country Ukraine	2.217	0.2	11.06	<0.001
Year 2010	0.409	0.175	2.34	0.020
Year 2011	0.449	0.175	2.57	0.011
Year 2012	0.247	0.175	1.41	0.159
Year 2013	0.321	0.178	1.81	0.072
Year 2014	0.349	0.176	1.99	0.048
Year 2015	0.62	0.177	3.5	<0.001
Year 2016	0.508	0.177	2.86	0.005
NACE 10	−0.631	0.202	−3.13	0.002
NACE 21	0.802	0.275	2.91	0.004
NACE 28	0.336	0.337	1	0.321
NACE 35	0.838	0.299	2.81	0.005
ABC B	0.535	0.109	4.93	<0.001
ABC C	0.979	0.108	9.09	<0.001
Country Ukraine NACE 10	−1.771	0.286	−6.2	<0.001
Country Ukraine NACE 21	−2.678	0.287	−9.33	<0.001
Country Ukraine NACE 28	−2.415	0.28	−8.63	<0.001
Country Ukraine NACE 35	−2.938	0.276	−10.64	<0.001

Tab. 4: Accumulated analysis of variance

Factor	d.f.	s.s.	m.s.	F	p-value
HHI	1	18.0513	18.0513	39.45	<0.001
Country	1	2.2251	2.2251	4.86	0.028
Year	7	6.737	0.9624	2.1	0.044
NACE	4	56.3583	14.0896	30.79	<0.001
ABC	2	39.8516	19.9258	43.55	<0.001
Country NACE	4	64.8383	16.2096	35.42	<0.001
Residual	220	100.6699	0.4576		
Total	239	288.7315	1.2081		

8.2 Profit

Tab. 5: Estimates of parameters

Parameter	Estimate	s.e.	T	p-value
Constant	9527	2451	3.89	<0.001
HHI	23451	26235	0.89	0.373
Year 2010	979	2556	0.38	0.702
Year 2011	2999	2561	1.17	0.244
Year 2012	2005	2622	0.76	0.446
Year 2013	3760	2564	1.47	0.145
Year 2014	1084	2555	0.42	0.672
Year 2015	426	2556	0.17	0.868
Year 2016	661	2558	0.26	0.797
NACE 10	1474	2745	0.54	0.592
NACE 21	7048	2672	2.64	0.010
NACE 28	−1417	4005	−0.35	0.724
NACE 35	7604	3998	1.9	0.060
ABC B	−14721	1605	−9.17	<0.001
ABC C	−16221	1567	−10.35	<0.001

Tab. 6: Accumulated analysis of variance

Factor	d.f.	s.s.	m.s.	F	p-value
HHI	1	7.91E+08	7.91E+08	16.15	<0.001
Year	7	1.81E+08	2.59E+07	0.53	0.811
NACE	4	1.60E+09	3.99E+08	8.16	<0.001
ABC	2	6.28E+09	3.14E+09	64.18	<0.001
Residual	105	5.14E+09	4.90E+07		
Total	119	1.40E+10	1.18E+08		

8.3 ROA

Tab. 7: Estimates of parameters

Parameter	Estimate	s.e.	T	p-value
Constant	1.71	1.02	1.67	0.096
HHI	16.55	8.28	2	0.047
Country Ukraine	9.071	0.955	9.49	<0.001
Year 2010	−0.183	0.833	−0.22	0.826
Year 2011	1.046	0.833	1.26	0.211
Year 2012	0.857	0.833	1.03	0.305
Year 2013	0.487	0.848	0.57	0.566
Year 2014	1.136	0.84	1.35	0.177
Year 2015	3.749	0.844	4.44	<0.001
Year 2016	4.02	0.846	4.75	<0.001
NACE 10	−3.956	0.961	−4.12	<0.001
NACE 21	−1.36	1.31	−1.04	0.301
NACE 28	−1.76	1.61	−1.1	0.274
NACE 35	−8.71	1.42	−6.12	<0.001
ABC B	1.421	0.518	2.74	0.007
ABC C	0.038	0.514	0.07	0.941
Country Ukraine NACE 10	−9.74	1.36	−7.15	<0.001
Country Ukraine NACE 21	−6.34	1.37	−4.63	<0.001
Country Ukraine NACE 28	−9.58	1.34	−7.17	<0.001
Country Ukraine NACE 35	−9.75	1.32	−7.4	<0.001

Tab. 8: Accumulated analysis of variance

Factor	d.f.	s.s.	m.s.	F	p-value
HHI	1	883.66	883.66	84.9	<0.001
Country	1	17.33	17.33	1.67	0.198
Year	7	410.47	58.64	5.63	<0.001
NACE	4	3125.83	781.46	75.08	<0.001
ABC	2	98.2	49.1	4.72	0.010
Country NACE	4	848.77	212.19	20.39	<0.001
Residual	220	2289.86	10.41		
Total	239	7674.12	32.11		

8.4 Solvency

Tab. 9: Estimates of parameters

Parameter	Estimate	s.e.	T	p-value
Constant	21.91	2.71	8.08	<0.001
HHI	61	21.9	2.78	0.006
Country Ukraine	42.02	2.53	16.6	<0.001
Year 2010	0.29	2.21	0.13	0.894
Year 2011	−0.19	2.21	−0.09	0.932
Year 2012	−0.78	2.21	−0.35	0.725
Year 2013	0.78	2.25	0.35	0.728
Year 2014	−0.36	2.22	−0.16	0.871
Year 2015	0.96	2.24	0.43	0.667
Year 2016	1.38	2.24	0.61	0.539
NACE 10	−3.35	2.55	−1.32	0.189
NACE 21	12.96	3.48	3.73	<0.001
NACE 28	9.01	4.26	2.11	0.036
NACE 35	−16.38	3.77	−4.34	<0.001
ABC B	−0.71	1.37	−0.52	0.606
ABC C	−0.17	1.36	−0.13	0.898
Country Ukraine NACE 10	−32.47	3.61	−8.99	<0.001
Country Ukraine NACE 21	−33.33	3.63	−9.19	<0.001
Country Ukraine NACE 28	−39.28	3.54	−11.1	<0.001
Country Ukraine NACE 35	−26.23	3.49	−7.51	<0.001

Tab. 10: Accumulated analysis of variance

Factor	d.f.	s.s.	m.s.	F	p-value
HHI	1	1338.11	1338.11	18.31	<0.001
Country	1	10272.27	10272.27	140.58	<0.001
Year	7	50.65	7.24	0.1	0.998
NACE	4	23145.02	5786.26	79.19	<0.001
ABC	2	10.64	5.32	0.07	0.930
Country NACE	4	11256.55	2814.14	38.51	<0.001
Residual	220	16075.1	73.07		
Total	239	62148.35	260.03		

8.5 Value Added

Tab. 11: Estimates of parameters

Parameter	Estimate	s.e.	T	p-value
Constant	11667	2673	4.36	<0.001
HHI	−41004	21635	−1.9	0.059
Country Ukraine	−576	2496	−0.23	0.818
Year 2010	198	2176	0.09	0.928
Year 2011	1451	2176	0.67	0.506
Year 2012	−1282	2176	−0.59	0.556
Year 2013	2039	2214	0.92	0.358
Year 2014	−953	2193	−0.43	0.664
Year 2015	−1322	2205	−0.6	0.549
Year 2016	−678	2209	−0.31	0.759
NACE 10	1715	2511	0.68	0.495
NACE 21	11404	3429	3.33	0.001
NACE 28	9835	4203	2.34	0.020
NACE 35	19793	3720	5.32	<0.001
ABC B	−13437	1353	−9.93	<0.001
ABC C	−14256	1342	−10.63	<0.001
Country Ukraine NACE 10	1928	3559	0.54	0.589
Country Ukraine NACE 21	−4878	3576	−1.36	0.174
Country Ukraine NACE 28	−3818	3488	−1.09	0.275
Country Ukraine NACE 35	−1587	3440	−0.46	0.645

Tab. 12: Accumulated analysis of variance

Factor	d.f.	s.s.	m.s.	F	p-value
HHI	1	1.76E+09	1.76E+09	24.81	<0.001
Country	1	9.21E+06	9.21E+06	0.13	0.719
Year	7	4.39E+08	6.27E+07	0.88	0.520
NACE	4	4.25E+09	1.06E+09	14.95	<0.001
ABC	2	9.78E+09	4.89E+09	68.84	<0.001
Country NACE	4	2.80E+08	6.99E+07	0.98	0.417
Residual	220	1.56E+10	7.10E+07		
Total	239	3.21E+10	1.35E+08		

In the case of including ABC group A only, models are of the form

$$Y = \text{Constant} + \text{HHI} + \text{Country} + \\ + \text{Year} + \text{NACE} + \text{Country.NACE},$$

where for Y we gradually set Liquidity, Profit, ROA, Solvency and Value added (for Profit, the model is estimated for Ukraine only). Parameters for factors are differences compared with the reference level Country Romania, Year 2009 and NACE 1.

8.6 Liquidity

Tab. 13: Estimates of parameters

Parameter	Estimate	s.e.	T	p-value
Constant	2.077	0.305	6.81	<0.001
HHI	−8.91	3.33	−2.68	0.010
Country Ukraine	1.834	0.292	6.28	<0.001
Year 2010	0.458	0.249	1.84	0.071
Year 2011	0.641	0.249	2.57	0.013
Year 2012	0.275	0.25	1.1	0.275
Year 2013	0.364	0.255	1.43	0.159
Year 2014	0.334	0.252	1.33	0.189
Year 2015	0.685	0.254	2.7	0.009
Year 2016	0.176	0.255	0.69	0.492
NACE 10	−0.187	0.324	−0.58	0.565
NACE 21	1.806	0.419	4.31	<0.001
NACE 28	0.862	0.692	1.25	0.217
NACE 35	0.838	0.501	1.67	0.100
Country Ukraine NACE 10	−1.419	0.405	−3.5	<0.001
Country Ukraine NACE 21	−3.538	0.41	−8.63	<0.001
Country Ukraine NACE 28	−1.846	0.411	−4.49	<0.001
Country Ukraine NACE 35	−2.22	0.396	−5.61	<0.001

Tab. 14: Accumulated analysis of variance

Factor	d.f.	s.s.	m.s.	F	p-value
HHI	1	21.9253	21.9253	70.55	<0.001
Country	1	0.0751	0.0751	0.24	0.625
Year	7	3.6799	0.5257	1.69	0.128
NACE	4	10.92	2.73	8.78	<0.001
Country NACE	4	24.5969	6.1492	19.79	<0.001
Residual	62	19.2681	0.3108		
Total	79	80.4653	1.0185		

8.7 Profit

Tab. 15: Estimates of parameters

Parameter	Estimate	s.e.	T	p-value
Constant	−3605	3401	−1.06	0.299
HHI	161392	44774	3.6	0.001
Year 2010	2794	3861	0.72	0.476
Year 2011	8082	3871	2.09	0.046
Year 2012	2745	4051	0.68	0.504
Year 2013	10996	3870	2.84	0.008
Year 2014	2796	3860	0.72	0.475
Year 2015	1500	3864	0.39	0.701
Year 2016	1907	3861	0.49	0.625
NACE 10	−3776	4630	−0.82	0.422
NACE 21	12691	4073	3.12	0.004
NACE 28	−20339	7580	−2.68	0.012
NACE 35	8956	6821	1.31	0.200

Tab. 16: Accumulated analysis of variance

Factor	d.f.	s.s.	m.s.	F	p-value
HHI	1	1.22E+09	1.22E+09	32.84	<0.001
Year	7	4.76E+08	6.80E+07	1.83	0.123
NACE	4	4.64E+09	1.16E+09	31.15	<0.001
Residual	27	1.01E+09	3.72E+07		
Total	39	7.35E+09	1.88E+08		

8.8 ROA

Tab. 17: Estimates of parameters

Parameter	Estimate	s.e.	T	p-value
Constant	0.26	1.53	0.17	0.865
HHI	39.5	16.8	2.35	0.022
Country Ukraine	9.06	1.47	6.17	<0.001
Year 2010	0.05	1.25	0.04	0.968
Year 2011	1	1.26	0.79	0.430
Year 2012	1.39	1.26	1.1	0.274
Year 2013	1.7	1.28	1.32	0.191
Year 2014	0.19	1.27	0.15	0.882
Year 2015	3.18	1.28	2.49	0.016
Year 2016	3.42	1.28	2.67	0.01
NACE 10	−2.88	1.63	−1.77	0.081
NACE 21	−2.49	2.11	−1.18	0.243
NACE 28	−9.19	3.48	−2.64	0.010
NACE 35	−9.85	2.52	−3.9	<0.001
Country Ukraine NACE 10	−11.04	2.04	−5.41	<0.001
Country Ukraine NACE 21	−2.2	2.06	−1.07	0.290
Country Ukraine NACE 28	−6.96	2.07	−3.36	0.001
Country Ukraine NACE 35	−10.44	1.99	−5.24	<0.001

Tab. 18: Accumulated analysis of variance

Factor	d.f.	s.s.	m.s.	F	p-value
HHI	1	483.991	483.991	61.5	<0.001
Country	1	4.805	4.805	0.61	0.438
Year	7	83.384	11.912	1.51	0.179
NACE	4	688.062	172.015	21.86	<0.001
Country NACE	4	352.27	88.067	11.19	<0.001
Residual	62	487.951	7.87		
Total	79	2100.463	26.588		

8.9 Solvency

Tab. 19: Estimates of parameters

Parameter	Estimate	s.e.	T	p-value
Constant	28.9	2.68	10.8	<0.001
HHI	−6.6	29.2	−0.23	0.821
Country Ukraine	26.64	2.56	10.39	<0.001
Year 2010	−0.08	2.19	−0.04	0.970
Year 2011	0.49	2.19	0.23	0.823
Year 2012	−0.25	2.2	−0.12	0.908
Year 2013	0.54	2.24	0.24	0.811
Year 2014	−2.26	2.21	−1.02	0.311
Year 2015	−0.68	2.23	−0.31	0.760
Year 2016	0.51	2.24	0.23	0.819
NACE 10	0.98	2.84	0.35	0.731
NACE 21	25.84	3.68	7.02	<0.001
NACE 28	19.9	6.07	3.28	0.002
NACE 35	−2.31	4.4	−0.53	0.601
Country Ukraine NACE 10	−31.8	3.56	−8.94	<0.001
Country Ukraine NACE 21	−27.27	3.6	−7.58	<0.001
Country Ukraine NACE 28	−37.16	3.61	−10.3	<0.001
Country Ukraine NACE 35	−27.22	3.48	−7.83	<0.001

Tab. 20: Accumulated analysis of variance

Factor	d.f.	s.s.	m.s.	F	p-value
HHI	1	160.95	160.95	6.72	0.012
Country	1	45.88	45.88	1.92	0.171
Year	7	62.58	8.94	0.37	0.914
NACE	4	9054.39	2263.6	94.52	<0.001
Country NACE	4	3280.55	820.14	34.25	<0.001
Residual	62	1484.83	23.95		
Total	79	14089.18	178.34		

8.10 Value Added

Tab. 21: Estimates of parameters

Parameter	Estimate	s.e.	T	p-value
Constant	2027	4321	0.47	0.641
HHI	−29993	47196	−0.64	0.527
Country Ukraine	606	4136	0.15	0.884
Year 2010	1031	3533	0.29	0.771
Year 2011	4123	3534	1.17	0.248
Year 2012	−3043	3544	−0.86	0.394
Year 2013	7495	3614	2.07	0.042
Year 2014	−1365	3565	−0.38	0.703
Year 2015	−1940	3594	−0.54	0.591
Year 2016	−179	3609	−0.05	0.961
NACE 10	3094	4586	0.67	0.502
NACE 21	19949	5941	3.36	0.001
NACE 28	14809	9800	1.51	0.136
NACE 35	46656	7103	6.57	<0.001
Country Ukraine NACE 10	925	5743	0.16	0.873
Country Ukraine NACE 21	−9217	5808	−1.59	0.118
Country Ukraine NACE 28	−8623	5825	−1.48	0.144
Country Ukraine NACE 35	−5911	5610	−1.05	0.296

Tab. 22: Accumulated analysis of variance

Factor	d.f.	s.s.	m.s.	F	p-value
HHI	1	3.06E+09	3.06E+09	49.04	<0.001
Country	1	2.41E+01	2.41E+01	0	1.000
Year	7	1.06E+09	1.52E+08	2.43	0.029
NACE	4	1.40E+10	3.51E+09	56.28	<0.001
Country NACE	4	2.87E+08	7.18E+07	1.15	0.341
Residual	62	3.87E+09	6.24E+07		
Total	79	2.23E+10	2.83E+08		

To forming predictions of HHI, we employ model for full data

$$\begin{aligned}\text{HHI} = \ & \text{Constant} + \text{Country} + \text{Year} + \\ & + \text{NACE} + \text{ABC} + \text{Country.NACE}\end{aligned}$$

and for ABC group A only model

$$\begin{aligned}\text{HHI} = \ & \text{Constant} + \text{Country} + \text{Year} + \\ & + \text{NACE} + \text{Country.NACE}.\end{aligned}$$

Parameters for factors are differences compared with the reference level Country Romania, Year 2009, NACE 1 and – when included – ABC group A.

8.11 HHI Full Data

Tab. 23: Estimates of parameters

Parameter	Estimate	s.e.	T	p-value
Constant	0.05707	0.00737	7.74	<0.001
Country Ukraine	−0.02576	0.00756	−3.41	<0.001
Year 2010	−0.00203	0.00676	−0.3	0.764
Year 2011	0.001	0.00676	0.15	0.883
Year 2012	0.00071	0.00676	0.1	0.917
Year 2013	−0.01893	0.00676	−2.8	0.006
Year 2014	−0.01259	0.00676	−1.86	0.064
Year 2015	−0.01644	0.00676	−2.43	0.016
Year 2016	−0.01761	0.00676	−2.6	0.010
NACE 10	0.02869	0.00756	3.79	<0.001
NACE 21	0.11171	0.00756	14.77	<0.001
NACE 28	0.15843	0.00756	20.95	<0.001
NACE 35	0.13008	0.00756	17.2	<0.001
ABC B	−0.01094	0.00414	−2.64	0.009
ABC C	−0.00728	0.00414	−1.76	0.08
Country Ukraine NACE 10	0.0422	0.0107	3.94	<0.001
Country Ukraine NACE 21	−0.045	0.0107	−4.21	<0.001
Country Ukraine NACE 28	−0.0266	0.0107	−2.49	0.014
Country Ukraine NACE 35	0.0014	0.0107	0.13	0.894

Tab. 24: Accumulated analysis of variance

Factor	d.f.	s.s.	m.s.	F	p-value
Country	1	0.059052	0.059052	86.02	<0.001
Year	7	0.016801	0.0024	3.5	0.001
NACE	4	0.680401	0.1701	247.8	<0.001
ABC	2	0.004961	0.00248	3.61	0.029
Country NACE	4	0.052321	0.01308	19.05	<0.001
Residual	221	0.151706	0.000687		
Total	239	0.965242	0.004039		

8.12 HHI ABC Group A Only

Tab. 25: Estimates of parameters

Parameter	Estimate	s.e.	T	p-value
Constant	0.04928	0.00972	5.07	<0.001
Country Ukraine	−0.026	0.0105	−2.47	0.016
Year 2010	−0.00127	0.00943	−0.13	0.894
Year 2011	0.00221	0.00943	0.23	0.816
Year 2012	0.00617	0.00943	0.65	0.515
Year 2013	−0.01618	0.00943	−1.72	0.091
Year 2014	−0.01024	0.00943	−1.09	0.281
Year 2015	−0.014	0.00943	−1.48	0.143
Year 2016	−0.01566	0.00943	−1.66	0.102
NACE 10	0.0494	0.0105	4.69	<0.001
NACE 21	0.094	0.0105	8.92	<0.001
NACE 28	0.19	0.0105	18.03	<0.001
NACE 35	0.1251	0.0105	11.87	<0.001
Country Ukraine NACE 10	0.0284	0.0149	1.9	0.062
Country Ukraine NACE 21	−0.0338	0.0149	−2.27	0.027
Country Ukraine NACE 28	−0.0351	0.0149	−2.35	0.022
Country Ukraine NACE 35	0.0111	0.0149	0.75	0.458

Tab. 26: Accumulated analysis of variance

Factor	**d.f.**	**s.s.**	**m.s.**	F	p**-value**
Country	1	0.020348	0.020348	45.77	<0.001
Year	7	0.00553	0.00079	1.78	0.108
NACE	4	0.278657	0.069664	156.69	<0.001
Country NACE	4	0.012512	0.003128	7.04	<0.001
Residual	63	0.028009	0.000445		
Total	79	0.345055	0.004368		

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