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Profitability of the Manufacturing Sector of Bulgaria and of the Other Central and Eastern European EU Countries: Comparison and Empirical Analysis

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Contents

Abstract: The paper provides descriptive and quantitative analyses of firm profitability in the manufacturing sector of Bulgaria and of the other Central and Eastern European (CEE) member countries of the European Union (EU) over the period 2015–2019 using firm-level data from the Orbis database. The profitability of Bulgaria's manufacturing sector as a whole and of the groups of the nationally-owned and of the small firms is shown to consistently lie in the highest quartile of the cross-country profitability distributions. Quantile regression results further indicate that firm profitability in the CEE EU countries is negatively associated with higher GDP per capita, higher corporate income tax rates and, in most specifications, larger firm size. In contrast, higher market concentration is found to have a positive effect on firm profitability in most of the specifications. The findings help explain the profitability of the Bulgarian manufacturing sector and are in line with the economic literature.

Keywords: firm profitability, manufacturing sector, quantile regression

JEL classification: D22, L25, L60

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1. Introduction

The manufacturing sector is important for Bulgaria and for the other ten Central and Eastern European (CEE) member countries of the European Union (EU).[1] During the period under study (2015–2019), the manufacturing sector had the largest share of employees and also the largest share of total value added at factor cost among all the economic sectors of the Bulgarian economy. Furthermore, according to the same two criteria, on average, the manufacturing sector made up a larger part of the economies of the group of the CEE EU countries compared to the group comprised of the rest of the EU countries. Therefore, understanding the determinants of firm profitability in the manufacturing sector of the CEE EU countries, a group of relatively similar economies, is important.

The aim of the present paper is, on the one hand, to compare firms' profitability in the manufacturing sector of Bulgaria to the manufacturing sectors of the other CEE EU countries, as the focus of the present analysis lies on Bulgaria, and, on the other hand, to study the effects of selected country-specific, firm-specific and industry-specific factors on the profitability of the firms operating in the manufacturing sectors of the CEE EU countries in general.

In the first part of the paper, a descriptive analysis is performed in which the reported firm profitability of the manufacturing sector of Bulgaria is computed and compared to the respective firm profitability in the other ten CEE EU countries. These countries comprise a relatively comparable sample due to them being small open economies, characterised by a transition from command economies to market economies and ultimately becoming part of the EU (*e.g.* ECB, 2018). Although the CEE EU countries are similar in some aspects, there is also heterogeneity among them as they are in a different stage in their convergence process towards the EU average in terms of their per capita income. The descriptive analysis of firm profitability in manufacturing is performed at an aggregate level. It is done at the level of the manufacturing sector in general and also for different divisions of the sample, such as according to the ownership of the firms (whether nationally-owned or not) as well as according to firm size and also to the manufacturing subsector.

In the second part of the paper, the effects of different country-specific, firm-specific and industry-specific factors on firm profitability in the manufacturing sectors of the CEE EU countries are estimated. These factors are suggested by

[1] The other ten CEE EU countries are: Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. For short all of these countries, including Bulgaria, are denoted as the 'CEE EU countries' in the present paper. In the present paper, the country denominations are as the ones used by Eurostat.

their relevance for Bulgaria and by the observations made in the descriptive analysis in the present paper.

The descriptive and quantitative analyses in the present paper are done for the period 2015–2019, which consists of the five most recent years before the beginning of COVID-19 as COVID-19 constitutes an extraordinary event. Due to the measures undertaken by the governments in many jurisdictions to cope with COVID-19, for instance the imposition of lockdowns during which firms had to either freeze or lower their economic activity, there were consequently implications for the firms' economic and financial performance.

The present paper uses the ratio of the firms' profit and loss before tax to operating revenue, denoted as the PLBT margin, as a profitability measure. This profitability measure informs on whether or not and how well a firm can cover its costs through its revenues from its operations.

The descriptive analysis shows that in the studied period (2015–2019) the Bulgarian manufacturing sector is relatively more profitable than the manufacturing sectors of many of the other CEE EU countries. Namely, throughout the period under review, the PLBT margin of the Bulgarian manufacturing sector consistently lies in the highest quartile of the profitability distribution of the CEE EU countries. In addition, the nationally-owned firms and the small firms in Bulgaria are generally found to be the most profitable in their respective firm groups among the CEE EU countries.

Since during the studied period Bulgaria is the least converged among the CEE EU countries and has one of the lowest corporate income tax rates, a quantitative analysis is performed to determine the effects of factors including a country's per capita income and corporate income tax rate on the profitability of the CEE EU manufacturing firms. Also, as the performed descriptive analysis revealed differences in the profitability of the Bulgarian firms depending on their ownership and size, the effects of these factors on the CEE EU manufacturing firms' profitability are also examined. In addition, the market concentration within each manufacturing subsector, country and year is controlled for.

The results from the performed quantitative analysis show that firm profitability is affected negatively by a country's per capita income, used as a proxy for a country's level of economic convergence, and by a country's corporate income tax rate. Firm size is furthermore generally found to have a negative effect on firm profitability. At the same time, firm profitability is generally found to be affected positively by higher market concentration being present and to some degree by the firms being national rather than multinational. The obtained empirical results provide potential explanations for the observations made

in the descriptive part of the present paper and are in line with the economic literature on the determinants of firm profitability.

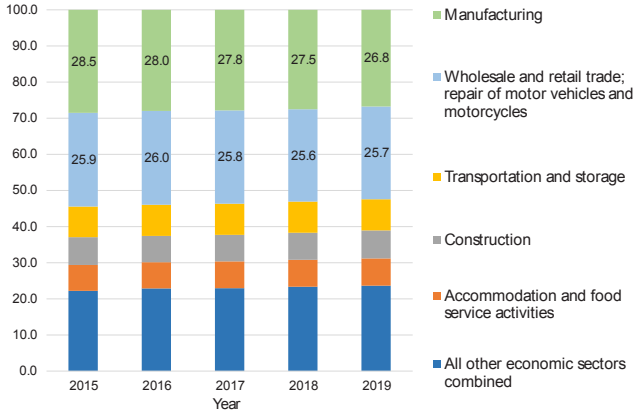
The paper is structured as follows. Section 2 describes the data sample used in the analyses in the present paper. The descriptive analysis is presented in Section 3. Section 4 presents a literature review on the effects of different factors on firm profitability, whereas the quantitative analysis, which considers these factors, is presented in Section 5. Section 6 concludes. Supplementary figures, as well as additional information on the data used in the performed analyses are presented in the Appendix.

2. Data used in the analyses

2.a. Importance of the manufacturing sector for the CEE EU countries

The analysis of firm profitability in the present paper is focused on the manufacturing sectors (NACE Rev. 2 Section C) of Bulgaria and compares it to the manufacturing sectors of the other ten CEE EU countries for the period 2015–2019. The manufacturing sector is chosen due to the relative importance of this economic sector for Bulgaria and more broadly for the CEE EU countries.

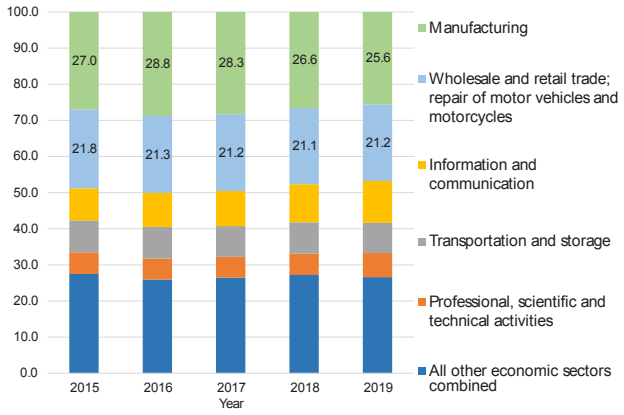
Figure 1: **Top 5 economic sectors in Bulgaria according to the share of employees (in percent)**



Source: National Statistical Institute of Bulgaria. Calculations by the author.

Note: Data for the Top 5 economic sectors in the figure are sorted from largest to smallest value of the share of employees (in percent) in 2019. The group 'All other economic sectors combined' comprises the following economic sectors: 'Administrative and support service activities'; 'Professional, scientific and technical activities'; 'Information and communication'; 'Real estate activities'; 'Water supply; sewerage, waste management and remediation activities'; 'Electricity, gas, steam and air conditioning supply'; 'Mining and quarrying'; 'Repair of computers and personal and household goods'.

Figure 2: **Top 5 economic sectors in Bulgaria according to the share of value added at factor cost (in percent)**



Source: National Statistical Institute of Bulgaria. Calculations by the author.

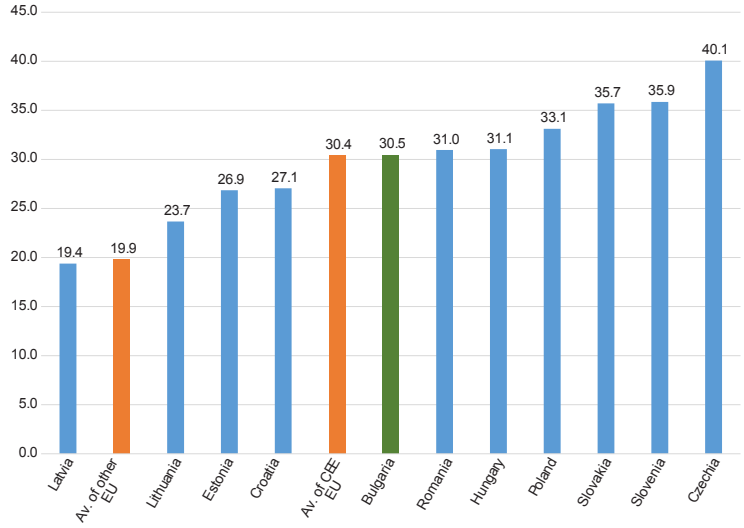
Note: Data for the Top 5 economic sectors in the figure are sorted from largest to smallest value of the share of value added at factor cost (in percent) in 2019. The group 'All other economic sectors combined' comprises the following economic sectors: 'Construction'; 'Electricity, gas, steam and air conditioning supply'; 'Administrative and support service activities'; 'Accommodation and food service activities'; 'Real estate activities'; 'Mining and quarrying'; 'Water supply; sewerage, waste management and remediation activities'; 'Repair of computers and personal and household goods'.

With respect to Bulgaria, Figure 1 shows that in all years under consideration the manufacturing sector had the largest share of employees among all the economic sectors of the country. In addition, Figure 2 shows that during the same period the manufacturing sector of Bulgaria also had the largest share of total value added at factor cost among all the sectors in the Bulgarian economy.

Figures 3 and 4 furthermore illustrate the relative importance of the manufacturing sector for the CEE EU countries as a group, including Bulgaria. Figure 3 depicts the average number of the employees in the manufacturing sector as a percentage of the employees in the total business economy over the period 2015–2019 for each of the CEE EU countries separately and also the average value for the CEE EU countries as a group. In the figure it can be seen that the average for the CEE EU countries is much larger than the corresponding average for the group of countries denoted as 'other EU' countries, which comprises all the other EU member countries apart from the CEE EU countries. The picture is similar when it comes to the average values of value added at factor cost in manufacturing as a percentage of the total business economy over the 2015–2019 period, which is shown in Figure 4. There again the average for the CEE EU countries is larger than the one for the 'other EU' countries. Still, even though Figures 3 and 4 show that there are certain similarities among

the CEE EU countries, these figures nevertheless indicate that there is also heterogeneity present among them.

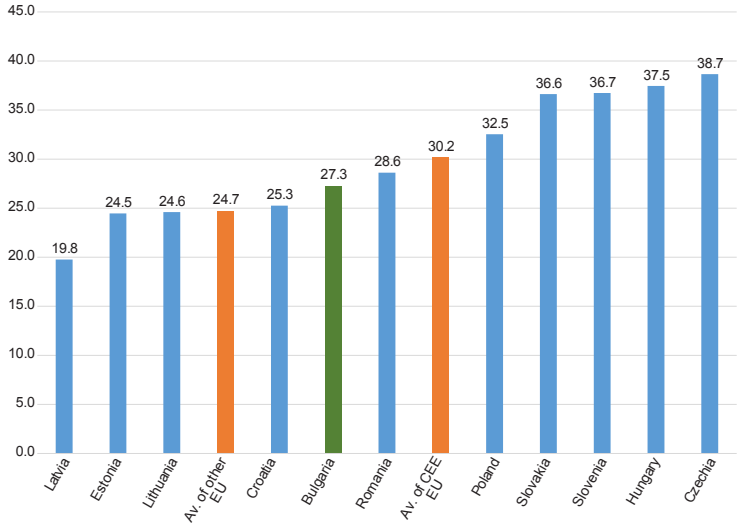
Figure 3: **Employees in the manufacturing sector as a percentage of the total business economy**



Source: Structural Business Statistics, Eurostat. Calculations by the author.

Note: The data represent an average for the period 2015–2019. 'Av. of other EU' denotes the average of the EU member countries (with the EU assumed to consist of the 27 member countries as of 2020 during the period 2015–2019) apart from the eleven CEE EU countries over their respective country averages over the period 2015–2019. 'Av. of CEE EU' denotes the average of the eleven CEE EU countries over their respective country averages over the period 2015–2019. 'Total business economy' stands for 'Total business economy; repair of computers, personal and household goods; except financial and insurance activities'. Data for Malta is available only for the years 2016, 2018 and 2019.

Figure 4: **Value added at factor cost in the manufacturing sector as a percentage of the total business economy**



Source: Structural Business Statistics, Eurostat. Calculations by the author.

Note: The data represent an average for the period 2015–2019. 'Av. of other EU' denotes the average of the EU member countries (with the EU assumed to consist of the 27 member countries as of 2020 during the period 2015–2019) apart from the eleven CEE EU countries over their respective country averages over the period 2015–2019. 'Av. of CEE EU' denotes the average of the eleven CEE EU countries over their respective country averages over the period 2015–2019. 'Total business economy' stands for 'Total business economy; repair of computers, personal and household goods; except financial and insurance activities'. Data for Malta is available only for the years 2016, 2018 and 2019.

2.b. Data sample

The present paper employs data from the Orbis database compiled by Bureau van Dijk, which contains information on the profit and loss and balance sheet data of firms.[2]

The analysis is done on a sample containing small, medium-sized and large firms. Micro firms, which are firms with less than 10 employees, are not included. As the focus of the present analysis lies on Bulgaria, not including the micro firms still provides for a relatively large coverage of the firms active in the manufacturing sector there. Table 1 presents average data for the period 2015–2019 for the manufacturing sector of Bulgaria for groups of firms comprised of a different number of employees. The micro firms comprise on average 75.7% of all the firms in the Bulgarian manufacturing sector. However, excluding the micro firms would imply excluding on average only around 4.4%

[2] Information on the preparation of the basic data sample is presented in Appendix B.1.

of the turnover, around 5.3% of the value added at factor cost and around 11.3% of the employees of the manufacturing sector of Bulgaria.

Table 1: **Distribution of firms in the Bulgarian manufacturing sector according to the number of employees**

	Average over the period 2015-2019			
Number of employees	< 10	10 - 49	50 - 249	250 +
Share of the number of enterprises, in percent	75.7	17.9	5.5	0.9
Share of turnover, in percent	4.4	12.4	25.8	57.5
Share of value added at factor cost, in percent	5.3	15.5	28.7	50.5
Share of employees, in percent	11.3	22.3	31.7	34.7

Source: National Statistical Institute of Bulgaria. Calculations by the author.

Note: Micro firms are firms with less than 10 persons employed, denoted by '< 10' in the table. Small firms are firms with at least 10 and less than or equal to 49 persons employed. Medium-sized firms are firms with at least 50 and less than or equal to 249 persons employed. Large firms are firms with 250 or more persons employed, denoted by '250 +' in the table. The firm-size classification is made according to the firm-size classes implemented by Eurostat for presenting the Structural Business Statistics with respect to the number of firm's employees.

In order to have a better picture about the scope of the sample that is used in the present analysis, the ratio of the data from the present sample to Eurostat's Structural Business Statistics (SBS) data on the small, medium-sized and large firms with respect to three parameters is computed. These parameters are, first, the number of enterprises, second, the turnover or gross premiums written, given in million euro, and, third, the number of employees.[3]

Table 2 presents the average of the present sample's country coverage as a percentage of the SBS over the 2015–2019 period, which is computed over the country coverages for each single year from 2015 to 2019. The average country coverage for the three parameters over the studied period shows that, with the exception of Czechia and Slovakia for all three parameters and of Poland for the number of enterprises, all the other CEE EU countries have an average coverage of above 50%, whereas in the majority of the cases the average coverage is even above 60%. For Bulgaria the average coverage of the present data sample as a percentage of the SBS over the five years of interest with respect to the number of enterprises is close to 70%, with respect to the turnover or gross premiums written it is almost 86% and with respect to the number of employees it is slightly below 84%, which represents a comparatively high data coverage.

[3] An approximation is used for the number of employees for some of the firm-year observations with missing data on this item and the iterative procedure which is implemented in this respect is described in Appendix B.2.

Table 2: **Sample coverage in percent of the Eurostat's Structural Business Statistics**

	Average over the period 2015-2019		
Country	% of the number of enterprises	% of turnover	% of the number of employees
Bulgaria	69.04	85.72	83.54
Croatia	73.97	79.40	79.17
Czechia	27.62	30.56	30.92
Estonia	69.26	76.29	73.62
Hungary	73.24	78.30	86.89
Latvia	72.57	74.80	75.53
Lithuania	51.43	64.49	73.90
Poland	32.28	63.88	61.65
Romania	66.44	82.27	80.79
Slovakia	30.59	33.94	35.36
Slovenia	73.34	82.14	76.22

Source: Structural Business Statistics, Eurostat; Orbis database by Bureau van Dijk. Calculations by the author.

Note: The Structural Business Statistics data used is on the small, medium-sized and large firms. The values denote the average country coverage computed over the country coverages for the three parameters (number of enterprises, turnover, number of employees) for each year over the period 2015–2019. '%' denotes 'percentage'. 'turnover' stands for 'turnover or gross premiums written in million euro'. Information on the preparation of the basic data sample is presented in Appendix B.1.

3. Descriptive analysis

The descriptive analysis of firm profitability is done for the manufacturing sector as a whole and also for different subgroups of firms, in particular subgroups according to whether the firm is nationally-owned or not (national and multinational firms), according to the size of the firm (small, medium-sized and large firms), as well as according to the manufacturing subsector in which the firm is operating (NACE Rev. 2 two-digit core codes from 10 to 33), since differences in firm profitability among the different subgroups of firms could exist.

In order to analyse firm profitability in the manufacturing sector of the CEE EU countries profitability measures are computed. The computed measures of firm profitability are:

- PLBT margin, defined as the ratio of the profit and loss before tax of a firm to the operating revenue of the firm;
- EBITDA margin, defined as the ratio of the earnings before interest, tax, depreciation and amortisation of a firm to the operating revenue of the firm;
- EBIT margin, defined as the ratio of the earnings before interest and tax of a firm to the operating revenue of the firm;

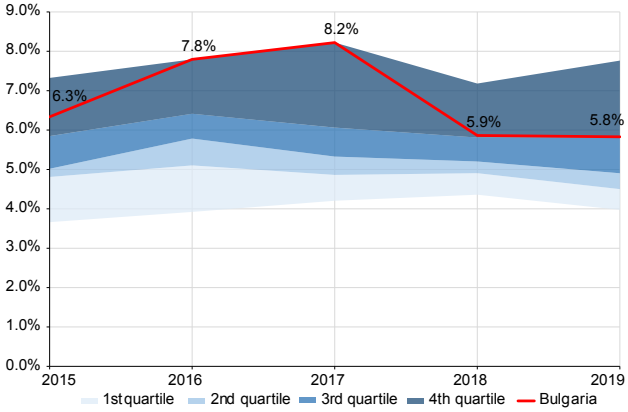
– Net Profit margin, defined as the ratio of the profit and loss after tax of a firm to the operating revenue of the firm.

The profitability measure which is shown in the present descriptive analysis is the PLBT margin.[4] The PLBT margin informs on whether or not and how well a firm can cover its costs through its revenues from its operations. Using the other three profitability measures leads to qualitatively similar results.

3.a. Firm profitability in the manufacturing sector

Figure 5 presents the PLBT margin at the aggregate level for the manufacturing sector as a whole in Bulgaria and the CEE EU countries. The shaded area in Figure 5 depicts the four quartiles of the distribution of the PLBT margin for a particular year for all CEE EU countries, including Bulgaria. As can be seen in Figure 5, the Bulgarian manufacturing sector (depicted by the red line in the figure) records a relatively high profitability compared to the peer CEE EU countries. For all five years in the period from 2015 to 2019 the PLBT margin of the Bulgarian manufacturing sector lies in the highest quartile of the profitability distribution.

Figure 5: **PLBT margin in the manufacturing sector of Bulgaria and the CEE EU countries**



Source: Orbis database by Bureau van Dijk. Calculations by the author.

Note: The line denoted 'Bulgaria' represents the PLBT margin of the manufacturing sector of Bulgaria. The shaded area depicts the four quartiles of the distribution of the PLBT margin in the manufacturing sector in a year in the CEE EU countries, including Bulgaria.

[4] For the descriptive analysis the data on the PLBT margin is computed at an aggregated level. The aggregation of the profit and loss before tax and of the operating revenue of the firms is done at different levels, such as for the manufacturing sector in a country as a whole or with respect to a specific grouping of the firms, for example according to the firms being small, medium-sized or large, and then the ratio of the two items is computed and expressed as a percentage.

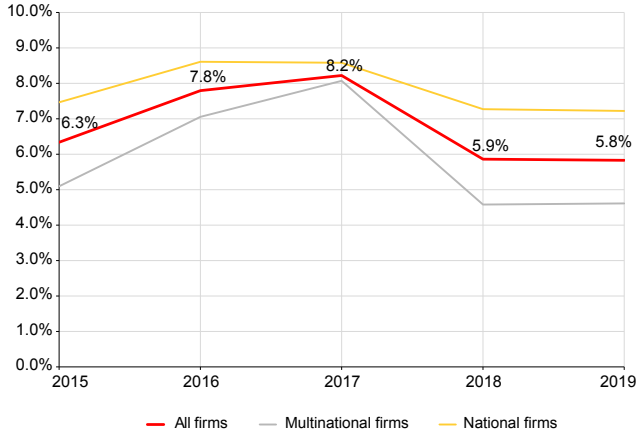
3.b. Firm ownership and profitability

In a next step, the sample is divided with respect to whether or not a firm is nationally-owned. A particular firm from the data sample can be classified as national or multinational or cannot be allocated among these two groups.[5]

The division between national and multinational firms is made as there might be differences in the financial performance between the two groups (as elaborated in the literature review in Section 4).

Figure 6 presents the PLBT margin at the aggregate level for the whole manufacturing sector of Bulgaria, as well as with respect to the distinction between national and multinational firms. It can be clearly seen that the multinational firms record a profitability which is lower than the one recorded for the national firms. In the quantitative analysis, firm ownership is controlled for by including a dummy variable on whether or not a firm is nationally-owned. One could expect the estimate for this dummy variable to be statistically significant which would be indicative for differences between the two groups of firms being present.

Figure 6: **PLBT margin in the manufacturing sector of Bulgaria with respect to firm ownership**



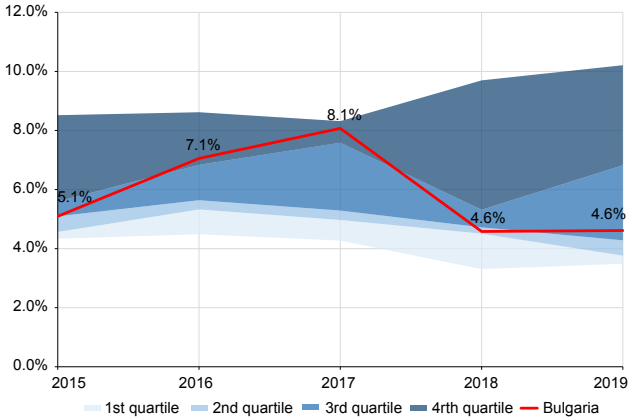
Source: Orbis database by Bureau van Dijk. Calculations by the author.

Note: The line denoted 'All firms' represents the PLBT margin of the manufacturing sector of Bulgaria as a whole and includes the firms which are classified as multinational and as national and the ones which cannot be allocated among these two groups of firms. Regarding the classification of a firm as national or multinational, see Appendix B.3.

[5] For information on the classification of a firm as being national or multinational, see Appendix B.3.

The next figure, Figure 7, depicts the profitability of the multinational firms in all eleven CEE EU countries. With the exception of the year 2018, the firms which are part of a multinational group in Bulgaria record a profitability which is either equal to the median of the distribution of the CEE EU countries or above the median. The national firms in Bulgaria, however, show a much higher profitability compared to the national firms in the other CEE EU countries, which can be seen in Figure 8. For the years from 2016 to 2019 the Bulgarian national firms form the maximum level of firm profitability for the group of the national firms among the CEE EU countries.

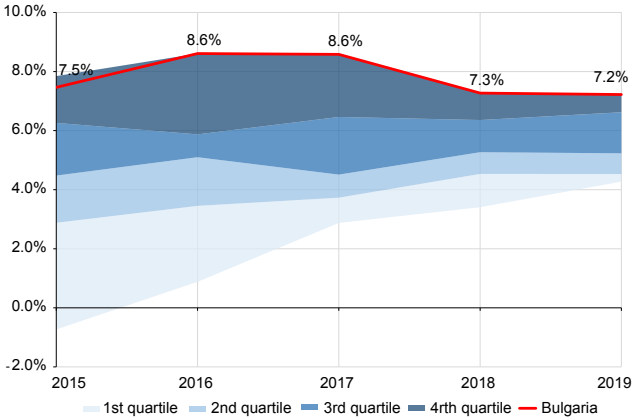
Figure 7: **PLBT margin of the multinational firms in the manufacturing sector of the CEE EU countries**



Source: Orbis database by Bureau van Dijk. Calculations by the author.

Note: The line denoted 'Bulgaria' represents the PLBT margin of the multinational firms in the manufacturing sector of Bulgaria. The shaded area depicts the four quartiles of the distribution of the PLBT margin of the multinational firms in the manufacturing sector in a year in the CEE EU countries, including Bulgaria. Regarding the classification of a firm as national or multinational, see Appendix B.3.

Figure 8: **PLBT margin of the national firms in the manufacturing sector of the CEE EU countries**



Source: Orbis database by Bureau van Dijk. Calculations by the author.

Note: The line denoted 'Bulgaria' represents the PLBT margin of the national firms in the manufacturing sector of Bulgaria. The shaded area depicts the four quartiles of the distribution of the PLBT margin of the national firms in the manufacturing sector in a year in the CEE EU countries, including Bulgaria. Regarding the classification of a firm as national or multinational, see Appendix B.3.

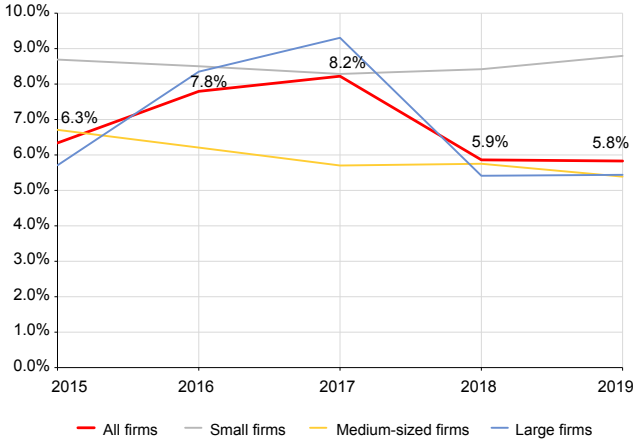
3.c. Firm size and profitability

This part of the paper looks at potential firm profitability variations across different firm sizes. The firm-size classification used is the one implemented by Eurostat for presenting the Structural Business Statistics with respect to the number of firm's employees.[6]

The descriptive analysis continues with the presentation of the PLBT margin of the manufacturing sector as a whole, as well as of the groups of small, medium-sized and large firms in the manufacturing sector of Bulgaria in Figure 9. It can be seen that the small firms have a consistently higher profitability than the medium-sized firms for the whole period of analysis. There is not much volatility in the recorded profitability of these two groups of firms, although with time the difference between the profitability of the small and of the medium-sized firms gradually increases. The large firms record comparatively much more volatility in their profitability over the years in the present sample. There does not seem to exist a clear tendency concerning the profitability of the large firms when compared to the profitability of the other two firm-size groups.

[6] Information on the definition of the different firm-size classes by Eurostat according to the number of employees is presented in the note under Figure 9.

Figure 9: **PLBT margin in the manufacturing sector of Bulgaria with respect to firm size**



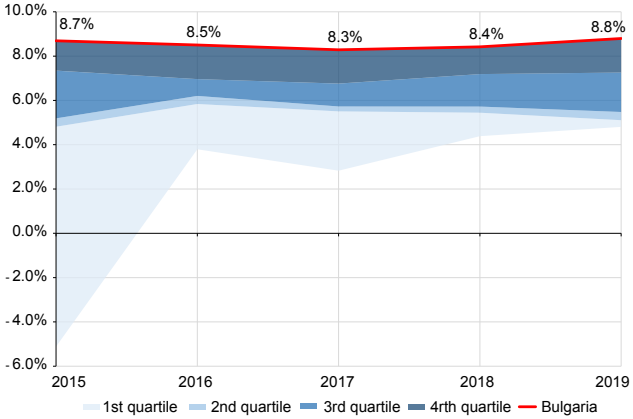
Source: Orbis database by Bureau van Dijk. Calculations by the author.

Note: The line denoted 'All firms' represents the PLBT margin of the manufacturing sector of Bulgaria as a whole and includes the firms which are classified as small, as medium-sized and as large and the ones which cannot be allocated among these three groups of firms. Small firms are firms with at least 10 and less than or equal to 49 persons employed. Medium-sized firms are firms with at least 50 and less than or equal to 249 persons employed. Large firms are firms with 250 or more persons employed.

Figure 10 presents the firm profitability of the small firms in the manufacturing sector of the CEE EU countries. It can be seen that the small firms in Bulgaria form the maximum of the distribution of firm profitability among the small firms in the eleven CEE EU countries in all the years under consideration. This finding is similar to the one for the national firms in Bulgaria, which for the period 2016–2019 also form the maximum level of firm profitability in their respective group among the CEE EU countries, as shown in Figure 8.

The next figure, Figure 11, depicts the firm profitability of the medium-sized firms in the CEE EU countries. The recorded profitability of the medium-sized firms in Bulgaria during the studied period is relatively close to the upper bound of the third quartile of the profitability distribution of these firms among the CEE EU countries. The large firms in Bulgaria record a profitability which is higher than the median of the profitability distribution of large firms among the CEE EU countries, as shown in Figure 12. Although the medium-sized firms and the large firms in the Bulgarian manufacturing sector do not perform as well as the small firms compared to their respective peers in the other ten CEE EU countries, their profitability is nevertheless relatively high. This provides additional evidence that during the studied period the Bulgarian manufacturing sector performs comparatively well in terms of profitability.

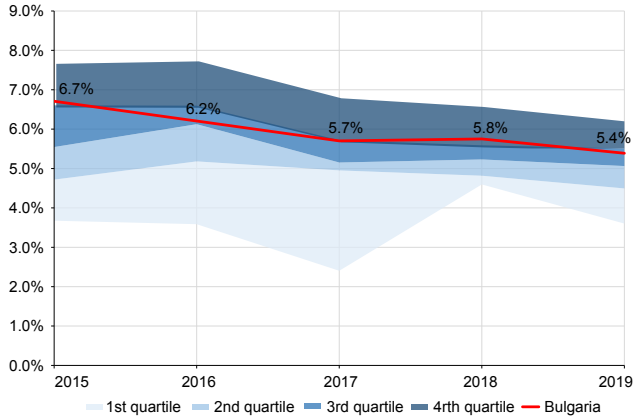
Figure 10: **PLBT margin of the small firms in the manufacturing sector of the CEE EU countries**



Source: Orbis database by Bureau van Dijk. Calculations by the author.

Note: The line denoted 'Bulgaria' represents the PLBT margin of the small firms in the manufacturing sector of Bulgaria. The shaded area depicts the four quartiles of the distribution of the PLBT margin of the small firms in the manufacturing sector in a year in the CEE EU countries, including Bulgaria. Small firms are firms with at least 10 and less than or equal to 49 persons employed.

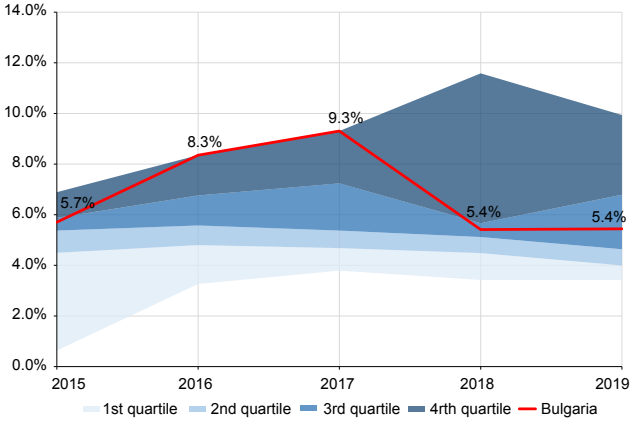
Figure 11: **PLBT margin of the medium-sized firms in the manufacturing sector of the CEE EU countries**



Source: Orbis database by Bureau van Dijk. Calculations by the author.

Note: The line denoted 'Bulgaria' represents the PLBT margin of the medium-sized firms in the manufacturing sector of Bulgaria. The shaded area depicts the four quartiles of the distribution of the PLBT margin of the medium-sized firms in the manufacturing sector in a year in the CEE EU countries, including Bulgaria. Medium-sized firms are firms with at least 50 and less than or equal to 249 persons employed.

Figure 12: **PLBT margin of the large firms in the manufacturing sector of the CEE EU countries**



Source: Orbis database by Bureau van Dijk. Calculations by the author.

Note: The line denoted 'Bulgaria' represents the PLBT margin of the large firms in the manufacturing sector of Bulgaria. The shaded area depicts the four quartiles of the distribution of the PLBT margin of the large firms in the manufacturing sector in a year in the CEE EU countries, including Bulgaria. Large firms are firms with 250 or more persons employed.

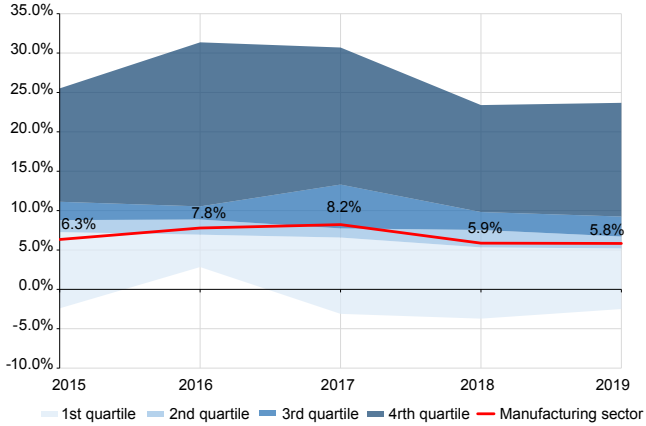
3.d. Profitability across the different subsectors in manufacturing

Next, Figure 13 shows the PLBT margin of the Bulgarian manufacturing sector as a whole (depicted by the red line) and the profitability distribution of all of the manufacturing subsectors of Bulgaria (depicted by the shaded area), where the subsectors are given by the NACE Rev. 2 two-digit core codes from 10 to 33.[7]

From Figure 13 it can be seen that there is significant heterogeneity present with respect to the profitability of the different manufacturing subsectors. Although there are some subsectors in manufacturing which record profitability much higher than the manufacturing sector as a whole does or some subsectors even do not record profits in some years, these observations could be regarded rather as outliers. The reason is that the area between the first and the fourth quartiles, which represents the middle 50% of the distribution, is relatively narrow compared to the whole area found between the minimum and the maximum values of the distribution of the PLBT margin for all the manufacturing subsectors in a year in Bulgaria.

[7] Due to the vast number of the manufacturing subsectors, they are not presented separately in the present paper. As a further reading, see Ivanov and Ivanova (2021) where the authors compute and show the profitability for different groupings of manufacturing subsectors in Bulgaria in a study on the role of price and non-price competitiveness for Bulgarian exports.

Figure 13: **PLBT margin in the manufacturing sector and in the manufacturing subsectors of Bulgaria**



Source: Orbis database by Bureau van Dijk. Calculations by the author.

Note: The line denoted 'Manufacturing sector' represents the PLBT margin for the manufacturing sector of Bulgaria as a whole. The shaded area depicts the four quartiles of the distribution of the PLBT margin for all the manufacturing subsectors (that is for all the NACE Rev. 2 two-digit core codes from 10 to 33) in a year in Bulgaria.

The potentially different degree of competition in the different manufacturing subsectors could provide an explanation for the observed heterogeneity. For this reason, the empirical analysis in Section 5 furthermore includes the degree of market concentration, as measured by the Herfindahl-Hirschman Index, as an explanatory variable. In addition, it seems that the maximum and the minimum values of the profitability distribution in Figure 13 tend to move in the same direction between the different years in the period under study. This could be due to some common macroeconomic factors, which have an effect on the PLBT margin of the manufacturing subsectors. This is why, in order to control for such common factors in the estimations made in the quantitative-analysis part of the present paper, year dummies are also included.

4. Literature review

Analyses of firm profitability have generally been made in the context of a single country (*e.g.* Becker-Blease *et al.*, 2010, in the context of the USA; Stierwald, 2010 – of Australia; Škuflić, Mlinarić and Družić, 2016 – of Croatia; Blažková and Dvouletý, 2018 – of Czechia; Odusanya, Yinusa and Ilo, 2018 – of Nigeria; Laporšek *et al.*, 2021 – of Slovenia) rather than on a group of countries as done in the present paper. Still, the analyses in Maurin, Roma and Vetlov (2011) as well as in Tonev (2018), in Bonanno, Ferrando and Rossi (2020) and in Yadav,

Pahi and Gangakhedkar (2022) are done in the context of more than one country, but their country coverages differ from the one in the present paper.

An important aspect of the present analyses lies on comparing the firm profitability in the manufacturing sector of Bulgaria to the respective firm profitability in the other ten CEE EU countries. For this purpose, the estimations made as part of the quantitative analyses in Section 5 include the GDP per capita and the statutory corporate income tax rate as explanatory variables of firm profitability. They constitute two country-specific factors which are relevant for Bulgaria, as during the period under study (2015–2019) Bulgaria has both the lowest GDP per capita in PPS (gross domestic product per capita in Purchasing Power Standards) and a relatively low statutory corporate income tax rate compared to the other CEE EU countries. In addition, firm-specific and industry-specific factors are furthermore included in the quantitative analyses as potential determinants of firm profitability. Their choice is motivated by the descriptive part of the present paper, where the available data sample allowed for making different divisions of the data according to firm ownership, firm size and the manufacturing subsector. Thus, the quantitative analyses also control for a firm being national or multinational, for firm size and for market concentration in the respective manufacturing subsectors. In what follows, a literature review of the effects of these factors on firm profitability is presented.

In this respect, according to Solow (1956), countries which are further away from their steady state will grow faster than countries which are closer to it. One could thus expect countries which are in the process of economic convergence to have higher growth and more profitability opportunities than more developed countries, *e.g.* countries with higher per capita incomes. The impact of a country's per capita income on firm profitability has been touched upon in the analysis done in Tonev (2018). In a study on profit shifting via the use of transfer pricing, Tonev (2018, Chapter 5) generally finds a negative relationship between firm profitability and the GDP per capita, with the underlying firm profitability being the reported profitability of multinational firms, in a sample from the Orbis database for the period 2004–2014. The main focus of Tonev (2018, Chapter 5), however, lies on the estimated effect which the corporate income tax rate has on reported firm profitability. The inclusion of the GDP per capita as an explanatory variable in the analyses is done as a means of controlling for aspects of the macroeconomic environment in the particular jurisdictions where the multinational firms' affiliates are operating in.

The effect of the corporate income tax rate on firm profitability has been studied in the economic literature in the context of the potential global tax minimising activities of multinational firms (multinational enterprises, MNEs for short). MNEs might use transfer pricing to shift profits out of relatively

high-tax jurisdictions into relatively low-tax jurisdictions. This could be done by setting higher prices for intra-firm imports coming from affiliated firms located in low-tax jurisdictions and lower prices for intra-firm exports going to affiliated firms located in low-tax jurisdictions (*e.g.* Clausing, 2003; Tonev, 2018, Chapter 5). Furthermore, MNEs' affiliates in relatively low-tax jurisdictions might have an incentive to lend funds internally to affiliated firms in high-tax jurisdictions as the interest payments might be tax deductible in the high-tax jurisdictions whereas the interest income might be taxed less in the low-tax jurisdictions (*e.g.* Egger *et al.*, 2014). In addition, MNEs might have incentives to register intellectual property, such as patents and trademarks, at affiliates located in relatively low-tax jurisdictions. The associated payments made for the right of use of the intellectual property by other affiliated firms, potentially registered in high-tax jurisdictions, would then accrue to the affiliate in the low-tax jurisdiction (*e.g.* Karkinsky and Riedel, 2012; Tonev, 2018, Chapter 5). However, not only multinational firms might have incentives to minimise their corporate tax payments. In the theoretical model in Sanyal, Gang and Goswami (2000), the authors show that in some circumstances an increase in the tax rate in a jurisdiction might result in less net tax revenue for the government as taxpayers and tax administrators might collude. Thus, due to cost minimisation at the firm level, where corporate taxes are perceived as costs by the firms, and the potential profit-shifting effect being at play in the case of the MNEs one would expect the corporate income tax rate to have a negative effect on reported firm profitability.

Regarding the MNEs, Dunning (1988) argues that the multinational firms might possess competitive advantages allowing them to compete with the national firms in the national firms' home jurisdictions. For instance, such a competitive advantage of the multinational firms could stem from the ownership of intangible assets such as patents. One would expect this competitive advantage to be reflected in the recorded profitability of the multinational firms when compared to the recorded profitability of the national firms. However, at the same time the multinational firms might have more opportunities compared to the national firms to minimise their corporate taxes due, *e.g.* by engaging in profit shifting (as described above), which would have the opposite effect on their recorded profitability. Thus, from a theoretical point of view it is *a priori* not clear which of the two potential effects for the profitability of the multinational firms would prevail – the competitive-advantage effect or the profit-shifting effect. In this regard, the empirical analysis includes a dummy variable which controls for a firm being national or multinational.

The present analysis also controls for firm size. Becker-Blease *et al.* (2010) note that the empirical evidence on the relationship between firm size and

firm profitability is mixed as there might be a trade-off between economies of scale and organisational cost. On the one hand, due to the potential existence of increasing economies of scale firms might become more cost efficient with size and thus more profitable. On the other hand, organisational theories posit that diseconomies of scale can emerge with firm size. In this respect, the organisational costs, in the form of transaction costs and agency costs, of the firms might increase with firm size and these costs would act in decreasing the firms' profitability. Increasing organisational costs could be the result of a larger number of administrative layers in the firm with bigger firm size and these administrative layers could be approximated by the firm's number of employees. In addition, Amato and Wilder (1985) note that due to the separation of ownership from management with firm size, a negative relationship between firm size and profitability might result from profitability maximisation at the firm being replaced by managerial utility maximisation.

Market concentration, measured by the Herfindahl-Hirschman Index, is furthermore controlled for in the present empirical analysis and one would expect a positive relationship between market concentration and firm profitability. The literature elaborates on different reasons for such a positive relationship. For instance, oligopoly theory provides the market-power hypothesis which states that with higher market concentration it might be easier for the firms to collude which would allow them to charge relatively higher prices and thus to have higher profits. However, not only higher prices charged by the firms can explain the existence of higher price-cost margins in more concentrated markets. The efficiency hypothesis provides an additional explanation and states that some firms might have efficiency advantages *vis-à-vis* the other firms allowing them to be more profitable due to them having relatively lower costs. Allen (1983) and Clarke, Davies and Waterson (1984) suggest that although in general both market-power and firm-efficiency effects can explain a positive concentration-profitability relationship, it is rather the market-power argument that is relevant for the existence of a positive relationship between market concentration and firm profitability.

5. Empirical analysis

5.a. Empirical method

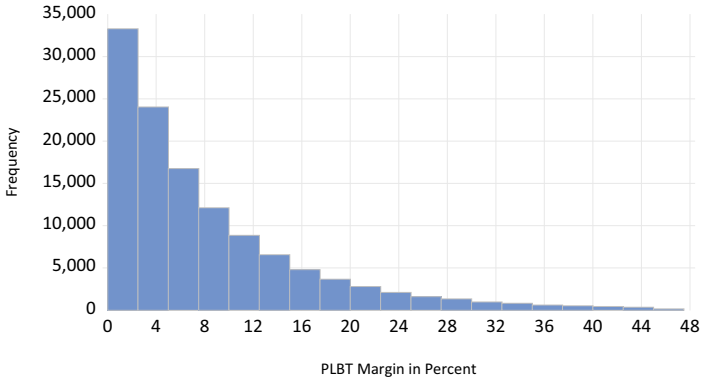
The empirical part of the present paper estimates the effects of country-specific, industry-specific and firm-specific factors on recorded firm profitability. The firm profitability measure used is the same as in the descriptive part, namely the PLBT margin, as the analysis in the empirical part is meant as a kind of a continuation of the analysis of the descriptive part in the present paper.

However, now the analysis is performed at the firm level and thus the PLBT margin is computed at the firm level.

In the present quantitative analysis only firm observations which have a value of the PLBT margin below the 99th percentile of the PLBT margin distribution and above zero are considered. This is done in order to take care of outliers with respect to exceptionally high values of the PLBT margin and also to study only firms which record profits before tax in a certain year. Including loss-making firms would mix fundamentally different economic situations, such as restructuring, start-up phases or temporary distress, and would complicate the interpretation of the estimated coefficients. The results should therefore be interpreted as conditional on firms being profitable in a given year.

Figure 14 depicts a histogram of the firm-year observations of the PLBT margin, which are part of the quantitative analysis. The histogram shows that there is a considerable number of observations of firms having a positive PLBT margin which is close to zero and a lower number of observations of firms having relatively high declared profitability.

Figure 14: **Histogram of the PLBT margin in percent at the firm level in the manufacturing sector of the CEE EU countries from the sample used in the quantile regression analyses**



Source: Orbis database by Bureau van Dijk. Calculations by the author.

Note: The PLBT margin in percent at the firm level in the manufacturing sector of the CEE EU countries is the dependent variable in the quantile regression analyses, in which only firms which have a value of the PLBT margin below the 99th percentile of the PLBT margin distribution and above 0 are included and also shown in the figure.

The empirical method used for the estimation of the effects of the different factors on firm profitability is the quantile regression. The quantile regression is an estimator which minimises the asymmetrically weighted absolute residuals as presented in

Koenker and Bassett (1978) and in Koenker and Hallock (2001). The estimation of the quantile regression is done due to its relative robustness to the dependent variable not being normally distributed, to the presence of heteroscedasticity in the data and to outliers (Cameron and Trivedi, 2010, Chapter 7). The distribution of the dependent variable, shown in Figure 14, suggests that the choice of the quantile regression is appropriate for the current empirical analysis.

A general functional form of a quantile regression is given by: $Q_q(y_i|\mathbf{x}_i) = \mathbf{x}_i'\boldsymbol{\beta}_q$, where y_i denotes the dependent variable which in the present analysis is firm i's PLBT margin in a particular year, the subscript q denotes a particular quantile and the explanatory variables are collected in the vector $\mathbf{x}_i$. The parameter estimates $\boldsymbol{\beta}_q$ can be different among the different quantiles q of the conditional distribution of the dependent variable.

5.b. Descriptive statistics

Table 3 presents descriptive statistics for the variables included in the estimated quantile regressions. The dependent variable, plbt_margin_pr, which is the PLBT margin at the firm level in the CEE EU countries expressed as a percentage, has a mean value of 8.2 which is much closer to its minimum value than to its maximum value, implying a data distribution as shown in Figure 14.

Table 3: **Descriptive statistics**

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
plbt_margin_pr	121,655	8.2103	8.2952	0.0002	46.4516
gdp_per_cap_pps	121,655	68.3658	11.4632	48	93
citr_pr	121,655	15.8924	3.8142	9	22
dummy_nat	121,655	0.7684	0.4218	0	1
log_empl_aprx	121,655	3.6948	1.1870	0	8.9401
sum_sqsh_opre	121,655	0.0272	0.0423	0.0024	1
dummy_bg	121,655	0.1495	0.3566	0	1

Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note: Only observations of firms which have a value of the PLBT margin below the 99th percentile of the PLBT margin distribution and above 0 are included in the quantile regression analyses and are presented in the table of descriptive statistics. 'plbt_margin_pr' denotes the PLBT margin at the firm level expressed as a percentage; 'gdp_per_cap_pps' denotes the GDP per capita in PPS as provided by Eurostat (downloaded from the website of Eurostat on 19/08/2022); 'citr_pr' denotes the general statutory corporate income tax rate expressed as a percentage and the data for the eleven CEE EU countries are taken from the EY Worldwide Corporate Tax Guides; 'dummy_nat' is a dummy variable which is equal to 1 if a firm is classified as national and is equal to 0 if it is classified as multinational, regarding the classification of a firm as national or multinational, see Appendix B.3; 'log_empl_aprx' denotes the natural logarithm of the number of employees of a firm in a particular year and is approximated for some firm-year observations with missing values by implementing the procedure described in Appendix B.2; 'sum_sqsh_opre' denotes the sum of the squared shares of operating revenues of firms from a NACE Rev. 2 two-digit manufacturing subsector in a year and a country which can take on values between 0 and 1, where a larger value implies higher market concentration, and represents the Herfindahl-Hirschman Index of market concentration; 'dummy_bg' is a dummy variable which is equal to 1 if a firm is located in Bulgaria and is equal to 0 if it is located in one of the other ten CEE EU countries.

A country-specific variable, which is included in the present empirical analysis, is the GDP per capita in PPS, gdp_per_cap_pps. Table 3 shows that during the studied period all of the CEE EU countries have a GDP per capita in PPS which lies below the average for the EU as a whole, which is normalised to 100 in each year (with the EU assumed to consist of the 27 member countries as of 2020 during the period 2015–2019). There is furthermore considerable heterogeneity among the CEE EU countries with respect to this variable. In the present paper, the GDP per capita in PPS is used in order to provide for better comparisons between countries as expressing the GDP per capita in common artificial currency units, such as the PPS, takes care of differences in the price levels between countries.

Another country-specific explanatory variable is the general statutory corporate income tax rate in force in a year in a particular country, expressed as a percentage and denoted as citr_pr. The span between the minimum and maximum corporate income tax rates is relatively large indicating heterogeneity being present among the CEE EU countries also with respect to this variable.

The distinction made in the descriptive part of the present paper depending on whether or not a firm is nationally-owned is also controlled for in the empirical part by the inclusion of a dummy variable. The dummy variable, dummy_nat, is equal to 1 if a firm is classified as national and is equal to 0 if it is classified as multinational, with the firm classification in this respect elaborated in Appendix B.3. The mean value of dummy_nat is equal to 0.7684 implying that around 77% of the data sample used in the quantile regressions is made of national firms with the rest being multinational.

A variable controlling for firm size is also included in the empirical analysis. The variable log_empl_aprx is the natural logarithm of the number of employees of a firm. This number is approximated for some of the firm-year observations with missing data on the number of employees and the implemented procedure is described in Appendix B.2. The descriptive statistics indicate that there is heterogeneity in the data sample with respect to this variable.

An explanatory variable which is specific to the particular manufacturing subsector is further included in the present estimations. The variable sum_sqsh_opre is the Herfindahl-Hirschman Index (HHI), which is a measure of market concentration. It is computed as the sum of the squared shares of the firms' operating revenues in the total sum of the operating revenues in a particular NACE Rev. 2 two-digit manufacturing subsector in a particular country and in a particular year. The HHI can take on values between 0 and 1, where a larger value implies higher market concentration. The mean value of the market concentration measure is very close to 0 indicating that on average the market concentration is rather low in the manufacturing subsectors in the present data sample.

As the focus of the present analyses lies particularly on Bulgaria, a dummy variable, dummy_bg, is included in the empirical part as well. It is equal to 1 if a firm is located in Bulgaria and is equal to 0 if it is located in one of the other ten CEE EU countries.[8] The mean value of 0.1495 of the variable dummy_bg implies that around 15% of the data sample used in the quantile regressions is made of firms located in Bulgaria with the rest being located in the other ten CEE EU countries.

5.c. Estimation results

5.c.1. Main estimation

The results of the main estimation, denoted as Estimation 1, are presented in Table 4. The estimation is done for five different quantiles of the conditional distribution of the dependent variable for the same set of explanatory variables. These quantiles are the 0.10, 0.30, 0.50, 0.70 and 0.90 quantile and the corresponding results are presented in the columns of Table 4, which are denoted as q0.10, q0.30, q0.50, q0.70 and q0.90, respectively.

Table 4: **Results from Estimation 1**

Estimation 1	Quantiles				
Variables	q0.10	q0.30	q0.50	q0.70	q0.90
gdp_per_cap_pps	-0.0019** (0.0008)	-0.0076*** (0.0017)	-0.0226*** (0.0026)	-0.0576*** (0.0036)	-0.1306*** (0.0083)
citr_pr	-0.0171*** (0.0027)	-0.0314*** (0.0051)	-0.0553*** (0.0086)	-0.0998*** (0.0118)	-0.2114*** (0.0267)
dummy_nat	0.2187*** (0.0826)	-0.2212* (0.1342)	-0.3737* (0.2101)	0.0648 (0.2964)	2.6214*** (0.5908)
log_empl_aprx	0.0357** (0.0170)	-0.0451* (0.0265)	-0.3274*** (0.0387)	-0.9023*** (0.0531)	-1.8872*** (0.1047)
dummy_nat × log_empl_aprx	-0.0981*** (0.0186)	-0.0885*** (0.0298)	-0.0869* (0.0444)	-0.2148*** (0.0628)	-0.6996*** (0.1285)
sum_sqsh_opre	-0.0802 (0.1758)	0.7419** (0.3686)	2.1431*** (0.6844)	3.2690*** (0.7913)	6.5364*** (1.7015)
Constant	1.2525*** (0.0932)	4.4631*** (0.1603)	9.7671*** (0.2436)	19.4489*** (0.3551)	38.7250*** (0.6809)
Observations	121,655	121,655	121,655	121,655	121,655

Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note: The PLBT margin at the firm level in the CEE EU countries expressed as a percentage is the dependent variable. × denotes an interaction term between the stated variables. ***, **, * indicate statistical significance at the 1%, 5% and 10% level of statistical significance, respectively. Bootstrapped standard errors computed by 400 repetitions in parentheses. Year dummies are included, but their estimates are not shown. q0.10, q0.30, q0.50, q0.70, q0.90 denote the 0.10, 0.30, 0.50, 0.70, 0.90 quantile, respectively.

[8] The information on the firm location is taken from the first two letters of Bureau van Dijk's firm identifier (BvD ID number), which describe the particular jurisdiction's two-letter ISO-code.

The first country-specific variable included in the estimation, the GDP per capita in PPS, has a negative sign and is highly statistically significant in all five columns of Table 4. The estimates are furthermore increasing in absolute value with a higher conditional quantile of the dependent variable, which is the PLBT margin at the firm level in the CEE EU countries. This suggests that the negative effect found for countries with higher per capita income on the declared firm profitability in these countries is stronger for firms with higher profitability. A similar finding is presented in Tonev (2018, Chapter 5), where the author controls for the macroeconomic environment by including the GDP per capita as an explanatory variable in a study of the effects of transfer pricing with heterogeneous firms on multinational firms' recorded profitability.

The corporate income tax rate is found to have a negative and statistically significant effect on firm profitability as well and this result is also in line with the analyses in Tonev (2018). In addition, as was the case with the effect of the GDP per capita in PPS, the negative effect estimated for the corporate income tax rate is also stronger for higher quantiles. Firms with higher PLBT margins, which are the more profitable firms, react more strongly to the corporate income tax rate as shown in Table 4 by the larger magnitude in absolute value of the estimated negative coefficients for the citr_pr variable for the higher quantiles. This finding is in line with the theoretical model presented in Haufler and Stähler (2013) of tax competition between two jurisdictions for internationally mobile heterogeneous firms, where with a rise in profitability firms are shown to become more tax sensitive.

The estimates for the dummy variable dummy_nat suggest that there is a U-shaped relationship across the different quantiles for a firm being national and its reported profitability. The results imply that national firms in the lower quantile of the firm profitability distribution, in the 0.10 quantile (denoted by q0.10), are more profitable than their multinational counterparts in the same quantile. For the 0.30 quantile (q0.30) and for the median, the 0.50 quantile (q0.50), however, the multinational firms are found to be more profitable than the national ones indicated by the negative sign of the estimates for dummy_nat, which are furthermore statistically significant. For these multinational firms it could be the case that the competitive advantage which they might possess outweighs the effects of any potential profit shifting they might do. Going further to higher quantiles, there is no statistically significant difference in the reported profitability between the national and the multinational firms in the 0.70 quantile (q0.70). For the firms with some of the highest declared profitability, which are in the 0.90 quantile (q0.90), the estimated coefficient for the dummy variable has a positive sign, is highly statistically significant and is furthermore of a much larger magnitude than the estimate for the 0.10 quantile and also of a much larger magnitude than the absolute value of the estimates for the 0.30 and the 0.50 quantiles. This result would thus imply that the more profitable multinational firms might have not only the incentives but also the means to declare lower profitability compared to the respective national firms.

The estimated coefficients for the variable log_empl_aprx, which is computed as the natural logarithm of the number of employees at the firm, represent the estimates for the effect of firm size on recorded firm profitability for the different quantiles. The estimates for log_empl_aprx are all statistically significant. For firms with relatively low recorded profitability, in the 0.10 quantile, the estimated relationship is positive. However, for higher quantiles of the PLBT margin the estimated relationship becomes negative and is furthermore highly statistically significant, which could be an indication of potential inefficiencies being present regarding bigger firm size and that such inefficiencies might be outweighing any potential positive economies-of-scale effects. A similar finding of a negative relationship between firm size and profitability is described in Samuels and Smyth (1968) and in Whittington (1980), each of the two papers performing its analysis based on data for UK firms. In a more recent study, Yadav, Pahi and Gangakhedkar (2022) also find a negative size-profitability relationship in their full sample of firm data from twelve Asia-Pacific economies.

The next explanatory variable is an interaction term between the dummy variable for a firm being national or multinational, dummy_nat, and the variable, which is used as a proxy for firm size, log_empl_aprx. The estimated coefficient is negative and statistically significant for the five quantiles estimated and presented in Table 4. For the 0.10, 0.30 and 0.50 quantiles the estimated coefficients are relatively close in magnitude but then they increase in absolute value for the 0.70 quantile and further for the 0.90 quantile. The estimated coefficients for the interaction term suggest that larger national firms have a lower declared profitability than smaller national firms and that this relationship is particularly pronounced for the higher quantiles of the profitability distribution. This could suggest that smaller national firms are potentially more efficient in their operations and consequently more profitable than bigger national firms, for instance due to a more flexible internal organisational structure.

The last explanatory variable in Estimation 1, sum_sqsh_opre, is the measure of market concentration, given by the HHI. With the exception of the estimate for the 0.10 quantile, which is furthermore not statistically significant, the estimates for the other quantiles presented in Table 4 are positive in value, highly statistically significant and increase strongly with higher quantiles. This implies that with higher market concentration reported firm profits increase and the effect is stronger for more profitable firms. As pointed out in the literature review in Section 4, one possible explanation for this finding could be that firms active in manufacturing subsectors with a lower degree of competition might be able to exercise higher market power, which would be reflected in higher recorded profitability. Škuflić, Mlinarić and Družić (2016) and Blažková and Dvouletý (2018) also find a positive relationship between market concentration and firm profitability in the manufacturing sector in Croatia and in the food processing industry in Czechia, respectively. It should be noted that market

concentration may be endogenous to firm profitability, as more profitable firms may themselves contribute to higher concentration over time. The estimated relationship should therefore not be interpreted as strict causal evidence.

Figures A.1 to A.6 in the Appendix show a graphical representation of the results from Estimation 1. In addition to the estimates for the 0.10, 0.30, 0.50, 0.70 and 0.90 quantiles, which are presented in Table 4, Figures A.1 to A.6 further show the estimates for each of the explanatory variables for the 0.20, 0.40, 0.60 and 0.80 quantiles as the graphical format allows for a more compact presentation of the estimation results compared to the table format. The 90% confidence interval for the estimated results is also shown and it is depicted by the area between the two orange lines in each graph. Figures A.1 to A.6 are consistent with the estimated results presented in Table 4. The figures furthermore provide graphical support for the estimation of a quantile regression due to the existence of visual differences in the estimated results and in the confidence intervals among different quantiles for the same explanatory variable.

Next, in a more formal approach two sets of Wald tests for parameter equivalence between different quantiles for the estimated results for each explanatory variable in Table 4 are estimated. Rejection by the Wald test for equivalence of the estimated parameters between any two different quantiles of the conditional distribution of the dependent variable could be an indication of heteroscedasticity being present in the data (Cameron and Trivedi, 2010, Chapter 7) and would thus imply that the estimation of a quantile regression is appropriate. The quantile regression would capture the potential differences in the magnitude of the estimated effects for the explanatory variables among the different quantiles of the conditional distribution of the dependent variable. In the first set of Wald tests, the potential equivalence between the parameter estimates for the 0.25 and the 0.50 quantiles (denoted as q0.25 and q0.50, respectively) is tested for and in the second set of Wald tests, the potential equivalence between the parameter estimates for the 0.50 and the 0.75 quantiles (q0.50 and q0.75) is tested for. The p-values of the Wald tests for parameter equivalence for the results of Estimation 1 are presented in Table 5. In all cases, with the exception of the case of the parameter equivalence between q0.25 and q0.50 for the interaction term between the variables dummy_nat and log_empl_aprx, the null hypothesis of the Wald tests for parameter equivalence can be rejected at conventional levels of statistical significance. These results imply that the estimated parameters are indeed different from each other across different quantiles and furthermore provide support for the estimation of the quantile regression.

Table 5: **Results of Wald tests for parameter equivalence between different quantiles for the results of Estimation 1**

Estimation 1	p-values of Wald tests for parameter equivalence:		
	Test:	q0.25=q0.50	q0.50=q0.75
Variables	gdp_per_cap_pps	0.0000	0.0000
	citr_pr	0.0003	0.0000
	dummy_nat	0.0573	0.0016
	log_empl_aprx	0.0000	0.0000
	dummy_nat×log_empl_aprx	0.5965	0.0001
	sum_sqsh_opre	0.0035	0.0564

Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note: p-values below 0.1000 (10% level of statistical significance) imply rejection of the null hypothesis of the respective Wald test for parameter equivalence between the different quantiles at conventional levels of statistical significance. q0.25, q0.50, q0.75 denote the 0.25, 0.50, 0.75 quantile, respectively. × denotes an interaction term between the stated variables.

5.c.2. Extended estimation

In a next step, further explanatory variables are added to Estimation 1, which is the main quantile regression estimated in the present paper. In this respect, a dummy variable, denoted as dummy_bg, is included. This dummy variable indicates whether or not an observation comes from a firm located in Bulgaria, as in the descriptive part of the present paper the firm profitability in the manufacturing sector of Bulgaria is compared to the other ten CEE EU countries. In addition, separate interaction terms between dummy_bg and the dummy variable for a firm being national or multinational, the firm size variable and the market concentration variable are included as explanatory variables. The new extended estimation is denoted as Estimation 2 and its results are presented in Table 6.

Table 6: **Results from Estimation 2**

Estimation 2	Quantiles				
Variables	q0.10	q0.30	q0.50	q0.70	q0.90
gdp_per_cap_pps	-0.0004 (0.0009)	-0.0028 (0.0019)	-0.0167*** (0.0027)	-0.0473*** (0.0040)	-0.1065*** (0.0085)
citr_pr	-0.0135*** (0.0030)	-0.0192*** (0.0053)	-0.0423*** (0.0091)	-0.0697*** (0.0136)	-0.1275*** (0.0268)
dummy_nat	0.1971** (0.0817)	-0.2697* (0.1390)	-0.4014* (0.2095)	0.0322 (0.3068)	2.5115*** (0.5560)
dummy_bg	0.1311 (0.1346)	0.4614* (0.2590)	1.0831** (0.4480)	2.9680*** (0.6195)	2.9748** (1.2570)
log_empl_aprx	0.0433** (0.0175)	-0.0436 (0.0274)	-0.3155*** (0.0388)	-0.8736*** (0.0536)	-1.8938*** (0.0987)
dummy_nat × dummy_bg	0.2222** (0.0898)	0.1510 (0.1680)	-0.0684 (0.2852)	-0.5674 (0.3893)	0.5431 (0.7069)
dummy_nat × log_empl_aprx	-0.0970*** (0.0187)	-0.0805*** (0.0303)	-0.0825* (0.0440)	-0.2017*** (0.0645)	-0.7049*** (0.1204)
log_empl_aprx × dummy_bg	-0.0716*** (0.0215)	-0.0841* (0.0431)	-0.1531** (0.0711)	-0.3711*** (0.1051)	-0.2852 (0.2140)
sum_sqsh_opre	-0.1527 (0.1733)	0.2669 (0.3762)	1.8951*** (0.6704)	3.4442*** (0.8263)	6.6178*** (1.5513)
sum_sqsh_opre × dummy_bg	0.7535 (0.5204)	2.0555 (1.4470)	-0.1782 (2.0890)	-5.9292** (2.8041)	-6.9081 (7.1261)
Constant	1.0576*** (0.0989)	3.9098*** (0.1916)	9.0769*** (0.2950)	18.0105*** (0.4126)	35.4919*** (0.7926)
Observations	121,655	121,655	121,655	121,655	121,655

Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note: The PLBT margin at the firm level in the CEE EU countries expressed as a percentage is the dependent variable. × denotes an interaction term between the stated variables. ***, **, * indicate statistical significance at the 1%, 5% and 10% level of statistical significance, respectively. Bootstrapped standard errors computed by 400 repetitions in parentheses. Year dummies are included, but their estimates are not shown. q0.10, q0.30, q0.50, q0.70, q0.90 denote the 0.10, 0.30, 0.50, 0.70, 0.90 quantile, respectively.

Qualitatively the results for the initial set of explanatory variables contained in Estimation 1 are maintained in Estimation 2, as can be seen in Table 6, which implies relative robustness of the main findings of the present quantitative analysis. More precisely, the estimates for the GDP per capita in PPS in Estimation 2 have the same negative sign and are of a relatively similar magnitude as the corresponding ones in Estimation 1. With the exception of the estimates for q0.10 and q0.30, which are not statistically significant in Estimation 2, the estimates for all the other quantiles (for q0.50, q0.70 and q0.90) are highly statistically significant as in Estimation 1. Countries with higher GDP per capita in PPS experience lower firm profitability and this effect

is stronger for firms in higher conditional quantiles of the dependent variable. The corporate income tax rate, the firm size variable as well as the interaction term between the dummy variable for a firm being national or multinational and the firm size variable also generally maintain their estimated negative effects on reported firm profitability. The U-shaped relationship found for the dummy variable for a firm being national or multinational remains as well. The same is the case with the estimated positive and statistically significant relationship between market concentration and firm profitability, which in Estimation 2 is the case for q0.50, q0.70 and q0.90, whereas in the case of Estimation 1 the estimated relationship is positive and statistically significant also for q0.30, in addition to q0.50, q0.70 and q0.90.

As shown in Table 6, except for q0.10, the dummy_bg variable is positive and statistically significant, which could imply that there might be some kind of competitive advantage for the firms operating in Bulgaria relative to the other firms in the present sample.[9] The finding from the descriptive-analysis part of the present paper about the relatively high profitability of the small firms in the manufacturing sector of Bulgaria compared to the respective medium-sized and large firms in Bulgaria is partly captured by the estimated results for the interaction term between the firm size variable and the dummy_bg variable. The estimated negative sign for the interaction term implies that larger firms which are located in Bulgaria have a lower reported profitability than smaller firms located in Bulgaria. The estimated effect is larger in absolute value for higher quantiles, which suggests that for firms with higher profitability the effect is stronger, except for q0.90 for which the estimated effect is furthermore not statistically significant. The estimates for the interaction terms between the dummy variable for a firm being national or multinational and dummy_bg as well as between the variable, which is used as a measure of market concentration, and dummy_bg are generally not statistically significant at conventional levels of statistical significance.

[9] Rather than pointing to a single underlying mechanism, this finding may reflect unobserved heterogeneity related to institutional, accounting or sectoral characteristics that are not fully captured by the available controls.

Table 7: **Results of Wald tests for parameter equivalence between different quantiles for the results of Estimation 2**

Estimation 2	p-values of Wald tests for parameter equivalence:		
	Test:	q0.25=q0.50	q0.50=q0.75
Variables	gdp_per_cap_pps	0.0000	0.0000
	citr_pr	0.0043	0.0027
	dummy_nat	0.0614	0.0030
	dummy_bg	0.0603	0.0001
	log_empl_aprx	0.0000	0.0000
	dummy_nat × dummy_bg	0.3526	0.3129
	dummy_nat × log_empl_aprx	0.6461	0.0004
	log_empl_aprx × dummy_bg	0.1632	0.0042
	sum_sqsh_opre	0.0043	0.0263
	sum_sqsh_opre × dummy_bg	0.2993	0.0412

Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note: p-values below 0.1000 (10% level of statistical significance) imply rejection of the null hypothesis of the respective Wald test for parameter equivalence between the different quantiles at conventional levels of statistical significance. q0.25, q0.50, q0.75 denote the 0.25, 0.50, 0.75 quantile, respectively. × denotes an interaction term between the stated variables.

The results of Estimation 2 are presented also graphically. They are shown in Figures A.7 to A.16 in the Appendix, which are consistent with the estimation results shown in Table 6 and are qualitatively similar to the respective figures showing the results of Estimation 1 (Figures A.1 to A.6 in the Appendix). Next, Wald tests for parameter equivalence between different quantiles are also performed on the results of Estimation 2 for the same two sets of quantiles as in the case of Estimation 1. The p-values from the Wald tests are presented in Table 7. With the exception of the p-values for the interaction term between the two dummy variables dummy_nat and dummy_bg, all the other p-values indicate that for one of the two cases or for both cases for potential parameter equivalence, which are for the parameter equivalence between q0.25 and q0.50 and between q0.50 and q0.75, the estimates are different from one another. Thus, the Wald tests on the results of Estimation 2 support the estimation of the quantile regression as was also the case with the Wald tests performed on the results of Estimation 1.

6. Conclusion

The present paper contributes to the literature on firm profitability by analysing both descriptively and quantitatively firm profitability in the manufacturing sector of the eleven CEE EU countries.

The focus of the descriptive analysis lies on making a comparison of the profitability of the firms in the manufacturing sector of Bulgaria with the profitability of their peers in the other ten CEE EU countries. The present paper finds that during the period of analysis, which is 2015–2019, the manufacturing sector of Bulgaria has a comparatively high profitability relative to the manufacturing sectors of the other CEE EU countries. The descriptive analysis shows namely that throughout the period under review, the PLBT margin of the Bulgarian manufacturing sector consistently lies in the highest quartile of the profitability distribution of the CEE EU countries. In addition, the descriptive analysis shows that the nationally-owned firms in the Bulgarian manufacturing sector tend to have a higher profitability not only compared to the respective multinational firms in Bulgaria, but also compared to the respective nationally-owned firms in the other CEE EU countries. Furthermore, the small firms in the Bulgarian manufacturing sector tend not only to have the highest reported profitability among the different firm-size groups in the manufacturing sector of Bulgaria, but also form the maximum of the recorded firm profitability in the manufacturing sector for the group of small firms among the CEE EU countries during the studied period.

The focus of the quantitative analysis lies on estimating the effects of different factors on reported firm profitability in the manufacturing sector of the CEE EU countries, where the choice of these factors is motivated by their relevance for Bulgaria and by the observations made in the descriptive-analysis part of the present paper. In the quantitative-analysis part, quantile regressions are estimated and their results show that firm profitability is affected negatively by a higher country's per capita income, higher corporate income tax rate and generally by bigger firm size, measured by a firm's number of employees. The quantile regressions furthermore generally find a positive effect of higher market concentration and to some extent of the firms being national rather than multinational on reported firm profitability. The results are in line with the economic literature on the determinants of firm profitability.

Given the data limitations and the scope of the present paper, the analysis of additional determinants of firm profitability in the manufacturing sector of the CEE EU countries is left for future research. Further work could also examine whether the relationships identified by the estimated quantile regressions between the explanatory variables and firm profitability in the manufacturing sector extend to the services sector in the CEE EU countries. Moreover, once sufficiently long and consistent annual firm-level financial data become available for the post–COVID-19 period, future studies could investigate firm profitability developments in these jurisdictions after the pandemic and compare them with the findings of the present paper. Finally, to provide a more comprehensive picture, a separate analysis focusing on the profitability of the micro firms in the manufacturing sector of the CEE EU countries would be a valuable extension and is likewise left for future research.

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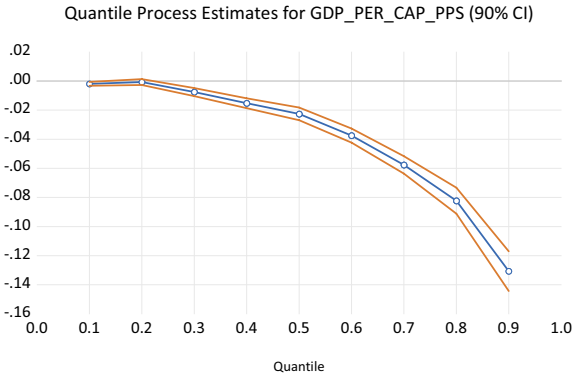
Appendix

A. Supplementary figures

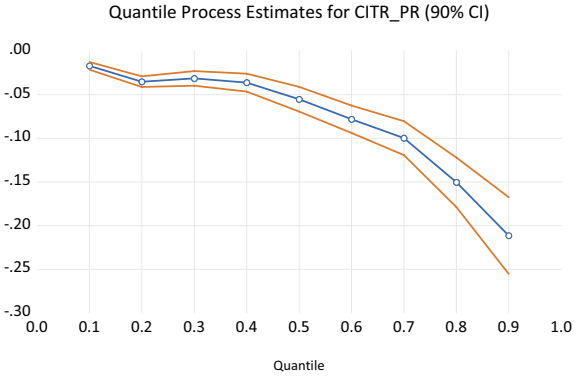
Figure A.1: **Graphical representation of the estimates for different quantiles for the variable 'gdp_per_cap_pps' from Estimation 1**



Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note: 'GDP_PER_CAP_PPS' in the figure denotes the GDP per capita in PPS. 90% confidence interval (CI) depicted by the area between the two orange lines.

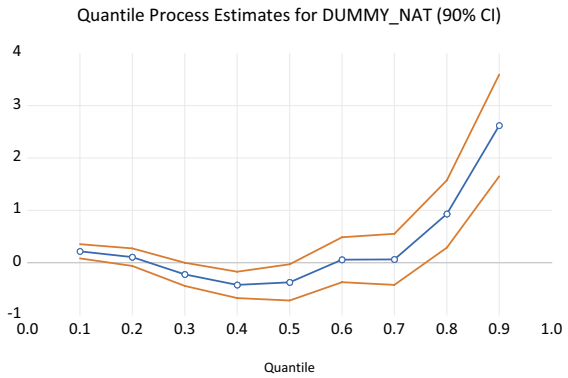
Figure A.2: **Graphical representation of the estimates for different quantiles for the variable 'citr_pr' from Estimation 1**



Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note: 'CITR_PR' in the figure denotes the general statutory corporate income tax rate expressed as a percentage. 90% confidence interval (CI) depicted by the area between the two orange lines.

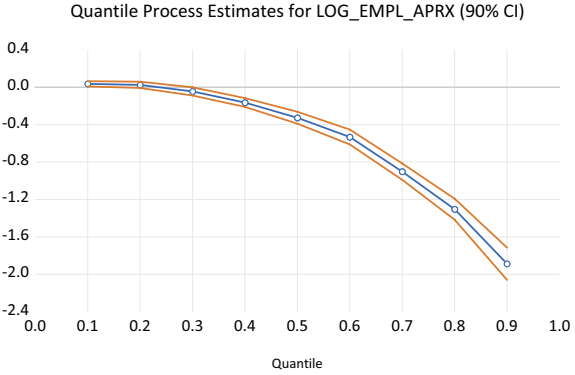
Figure A.3: **Graphical representation of the estimates for different quantiles for the variable 'dummy_nat' from Estimation 1**



Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note: 'DUMMY_NAT' in the figure denotes a dummy variable, which is equal to 1 if a firm is classified as national and is equal to 0 if it is classified as multinational. Regarding the classification of a firm as national or multinational, see Appendix B.3. 90% confidence interval (CI) depicted by the area between the two orange lines.

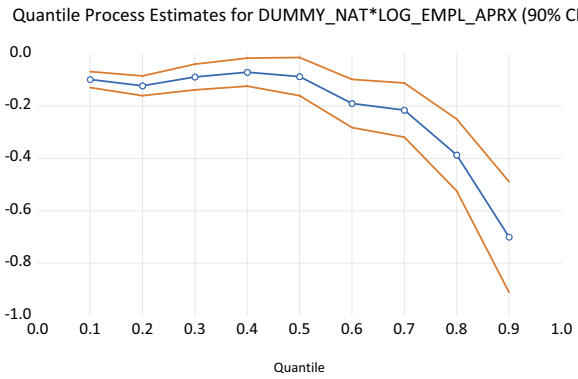
Figure A.4: **Graphical representation of the estimates for different quantiles for the variable 'log_empl_aprx' from Estimation 1**



Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note: 'LOG_EMPL_APRX' in the figure denotes the natural logarithm of the approximated number of employees of a firm. See Appendix B.2 for information on the approximation procedure implemented in this respect. 90% confidence interval (CI) depicted by the area between the two orange lines.

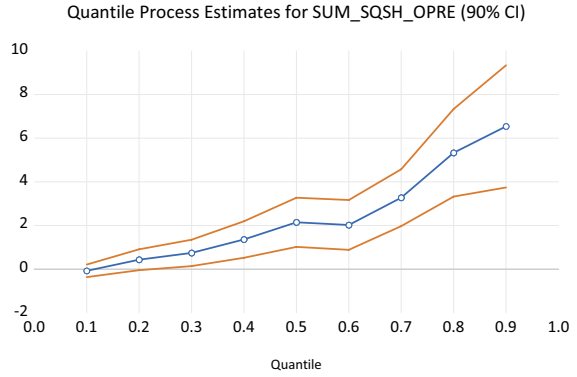
Figure A.5: **Graphical representation of the estimates for different quantiles for the interaction term between the variables 'dummy_nat' and 'log_empl_aprx' from Estimation 1**



Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note: 'DUMMY_NAT*LOG_EMPL_APRX' in the figure denotes an interaction term between 'DUMMY_NAT' and 'LOG_EMPL_APRX'. 'DUMMY_NAT' denotes a dummy variable, which is equal to 1 if a firm is classified as national and is equal to 0 if it is classified as multinational. Regarding the classification of a firm as national or multinational, see Appendix B.3. 'LOG_EMPL_APRX' denotes the natural logarithm of the approximated number of employees of a firm. See Appendix B.2 for information on the approximation procedure implemented in this respect. 90% confidence interval (CI) depicted by the area between the two orange lines.

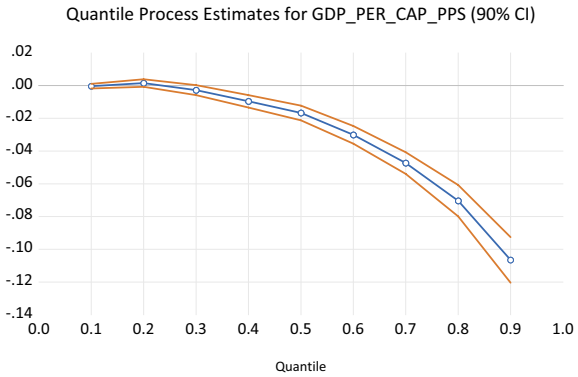
Figure A.6: **Graphical representation of the estimates for different quantiles for the variable 'sum_sqsh_opre' from Estimation 1**



Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note:'SUM_SQSH_OPRE' in the figure denotes a measure of market concentration, the Herfindahl-Hirschman Index, which can take on values between 0 and 1, where a larger value implies higher market concentration. 90% confidence interval (CI) depicted by the area between the two orange lines.

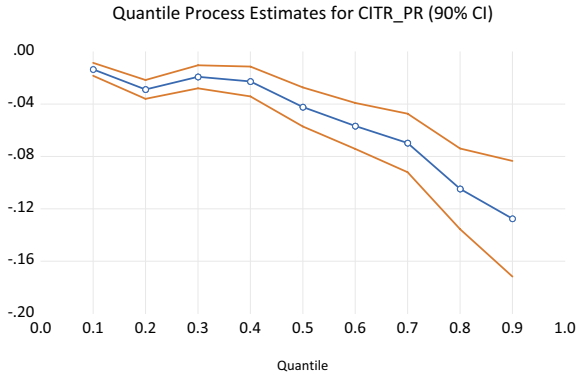
Figure A.7: **Graphical representation of the estimates for different quantiles for the variable 'gdp_per_cap_pps' from Estimation 2**



Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note: 'GDP_PER_CAP_PPS' in the figure denotes the GDP per capita in PPS. 90% confidence interval (CI) depicted by the area between the two orange lines.

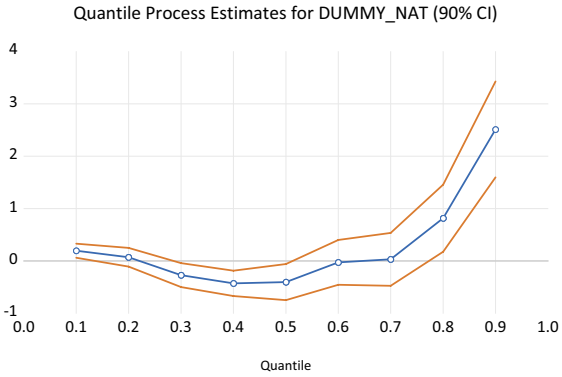
Figure A.8: **Graphical representation of the estimates for different quantiles for the variable 'citr_pr' from Estimation 2**



Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note: 'CITR_PR' in the figure denotes the general statutory corporate income tax rate expressed as a percentage. 90% confidence interval (CI) depicted by the area between the two orange lines.

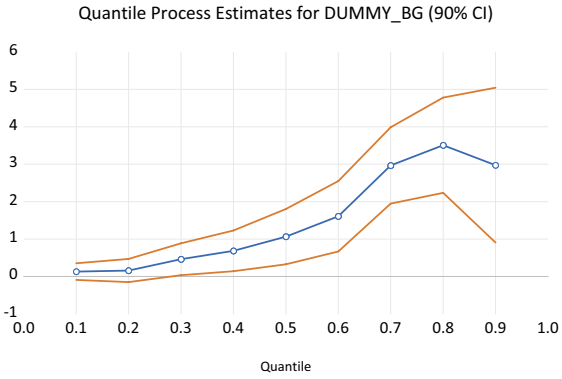
Figure A.9: **Graphical representation of the estimates for different quantiles for the variable 'dummy_nat' from Estimation 2**



Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note: 'DUMMY_NAT' in the figure denotes a dummy variable, which is equal to 1 if a firm is classified as national and is equal to 0 if it is classified as multinational. Regarding the classification of a firm as national or multinational, see Appendix B.3. 90% confidence interval (CI) depicted by the area between the two orange lines.

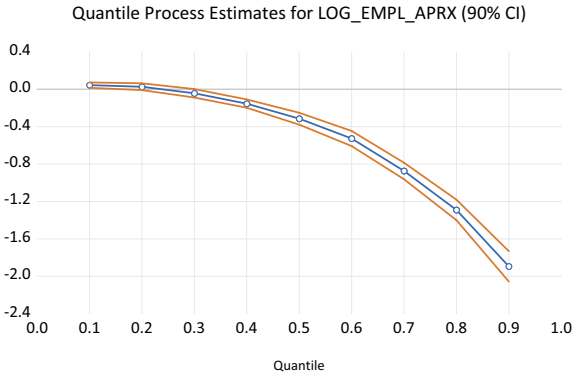
Figure A.10: **Graphical representation of the estimates for different quantiles for the variable 'dummy_bg' from Estimation 2**



Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note: 'DUMMY_BG' in the figure denotes a dummy variable, which is equal to 1 if a firm is located in Bulgaria and is equal to 0 if it is located in one of the other ten CEE EU countries. 90% confidence interval (CI) depicted by the area between the two orange lines.

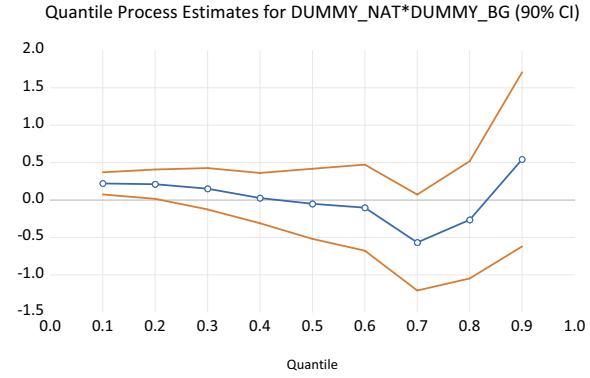
Figure A.11: **Graphical representation of the estimates for different quantiles for the variable 'log_empl_aprx' from Estimation 2**



Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note: 'LOG_EMPL_APRX' in the figure denotes the natural logarithm of the approximated number of employees of a firm. See Appendix B.2 for information on the approximation procedure implemented in this respect. 90% confidence interval (CI) depicted by the area between the two orange lines.

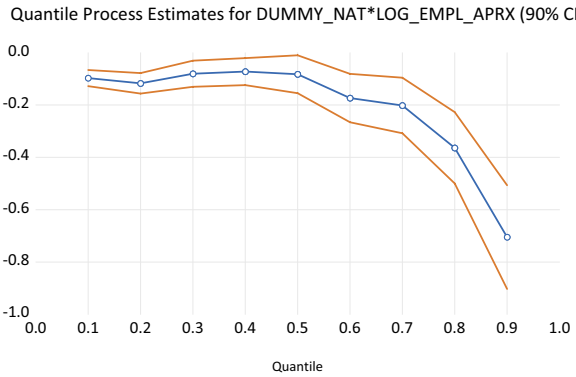
Figure A.12: **Graphical representation of the estimates for different quantiles for the interaction term between the variables 'dummy_nat' and 'dummy_bg' from Estimation 2**



Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note: 'DUMMY_NAT*DUMMY_BG' in the figure denotes an interaction term between 'DUMMY_NAT' and 'DUMMY_BG'. 'DUMMY_NAT' denotes a dummy variable, which is equal to 1 if a firm is classified as national and is equal to 0 if it is classified as multinational. Regarding the classification of a firm as national or multinational, see Appendix B.3. 'DUMMY_BG' denotes a dummy variable, which is equal to 1 if a firm is located in Bulgaria and is equal to 0 if it is located in one of the other ten CEE EU countries. 90% confidence interval (CI) depicted by the area between the two orange lines.

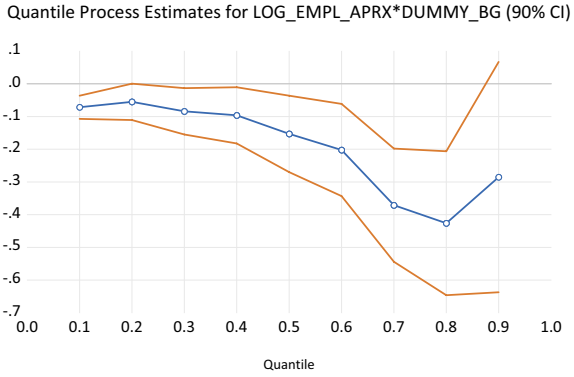
Figure A.13: **Graphical representation of the estimates for different quantiles for the interaction term between the variables 'dummy_nat' and 'log_empl_aprx' from Estimation 2**



Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note: 'DUMMY_NAT*LOG_EMPL_APRX' in the figure denotes an interaction term between 'DUMMY_NAT' and 'LOG_EMPL_APRX'. 'DUMMY_NAT' denotes a dummy variable, which is equal to 1 if a firm is classified as national and is equal to 0 if it is classified as multinational. Regarding the classification of a firm as national or multinational, see Appendix B.3. 'LOG_EMPL_APRX' denotes the natural logarithm of the approximated number of employees of a firm. See Appendix B.2 for information on the approximation procedure implemented in this respect. 90% confidence interval (CI) depicted by the area between the two orange lines.

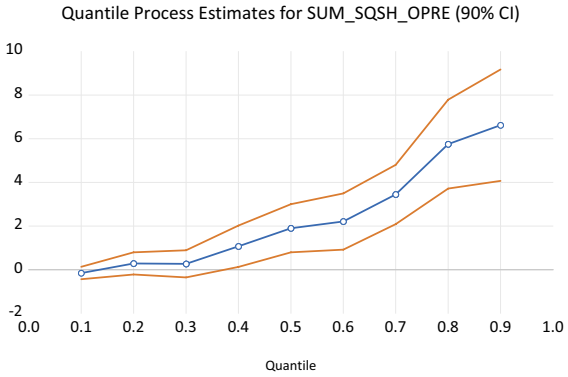
Figure A.14: **Graphical representation of the estimates for different quantiles for the interaction term between the variables 'log_empl_aprx' and 'dummy_bg' from Estimation 2**



Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note: 'LOG_EMPL_APRX*DUMMY_BG' in the figure denotes an interaction term between 'LOG_EMPL_APRX' and 'DUMMY_BG'. 'LOG_EMPL_APRX' denotes the natural logarithm of the approximated number of employees of a firm. See Appendix B.2 for information on the approximation procedure implemented in this respect. 'DUMMY_BG' denotes a dummy variable, which is equal to 1 if a firm is located in Bulgaria and is equal to 0 if it is located in one of the other ten CEE EU countries. 90% confidence interval (CI) depicted by the area between the two orange lines.

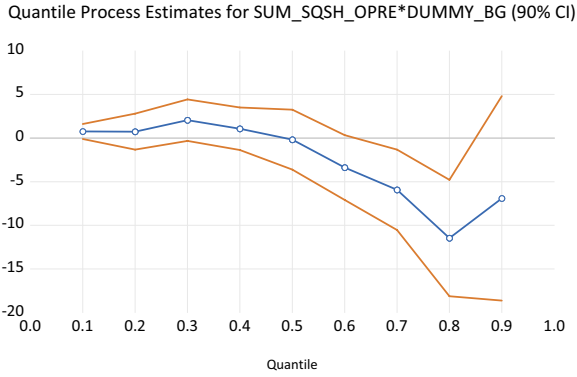
Figure A.15: **Graphical representation of the estimates for different quantiles for the variable 'sum_sqsh_opre' from Estimation 2**



Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note: 'SUM_SQSH_OPRE' in the figure denotes a measure of market concentration, the Herfindahl-Hirschman Index, which can take on values between 0 and 1, where a larger value implies higher market concentration. 90% confidence interval (CI) depicted by the area between the two orange lines.

Figure A.16: **Graphical representation of the estimates for different quantiles for the interaction term between the variables 'sum_sqsh_opre' and 'dummy_bg' from Estimation 2**



Source: Orbis database by Bureau van Dijk; Eurostat; EY. Calculations by the author.

Note: 'SUM_SQSH_OPRE*DUMMY_BG' in the figure denotes an interaction term between 'SUM_SQSH_OPRE' and 'DUMMY_BG'. 'SUM_SQSH_OPRE' denotes a measure of market concentration, the Herfindahl-Hirschman Index, which can take on values between 0 and 1, where a larger value implies higher market concentration. 'DUMMY_BG' denotes a dummy variable, which is equal to 1 if a firm is located in Bulgaria and is equal to 0 if it is located in one of the other ten CEE EU countries. 90% confidence interval (CI) depicted by the area between the two orange lines.

B. Additional information on the data used in the analyses

B.1. Preparation of the basic data sample

As described in the main text, firm-level data from the Orbis database compiled by Bureau van Dijk are used in the analyses done in the present paper. The basic data sample is compiled in the following way. Data from unconsolidated firm financial accounts for the five years in the period from 2015 to 2019 from the eleven Central and Eastern European countries (Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia), which are member countries of the EU (Bulgaria and Romania since 2007, Croatia since 2013, whereas the other eight countries since 2004), is used.

The chosen sector of economic activity of these firms is the manufacturing sector, thus the firms have a NACE Rev. 2 two-digit core code from 10 to 33. The minimum number of employees is set to 10 in the last available year for a particular firm in the Orbis database at the time of the data download (which was the autumn of 2021). Thus micro firms are not included. The focus of the present analysis lies particularly on Bulgaria and although the micro firms comprise 75.7% of all the firms in the manufacturing sector of Bulgaria on average over the 2015–2019 period, they nevertheless make a disproportionately much smaller part of the turnover (4.4%), of the value added at factor cost (5.3%) and of the employees (11.3%) in the Bulgarian manufacturing sector on average over the same period, as can be seen in Table 1 in the main text. Not including the micro firms still leaves almost all of the firms which make up the turnover (95.6%) and the value added at factor cost (94.7%) in the Bulgarian manufacturing sector on average over the 2015–2019 period.

With respect to Bulgaria, which the focus of the present analysis lies particularly on, firms which are not required by law to register for VAT (Value Added Tax) purposes are not included in the data sample as they do not face the same obligations as firms which are required to do so. For instance, according to Article 123 (1) of the VAT Law of Bulgaria each registered entity is obliged to keep detailed accounting records that are sufficient for the revenue authorities to establish its obligations under the VAT Law. In addition, according to Article 124 (1) of the VAT Law of Bulgaria the entities registered under the VAT Law must keep a purchase journal and a sales journal. The threshold amount according to Article 96 (1) of the VAT Law of Bulgaria with respect to obligatory registration for VAT purposes, which was in force in 2021 in Bulgaria (the year of the data download), was BGN 50,000, which corresponds to EUR 25,564. For comparability across the countries in the sample, the minimum annual turnover for a firm in the data sample is set to EUR 25,564 in the last available year for a particular firm in the Orbis database (at the time of the data download).

In addition, only observations, for which the number of months for the reported financial information is equal to 12, are kept. Furthermore, in each year only the observations, for which the item 'Profit and Loss before Tax' and the item 'Operating Revenue' are not equal to a missing value, are kept.

In a next step, an accounting check is performed. This accounting check should ensure that at the firm level in a particular year the amount of the item 'Total Assets' is equal to the sum of the items 'Total Liabilities' and 'Shareholder Funds'. In this respect, first the item 'Total Assets' (TOAS) of a firm is computed as the sum of the items 'Fixed Assets' and 'Current Assets' of the firm. Then the item 'Total Liabilities and Shareholder Funds' (TOLIABSHFD) of a firm is computed as the sum of the items 'Current Liabilities' and 'Non-Current Liabilities', whose sum represents the item 'Total Liabilities', and of the item 'Shareholder Funds' of the firm. After that, the variable 'Accounting Error' is computed as the result from the subtraction of TOLIABSHFD from TOAS. The variable 'Accounting Error' should be equal to zero due to the accounting equality of the two items, TOLIABSHFD and TOAS, but this is not the case for all of the observations. As this could be due to an issue of rounding, the following procedure is executed in order to allow for a small deviation of the data in the accounting check. In this regard, a ratio of the variable 'Accounting Error' to the bigger of the two items, TOAS or TOLIABSHFD, is computed and in case that in absolute value this ratio is larger than 0.01, implying larger than 1%, then the respective observation is dropped from the sample. Observations are furthermore dropped if one of the two items, TOAS or TOLIABSHFD, is equal to zero or is equal to a missing value.

In addition, all observations, for which the item 'Profit and Loss after Tax' is equal to a missing value, are dropped from the sample. One observation is furthermore dropped due to an extraordinarily large amount of the item 'Tangible Fixed Assets' of a firm.

After the described cleaning procedure is performed, the basic data sample which remains for the analyses in the present paper is left with 239,217 observations for the period from 2015 to 2019, down from 288,924 observations.

B.2. About the iterative procedure implemented in filling in missing data on the number of employees for some firm-year observations

In order to fill in some of the missing firm-year observations on the item 'Number of Employees' (EMPL), an iterative procedure is performed, which indirectly assumes that the number of employees of a firm does not change significantly during the five years in the present sample.

The implemented procedure looks first for available information for the same firm from the closest year ahead of the firm-year observation with missing data

on EMPL. In case that the last available year with data for this firm in the sample is reached without finding information on EMPL, then the closest year before the year with the missing information on EMPL is checked for available information. If necessary, the procedure is then repeated one year at a time until the first available year with data for this firm in the sample is reached.

The procedure is performed one year at a time until information on EMPL is found. It is then assumed that the firm-year observation with missing data had the same value of EMPL as the firm-year observation with available data on this item. In the described way, in some of the cases the missing information on the number of employees of a firm in a given year can be approximated. In case that there is no information on the item EMPL in the sample, the particular firm is left without a size classification. Such firm-year observations are nevertheless not excluded from analyses in the present paper for which no information on firm size, given by the number of employees, is required but other information required for a particular analysis is available.

B.3 Classification of a firm as national or multinational

The classification of a firm as national or multinational is done in the following way. The information on the home jurisdiction of a firm is taken from the first two letters of Bureau van Dijk's firm identifier (BvD ID number), which give the two-letter ISO-code of the particular jurisdiction. If the country codes of the firm and of its GUO (global ultimate owner as defined in Bureau van Dijk's Orbis database), which in the present paper is assumed to be the firm's parent company, are the same then the firm is classified as national. If the two country codes are not the same and the two-letter ISO-code of the GUO is a valid ISO-code of a jurisdiction, then the firm is classified as multinational. In the other cases, also when no information on the GUO is available, the firm cannot be classified as national or multinational. Such firm-year observations are nevertheless not excluded from analyses in the present paper for which no information on whether a firm is national or multinational is required but other information required for a particular analysis is available.

It should be noted that even if the GUO and the firm, which is to be classified as national or multinational, are from the same jurisdiction, the GUO might still have affiliated firms in other jurisdictions. However, such information is not available for the present analysis. Thus, although the firm might be part of a multinational group, in such a case in the present paper it is still classified as nationally-owned from the point of view of the GUO's jurisdiction.

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The sculptural composition by Kiril Shivarov depicting Hermes and Demeter on the southern façade of the Bulgarian National Bank building is used in cover design.