sustainability

MDPI

Article

Capital Investments and Manufacturing Firms' Performance: Panel-Data Analysis

Vanja Grozdić [1,*], Branislav Marić [1], Mladen Radišić [1], Jarmila Šebestová [2] and Marcin Lis [3]

[1] Department of Industrial Engineering and Management, Faculty of Technical Sciences, University of Novi Sad, 21000 Novi Sad, Serbia; bmaric@uns.ac.rs (B.M.); mladenr@uns.ac.rs (M.R.)
[2] Department of Business Economics and Management, School of Business Administration in Karvina, Silesian University in Opava, 746 01 Opava, Czech Republic; sebestova@opf.slu.cz
[3] Faculty of Applied Sciences, WSB University, 41-300 Dąbrowa Górnicza, Poland; mlis@wsb.edu.pl
* Correspondence: vanja.grozdic@protonmail.com; Tel.: +381-63-7677-089

Received: 9 December 2019; Accepted: 21 February 2020; Published: 24 February 2020

check for updates

Abstract: The main goal of this study was to examine the effects of capital investments on firm performance, using panel-data analysis. For this purpose, financial data were gathered for 60 manufacturing firms based in Serbia, in the period from 2004 to 2016. The main research hypotheses were developed in accordance with the definition, nature, and time aspect of capital investments. Therefore, empirical expectation of this study was that the relationship between capital investments and firm performance should be positive—they probably bring losses to the firm in the short term, but they should increase firm performance in the long term. Finally, the results have indeed shown that capital investments have statistically significant negative effect on the short-term performance, but positive effect on the long-term performance of the analyzed firms, while controlling for time-fixed effects and certain internal factors.

Keywords: capital investments; firm performance; profitability; sustainability; panel data

1. Introduction

Today, Serbia is technologically lagging behind European industries and needs strong domestic industry to ensure economic sustainability. Serbian industry was largely devastated due to sanctions and wars in the 1990s. During that period, separated from foreign markets, it was impossible for Serbian industry to keep track of technological development. Isolation, as well as the lack of financial resources, made fixed assets technologically obsolete and poorly maintained. Foreign direct investments (FDI) are important, especially those with high technological intensity—bringing in new technologies and new knowledge, and employing domestic labor, but profitable domestic investments in fixed assets—which are not just the path to unjustified and excessive borrowing, represent one of the most important factors for abandoning a perennial economic stagnation. Figure 1 shows investments in fixed assets as percentage of gross domestic product (GDP) [1], where we can see that these investments in Serbia are mainly below European average.

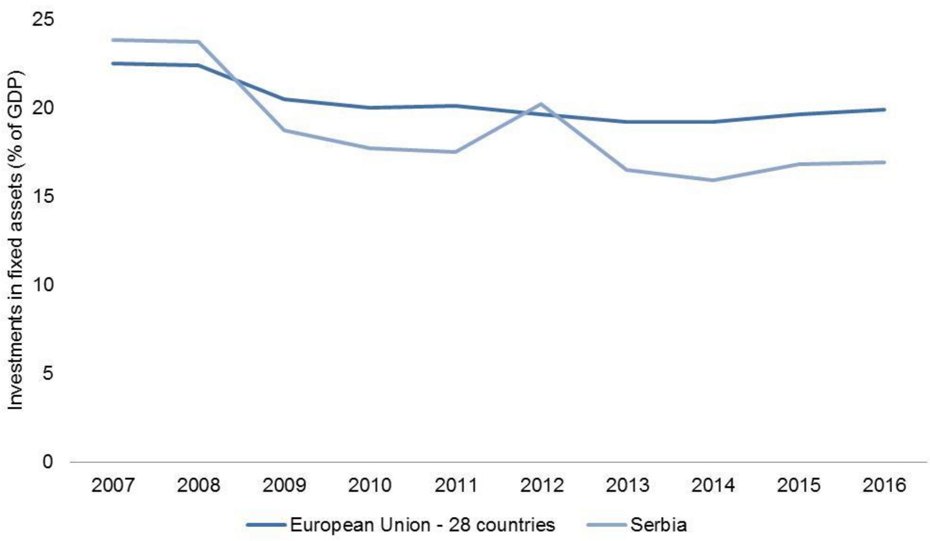

Figure 1. Investments in fixed assets as percentage of GDP (2007-2016). Source: Eurostat.

Capital investments, i.e., investments in fixed assets, represent an important factor that can serve as a signal in predicting the future profitability of the firm and stock returns [2]. Assessing the impact of investment at the level of the firm has not always been a viable research topic because, for many years, it was hindered by the lack of observed investment data and it is only recently that scholars have started to document the nature of firms' investment behavior [3]. Since most of the research regarding investment impact analysis focuses on the macroeconomic level, such as the impact of FDI on GDP growth, this paper attempts to fill the gap at the microeconomic level, i.e., the level of the firm.

Capital investments are necessary for growth and economic development, which implies that growth, beside other factors, is a function of investments. However, since accumulation depends on growth, we can also say that investments are function of growth. Therefore, theoretically, there is a clear interdependence between growth and capital investments.

Sustainable development of the manufacturing firms is closely related to the selection and realization of the capital investments, or investment projects, regardless of whether it is a replacement, modernization, expansion, or some other type of investments. Moreover, sustainable manufacturing largely depends on the process of selection and realization of investment projects, since they have to be selected and implemented based on their environmental and social impact evaluation, beside the assessment of other associated risks—that can be systematized as investment, financial, organizational, technical, technological, operational and informational risk [4]. As a consequence, manufactured products should use processes that minimize negative environmental impacts, should conserve energy and natural resources, should be safe for employees, communities, and consumers and should be economically sound [5]. Managing physical assets and technologies, or investment—capital intensive—projects, lead to the accumulation of capabilities in the firm, associated with continuous improvement and process innovations, as well as with corporate sustainable development [6]. Hence, capital investments are crucial link for manufacturing firms to create a long-term economic value, as well as to achieve sustainable development, having in mind their social and environmental impacts.

At the firm level, we can say that capital investments, in one hand, have a short-term character, since they represent the firm expense, but in the other hand, capital investments have a long-term nature, since they should bring some benefits to the firm in the future. Accordingly, the main goal of this study was to analyze this relationship between capital investments and firm performance, or more precisely, to examine the effect of capital investments on the firm performance, including both short-term and long-term aspects. Establishing the relationship between capital investments and firm performance, and confirming or disconfirming the effectiveness of capital investments, will contribute to the knowledge accumulation in this area and provide an insight for future capital investments of manufacturing firms.

The rest of the paper is organized as follows. Literature review of the relationship between capital investments and firm performance is presented in Section 2. Section 3 describes research methodology. Data analysis, including descriptive statistics, general model, and preliminary assumptions tests for panel data, is presented in Section 4. Section 5 analyzes regression results. Section 6 concludes.

2. Literature Review

There is a certain number of studies that examine the relationship between firm performance, using different measures of performance, and capital investments, while employing different statistical tests and econometric approaches. The findings are divided, resulting in negative or positive relationship between capital investments and firm performance. Our empirical expectation is that there is a positive relationship between capital investments and firm performance because of the definition, nature, and time aspect of capital investments—although they probably bring losses to the firm in the short term, they should increase the firm performance in the long term.

Power [7], on the case of US manufacturing firms, founds no evidence of a strong positive relationship between productivity and tangible investments which cautions against the efficacy of fiscal policy that is based on the premise that investment causes high productivity. Author, also, concludes that reason for the weak relationship between productivity and investment is that higher productivity is simply not the primary motivation for investments and quotes Grabowski and Mueller [8] that overinvestment, poor-quality investments, and low productivity can result if managers are maximizing their own utility rather than firm profits. Nilsen et al. [9], on the case of Norwegian firms, while examining the relationship between productivity and investments in fixed assets, found that productivity improvements are not related to these investments, more precisely they found significant effect of tangible investment on productivity, but this effect vanishes over time. Shima [10] investigates the impact of capital investments on productivity at the firm level using data of Japanese manufacturing industries and find also a negative relationship which, according to the author, predicts that firms face sunk costs.

Titman et al. [11] showed that US non-financial firms with substantially increase in capital investments subsequently achieve negative benchmark-adjusted returns and that the negative capital investments-return relationship is stronger for firms with higher cash flows and/or lower debt ratios, which probably have a greater tendency to overinvest. Jovanovic et al. [12], again on the case of US manufacturing firms, found that capital investments of established firms—"intensive" investments—are negatively related with Tobin's Q, compared to the new firms, because a high Q is a signal of low compatibility of old capital with the new and, hence, of high implementation costs specific to incumbents. According to Yao et al. [13] there is a pervasive negative relationship between asset growth and subsequent stock returns of Asian firms, suggesting potential inefficiencies of the region's financial systems in allocating capitals and valuing investment opportunities. Using data from 624 firms in the United States, Sircar et al. [14], found that both IT and corporate investments have a strong positive relationship with sales, assets, and equity, but not with net income. Singh et al. [15], using data from 120 firms in 30 countries, showed that environmental technology investments have a negative impact on profitability, i.e., return on assets, through pollution prevention capability and that firms should relocate their environmental expenditures to enhance firms' economic performance.

Aktas et al. [16], while examining the relationship between working capital management and firm performance, on the case of US firms, found that fixed asset growth is negatively associated with firm performance, measured by return on assets, and also statistically insignificant. Similar, Alipour et al. [17], while examining the relationship between working capital management and firm performance, on the case of UK firms, showed that tangible fixed assets have a negative and statistically significant impact on their return on assets. Jindrichovska et al. [18], on the case of 260 Czech firms, also found a negative relationship between growth of tangible assets, as a share of total assets, and return on assets of those firms. Fernández-Rodríguez et al. [19], while examining the influence of ownership structure on tax rates of Spanish firms, found that growth of fixed assets, expressed by capital intensity, has a negative and significant relationship with effective tax rate of the state owned companies, expressed as a relationship between tax expense and pretax income. Aljinović Barać and Muminović [20], on the case of dairy processing industry in Slovenia, Croatia, and Serbia found that companies with higher level of capital investments per employee obtain lower financial performance, expressed by return on assets, and that possible explanation for that can be found in the time lag between the moment of investment and the moment in the future when investment will generate the profit.

On the other hand, Grazzi et al. [3], on the case of French and Italian manufacturing firm-level data, using econometric approach that allows disentangling of the repair and maintenance episodes from large tangible investments, and after controlling for firm characteristics, found that tangible investments are associated with higher productivity, profitability, and employment. Ching-Hai et al. [21], while examining relationship between capital expenditures and corporate earnings of manufacturing firms listed on the Taiwan Stock Exchange, and after controlling for current corporate earnings, found a significantly positive association between capital expenditures and future corporate earnings. Aw et al. [22], also on the sample of Taiwanese electronics producers, found that firm future profitability is improved by investments in both R&D and physical capital. Gradzewicz [23] showed that productivity of Polish firms falls after investment and slowly recovers thereafter, which is consistent with learning-by-doing effects, and that investments are also associated with subsequent significant sales increase. Namiotko et al. [24], on the case of Lithuanian farms, found that the farms showed lower inefficiency in the presence of the investment spikes, which indicates that the farms, operating in the region of increasing returns to scale, could increase productivity by increasing their inputs and investments.

Fama and French [25] studied the relationship between firm investments and profitability for the aggregate non-financial US corporations and found that corporate investments lead to higher profitability. Yu et al. [26], while examining China's manufacturing firm-level dataset, showed that the only visible profitability–growth relationship is mediated via capital investments and that capital investments have a positive and significant effect on firms' productivity, both in levels and growth rates, and the effect on sales growth is even bigger. Lööf and Heshmati [27] examined the relationship between performance and tangible, as well as R&D investments of Swedish firms, and found that profitability is strongly associated with physical investments, but not with R&D investments. Johansson and Lööf [28], also on the case of Swedish manufacturing firms, found that the impact of physical capital (investment) on profitability is significant, positive, and systematically larger than for the comparable labor productivity estimations.

Licandro et al. [29] in their study showed that sales and productivity of innovative Spanish firms rise as a result of large tangible investment episodes and, hence, that they substantially improve their market shares, which is not the case for the non-innovative firms. Kapelko et al. [30], also on the case of Spanish manufacturing firms, found that capital investments produce a significant productivity change loss in the first year after investment, but thereafter productivity improves, resulting in the U-shape pattern of relationship. Amoroso et al. [31], on the case of EU firms, while making distinction between R&D and physical investments, showed that both R&D and physical investments, have a positive effect on the performance, expressed by the operating profit, and that larger firms also get higher returns in the presence of risk. Curtis et al. [32], using financial data on mergers and acquisitions, found that capital expenditures, as well as R&D expenditures, have a positive effect on the net profit and future earnings volatility of analyzed firms. Taipi and Ballkoci [33], on a sample of 30 construction firms in Albania, showed that capital investments have a positive effect on their future profitability, expressed by return on assets. Sudiyatno et al. [34] and Pandya [35] also found that capital investments have a positive effect on profitability, i.e., return on assets, on the case of manufacturing companies in Indonesia and infrastructure companies in India, respectively.

There are many researchers who examined the relationship between technology investments and performance, such as, for example, Mithas et al. [36], who found, on a sample of 400 global firms, that technology investments have a positive impact on revenue growth and profitability. Similar, Arvanitis et al. [37], on the case of Swiss firms, investigated the effects of energy-related technologies on economic performance at firm level and found a positive direct effect of investment expenditures for energy-related technologies on labor productivity, and a positive indirect effect of energy taxes via investment in energy-related technologies. Also, Bostian et al. [38], using plant-level production data for Swedish manufacturing firms, showed that environmental technology investments have a positive effect on the firm performance, measured by the productivity changes. Lee et al. [39], on the case of Korean biotechnology firms, while examining the relationship between R&D intensity and firm value, found that total asset investments and asset tangibility have a positive effect on the firm value, measured by Tobin's Q.

Although the literature covers a wide variety of firm performance measures, mainly expressed through productivity and profitability, this study will focus on profitability as a final component of the chain: capital investments—improved productivity—increased profitability. Tables 1 and 2 summarize literature review.

Table 1. Summary of literature review—part I.

Author(s)	**Year**	**Region**	**Dependent Variable (DV)**	**Relationship between Capital Investments and DV**
Power, L.	1998	United States	Productivity	Negative
Nilsen, Ø. A.; Raknerud, A.; Rybalka, M.; & Skjerpen, T.	2008	Norway	Productivity	Negative
Shima, K.	2010	Japan	Productivity	Negative
Singh, Nitish; Jieqiong Ma; and Jie Yang	2016	Global	Profitability (ROA)	Negative
Aktas, Nihat; Ettore Croci; and Dimitris Petmezas	2015	United States	Profitability (ROA)	Negative
Alipour, Mohammad; Mir Farhad Seddigh Mohammadi; and Hojjatollah Derakhshan	2015	United Kingdom	Profitability (ROA)	Negative
Jindrichovska, Irena; Erginbay Ugurlu, and Dana Kubickova	2013	Czech Republic	Profitability (ROA)	Negative
Aljinović Barać, Željana, and Saša Muminović	2013	Slovenia, Croatia, Serbia	Profitability (ROA)	Negative
Fernández-Rodríguez, Elena; Roberto García-Fernández; and Antonio Martínez-Arias	2019	Spain	Tax expense, Pretax Income	Negative
Titman, Sheridan; KC John Wei; and Feixue Xie	2004	United States	Benchmark-Adjusted Returns	Negative
Jovanovic, Boyan; and Peter L. Rousseau	2014	United States	Tobin's Q	Negative
Yao, Tong; Tong Yu; Ting Zhang; and Shaw Chen	2011	Asia	Stock Returns	Negative
Sircar, Sumit; Joe L. Turnbow; and Bijoy Bordoloi	2000	United States	Net income	Negative

Table 2. Summary of literature review—part II.

Author(s)	Year	Region	Dependent Variable (DV)	Relationship between Capital Investments and DV
Grazzi, Marco; Nadia Jacoby; and Tania Treibich	2016	Italy, France	Productivity, Profitability, Employment	Positive
Namiotko, Virginia; and Tomas Baležentis	2017	Lithuania	Productivity	Positive
Kapelko, Magdalena; Alfons Oude Lansink; and Spiro E. Stefanou	2015	Spain	Productivity	Positive
Arvanitis, Spyros; Michael Penede; Christian Rammer; Tobias Stucki; and Martin Woerter	2017	Switzerland	Productivity	Positive
Bostian, Moriah; Rolf Färe; Shawna Grosskopf; and Tommy Lundgren	2016	Sweden	Productivity	Positive
Fama, Eugene F.; and Kenneth R. French	1999	United States	Profitability	Positive
Aw, Bee Yan; Mark J. Roberts; and Daniel Yi Xu	2008	Taiwan	Profitability	Positive
Lööf, Hans; and Almas Heshmati	2008	Sweden	Profitability	Positive
Johansson, Börje; and Hans Lööf	2008	Sweden	Profitability, Productivity	Positive
Yu, X.; Dosi, G.; Grazzi, M.; & Lei, J.	2017	China	Profitability, Sales	Positive
Mithas, Sunil; Ali R. Tafti; Indranil Bardhan; and Jie Mein Goh	2012	Global	Profitability, Revenue	Positive
Ester Taipi; Valbona Ballkoci	2017	Albania	Profitability (ROA)	Positive
Sudiyatno, Bambang; Elen Puspitasari; and Andi Kartika	2012	Indonesia	Profitability (ROA)	Positive
Pandya, Bhargav	2017	India	Profitability (ROA)	Positive
Gradzewicz, Michal	2018	Poland	Sales	Positive
Licandro, Omar; Reyes Maroto; and Luis A. Puch	2004	Spain	Sales, Productivity	Positive
Ching-Hai, Jiang; Chen Hsiang-Lan; and Huang Yen-Sheng	2006	Taiwan	Corporate Earnings	Positive
Amoroso, Sara; Pietro Moncada-Paternò-Castello; and Antonio Vezzani	2017	EU	Operating profit	Positive
Curtis, Asher; Sarah E. McVay; and Sara Toynbee	2018	Global	Net profit, Earnings	Positive
Lee, Namryoung; and Jaehong Lee	2019	Korea	Tobin's Q	Positive

3. Methodology and Hypotheses Development

Capital investment, or investment project, theoretically can be defined as a series of cash inflows and outflows, which typically begins with cash outflows (initial investment), followed by cash inflows and/or cash outflows in subsequent years of the project [40], or simply as a series of outflows that can bring some inflows in the future. Capital investment in a manufacturing firm can be realized in one year, or in more than one year, in case of large projects, while benefits are usually collected through several upcoming years after realization. In accordance with this long-term nature of capital investments, theoretical definition, and also assumption that capital investments from previous year should affect the firm performance in the next year, we can say that capital investments can have negative effect on firm performance in the short term (during the one year, i.e., the year of investment), but they should have positive effect on firm performance in the long term (year after investment). Accordingly, we can define our main research hypotheses as follows:

Hypothesis 1: *Capital investments have a negative effect on the short-term performance of manufacturing firms.*

Hypothesis 2: *Capital investments have a positive effect on the long-term performance of manufacturing firms.*

For this study we have chosen manufacturing firms, i.e., capital intensive firms that require large amount of capital investments to produce goods. Sixty manufacturing firms from Serbia, selected based on financial data availability, with historical data from 2004–2016 (total of 600 available observations with some missing data), were analyzed. As a proxy for firm performance we have used profitability–growth, expressed by ROA (Return on Assets), since ROA, according to Hagel et al. [41], represent better metric of financial performance than income statement profitability measures—it takes into account the assets used to support business activities and determines whether the company is able to generate an adequate return on these assets rather than simply showing robust return on sales. As for capital investments, as a proxy we have used capital investment rate.

There are several procedures for choosing the lag length in finite distributed lag models (in which the effect of a regressor X on Y occurs over time rather than all at once), but there is no perfect answer which lag length to choose, especially in panel models. Having in mind the statistical problems that can occur, especially in short panels (less than 20-30 years), such as multicollinearity and sample reduction (each time we lengthen the lag by one period, we lose two degrees of freedom), we have chosen one year as a lag length of the regressor. More precisely, for the purpose of this study, to capture the long-term effect of capital investments on performance, we have used one-year lag of capital investment rate.

While examining the relationship between these growth rates, we have controlled time-fixed effects using year dummies, and certain internal factors, such as firm size, leverage, total asset turnover, and asset tangibility. Financial data for the manufacturing firms were obtained from the Serbian Business Registers Agency database [42].

Panel data describes the behavior of individuals/entities, both across individuals/entities and over time—they have both cross-sectional and time-series dimensions. Panel data can be balanced when all individuals/entities are observed in all time periods or, as in our case, unbalanced when individuals/entities are not observed in all time periods, i.e., there are missing data points because of the occasional panel attrition. The main three types of panel-data models are pooled Ordinary Least Squares (OLS) model (assumes constant coefficients), fixed effects model (assumes that the individual specific effects are correlated with the regressors), and random effects model (assumes that the individual specific effects are not correlated with the regressors). To choose appropriate panel model, Hausman test and Breusch–Pagan Lagrange multiplier have been employed, as well as appropriate tests regarding assumptions of serial correlation, heteroscedasticity, and cross-sectional dependence presence in analyzed panel data.

4. Data Analysis

4.1. Descriptive Statistics

Results for overall descriptive statistics, as well as descriptive statistics with decomposition in between and within standard deviation, for main variables of interest, firm performance expressed with ROA and firm capital investments CI, are presented in Table 3. On one hand, Table 3 shows overall descriptive statistics of main variables, where we can see that 60 firms (ID), analyzed over period from 2004-2016, have mean ROA (−0.054) with standard deviation (1.087) and mean CI (0.093) with standard deviation (0.595). On the other hand, Table 3 shows descriptive statistics with decomposition in between firms and within firms over time variation. First, it is obviously that firm (ID) does not vary over time (Year), but since we have unbalanced panel, we can see that time (Year) do vary between firms (ID). The interesting part is that both variables, ROA and CI for manufacturing firms, have more variation within firms over time (1.037 and 0.559, respectively for ROA and CI), than variation between firms (0.441 and 0.204, respectively for ROA and CI). Also, in Table 3 we can see overall, between and within descriptive statistics for all control variables included in the model. Figure 2 shows bar charts of mean ROA and CI, grouped by firms and by time, and, if we look at the graphs **(b)** and **(d)**, we already have an indication that CI will probably have a negative effect on the short-term ROA.

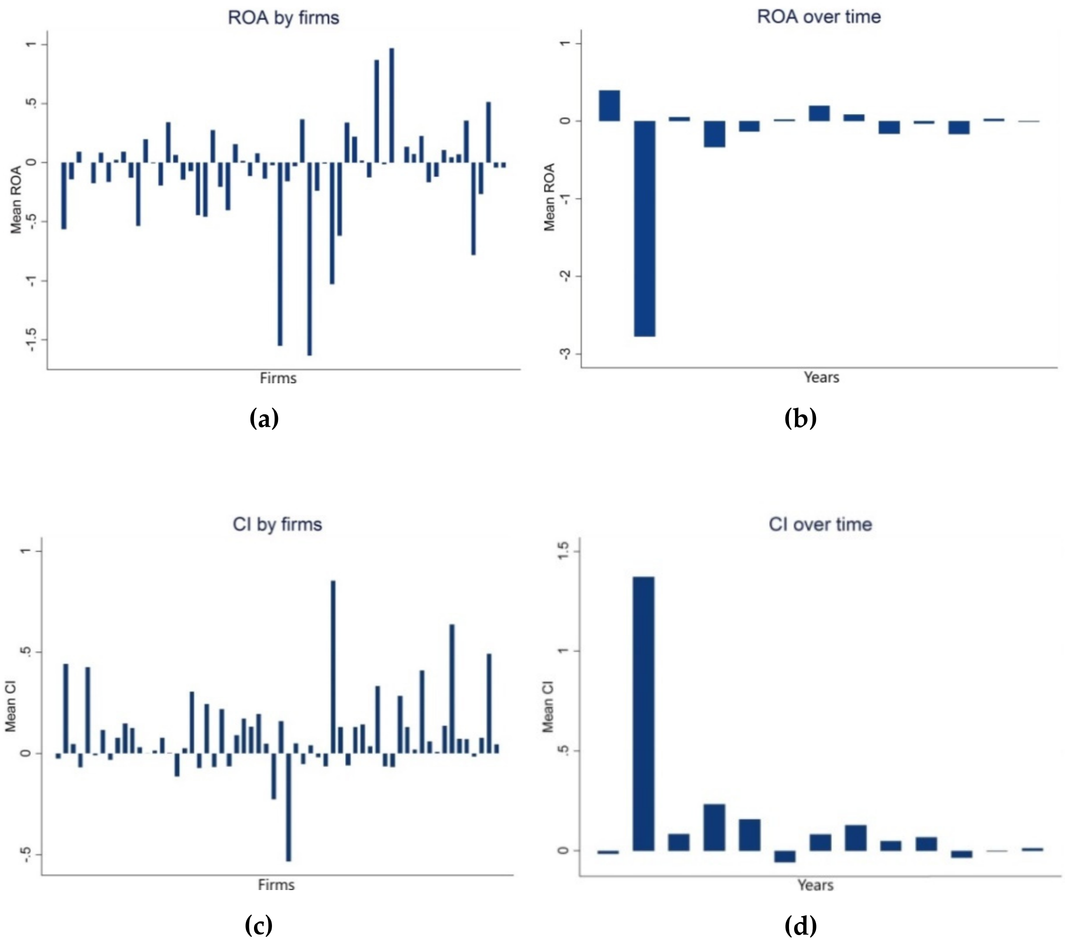

Figure 2. Bar charts of mean ROA and CI, by 60 firms and over time (2004-2016): **(a)** Mean ROA by firms; **(b)** Mean ROA over time; **(c)** Mean CI by firms; **(d)** Mean CI over time.

Table 3. Descriptive statistics.

Variable		Mean	St. Dv.	Min	Max	Observations
ID	overall	30	17.318	1	60	N = 600
	between		17.464	1	60	n = 60
	within		0	30	30	T-bar = 10
Year	overall	2010.568	2.966	2004	2016	N = 600
	between		0.576	2009	2012	n = 60
	within		2.911	2005.068	2016.068	T-bar = 10
ROA	overall	−0.054	1.087	−5.495	4.286	N = 434
	between		0.441	−1.636	0.969	n = 58
	within		1.037	−4.930	3.875	T-bar =7.483
CI	overall	0.093	0.595	−6.406	9.167	N = 589
	between		0.204	−0.533	0.854	n = 60
	within		0.559	−5.780	8.406	T-bar =9.817
CI_LAG	overall	0.106	0.624	−6.406	9.167	N = 529
	between		0.224	−0.584	0.932	n = 60
	within		0.582	−5.716	8.341	T-bar = 8.817

Table 3. *Cont.*

Variable		Mean	St. Dv.	Min	Max	Observations
SIZE	overall	9.423	1.666	5.732	15.584	N = 556
	between		1.584	6.496	14.562	n = 60
	within		0.468	7.867	14.599	T-bar = 9.267
LEV	overall	0.198	1.360	−4.186	5.902	N = 487
	between		1.276	−2.627	3.290	n = 59
	within		0.578	−1.848	4.206	T-bar = 8.254
TAT	overall	1.009	0.086	0.232	1.378	N = 556
	between		0.074	0.769	1.182	n = 60
	within		0.045	0.472	1.250	T-bar = 9.267
TANG	overall	−1.036	0.741	−6.073	−0.137	N = 556
	between		0.676	−4.189	−0.303	n = 60
	within		0.391	−4.001	1.046	T-bar = 9.267

4.2. Pooled OLS vs Fixed Effects vs Random Effects

First, we must choose between three types of panel models: the pooled OLS model, the fixed effects model (FE), and the random effects model (RE). To choose between these model types, first step would be to decide between FE and RE model using Hausman test. If we conclude that FE model is the better one, than we can use F-test for fixed effects to decide between FE and OLS model. However, if we conclude that RE is the better one, than we should choose between RE and OLS model, using Breusch–Pagan Lagrange multiplier (LM).

Hence, to decide between FE and RE model, first we should perform Hausman test (Appendix A, Table A1). Table A1, Appendix A, shows that Prob > chi2 (0.473) is higher than 0.05, so we cannot reject the null hypothesis, which implies that there is no correlation between the error term and the regressors, and we can conclude that RE is preferred model.

Given that Hausman test showed that between FE and RE model, RE model is the better one, now we need to compare RE and OLS model. We will do this by employing Breusch-Pagan LM for random effects testing shown in Appendix A, Table A2. Table A2, Appendix A, shows that Prob > chibar2 (1.000) is higher than 0.05, so we cannot reject the null hypothesis, which implies that the variances across firms are zero, and we can conclude that pooled OLS is preferred model.

In accordance with this model selection procedure, the rest of the paper will focus on the pooled OLS as preferred model. However, we will also present the results for fixed effects and random effects regressions. These results can be found in Appendix B, Tables A5 and A6, respectively.

4.3. General Model

The estimating equation for pooled OLS model can be presented as follows:

$$Y_{it} = \alpha + \beta X_{it} + \mu_{it} \tag{1}$$

In Equation (1), Y_{it} is the dependent variable of entity (i) in time (t), α is the constant intercept, X_{it} represents independent and / or control variable of entity (i) in time (t), β is the coefficient for that variable and μ_{it} is the error term.

Equation for capital investment, measured as capital investment rate, can be presented as follows:

$$CI_{it} = I_{it} / K_{i,t\text{-}1} \tag{2}$$

In Equation (2), CI_{it} is capital investment rate of firm (i) in year (t), I_{it} is investment of firm (i) in year (t), or flow variable, and $K_{i,t\text{-}1}$ is tangible fixed assets of firm (i) at the end of the previous year, or stock variable.

The empirical model, summarized by Equations (1) and (2), is shown in Equation (3), where ROA_{it} is the dependent variable that represent performance measure Return on Assets, calculated as ratio of Net Income and Total Assets of firm (i) during year (t), α represents the constant, CI_{it} is the first independent variable that represent Capital Investment, calculated as difference between firms' Fixed Assets in year (t) and Fixed Assets in year (t-1), divided by Fixed Assets in year (t-1), CI_LAG_{it} is the second independent variable that represent one year lagged CI variable for firm (i), used for capturing the effect of capital investments on firm performance in the long term, $SIZE_{it}$ is the first internal control variable that represent firm's size, calculated as a Natural Log of Total Assets of firm (i) in year (t), LEV_{it} is the second internal control variable that represent firm's Leverage, calculated as a Debt to Equity ratio of firm (i) in year (t), TAT_{it} is the third internal control variable that represent firm's Total Asset Turnover, calculated as Net Sales to Total Assets ratio of firm (i) in year (t), TANG is the fourth internal control variable that represent firm's Asset Tangibility, calculated as Fixed Assets to Total Assets ratio of firm (i) in year (t), $YEAR_t$ is the year dummy variable, used for controlling time-fixed effects, and μ_{it} is the standard error term in regression analysis. To ensure normality of the data, natural logs have been used for all variables. Table 4 summarizes model variables and their calculations.

$$ROA_{it} = \alpha + \beta_1 CI_{it} + \beta_2 CI\_LAG_{it} + \beta_3 SIZE_{it} + \beta_4 LEV_{it} + \beta_5 TAT_{it} + \beta_6 TANG_{it} + YEAR_t + \mu_{it} \quad (3)$$

Table 4. Summary of model variables.

Type of Variable	Variable	Calculation
Dependent (DV)	Return on Assets (ROA)	Net Income/Total Assets
Independent (IV)	Capital Investment (CI)	Fixed Assets (t)—Fixed Assets (t-1)/ Fixed Assets (t-1)
	Lagged Capital Investment (CI_LAG)	One-year lagged CI
Control (CV)	Firm's size (SIZE)	Natural Log of Total Assets
	Leverage (LEV)	Debt/Equity
	Total Assets Turnover (TAT)	Net Sales/Total Assets
	Tangibility (TANG)	Fixed Assets/Total Assets

4.4. Pooled OLS Preliminary Assumptions

For pooled OLS model to be accurate, there are some assumptions which needs to be tested. The most important ones are no serial correlation, homoscedasticity, and no cross-sectional dependence.

In longitudinal data, subjects are measured repeatedly over time and repeated measurements of a subject tend to be related to one another [43]. Because serial correlation in linear panel-data models biases the standard errors and causes the results to be less efficient, researchers need to identify serial correlation in the idiosyncratic error term in a panel-data model, and a Wooldridge test is very attractive because it requires relatively few assumptions and is easy to implement [44]. Serial correlation refers to the situation in which residuals are correlated across time and ignoring serial correlation where it exists, causes consistent but inefficient estimates, biased standard errors and inference about the significance of regressors may be incorrect under serial correlation conditions [45]. Even though the serial correlation can be ignored in short panels (less than 20-30 years), we will employ Wooldridge test which examine the serial correlation in panel data. These results are presented in Table A3, Appendix A.

When fitting regression models to data, an important assumption is that the variability is common among all observations, which is called homoscedasticity (this means "same scatter", or constant variance), but when the scatter varies by observation, the data are said to be heteroscedastic, which affects the efficiency of the regression coefficient estimators although these estimators remain unbiased even in the presence of heteroscedasticity [43]. Homoscedastic assumption that the variability is common among all observations, according to Baltagi [46], may be a restrictive assumption for data panels, where cross-sectional units may often be a different size and as a result exhibit different variations. Assuming homoscedastic disturbances when heteroscedasticity is present will yield consistent estimation results of coefficients that are not efficient, the standard errors of the estimates will be biased and the inference about the significance of regressors may be incorrect [45]. To test for heteroscedasticity in panel data, we will use Breusch-Pagan / Cook-Weisberg test. The results regarding heteroscedasticity are also presented in Table A3, Appendix A.

In Table A3, Appendix A, regarding serial correlation, we can see that the Prob > F (0.045) is less than 0.05, so we can reject the null hypothesis and conclude that there is a presence of serial correlation in our panel data. Also, in Table A3, Appendix A, regarding heteroscedasticity, we can see that the Prob > chi2 (0.0016) is less than 0.05, so again we can reject the null hypothesis and conclude that there is presence of heteroscedasticity in our panel data.

A growing body of the panel-data literature comes to the conclusion that panel datasets are likely to exhibit substantial cross-sectional dependence, which may arise due to the presence of common shocks and unobserved components that become part of the error term ultimately, due to spatial dependence, as well as due to idiosyncratic pair-wise dependence in the disturbances with no particular pattern of common components or spatial dependence [47]. Ignoring cross-sectional dependence may affect the first-order properties (unbiasedness, consistency) of standard panel estimators and even if the first-order properties of these estimators remain unaffected, the presence of error cross-sectional dependence may largely reduce the extent to which they can provide efficiency gains over estimating using, say, OLS for each individual [48]. According to De Hoyos and Sarafidis [47], if assume standard panel model, under the null hypothesis μ_{it} is assumed to be independent and identically distributed over time periods and across cross-sectional units, and under the alternative μ_{it} may be correlated across cross-sections but the assumption of no serial correlation remains. To test cross-sectional dependence in panel data, we will employ CD-test, as described in Pesaran [49] and Pesaran [50] for a varlist of any length. The results are presented in Table A4, Appendix A.

In Table A4, Appendix A, regarding cross-sectional dependence, we can see that the *p*-values are less than 0.05, so we can reject the null hypothesis and we can conclude that there is presence of cross-sectional dependence in our panel data.

5. Results and Discussion

Since all three assumptions for pooled OLS model to be accurate (no serial correlation, homoscedasticity, and no cross-sectional dependence) are violated, we will use robust standard errors (Driscoll–Kraay standard errors), which will help us to deal with these violations.

According to Hoechle [51], in order to ensure valid statistical inference when some of the underlying regression model's assumptions are violated, it is common to rely on robust standard errors. Following Hoechle [51], we will run pooled OLS regression with Driscoll–Kraay standard errors, which deals with heteroscedasticity, autocorrelation, and cross-sectional dependence assumptions violations.

Regression is performed according to the general model equation described in Section 4.3, as well as preliminary performed Hausman test, Breusch-Pagan LM, serial correlation, heteroscedasticity, and cross-sectional dependence test. Table 5 shows the results from hierarchical pooled OLS regression testing hypotheses that capital investments probably have negative effect on the firm performance in the short term, but positive effect on the firm performance in the long term, while controlling for time-fixed effects and certain internal factors, such as firm size, leverage, total asset turnover, and asset tangibility. We will now present the results concerning our four models.

Result 1: Model 1 provides evidence that CI has a negative, statistically insignificant, effect on ROA (−0.272) and CI_LAG has a positive, statistically significant, effect on ROA (0.101), at level 0.001. This model confirms our second hypothesis and indicates that for certain increase in capital investments, ROA of manufacturing firms is expected to increase in the year after investment, while holding firm size constant. We can see that firm size (SIZE), as a control variable, has a negative effect on ROA (−0.044) and statistically significant, at level 0.001. Larger firms should have a larger profitability, since they can achieve lower cost per unit, which is in line with the economies of scale. Although most studies reports a positive relationship between firm size and profitability, there are also researchers who found a negative relationship between these two variables (see, e.g., Kartikasari et al. [52]). According to Pervan et al. [53], a conceptual framework that advocates a negative relationship between firm size and profitability is noted in the alternative theories of the firm, which suggest that large firms come under the control of managers pursuing self-interested goals and therefore profit maximization as the firm's objective function may be replaced by managerial utility maximization function. This can imply that managers of large manufacturing firms in Serbia put their own goals in front of the companies' goals.

Result 2: Model 2 provides evidence that CI has a negative effect on ROA (−0.815) and CI_LAG has a positive effect on ROA (0.086), with statistically significant coefficients, at level 0.001. This model confirms our both hypotheses and indicates that for certain increase in capital investments, ROA of manufacturing firms is expected to decrease in the year of investment, but to increase in the year after investment, while holding firm size and leverage constant. Also, leverage (LEV), as additional control variable, has a negative effect on ROA (−0.020). This can be considered to be a reasonable result, since it is clear that greater borrowing implies a reduction of profitability. Obviously, this rule also applies to manufacturing firms in Serbia. There are many researchers who have examined capital structure and firms' performance and found a negative relationship between leverage and profitability (see, e.g., Ahmad et al. [54]). However, in our case the effect of leverage on profitability remain statistically insignificant. We can see that in this particular model, the effect of firm size, as a control variable, on profitability is still negative (−0.046) and statistically significant, at level 0.01. Moreover, in this particular model, the intercept is also statistically significant, at level 0.01.

Result 3: Model 3 provides evidence that CI has a negative effect on ROA (−0.826) and CI_LAG has a positive effect on ROA (0.083), again with statistically significant coefficients, at level 0.001. This model also confirms our both hypotheses and indicates that for certain increase in capital investments, ROA of manufacturing firms is expected to decrease in the year of investment, but to increase in the year after investment, while holding firm size, leverage, and total asset turnover constant. We can see that total asset turnover (TAT), as additional control variable, has a positive effect on ROA (0.928) and statistically significant, at level 0.05. This also can be considered to be a reasonable result, since total asset turnover, as an efficiency measure, shows how firm uses its assets in generating revenue, where higher value of this ratio indicates a better managing of firm's assets. This can imply that manufacturing firms in Serbia manage their assets effectively. A positive relationship between total asset turnover and profitability has been proven in many studies (see, e.g., Dencic-Mihajlov [55]). In this particular model, the effect of firm size and leverage, as control variables, is statistically insignificant and still negative.

Result 4: Model 4 provides evidence that CI has a negative effect on ROA (−0.810) and CI_LAG has a positive effect on ROA (0.081), also with statistically significant coefficients, at level 0.001. This model again confirms our both hypotheses and indicates that for certain increase in capital investments, ROA of manufacturing firms is expected to decrease in the year of investment, but to increase in the year after investment, while holding firm size, leverage, total asset turnover, and asset tangibility constant. Tangibility (TANG), as additional control variable, has a positive effect on ROA (0.209) and statistically significant, at level 0.05. Although there are divided opinions how tangibility should affect profitability, considering the negative effects of amortization costs, this result can be reasonable, since, according to Bhuta et al. [56], firm with large amount of fixed asset tends to be more profitable because of increasing its future assets value. Similarly, Al-Jafari et al. [57], in their study found a positive relationship between tangibility and profitability. Moreover, we can see that in this particular model, the effect of total asset turnover, as a control variable, on profitability is still positive (1.969) and statistically significant, at level 0.05. The effect of firm size and leverage, as control variables, remain negative and statistically insignificant.

In addition to these regression results, we can also see that R-sqr becomes higher by adding a control variable, from 0.067 to 0.114, but still remain very low. This does not instantly indicate that model is not good, but rather that a predictability of the model is low, which is a very common, especially in the cases where is hard to predict behavior of some entities, as in social and economic areas. According to Kutner et al. [58], there are three misunderstandings regarding R-sqr: (1) high coefficient of determination indicates that useful predictions can be made (arises because R-sqr measures only a relative reduction from the total variation and provides no information about absolute precision for estimating a mean response or predicting a new observation), (2) high coefficient of determination indicates that the estimated regression line is a good fit, and (3) low coefficient of determination indicates that X and Y are not related (the last two arise because R-sqr measures the degree of linear association between X and Y, whereas the actual regression relationship may be curvilinear).

To summarize, all four models formed by hierarchical regression (adding internal control variables, one by one) and presented in Table 5 confirm our main research hypotheses, but with different statistical significance results. More precisely, the results in Table 5 provide evidence that for certain increase in capital investments, ROA of manufacturing firms is expected to decrease in the year of investment, but to increase in the year after investment, while holding firm size, leverage, total asset turnover, and asset tangibility constant, and controlling for time-fixed effects as well. Our results support the findings from researchers such as Taipi and Ballkoci [33], Sudiyatno et al. [34], Pandya [35], who found a positive effect of capital investments on profitability, measured by return on assets. Moreover, our results support and complement the findings from Aljinović Barać and Muminović [20], who found, on the case of dairy processing industry in Slovenia, Croatia, and Serbia, a negative effect of capital investments on the short-term profitability, also expressed by return on assets, for which, according to the authors, a possible explanation can be found in the time lag between the moment of investment and the moment in the future when investment will generate the profit. Although other researchers have used different measures of profitability in their studies, we can say that in general, the results of this study also support the findings from, for example, Grazzi et al. [3], Aw et al. [22], Fama and French [25], Yu et al. [26], Lööf and Heshmati [27], Johansson and Lööf [28], Amoroso et al. [31], Curtis et al. [32], who found a positive relationship between capital investments and profitability.

Table 5. Pooled OLS regression results.

Variable	Model 1 b/se	Model 2 b/se	Model 3 b/se	Model 4 b/se
CI	−0.272	−0.815 ***	−0.826 ***	−0.810 ***
	(0.17)	(0.10)	(0.09)	(0.10)
CI_LAG	0.101 ***	0.086 ***	0.083 ***	0.081 ***
	(0.02)	(0.02)	(0.02)	(0.02)
SIZE	−0.044 ***	−0.046 **	−0.033	−0.023
	(0.01)	(0.01)	(0.02)	(0.02)
LEV		−0.020	−0.039	−0.046
		(0.03)	(0.03)	(0.03)
TAT			0.928 *	1.969 *
			(0.43)	(0.79)
TANG				0.209 *
				(0.10)
constant	0.354	0.711 **	−0.365	−1.257
	(0.20)	(0.26)	(0.66)	(1.00)
YEAR dummies	Yes	Yes	Yes	Yes
N	58	56	56	56
R-sqr	0.067	0.101	0.104	0.114
df	57	55	55	55

Notes: Pooled OLS regression with Driscoll–Kraay standard errors. Four models formed by hierarchical regression (adding internal control variables, one by one). ROA as dependent variable. Standard errors in parentheses. Significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

6. Conclusions

The findings of this study confirmed our main research hypotheses and empirical expectation that relationship between capital investments and firm performance should be positive because of the definition, nature, and time aspect of capital investments—they probably bring losses to the firm in the short term, but they should increase firm performance in the long term. Accordingly, we have indeed shown that capital investments have a negative effect on the firm performance in the short term, but positive effect on the firm performance in the long term. More precisely, we found, in our panel data set, using pooled OLS regression, statistically significant effect of capital investments on firm performance, measured by return on assets, and considering both short-term and long-term aspects, while controlling for time-fixed effects and certain internal factors, such as firm size, leverage, total asset turnover, and asset tangibility.

The results of this research can contribute to the benefit of manufacturing firms, considering that capital investments have an important role in their sustainable development. They can be used by managers of manufacturing firms as a helpful tool while making strategic and investment decisions. These results also support the general fiscal policy which assumes that capital investments have a central role in stimulating growth and that capital investments causes better performance. Generally, the implication of our research is that the state governments, and especially government in Serbia where all analyzed firms are from, should encourage and support capital investment activities to ensure economic sustainability, while manufacturing firms, especially in Serbia, should invest more in sustainable production projects—which should be profitable, not just the path to insolvent borrowing.

This research, however, has some limitations. First, because of the lack of data, this study does not include factors such as, for example, particular type of manufacturing industry, state, or private ownership of the firm, exporter or importer firm, or other firm characteristics, which would help us to understand the relationship between capital investments and firm performance in a more comprehensive way. Second, the measurement of capital investment should also include amortization costs, but again, lack of data prevented inclusion of this component. Since this topic is, in general, poorly covered by the literature concerning the regional aspects, it could also be interesting to expand the research and see how capital investments, in interaction with geographical characteristics, affect firms' performance in different regions and possibly over a longer period of time. However, most of these factors require a larger amount of data, which lead us to the sample size as a third limitation of this study. The results could be affected by sample size, and a larger one would, surely, decrease the likelihood of skewing the results, which would increase the power of the study. Nevertheless, these limitations can be a solid ground for the future research directions.

Author Contributions: Conceptualization, V.G.; Formal analysis, V.G. and B.M.; Methodology, V.G., B.M. and M.R.; Resources, V.G.; Software, V.G.; Supervision, B.M. and M.R.; Validation, B.M., M.R., J.Š. and M.L.; Visualization, V.G.; Writing—original draft, V.G.; Writing—review and editing, V.G., B.M., M.R., J.Š. and M.L. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A. Hausman, Breusch and Pagan Lagrangian multiplier, serial correlation, heteroscedasticity and cross-sectional dependence tests.

Table A1. Hausman test for fixed effects and random effects.

	Coefficients			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
Variable	**fixed**	**random**	**Difference**	**S.E.**
CI	−0.796	−0.810	0.014	0.128
CI_LAG	0.074	0.081	−0.006	0.035
SIZE	−0.298	−0.023	−0.275	0.274
LEV	−0.172	−0.046	−0.127	0.096
TAT	6.418	1.969	4.449	2.418
TANG	0.317	0.209	0.108	0.207

b = consistent under Ho and Ha; obtained from xtreg. B = inconsistent under Ha, efficient under Ho; obtained from xtreg. Test: Ho: difference in coefficients not systematic. chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 14.71; Prob>chi2 = 0.4727.

Table A2. Breusch and Pagan Lagrangian multiplier test for random effects.

Variable	Var	sd = sqrt (Var)
ROA	1.000	1.000
e	0.946	0.973
u	0.000	0.000

ROA[ID,t] = Xb + u[ID] + e[ID,t]. Test: Var(u) = 0. chibar2(01) = 0.00. Prob > chibar2 = 1.0000.

Table A3. Test for serial correlation and heteroscedasticity in panel data.

Serial correlation/ Heteroscedasticity		Wooldrige test. H0: no first-order autocorrelation	Breusch-Pagan/Cook-Weisberg H0: Constant variance
Serial correlation	F (1,48)	6.202	
	Prob > F	0.016	
Heteroscedasticity	chi2 (1)		9.57
	Prob > chi2		0.002

Table A4. CD-test for cross-sectional dependence in panel data.

Variable	CD-test	*p*-value	average joint T	Mean	mean abs
ROA	4.221	0	6.28	0.03	0.3
CI	22.525	0	8.93	0.18	0.32
CI_LAG	23.535	0	7.93	0.2	0.35
SIZE	23.716	0	8.11	0.19	0.56
LEV	3.059	0.002	6.83	0.03	0.42
TAT	2.724	0.006	8.11	0.02	0.41
TANG	6.474	0	8.11	0.05	0.48

Notes: Under the null hypothesis of cross-section independence, CD ~ N(0,1). P-values close to zero indicate data are correlated across panel groups.

Appendix B. Fixed effects and random effects regression results.

Table A5. Fixed effects regression results.

Variable	Model 1 b/se	Model 2 b/se	Model 3 b/se	Model 4 b/se
CI	−0.196	−0.785 **	−0.749 **	−0.796 **
	(0.18)	(0.25)	(0.27)	(0.27)
CI_LAG	0.089 *	0.074 *	0.072	0.074
	(0.03)	(0.03)	(0.04)	(0.04)
SIZE	−0.288	−0.520 **	−0.267	−0.298
	(0.18)	(0.15)	(0.19)	(0.19)
LEV		−0.172	−0.186	−0.172
		(0.11)	(0.11)	(0.11)
TAT			5.973 *	6.418 *
			(2.58)	(2.42)
TANG				0.317
				(0.16)
constant	2.846	5.371 ***	−3.177	−2.990
	(1.65)	(1.43)	(3.99)	(3.94)
YEAR dummies	Yes	Yes	Yes	Yes
N	58	56	56	56
R-sqr	0.076	0.125	0.140	0.146
df	57	55	55	55

Notes: Fixed effects regression with Driscoll–Kraay standard errors. Four models formed by hierarchical regression (adding internal control variables, one by one). ROA as dependent variable. Standard errors in parentheses. Significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A6. Random effects regression results.

Variable	Model 1 b/se	Model 2 b/se	Model 3 b/se	Model 4 b/se
CI	−0.272	−0.815 *	−0.826 **	−0.810 *
	(0.21)	(0.32)	(0.32)	(0.33)
CI_LAG	0.101 *	0.086 *	0.083 *	0.081
	(0.04)	(0.04)	(0.04)	(0.04)
SIZE	−0.044 *	−0.046	−0.033	−0.023
	(0.02)	(0.02)	(0.03)	(0.03)
LEV		−0.020	−0.039	−0.046
		(0.03)	(0.03)	(0.04)
TAT			0.928	1.969
			(0.91)	(1.02)
TANG				0.209 **
				(0.08)
constant	0.354	0.711	−0.365	−1.257
	(0.47)	(0.45)	(1.13)	(1.22)
YEAR dummies	Yes	Yes	Yes	Yes
N	58	56	56	56
R-sqr	0.067	0.101	0.104	0.114
df	57	55	55	55

Notes: Random effects Generalized Least Squares (GLS) regression with clustered standard errors. Four models formed by hierarchical regression (adding internal control variables, one by one). ROA as dependent variable. Standard errors in parentheses. RE coefficients match with pooled OLS coefficients because "rho=0" (variability is mainly within firms, not between firms). Significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

References

1. Eurostat. Available online: https://ec.europa.eu/eurostat/home (accessed on 28 October 2019).
2. Lev, B.; Thiagarajan, S.R. Fundamental information analysis. *J. Account. Res.* **1993**, *31*, 190–215. [CrossRef]
3. Grazzi, M.; Nadia, J.; Tania, T. Dynamics of investment and firm performance: Comparative evidence from manufacturing industries. *Empir. Econ.* **2016**, *51*, 125–179. [CrossRef]
4. Shpak, N.; Sorochak, O.; Hvozd, M.; Sroka, M. Risk evaluation of the reengineering projects: A case study analysis. *Sci. Ann. Econ. Bus.* **2018**, *65*, 215–226. [CrossRef]
5. US. Department of Commerce. Sustainable Manufacturing Initiatives (SMI): A True Public–Private Dialogue. 2010. Available online: https://www.oecd.org/sti/ind/45010349.pdf (accessed on 9 September 2019).
6. Bansal, P. Evolving sustainably: A longitudinal study of corporate sustainable development. *Strateg. Manag. J.* **2005**, *26*, 197–218. [CrossRef]
7. Power, L. The missing link: Technology, investment, and productivity. *Rev. Econ. Stat.* **1998**, *80*, 300–313. [CrossRef]
8. Grabowski, H.G.; Dennis, C.M. Managerial and stockholder welfare models of firm expenditures. *Rev. Econ. Stat.* **1972**, *54*, 9–24. [CrossRef]
9. Nilsen, Ø.A.; Raknerud, A.; Rybalka, M.; Skjerpen, T. Lumpy investments, factor adjustments, and labour productivity. *Oxf. Econ. Pap.* **2008**, *61*, 104–127. [CrossRef]
10. Shima, K. Lumpy capital adjustment and technical efficiency. *Econ. Bull.* **2010**, *30*, 2817–2824.
11. Titman, S.; Wei, K.J.; Feixue, X. Capital investments and stock returns. *J. Financ. Quant. Anal.* **2004**, *39*, 677–700. [CrossRef]
12. Jovanovic, B.; Peter, L. Rousseau. Extensive and intensive investment over the business cycle. *J. Political Econ.* **2014**, *122*, 863–908. [CrossRef]
13. Yao, T.; Yu, T.; Zhang, T.; Chen, S. Asset growth and stock returns: Evidence from Asian financial markets. *Pac. Basin Financ. J.* **2011**, *19*, 115–139. [CrossRef]
14. Sircar, S.; Turnbow, J.L.; Bordoloi, B. A framework for assessing the relationship between information technology investments and firm performance. *J. Manag. Inf. Syst.* **2000**, *16*, 69–97. [CrossRef]
15. Singh, N.; Ma, J.; Yang, J. Optimizing environmental expenditures for maximizing economic performance. *Manag. Decis.* **2016**, *54*, 2544–2561. [CrossRef]

16. Aktas, N.; Croci, E.; Petmezas, D. Is working capital management value-enhancing? Evidence from firm performance and investments. *J. Corp. Financ.* **2015**, *30*, 98–113. [CrossRef]
17. Alipour, M.; Mohammadi, M.F.S.; Derakhshan, H. Determinants of capital structure: An empirical study of firms in Iran. *Int. J. Law Manag.* **2015**, *57*, 53–83. [CrossRef]
18. Jindrichovska, I.; Ugurlu, E.; Kubickova, D. Changes in capital structure of Czech SMEs: A dynamic panel data approach. *Ekon. Manag.* **2013**, *3*, 19.
19. Fernández-Rodríguez, E.; García-Fernández, R.; Martínez-Arias, A. Influence of Ownership Structure on the Determinants of Effective Tax Rates of Spanish Companies. *Sustainability* **2019**, *11*, 1441. [CrossRef]
20. Aljinović Barać, Ž.; Muminović, S. The impact of capital investments on dairy processing industry features: Evidence from Slovenia, Croatia and Serbia. *Mljekarstvo Časopis Za Unaprjeđenje Proizv. I Prerade Mlijeka* **2013**, *63*, 140–149.
21. Ching-Hai, J.; Hsiang-Lan, C.; Yen-Sheng, H. Capital expenditures and corporate earnings. *Manag. Financ.* **2006**, *32*, 853.
22. Aw, B.Y.; Mark, J.R.; Daniel, Y.X. R&D investments, exporting, and the evolution of firm productivity. *Am. Econ. Rev.* **2008**, *98*, 451–456.
23. Gradzewicz, M. What happens after an investment spike-investment events and firm performance. *J. Bus.* **2020**. [CrossRef]
24. Namiotko, V.; Baležentis, T. Dynamic Efficiency under Investment Spikes in Lithuanian Cereal and Dairy Farms. *Econ. Sociol.* **2017**, *10*, 33. [CrossRef]
25. Fama, E.F.; Kenneth, R.F. The corporate cost of capital and the return on corporate investment. *J. Financ.* **1999**, *54*, 1939–1967. [CrossRef]
26. Yu, X.; Dosi, G.; Grazzi, M.; Lei, J. Inside the virtuous circle between productivity, profitability, investment and corporate growth: An anatomy of Chinese industrialization. *Res. Policy* **2017**, *46*, 1020–1038. [CrossRef]
27. Lööf, H.; Heshmati, A. Investment and performance of firms: Correlation or causality? *Corp. Ownersh. Control* **2008**, *6*, 268–282.
28. Johansson, B.; Lööf, H. The impact of firm's R&D strategy on profit and productivity. *Work. Pap. Ser. Econ. Inst. Innov. R. Inst. Technol.* **2008**, *156*, 28.
29. Licandro, O.; Maroto, R.; Luis, A.P. Innovation, investment and productivity: Evidence from Spanish firms. *EUI Work. Pap. Eco* **2004**, *7*, 38.
30. Kapelko, M.; Lansink, A.O.; Stefanou, S.E. Analyzing the impact of investment spikes on dynamic productivity growth. *Omega* **2015**, *54*, 116–124. [CrossRef]
31. Amoroso, S.; Moncada-Paternò-Castello, P.; Vezzani, A. R&D profitability: The role of risk and Knightian uncertainty. *Small Bus. Econ.* **2017**, *48*, 331–343.
32. Curtis, A.; McVay, S.E.; Toynbee, S. The changing implications of research and development expenditures for future profitability. *Available SSRN* **2018**, *2402886*, 49.
33. Ester, T.; Ballkoci, V. Capital Expenditure and Firm Performance Evidence from Albanian Construction Sector. *Eur. Sci. J.* **2017**, *13*, 231–238.
34. Sudiyatno, B.; Puspitasari, E.; Kartika, A. The company's policy, firm performance, and firm Value: An empirical research on Indonesia Stock Exchange. *Am. Int. J. Contemp. Res.* **2012**, *2*, 30–40.
35. Pandya, B. Impact of capital expenditure on firm's financial performance: A Study of Select Infrastructure Companies in India. *NICE J. Bus.* **2017**, *12*, 75–83.
36. Mithas, S.; Ali, R.T.; Bardhan, I.; Goh, J.M. Information technology and firm profitability: Mechanisms and empirical evidence. *MIS Q.* **2012**, *36*, 205–224. [CrossRef]
37. Arvanitis, S.; Penede, M.; Rammer, C.; Stucki, T.; Woerter, M. Development and utilization of energy-related technologies, economic performance and the role of policy instruments. *J. Clean. Prod.* **2017**, *159*, 47–61. [CrossRef]
38. Bostian, M.; Färe, R.; Grosskopf, S.; Lundgren, T. Environmental investment and firm performance: A network approach. *Energy Econ.* **2016**, *57*, 243–255. [CrossRef]
39. Lee, N.; Lee, J. External Financing, R&D Intensity, and Firm Value in Biotechnology Companies. *Sustainability* **2019**, *11*, 4141.
40. Götze, U.; Northcott, D.; Schuster, P. Investment Appraisal. In *Methods and Models*; Springer: Berlin/Heidelberg, Germany, 2008; p. 3.
41. Hagel, J.; Brown, J.S.; Davison, L. The best way to measure company performance. *Harv. Bus. Rev.* **2010**, *4*.

42. Serbian Busines Register Agency. Available online: https://www.apr.gov.rs/home.1435.html (accessed on 9 September 2019).
43. Frees, E.W. Fixed Effects Models. In *Longitudinal and Panel Data: Analysis and Applications in the Social Sciences*; Cambridge University Press: Cambridge, UK, 2004; pp. 20–22.
44. Drukker, D.M. Testing for serial correlation in linear panel-data models. *Stata J.* **2003**, *3*, 168–177. [CrossRef]
45. De Jager, P. Panel data techniques and accounting research. *Meditari Account. Res.* **2008**, *16*, 53–68. [CrossRef]
46. Baltagi, B.H. *Econometric Analysis of Panel Data*, 3rd ed.; John Wiley & Sons: Hoboken, NJ, USA, 2005; p. 79.
47. De Hoyos, R.E.; Sarafidis, V. Testing for cross-sectional dependence in panel-data models. *Stata J.* **2006**, *6*, 482–496. [CrossRef]
48. Sarafidis, V.; Wansbeek, T. Cross-sectional dependence in panel data analysis. *Econom. Rev.* **2012**, *31*, 483–531. [CrossRef]
49. Pesaran, M.H. General diagnostic tests for cross section dependence in panels. *IZA Discuss. Pap.* **2004**, *1240*, 41.
50. Pesaran, M.H. Testing weak cross-sectional dependence in large panels. *Econom. Rev.* **2015**, *34*, 1089–1117. [CrossRef]
51. Hoechle, D. Robust standard errors for panel regressions with cross-sectional dependence. *Stata J.* **2007**, *7*, 281–312. [CrossRef]
52. Kartikasari, D.; Merianti, M. The effect of leverage and firm size to profitability of public manufacturing companies in Indonesia. *Int. J. Econ. Financ. Issues* **2016**, *6*, 409–413.
53. Pervan, M.; Višić, J. Influence of firm size on its business success. *Croat. Oper. Res. Rev.* **2012**, *3*, 213–223.
54. Ahmad, N.; Salman, A.; Shamsi, A. Impact of financial leverage on firms' profitability: An investigation from cement sector of Pakistan. *Res. J. Financ. Account.* **2015**, *6*, 1697–2222.
55. Dencic-MIihajlov, K. Profitability during the financial crisis: Evidence from the regulated capital market in Serbia. *South East. Eur. J. Econ.* **2015**, *12*, 7–33.
56. Bhutta, N.T.; Hasan, A. Impact of firm specific factors on profitability of firms in food sector. *Open J. Account.* **2013**, *2*, 19. [CrossRef]
57. Al-Jafari, M.K.; Samman, A.H. Determinants of profitability: Evidence from industrial companies listed on Muscat Securities Market. *Rev. Eur. Stud.* **2015**, *7*, 303. [CrossRef]
58. Kutner, M.H.; Nachtsheim, C.J.; Neter, J.; Li, W. *Applied Linear Statistical Models*; McGraw-Hill Irwin: New York, NY, USA, 2005.