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Which Determinants Matter for Working Capital Management in Energy Industry? The Case of European Union Economy

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Abstract: The main purpose of the paper is to identify firm-, industry- and country-specific determinants of working capital management (WCM) in energy industry. The empirical research is based on 6122 EU companies operating in the years 2011–2018. The influence of internal factors on variables describing WCM (cash conversion cycle—CCC, financial liquidity—LIQ and level of working capital—WC) were identified. The factors included: size of the company (positive effect), its growth, tangibility and indebtedness (negative effect). Cash flow had a positive effect on CCC and a negative effect on LIQ and WC. The influence of industry-specific factors were also found. Companies applied similar strategies in CCC and LIQ management, following their industry averages. Measures of WCM decreased under the influence of an increase in average trade payables in the industry. Following country-specific factors were found to be significant: (i) growth of GDP and strength of legal rights had negative influence on all measures of WCM, (ii) unemployment positively affects LIQ and WC and negatively CCC, (iii) an increase in the share of renewable energy sources caused a decrease in all WCM measures, while (iv) with an increase in energy consumption, CCC and WC increased.

Keywords: working capital management; liquidity; cash conversion cycle; energy industry; European Union

1. Introduction

The years 2021 and 2022 have been a period of fast-developing crisis in energy markets around the world. This crisis, which has its roots in the COVID-19 pandemic, has been reflected in rapidly rising energy prices, which in turn have been affecting all energy consumers (from industrial companies to individual customers) [1]. In this context, it had and will have serious consequences for the entire economy.

In the European Union countries, the energy market is strictly regulated. The reason for the regulation at the level of the community and its members is the need to ensure the energy security for the economy by controlling the production and distribution of energy. A common EU energy policy was launched at the beginning of this century. It aimed to harmonize energy production regulations and to establish the same competences for national regulators. Environmental goals also play a significant role in the EU’s energy policy and require technological development with the increasing use of renewable energy sources [2,3]. At the same time, market demonopolization and liberalization are becoming priorities of EU energy policy [4,5]. Thus, on the one hand, a common policy leads to harmonization of the conditions for the operations of the energy sector, while on the other hand, it enables considerable differentiation in line with the needs and possibilities of producers and consumers.

Energy prices are primarily determined by the costs of its production, that is, firstly, the price of the raw material and secondly, the efficiency of its processing. In times of increasing use of renewable energy sources, the second component of the price is becoming...
increasingly important. Hence, working capital management (WCM) is receiving increasing attention in energy companies.

WCM is related to determining the relationship between current assets and current liabilities and the rate at which they are rotated in order to earn adequate profit while maintaining liquidity. When compared to the study of long-term decisions (investment and capital structure), the research of WCM does not have a long tradition, however, it is gaining importance day by day [6,7]. Analyzing 92 articles from 1980 to 2012, Singh and Kumar [8] showed that the most common studies concerned: (i) the impact of WCM on corporate profitability and (ii) determinants of WCM. This was also confirmed by Prasad et al. [9] by analyzing the content of all articles on WCM highlighted by Google Scholar up to 2018 with a citation count of more than 50. Interestingly, among the analyzed articles, none referred to the energy industry. The papers by Zimon [10], Lifland [11], Mbawuni et al. [12], Masinde and Ochieng [13] and Khan and Yahya [14] are among the few WCM studies in the energy sector and address different aspects of the relationship between corporate performance and WCM. Among them, there is a lack of papers dealing directly with the determinants of WCM and this fact has been the main challenge in our study. Learning about these determinants shall not only enrich the empirical scientific facts about the energy industry, but also provides important information to corporate managers and state regulators for making decisions that have a real impact on WCM.

The main aim of our paper has been to identify the determinants of WCM in the energy industry at the firm, industry and country level. Companies from 25 European Union countries were investigated. The results have been discussed in relation to the determinants identified in other studies.

Our study makes several contributions to knowledge. The new findings mainly concern the identification of WCM determinants in the energy industry. As a measure of WCM cash conversion cycle, financial liquidity and level of working capital were applied. Among firm-specific determinants, firm size had a positive effect, while its growth, the share of fixed assets in total assets and debt had a negative effect. Cash flows had a positive effect on the length of the cash conversion cycle and a negative effect on financial liquidity and the level of working capital. The influence of industry-specific factors were also found. Companies applied similar strategies in managing the cash conversion cycle and maintaining financial liquidity, following their industry averages. All measures of working capital management decreased under the influence of an increase in average trade payables in the industry. Among the country-specific factors, the following were found to be significant: (i) gross domestic product growth and strength of legal rights had unambiguously negative effects on working capital management measures, (ii) unemployment positively affected liquidity and the size of working capital; in the case of the length of the cash conversion cycle, this relationship was negative, (iii) an increase in the share of renewable energy sources in a given country caused a decrease in the values of all working capital management measures, while (iv) with an increase in energy consumption, the length of the cash conversion cycle and working capital also increased.

The paper has been divided into six parts. It begins with the characteristic and the theoretical justification of the determinants of WCM mentioned in the literature concerning previous empirical research. In this chapter, we have also formulated the research hypotheses. The second part has been devoted to the description of the research material and the applied method. The third part presents the results of the conducted empirical study. The fourth part is the robustness check. The paper concludes with a discussion and conclusions.

2. Literature Review and Research Hypotheses
2.1. Theories of Working Capital Management

WCM involves making decisions regarding the level of current assets (inventories, receivables and cash) in connection with current liabilities (short-term debt). The domain of WCM also includes controlling the speed of current asset turnover and the timeliness of liability repayment [15,16].
WCM starts with the decision to purchase materials. These are then transformed into finished products and kept in stock until sold. This period is called the inventory turnover cycle (ITC). The sale of products is followed by a period of waiting for payment of receivables (average collection period—ACP). Usually, accounts payable (APP) is also paid by this time. During the time equal to ITC + ACP—APP, the company is operating with a cash deficit. This period, called cash conversion cycle (CCC), is considered in the literature as the most important measure of WCM [17–19].

CCC can be financed by a company using (i) short-term bank loans and/or (ii) capital employed (equity + long-term debt). The value of current assets financed by capital employed is the value of working capital (WC). The size of the WC and the length of the CCC shape the company’s ability to repay its current liabilities, i.e., its liquidity (LIQ) [20–22]. These three measures (CCC, WC and LIQ), therefore, form a set of indicators that describe the quality of WCM.

Three theories are most commonly used to explain WCM in an enterprise [19,23]: (i) the CCC theory, (ii) the operating cycle theory and (iii) the pecking order theory. The CCC theory refers to the shaping of the CCC by regulating the timing of the payment of accounts payable (the faster the firm pays accounts payable, the longer the CCC) and the timing of the receipt of cash from sales (the later the firm recovers the money locked up in accounts receivable, the longer the CCC) [24]. The longer the CCC, the less efficient the WCM [25–28].

The operating cycle is the sum of inventory turnover (ITC) and average collection period (ACP). The operating theory claims that companies extending payment terms to their customers increase receivables and accelerate inventory turnover [29,30]. However, this means increasing cash shortages and consequently, liquidity risk [31]. According to the pecking order theory, firms apply sources of finance according to a certain order [32]: (i) retained earnings, (ii) debt and (iii) new equity. WC financing is mainly done from retained earnings, which means that it is a direction that competes with investing in fixed assets.

2.2. Firm-Specific Determinants of Working Capital Management

An analysis of theories attempting to explain WCM leads to the conclusion that many factors can shape its performance. The first group of determinants consists of firm-specific factors that refer to the characteristics of the firm and its operations [33–36]: firm size (SIZE), its growth rate (GROW), financial surplus generated (CF), tangibility (TANG) and debt level (DR). Table A1 presents selected empirical studies in this regard.

Larger enterprises have more diversified activity. This results in a relatively smaller share of current assets in total assets than it is in the case in smaller companies. According to the operating cycle theory, this implies a faster turnover of current assets, a shorter CCC and less need for financial liquidity. The opposite direction of the relationship between firm size and WCM measures is indicated by the CCC and the pecking order theory. Larger firms, benefiting from greater access to capital, especially long-term capital, can allocate its larger amounts to WC investments, thereby lengthening the CCC and reducing liquidity risk (LIQ).

Despite the ongoing demonopolisation and liberalization of the market, the energy industry is still dominated by large companies, supported by the state, characterized by high equity capital willingly financed by banks and capital markets. A hypothesis can therefore be formulated:

**Hypothesis 1.1 (H1.1).** Firm size causes an increase in WCM measures.

This hypothesis is also supported by previous empirical studies (see Table A1).

Growth of the company (GROW) is represented by increasing sales, which means increasing inventories and receivables held. The operating cycle theory, therefore, indicates a growing CCC, which in turn should translate into increased investment in WC. A negative relationship between GROW and WCM measures can be derived from the CCC and the
pecking order theory. In the first case, fast-growing firms lengthen their liability repayment terms, shortening the CCC and lowering liquidity levels. According to the second theory, the growth of a firm requires more investment in fixed assets and thus, a competing direction of investment to WC. Most empirical studies listed in Table A1 confirm the negative dependence of WCM measures on GROW:

**Hypothesis 1.2 (H1.2).** Firm growth negatively affects WCM measures.

The positive relationship between generated cash flow and WCM measures stems from the pecking order theory. This is because it is the primary source of funding for a company’s operations, including WCM. An opposite relationship can be derived from the CCC theory, according to which the financial surplus is primarily used to repay short-term bank loans, thus reducing the ability to finance the longer CCC. A positive relationship between cash flow and WCM measures was detected by Baños-Caballero et al. [37], Hill et al. [38] and Sardo and Serrasqueiro [39], while a negative relationship was found by Moussa [33], Singh and Kumar [7], Baños-Caballero et al. [34]. The empirical findings are therefore not conclusive. However, in the energy industry, given the wide access to capital (including long-term capital), repayments of short-term financing do not seem urgent. Thus:

**Hypothesis 1.3 (H1.3).** Financial surplus is positively related to measures of WCM.

Fixed assets are intrinsically an investment competitor to WCM. In this case, all three theories describing WCM predict negative relationship between TANG and WCM. This is also confirmed by studies by Drever and Hutchinson [40], Baños-Caballero et al. [37], Singh and Kumar [7], Wasiuzzaman [22] and Sharma et al. [41]:

**Hypothesis 1.4 (H1.4).** An increase in the share of fixed assets in total assets negatively affects WCM measures.

The capital structure of a company is one of the most important determinants of WCM. An increase in long-term debt in the financing of the company increases WC, enables the extension of CCC and improves liquidity. According to the pecking order theory and the CCC theory, short-term bank loans increase the possibility of financing the CCC, causing its extension and improving LIQ. In the case of trade liabilities, the relationship is the opposite. However, for companies with a high level of debt, as indicated by the pecking order theory, the sensitivity to the demand for WC increases. Therefore these firms seek to increase WCM efficiency and shorten CCC. High debt also implies higher liquidity risk (lower LIQ). Only two of the studies listed in Table A1 empirically document a positive relationship between WCM and DR. Most confirm the opposite direction of the relationship:

**Hypothesis 1.5 (H1.5).** WCM is negatively correlated with firm debt.

2.3. Industry Level of Factors Influencing Working Capital Management

The results of the studies summarized in Table A1 also prove that an important differentiating feature of WCM measures is the industry to which the firm belongs. This confirms the well-established view in the literature that, in addition to firm-specific determinants of WCM, there are factors arising from industry specificity [33–36]. However, the identification of these determinants which were studied, among others, by Filbeck and Krueger [42] and Kieschnick et al. [27] hitherto has remained at an explanatory stage. The authors of both studies observed that the variability of WCM measures of firms within an industry was small compared to the differences identified between industries. Therefore, it can be assumed that within an industry, firms follow similar strategies in the direction of average WCM measures [43]:
Hypothesis 2.1 (H2.1). A firm’s WCM is positively related to the median of its industry measures.

There is also evidence, e.g., Niskanen and Niskanen [44], that within an industry, firms have similar policies of financing current assets with trade credit. Under this assumption, WCM measures should depend on industry averages of these quantities:

Hypothesis 2.2 (H2.2). A firm’s WCM depends on the average measures of current assets and trade liabilities in a given industry.

2.4. Country-Specific WCM Determinants

The third group of WCM determinants is formed by the characteristics of the economy in which enterprises operate. They are relatively rarely studied. However, the results of studies conducted, among others, by Baños-Caballero et al. [36], Koralun-Bereznicka [23], Cetenak et al. [45], Moussa [33] and Dang [46] confirm that:

Hypothesis 3 (H3). WCM depends on the country (economy) in which the company operates.

Most of the abovementioned authors have argued the dependence of WCM on macroeconomic factors (mainly GDP, inflation, exchange rates), obtaining very different results (positive dependence, negative dependence or no dependence). Cetenak et al. [45] extended his study to institutional factors. He observed increasing measures of WCM with increasing levels of rule of law. He diagnosed a negative relationship related to access to credit.

The first symptom of a worsening economic situation (declining GDP dynamics) is a prolonged period of the repayment of receivables, which, if their level is rising, also means a prolongation of the period of liabilities repayment and, as a result, worsening of the effectiveness of WCM (the operating cycle theory). Reduced possibilities of financing WCM (with credit and financial surplus) result in shortening of CCC and a deterioration of liquidity. This implies a positive relationship between WCM and GDP. The opposite relationship (negative) is explained by the pecking order theory. In the case of improving economic conditions (rising GDP), the company engages retained earnings and borrowed debt mainly in fixed asset investments. This results in shortening of the CCC and a deterioration of liquidity.

In the event of an economic downturn, the energy industry may temporarily face difficulties in collecting debts. However, as a strategic sector, it should not experience difficulties in accessing capital. At the same time, economic prosperity favors infrastructure investments in this sector, which compete with WCM. Thus:

Hypothesis 3.1 (H3.1). GDP growth negatively affects WCM measures.

Research conducted, among others, by Lin [47] has shown that WCM is significantly dependent on labor costs. The higher they are, the less resources are allocated to invest in WCM. This implies that higher unemployment resulting in lower labor costs should increase WCM efficiency. Energy companies remain a significant employer in EU countries, so the hypothesis can be formulated that:

Hypothesis 3.2 (H3.2). An increase in unemployment has a positive effect on WCM measures.

By state and international standards, the energy industry is a highly regulated industry. This means that a significant institutional factor shaping WCM may be the strength of legal rights. The higher the standards and legal culture in a country, the higher the degree of protection of the rights of energy suppliers, but also of energy consumers. Lower systematic risk means better opportunities to invest in WCM. A positive relationship between the strength of legal rights and WCM level was detected by Cetenak et al. [44]. On the other hand, higher protection of creditors’ rights and the level of legal culture may encourage firms
to be more risky in working capital management, especially in highly regulated sectors. Hence, the direction of the effect of strength of legal rights on WCM measures in the energy industry remains undefined.

**Hypothesis 3.3 (H3.3).** The level of strength of legal rights significantly affects WCM measures.

Supranational regulations in the European Union concerning the directions of development of the energy industry [48] result in: (i) energy consumption and (ii) the share of renewable energy sources becoming the important elements shaping the efficiency of enterprises of this industry at the national level. In the first case, EU directives set limits on the energy intensity of the economies of its members. The second factor is primarily the obligatory increase in the share of renewable energy sources in energy production. Both factors have not been analyzed so far in the context of WCM in the energy industry, which justifies the last two research hypotheses:

**Hypothesis 3.4 (H3.4).** WCM depends on the amount of energy consumption in a country.

**Hypothesis 3.5 (H3.5).** The WCM measures are influenced by the share of renewable energy sources used in a country.

### 3. Methodology and Research Material

#### 3.1. Research Method

Table 1 defines the variables used in the study. CCC, LIQ and WC are WCM measures, i.e., dependent variables. Items 4 to 8 are variables that are proxies for firm-specific factors. Variables 9 to 13 are assumed to be industry-specific WCM determinants. The remaining variables refer to country-specific factors of WCM.

In order to test whether and to what extent CCC, LIQ and WC depend on the country in which the companies operate, we used ANOVA analysis of variance. By grouping the empirical data of WCM measures by country, it allowed us to identify differences between the averages in these groups [49].

The impact of individual determinants on WCM measures were diagnosed using panel models:

**regression model (Ordinary Least Squares Method):**

\[
\begin{align*}
\text{CCC}_{it} & = \beta_0 + \beta_1 \text{CF}_{it} + \beta_2 \text{DR}_{it} + \beta_3 \text{SIZE}_{it} + \beta_4 \text{GROW}_{it} + \beta_5 \text{CF}_{it} + \beta_6 \text{TANG}_{it} \\
& + \beta_7 \text{IND}_\text{CCC} \mid \text{IND}_\text{CR} \mid \text{IND}_W \text{C}_{it} + \beta_8 \text{IND}_\text{CUR}_\text{ASSET}_{it} + \beta_9 \text{IND}_\text{PAYABL}_{it} + \beta_{10} \text{GDP}_\text{GROW}_{it} + \beta_{11} \text{UNEMPL}_{it} + \beta_{12} \text{Legal	extunderscore rights}_{it} + \beta_{13} \text{RE	extunderscore Share}_{it} + \beta_{14} \text{POW	extunderscore CONS}_{it} + \epsilon_{it}
\end{align*}
\]

**model with fixed effects:**

\[
\begin{align*}
\text{CCC}_{it} & = \beta_i + \beta_1 \text{CF}_{it} + \beta_2 \text{DR}_{it} + \beta_3 \text{SIZE}_{it} + \beta_4 \text{GROW}_{it} + \beta_5 \text{CF}_{it} + \beta_6 \text{TANG}_{it} + \\
& + \beta_7 \text{IND}_\text{CCC} \mid \text{IND}_\text{CR} \mid \text{IND}_W \text{C}_{it} + \beta_8 \text{IND}_\text{CUR}_\text{ASSET}_{it} + \beta_9 \text{IND}_\text{PAYABL}_{it} + \beta_{10} \text{GDP}_\text{GROW}_{it} + \\
& + \beta_{11} \text{UNEMPL}_{it} + \beta_{12} \text{Legal	extunderscore rights}_{it} + \beta_{13} \text{RE	extunderscore Share}_{it} + + \beta_{14} \text{POW	extunderscore CONS}_{it} + \mu_{it},
\end{align*}
\]

**model with random effects:**

\[
\begin{align*}
\text{CCC}_{it} & = \beta_0 + \beta_1 \text{CF}_{it} + \beta_2 \text{DR}_{it} + \beta_3 \text{SIZE}_{it} + \beta_4 \text{GROW}_{it} + \beta_5 \text{CF}_{it} + \beta_6 \text{TANG}_{it} + \\
& + \beta_7 \text{IND}_\text{CCC} \mid \text{IND}_\text{CR} \mid \text{IND}_W \text{C}_{it} + \beta_8 \text{IND}_\text{CUR}_\text{ASSET}_{it} + \beta_9 \text{IND}_\text{PAYABL}_{it} + \beta_{10} \text{GDP}_\text{GROW}_{it} + \\
& + \beta_{11} \text{UNEMPL}_{it} + \beta_{12} \text{Legal	extunderscore rights}_{it} + \beta_{13} \text{RE	extunderscore Share}_{it} + + \beta_{14} \text{POW	extunderscore CONS}_{it} + \epsilon_{it} + \mu_{it}.
\end{align*}
\]

The choice of the relevant model was based on the Breusch–Pagan and the Hausmann tests. We checked the existence of individual effects by applying the first test. If they were found, the second test was applied to identify random or fixed nature of individual effects [50]. Heteroscedasticity- and autocorrelation-consistent (HAC) standard errors
were applied to prevent misjudgment of the significance of particular variables due to the presence of heteroscedasticity and autocorrelation in the models [51]. The estimated parameters of the models were subjected to a robustness check.

Table 1. Variables used in the study.

| No. | Variable                                      | Abbreviation          | Measures                                                                 |
|-----|-----------------------------------------------|-----------------------|--------------------------------------------------------------------------|
| 1.  | Cash conversion cycle                         | CCC                   | Average collection period + Inventory cycle—Accounts payable period      |
| 2.  | Current liquidity ratio                       | LIQ                   | Current assets short-term liabilities                                     |
| 3.  | Working capital ratio                         | WC                    | Current assets—current liabilities                                       |
| 4.  | Size of the enterprise                        | SIZE                  | ln(total assets)                                                          |
| 5.  | Growth opportunities                          | GROW                  | Total assets                                                              |
| 6.  | Cash flow proxy                               | CF                    | net profit−depreciation and amortization                                  |
| 7.  | Assets structure (tangibility)                | TANG                  | Fixed assets                                                              |
| 8.  | Capital structure (total debt ratio)          | DR                    | Total debt                                                               |
| 9.  | Cash conversion cycle median in country/industry | IND_CCC               | Median of CCC in particular country                                       |
| 10. | Current ratio median in country/industry      | IND_LIQ               | Median of LIQ in particular country                                       |
| 11. | Working capital median in country/industry    | IND_WC                | Median of WC in particular country                                        |
| 12. | Current assets median in country/industry     | IND_CUR_ASSET         | Median of current assets in particular country                            |
| 13. | Trade payables median in country/industry     | IND_PAYABL            | Median of trade payables in particular country                            |
| 14. | Annual growth of GDP                          | GDP_GROW              | GDP growth (annual %)                                                     |
| 15. | Rate of unemployment                          | UNEMPL                | Unemployment rate (%)                                                     |
| 16. | Strength of legal rights index                | Legal_rights          | 0 = weak to 12 = strong                                                   |
| 17. | Final energy consumption (in TOE) per 1000 inhabitants | POW_CONS               | Final energy consumption × 1000                                         |
| 18. | Share of renewable energy in gross final energy consumption | RE_Share             | Percentage RE share                                                       |

Source: Own elaboration based on studies listed in Table A1 and databases [49–51].

3.2. Data Description

The data sources for the empirical study are as follows: (i) ORBIS—database provided by Bureau Van Dijk including about 40 million corporate financial statements from all over the world, (ii) World Bank database [52], IMF database [53] and Eurostat [54]. From these databases, we extracted data on macroeconomic and institutional characteristics of EU countries.

The research sample included enterprises classified according to NACE Rev. 2 in section D and item 35.1 (electric power generation, transmission and distribution), for which selected financial data (fixed assets, current assets, depreciation, revenues, operating income) were available throughout the adopted research period (2011–2018). Taking into account the above criteria, the extracted data concerned companies from the 25 EU countries. Then, in order to limit the impact of outliers, we performed 98% winsorization of the data. In the end, the research sample contained data of 6122 companies with a total number of observations of 48,976.
The macroeconomic and institutional data collected covered all countries included in the study and the entire study period. The exception was the strength of legal rights index variable, which covered the period 2013–2018.

Table 2 presents descriptive statistics of all variables calculated for data collected.

| No. | Variable         | Mean   | Median | Std. Dev. | Min. | Max. |
|-----|-----------------|--------|--------|-----------|------|------|
| 1.  | CCC             | 32.600 | 23.119 | 77.586    | −244.280 | 290.060 |
| 2.  | LIQ             | 3.833  | 1.395  | 8.424     | 0.037   | 123.330 |
| 3.  | WC              | 0.055  | 0.047  | 0.247     | −0.773 | 0.804 |
| 4.  | SIZE            | 7.915  | 7.697  | 1.961     | 3.522   | 14.385 |
| 5.  | GROW            | −0.013 | −0.041 | 0.158     | −0.424 | 1.708 |
| 6.  | CF              | 0.090  | 0.083  | 0.058     | −0.054 | 0.303 |
| 7.  | TANG            | 0.733  | 0.821  | 0.241     | 0.005   | 0.991 |
| 8.  | DR              | 0.639  | 0.711  | 0.272     | 0.006   | 0.995 |
| 9.  | IND_CCC         | 23.241 | 23.509 | 3.079     | 18.172  | 28.367 |
| 10. | IND_LIQ         | 1.407  | 1.384  | 0.124     | 1.226   | 1.633 |
| 11. | IND_WC          | 0.048  | 0.044  | 0.014     | 0.028   | 0.074 |
| 12. | IND_CUR_ASSET   | 445.310 | 441.580 | 15.494     | 426.700  | 478.090 |
| 13. | IND_PAYABL      | 23.734 | 23.037 | 10.114    | 11.931  | 41.175 |
| 14. | GDP_GROW        | 0.010  | 0.011  | 0.021     | −0.091  | 0.252 |
| 15. | UNEMPL          | 0.133  | 0.117  | 0.061     | 0.022   | 0.275 |
| 16. | Legal_rights    | 4.100  | 4.000  | 1.916     | 2.000   | 9.000 |
| 17. | RE_Share        | 0.186  | 0.167  | 0.088     | 0.029   | 0.546 |
| 18. | POW_CONS        | 0.493  | 0.430  | 0.195     | 0.175   | 1.290 |

Source: Own elaboration.

The average CCC in the energy industry equals to 32 days, hence, it has very high standard error. Similarly, the share of working capital in total assets (WC) is highly differentiated and ranges from −77% to 80%. This means that there are companies with negative working capital in the sample. The median of current liquidity ratio (LIQ) is equal of 1.4.

Among the variables corresponding to firm-specific WCM determinants, GROW stands out, whose average values take a negative value. This means that in the energy industry in the studied period, for the majority of the companies, a decrease in the value of assets was observed. However, at the same time, they generated positive cash flows (CF). Their average indebtedness was 64%, although the higher median (71%) indicates that much higher indebtedness prevailed.

Industry WCM determinants in terms of average median CCC, LIQ and WC do not deviate in their values from average firm-specific variables. The industry is also characterized by low variation in the level of current assets. The level of trade payables (IND_PAYABL) is slightly more variable.

Variables characterizing the macroeconomic and institutional features of the economies included in the study indicate significant variation in the economic conditions of energy companies.

Table 3 shows the values of variance inflation factors (VIF), allowing for multicollinearity analysis.

The VIF values indicate that for models where the dependent variables are LIQ and WC, the models cannot contain simultaneously the variables IND_CUR_ASSET, IND_PAYABL and IND_LIQ and IND_WC. This would result in significant multicollinearity in the respective model (VIF values above 10). Table A2 contains Pearson correlation coefficients calculated for all pairs of independent variables. These coefficients also indicate that abovementioned variables show a strong correlation (above 0.8). In the case of the remaining independent variables, which are used together in the models, the phenomenon of multicollinearity does not occur [55].
Table 3. Multicollinearity analysis—Variance Inflation Factors.

| Variables: Dependent/Independent | CCC | LIQ | LIQ | LIQ | WC | WC | WC |
|---------------------------------|-----|-----|-----|-----|----|----|----|
| SIZE                            | 1.1 | 1.1 | 1.1 | 1.1 | 1.1| 1.1| 1.1|
| GROW                            | 1.1 | 1.1 | 1.1 | 1.1 | 1.1| 1.1| 1.1|
| CF                              | 1.1 | 1.1 | 1.1 | 1.1 | 1.1| 1.1| 1.1|
| TANG                            | 1.2 | 1.2 | 1.2 | 1.2 | 1.2| 1.2| 1.2|
| DR                              | 1.2 | 1.2 | 1.2 | 1.2 | 1.2| 1.2| 1.2|
| IND_CCC                         | 2.8 |     |     |     |    |    |    |
| IND_LIQ                         |     | 398.9 | 1.5 |     |    |    |    |
| IND_WC                          |     |     |     |     |    |    |    |
| IND_CUR_ASSET                   | 6.2 | 253.3 | 2.5 | 596.7 | 2.5 |
| IND_PAYABL                      | 5.7 | 25.1 | 3.4 | 77.2 | 3.4 |
| GDP_GROW                        | 2.6 | 2.9 | 1.9 | 2.4 | 1.9 | 2.4 |
| UNEMPL                          | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| Legal_rights                    | 1.9 | 2.0 | 1.8 | 1.9 | 1.8 | 1.9 |
| RE_Share                        | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| POW_CONS                        | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 |

Source: Own elaboration.

4. Research Outcomes

The results of ANOVA analysis for all WCM measures accounting for differentiation of averages by country have been presented in Table 4.

Table 4. ANOVA analysis for identifying the impact of the country on the variation of WCM measures.

| Effect               | Sum of Squares | df | Mean Squares | F      | p-Value |
|----------------------|----------------|----|--------------|--------|---------|
| One-Dimensional Significance Tests for CCC Parameterization with Sigma-Restrictions Decomposition of Effective Hypotheses |
| Constant             | 1,252,084      | 1  | 1,252,084    | 225.5811 | 0.00 |
| Country              | 19,164,732     | 22 | 871,124      | 156.9456 | 0.00 |
| Error                | 225,210,885    | 40,575 | 5550 |        | |
| Constant             | 19,828         | 1  | 19,827,60    | 283.4225 | 0.00 |
| Country              | 50,988         | 23 | 2216.87      | 31.6887 | 0.00 |
| Error                | 3,424,572      | 48,952 | 69.96 |        | |
| Constant             | 7.066          | 1  | 7.065683     | 116.7860 | 0.00 |
| Country              | 22.368         | 23 | 0.972527     | 16.0745 | 0.00 |
| Error                | 2902.481       | 47,974 | 0.060501 |        |

The numbers in parentheses represent the share of the sum of squares for individual variables in relation to the total sum of squares. Source: Own elaboration.

All three measures of WCM in the energy industry show statistically significant differences with respect to the countries studied. Belonging to a particular economy explains as much as 7.8% of the variation in the CCC. In the case of LIQ, the variability of this index is explained by country-specific WCM determinants in 1.46%. The most insensitive country factor is the WC level (0.76%).

Table A3 presents the results of parameter estimation of the assumed panel models. Breusch–Pagan and Hausman tests showed that the models with fixed individual effects are the most appropriate in all cases.
The SIZE variable has a statistically significant and positive effect on all three WCM measures (CCC, LIQ and WC). A negative relationship was detected for the GROW and TANG variables. For the CF variable, a positive effect on CCC was observed, while LIQ and WC had the opposite effect. Corporate debt (DR) was found to be a significant factor for LIQ and WC. In both cases, a negative relationship was diagnosed.

Among the industry-specific determinants, significant relationships of WCM measures were shown with IND_CCC, IND_LIQ and IND_PAYABL. CCC values for a single firm revert to industry CCC median, while LIQ values follow levels of industry LIQ median. In the case of IND_PAYABL, it negatively affects all three WCM measures.

Of the country-specific factors, GDP dynamics and Legal_rights had an unambiguously negative effect on WCM. UNEMPLOY positively affects LIQ and WC. In the case of CCC, the relationship is negative. An increase in a country’s renewable energy share ratio (RE_Share) causes a decrease in all WCM measures. The CCC and WC increase with energy consumption (POW_CONS).

5. Robustness Check

The estimated effects were also checked in a robustness check. One method of determining whether the effects of interest are stable is to remove or add variables [56]. Table A3 presents 2 models for the dependent variable CCC—the original model and the final model containing only statistically significant variables. However, a total of 4 models were estimated for the dependent variable CCC, sequentially eliminating further statistically insignificant variables. The earlier 3 models can therefore provide a robustness check for the final model. In all these models, all statistically significant variables have the same signs, which indicates the stability of the direction of the examined relationships. Similarly for the dependent variables CR and WC, a total of 8 models for the dependent variable CR and 6 models for the dependent variable WC were analyzed. In all these models, all statistically significant coefficients of independent variables have the same signs, which indicates stability of the direction of the examined dependencies.

In the models applied, the SIZE and GROW variables were based on the value of total assets. However, revenue-based versions of these variables are often used. Therefore, versions of the models in which SIZE and GROW variables were based on revenue, or one of the variables based on revenue and the other on assets, were also checked. Thus, 3 additional model combinations were checked for each of the dependent variables. This check revealed that the GROW variable does not change sign, regardless of the definition used, while the SIZE variable changes sign to negative when calculated as the logarithm of revenue. As for all other independent variables, they are not affected by changes in any combination of the SIZE and GROW variables.

Dang et al. [57] indicated that SIZE variable based on assets or sales revenue most often yields the same sign and significance, but may sometimes differ. Furthermore, the authors found that changing the definition of the SIZE variable can lead to changes in the signs standing in front of the parameters for other independent variables. We also tested models in both versions, and we observed a sign change with the SIZE variable as well. However, we did not observe a sign change with any other variable. The robustness check performed indicates stability in the direction of all the relationships examined, except for the SIZE variable, whose positive relationship is stable when using the value of total assets as the basis for the calculation.

6. Discussion

In terms of identifying firm-specific WCM determinants, our study provided the strongest evidence to support hypotheses H1.1, H1.2 and H1.4. The larger the energy firm, the higher all WCM measures (H1.1). This observation is consistent with studies in other industries and sectors listed in Table A1 [22,27,33,34,41,58]. This means that also in the energy industry, a company’s potential, easier access to capital and more diversified
business, which are associated with its size, create better conditions for investment in working capital and its better use.

Similarly to most studies by other authors [22,33,34,38,39,59], we showed that also in the energy industry, the firm’s growth rate caused a decrease in the level of WCM measures (H1.2). This may imply that although growing firms invest primarily in fixed assets, working capital is not their priority. This hypothesis needs to be confirmed in further research. However, it is reinforced by the detected decrease in WCM measures as the share of fixed assets in total assets increases (H1.4), consistent with previous studies by Drever and Hutchinson [40], Baños-Caballero et al. [34,37], Singh and Kumar [60], Wasiuzzaman [22] and Sharma et al. [41].

An increase in free cash flow increases the length of CCC while significantly decreasing WC and LIQ. This does not support our hypothesis H1.3. A negative relationship between CF and WCM was pointed out by Baños-Caballero et al. [34], Singh and Kumar [60] and Moussa [33], arguing that the growing financial surplus was first invested in fixed assets. However, if the diagnosed positive impact of CF on CCC is taken into account, it also seems likely that a higher surplus also motivates energy companies to give customers longer payment terms.

Our study also partially supported hypothesis H1.5. An increase in the indebtedness of an energy company causes a decrease in WC and LIQ levels. The same relationship was detected by the six authors of the studies listed in Table A1. The impact of debt on CCC in the energy industry was not confirmed by us. This may indicate, as in the case of CF, that the debt incurred is mainly directed into fixed asset investments.

In terms of industry-specific WCM determinants, we demonstrated that energy companies applied similar strategies in managing CCC and LIQ (partial support of H2.1). We did not confirm the same industry characteristic for WC size. In the energy industry, an increase in average trade payables caused a decrease in all WCM measures, however, these are not affected by the level of current assets (partial support H2.2).

All three WCM measures show statistically significant differences between the countries in which the examined companies operate (confirmation of H3). This is most widely true for CCC. WC level is the least sensitive depending on the change of a country. This means that energy companies in different countries, while varying little in terms of created WC levels, clearly use short-term bank loans to finance CCC in a different way.

The study provided evidence to support hypotheses H3.1 to H3.5. An increase in GDP dynamics causes a decrease in WCM measures in the energy industry. A similar relationship was also observed by Moussa [33] and Nyeadi et al. [58]. The detected increase in WC and LIQ values due to an increase in unemployment is a new observation not previously studied in the literature. Similarly, a rarely studied relationship is the effect of strength of legal rights on WCM. In the case of the energy industry, we detected the opposite relationship to that diagnosed by Cetenak et al. [45]. An increase in the strength of legal rights index companies causes a decrease in WCM measures.

The increase in the share of renewable energy sources causes a decrease in the WCM measures of the energy industry. This may imply that these sources require increased investment in fixed assets. This relationship appears to be of particular interest but requires further research. When energy consumption increases, an increase in WC levels is observed, which allows the CCC to be extended.

7. Conclusions

The results of the study show that the influence of firm-specific determinants on WCM in the energy industry does not differ from that identified in other industries or sectors. Considering the directions of the detected relationships, it seems that the WCM decisions of energy companies are best explained by the cash conversion cycle theory.

Energy industry companies follow industry average measures of liquidity and the cash conversion cycle when making WCM decisions. We did not observe this relationship for the WC level. This means that the implementation of similar strategies for maintaining liquidity
and the length of the cash conversion cycle is based on their differentiated financing (mix of WC and short-term bank loans). This is confirmed by the detected feature that while energy industry companies have similar credit strategies in terms of cooperation with suppliers, there are differences in managing the levels of current assets.

The level of working capital, the cash conversion cycle and financial liquidity depend on the country in which the enterprises operate. Decreasing WCM measures with increasing GDP dynamics and their growth with the increasing unemployment correspond to their detected reduction under the influence of increasing cash flow and tangibility. Taking into account all these dependencies, it can be assumed that the improvement of economic conditions resulting in better financial performance of enterprises provides a greater incentive in the energy industry to invest in fixed assets than in WCM. At the same time, we observed that an increase in the level of stakeholder protection of energy companies also provides an incentive to ease WCM policies. Energy industry country-specific determinants indicate that the development of renewable energy sources does not provide an incentive to invest in WCM, in contrast to increasing consumption of this energy. In the case of highly energy-intensive economies, companies are more likely to finance the CCC from the WC generated rather than from bank loans.

In conclusion, the following findings concerning energy industry can be identified as the most important:

- the WCM decisions of energy companies are best explained by the cash conversion cycle theory,
- the implementation of similar strategies for maintaining liquidity and the length of the cash conversion cycle is based on their differentiated financing,
- the level of working capital, the cash conversion cycle and the financial liquidity depend on the country in which the enterprises operate,
- the development of renewable energy sources does not provide an incentive to invest in WCM.

The results of our study are also important for business practice. Taking advantage of the good economic situation and good financial results to invest in fixed assets, managers of energy companies should monitor the quality of working capital management due to the growing risk of loss of liquidity and ability to finance the cash conversion cycle. This is particularly important in economies strongly supporting the development of renewable energy sources. If, at the same time, these economies are highly energy-intensive, it is worthwhile to consider financing the cash conversion cycle with short-term bank loans to a greater extent, using the profits generated for investment in fixed assets.

The most important research limitation is related to endogeneity. This issue is not addressed in the models. The problem of endogeneity occurs mainly in the case of simultaneous equation models, measurement errors and omitted variables. We made efforts to remove unreliable data, but two-way interactions are possible in the relationships studied. Unobservable firm/manager characteristics related to preferences regarding WCM were also not included. Therefore, the endogeneity problem could arise. However, we believe that this problem did not significantly affect our results. These models were estimated in several versions, with more and fewer variables, with different measures of the SIZE and GROW variables. All of these changes did not alter the relationships tested and did not change the conclusions. The other research limitations are as follows: (i) large differences in the included number of enterprises in individual economies, (ii) a small number of WCM determinants included and (iii) applying the static approach in the identification of WCM factors without taking into account changes over time.

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## Appendix A

### Table A1. Empirical studies on WCM determinants.

| Author | Research Sample and Period | Dependent Variable | Positive Determinants of WCM | Negative Determinants of WCM | Other Determinants |
|--------|----------------------------|--------------------|-----------------------------|------------------------------|------------------|
| Kieschnick et al. [27] | 3155 US companies listed on stock exchange in the period 1990–2004 | CCC | Size, Growth, Executive ownership | External board members, Executive compensation | - |
| Drever and Hutchinson [40] | 3429 Australian SMEs in the years 1994–1998 | WC | Age | Tangibility, Profitability | Industry |
| Nazir and Afza [36] | 132 public companies from Pakistan listed in the period 2004–2007 | WC | Operating cycle, Profitability | Leverage | Industry |
| Baños-Caballero et al. [34] | 4076 Spanish SMEs in the years 2001–2005 | CCC | Size, Age, ROA | Cash flow, Leverage, Tangibility | Industry |
| Hill et al. [38] | 3343 US companies from 1996 to 2006 from Compustat database | WC | Operating cash flow, Size | Market-to-book ratio, Sales variance | Industry |
| Gill [59] | 166 Canadian listed firms for the period 2008–2010 | WC | Operating cycle, Profitability, Internationalization | Growth, Size | Industry |
| Baños-Caballero et al. [37] | 60 Spanish public companies listed in the years 1997–2004 | CCC | Cash flow, Financial distress, GDP | Growth, Tangibility, Profitability, Leverage | - |
| Nobanee and Abraham [61] | 5802 non-financial US SMEs for the period of 1990–2004 | Current assets/Total assets | Net trade cycle | Long-term debt | Industry |
| Singh and Kumar [60] | 254 manufacturing SMEs operating in India for the period 2010 to 2014 | WC | Profitability, Growth | Leverage, Cash flow, Tangibility | - |
| Cetenak et al. [45] | 1253 firms across 13 industries from 14 emerging markets between year 2000 and 2014 | WC | Tobin Q, Altman Z-score, Exchange rate, Rule of law | Profitability, Access to credit | Industry |
| Wasiuzzaman [22] | 986 SMEs in Malaysia from 2011 to 2014 | WC | Profitability, Size, Age | Growth, Tangibility, Firm status | - |
| Author | Research Sample and Period | Dependent Variable | Positive Determinants of WCM | Negative Determinants of WCM | Other Determinants |
|--------|-----------------------------|--------------------|-------------------------------|-------------------------------|-------------------|
| Nyeadi et al. [58] | 28 listed firms on the Ghana Stock Exchange in the years 2007–2014 | WC | Size, Age, Profitability | GDP | - |
| Moussa [33] | 68 listed Egyptian firms for the period 2000–2010 | WC, CCC | Size, Age, Profitability | GDP, Leverage, Growth, Operating cash flow | Industry |
| Sharma et al. [41] | 150 companies listed on Bombay Stock Exchange in the years 2009–2017 | WC | Size of directors board, Profitability | Size, Tangibility | Industry |
| Dang [46] | 6700 observations from companies listed on Vietnam’s stock exchange in the years 2008–2019 | CR | Capital adequacy, ROE, Leverage | ROA | GDP |
| Sardo and Serrasqueiro [39] | 3994 Iberian manufacturing SMEs for the period 2011–2017 | WC | Age, Cash flow, Long-term debt | Size, Growth | - |

Source: Own elaboration. WC—Working capital amount directly or scaled; LIQ—Current liquidity ratio; CCC—Cash conversion cycle; ROA—Return on assets; ROE—Return on equity; GDP—Gross domestic product.
Table A2. Pearson correlation matrix for all variables.

|       | SIZE | GROW | CF    | TANG | DR    | IND_CCC | IND_LIQ | IND_WC | IND_CUR_ASSET | IND_PAYABL | GDP_GROW | UNEMPL | LEGAL_RIGHT | RE_SHARE | POW_CONS |
|-------|------|------|-------|------|-------|---------|---------|--------|---------------|------------|----------|--------|-------------|----------|----------|
| SIZE  | 1.00 | 0.110| −0.085|−0.005|−0.040 |−0.009  |−0.021  |−0.021 |−0.019         | 0.019      |−0.001   |−0.210 | 0.040       | 0.127    | 0.135    |
| GROW  | 1.00 |      |−0.079 |−0.178|−0.056 |−0.071  |−0.054  |−0.050 |−0.020         | 0.069      |−0.045   |−0.078 | 0.021       | 0.024    | 0.047    |
| CF    | 1.00 |      | 0.013 |−0.217| 0.025 | 0.154  | 0.155  | 0.140 |−0.132         | 0.100      |−0.029   | 0.061 | −0.002      |−0.029   |          |
| TANG  | 1.00 |      |−0.090 |−0.183|−0.182 |−0.139  | 0.177  |−0.162 |−0.034         |−0.155      |−0.065   |−0.014 |            |          |          |
| DR    | 1.00 |      | 0.360 | 0.318 |−0.122 |−0.625  | 0.530  |−0.002 | 0.011         | 0.110      |−0.036   |      |            |          |          |
| IND_CCC |      |      | 1.00 | 0.998| 0.819 |−0.920  | 0.492  |−0.181 | 0.015         | 0.153      |−0.006   |      |            |          |          |
| IND_LIQ |      |      | 1.00 | 0.844| 0.477 |−0.909  | 0.477  |−0.188 | 0.014         | 0.149      |−0.003   |      |            |          |          |
| IND_WC |      |      | 1.00 |−0.568| 0.322 |−0.237  | 0.012  | 0.079 | 0.018         |           |          |      |            |          |          |
| IND_CUR_ASSET |      |      | 1.00 |−0.539| 0.133 |−0.017  |−0.167 | 0.017 |           |           |          |      |            |          |          |
| IND_PAYABL |      |      | 1.00 |−0.265| 0.501 | 0.178  | 0.114 |      |           |           |          |      |            |          |          |
| GDP_GROW |      |      | 1.00 |−0.054|−0.249 |−0.304  | 0.349 |      |           |           |          |      |            |          |          |
| UNEMPL |      |      | 1.00 | 0.274| 0.789 |      |      |      |           |           |          |      |            |          |          |
| LEGAL_RIGHT |      |      |      |      |      |      |      |      |           |           |          |      |            |          |          |
| RE_SHARE |      |      |      |      |      |      |      |      |           |           |          |      |            |          |          |
| POW_CONS |      |      |      |      |      |      |      |      |           |           |          |      |            |          |          |

Source: Own elaboration.
## Table A3. Results of model estimations.

| Model | CCC | LIQ | WC |
|-------|-----|-----|-----|
|       | Fixed effects | Fixed effects | Fixed effects | Fixed effects | Fixed effects | Fixed effects | Fixed effects | Fixed effects | Fixed effects |
| Const | -132.794 *** | -162.014 *** | 7.037 * | 5.815 ** | 6.699 ** | 6.654 ** | 0.439 *** | 0.477 *** | 0.459 *** |
| (48.885) | (33.285) | (3.866) | (2.492) | (3.920) | (3.004) | (0.686) | (0.707) | (0.697) | (0.686) |
| SIZE | 8.333 *** | 7.311 ** | 1.519 *** | 1.719 *** | 1.530 *** | 1.726 *** | 0.061 *** | 0.061 *** | 0.061 *** |
| (3.392) | (3.257) | (0.356) | (0.296) | (0.356) | (0.286) | (0.007) | (0.007) | (0.007) | (0.007) |
| GROW | -11.021 *** | -11.137 *** | -1.495 *** | -1.324 *** | -1.490 *** | -1.328 *** | -0.056 *** | -0.056 *** | -0.056 *** |
| (3.583) | (3.588) | (0.330) | (0.249) | (0.330) | (0.251) | (0.007) | (0.007) | (0.007) | (0.007) |
| CF | 70.417 *** | 73.622 *** | -8.772 *** | -9.605 *** | -8.642 *** | -9.553 *** | -0.051 ** | -0.051 ** | -0.049 ** |
| (12.978) | (12.682) | (1.483) | (1.392) | (1.488) | (1.400) | (0.022) | (0.022) | (0.022) | (0.022) |
| TANG | -53.059 *** | -53.582 *** | -13.683 *** | -13.113 *** | -13.672 *** | -13.106 *** | -0.868 *** | -0.869 *** | -0.868 *** |
| (7.013) | (7.009) | (0.901) | (0.846) | (0.900) | (0.847) | (0.014) | (0.014) | (0.014) | (0.014) |
| DR | -7.142 | 5.634 | -8.333 *** | -8.579 *** | -8.809 *** | -8.568 *** | -0.364 *** | -0.364 *** | -0.362 *** |
| (0.267) | (0.188) | (0.774) | (0.702) | (0.702) | (0.702) | (0.015) | (0.015) | (0.015) | (0.015) |
| IND_CCC | 1.765 *** | 1.830 *** | 1.431 ** | 2.384 *** | 1.431 ** | 2.384 *** | 0.009 | 0.009 | 0.009 |
| (0.267) | (0.188) | (0.713) | (0.578) | (0.713) | (0.578) | (0.112) | (0.112) | (0.112) | (0.112) |
| IND_LIQ | 0.002 | 0.007 ** | 0.002 | 0.007 ** | 0.002 | 0.007 ** | -0.0001 | -0.0001 | -0.0001 |
| (0.004) | (0.003) | (0.004) | (0.003) | (0.004) | (0.003) | (0.0001) | (0.0001) | (0.0001) | (0.0001) |
| IND_PAYABL | -0.271 ** | -0.225 *** | -5.280 ** | -4.764 * | -7.761 *** | -5.643 * | 0.103 ** | 0.103 ** | 0.103 ** |
| (0.116) | (0.087) | (0.101) | (0.090) | (0.080) | (0.080) | (0.010) | (0.010) | (0.010) | (0.010) |
| GDP_GROW | 73.705 *** | 81.197 *** | -2.572 | -2.416 | -2.501 | -2.418 | 0.226 *** | 0.225 *** | 0.227 *** |
| (29.279) | (29.279) | (2.646) | (2.646) | (2.646) | (2.646) | (0.052) | (0.052) | (0.052) | (0.052) |
| UNEMPL | -1.961 ** | -1.841 ** | 0.066 | 0.044 | -0.005 ** | -0.005 ** | -0.005 ** | -0.005 ** | -0.005 ** |
| (0.919) | (0.893) | (0.152) | (0.152) | (0.152) | (0.152) | (0.002) | (0.002) | (0.002) | (0.002) |
| Legal_rights | -70.652 | -67.792 ** | -12.928 ** | -14.709 *** | -16.262 *** | -16.090 *** | -0.297 *** | -0.297 *** | -0.297 *** |
| (58.029) | (58.029) | (6.173) | (6.173) | (6.173) | (6.173) | (0.100) | (0.100) | (0.100) | (0.100) |
| RE_Share | 233.398 *** | 257.371 *** | 3.988 | 5.216 | 0.134 * | 0.136 ** | 0.138 ** | 0.138 ** | 0.138 ** |
| (46.420) | (43.836) | (4.866) | (5.013) | (5.013) | (5.013) | (0.076) | (0.076) | (0.076) | (0.076) |

- No. of observations: 28,406
- Joint test on named regressors: 28,406
- Breusch–Pagan test: 28,406
- Hausman test: 28,406

* Dependence is significant at the level of 0.1; ** dependence is significant at the level of 0.05; *** dependence is significant at the level of 0.01 (standard errors in parentheses). Source: Own elaboration.
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