

RESEARCH ARTICLE

Does a country's environmental policy affect the value of small and medium sized enterprises liquidity in the energy sector?

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Abstract

Cash management is important for energy SMEs, which, differently from large firms, face severe financial constraints and need to seize growth opportunities to ensure their survival. This paper, analyzing a large sample of European energy SMEs, finds a positive effect of holding a buffer of cash on firm performance. It shows that a stock of cash allows energy firms to prevent negative contingencies and/or achieve valuable growth patterns and investments. Moreover, considering that the energy industry is involved in environmental sustainability policies promoted by national governments, we find that complying with environmental regulations reduces the value of cash. Countries that pay more attention to environmental issues provide energy SMEs with growth opportunities and financial support, reducing the need to hold a stock of cash. A key implication is that, in a context with high environmental concern, energy SMEs have more financial flexibility to guarantee their growth with positive externalities for the energy sector.

KEYWORDS

cash holdings, corporate liquidity, energy sector, environmental performance, environmental sustainability, SMEs

JEL CLASSIFICATION

O13, O44, P48, Q40, Q56

1 | INTRODUCTION

Energy is a fundamental input for economic activity, and the relevance of the energy sector in achieving sustainable development has been widely debated in the extant literature (Vera & Langlois, 2007). Environmental sustainability is an important dimension of corporate social responsibility (CSR) and the energy sector has a key role on its development (Brockett & Rezaee, 2012; Stjepcevic & Siksnelyte, 2017). The energy supply industry is vast, powering the world economy, with relevant growth potential and strong needs for investment and finance. The relevance of efficient investments for firms having CSR goals is also evidenced by Khediri (2021). Since the EU energy

markets were liberalized, as noted by Burger et al. (2007), 'utilities became exposed to a variety of risks: volatile fuel (especially gas, oil, and coal) and CO₂ emission certificate prices, fluctuating wholesale electricity market prices, customers' changing their supplier, and uncertain customer demand. Moreover, the transition to a low-carbon economy and climate targets required by-law a change in the business model and many investments to firms. Therefore, risk and financial management have become a key challenge for energy companies that have an important role in delivering sustainable development.

In this context, where financing is crucial for environmental sustainability, Cariola et al. (2020) suggest that the way in which small and medium sized enterprises (henceforth SMEs) operating in the

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energy sector manage their financing influences their performance, providing important suggestions and implications for firms in this industry. At the core of the paper is the concern about the huge financial constraints that SMEs in the energy sector have to face due to the high growth opportunities related to environmental issues. Specifically, the problem concerns the threat of financial distress. In this regard, as part of the financial policies that are established by firms, jointly with debt and trade credit decisions, it is relevant to mention the role of cash holding choices, referring to the buffer of cash and cash equivalents that firms hold on their balance sheets.

Prior general studies focus on the role of cash holdings only in terms of transactional reasons (Miller & Orr, 1966; O'Brien & Folta, 2009). However, a wide literature reveals a huge amount of money observed on firms' balance sheet (e.g., Bigelli & Sánchez-Vidal, 2012; Harris & Raviv, 2017; Seifert & Gonenc, 2016), suggesting a double role of cash holdings: first as a buffer to face negative contingencies and second as an option to grasp growth opportunities easily and quickly (Drobetz et al., 2010).

The role of cash holdings is as relevant in the energy sector as in others, but for energy firms companies CSR is a requirement (Stjepcevic & Siksnylyte, 2017). The mass media attention towards environmental sustainability induces energy firms to take care the stakeholders' needs. With this regard, several contributions focus on the relationship between CSR and stakeholder theories (Brown & Forster, 2013; Freeman & Dmytryiev, 2017; Russo & Perrini, 2010), also in the energy sector (Chang et al., 2017). The attention to large companies across the world is high, although the vast majority of the firms in the energy sector are of small or medium size, showing different growth opportunities and financial needs. We observe that cash holdings are particularly important for SMEs operating in the energy sector, accounting for about 15% of their total assets, while they are less used by large energy firms (around 5%). Energy SMEs are sensitive to financial shocks, such as the COVID-19 crisis or the current conflict in Ukraine. Investments in technological innovation entail a strong financial response from energy firms, for which cash resources should be properly managed by SMEs' executives. Despite their relevance in the energy industry, SMEs' characteristics make them subject to financial constraint problems due to their information opaqueness (Berger & Udell, 1998). With this regard, Zhang et al. (2020) suggest that financially constrained firms hold more cash to finance green investments.

The main and on-vogue theoretical argument to justify cash-holding behavior is the precautionary perspective, which suggests that managers hold a stock of cash as a tool to sustain the business in times of crisis and in the event of unforeseen needs or to support the processes of growth and business development (La Rocca & Cambrea, 2018; Opler et al., 1999; Pinkowitz & Williamson, 2002; Zhang et al., 2020). This is a perspective that seems to suit perfectly the situation that SMEs are used to facing in the energy industry, in which new and changing technologies are obvious, government and environmental issues can quickly change the rules of the game and financial needs are fundamental.

The empirical literature scrutinizes the antecedents and consequences of cash holdings, finding controversial results considering that the costs (managerial opportunism) and benefits (the precautionary motive) of cash are jointly at work. Although the vast majority of the studies identify a positive effect of cash holdings on firm performance (Daniel et al., 2004; Kim & Bettis, 2014; La Rocca & Cambrea, 2018), a few studies observe a negative effect as well (Dittmar et al., 2003; Harford et al., 2008). The different evidence obtained suggests that some factors can shape the effect of cash holdings on firm value. Such factors could concern firm-specific characteristics and external factors (La Rocca & Cambrea, 2018). Among the external factors, the outside context in which a firm operates affects the value of cash holdings (Deb et al., 2016; Faulkender & Wang, 2006). Deb et al. (2016) interestingly argue that "Cash is more beneficial for firms operating in highly competitive, research-intensive, or growth-focused industries." Therefore, there are some circumstances that are industry-specific that shape the benefits and costs of holding cash and its effect on firm performance. The above-mentioned literature arouses the interest in investigating the role of cash holdings according to industry characteristics. Firms operating in R&D-intensive industries, characterized by uncertainty, complexity, a rapid pace of technological change and difficulty in obtaining external finance, gain competitive advantages if they keep a stock of cash, which is useful for facing these industry challenges or absorbing adverse shocks (Deb et al., 2016; Denis & Sibilkov, 2010).

Therefore, considering the relevance of industry-specific factors in shaping the value of cash holdings it is of great interest to investigate the role of cash reserves in boosting success in an industry like the energy sector, which is typically high-growth, R&D-intensive and highly competitive. Nowadays, energy firms have the goal to minimize the environmental impact and, in doing so, they are in need to innovate and invest using cash resources (Costa-Campi et al., 2019).

Thus, with this paper, we focus on the role of cash holdings in supporting the performance of SMEs in the energy sector. We intend to investigate the importance of cash holdings for firms operating in a particular industry that typically has high growth opportunities and huge financial needs that often are related to relevant financial constraint problems. Moreover, we focus on SMEs as they represent the kind of firms that are mainly subject to financial constraint problems (Berger & Udell, 1998) but at the same time play, an important role in the European Energy Union.¹ The focus on energy SMEs aims to consider the effect for the vast majority of firms that are widely spread across Europe. Moreover, the recent work by Patel et al. (2021) underlines the relevance of SMEs in the energy sector.

The novelty of the paper is that, for the first time, we study the relationship between cash holdings and firm performance in the energy sector. Moreover, we consider the moderating role of a country's environmental performance to understand whether the way cash that energy SMEs use to finance their investments affects energy firms' performance varies depending on the country's attention

¹Sustainable Energy Week (an initiative promoted by the European Commission) highlights that 'SMEs are key contributors to the transition towards a European Energy Union' (March 2020). <https://www.eusew.eu/smes-and-entrepreneurs-driverstowards-clean-energy>.

towards environmental issues. We interestingly find that cash reserves increase SMEs' performance. However, such an effect is smaller in those countries that pay particular attention to environmental issues as investing incentives make the role of cash less relevant to energy SMEs. Our work introduces the role of cash for energy firms, providing a piece of knowledge that could increase our understanding of the environmental concern of energy businesses. Our work provides implications for manager of energy firms that have relevant social and environmental responsibilities. Managerial ability and stakeholder accountability are important in achieving energy goals (Gong et al., 2021), for which it is crucial that managers have adequate information and tools to support the business of their companies.

2 | LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 | The relationship between cash holdings and firm performance: Direction of research on SMEs

The value of cash holdings is a much-debated topic that has animated academia since the second half of the 1990s, highlighting the potential beneficial or detrimental effects on firm performance (Ammann et al., 2011; Bates et al., 2009; Dittmar et al., 2003; Faulkender & Wang, 2006; Harford et al., 2008; Kalcheva & Lins, 2007; La Rocca et al., 2018; Opler et al., 1999; Pinkowitz & Williamson, 2002).

The existing literature provides three theoretical models that explain the patterns of cash holdings: the trade-off theory, the pecking order theory and the free cash flow theory. According to the trade-off theory, firms set their optimal level of cash holdings by weighting the marginal costs and marginal benefits of holding cash (Opler et al., 1999). The pecking order theory (Myers, 1984) suggests that firms try to minimize asymmetric information and other financing costs by financing their investments first with retained earnings, then with safe and risky debt and finally with equity. Finally, the free cash flow theory of Jensen (1986) describes managers as having an incentive to build up cash to increase the amount of assets under their control and to gain discretionary power over the firm's investment decisions.

The traditional agency theory predicts that ample cash reserves induce managers to engage in value-destroying business expansion or excessive continuation of inefficient projects (e.g., due to empire-building tendencies, as described by Jensen, 1986). On the contrary, the theory of precautionary motives argues that having ample cash on hand provides operational flexibility for managers. Firms with large reserves of cash can finance and support potential investment opportunities when they arise or compete aggressively with their rivals in the market (Mikkelsen & Partch, 2003). Fresard (2010) documents that, when the competition is high, firms with more cash gain market share and consequently enhance their operating performance, while Tong (2011) argues that cash holdings serve as a potentially important channel through which investments in terms of firm diversification can affect the corporate value. Some

works find that the relevance of cash holdings for firms is weaker in countries with poor investor protection (Dittmar & Mahrt-Smith, 2007; Kalcheva & Lins, 2007; Pinkowitz et al., 2006). Faulkender and Wang (2006) and Denis and Sibilkov (2010) highlight that cash holdings are more valuable for financially constrained firms. Drobetz et al. (2010) indicate that the value of corporate cash holdings is lower in states with a higher degree of information asymmetry. Deb et al. (2016) examine how various external contexts affect the impact of cash holdings on performance, finding that, evidencing that cash has benefits that are more significant for firms operating in highly competitive, research-intensive or growth-focused industries.

Despite a large body of literature on corporate cash holdings, mainly focused on the US, only a few papers deal with SMEs in EU (e.g., La Rocca et al., 2018). The authors, investigating the role of liquid assets across industries, find that cash holdings have a positive effect on operating performance. Therefore, the transaction and precautionary savings motives prevail over potential opportunistic problems. Moreover, they identify the moderating role of various firm, country-specific and macroeconomic factors in the above-mentioned relationship.

Based on the above, we believe that new research into corporate cash holdings with a focus on SMEs is needed for at least four reasons. First, the amount of research that deals with the cash holding-performance relationship for SMEs in Europe is very scarce. Second, the financial strategies of SMEs differ from those of large companies because of their higher degree of information opacity and different access to the external market. Third, Bates et al. (2009), Lyandres and Palazzo (2012), Pinkowitz et al. (2012), Kim and Bettis (2014), and Deb et al. (2016) suggest that industry characteristics are a key determinant of corporate cash holdings. Fourth, the current debate in the literature seems to highlight the need to investigate the role of moderating factors (La Rocca et al., 2012, 2018) in the influence of cash holdings on firm performance.

2.2 | The effect of cash holdings on SMEs performance in the EU energy sector

Energy SMEs face high financial constrain problems, represent a large part of energy businesses in the European Union and are particularly important in the energy sector (Patel et al., 2021). It is important to mention that 92.3% of our observations concerns energy SMEs, while only 7.7% refers to large energy companies, demonstrating the relevance of studying small energy businesses. Moreover, cash holdings are vital for energy SMEs, as it accounts for about 15% of total assets, while they are much less relevant for large energy firms. However, the costs and benefits, and the consequent motivation, of holding cash can differ in intensity depending on industry-specific characteristics. Previous studies suggest that the extent of agency conflicts (Jensen, 1986), the intensity of growth opportunities (Bates et al., 2009; Opler et al., 1999) and the degree of financial constraint (Denis & Sibilkov, 2010) are



attributable to firm- and industry-specific characteristics. According to the European Commission, “the energy sector is one of the pillars of growth, competitiveness and development for modern economies.”² Motivated by the unique combination of specific features that characterize firms operating in the energy sector (e.g., rich investment opportunities, significant costs of obtaining external financing, high cash flow volatility and uncertainty, path dependency and reliance on long-lived assets, and high financial and operating leverage), our attention in this study is devoted to extending the empirical evidence on corporate cash holdings. The Renewable Energy Directive and other electricity-related EU legislation concerning energy market regulation, the security of the electricity supply, trans-European networks and the EU emissions trading system generate many obligations that at the same time impose constraints on and offer opportunities to energy firms. According to the report of the Institution of Engineering and Technology (2017),³ the energy sector, requires significant investments. Consistent with the view of the trade-off theory, transaction costs, the precautionary savings motive, large cash reserves provide operational flexibility for managers. In the presence of potential investment opportunities, cash-rich energy firms use corporate liquidity as a way to support these investments (Zhang et al., 2020). Proper investments at the appropriate time help energy firms to achieve their financial objectives.

Based on the precautionary saving motive, it is reasonable to assume that energy firms will be interested in maintaining substantial cash reserves to capture growth opportunities arising in this sector promptly to safeguard their survival from the risk of financial distress. Energy companies operate in an environment that is often described as unstable, with high price volatility and a multitude of complex products (Burger et al., 2007), for which they face high cash flow (Zhang et al., 2016). According to Opler et al. (1999), Ferreira and Vilela (2004), and Ozkan and Ozkan (2004), these characteristics are related to high corporate cash holdings. Moreover, investments of are sensitive to cash (Guan et al., 2021; Moyen, 2004) In the context of the transaction costs theory, using liquid assets to make payments, energy companies can save on the transaction costs associated with having to liquidate assets. Based on the pecking order theory (Myers, 1984), in the presence of asymmetric information, raising external financing is more costly than using internal financing. For these reasons, information opaque SMEs operating in a sector with plenty of growth opportunities will prefer to keep internally generated cash to undertake investments that could increase their performance.

All these arguments, together with the finding of La Rocca et al. (2018) about the relevant role of precautionary arguments in SMEs, suggest a positive relationship between cash holdings and firm operating performance.

Hypothesis 1. *Holding cash generates higher SMEs' performance in the energy sector.*

²<https://op.europa.eu/it/publication-detail/-/publication/41488d59-2032-11ec-bd8e-01aa75ed71a1>

³<https://www.theiet.org/factfiles/energy/energy-white-page.cfm>

2.3 | The moderating role of EU environmental policies in the cash holdings–SMEs performance relationship

The purpose of this section is to discuss the possible moderating role of EU environmental performance in the relationship between the cash holdings and the firm performance of EU energy SMEs. The issues pertaining to sustainability and the responsible way of conducting business in the EU energy industry have become crucial in today's complex energy business environment. According to Thomson Reuters Innovation Lab,⁴ “The latest environmental reports show that we, as a planet, are falling further behind as a global economy in meeting the climate change goals set forth at COP21. It is critically important that all organizations, in energy and every other sector, understand the risks to the global economy if there is not a systemic change in emissions.” According to the World Energy Investment Outlook 2018,⁵ “investment in energy efficiency is closely linked to government policies.”

A country's environmental performance could have a crucial role in the relationship between cash holdings and firm performance. Indeed, environmental sustainability is a dimension of CSR and, as evidenced by Stjepcevic and Siksnelyte (2017), political regulation is an important driver of CSR in energy sector. Some arguments suggest that national sustainability policies could increase the expected positive effect of cash on performance, while others indicate a decreasing effect. According to the first reasoning, a country that stimulates energy investments could create a favorable economic environment with plenty of growth opportunities (Frondel et al., 2010). Liu et al. (2021) suggest that political legitimacy reduces financial constraints of firms with better environmental performance. In this context, cash holdings, which are essential to sustain new investments, can be used by SMEs to capture growth opportunities (Chen & Chuang, 2009). Consequently, the presence of cash on SMEs' balance sheet, together with the government's stimulus to invest, could encourage managers to seize new profitable business opportunities that improve their firm's operating performance. Consequently, higher country environmental performance could amplify the positive cash–performance relationship.

From another perspective, countries that pay particular attention to environmental issues could force companies to make investments in environmental sustainability (Ng & Zheng, 2018; Ramanathan et al., 2014), adding costs that reduce their performance (Palmer et al., 1995). Thus, in a context in which sustainable investments are mandatory, the positive cash–performance relationship of energy firms could be negatively affected in two ways. First, the obligation to invest reduces SMEs' cash and could increase SMEs' financial constraints, causing difficulties to invest in profitable growth opportunities. Second, it is likely that, in countries where the environmental

⁴Thomson Reuters. Top 100 Global Energy Leaders Report 2018. <https://www.thomsonreuters.com/content/dam/ewp-m/documents/thomsonreuters/en/pdf/reports/thomson-reuters-top-100-global-tech-leaders-report.pdf>

⁵Source: European Commission Press Release Database. <https://www.iea.org/reports/world-energy-investment-2018>

concern is high, governments will provide support tools, such as tax incentives (Qadir et al., 2021) or government subsidies (Yang et al., 2019) and so on, that help SMEs to capture growth opportunities. Such tools could act as a substitute for cash holdings to make new investments, for which cash reserves would be less relevant to corporate performance. Moreover, in a country where the investing opportunities are abundant, banks and other financial intermediaries may be more likely to provide debt as a substitute for cash (Fasano & Deloof, 2021), which is also more valuable for energy SMEs embedded in countries where the environmental performance is high (Cariola et al., 2020). In line with this, Li et al. (2021) find that in an institutional context that pays more attention toward environmental issues, the cost of debt is lower. Thus, according to this perspective, higher environmental performance in a country reduces the positive effect of cash on firm performance.

Considering the above arguments, we would expect a country's environmental performance to moderate the effect of cash holdings on the operating performance of SMEs in the energy sector. Thus, we formulate the following hypothesis.

Hypothesis 2. *The level of a country's environmental performance moderates the relationship between cash holdings and SMEs' performance.*

3 | EMPIRICAL ANALYSIS

3.1 | Sample

Accounting and financial firm data are obtained from the Orbis database provided by Bureau van Dijk. We follow the data selection processes used by Patari et al. (2012), to obtain a sample consisting of firms operating in the energy sector.⁶ We consider only SMEs selected according to the European Commission Recommendation 2003/361/EC. We drop observations with input mistakes (e.g., non-positive values for total book assets and negative numbers of years for which a firm has been operating). Moreover, to limit the potential impact of outliers, we winsorize all the firm-specific variables at the 1st and 99th percentiles. After performing our data selection, we end up with an unbalanced panel comprising 30,147 firm-year observations during the period 2015–2019 in the European Union. Finally, data on the environmental performance moderator are obtained from Yale University's Center for Environmental Law & Policy and Columbia University in collaboration with the World Economic Forum.⁷

3.2 | Methodology and variable definitions

To test our Hypothesis 1, we apply the following empirical model:

$$\text{Firm Performance} = f(\text{Cash Holdings}, \text{Control Variables})$$

In the panel regression framework, we control for time-invariant firm-specific characteristics. This estimator reduces bias with respect to any omitted variables.

Moreover, to test our Hypothesis 2, the following empirical model is applied:

$$\text{Firm Performance} = f(\text{Cash Holdings}, \text{Environmental Performance}, \text{Cash Holdings} \times \text{Environmental Performance}[\text{Interaction}], \text{Control Variables})$$

Specifically, Hypothesis 2 is tested by adding the interaction term between the variable *Cash Holdings* and the variable measuring the environmental performance. The econometric technique employed in both models is panel Fixed Effects (FE).

The dependent variable of the study is the Return on Assets (ROA), which is used as a proxy for firm performance, measured as operating income divided by total assets. The key independent variable is *Cash Holdings*, measured as the availability of cash and cash equivalents scaled to the total assets. In addition to cash, short-term investments and other types of liquidity (easily convertible into cash and involving an irrelevant risk of loss of value) are included.

Considering that the successful implementation of sustainability initiatives has to become the core mission of EU energy companies, this study employs the environmental performance index as a moderator to evaluate the role of cash holdings in the operating performance of EU energy SMEs. We measure the national environmental performance through the environmental performance index (EPI), which refers to the variable *EPI_Yale*, and is provided jointly by Yale University's Center for Environmental Law & Policy and Columbia University in collaboration with the World Economic Forum.⁸ The EPI ranks 180 countries on 24 performance indicators across 10 issue categories covering environmental health and ecosystem vitality: air quality, water and sanitation, heavy metals, biodiversity and habitat, forests, fisheries, climate and energy, air pollution, water resources and agriculture. “These indicators provide a gauge at a national scale of how close countries are to established environmental policy targets. The EPI offers a scorecard that highlights leaders and laggards in environmental performance and provides practical guidance for countries that aspire to move toward a sustainable future” (EPI Report, 2020⁹). The EPI builds on the best available global data from international research entities, such as the Institute for Health Metrics and Evaluation, the World Resources Institute and the Sea Around Us Project at the University of British Columbia, as well as international organizations such as the World Bank and the UN Food and Agriculture Organization.

To test whether the relationship between cash holdings and performance is moderated by the existence of better country environmental performance, an interaction variable is included in the model. We also include some control variables. *Leverage* is measured as the

⁶Detailed information about the selection process is provided in Table 5.

⁷<https://epi.envirocenter.yale.edu/2018-epi-report/methodology>

⁸<https://epi.envirocenter.yale.edu/2018-epi-report/methodology>

⁹<https://epi.yale.edu/downloads/epi2020report20210112.pdf>

**TABLE 1** Descriptive statistics

	Mean	SD	Min	25th Percentile	Median	75th Percentile	Max
ROA	0.028	0.222	-1.460	-0.002	0.031	0.087	0.792
Cash Holdings	0.146	0.204	0.000	0.016	0.063	0.184	1.000
EPI	0.580	0.348	0.000	0.000	0.770	0.843	0.907
Leverage	0.052	0.124	0.000	0.000	0.000	0.049	0.805
Size (log)	7.071	2.187	0.000	5.694	7.465	8.697	10.667
Age (years)	12.877	14.362	0.000	4.000	9.000	17.000	217.000
Growth Opp.	0.848	5.215	-1.000	-0.111	0.001	0.167	45.962
Tangibility	0.487	0.339	0.000	0.128	0.552	0.795	1.000
NWC	0.071	0.205	-0.686	0.000	0.026	0.125	0.797

TABLE 2 Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	VIF
(1) ROA	1.00									
(2) Cash Holdings	0.06***	1.00								1.40
(3) EPI	-0.02***	-0.05***	1.00							1.02
(4) Leverage	-0.07***	-0.10***	0.01***	1.00						1.02
(5) Size (log)	0.14***	-0.35***	0.01***	0.01*	1.00					1.23
(6) Age (years)	0.07***	-0.04***	-0.07***	-0.04***	0.31***	1.00				1.11
(7) Growth Opp.	0.03***	-0.01***	0.09***	0.00	0.06***	-0.05***	1.00			1.02
(8) Tangibility	0.01**	-0.43***	0.06***	0.03***	0.14***	-0.00	-0.06***	1.00		1.38
(9) NWC	0.13***	-0.07***	-0.02***	0.01***	0.05***	0.05***	0.02***	-0.29***	1.00	1.15

Notes: ***: denotes significance at the 1% level; **: denotes significance at the 5% level; *: denotes significance at the 10% level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

ratio of financial debt to debt plus equity. This variable allows us to monitor the ability to acquire additional external financial resources. *Tangibility*, calculated as the ratio of tangible assets to total assets, is useful for measuring the weight of company assets that could be used as collateral, thereby reducing the degree of information opacity. *Size*, measured as the logarithm of the total assets, shows that a larger firm size, offering greater equity guarantees and stability of cash flows, should be inversely proportional to the probability of default. *Age* is the natural logarithm of one plus the age in years of the firm. *Growth Opportunity* takes into account the firm's chance to undertake new profitable projects and is measured as the rate of sales growth. *Ownership Concentration* is the percentage of shares of the main owner of the firm. Net working capital is the ratio between net operating working capital (accounting receivables plus inventories minus accounting payables) and total assets.

3.3 | Descriptive statistics

Table 1 shows the descriptive statistics of the variables according to our sample of energy SMEs from 27 European countries over the period 2015–2019.

In terms of descriptive statistics, we compare our results based on SMEs in the energy sector with those of La Rocca et al. (2018)

concerning all non-financial firms in Europe. Table 1 shows that, on average, a firm in our sample has an ROA of 2.8%, while, in La Rocca et al.'s (2018) study, the average was 6.7%; in our study, the average cash holdings are 14.6%, which is not far from 10% that La Rocca et al. (2018) obtain. Thus, it seems that there are worse performances in the energy sector than in other sectors despite the similar amounts of cash.

The correlation matrix in Table 2 represents the correlation coefficients of the variables used in the model.

The maximum variance inflation factor (VIF) is 1.40, indicating that there is no particular problem in terms of multicollinearity, as the generally accepted threshold is 10 (or more prudentially 5). Table 3 shows how our main variables evolve over the years, while Table 4 highlights the differences among countries.

4 | EMPIRICAL ANALYSIS

4.1 | Main results

Table 5 presents the empirical results, using the panel-data analysis technique, concerning the relationship between cash holdings and firm performance and the moderating role of a country's environmental performance in our sample of EU energy SMEs. Before launching

TABLE 3 Means of firm-level variables along years

	ROA	Cash hold.	EPI	Lever.	Size (log)	Age (years)	Growth opportunity	Tangib.	NWC
2013	0.009	0.128	0.868	0.047	6.686	9.586	0.619	0.547	0.054
2014	0.010	0.127	0.868	0.048	6.701	1.015	0.741	0.5400	0.058
2015	0.012	0.134	0.855	0.045	6.668	1.066	0.618	0.527	0.061
2016	0.022	0.141	0.855	0.043	6.694	1.122	0.579	0.512	0.066
2017	0.022	0.150	0.718	0.045	6.667	1.180	0.590	0.501	0.067
2018	0.027	0.158	0.718	0.045	6.644	1.232	0.606	0.483	0.069
2019	0.025	0.164	0.686	0.044	6.566	1.287	0.560	0.471	0.070

TABLE 4 Means of variables per country

Country	ROA	Cash hold.	EPI Yale	Lever	Size (log)	Age (years)	Grow. Opp.	Tangib	Net working capital
Armenia	0.103	0.024	0.208	0.010	1.045	11.5	7768	0.878	0.039
Austria	0.090	0.105	0.207	0.001	8.702	2.217	0.056	0.589	0.081
Belgio	0.017	0.139	0.188	0.084	8.757	1.702	1636	0.300	0.141
Bulgaria	0.052	0.169	0.199	0.021	5.512	8.105	0.386	0.653	0.009
Cipro	0.119	0.121	0.137	0.168	7.924	1.127	0.252	0.229	0.192
Croazia	-0.009	0.115	0.188	0.019	600	6.835	1324	0.457	0.135
Danimarca	0.003	0.180	0.182	0.137	8.138	8.916	0.187	0.538	-0.002
Estonia	0.051	0.142	0.212	0.072	6.653	1.529	0.673	0.570	0.136
Finlandia	0.013	0.168	0.199	0.041	7.400	1.796	0.973	0.558	0.055
Francia	0.009	0.176	0.190	0.045	8.036	1.703	0.952	0.362	0.043
Germania	0.045	0.133	0.194	0.019	8.298	1.378	0.848	0.567	0.071
Grecia	-0.035	0.171	0.183	0.044	7.006	9.696	0.615	0.475	0.053
Irlanda	-0.060	0.234	0.180	0.214	8.391	1.151	1333	0.310	0.044
Italia	0.039	0.115	0.186	0.044	7.665	1.367	0.980	0.349	0.073
Lettonia	0.018	0.122	0.209	0.101	6.050	1.284	0.725	0.587	0.057
Lituania	0.051	0.190	0.213	0.064	5.288	7.618	0.497	0.455	0.037
Lussemburgo	0.285	0.058	0.823	0.000	8.663	0	0.000	0.525	0.105
Paesi Bassi	-0.218	0.228	0.153	0.023	9.383	140	3004	0.115	0.133
Polonia	0.017	0.146	0.184	0.063	7.395	1.385	1105	0.524	0.126
Portogallo	0.023	0.155	0.188	0.074	6.868	1.277	1107	0.389	0.045
Rep. Ceca	0.011	0.158	0.211	0.024	7.528	1.341	0.923	0.542	0.018
Rep. Slovacca	0.027	0.159	0.212	0.062	7.393	1.273	0.787	0.542	0.016
Romania	-0.043	0.132	0.184	0.029	534	6.972	0.948	0.495	0.165
Slovenia	0.026	0.151	0.201	0.164	4.717	753	0.331	0.677	-0.020
Spagna	0.044	0.168	0.206	0.032	6.873	1.490	0.567	0.411	0.122
Svezia	0.025	0.186	0.214	0.021	7.214	187	0.552	0.542	0.036
Ungheria	0.009	0.182	0.174	0.016	6.427	1.051	1269	0.524	0.036

our regressions, we first ran the Hausman test, suggesting that panel FE model should be used instead of random effects model.

Column (2) of Table 5 shows that, when we add the variable *Cash Holdings*, it raises the R^2 coefficient, suggesting that this variable provides an important piece of information explaining SMEs' performance. The *Cash Holdings* variable is statistically significant, with the expected positive effect, confirming Hypothesis 1 in line with precautionary saving motives. This finding is consistent with the results of

Almeida et al. (2004), Denis and Sibilkov (2010) and La Rocca et al. (2018) for EU SMEs. Column (3) of Table 5 introduces the variable *EPI_Yale*, reporting a non-significant effect. Column (4) of Table 5 shows the results considering the variable *EPI_Yale* and its interaction with *Cash Holdings*. While the main effect of *EPI_Yale* is statistically not significant, its interaction with *Cash Holdings* is negative and statistically significant. Thus, Hypothesis 2 is supported, showing that the role of cash holdings in firm performance is significantly



TABLE 5 Results of the relationship between cash holdings and energy SMEs operating performance: The moderating role of environmental performance

	(1) Model with control variables	(2) Model with Cash Holdings	(3) Model with Cash Holdings and Environmental Performance Index	(4) Model with the interaction Cash Holdings × EPI_Yale
Cash Holdings		0.225*** (0.024)	0.225*** (0.024)	1.357*** (0.454)
EPI_Yale			0.054 (0.038)	0.062 (0.038)
Cash Holdings × EPI_Yale (interaction)				−1.876** (0.747)
Leverage	−0.156*** (0.021)	−0.157*** (0.022)	−0.157*** (0.022)	−0.156*** (0.022)
Size (log)	0.067*** (0.007)	0.072*** (0.007)	0.072*** (0.007)	0.072*** (0.007)
Age (years)	0.006** (0.002)	0.006** (0.002)	0.008*** (0.003)	0.008*** (0.003)
Growth Opportunity	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
Tangibility	−0.102*** (0.019)	−0.024 (0.021)	−0.025 (0.021)	−0.022 (0.021)
Net Working Capital	0.131*** (0.019)	0.180*** (0.021)	0.180*** (0.021)	0.182*** (0.021)
Constant	0.520** (0.064)	−0.629 (0.068)	0.701 (0.085)	0.709 (0.084)
R ²	0.059	0.081	0.081	0.083
Observations	30,147	30,147	30,147	30,147

Notes: Following the data selection processes used by Patari et al. (2012), we keep firms with NACE (NACE is the acronym used to designate the various statistical classifications of economic activities developed since 1970 in the European Union. NACE provides the framework for collecting and presenting a large range of statistical data according to economic activity in the fields of economic statistics (e.g. production, employment and national accounts) and in other statistical domains.) codes as follows: 06 (extraction of crude petroleum and natural gas), 0610 (extraction of crude petroleum), 0620 (extraction of natural gas), 0910 (support activities for petroleum and natural gas extraction), 0990 (support activities for other mining and quarrying), 1991 (manufacture of coke oven products), 1992 (manufacture of refined petroleum products), 3510 (electric power generation, transmission and distribution), 3511 (production of electricity), 3512 (transmission of electricity), 3513 (distribution of electricity), 3514 (trade of electricity), 3520 (manufacture of gas; distribution of gaseous fuels through mains), 3521 (manufacture of gas), 3522 (distribution of gaseous fuels through mains), 3523 (trade of gas through mains), 3530 (steam and air conditioning supply) and 4950 (transport via pipeline). Standard errors in parentheses. Robust standard errors are reported in brackets. ***: denotes significance at the 1% level; **: denotes significance at the 5% level; *: denotes significance at the 10% level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

moderated by the degree of environmental performance at the country level.

According to Brambor et al. (2006) and Cariola et al. (2020), with regard to the interaction model considering the environmental performance, it is useful to plot the marginal effect of the variable *Cash Holdings* across all the observed range of the moderator variable in addition to using a traditional table of results. Thus, in Figure 1, we consider the partial effect of cash holdings conditional on the level of the national environmental performance.

According to Figure 1, the influence of cash holdings on SMEs' performance is indeed dependent on the environmental policies at the country level. With low levels of this moderator, the estimated

marginal effect of cash holdings is positive. When the value of such a moderator increases, the impact of cash holdings on SMEs' performance changes. In particular, this figure suggests that the effect of cash holdings decreases and becomes negative, with *EPI_Yale* increasing, that is for high levels of national environmental performance. To sum up, this graph confirms that the effect of cash holdings on firm performance is strongly conditioned by the extent of environmental attention in a country. The findings interestingly suggest that, in those countries that pay particular attention to environmental policies, cash has a smaller role in corporate performance. This indicates that a national context that supports investments in energy sustainable projects makes the accumulation of cash holdings less relevant. With cash and debt



FIGURE 1 Marginal effect of cash holdings on firm performance moderated by country environmental performance. [Colour figure can be viewed at wileyonlinelibrary.com]

being substitutes, the findings are in line with those of Cariola et al. (2020), according to whom, in countries where the environmental performance index is high, the use of debt by energy SMEs is more valuable.

4.2 | Robustness tests

This section aims to offer a set of empirical analyses to test for robustness and support our main results. In column (1) and column (2) of Table 6, we consider an alternative measure of environmental performance. In particular, we use an environmental performance index named EPI_CES that is obtained from the Database for Institutional Comparisons in Europe (DICE), which is a service product provided by the Center for Economic Studies (CES).¹⁰

Even when using an alternative index of environmental performance, we find the same results as in our main model. In addition, we run many other robustness tests, which can be provided on request. First, we rerun the previous models, introducing a correction in the econometric technique that is, using the standard error cluster robust at the country level. The results are qualitatively and quantitatively the same as those in our main model. Moreover, we run our regressions using the ordinary least square technique with robust standard errors and including country, year and industry fixed-effects. Even in this case our main model results were confirmed. In addition, we use different dependent variables. As the operating performance can be affected by the sector, instead of using industry fixed effects as controls, we use an adjusted index by sector, named industry-adjusted ROA. Industry-adjusted comparisons allow us to examine the firm-specific performance irrespective of any industry-wide factors that may affect the ROA. It is likely that cash holdings provide a greater competitive edge in some areas than in others. As suggested by Slater and Zwirlein (1992), firms should not be able to achieve an ROA

TABLE 6 Robustness tests on the relationship between cash holdings and firm operating performance conditioned by country's environmental performance in EU energy sector

	(4) Model with Cash Holdings and alternative index EPI_CES	(5) Model with the interaction Cash Holdings × EPI_CES
Cash	0.198*** (0.011)	0.232*** (0.017)
EPI_CES	−0.004 (0.049)	0.150** (0.061)
Cash Holdings × EPI_CES		−1.218*** (0.444)
Leverage	−0.091*** (0.013)	−0.090*** (0.013)
Size (log)	0.008*** (0.001)	0.008*** (0.001)
Age (years)	−0.000* (0.000)	−0.000* (0.000)
Growth Opportunity	0.001* (0.000)	0.001* (0.000)
Tangibility	0.043*** (0.004)	0.043*** (0.004)
Net Working Capital	0.154*** (0.009)	0.154*** (0.009)
Constant	−0.484 (0.053)	−0.067 (0.009)
R ²	0.056	0.056
Observations	30,147	30,147

Notes: Standard errors in parentheses. Robust standard errors are reported in brackets. ***: denotes significance at the 1% level; **: denotes significance at the 5% level; *: denotes significance at the 10% level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

higher than the average in their industry if they do not have a competitive advantage. Therefore, the ROA is an indicator of a firm's ability to create value (Husna & Satria, 2019) and the industry-adjusted ROA is usually used to approximate the market power of a firm (Bettis, 1981), controlling for the specific industry affiliation.

4.3 | Further tests

4.3.1 | Comparison with large European energy firms

In this section (Tables 7 and 8), we compare our main results in Table 5 on energy SMEs with the results obtained from a sample of large European energy firms. The aim of this section is to understand whether our main results are typical of SMEs operating in the energy sector or whether large companies in this industry are affected in the

¹⁰www.cesifo-group.de

**TABLE 7** Descriptive statistics of large European energy firms, used for comparison with our sample of European energy SMEs firms

	Mean	Median	SD	Min.	25th percentile	75th percentile	Max.
ROA	0.043	0.086	-0.343	0.016	0.047	0.076	0.323
Cash Holdings	0.053	0.075	0.000	0.003	0.023	0.073	0.471
EPI	0.799	0.065	0.609	0.770	0.806	0.847	0.907
Leverage	0.040	0.075	0.000	0.000	0.011	0.043	0.473
Size (log)	14.228	1.884	10.379	12.747	14.068	15.636	18.528
Age (years)	34.966	32.769	0.000	13.000	21.000	50.000	176.000
Growth. Opp.	0.081	0.409	-0.708	-0.068	0.021	0.124	2.796
Tangibility	0.539	0.283	0.000	0.345	0.612	0.769	0.940
NWC	0.078	0.129	-0.231	0.010	0.037	0.098	0.606

TABLE 8 Results of the relationship between cash holdings and firm operating performance in a sample of large European energy firms

	(3) Model with cash holdings	(4) Interaction with EPI_CES	(5) Interaction with EPI Yale
Cash Holdings	0.045* (0.026)	0.017 (0.043)	-0.515* (0.289)
EPI_Yale			-0.029 (0.021)
Cash Holdings × EPI_Yale (interaction)		0.000*** (0.000)	
EPI_CES			7.113 (0.361)
Cash Holdings × EPI_CES (interaction)		0.001 (0.001)	
Leverage	-0.080*** (0.022)	-0.067*** (0.022)	-0.079*** (0.022)
Size	-0.003*** (0.001)	-0.002** (0.001)	-0.003*** (0.001)
Age (log)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Growth Opportunity	0.037*** (0.007)	0.037*** (0.007)	0.036*** (0.007)
Tangibility	-0.002 (0.006)	0.003 (0.006)	-0.002 (0.006)
Net Working Capital	0.042** (0.016)	0.045*** (0.016)	0.041** (0.017)
Constant	0.076 (0.013)	0.051 (0.015)	0.100 (0.021)
R ²	0.039	0.049	0.040
Observations	2483	2483	2483

Notes: Standard errors in parentheses. Robust standard errors are reported in brackets. ***: denotes significance at the 1% level; **: denotes significance at the 5% level; *: denotes significance at the 10% level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

same way by the sustainable environmental policy at the country level. We hypothesize that the role of the EPI in the value of cash holdings changes with companies' size. We construct a firm-level sample of large European companies using the Orbis database.

Table 7 shows the descriptive statistics, and it is noticeable that the performance of large energy firms is slightly higher than those of energy SMEs, while the former seems to have less cash in stock than the latter.

Thus, it results that the cash-holding behavior of SMEs is different from that of large firms. Finally, Table 8 reports the regression results for the sample of large European energy firms.

Table 8 shows that, for large energy firms, the moderating role of the EPI is never statistically significant. For these large firms, which operate all over the world, constraints imposed by national laws do not affect their performance.

4.3.2 | COVID-19 crisis

The 2020 COVID-19 crisis represents an economic shock all over the world and firms had to significantly revise their business model due to the effects of the pandemic, with implications for their performance. In this turbulent context, our second further investigates whether the effect observed in our main model differs during the COVID-19 crisis. In particular, we studied the effect of the pandemic using three-way interaction regressions, where the relationship between cash and performance is moderated by the environmental performance of countries and the variable Dummy COVID-19, which equals to one if the year is 2020, zero otherwise. Thus, we ran a regression analysis, including all three independent variables, all three pairs of two-way interaction terms, and the three-way interaction term. Interestingly, our results (reported in Figure 2¹¹) show that during the COVID-19 crisis the moderating effect of EPI observed during previous years does not substantially changes.

5 | DISCUSSION

Our results show that cash holdings are relevant for SMEs that are active in the energy sector. According to the precautionary motive, it seems that keeping a buffer of cash facilitates energy SMEs' growth. The high growth opportunities existing in the energy industry induce managers to increase liquid assets to avoid missing valuable business initiatives that could have a significant environmental impact. Keeping internally generated cash allows firms to make new investments that could increase the corporate performance. Hence, energy SMEs react to their financial constraint problems and face competition in such a developing market through the accumulation of cash. Thus, the role of cash is double: first, it provides greater financial flexibility, allowing firms to make investments more easily; second, it reduces financial constraint problems, which could be a huge concern for firms needing to make new investments.

Moreover, our work points out that a country's attention to environmental policies moderates the cash–performance relationship. In particular, an increase in a country's environmental performance reduces the positive effect of cash holdings on SMEs' operating results. This evidence, in line with the work of Deb et al. (2016), demonstrates that the external setting in which firms operate influences the value of holding cash. In particular, it seems that, in countries where the environmental performance index is high, the role of cash

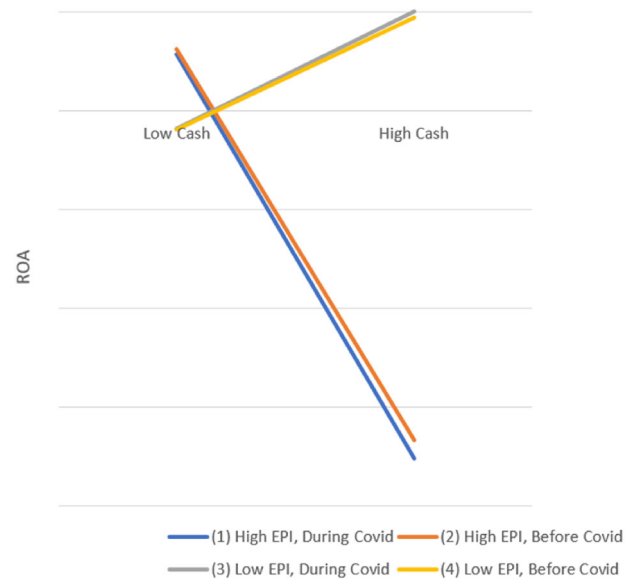


FIGURE 2 Marginal effect of cash holdings on firm performance moderated by country environmental performance before and after COVID-19 crisis [Colour figure can be viewed at wileyonlinelibrary.com]

in energy SMEs' performance is lower. In other words, cash holdings are less valuable in those contexts in which the government pays special attention to environmental issues. Thus, the question arising from our work is the following: 'Why does a country's high attention to environmental policies reduce the relevance of cash to energy SMEs' performance?' A possible explanation lies in the fact that environmentally proactive nations support energy investments by sustaining firms even if they have insufficient cash buffers. Consequently, cash reserves have a lower impact on operating revenues with respect to SMEs operating in countries where the environmental concern is lower. Hence, governments' care of environmental issues could act as a tool that mitigates the asymmetric information problems of SMEs. In such countries, policy makers would be interested in supporting all energy firms, independent of their financial condition, for which such political consideration dissolves the benefits related to holding cash. The work of Cariola et al. (2020) suggests that higher values of a country's environmental performance correspond to a more valuable use of debt. Moreover, it is likely that, in a country where energy projects have a great chance of success, banks and other financial intermediaries are more willing to finance energy SMEs. Thus, in line with our findings, it is reasonable that cash, which is a substitute for debt (Fasano & Deloof, 2021), is less relevant in such contexts.

Therefore, we suggest that governments enhance their environmental policies as they can reduce financial constraints and increase corporate performance, avoiding the effort and the cost opportunities related to the accumulation of cash. From a firm-level point of view, managers of informationally opaque SMEs with a low cash level could reallocate their investments to those nations where the environmental policies allow them to grow despite these difficulties. Another implication for energy SMEs is that they should not be afraid of using their liquidity if they operate in geographical contexts full of growth

¹¹Regression results are available upon request to the authors.



opportunities as the decrease in cash will not hamper their operating performance.

Our work enriches the existing literature studying environmental performance and corporate performance. Future studies could deepen the knowledge of these aspects by investigating the patterns that make cash less relevant in countries with more environmental attention. More generally, future research should consider that the macro-level factors with which energy SMEs operate could affect their operating performance. For instance, they could jointly consider a country's institutional quality, financial system and environmental performance. Additionally, academics could investigate the joint effect of cash and other financial policies (e.g., debt, crowdfunding, trade credit, etc.) on energy SMEs' performance.

6 | CONCLUSION

The objective of this study is to examine the relationship between cash holdings and firm operating performance in the European context of energy SMEs. We focus on the energy industry, in which sustainability and environmental responsibility issues are of special interest. Our findings are in line with the main extant literature indicating that cash holdings have a positive effect on firm performance (Daniel et al., 2004; Kim & Bettis, 2014; La Rocca & Cambrea, 2018).

In the energy industry, the role of environmental performance in the relationship between corporate liquidity and SME performance has not yet been studied. A rapidly growing corporate trend in the European energy sector in recent years is the number of SMEs engaged in the strategy decision to 'go green', which has a positive environmental impact. With this trend, firms' investments in environmental sustainability could affect the cash holdings–performance relationship. We attempt to determine how the level of a country's environmental performance influences the cash holdings–performance relationship. We test our hypothesis with 25,224 firm-year observations of European energy SMEs during the period 2008–2015 in 27 countries. The results suggest that the role of cash holdings in firm performance is significantly moderated by the degree of environmental performance at the country level. In particular, the national environmental performance reduces the positive effect of cash on the operating performance.

Thus, the effect of cash holdings on firm performance is strongly conditioned by the extent of environmental attention in a country. In those countries that care about environmental policies, the role of cash in energy SMEs' performance is lower, indicating that, when governments help firms with energy investments, cash accumulation loses its relevance. Hence, cash seems to matter less in environmentally proactive countries and the precautionary motive to hold cash is less relevant. It is likely that, in such countries, the need to undertake new investments increases the cash difficulties that obstruct the growth of SMEs' performance. Another possible explanation is that environmentally proactive countries support energy SMEs' growth even in the absence of cash reserves and in the presence of information asymmetries. Thus, cash holdings have a scant role in operating revenues.

Our work provides important implications for governments and enterprises. We suggest that policy makers sustain environmental policies, as they could reduce financial constraints and asymmetric information problems and increase energy investments. Additionally, we suggest that energy SMEs should invest in those countries that better support their environmental initiatives.

Our work also provides directions for future research. In particular, academics could try to understand better the reasons for cash reserves being less influential on corporate performance in countries with more environmental attention. Moreover, they should pay more attention to corporate financial policies and macro-economic contingencies when investigating energy SMEs' corporate performance. Additionally, future research could study the cash and investing decisions of energy firms in the light of the current conflict in Ukraine, after which many countries have been forced to reconsider their energy supplies. The war is a structural break that can provide insights about the role of corporate cash stock as buffer against negative contingencies on the market. It would be interesting for future studies to investigate whether energy firms that have higher buffers of cash during are better able to cope with the consequences of the war. More in general, it is important to scrutinize what is the role of cash holdings during structural breaks such as the conflict in Ukraine.

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