



## Environmental disclosure and corporate cash holdings Policies: Which macro-categories matter?

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### ABSTRACT

This study investigates the relationship between environmental disclosure practices and corporate cash-holding policies, emphasising the tunnelling risks minority shareholders face. Utilising the Global Reporting Initiative (GRI) as a framework for disclosure and applying fuzzy-set Qualitative Comparative Analysis (fsQCA) to a sample of 254 European firms listed on the STOXX Europe 600, the analysis identifies distinct configurations of environmental disclosure linked to varying levels of cash holdings. The results indicate that firms with high levels of cash holdings tend to engage in comprehensive environmental disclosure—especially concerning energy, water efficiency, emissions, waste, and supplier environmental assessments—which may diminish opacity and signal a reduced risk of expropriation. In contrast, firms with low cash holdings typically offer narrow or selective disclosures, generally limited to energy and emissions, while neglecting other significant areas such as materials, biodiversity, and supply chain impacts. This fragmented approach introduces opacity in corporate priorities and decision-making, potentially raising concerns among minority shareholders regarding hidden risks and misalignment between managerial actions and broader stakeholder interests. Throughout the sample, biodiversity is consistently underreported. By illustrating how the breadth of environmental disclosure interacts with cash-holding levels, this study highlights the role of transparency in influencing the perceived likelihood of cash being diverted for private benefit in contexts characterised by agency conflicts.

### 1. Introduction

Cash holdings have long been a central topic in corporate finance (Weidemann, 2018). On the one hand, they provide firms with financial flexibility, enabling them to fund operations and investments internally without depending on external capital (Kim & Bettis, 2014). On the other hand, excess cash can lead to agency problems, particularly in firms with concentrated ownership. As first outlined by Jensen and Meckling (Jensen & Meckling, 1976), agency theory suggests that corporate resources may be diverted for private

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benefit when control and ownership are separated—or when dominant shareholders can act without adequate oversight. In this context, large cash reserves may serve as a means through which majority shareholders expropriate minority ones, a phenomenon commonly referred to as tunnelling (Lin et al., 2012).

How can minority shareholders avoid investing in firms with a higher tunnelling risk? Addressing this question requires a deeper understanding of the factors that drive corporate cash-holding policies. While prior literature has explored traditional determinants—such as firm size (Bates et al., 2009), leverage (Acharya et al., 2007), profitability (Kalcheva & Lins, 2007), and dividend policy (Dittmar et al., 2003)—emerging research has started to investigate how non-financial disclosure, mainly related to Corporate Social Responsibility (CSR) and Environmental, Social, and Governance (ESG) factors, may also affect cash-holding policies.

CSR and ESG disclosures can enhance transparency, reduce information asymmetry, and signal a firm's commitment to stakeholder-oriented governance (Aroui & Pijourlet, 2017). For example, Lu et al. (Lu et al., 2016) demonstrate that CSR reporting facilitates external monitoring. Cheung (Cheung, 2016) finds that firms with stronger CSR profiles tend to hold less cash due to lower perceived risk and more significant reputational capital. Similarly, the trust-based view of CSR suggests that responsible firms enjoy easier access to credit and thus have reduced incentives to accumulate precautionary cash buffers (Cheng et al., 2014; Cheung & Pok, 2019).

Among the ESG components, the environmental dimension has become particularly significant to investors and lenders due to mounting regulatory pressure and concerns over climate-related risks. Recent studies, such as Liao et al. (Liao et al., 2023), have explored how environmental responsibility correlates with lower cash holdings. However, such research typically relies on composite environmental scores, which obscure the relative importance of specific disclosure areas.

To address this limitation, the present study adopts a more detailed approach. It investigates how specific macro-categories of environmental disclosure—based on the Global Reporting Initiative (GRI) framework—affect corporate cash-holding policies. This focus is particularly relevant for minority shareholders, who must depend on publicly disclosed information to evaluate agency risks and the potential for value diversion.

The study empirically applies fuzzy-set Qualitative Comparative Analysis (fsQCA) to a sample of 254 European firms listed on the STOXX Europe 600 Index. These firms are subject to European ESG regulations, including Directive 2014/95/EU (the Non-Financial Reporting Directive) and Directive 2022/2464/EU (the Corporate Sustainability Reporting Directive). Unlike correlational models that isolate the net effect of individual predictors, fsQCA captures how different conditions combine to produce an outcome. This configurational logic is particularly useful for addressing endogeneity concerns common in corporate finance, where financial policies—such as cash holdings—are not determined in isolation but alongside other strategic choices. By focusing on patterns of causal complexity rather than linear associations, fsQCA helps mitigate the bias arising from omitted variables or reciprocal relationships between disclosure and financial decisions (Carmona et al., 2023; Schauten et al., 2013).

The analysis reveals that firms with high cash holdings frequently accompany them with comprehensive environmental disclosures, especially in energy, water efficiency, emissions, waste, and supplier assessments. This combination may help alleviate concerns about tunnelling by decreasing opacity and strengthening external accountability. In contrast, firms with low cash holdings typically offer limited or selective disclosure, which may raise red flags due to the opacity it creates surrounding corporate priorities and strategic intent—potentially obscuring behaviours related to expropriation risk.

This study contributes to the literature in two main ways. First, it employs a configurational approach to examine how specific macro-categories of environmental disclosure—based on GRI standards—are associated with different levels of cash holdings. This enables us to move beyond aggregated environmental scores and identify the patterns most relevant to understanding corporate financial behaviour. Second, it frames these patterns within the tunnelling narrative. By analysing how disclosure breadth varies across firms with different liquidity levels, the study offers insights into how environmental transparency—or its absence—can shape perceptions of expropriation risk. In doing so, it underscores the potential for environmental disclosure to serve as an interpretive lens for minority shareholders, evaluating whether cash reserves will likely be used opportunistically or in line with stakeholder interests.

## 2. Literature review

Environmental disclosure, a vital aspect of non-financial reporting, has garnered increasing attention as regulators, investors, and financial intermediaries call for greater transparency concerning firms' sustainability practices. In addition to showcasing environmental accountability, such disclosures can affect perceptions of governance quality and influence financial decisions, including corporate cash-holding strategies.

Prior research indicates that environmental transparency influences how firms manage their liquidity. Companies with greater environmental disclosure often benefit from enhanced access to capital markets and lower financing costs, which reduces the need to maintain sizeable precautionary cash buffers (Dhaliwal et al., 2011). Conversely, firms facing high environmental risks or providing weak disclosure may retain more cash to hedge against potential regulatory sanctions or reputational costs (García-Sánchez et al., 2020).

More broadly, studies on ESG integration indicate that firms with stronger ESG performance—particularly in the environmental dimension—tend to demonstrate lower cash-hoarding tendencies and more stable cash flow management (Chen et al., 2024). This suggests that environmental disclosure may be strategic in corporate finance by addressing stakeholder expectations and signalling lower risk exposure.

From an agency theory perspective, this signalling role becomes particularly significant. Jensen and Meckling (Jensen & Meckling, 1976) highlight that when ownership and control are separated—or when dominant shareholders face inadequate monitoring—large cash reserves can turn into a means for opportunistic behaviour. In such situations, tunnelling—the misappropriation of firm resources

for personal gain—becomes a significant concern, especially for minority shareholders. Environmental disclosure, by reducing information asymmetry and enhancing external accountability, can act as a mechanism to alleviate this expropriation risk (Harjoto & Jo, 2011).

However, much of the existing literature relies on composite environmental performance scores. These aggregated measures obscure which specific areas of disclosure matter most to stakeholders and overlook how disclosure elements might combine to influence financial policy. Additionally, prior research typically applies variance-based methods that focus on the independent effects of individual predictors. This limits our ability to understand the configurational logic behind disclosure strategies—precisely, how different combinations of environmental categories may jointly shape cash-holding behaviour.

This study uses fsQCA to examine GRI-based environmental disclosures and address these gaps. This configurational approach captures the interplay of various disclosure categories, providing a more nuanced understanding of how transparency relates to cash holdings—particularly concerning tunnelling issues and minority shareholder protection.

### 3. Methodology

#### 3.1. Fuzzy-set Qualitative Comparative Analysis (fsQCA)

This study utilises fsQCA, an asymmetric data analysis technique that combines the strengths of both quantitative and qualitative methodologies. fsQCA preserves the richness and complexity of individual cases while providing generalisable insights across larger samples.

The method is particularly suited to addressing causal complexity, where the same outcome may arise from different combinations of conditions—a concept known as equifinality. It also captures conjunctural causation, acknowledging that multiple factors often work together to produce an outcome. These two features define the configurational approach to causal analysis (Ragin, 1987), with fsQCA being one of its most prominent methodological applications (Pappas & Woodside, 2021).

Unlike traditional variance-based techniques, fsQCA does not depend on assumptions of linearity or additive effects. This characteristic makes it particularly valuable for examining the relationship between CSR/ESG disclosure and financial outcomes, such as cash holdings, where interactions among various disclosure categories are likely. fsQCA employs calibrated measures ranging from 0 to 1, enabling researchers to consider partial membership in causal sets and assess the degree of association between observed cases and specific outcomes (Vis, 2012). It is suitable for small and large sample sizes, making it practical for detailed case-oriented research and more generalisable analyses across larger datasets (Greckhamer et al., 2013). Furthermore, it is resilient to outliers, as its reliance on set membership scores reduces the impact of extreme values (Liu et al., 2017).

The empirical analysis is conducted using fsQCA 4.1 software developed by Ragin and Davey (Ragin & Davey, 2022), following a two-step procedure: calibration and identification of relevant configurations (Pappas & Woodside, 2021; Woodside, 2014). The first step involves identifying cases that deviate from dominant patterns and are typically excluded by variance-based approaches but can provide insight into asymmetric causality.

When calibrating data, raw interval or ordinal data are converted into degrees of membership in the relevant sets. This study adopts the direct calibration method used in prior fsQCA research on CSR/ESG disclosure (Santamaria et al., 2021). Thresholds are established at the 0.95, 0.50, and 0.05 percentiles to assign full membership, crossover points, and full non-membership, respectively, ensuring all values fall within the [0, 1] range. To address cross-over cases—specifically, those falling precisely at the 0.50 threshold and potentially causing classification issues—we added a constant of 0.001, following the recommendation of Fiss (Fiss, 2011). After calibration, a truth table displays all logically possible combinations of causal conditions and their relationship with the outcome. This table is then organised by frequency—indicating the number of cases supporting a particular configuration—and consistency, which measures how reliably a configuration is linked to the outcome (Ragin et al., 2008). In line with previous ESG disclosure studies using fsQCA, a consistency threshold of 0.80 is applied (Santamaria et al., 2021). For the final interpretation, this study concentrates on the intermediate solutions recommended by Chen Liang et al. (Chen Liang et al., 2023) to reflect theoretically plausible assumptions about the presence or absence of causal conditions.

#### 3.2. Sample selection and data collection

The analysis focuses on companies listed on the STOXX Europe 600 Index as of December 31, 2021. This index broadly represents European countries and industries, encompassing approximately 90 % of the region's investable market. Firms in the Banks, Financial Services, and Insurance sectors (55) were excluded due to their structural differences from industrial firms (Brogi & Lagasio, 2019).

Next, companies that did not include a GRI Content Index in their non-financial reports were excluded. These 291 firms disclosed environmental information using alternative reporting standards instead of the GRI framework. This filtering resulted in a final sample of 254 non-financial firms. This selection aligns with the findings of Giannarakis et al. (Giannarakis et al., 2023), which report that only about 68 % of Europe's largest companies have adopted GRI-based non-financial disclosure standards.

Data on cash holdings were sourced from Orbis Bureau van Dijk. Following Cheung and Wai (Cheung & Wai, 2016), cash holdings were calculated as the ratio of cash and cash equivalents to the book value of total assets.

Environmental disclosure data were extracted manually by reviewing each firm's GRI Content Index section in their non-financial reports. To ensure data reliability, two independent coders processed and cross-validated the information. The GRI Content Index comprises 31 indicators grouped under macro-categories related to the environmental pillar. Each item was coded as one if disclosed and zero if not. Composite disclosure scores were calibrated using the 0.95, 0.50, and 0.05 percentiles to create fuzzy-set scores, which

served as causal conditions in the fsQCA analysis of corporate cash-holding policies.

The complete list of GRI-based environmental macro-categories is presented in [Table 1](#).

## 4. Results

### 4.1. Descriptive statistics

[Table 2](#) displays the descriptive statistics for all variables utilised in the analysis.

The sample comprises 254 firms with complete data for all variables. The average value of the 'Cash1' variable—measuring the ratio of cash and cash equivalents to total assets—stands at 0.0977, indicating that most firms maintain relatively low levels of cash holdings compared to the maximum observed value. Most disclosure-related variables show mean values close to the midpoint of their respective ranges, suggesting a balanced distribution across the sample. An exception is the 'Emi' variable (related to emissions), which exhibits a higher mean and a lower standard deviation, indicating that disclosure in this area is both more frequent and more homogeneous across firms.

[Table 3](#) presents the sectoral breakdown of the sample, highlighting the distribution of firms across various industries.

The most represented sector is "Industrial Goods & Services," with 48 firms, followed by "Health Care" with 26 firms. "Construction & Materials" and "Food, Beverage & Tobacco" each consist of 18 firms, while "Technology" and "Real Estate" are also well represented, with 19 and 17 firms, respectively. The "Personal Care, Drug & Grocery Store" sector includes 10 firms. Other sectors, such as "Chemicals," "Energy," and "Basic Resources," comprise 14, 14, and 12 firms, respectively. The least represented sectors are "Media" and "Travel & Leisure," each with only four firms.

[Table 4](#) presents the distribution of firms by country, highlighting the geographical diversity of the sample.

Great Britain leads the sample with 38 firms, closely followed by Germany and Switzerland, with 35. Sweden also has a strong representation of 33 firms. France and Italy contribute 22 and 14 firms, respectively, while the Netherlands and Spain account for 17 and 16 firms. Belgium and Denmark each include six firms. At the lower end of the distribution, Luxembourg and Poland are represented by only one firm each.

### 4.2. fsQCA results

This section presents the fsQCA results for high and low cash holdings, defined as firms with a "Cash1" score above and below 0.5000. The analysis explores how various configurations of GRI-based environmental disclosure items relate to these two groups.

[Table 5](#) presents five distinct solutions, each reflecting a unique combination of causal conditions linked to high cash holdings.

Solution 1 (S1) demonstrates that firms with high cash holdings tend to disclose extensively across multiple environmental dimensions, particularly energy, water efficiency, emissions, waste, and supplier environmental assessments. This is the most influential configuration, featuring the highest unique coverage (18.42 %) and a consistency score of 98.59 %. In contrast, Solution 2 (S2) indicates that some firms with high cash reserves exhibit limited environmental disclosure, as evidenced by the absence of several GRI-based indicators. Despite this minimal reporting, the configuration still accounts for 5.80 % of the sample, with a consistency of 97.69 %. Solution 3 (S3) shares similarities with S2 but places a greater emphasis on supplier environmental assessments and less on waste disclosure; it has a unique coverage of 0.61 % and a consistency of 97.90 %. Solution 4 (S4) connects high cash holdings to disclosures emphasising water efficiency, emissions, and waste, with a unique coverage of 2.56 % and an exceptionally high consistency of 99.98 %. Solution 5 (S5) closely resembles S4 but emphasises energy and supplier assessments while downplaying waste; it covers 1.05 % of the sample while maintaining perfect consistency (1.00). Together, these five solutions explain 73.64 % of the cases with high cash holdings and achieve an overall consistency score of 97.69 %.

Focusing on firms with low cash holdings, [Table 6](#) presents the configurations of causal conditions derived from their GRI-based environmental disclosure practices.

Solution 1 (S1) indicates that firms with low cash holdings primarily disclose information regarding their suppliers' environmental assessments. However, they offer limited details on materials, energy, water efficiency, biodiversity, and emissions. This configuration represents 2.69 % of the sample and attains a consistency score of 0.9130.

Solution 2 (S2), the most prominent in the low-cash group, indicates that 29.29 % of firms emphasise disclosures on energy and emissions but provide limited information on materials, biodiversity, waste, and supplier environmental assessments. Its consistency is measured at 0.9072.

**Table 1**  
GRI-based macro-categories.

GRI-Based Environmental Macro-Categories	Causal Condition Name
GRI 301: Materials 2016	<i>Mat</i>
GRI 302: Energy 2016	<i>Eng</i>
GRI 303: Water and Effluents 2018	<i>WatEff</i>
GRI 304: Biodiversity 2016	<i>Bio</i>
GRI 305: Emissions 2016	<i>Emi</i>
GRI 306: Waste 2020	<i>Was</i>
GRI 308: Supplier Environmental Assessment 2016	<i>SupEnv</i>

**Table 2**  
Descriptive statistics.

Variable	N	Min	Max	Mean	Std. Dev.
<i>Cash1</i>	254	0.0000	0.4485	0.0977	0.0748
<i>Mat</i>	254	0.0000	1.0000	0.3005	0.3787
<i>Eng</i>	254	0.0000	1.0000	0.5701	0.3177
<i>WatEff</i>	254	0.0000	1.0000	0.4589	0.3992
<i>Bio</i>	254	0.0000	1.0000	0.2343	0.3669
<i>Emi</i>	254	0.0000	1.0000	0.6985	0.2576
<i>Was</i>	254	0.0000	1.0000	0.5465	0.4124
<i>SupEnv</i>	254	0.0000	1.0000	0.4961	0.4098

**Table 3**  
Sector breakdown.

Sector	N
Automobiles & Parts	7
Basic Resources	12
Chemicals	14
Construction & Materials	18
Consumer Products & Services	12
Energy	14
Food, Beverage & Tobacco	18
Health Care	26
Industrial Goods & Services	48
Media	4
Personal Care, Drug & Grocery Store	10
Real Estate	17
Retail	5
Technology	19
Telecommunications	11
Travel & Leisure	4
Utilities	15
<b>Total</b>	<b>254</b>

**Table 4**  
Country breakdown.

Country	N
Austria	4
Belgium	6
Denmark	6
Finland	11
France	22
Germany	35
Great Britain	38
Ireland	4
Italy	14
Luxembourg	1
Netherlands	17
Norway	8
Poland	1
Portugal	3
Spain	16
Sweden	33
Switzerland	35
<b>Total</b>	<b>254</b>

Solution 3 (S3) closely resembles S2 in its emphasis on emissions. However, it also highlights that a small share of firms (0.38 %) report on water efficiency, waste, and supplier assessments while still underreporting materials and biodiversity. This solution has a consistency score of 0.8981.

Solution 4 (S4) shows a disclosure pattern broadly consistent with S3 but emphasises energy more. As with the other solutions, limited attention remains on biodiversity. This configuration encompasses 4.26 % of the firms and achieves a consistency score of 0.9008.

These four solutions account for the disclosure patterns linked to 72.12 % of the firms with low cash holdings, bolstered by an overall solution consistency of 0.8592.

**Table 5**  
Configurations of causal conditions: Environmental disclosure – high cash holdings.

Conditions	S1	S2	S3	S4	S5
<i>Mat</i>		⊗	⊗	⊗	⊗
<i>Eng</i>	●	⊗	⊗	⊗	●
<i>WatEff</i>	●	⊗	⊗	●	●
<i>Bio</i>		⊗	⊗	⊗	⊗
<i>Emi</i>	●	⊗	⊗	●	●
<i>Was</i>	●	⊗		●	
<i>SupEnv</i>	●		●		●
Raw Coverage	0.4412	0.4663	0.3084	0.3832	0.2876
Unique Coverage	0.1842	0.0580	0.0061	0.0256	0.0105
Consistency	0.9859	0.9769	0.9790	0.9998	1.0000
<b>Solution Coverage</b>	<b>0.7364</b>				
<b>Solution Consistency</b>	<b>0.9769</b>				

**Note:** ● indicates the presence of a condition. Blank spaces indicate that the condition is not relevant. ⊗ Indicates the absence or negation of a condition. "Mat" is for "GRI 301: Materials 2016". "Eng" stands for "GRI 302: Energy 2016". "WatEff" is the short form of "GRI 303: Water and Effluents 2018". "Bio" represents "GRI 304: Biodiversity 2016". "Emi" is the abbreviation for "GRI 305: Emissions 2016". "Was" denotes "GRI 306: Waste 2020". "SupEnv" signifies "GRI 308: Supplier Environmental Assessment 2016".

**Table 6**  
Configurations of causal conditions: Environmental disclosure – low cash holdings.

Conditions	S1	S2	S3	S4
<i>Mat</i>	⊗	⊗	⊗	
<i>Eng</i>	⊗	●		●
<i>WatEff</i>	⊗		●	●
<i>Bio</i>	⊗	⊗	⊗	⊗
<i>Emi</i>	⊗	●	●	●
<i>Was</i>		⊗	●	●
<i>SupEnv</i>	●	⊗	●	●
Raw Coverage	0.3287	0.5175	0.3446	0.3821
Unique Coverage	0.0269	0.2929	0.0038	0.0426
Consistency	0.9130	0.9072	0.8981	0.9008
<b>Solution Coverage</b>	<b>0.7212</b>			
<b>Solution Consistency</b>	<b>0.8592</b>			

**Note:** ● indicates the presence of a condition. Blank spaces indicate that the condition is not relevant. ⊗ Indicates the absence or negation of a condition. "Mat" is for "GRI 301: Materials 2016". "Eng" stands for "GRI 302: Energy 2016". "WatEff" is the short form of "GRI 303: Water and Effluents 2018". "Bio" represents "GRI 304: Biodiversity 2016". "Emi" is the abbreviation for "GRI 305: Emissions 2016". "Was" denotes "GRI 306: Waste 2020". "SupEnv" signifies "GRI 308: Supplier Environmental Assessment 2016".

**Table 7** compares the environmental disclosure practices based on the GRI of firms with high and low cash holdings.

A consistent finding across all groups is the underemphasis on biodiversity-related disclosures, highlighting a common blind spot in corporate environmental reporting. In contrast, themes such as energy, water efficiency, emissions, waste, and supplier environmental assessments recur frequently, suggesting their broader relevance to how firms communicate sustainability practices. A closer look at the most representative solutions—S1 for high cash holdings (18.42 %) and S2 for low cash holdings (29.29 %)—reveals marked differences. Firms with high cash holdings tend to be more forthcoming in their disclosures, particularly regarding water efficiency, waste management, and supplier environmental assessments. Conversely, firms with low cash holdings are more selective in reporting, often omitting these dimensions. This divergence underscores how the breadth of disclosure varies with cash position.

## 5. Discussion

The findings of this study offer new insights into how environmental disclosure practices—based on GRI indicators—are connected to corporate cash-holding levels, particularly concerning tunnelling risk. The fsQCA analysis reveals distinct disclosure patterns linked with firms with high or low cash levels, providing a nuanced perspective on the intersection of financial policy and environmental transparency in contexts susceptible to agency conflicts.

**Table 7**

Configurations of causal conditions: Environmental disclosure – high Vs. Low cash holdings.

Conditions	S1 – H	S2 – H	S3 – H	S4 – H	S5 – H	S1 – L	S2 – L	S3 – L	S4 – L
<i>Mat</i>		⊗	⊗	⊗	⊗	⊗	⊗	⊗	
<i>Eng</i>	●	⊗	⊗	⊗	●	⊗	●		●
<i>WatEff</i>	●	⊗	⊗	●	●	⊗		●	●
<i>Bio</i>		⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗
<i>Emi</i>	●	⊗	⊗	●	●	⊗	●	●	●
<i>Was</i>	●	⊗		●			⊗	●	●
<i>SupEnv</i>	●		●		●	●	⊗	●	●
Raw Coverage	0.4412	0.4663	0.3084	0.3832	0.2876	0.3287	0.5175	0.3446	0.3821
Unique Coverage	0.1842	0.0580	0.0061	0.0256	0.0105	0.0269	0.2929	0.0038	0.0426
Consistency	0.9859	0.9769	0.9790	0.9998	1.0000	0.9130	0.9072	0.8981	0.9008
<b>Solution Coverage</b>	<b>0.7364</b>					<b>0.7212</b>			
<b>Solution Consistency</b>	<b>0.9769</b>					<b>0.8592</b>			

**Note:** ● indicates the presence of a condition. Blank spaces indicate that the condition is not relevant. ⊗ Indicates the absence or negation of a condition. "Mat" is for "GRI 301: Materials 2016". "Eng" stands for "GRI 302: Energy 2016". "WatEff" is the short form of "GRI 303: Water and Effluents 2018". "Bio" represents "GRI 304: Biodiversity 2016". "Emi" is the abbreviation for "GRI 305: Emissions 2016". "Was" denotes "GRI 306: Waste 2020". "SupEnv" signifies "GRI 308: Supplier Environmental Assessment 2016".

Several configurations strongly focus on broad and multi-dimensional environmental disclosure among firms with significant cash reserves. Key categories such as energy, water efficiency, emissions, waste management, and supplier environmental assessments frequently recur, particularly in the most representative solutions. These firms combine their liquidity with transparency, which may reduce the informational asymmetries that often raise concerns about the opportunistic use of financial slack. For minority shareholders, a broader disclosure provides a clearer signal that cash reserves are maintained for strategic flexibility rather than potential expropriation.

In contrast, firms with low cash holdings tend to disclose selectively, often omitting key environmental areas such as waste management and supplier assessments. While low liquidity may seem less susceptible to tunnelling at first glance, the limited scope of disclosure raises a different type of agency concern—one rooted in opacity. This fragmented reporting approach can obscure internal decision-making and strategic intent, making it challenging for external stakeholders to evaluate whether financial and environmental practices align with long-term value creation. In this context, tunnelling risk may arise not from excess cash but from the lack of clarity surrounding corporate priorities and accountability mechanisms.

A notable finding is the systematic underreporting of biodiversity-related disclosures across high and low-cash-holding firms. Consistent across all configurations, this omission indicates a blind spot in sustainability communication. Given the increasing importance of biodiversity for regulatory frameworks and stakeholder evaluations, this gap may represent a missed opportunity to enhance governance credibility—particularly in industries with significant environmental footprints.

Together, these patterns reinforce the core argument of the study: cash holdings should not be evaluated in isolation. Instead, the breadth and specificity of environmental disclosure serve as interpretive signals that help stakeholders—predominantly minority shareholders—accurately discern the extent of firms' commitment to transparent and accountable governance. While high liquidity often raises concerns under agency theory, this study shows that those issues can be mitigated when environmental disclosure is broad and consistent. Conversely, limited disclosure—even in firms with modest cash reserves—may increase suspicion by obscuring corporate behaviour and undermining stakeholder trust.

## 6. Conclusion

This study enhances the understanding of how environmental disclosure practices relate to corporate cash-holding policies, providing insights from a configurational perspective rooted in agency theory. The findings indicate that high cash holdings—often considered a potential avenue for tunnelling—can acquire a different significance when paired with thorough environmental disclosure. In these instances, transparency is a signalling mechanism that diminishes informational opacity and bolsters stakeholder accountability. For minority shareholders, this combination of liquidity and disclosure presents a more nuanced perspective for evaluating expropriation risk.

Conversely, firms with lower cash reserves tend to adopt a more selective approach to environmental reporting. Although their limited liquidity might imply a lower risk of tunnelling through cash hoarding, their fragmented disclosures introduce opacity that may obscure decision-making and internal priorities. This lack of transparency can still raise agency concerns, particularly for minority investors who rely on consistent, comprehensive information to assess governance quality and alignment with stakeholder interests.

The findings highlight the importance of interpreting financial and non-financial information together. Cash levels alone do not determine agency risk; instead, the transparency regarding how these financial resources are managed ultimately shapes stakeholder assessments. Substantial environmental disclosure emerges as a governance-enhancing mechanism that can mitigate agency problems

and bolster investor confidence.

From a practical standpoint, these insights are particularly relevant for minority shareholders and institutional investors. Assessing tunnelling risk requires more than simply examining cash levels in isolation; it also demands attention to the structure and extent of environmental reporting. Firms that comprehensively disclose key GRI-based categories may signal stronger governance and lower expropriation risk, even when cash reserves are substantial. This underscores the strategic value of transparent environmental disclosure for corporate managers to mitigate agency concerns and reassure stakeholders. For regulators and standard setters, the findings support ongoing efforts to promote completeness and consistency in non-financial reporting—especially in underreported areas that influence investor perceptions of opacity and governance quality.

Despite its contributions, the study has several limitations. First, it employs GRI indicators as the sole framework for evaluating environmental disclosure. Although widely used, GRI standards may not fully capture the diversity of sustainability practices or the specificity of industry-level reporting. Future research could integrate complementary frameworks, such as the SASB or TCFD, to broaden the analytical lens. Second, the cross-sectional design limits the ability to track how disclosure and financial behaviour evolve. Longitudinal research could provide greater insight into how changes in regulation or stakeholder expectations influence these dynamics. Third, while this study focuses on cash holdings, future research might examine how other financial policies—such as leverage, investment intensity, or payout decisions—interact with disclosure strategies and affect agency outcomes. Sector- or country-specific studies may also reveal important contextual nuances. Last, although the analysis centres on the environmental dimension of ESG, future research could explore how the social and governance pillars interact with financial policies, advancing a more integrated understanding of ESG-finance linkages in agency-prone contexts.

### Author statement

Carmen Gallucci: Conceptualization, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Writing – original draft, Writing – review and editing. Rosalia Santulli: Conceptualization, Investigation, Methodology, Validation, Writing – original draft, Writing – review and editing. Riccardo Tiplaldi: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Validation, Writing – original draft, Writing – review and editing.

### Declaration of competing interests

The Authors have nothing to declare.

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