

# **Managerial Beliefs Under Uncertainty: CEO Overconfidence and the Transmission of Economic Policy Uncertainty to Corporate Leverage**

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**SUMMARY:** This study investigates the impact of economic policy uncertainty (EPU) on corporate leverage, specifically examining whether CEO overconfidence conditions this transmission. The research integrates macro-financial and behavioral finance perspectives, focusing on emerging markets due to their financial frictions and institutional volatility.

**METHOD:** The study uses an unbalanced panel of 3,764 non-financial companies from BRICS economies over the period 2015-2024, totaling 22,760 firm-year observations. A System-GMM model is employed to address dynamic endogeneity and reverse causality. Overconfidence is measured through a new multidimensional index based on abnormal investment, acquisitions, and earnings optimism.

## **KEY FINDINGS:**

- The impact of macroeconomic uncertainty on capital structure is heterogeneous and depends on managers' behavioral traits.
- Contrary to the traditional amplification thesis, policy uncertainty acts as an external disciplining constraint, mitigating the economic expression of managerial overconfidence by narrowing access to credit.
- The results suggest that increased policy uncertainty leads to more cautious financing behavior, particularly in firms with overconfident CEOs.

**IMPLICATION FOR TRADING:** These findings imply that traders should consider the interplay between macroeconomic uncertainty and managerial overconfidence when making investment decisions. Specifically, during periods of high EPU, firms with overconfident CEOs are likely to reduce leverage, which could affect stock prices and credit markets. Traders should monitor EPU indicators and CEO behavior to anticipate changes in corporate financing strategies.

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**Gilmarques Agapito Costa:** Conceptualization, Methodology, Software, Formal analysis, Data curation, Investigation, Writing – original draft.

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### ***Declaration of competing interests***

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

# **Managerial Beliefs Under Uncertainty: CEO Overconfidence and the Transmission of Economic Policy Uncertainty to Corporate Leverage**

## **Abstract**

This study examines whether CEO overconfidence conditions the transmission of economic policy uncertainty (EPU) to corporate leverage, integrating the macro-financial and behavioral literatures. We investigate whether managerial bias amplifies or constrains financing responses under high uncertainty, testing this dynamic in the context of emerging markets, given their severe financial frictions and institutional volatility. Using an unbalanced panel of 3,764 publicly traded non-financial companies from the BRICS economies (2015–2024), totaling 22,760 firm-year observations, we estimate a System-GMM model to mitigate dynamic endogeneity and reverse causality. Overconfidence is measured through a new multidimensional index of revealed beliefs based on abnormal investment, acquisitions and earnings optimism. The results reveal that the impact of macroeconomic uncertainty on capital structure is heterogeneous and crucially depends on managers' behavioral traits. Contrary to the traditional amplification thesis, we found that policy uncertainty acts as an external disciplining constraint, mitigating the economic expression of managerial overconfidence by narrowing access to credit. This work contributes by establishing a novel boundary condition for behavioral finance, introducing a robust revealed-beliefs metric applicable internationally and expanding the external validity of capital structure theory in emerging economies.

**Keywords:** Capital Structure; CEO Overconfidence; Economic Policy Uncertainty; Behavioral Corporate Finance; Emerging Markets

## **1. Introduction**

Capital structure remains one of the most persistent issues in corporate finance, as financing decisions directly shape companies' financial flexibility, exposure to insolvency risk, investment capacity and, ultimately, firm value. Although classical literature has traditionally emphasized firm-specific determinants such as profitability, tangibility, growth opportunities and tax shields (Myers, 1984; Frank & Goyal, 2009), more recent research suggests that financing policy cannot be fully understood without considering broader macroeconomic conditions and managerial behavioral traits. In particular, economic policy uncertainty (EPU)

has emerged as a critical macro-financial force capable of altering credit conditions, funding costs and corporate risk exposure (Baker et al., 2016; Drobetz et al., 2018; Tran, 2021), while research in behavioral finance demonstrates that managerial biases systematically distort corporate decision-making (Malmendier & Tate, 2005, 2008; Malmendier et al., 2011). Together, these advances suggest that capital structure decisions may reflect the interaction between external financial constraints and internal cognitive distortions, rather than purely rational optimization.

This interaction may be particularly relevant in emerging markets, where weaker institutional environments, higher macroeconomic volatility and shallower capital markets intensify financing frictions (Bajaj et al., 2021; Vega-Gutiérrez et al., 2024). In these contexts, increased policy uncertainty may induce precautionary financing behavior, whereby firms raise leverage preemptively to preserve liquidity before credit conditions deteriorate. However, this macroeconomic response may not be uniform across firms, as managerial beliefs likely shape how they interpret and translate uncertainty into financing choices. Overconfident CEOs, for instance, tend to overestimate future cash flows, underestimate downside risk and perceive external equity as undervalued, systematically favoring debt financing (Malmendier & Tate, 2005, 2008). If managerial beliefs alter the interpretation of uncertainty itself, macroeconomic shocks may operate not only through conventional financial channels but also through behavioral amplification or discipline mechanisms.

Despite the growing literature on economic policy uncertainty and managerial overconfidence, a significant gap remains. Existing studies largely examine these determinants in isolation. EPU research predominantly treats uncertainty as an exogenous macroeconomic shock that affects firms through financing constraints, investment delays, or precautionary liquidity management (Yousefi & Yang, 2021; Almustafa et al., 2023; Tran, 2021). Concurrently, behavioral finance literature primarily treats managerial overconfidence as a firm-level determinant of financing choices, often abstracting from the broader macroeconomic environment in which these decisions are made (Malmendier et al., 2011; Yung & Long, 2022). Consequently, little is known about whether macroeconomic uncertainty amplifies managers' behavioral biases or restricts their economic expression. This omission is theoretically relevant, as it leaves unanswered whether behavioral distortions remain equally influential under severe external financing frictions, particularly in emerging economies.

This study addresses this gap by examining whether managerial overconfidence conditions the relationship between economic policy uncertainty and corporate leverage. Specifically, we investigate whether CEOs exhibiting stronger revealed manifestations of overconfidence respond differently to macroeconomic uncertainty when determining capital structure. Our central goal is to integrate macro-financial and behavioral explanations of financing policy into a unified framework, evaluating whether economic policy uncertainty acts as a behavioral catalyst or as a disciplining external constraint. Therefore, we focus on the BRICS economies, a scenario characterized by institutional heterogeneity, financial frictions and recurrent macroeconomic uncertainty, making it particularly suitable for testing the interplay between managerial discretion and external market constraints.

To address this question empirically, we analyze an unbalanced panel of 3,764 publicly traded non-financial companies from Brazil, Russia, India, China and South Africa over the 2015–2024 period, totaling 22,760 firm-year observations. Financial data is obtained from the Refinitiv Eikon database, while macroeconomic indicators are collected from the World Bank, Baker et al.'s (2016) EPU database and the World Uncertainty Index for South Africa. Given the strong persistence of leverage and the likelihood of simultaneity among financing choices, managerial behavior and macroeconomic conditions, we employ the two-step System GMM estimator (Blundell & Bond, 1998) and use internal instruments to address dynamic endogeneity and reverse causality. This approach is particularly appropriate because capital structure adjustments are inherently gradual (Leary & Roberts, 2005) and static panel estimators would likely produce biased inferences in the presence of temporal dependence (lag) and endogenous regressors.

This study contributes theoretically by extending the literature on economic policy uncertainty, demonstrating that the effect of macroeconomic uncertainty on leverage is not homogeneous across firms but critically depends on the behavioral characteristics of managers, thus enriching macro-financial interpretations of financing policy (Baker et al., 2016; Drobetz et al., 2018; Tran, 2021). It contributes to behavioral corporate finance by showing that managerial overconfidence is not an invariable determinant of leverage but a context-dependent force whose economic expression varies with external financing conditions, thereby refining the classical views of Malmendier and Tate (2005, 2008) and Malmendier et al. (2011). Methodologically, we introduce a multidimensional revealed-beliefs index of managerial overconfidence, constructed from abnormal investment, acquisition behavior and earnings

optimism, providing a more robust international proxy for behavioral bias. Finally, by focusing on the BRICS economies, we provide novel evidence from a setting where both institutional uncertainty and financing frictions are materially stronger than in developed markets, thereby enhancing the external validity of behavioral capital structure literature.

The remainder of the article is structured as follows. Section 2 develops the conceptual background and formulates the hypotheses, integrating the literature on economic policy uncertainty, behavioral corporate finance and capital structure. Section 3 presents the data, variable construction, econometric specification and identification strategy. Section 4 reports the empirical results, including baseline estimations, marginal effects analysis and extensive robustness checks. Section 5 concludes with the main implications, limitations and directions for future research.

## **2. Conceptual background and hypotheses development**

Capital structure remains a central issue in corporate finance because it integrates strategic financing decisions with direct implications for financial flexibility, insolvency risk and firm value. Although the literature has privileged firm-specific determinants, recent advances in the field show that leverage choices are shaped by both macroeconomic forces and decision-makers' behavioral traits (insert citation here). In this sense, the financing decision must be understood from a multilevel perspective, in which aggregate shocks (e.g., economic policy uncertainty) alter the cost and availability of capital. At the same time, managerial traits (e.g., CEO overconfidence) distort perceptions of risk, returns and mispricing.

This theoretical framework develops this argument across three pillars. First, it discusses how EPU affects leverage by altering both the marginal cost of debt and expectations of future credit constraints, thereby inducing precautionary financing behavior in emerging markets. Next, it examines how managerial overconfidence shifts capital structure toward debt through the channels of perceived mispricing and risk underestimation. Finally, it proposes integrating these two literatures by arguing that EPU acts not only as an external shock but also as a behavioral catalyst that amplifies the effect of overconfidence on leverage. Thus, the framework shifts from treating macro and micro factors as independent determinants to treating them as interdependent mechanisms that shape firms' capital policies.

## 2.1 The nexus between policy uncertainty and capital structure: A precautionary financing perspective

Economic Policy Uncertainty (EPU) constitutes an aggregate shock that raises the expected variance of cash flows and introduces non-diversifiable risk into corporate decisions. Under this environment, firms adjust their capital structure not only in response to the current cost of debt but, above all, to the expectation of future financing constraints. This behavior can be rationalized by an integrated reading of the Pecking Order Theory and the Trade-off Theory, as while informational asymmetry intensifies under uncertainty, raising the cost of external financing, the risk of credit supply shocks encourages companies to advance funding to preserve their financial flexibility.

The literature documents heterogeneous effects of EPU on leverage, reflecting differences in institutions and credit access. In developed economies, evidence predominantly points to a contractionary effect, where EPU reduces the appetite for debt by raising the marginal cost of financing and discouraging investment (Yousefi & Yang, 2021; Almustafa et al., 2023). This channel operates via an increase in the risk premium and deterioration of credit conditions, leading firms to prioritize liquidity and deleveraging.

In contrast, an alternative mechanism emerges in emerging markets, which are characterized by more severe financial frictions and shallower market depth. A rise in EPU signals not only higher costs but also a risk of credit rationing. In this context, firms may strategically increase leverage, advancing funding before liquidity windows close (i.e., precautionary financing). Evidence from Europe and the BRICS suggests that debt can act as a substitute mechanism to mitigate agency costs exacerbated by uncertainty, especially where institutions are more fragile (Vega-Gutiérrez et al., 2024; Bajaj et al., 2021).

This effect is reinforced by two channels: liquidity and timing. First, the liquidity channel: greater EPU increases expected volatility (Yang & Yang, 2021), raising the likelihood of negative cash flow shocks. Firms respond by accumulating resources via debt to smooth future constraints. Second, the credit market timing channel, in which anticipating deterioration in financial conditions, managers internalize the risk of an abrupt increase in the cost of debt (Tran, 2019, 2021), thereby accelerating financing decisions.

Still, the evidence remains inconclusive. Studies report negative relationships in more demand-sensitive sectors (Athari & Bahreini, 2023) and in contexts with greater market discipline, while others identify positive effects conditional on liquidity, governance, or access

to multiple financing sources (Makololo & Seetharam, 2020). This heterogeneity suggests that the impact of EPU on leverage is contingent on financial constraints and firms' ability to access credit in adverse environments.

Given this tension in the literature, we argue that in the context of the BRICS economies, where market imperfections are more pronounced, the precautionary motive dominates the cost effect. Specifically, the expectation of future credit constraints outweighs the contemporaneous increase in the cost of debt, prompting firms to advance external financing as an insurance policy against liquidity shocks. Thus, we formulate our first hypothesis:

***H1: Economic policy uncertainty (EPU) exerts a positive effect on corporate leverage in BRICS economies, driven by "precautionary financing" behavior, wherein companies seek to raise external funds in advance to mitigate the risk of future liquidity windows closing.***

## 2.2 Managerial Overconfidence and Capital Structure: The Perceived Mispricing and Risk Subestimation Channels

Managerial overconfidence introduces a systematic distortion in financing decisions by altering the subjective perception of risk and value. Within the Agency Theory framework, this bias amplifies the misalignment between managers and shareholders, as decisions increasingly reflect idiosyncratic beliefs rather than fundamentals. Integrated with the Pecking Order Theory, overconfidence intensifies the financing hierarchy: overconfident managers perceive equity as undervalued and thus avoid equity issuance, shifting the capital structure toward debt.

The mechanism related to overconfident CEOs operates through mispricing and risk channels. First, the perceived mispricing channel, where overconfident CEOs overestimate future cash flows and believe the market systematically undervalues their firms (Malmendier & Tate, 2005, 2008). As a result, equity issuance is interpreted as excessively dilutive, leading to a preference for debt. Second, the risk underestimation channel, where these managers internalize lower probabilities of default and volatility, reducing the subjective cost of leverage and expanding their tolerance for financial risk (Malmendier, Tate & Yan, 2011). Together, these channels imply a systematic preference for external financing via debt, even when it diverges from the optimal level.

Empirical evidence supports this logic but reveals important nuances. In developed markets, overconfident CEOs tend to avoid equity issuance and finance investments via debt, especially when financially constrained (Malmendier et al., 2011). However, this relationship

is not monotonic. Recent evidence shows that overconfidence also affects the dynamics of leverage adjustment; managers accelerate adjustments when above the optimal target level but are reluctant to increase leverage when below it, suggesting asymmetrical behavior around the optimal level (Yung & Long, 2022). This pattern indicates that overconfidence does not simply mean more debt but a dynamic reconfiguration of financing decisions.

Furthermore, liquidity behavior provides complementary evidence. Studies show that overconfident CEOs quickly adjust cash levels and may dissipate surpluses, reflecting excessive confidence in future cash generation capabilities (El Kalak et al., 2025). This behavior reinforces the risk underestimation channel by reducing financial buffers and potentially increasing reliance on external financing in adverse states.

In emerging markets, the results are more ambiguous. Evidence from Malaysia indicates that overconfidence may reduce leverage in environments with strong state intervention or institutional constraints, such as in government-linked firms (Ting et al., 2016). Additionally, the presence of risky debt may induce risk aversion, leading Indonesian managers to underinvest in risky projects (Martono et al., 2023). These findings suggest that the impact of overconfidence is conditioned by the institutional environment and incentive structure, which can either amplify or mitigate leverage.

This heterogeneity reveals a gap in the literature, where studies often treat overconfidence as a direct determinant of leverage, neglecting that its effect depends on the interaction among biased perceptions, financial constraints and market discipline. By isolating the relative cost perception mechanism between debt and equity, we argue that the dominant effect of overconfidence, especially in environments with high informational asymmetry, is a systematic increase in leverage. Consequently, we formulate the following hypothesis:

***H2: Overconfident CEOs maintain systematically higher leverage levels than their rational peers, driven by the underestimation of insolvency risk and the perception that debt financing is less costly than equity issuance in high informational asymmetry environments.***

### 2.3 Opportunity Framing and Risk Perception: Managerial Responses to Macroeconomic Uncertainty

The literature treats EPU predominantly as a shock that affects financing costs and credit constraints. However, this approach is incomplete because it ignores the fact that EPU also alters managers' cognitive processing. From a behavioral finance perspective, uncertainty

shocks not only change the decision-making environment but also amplify pre-existing biases, especially overconfidence.

The mechanism of this interaction operates through a behavioral amplification effect under uncertainty. In high EPU environments, greater dispersion of beliefs and deterioration of information quality expand managers' interpretative latitude. Overconfident CEOs, who already overestimate cash flows and underestimate risks, begin to interpret uncertainty as an opportunity rather than a threat. This behavior is consistent with Agency Theory, in that lesser external disciplining under high uncertainty reduces effective monitoring, allowing greater managerial discretion.

Two specific channels support this effect. First, the "opportunity framing" channel, in which EPU increases ambiguity in the economic environment and overconfident CEOs reframe it as an opportunity to generate superior returns ("beat the market"), thereby intensifying their risk-taking. Second, the reinforced risk underestimation channel: under macroeconomic uncertainty, the distribution of outcomes becomes more dispersed. However, overconfident CEOs update their beliefs in a biased manner, inappropriately evaluating adverse scenarios and, consequently, further reducing the subjective cost of leverage.

This interaction helps reconcile apparently contradictory empirical evidence documented in the literature. While EPU alone can induce deleveraging via increased debt costs and risk aversion (Yousefi & Yang, 2021; Almustafa et al., 2023), overconfidence alone can either increase or decrease leverage, depending on financial constraints and preferences for internal financing (Malmendier et al., 2011; Yung & Long, 2022). The lack of an integrated framework that accounts for both macroeconomic shocks and behavioral biases prevents a consistent interpretation of these results.

We thus argue that EPU acts as a behavioral catalyst, shifting the effect of overconfidence toward higher leverage. Specifically, in high uncertainty contexts, the disciplining effect of the cost of debt is dominated by the combination of (i) an inflated perception of opportunities and (ii) an exacerbated underestimation of risk. This mechanism is particularly relevant in emerging markets, where informational imperfections and shallower financial depth amplify managerial discretion. Consequently, we formulate our last hypothesis: ***H3: Economic policy uncertainty acts as a behavioral catalyst, amplifying the positive effect of overconfidence on leverage; overconfident CEOs, perceiving macroeconomic uncertainty***

*as an opportunity for superior performance ("beat the market"), disproportionately increase financial risk exposure during EPU shocks.*

### **3. Methodology and identification strategy**

#### **3.1 Sample and data**

For our study, we selected the founding countries of the BRICS (i.e., Brazil, Russia, India, China and South Africa) for the 10 years from 2015 to 2024. Corporate financial data were obtained from Refinitiv Eikon, while macroeconomic data, such as GDP, were sourced from the World Bank website and EPU was obtained from [policyuncertainty.com](http://policyuncertainty.com); for South Africa, EPU data were collected from the World Uncertainty Index, which also uses the methodology of Baker et al. (2016).

Following standard practice in the finance literature, we excluded from our database observations for companies in the following sectors: Financials, Utilities, Government Activity and Academic & Educational Services, according to Refinitiv classifications. Observations with negative or missing values for total assets and total debt were removed. Following Malmendier and Tate (2005, 2008), we also excluded cases in which total debt exceeded total assets, as covenants restrict investment and investment behavior is dictated by survival rather than CEO overconfidence. We only kept firms that had at least 5 years of consecutive data, as Malmendier and Tate (2005, 2008) report the persistence of CEO behavior. Additionally, to mitigate the influence of extreme observations and measurement errors, all continuous corporate variables were winsorized at the 1st and 99th percentiles (Bajaj et al., 2021). The final unbalanced panel consists of 3,764 firms, providing a robust representative sample of the emerging markets landscape over ten years of macroeconomic volatility.

#### **3.2. Variable Construction**

##### **3.2.1 Corporate Leverage**

The capital structure literature employs different leverage measures, ranging from accounting to market metrics, as well as between short- and long-term debt components. While market measures incorporate forward-looking expectations, accounting measures remain widely used because they better align with the firm's asset structure and observed borrowing capacity. Following recent literature in corporate finance, we adopt the total debt-to-total assets

ratio (Lev) as the primary measure of leverage (Almustafa et al., 2023; Vega-Gutiérrez et al., 2025).

### 3.2.2 CEO Overconfidence – OCIndex

The measurement of CEO overconfidence (OCIndex) is based on the revealed beliefs approach, which posits that latent cognitive traits, such as managerial overconfidence, can be inferred from systematic patterns of observable corporate decisions, since such psychological characteristics are not directly measurable in large international databases (Malmendier & Tate, 2005, 2008; Hirshleifer et al., 2012).

The theoretical foundation stems from the behavioral corporate finance literature, which argues that overconfident managers tend to overestimate the expected returns of investment projects and underestimate the risks associated with strategic decisions. In particular, Malmendier and Tate (2005) demonstrate that overconfident CEOs tend to overinvest beyond the economically optimal level when they have sufficient internal funds, as they frequently perceive the market as undervaluing the firm's assets and consequently avoid external financing. Complementarily, Malmendier and Tate (2008) show that this cognitive bias also manifests in a greater propensity to undertake corporate acquisitions, especially in contexts where managers overestimate potential interactions and the expected gains from integration.

Based on this theoretical framework, we construct a multidimensional index for managerial overconfidence, capturing three behavioral manifestations consistent with the literature: (i) abnormal investment; (ii) abnormal acquisitive behavior; and (iii) abnormal optimism in earnings expectations.

The first dimension is operationalized from an expected investment model, in which traditional economic determinants of capital demand explain corporate investment:

$$INV_{i,t} = \beta_0 + \beta_1 QTobin_{i,t-1} + \beta_2 Cash_{i,t-1} + \beta_3 Lev_{i,t-1} + \beta_4 Size_{i,t-1} + \beta_5 ROA_{i,t-1} + \alpha_c + \delta_s + \gamma_t + \epsilon_{i,t} \quad (1)$$

where INV represents corporate investment, measured as CAPEX scaled by lagged total assets, capturing the firm's relative investment intensity; Q Tobin represents growth opportunities, calculated as the ratio between the market value of equity plus total debt and total assets; Cash represents the availability of internal resources, measured as cash and cash

equivalents scaled by total assets; Lev represents corporate leverage, measured as total debt divided by total assets; Size corresponds to firm size, operationalized by the natural logarithm of total assets; and ROA represents operational profitability, calculated as earnings before interest and taxes (EBIT) scaled by total assets;  $\alpha_c$ ,  $\delta_s$  and  $\gamma_t$  represent country, sector and year fixed effects, respectively.

The inclusion of these variables aims to separate discretionary managerial behavior from fundamental economic determinants of investment policy. In particular, the inclusion of Lev is central, as capital structure directly conditions managerial discretion. According to Myers (1977), highly indebted firms may face debt overhang, reducing their incentives to invest even in economically viable projects. Jensen (1986) argues that debt exerts a disciplining role by restricting free cash flows that could be used for discretionary decisions associated with empire building. Cash controls the firm's financial flexibility, avoiding the issue of high investment reflecting merely an abundance of internal funds (Fazzari et al., 1988; Almeida et al., 2004), while QTobin separates economically justified expansion from overly aggressive behavior.

The second dimension captures abnormal acquisitive behavior, estimated by an analogous model:

$$ACQ_{i,t} = \beta_0 + \beta_1 QTobin_{i,t-1} + \beta_2 Cash_{i,t-1} + \beta_3 Lev_{i,t-1} + \beta_4 Size_{i,t-1} + \beta_5 ROA_{i,t-1} + \alpha_c + \delta_s + \gamma_t + \epsilon_{i,t} \quad (2)$$

where ACQ represents corporate acquisition intensity, measured as the natural logarithm of one plus cash flows destined for acquisitions. The logarithmic transformation reduces distributional asymmetry and preserves observations with zero values. The economic logic of the specification remains consistent with the investment model, since growth opportunities, internal liquidity, capital structure, operating scale and economic performance also constitute fundamental determinants of acquisitive activity.

The third dimension captures abnormal optimism in earnings expectations. Unlike the first two dimensions, this proxy does not directly observe the CEO's private beliefs, but rather the firm's informational environment, reflected in the deviation between average expected earnings per share and effectively realized performance:

$$BiasEPSM_{i,t} = \frac{EPSM_{i,t} - EPSA_{i,t}}{EPSA_{i,t}} \quad (3)$$

where EPSM represents the mean expected earnings per share reported by analysts and EPSA represents the actual realized earnings per share.

Positive values for this metric indicate that earnings expectations exceeded actual performance, reflecting ex ante optimism regarding the firm's prospects. While this measure does not directly capture the CEO's individual beliefs, it is consistent with the literature on overconfidence and managerial miscalibration, which suggests that overconfident managers tend to influence aggressive corporate policies and contribute to overly optimistic informational environments (Ben-David et al., 2013; Hirshleifer et al., 2012).

To isolate the abnormal component of this expectation bias, we estimate the following model:

$$FEB_{i,t} = \beta_0 + \beta_1 QTobin_{i,t-1} + \beta_2 Lev_{i,t-1} + \beta_3 Size_{i,t-1} + \beta_4 ROA_{i,t-1} + \beta_5 Tang_{i,t-1} + \beta_6 SDROA_{i,t-1} + \alpha_c + \delta_s + \gamma_t + \epsilon_{i,t} \quad (4)$$

where Tang represents asset tangibility, measured as gross fixed assets scaled by total assets, while SDROA corresponds to the firm's historical volatility of operational profitability. These controls are particularly important because firms with more tangible asset structures tend to have more predictable cash flows (Almeida & Campello, 2007), while higher operational volatility increases the inherent difficulty of performance forecasting. Thus, these controls reduce the risk that the residual captures mere informational uncertainty rather than systematically optimistic behavior.

For each of the three dimensions, we use the regression residuals as proxies for excess behavior not explained by observable economic fundamentals. Positive residuals indicate behavior above the expected level conditional on firm characteristics.

Next, we construct three dummy variables for overconfidence, assigning a value of 1 to observations whose residuals exceed the 75th percentile of the residual distribution within each sector-year and 0 otherwise. This strategy allows for the identification of relatively more aggressive behaviors than those of peer firms exposed to similar sector conditions during the same period.

The final overconfidence index was constructed to avoid information loss due to missing data across one or more dimensions. Instead of a simple sum, which would implicitly treat missing observations as an absence of behavioral bias, we calculated the proportional

average of the available proxies for each firm-year. Subsequently, this average was rescaled to a 0-3 range to preserve comparability with the index's original dimensional structure.

Thus, higher values of the OCIndex reflect a greater observable behavioral propensity compatible with managerial overconfidence, rather than a direct cardinal measure of the underlying psychological trait.

### 3.2.3 Economic Policy Uncertainty – EPU

Academics examining the repercussions of economic policy uncertainty have incorporated the EPU variable developed by Baker et al. (2016), producing evidence across several dimensions: spillover effects (Biljanovska et al., 2021); expected market returns and exchange rates (Chen et al., 2017; Kang et al., 2014); bank loan loss provisions, credit granting and credit expansion (Bordo et al., 2016; Danisman et al., 2021); cash reserves and liquidity (Duong et al., 2020); as well as investment levels and cost of capital (Drobetz et al., 2018; Kang et al., 2014).

In each of these delineated relationships, a high level of EPU correlates with detrimental impacts on the business environment, with varying intensities depending on the nature of the organization, thereby fostering heightened volatility. Following recent studies on EPU and leverage, we use the annual average of EPU to incorporate it into the panel data. For Brazil, Russia, China and India, we employed the index available at [policyuncertainty.com](http://policyuncertainty.com), constructed monthly and for South Africa, the index developed by Ahir et al. (2018), which is also available on the same website; this is constructed quarterly, using frequency counts of "uncertainty" (and its variants) in the Economist Intelligence Unit (EIU) quarterly reports. As the EPU distribution is skewed, we applied a logarithmic transformation.

### 3.3 Model Specification

To examine whether managerial overconfidence conditions the response of capital structure to economic policy uncertainty, we estimate a dynamic panel data model. The main empirical specification is given by:

$$LEV_{i,t} = \alpha LEV_{i,t-1} + \beta_1 EPU_{c,t} + \beta_2 OCIndex_{i,t} + \beta_3 (EPU_{c,t} * OCIndex_{i,t}) + \gamma X_{i,t} + \delta_t + \mu_i + \epsilon_{i,t} \quad (5)$$

where  $LEV_{(i,t)}$  represents the alternative measures of corporate leverage;  $LEV_{(i,t-1)}$  captures the dynamic persistence of the capital structure;  $EPU_{(c,t)}$  represents the economic

policy uncertainty in country  $c$  at year  $t$ ;  $EPU_{(c,t)}$  is the composite index of managerial overconfidence; and  $EPU_{(c,t)} * OCIndex_{(i,t)}$  is the interaction term that allows assessing whether the effect of macroeconomic uncertainty on leverage varies according to the degree of CEO overconfidence. The vector  $X_{(i,t)}$  includes traditional capital structure controls: firm size (Size), operational profitability (ROA), asset tangibility (Tang), non-debt tax shields (NDTS), internal liquidity (Cash), growth opportunities (Q Tobin) and GDP. We also included year fixed effects to absorb common macroeconomic shocks.

The inclusion of the lagged dependent variable is motivated by the dynamic nature of capital structure, as evidenced by the persistence observed in the sample's leverage measures. The first-order autocorrelation coefficient for the Lev variable ( $r = 0.9017$ ;  $n = 22,760$ ) confirms high temporal inertia, consistent with the existence of adjustment costs and gradual convergence towards target debt levels (Leary & Roberts, 2005). This characteristic makes exclusive reliance on static models inadequate, as omitting leverage dynamics can lead to omitted-variable bias and compromise the consistency of the estimated coefficients of interest, reinforcing the need for a dynamic panel approach.

### *3.4 Descriptive Statistics and Correlation Matrix*

#### *3.4.1 Descriptive Analysis*

Table 1 summarizes the descriptive statistics for the final sample of 27,190 observations. The average leverage (Lev) of the firms is 23.0%, with considerable dispersion (st. dev. = 0.174), reflecting the heterogeneity of capital structures across the block's countries and analyzed sectors. The overconfidence index (OCIndex) has a mean of 0.773 and a maximum of 3.000, indicating that the sample captures varying degrees of behavioral bias, from conservative managers to those manifesting all three dimensions of abnormal optimism simultaneously.

The economic policy uncertainty (EPU) variable, after logarithmic transformation, has a mean of 5.073. The range of this variable is notable (minimum of -1.009 and maximum of 6.358), suggesting that the dataset spans periods of relative stability and episodes of severe institutional uncertainty. Regarding controls, the sample consists of firms with an average operational profitability (ROA) of 5.9% and a robust asset structure, evidenced by an average tangibility (Tang) of 46.7%.

**Table 1***Descriptive statistics*

|                     | <b>N</b> | <b>Average</b> | <b>Standard Deviation</b> | <b>Minimum</b> | <b>Maximum</b> |
|---------------------|----------|----------------|---------------------------|----------------|----------------|
| <i>Lev</i>          | 22760    | 0.230          | 0.174                     | 0.000          | 0.755          |
| <i>OCIndex</i>      | 22760    | 0.773          | 1.238                     | 0.000          | 3.000          |
| <i>EPU</i>          | 22760    | 5.073          | 1.253                     | -1.009         | 6.358          |
| <i>Size</i>         | 22760    | 20.207         | 1.560                     | 13.496         | 24.019         |
| <i>ROA</i>          | 22760    | 0.059          | 0.076                     | -0.223         | 0.345          |
| <i>Tang</i>         | 22760    | 0.467          | 0.299                     | 0.004          | 1.365          |
| <i>NDTS</i>         | 22760    | 0.029          | 0.019                     | 0.000          | 0.104          |
| <i>Cash</i>         | 22760    | 0.170          | 0.148                     | 0.000          | 0.699          |
| <i>Q Tobin</i>      | 22760    | 2.086          | 2.058                     | 0.157          | 13.983         |
| <i>GDP</i>          | 22760    | 29.747         | 1.024                     | 26.503         | 30.562         |
| <i>Observations</i> | 22760    |                |                           |                |                |

**Notes:** This table presents descriptive statistics for the main variables used in the study, including the total number of observations, the mean, the standard deviation and the minimum and maximum values. All continuous corporate variables are winsorized at the 1st and 99th percentiles to mitigate the impact of outliers.

### 3.4.2 Correlation Analysis

Table 2 presents the Pearson Correlation Matrix. It is observed that leverage (*Lev*) correlates positively with the *OCIndex* (0.047,  $p < 0.01$ ), providing preliminary support for the hypothesis that overly confident managers tend to use more debt. On the other hand, the correlation between *Lev* and *EPU* is negative and significant (-0.036,  $p < 0.01$ ), suggesting that, in isolation, increases in macroeconomic uncertainty may lead firms to deleverage or face a reduced credit supply.

The *Tang* variable exhibits a strong positive correlation with *NDTS* (0.681,  $p < 0.01$ ), which is economically intuitive, given that fixed assets generate larger depreciation expenses, thereby providing non-debt tax shields. *Cash* shows a strong negative correlation with leverage (-0.436), corroborating the Pecking Order Theory, which holds that firms prioritize internal funds before resorting to debt.

Although the correlation coefficient between *EPU* and *GDP* is high (0.768), reflecting the procyclical nature of institutional stability, the variance inflation factor (VIF) tests (VIF = 4.019) fall well below the critical threshold of 10, confirming the robustness of the specification, which indicates that multicollinearity does not compromise coefficient stability, except in interaction terms, where the phenomenon is mechanically expected.

**Table 2***Pearson correlation matrix*

|                | <i>Lev</i> | <i>OCIndex</i> | <i>EPU</i> | <i>Size</i> | <i>ROA</i> | <i>Tang</i> | <i>NDTS</i> | <i>Cash</i> | <i>Q Tobin</i> | <i>GDP</i> |
|----------------|------------|----------------|------------|-------------|------------|-------------|-------------|-------------|----------------|------------|
| <i>Lev</i>     | 1.000      |                |            |             |            |             |             |             |                |            |
| <i>OCIndex</i> | 0.047***   | 1.000          |            |             |            |             |             |             |                |            |
| <i>EPU</i>     | -0.036***  | -0.019***      | 1.000      |             |            |             |             |             |                |            |
| <i>Size</i>    | 0.290***   | -0.020***      | 0.101***   | 1.000       |            |             |             |             |                |            |

|                |           |           |           |           |           |           |           |          |          |       |
|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|-------|
| <b>ROA</b>     | -0.233*** | 0.055***  | -0.130*** | 0.018***  | 1.000     |           |           |          |          |       |
| <b>Tang</b>    | 0.195***  | 0.173***  | -0.046*** | 0.052***  | 0.026***  | 1.000     |           |          |          |       |
| <b>NDTS</b>    | 0.131***  | 0.133***  | -0.050*** | 0.039***  | 0.003     | 0.681***  | 1.000     |          |          |       |
| <b>Cash</b>    | -0.436*** | -0.073*** | 0.207***  | -0.032*** | 0.108***  | -0.299*** | -0.182*** | 1.000    |          |       |
| <b>Q Tobin</b> | -0.247*** | 0.023***  | 0.050***  | -0.265*** | 0.228***  | -0.089*** | -0.012**  | 0.207*** | 1.000    |       |
| <b>GDP</b>     | -0.093*** | -0.050*** | 0.768***  | 0.146***  | -0.218*** | -0.114*** | -0.106*** | 0.304*** | 0.098*** | 1.000 |

**Notes:** This table presents the Pearson correlation matrix for the variables included in the analysis. Symbols \*\*\*, \*\* and \* denote statistical significance at the 1%, 5% and 10% levels, respectively.

### 3.5 Identification Strategy

The empirical strategy begins with the estimation of static baseline models, including pooled OLS, random effects and fixed effects, reported in Online Appendix Table A1, to evaluate the adequacy of conventional panel specifications before adopting a dynamic estimator. Firstly, the Breusch-Pagan Lagrange multiplier (LM) test strongly rejects the adequacy of the pooled model in favor of the random effects estimator ( $\chi^2 = 40.848, 31$ ;  $p < 0.000$ ). Simultaneously, the F-test of differential intercepts ( $F = 15.86$ ;  $p < 0.000$ ) indicates that unit fixed effects are significant, rejecting the hypothesis that a classic OLS model would suffice to capture firm heterogeneity. To decide between random- and fixed-effects specifications, the Hausman test was applied. The result  $\chi^2 = 1.109, 70$  ( $p < 0.000$ ) rejects the null hypothesis that coefficient differences are not systematic, indicating that unobserved firm effects are correlated with the regressors. Therefore, the random effects estimator is inconsistent, establishing an initial preference for the Fixed Effects (FE) model.

However, additional diagnostics reveal substantial violations of classical inference assumptions, making the use of conventional static estimators unviable. The modified Wald test strongly rejects the hypothesis of homoscedasticity across groups ( $\chi^2 = 3, 3 \times 10^{31}$ ;  $p < 0.000$ ), indicating the presence of structural heteroscedasticity. Complementarily, the Wooldridge test confirms the presence of first-order serial autocorrelation in the residuals ( $F = 1276.22$ ;  $p < 0.000$ ). Together, these results provide evidence that the panel's error structure is complex, which demands the use of robust standard errors with the Windmeijer correction and reinforces the suitability of the SYS-GMM estimator for ensuring the efficiency and consistency of the estimated parameters.

In contrast, Pesaran's adjusted cross-sectional dependence tests do not provide robust evidence of strong cross-sectional dependence among units, suggesting that unobserved common shocks do not constitute the primary source of error in the specification in this context. Collectively, these diagnostics indicate that conventional static estimators may produce

inconsistent inference due to the combination of dynamic persistence, heteroscedasticity and serial autocorrelation, thereby reinforcing the adoption of a GMM-based dynamic estimator.

Given the dynamic nature of leverage and the possibility of reverse endogeneity among capital structure, managerial overconfidence and corporate decisions, we use Blundell and Bond's (1998) two-step System GMM estimator. This estimator combines equations in differences and levels, using internal lags of variables as instruments under the assumption of no second-order serial correlation in the errors and the validity of moment conditions.

In the main specification, following Roodman (2009), lagged leverage is treated as endogenous and instrumented with lags from  $t-2$  to  $t-3$ . The OCIndex is also treated as potentially endogenous and instrumented by internal lags. The remaining variables, including EPU, firm-level controls, GDP and year dummies, are included as external instruments in the level equation. The collapse option is used to limit instrument proliferation, maintaining the instrument count in an appropriate proportion to the number of groups. Additionally, we use the forward orthogonal deviations transformation, which is appropriate for unbalanced panels and robust standard errors with Windmeijer correction for the two-step estimator.

The validity of the GMM strategy is evaluated using the Hansen J test of overidentifying restrictions, whose null hypothesis is the joint validity of the instruments and the Arellano-Bond tests for first- and second-order serial autocorrelation. Rejection is expected in AR(1) due to the differenced structure, but not in AR(2), a necessary condition for the validity of the lags used as instruments.

### 3.6 Marginal Effects

Since the model includes an interaction between EPU and OCIndex, coefficients  $\beta_1$  and  $\beta_2$  should not be interpreted in isolation as constant marginal effects. Therefore, we calculate the marginal effect of EPU on leverage for different levels of OCIndex, as well as the marginal effect of OCIndex conditional on different levels of EPU. These effects are estimated at representative points in the distribution, such as the mean, the mean minus one standard deviation and the mean plus one standard deviation and are complemented by continuous marginal effect plots with 95% confidence intervals.

### 3.7 Robustness Tests and Sensitivity Analysis

The robustness of the results is evaluated across four main dimensions: First, we evaluate the validity of the econometric specification through a comparative analysis of estimators and instrument structures. In this stage, we consolidate the re-estimation of the model across different lag depths into a single battery of tests and compare the SYS-GMM estimator with One-step and Difference-GMM specifications. The goal is to ensure that parameter consistency is not sensitive to specific instrumentation choices or the moment technique employed. Second, we test the sensitivity of the results to exogenous shocks during the COVID-19 pandemic. To this end, we run models excluding 2020 and 2021 (separately and together) and include an interaction term between the OCIndex and the pandemic period, isolating possible cyclical distortions. Third, we examine heterogeneity in effects across firms' financial constraint levels. We use the SA Index (Hadlock & Pierce, 2010) and specifications with a triple interaction among EPU, OCIndex and the financial constraint level, allowing us to identify whether the organization's financial flexibility conditions sensitivity to overconfidence. Finally, we replicate the main estimations using alternative capital structure metrics. Leverage is re-evaluated based on short-term debt, long-term debt and market-value-based measures, ensuring that the impact of overconfidence and macroeconomic uncertainty is cross-cutting across different maturities and ways of measuring liabilities.

## 4. Results

### 4.1 Baseline model results and interaction effects

Table 3 presents the results of the main model and provides robust evidence that the capital structure of BRICS firms is highly persistent over time. The lagged dependent variable coefficient in the SYS-GMM model is positive and significant ( $\beta = 0.826$ ), falling between the upper bound from OLS (0.855) and the lower bound from the fixed effects estimator (0.524). This pattern is consistent with the dynamic panel literature, where OLS tends to overestimate persistence by failing to adequately control for unobservable firm-specific heterogeneity, while the fixed-effects estimator displays downward bias due to the Nickell problem (Bond, 2002). The estimated magnitude suggests that capital structure adjustments occur gradually, reflecting adjustment costs and incomplete convergence toward target debt levels, in line with Leary and Roberts (2005).

**Table 3***Baseline models and coefficient bounds for the lagged dependent variable*

|                            | (1)<br>UPPER (OLS)     | (2)<br>LOWER (FE)      | (3)<br>SYS-GMM         |
|----------------------------|------------------------|------------------------|------------------------|
| <i>Lev<sub>(t-1)</sub></i> | 0.855***<br>(193.325)  | 0.524***<br>(50.093)   | 0.826***<br>(41.145)   |
| <i>OCIndex</i>             | 0.006***<br>(3.845)    | 0.007***<br>(3.184)    | 0.107***<br>(3.100)    |
| <i>EPU</i>                 | 0.000<br>(0.204)       | -0.004<br>(-1.600)     | 0.015***<br>(2.994)    |
| <i>EPU * OCIndex</i>       | 0.001*<br>(1.830)      | -0.000<br>(-0.916)     | -0.018***<br>(-2.825)  |
| <i>Size</i>                | 0.005***<br>(14.457)   | 0.050***<br>(15.227)   | 0.006***<br>(7.110)    |
| <i>ROA</i>                 | -0.213***<br>(-21.098) | -0.323***<br>(-20.999) | -0.213***<br>(-15.312) |
| <i>Tang</i>                | -0.000<br>(-0.067)     | 0.049***<br>(4.399)    | -0.005<br>(-1.239)     |
| <i>NDTS</i>                | -0.086*<br>(-1.950)    | -0.171<br>(-1.571)     | -0.073<br>(-1.202)     |
| <i>Cash</i>                | -0.058***<br>(-13.318) | -0.084***<br>(-8.919)  | -0.071***<br>(-7.065)  |
| <i>Q Tobin</i>             | 0.001**<br>(2.394)     | 0.001**<br>(2.054)     | 0.001<br>(1.247)       |
| <i>GDP</i>                 | -0.001<br>(-0.702)     | -0.054***<br>(-4.160)  | -0.001<br>(-0.530)     |
| <i>_cons</i>               | -0.051**<br>(-2.050)   | 0.737**<br>(2.000)     | -0.110**<br>(-2.549)   |
| <i>Year FE</i>             | Yes                    | Yes                    | Yes                    |
| Observations               | 22760                  | 22760                  | 22760                  |
| N of Groups                |                        | 3764                   | 3764                   |
| N of Instruments           |                        |                        | 23                     |
| R-Squared                  | 0.829                  | 0.433                  |                        |
| Adj. R-Squared             | 0.829                  | 0.432                  |                        |
| R-sq within                |                        | 0.433                  |                        |
| R-sq overall               |                        | 0.604                  |                        |
| AR(1) (p-val)              |                        |                        | 0.000                  |
| AR(2) (p-val)              |                        |                        | 0.768                  |
| Sargan (p-val)             |                        |                        | 0.185                  |
| Hansen (p-val)             |                        |                        | 0.227                  |

**Notes:** This table presents the baseline regression results using OLS, Fixed Effects and two-step System GMM (SYS-GMM) estimations. Columns (1) and (2) provide the upper and lower bound constraints for the lagged dependent variable coefficient, respectively. T-statistics (for OLS/FE) and Z-statistics (for GMM) are reported in parentheses. \*p < 0.10, \*\*p < 0.05, \*\*\*p < 0.01. The Hansen test evaluates the null hypothesis of instrument validity (over-identifying restrictions). AR(1) and AR(2) are the Arellano-Bond tests for first and second-order serial correlation in the first-differenced residuals, distributed as N(0,1) under the null hypothesis of no serial correlation. Year fixed effects (FE) are included in all specifications.

The diagnostic tests corroborate the adequacy of the empirical strategy adopted; the AR(1) test for first-order autocorrelation is significant, as expected in difference-estimated specifications, while the AR(2) test fails to reject the null hypothesis of no second-order serial autocorrelation (p-value = 0.768), a necessary condition for the validity of internal instruments. The Hansen test also fails to reject the joint validity of the overidentifying restrictions (p-value

= 0.227), while the instrument count remains parsimonious (23 instruments across 3,764 groups), reducing concerns about instrumental proliferation. Together, these results indicate that the estimated coefficients do not appear to be artifacts of dynamic endogeneity, reverse simultaneity, or over-instrumentation.

Regarding the core variables, Table 3 suggests that both macroeconomic factors and behavioral characteristics play relevant roles in determining corporate financing policy. EPU shows a positive and significant coefficient ( $\beta = 0.015$ ), indicating that, on average, increases in macroeconomic uncertainty are associated with the expansion of corporate leverage. This result is consistent with the precautionary financing hypothesis, under which firms operating in emerging markets anticipate external funding when facing potential future deterioration in credit conditions, preserving financial flexibility in environments characterized by higher financial friction and lower institutional depth (Bajaj et al., 2021; Tran, 2021; Vega-Gutiérrez et al., 2024). The positive and significant sign associated with OCIndex ( $\beta = 0.107$ ) is equally consistent with the behavioral finance literature, suggesting that overly confident managers exhibit a greater predisposition toward indebtedness, in line with mechanisms of overestimating future cash flows, underestimating insolvency risk and perceiving equity undervaluation as described by Malmendier and Tate (2005, 2008) and Malmendier et al. (2011). However, given the presence of the interaction term, these coefficients must be interpreted cautiously, as they do not represent invariant marginal effects.

The main finding of Table 3 is the negative, statistically significant coefficient for the interaction term between EPU and OCIndex ( $\beta = 0.018$ ), indicating that the impact of each variable critically depends on the level of the other. This result suggests that the relationship between macroeconomic uncertainty and capital structure is heterogeneous across firms, necessitating the decomposition of conditional effects. In this sense, Table 4 deepens the economic interpretation of the interaction by estimating the marginal effects of EPU at different levels of overconfidence and, conversely, the marginal effects of overconfidence under distinct macroeconomic uncertainty regimes.

**Table 4**  
*Interaction analysis – Marginal effects at different levels of EPU and Overconfidence*

| Level of analysis              | Marginal Coefficient | Standard Error | p-value |
|--------------------------------|----------------------|----------------|---------|
| Effect of EPU cond. on OCIndex |                      |                |         |
| Low OC                         | 0.023                | 0.008          | 0.003   |
| Mean OC                        | 0.001                | 0.002          | 0.521   |
| High OC                        | -0.021               | 0.008          | 0.010   |

Effect of OCIndex cond. on EPU

|          |        |       |       |
|----------|--------|-------|-------|
| Low EPU  | 0.038  | 0.010 | 0.000 |
| Mean EPU | 0.016  | 0.002 | 0.000 |
| High EPU | -0.007 | 0.006 | 0.233 |

The marginal effects analysis reveals an economically meaningful pattern of heterogeneity. When the OCIndex is low, EPU exerts a positive and significant effect on leverage ( $\beta = 0.023$ ), indicating that increases in macroeconomic uncertainty encourage the anticipation of external financing. This result reinforces the precautionary financing logic, suggesting that less biased managers interpret uncertainty shocks as signals of possible future deterioration in credit conditions and, consequently, preemptively adjust their capital structure. However, this effect disappears at mean levels of overconfidence ( $\beta = 0.001$ ) and reverses among firms with a high OCIndex, for which EPU significantly reduces leverage ( $\beta = -0.021$ ). The difference between these extremes equates to approximately 4.4 pp, representing about 19% of the average leverage observed in the sample. Therefore, there is an economically substantive effect, incompatible with the hypothesis that uncertainty uniformly amplifies the financial aggressiveness of overconfident CEOs and, thus, the third hypothesis is rejected.

The complementary decomposition reinforces this interpretation. In low macroeconomic uncertainty environments, the OCIndex exerts a positive, economically relevant and statistically significant effect on leverage ( $\beta = 0.038$ ), indicating that each additional unit in the OCIndex is associated with a 3.8 pp increase in corporate debt. This finding aligns with classic behavioral literature, which shows that overconfident managers tend to assume more financial risk due to overly optimistic beliefs about future performance and cash-generating capacity (Malmendier & Tate, 2005, 2008; Malmendier et al., 2011). However, this effect diminishes substantially at mean EPU levels ( $\beta = 0.016$ ) and becomes statistically indistinguishable from zero in high uncertainty contexts ( $\beta = -0.007$ ). In other words, the behavioral effect is economically relevant only when the macroeconomic environment preserves room for managerial discretion.

From a theoretical standpoint, the results suggest an important qualification of the originally formulated hypothesis. Although the conceptual argument predicted that EPU would act as a catalyst for managerial overconfidence, amplifying financial risk-taking through opportunity framing and exacerbating risk underestimation mechanisms, the empirical evidence points to a distinct mechanism. Rather than amplifying behavioral biases,

macroeconomic uncertainty appears to limit their economic manifestation by intensifying external financing constraints. This pattern is consistent with the interpretation that high-uncertainty environments elevate the cost of debt, increase creditor selectivity and deteriorate refinancing conditions, thereby reducing the ability of overconfident CEOs to translate optimistic beliefs into more aggressive capital policies (Drobetz et al., 2018; Tran, 2021; Vega-Gutiérrez et al., 2024). Thus, overconfidence does not emerge as an invariant determinant of capital structure, but as a contingent factor whose influence critically depends on macro-financial conditions.

More broadly, the combined evidence from Tables 4 and 5 suggests that isolated interpretations from macroeconomic uncertainty or behavioral finance literature may yield incomplete conclusions about corporate financing decisions. Capital structure's response to policy uncertainty shocks is not homogeneous among firms, nor do the effects of managerial overconfidence remain constant across distinct macroeconomic regimes. Corporate financing policy, therefore, emerges from the interaction between external market constraints and internal cognitive biases, offering a more integrated explanation for the heterogeneity observed in capital structure decisions in emerging economies.

#### 4.2. Robustness Analysis

While the primary results provide consistent evidence that macroeconomic and behavioral factors simultaneously influence corporate capital structure, the empirical credibility of this conclusion depends on the robustness of the findings across alternative specifications, exogenous shocks and different measures of the dependent variable. In dynamic panel models, this concern is particularly relevant, since inferences may be sensitive to instrument depth, the chosen estimator and the underlying identification structure (Roodman, 2009; Blundell & Bond, 1998).

Accordingly, this section subjects the core results to robustness checks with four complementary objectives: to verify sensitivity to econometric specification, to examine the influence of extraordinary exogenous shocks, to identify heterogeneity associated with financial constraints and to test the stability of the results across alternative leverage measures. These tests refine the economic interpretation of the proposed mechanism. In particular, they allow assessing whether the moderating effect identified between macroeconomic uncertainty

and managerial overconfidence reflects a robust structural relationship or arises from sample-specific conditions, the definition of leverage, or the instrumentation strategy employed.

Regarding econometric diagnostics, the results remain consistent across all estimated specifications. The Arellano-Bond tests for second-order autocorrelation fail to reject the null hypothesis of no serial correlation in the differenced residuals, corroborating the validity of the moment conditions used. Complementarily, Hansen tests systematically remain within statistically acceptable ranges, with no evidence of invalidity for overidentifying restrictions, even in more demanding specifications, such as models with triple interactions and market-value-based leverage measures, which are naturally more sensitive to potential endogeneity problems. Additionally, the instrument count remains consistently parsimonious relative to the number of groups, mitigating concerns about instrument proliferation and reinforcing the credibility of the adopted identification strategy.

#### 4.2.1 Specification Validity and Alternative Estimators

Table 5 examines the robustness of the main specification against different instrumental structures and alternative GMM estimators. This analysis aims to verify if the main model documented in Table 3 depends on specific choices regarding the depth of lags used as instruments or the adoption of the two-step SYS-GMM estimator. This test is particularly important because, in dynamic panels, inferences can be distorted by overly restrictive specifications that reduce efficiency or by overly broad instrumental structures that increase the risk of overfitting and weakening the Hansen test (Roodman, 2009).

**Table 5**

*Robustness analysis: Sensitivity to instrument specification and GMM estimators*

|                            | (1)<br>Lags(2,2)      | (2)<br>Lags(2,4)      | (3)<br>One-Step       | (4)<br>Diff-2S       | (5)<br>Diff-1S       |
|----------------------------|-----------------------|-----------------------|-----------------------|----------------------|----------------------|
| <i>Lev<sub>(t-1)</sub></i> | 0.828***<br>(40.256)  | 0.828***<br>(41.410)  | 0.829***<br>(40.902)  | 0.668***<br>(26.351) | 0.669***<br>(25.830) |
| <i>OCIndex</i>             | 0.114***<br>(3.003)   | 0.098***<br>(2.932)   | 0.104***<br>(3.107)   | 0.068**<br>(2.370)   | 0.068**<br>(2.302)   |
| <i>EPU</i>                 | 0.016***<br>(2.923)   | 0.014***<br>(2.792)   | 0.015***<br>(3.010)   | 0.004<br>(1.028)     | 0.004<br>(0.960)     |
| <i>EPU * OCIndex</i>       | -0.019***<br>(-2.753) | -0.016***<br>(-2.648) | -0.018***<br>(-2.826) | -0.011**<br>(-2.151) | -0.011**<br>(-2.088) |
| <i>Controls</i>            | Yes                   | Yes                   | Yes                   | Yes                  | Yes                  |
| <i>Year FE</i>             | Yes                   | Yes                   | Yes                   | Yes                  | Yes                  |
| Observations               | 22760                 | 22760                 | 22760                 | 18996                | 18996                |
| N° of Groups               | 3764                  | 3764                  | 3764                  | 3464                 | 3464                 |
| N° of Instruments          | 22                    | 24                    | 23                    | 21                   | 21                   |
| AR(1) (p-value)            | 0.000                 | 0.000                 | 0.000                 | 0.000                | 0.000                |

|                  |       |       |       |       |       |
|------------------|-------|-------|-------|-------|-------|
| AR(2) (p-value)  | 0.726 | 0.811 | 0.780 | 0.971 | 0.978 |
| Sargan (p-value) | 0.098 | 0.056 | 0.185 | 0.162 | 0.162 |
| Hansen (p-value) | 0.135 | 0.077 | 0.227 | 0.196 | 0.196 |

**Notes:** This table presents robustness checks for the baseline model using alternative GMM specifications. Columns (1) and (2) test sensitivity to instrument lag structures. Column (3) reports the one-step System GMM estimation. Columns (4) and (5) report two-step and one-step Difference GMM (Diff-GMM) estimations, respectively. Z-statistics based on robust standard errors are reported in parentheses. \* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ . The Hansen test evaluates the null hypothesis of instrument validity. AR(1) and AR(2) are the Arellano-Bond tests for first and second-order serial correlation in the first-differenced residuals, distributed as  $N(0,1)$  under the null hypothesis of no serial correlation. Year fixed effects are included in all specifications.

The results show high stability for the main model. In columns (1) and (2), which respectively restrict and expand the depth of instrumental lags, the lagged dependent variable coefficient remains positive and significant in both ( $\beta = 0.828$ ), accurately reproducing the magnitude observed in the main model ( $\beta = 0.826$ ). This pattern suggests that the dynamic persistence of capital structure is not an artifact of a specific instrumental configuration, but a robust structural characteristic of the sampled firms' financial behavior. This stability reinforces the interpretation of gradual leverage adjustment, consistent with adjustment costs and partial convergence toward target debt levels (Leary & Roberts, 2005).

The coefficients of the central variables remain qualitatively consistent; the OCIndex maintains a positive and significant coefficient across all SYS-GMM specifications, with  $\beta$  between 0.098 and 0.114, indicating the main result does not depend on the specific choice of instrumental depth. In economic terms, the magnitude remains substantial; even in the most conservative SYS-GMM specification, a unit increase in the OCIndex is associated with a near 10 p.p. increase in leverage. This pattern bolsters the behavioral interpretation that overconfident CEOs systematically underestimate financial risk and overestimate their future cash-generating capacity, thereby elevating their propensity to finance with debt (Malmendier & Tate, 2005, 2008; Malmendier et al., 2011).

The EPU variable also maintains its positive sign and statistical significance in the alternative SYS-GMM specifications, with  $\beta$  ranging from 0.014 to 0.016, replicating almost entirely the evidence from Table 3. This result reinforces the precautionary financing interpretation, suggesting that leverage's positive response to macroeconomic uncertainty does not stem from econometric fragility but from a persistent economic mechanism in emerging markets characterized by a higher risk of credit rationing (Bajaj et al., 2021; Tran, 2021). The central result remains stable across all SYS-GMM specifications: the interaction term between EPU and OCIndex remains negative and significant, with  $\beta$  ranging from -0.016 to -0.019, confirming that macroeconomic uncertainty's disciplining effect on behavioral bias does not

depend on the adopted instrumental setup. This pattern is relevant because it eliminates the possibility that the study's main contribution is simply a product of instrument sensitivity.

Column (3), which estimates the model via one-step SYS-GMM, produces virtually identical results to the main two-step specification. This stability indicates that the findings are not driven by the efficiency correction associated with the two-step estimator with Windmeijer adjustment, reinforcing inference robustness.

Columns (4) and (5), based on the Difference-GMM estimator, offer an additional test. As expected in Difference-GMM models, the magnitude of the dynamic persistence coefficient decreases substantially to approximately 0.669. This behavior reflects the well-known downward bias of Difference-GMM in contexts of high temporal persistence, where level lags are weak instruments (Blundell & Bond, 1998). Nevertheless, the OCIndex remains positive and significant ( $\beta = 0.068$ ), while the interaction term between EPU and OCIndex preserves its negative and significant sign ( $\beta = -0.011$ ).

The only substantive difference emerges in the isolated EPU variable, which loses statistical significance in the Difference-GMM specifications. This change does not compromise the study's central interpretation but suggests that the average effect of macroeconomic uncertainty on leverage is more sensitive to estimator efficiency than the moderating mechanism between EPU and OCIndex. In other words, although the magnitude of EPU's average effect depends partly on the econometric specification, the evidence that uncertainty systematically alters the influence of managerial bias remains robust.

#### *4.2.2 Sensitivity to External Shocks: The Impact of the COVID-19 Pandemic*

Table 6 examines whether the main results remain stable in the face of the largest exogenous shock observed in the sample period: the COVID-19 pandemic. This test is particularly relevant because the pandemic simultaneously represented a macroeconomic rupture event, an abrupt liquidity shock and a period of high global institutional uncertainty, with the potential to structurally alter both corporate financing behavior and managers' discretionary actions. In such a context, it becomes imperative to distinguish whether the central results reflect a persistent structural mechanism or are predominantly influenced by an exceptional episode.

The first three columns re-estimate the main model, separately excluding the years 2020, 2021 and then the entire pandemic period (2020–2021). Column (4), in turn, retains the full

sample and explicitly introduces an interaction term between managerial overconfidence and a binary indicator for the pandemic years (COVID). Together, these specifications enable evaluation of both the sensitivity of the results to the temporal composition of the sample and the potential alteration of overconfidence's economic effect during the pandemic outbreak.

The dynamic persistence of capital structure remains high across all specifications, with lagged dependent variable coefficients ( $Lev_{t-1}$ ) ranging from 0.803 to 0.859. This stability indicates that the inertial nature of corporate financing decisions remains intact even in the face of an extreme systemic shock, demonstrating that the gradual adjustment pattern of capital structure does not rely on the inclusion of the pandemic period.

**Table 6**  
*Impact of the COVID-19 Pandemic on Managerial Overconfidence and Leverage*

|                   | (1)<br>Excl. 2020   | (2)<br>Excl. 2021   | (3)<br>Excl. 2020-21 | (4)<br>COVID Interaction |
|-------------------|---------------------|---------------------|----------------------|--------------------------|
| $Lev_{t-1}$       | 0.859***<br>(35.02) | 0.807***<br>(30.66) | 0.803***<br>(28.25)  | 0.826***<br>(41.09)      |
| $OCIndex$         | 0.102**<br>(2.46)   | 0.067**<br>(2.01)   | 0.039<br>(1.08)      | 0.114***<br>(3.13)       |
| $OCIndex * COVID$ |                     |                     |                      | -0.005***<br>(-2.87)     |
| $EPU$             | 0.014**<br>(2.26)   | 0.010*<br>(1.85)    | 0.007<br>(1.12)      | 0.016***<br>(3.02)       |
| $EPU * OCIndex$   | -0.017**<br>(-2.22) | -0.011*<br>(-1.73)  | -0.006<br>(-0.82)    | -0.019***<br>(-2.86)     |
| <b>Controls</b>   | Yes                 | Yes                 | Yes                  | Yes                      |
| <b>Year FE</b>    | Yes                 | Yes                 | Yes                  | Yes                      |
| Observations      | 17372               | 17004               | 14388                | 22760                    |
| N° of Groups      | 3742                | 3745                | 3714                 | 3764                     |
| N° of Instruments | 21                  | 21                  | 20                   | 24                       |
| AR(1) (p-value)   | 0.000               | 0.000               | 0.000                | 0.000                    |
| AR(2) (p-value)   | 0.896               | 0.481               | 0.843                | 0.797                    |
| Sargan (p-value)  | 0.639               | 0.474               | 0.322                | 0.186                    |
| Hansen (p-value)  | 0.627               | 0.517               | 0.361                | 0.228                    |

**Notes:** This table presents robustness checks on the impact of the COVID-19 pandemic on the relationship between overconfidence, uncertainty and leverage. Columns (1), (2) and (3) present two-step System GMM estimations excluding the years 2020, 2021 and the full 2020-2021 period, respectively. Column (4) includes an interaction term between overconfidence and a COVID-19 dummy (equal to 1 for the years 2020 and 2021). Z-statistics based on robust standard errors are reported in parentheses. \* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ . The Hansen test evaluates the null hypothesis of instrument validity. AR(1) and AR(2) are the Arellano-Bond tests for first and second-order serial correlation in the first-differenced residuals, distributed as  $N(0,1)$  under the null hypothesis of no serial correlation.

Regarding the variables of interest, the results suggest that the pandemic marginally altered the economic intensity of the effects, while preserving the general direction of the main model's signs. In columns (1) and (2), which individually exclude 2020 and 2021, the  $OCIndex$  remains positive and significant with  $\beta$  of 0.102 and 0.067, respectively. However, when both years are excluded simultaneously in column (3), the  $OCIndex$  coefficient loses statistical

significance ( $\beta = 0.039$ ). This change primarily stems from a substantial reduction in sample size (by over 8,000 observations) and the resulting loss of the estimator's statistical power and should not be interpreted as invalidating the behavioral hypothesis.

The EPU variable displays analogous behavior. When 2020 or 2021 are excluded individually, uncertainty retains its positive sign and statistical significance ( $\beta = 0.014$  and  $\beta = 0.010$ , respectively). By entirely removing the pandemic biennium in column (3), the coefficient becomes statistically indistinguishable from zero ( $\beta = 0.007$ ). This pattern suggests that the positive relationship between macroeconomic uncertainty and leverage is accentuated during periods of severe systemic disruption, consistent with the precautionary financing logic. In environments of extreme uncertainty, the incentive to preemptively fund tends to intensify, given the higher perceived probability of credit windows closing and refinancing conditions deteriorating (Tran, 2021; Bajaj et al., 2021).

The interaction term between EPU and OCIndex provides informative complementary evidence. In columns (1) and (2), the interaction remains negative and statistically significant ( $\beta = -0.017$  and  $\beta = -0.011$ ), qualitatively reproducing the central mitigating mechanism documented earlier. However, in column (3), the loss of sample power also causes the interaction term to lose statistical significance ( $\beta = -0.006$ ).

Lastly, column (4) allows examining the pandemic dynamic directly through the full sample. The coefficient of the OCIndex\*COVID term is negative and significant ( $\beta = -0.005$ ), indicating that the marginal influence of overconfidence on leverage was smaller during the years of the health and economic crisis. This result reinforces the paper's central thesis: severe macroeconomic uncertainty and external shocks do not amplify discretionary behavioral biases; rather, they tend to constrain them. This evidence dialogues with the literature on financial constraints in periods of crisis (Drobetz et al., 2018; Tran, 2021), which documents that severe uncertainty shocks raise the cost of external capital and contract the credit supply. Under such circumstances, overconfident CEOs no longer operate in an environment of broad discretion and face severe constraints imposed by the financial market. Thus, even CEOs inclined to underestimate risks face objective liquidity constraints that limit their ability to leverage the firm.

#### 4.2.3 Financial Constraints and Extreme Uncertainty Scenarios

Table 7 deepens the economic interpretation of the mechanism identified in the main analyses by examining whether the relationship among managerial overconfidence, macroeconomic uncertainty and capital structure varies depending on contexts of extreme uncertainty and heterogeneity in firms' financial constraints. While Tables 4 and 5 demonstrate that macroeconomic uncertainty reduces, on average, the economic manifestation of overconfidence in financing decisions, this analysis investigates whether this disciplining effect is homogeneous across firms or depends on the severity of the macro-financial environment and available financial flexibility.

**Table 7**

*Heterogeneity analysis: The impact of financial constraints and extreme uncertainty episodes*

|                             | (1)<br>Extreme EPU   | (2)<br>Triple Interaction | (3)<br>Non-Restricted | (4)<br>Restricted    |
|-----------------------------|----------------------|---------------------------|-----------------------|----------------------|
| <i>Lev<sub>(t-1)</sub></i>  | 0.822***<br>(41.61)  | 0.824***<br>(41.03)       | 0.826***<br>(37.78)   | 0.624***<br>(7.14)   |
| <i>OCIndex</i>              | 0.010***<br>(17.74)  | 0.103***<br>(2.95)        | 0.065**<br>(2.44)     | -0.211***<br>(-3.08) |
| <i>EPU</i>                  |                      | 0.015***<br>(2.82)        | 0.009**<br>(2.28)     | -0.017**<br>(-2.05)  |
| <i>EPU * OCIndex</i>        |                      | -0.017***<br>(-2.69)      | -0.010**<br>(-2.09)   | 0.040***<br>(3.18)   |
| <i>EPU Extreme</i>          | 0.027***<br>(3.13)   |                           |                       |                      |
| <i>EPU Ext * OCIndex</i>    | -0.009***<br>(-3.71) |                           |                       |                      |
| <i>Restricted</i>           |                      | 0.081***<br>(2.87)        |                       |                      |
| <i>OCIndex * Restricted</i> |                      | -0.091**<br>(-2.57)       |                       |                      |
| <i>EPU * Restricted</i>     |                      | -0.013**<br>(-2.51)       |                       |                      |
| <i>OCInd * EPU * Rest</i>   |                      | 0.017**<br>(2.55)         |                       |                      |
| <i>Controls</i>             | Yes                  | Yes                       | Yes                   | Yes                  |
| <i>Year FE</i>              | Yes                  | Yes                       | Yes                   | Yes                  |
| Observations                | 22760                | 22760                     | 17404                 | 5356                 |
| N° of Groups                | 3764                 | 3764                      | 2748                  | 1795                 |
| N° of Instruments           | 23                   | 27                        | 23                    | 22                   |
| AR(1) (p-value)             | 0.000                | 0.000                     | 0.000                 | 0.000                |
| AR(2) (p-value)             | 0.952                | 0.639                     | 0.534                 | 0.276                |
| Sargan (p-value)            | 0.232                | 0.088                     | 0.489                 | 0.061                |
| Hansen (p-value)            | 0.393                | 0.138                     | 0.546                 | 0.152                |

**Notes:** This table reports the heterogeneity analysis of extreme-uncertainty episodes and financial constraints using two-step System GMM estimations. Column (1) evaluates the impact of extreme EPU episodes, defined as periods where EPU is one standard deviation above the mean. Column (2) presents a triple interaction model including a financial constraint dummy. Columns (3) and (4) report results for sub-samples of non-financially restricted and restricted firms, respectively. Z-statistics based on robust standard errors are reported in parentheses. \* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ . The Hansen test evaluates the null hypothesis of instrument validity. AR(1) and AR(2) are the Arellano-Bond tests for first and second-order serial correlation in the first-differenced residuals, distributed as  $N(0,1)$  under the null hypothesis of no serial correlation. Year fixed effects are included in all specifications.

The literature on capital structure under uncertainty suggests that financial constraints deeply condition firms' responsive capacity to macroeconomic shocks (Hadlock & Pierce, 2010; Almeida & Campello, 2007), while behavioral literature notes that managerial biases manifest with greater intensity when there is sufficient discretion to translate subjective beliefs into observable corporate decisions (Malmendier & Tate, 2005, 2008). Thus, the interaction between external constraints and internal biases constitutes a direct test of the study's proposed conceptual logic.

Column (1) specifically examines extreme uncertainty episodes, defined as periods in which EPU exceeds one standard deviation above the mean. Results indicate that extreme uncertainty shocks preserve uncertainty's positive average effect on leverage while simultaneously intensifying its disciplining role for overconfident managers. The coefficient associated with the extreme-uncertainty dummy is positive and significant ( $\beta = 0.027$ ), suggesting that exceptional episodes of uncertainty raise firms' average leverage. In economic terms, this effect is substantially larger than the EPU's average coefficient in the main model, indicating that severe shocks amplify the incentive to precautionary borrow.

This result directly reinforces the precautionary financing hypothesis. In extreme-uncertainty scenarios, firms seem to rely on external funding as a defensive mechanism against the higher perceived probability of credit disruption, liquidity deterioration and increased refinancing risk. In emerging markets, where financial frictions are more pronounced and credit market depth is relatively lower, this behavior is particularly plausible (Bajaj et al., 2021; Makololo & Seetharam, 2020).

The interaction term between extreme uncertainty and managerial overconfidence remains negative and significant ( $\beta = -0.009$ ). This finding implies that, although extreme uncertainty episodes raise firms' average leverage, this increase is significantly smaller among firms led by overconfident CEOs. Conceptually, the evidence bolsters the earlier interpretation: severe uncertainty shocks do not amplify behavioral discretion; rather, they make external constraints sufficiently binding to limit their economic manifestation.

Column (2) deepens this interpretation by explicitly introducing the heterogeneity associated with financial constraints through a triple interaction model. The positive and significant coefficient of the financial constraint dummy ( $\beta = 0.081$ ) suggests that financially constrained firms, on average, operate with higher leverage, consistent with a structural dependence on external financing in contexts of reduced financial flexibility.

However, the interaction term between OCIndex and financial constraints is negative and significant ( $\beta = -0.091$ ), indicating that overconfidence's positive effect on leverage is substantially weaker among financially restricted firms. This result is theoretically coherent, as overconfidence can only influence financial decisions when there is sufficient discretionary margin for the manager to act. In structurally restricted firms, this margin is naturally reduced, as credit market limitations constrain the implementation of idiosyncratic managerial preferences.

The negative and significant interaction coefficient between EPU and financial constraints ( $\beta = -0.013$ ) adds an important nuance. Unlike the precautionary financing logic observed in more flexible firms, financially constrained firms seem less able to increase leverage in response to uncertainty shocks, possibly because they face precisely the credit constraints that other firms try to anticipate. The triple interaction term among overconfidence, uncertainty and financial constraints presents a significant coefficient ( $\beta = 0.017$ ). This result implies that, within the subset of financially restricted firms, uncertainty's disciplining effect on overconfident managers is partially reversed. In economic terms, this indicates that the combination of financial constraints and overconfidence can produce behavior distinct from the sample average.

This evidence is conceptually sophisticated. In non-restricted firms, uncertainty seems to limit overconfidence by toughening external financing conditions. However, in structurally constrained firms, overconfident CEOs might respond to macroeconomic deterioration more aggressively, possibly seeking to secure access to residual credit before financial conditions worsen further. In other words, financial constraints appear to partially transform uncertainty from a disciplining mechanism into a trigger for aggressive defensive behavior.

Columns (3) and (4), which explicitly segment the sample into non-financially restricted and restricted firms, confirm this interpretation quite convincingly. In the non-restricted firm group in column (3), the pattern remains aligned with the main evidence. OCIndex and EPU maintain positive and significant coefficients ( $\beta = 0.065$  and  $\beta = 0.009$ , respectively). The interaction term between EPU and OCIndex remains negative and significant ( $\beta = -0.010$ ), reproducing almost entirely the central mechanism documented in Table 3.

This finding indicates that, among firms with greater financial flexibility, the core narrative remains fully valid: macroeconomic uncertainty increases the average demand for

external financing but simultaneously restricts the economic manifestation of managerial overconfidence.

The contrast with the financially restricted firm group in column (4) is revealing. In this subset, the OCIndex and EPU coefficients become negative and significant ( $\beta = -0.211$  and  $\beta = -0.017$ , respectively). Meanwhile, the interaction term between EPU and OCIndex becomes positive and significant ( $\beta = 0.040$ ). This sign reversal represents one of the paper's most important pieces of evidence. It shows that in severely restricted firms, the dynamics observed in the sample average flip. In these environments, overconfidence alone seems associated with lower leverage, possibly because overconfident managers prefer to avoid financing conditions perceived as overly adverse or believe in future internal alternatives. Nonetheless, when combined with high uncertainty, these same managers become more aggressive, possibly anticipating further deterioration in credit access.

Theoretically, these results substantially refine the interpretation developed in earlier sections. The evidence proves that the macro-financial discipline hypothesis is valid on average, but not universal. Uncertainty's effect on managerial behavior depends critically on the firm's financial flexibility. In higher discretion contexts, uncertainty disciplines. In severe restriction contexts, the same uncertainty may trigger opportunistic defensive behavior.

#### *4.2.4 Alternative Leverage Measures*

Table 8 assesses whether the primary evidence remains robust when the dependent variable is redefined to capture different dimensions of corporate capital structure. This test is vital because the economic interpretation of leverage depends heavily on the adopted metric. Accounting and market measures capture different financing rationalities, while segmenting between short-term and long-term debt allows identifying whether the observed mechanism operates predominantly through short-term liquidity management or structural capital decisions. Thus, this analysis enables distinguishing whether the core results reflect a general financing policy phenomenon or are restricted to the specific leverage definition used in the main model.

Columns (1) and (2) re-estimate the model using accounting measures segmented into short-term debt and long-term debt. Columns (3) and (4), in turn, use market-value-based leverage measures, constructed from two different denominator definitions, capturing varying capital structure sensitivities to market pricing. Since these measures share mechanical

components with growth opportunity proxies, Tobin's (Q) is included in lagged form, mitigating mechanical simultaneity and spurious correlation, per established practice in the capital structure literature (Fama & French, 2002).

**Table 8**  
*Regression results for alternative leverage proxies*

|                                      | (1)<br>Short Term   | (2)<br>Long Term     | (3)<br>Mlev Capital  | (4)<br>Mlev Assets   |
|--------------------------------------|---------------------|----------------------|----------------------|----------------------|
| <i>Short Term</i> <sub>(t-1)</sub>   | 0.828***<br>(15.68) |                      |                      |                      |
| <i>Long Term</i> <sub>(t-1)</sub>    |                     | 0.756***<br>(25.14)  |                      |                      |
| <i>Mlev Capital</i> <sub>(t-1)</sub> |                     |                      | 0.869***<br>(36.11)  |                      |
| <i>Mlev Assets</i> <sub>(t-1)</sub>  |                     |                      |                      | 0.874***<br>(38.54)  |
| <i>OCIndex</i>                       | -0.167<br>(-1.44)   | 0.093***<br>(3.07)   | -0.043***<br>(-3.30) | -0.036***<br>(-4.07) |
| <i>EPU</i>                           | -0.025<br>(-1.53)   | 0.016***<br>(3.51)   | -0.009***<br>(-3.78) | -0.008***<br>(-5.58) |
| <i>EPU * OCIndex</i>                 | 0.031<br>(1.46)     | -0.016***<br>(-2.83) | 0.010***<br>(3.97)   | 0.008***<br>(4.92)   |
| <i>Q Tobin</i>                       | 0.001<br>(1.11)     | 0.000<br>(0.55)      |                      |                      |
| <i>Q Tobin</i> <sub>(t-1)</sub>      |                     |                      | -0.000<br>(-0.30)    | 0.000<br>(0.55)      |
| <i>Controls</i>                      | Yes                 | Yes                  | Yes                  | Yes                  |
| <i>Year FE</i>                       | Yes                 | Yes                  | Yes                  | Yes                  |
| Observations                         | 22760               | 22760                | 22760                | 22751                |
| N° of Groups                         | 3764                | 3764                 | 3764                 | 3763                 |
| N° of Instruments                    | 23                  | 23                   | 22                   | 25                   |
| AR(1) (p-value)                      | 0.000               | 0.000                | 0.000                | 0.000                |
| AR(2) (p-value)                      | 0.172               | 0.573                | 0.602                | 0.548                |
| Sargan (p-value)                     | 0.533               | 0.020                | 0.652                | 0.008                |
| Hansen (p-value)                     | 0.674               | 0.225                | 0.705                | 0.130                |

**Notes:** This table reports robustness checks using alternative definitions of the dependent variable. Columns (1) and (2) employ book leverage measures: short-term and long-term debt, respectively. Columns (3) and (4) employ market leverage measures: market-to-capitalization and market-to-assets leverage. For market-based specifications, the Q de Tobin is lagged by one period ( $Q\ Tobin_{t-1}$ ) to mitigate mechanical correlation and simultaneity bias. All models are estimated using a two-step System GMM with robust standard errors. Z-statistics are reported in parentheses. \* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ . The Hansen test evaluates the null hypothesis of instrument validity. AR(1) and AR(2) are the Arellano-Bond tests for first and second-order serial correlation in the first-differenced residuals, distributed as  $N(0,1)$  under the null hypothesis of no serial correlation. Year fixed effects are included in all specifications.

Results initially indicate that capital structure's dynamic persistence remains high regardless of the definition of the dependent variable. The coefficients for the lagged dependent variables range from 0.756 to 0.874, all statistically significant at the 1% level. This pattern corroborates the interpretation developed since Table 3, showing that corporate financing policy exhibits strong temporal inertia, regardless of the metric used, consistent with adjustment costs, contractual rigidity and gradual convergence toward target capital structures.

However, the breakdown reveals important economic heterogeneity in the study's central mechanism. Column (1), based on short-term debt, presents a noticeably distinct pattern from the main model. Neither the managerial overconfidence coefficient ( $\beta = -0.167$ ) nor the EPU coefficient ( $\beta = -0.025$ ) is statistically significant, nor is their interaction term. This result suggests the mechanism identified in the main analyses does not predominantly operate via short-term liabilities.

This evidence is economically plausible because short-term debt tends to reflect operational needs, working capital management and transient liquidity, which are frequently constrained by stricter contractual requirements and lower managerial discretion. Under these circumstances, overconfident CEOs' ability to actively influence the financial structure may be more limited. Similarly, macroeconomic uncertainty shocks can yield ambiguous effects on short-term financing, merging higher demand for liquidity with a stronger retraction in the very short-term credit supply.

Conversely, in column (2), based on long-term debt, OCIndex and EPU maintain positive and significant coefficients ( $\beta = 0.093$  and  $0.016$ , respectively), while their interaction term remains negative and significant ( $\beta = -0.016$ ). This pattern closely replicates the main model's evidence, indicating that the study's mechanism operates primarily through long-term structural financing decisions rather than through transient liquidity adjustments. This outcome substantially strengthens the paper's theoretical interpretation. If the identified mechanism merely reflected opportunistic short-term liquidity management, its relevance to the capital structure literature would be more limited. However, the fact that it emerges precisely in long-term debt suggests we are capturing genuinely strategic choices concerning capital structure.

From a behavioral perspective, this result closely aligns with managerial overconfidence literature. Overconfident CEOs tend to make financing decisions based on subjective beliefs about future cash flows, the relative cost between debt and equity and future refinancing capacity (Malmendier & Tate, 2005, 2008; Malmendier et al., 2011). Such choices manifest more naturally in structural long-term decisions than in operational-natured financial instruments.

Columns (3) and (4), utilizing market leverage measures, introduce an additional nuance. In these specifications, both OCIndex and EPU begin to display negative coefficients, while the interaction term remains positive and significant. In column (3), using a market leverage measure based on the financial capital structure, the OCIndex and EPU coefficients

yield  $\beta = -0.043$  and  $-0.009$ , respectively, while their interaction term is positive ( $\beta = 0.010$ ). Column (4), based on the market value of assets, reproduces the same pattern as column (3).

At first glance, this reversal might seem contradictory to the main results. However, economically, it is fully consistent with the conceptual difference between accounting and market measures. While accounting metrics reflect observable nominal financing decisions, market metrics simultaneously incorporate shifts in investor perceptions and fluctuations in the relative value of equity. Under high macroeconomic uncertainty, market capitalization tends to be highly volatile, mechanically altering the debt-to-market-value ratio even in the absence of immediate changes to nominal debt.

Thus, EPU's negative coefficient in market specifications is consistent with environments where uncertainty shocks diminish perceived firm value and alter the relative debt-to-equity mix from a market perspective. Likewise, the reversal in the overconfidence coefficient may precisely reflect the higher sensitivity of firms led by aggressive CEOs to market repricing, especially when investors penalize financial structures perceived as riskier.

The positive sign of the interaction term in these specifications does not contradict the main narrative but points to a separate mechanism. While uncertainty restricts overconfident CEOs' ability to expand nominal debt in accounting measures, in market metrics, the positive interaction suggests that the combination of overconfidence and uncertainty alters the relative pricing of capital structure from the investors' viewpoint.

Overall, the robustness checks substantially reinforce the empirical credibility and theoretical consistency of the principal findings. The results' stability across alternative instrumentation and GMM estimator specifications indicates that the central evidence does not stem from idiosyncratic econometric choices but reflects a persistent structural mechanism. Sensitivity analysis to the pandemic shock demonstrates that, although the effect intensity varies during severe macroeconomic ruptures, the core interpretation remains intact: high-uncertainty environments diminish managerial discretion by intensifying external financing constraints. Complementarily, heterogeneity analysis reveals that this mechanism does not operate uniformly among firms, critically depending instead on financial flexibility, showing that the interplay between behavioral biases and structural constraints is intrinsically nonlinear. Tests using alternative leverage measures confirm that the main results are particularly robust for structural accounting proxies, particularly long-term debt, while highlighting that the interaction between overconfidence and macroeconomic uncertainty also affects the market

pricing of capital structure. In summary, the robustness battery not only confirms the statistical stability of the main outcomes but also broadens their economic interpretation, proving that the nexus among macroeconomic uncertainty, managerial behavior and corporate financing decisions is structurally robust, contingent on the firm's financial environment and relevant to both the accounting and valuation dimensions of capital structure.

## 5. Main Conclusions

This study investigated whether managerial overconfidence conditions the transmission of economic policy uncertainty to corporate capital structure decisions in emerging economies, specifically examining whether overconfident CEOs amplify or attenuate leverage's response to macro-institutional shocks. To this end, we analyzed a sample of 22,760 firm-year observations, covering 3,764 non-financial companies from the founding BRICS nations from 2015 to 2024, with data extracted from Refinitiv Eikon and supplemented by external macroeconomic indicators. Given leverage's high temporal persistence and potential endogeneity among financial choices, managerial traits and macroeconomic circumstances, we adopted Blundell and Bond's (1998) two-step System GMM estimator as the main empirical strategy, complemented by a broad battery of robustness checks utilizing alternative estimators, exogenous shocks, financial heterogeneity and alternative leverage proxies.

The core results offer consistent evidence that corporate capital structure in emerging economies is simultaneously shaped by macroeconomic and behavioral factors, yet in a strongly contingent manner. First, we documented leverage's high dynamic persistence, congruent with partial capital structure adjustment literature (Leary & Roberts, 2005). Second, we identified that both economic policy uncertainty and managerial overconfidence exert, on average, positive effects on leverage, respectively corroborating the precautionary financing logic discussed by Bajaj et al. (2021), Tran (2021) and Vega-Gutiérrez et al. (2024), as well as the behavioral finance literature spearheaded by Malmendier and Tate (2005, 2008) and expanded by Malmendier et al. (2011). However, the study's central evidence lies in the interaction effect: contrary to the original hypothesis formulated, macroeconomic uncertainty does not amplify overconfidence's impact on debt policy; instead, it progressively curtails its economic manifestation.

The marginal effects breakdown and robustness checks deepen this interpretation. Findings show that EPU increases leverage only among firms led by managers with low

overconfidence, a pattern consistent with rational anticipatory financing decisions in settings with potential credit constraints. Contrastingly, among highly overconfident CEOs, EPU significantly reduces leverage, suggesting that deteriorating external funding conditions bind managerial discretion. This evidence is broadly robust to alternative instrumentation choices, distinct GMM estimators, exclusion of pandemic years, interactions with extreme-uncertainty shocks, financial constraint heterogeneity and alternative leverage metrics. Crucially, the outcomes indicate the identified mechanism associates most firmly with structural long-term debt choices and firms' financial flexibility, reinforcing the inference that external market constraints function as disciplinary mechanisms against managerial cognitive biases.

### 5.1. Theoretical and practical contributions

This paper provides theoretical contributions by broadening economic policy uncertainty literature, demonstrating that EPU's effects on capital structure are not homogeneous across firms but critically depend on decision-makers' behavioral traits, thereby expanding predominantly macro-financial lenses (Baker et al., 2016; Drobetz et al., 2018; Tran, 2021). Furthermore, it contributes to behavioral finance by demonstrating that managerial overconfidence is not an invariant financing determinant but a bias whose economic implications depend on external market conditions, thereby refining the classical interpretation of Malmendier and Tate (2005, 2008) and Malmendier et al. (2011). Ultimately, by concurrently weaving macro- and micro-behavioral elements, the study offers a multilevel reading of capital structure, bridging literatures conventionally treated independently.

Empirically, this work pushes boundaries by supplying novel evidence from the emerging BRICS economies, an under-explored backdrop for the nexus between EPU, managerial biases and financing decisions. Methodologically, constructing a multidimensional overconfidence index grounded in the revealed beliefs paradigm (Malmendier & Tate, 2005; Hirshleifer et al., 2012), meshing abnormal investments, acquisitive behavior and profit expectation optimism, amplifies the sophistication of behavioral measurement across large-scale international datasets. Moreover, the adoption of a dynamic identification strategy, bolstered by intensive econometric validation, strengthens the causal credibility of the inferences. From a practical viewpoint, the results counsel investors, creditors and policymakers to acknowledge that managerial biases may be neutralized or amplified by the

prevailing macro-financial regime, implying that corporate risk assessments must not treat managerial behavior as a static attribute.

## 5.2. Limitations and future research

Despite these contributions, a few limitations warrant recognition. Though theoretically sound within behavioral contexts, the deployed overconfidence index remains an indirect proxy leaning on revealed actions rather than a direct observational gauge of a CEO's beliefs. The analysis focuses on the founding BRICS members, limiting generalizability to developed economies or other emerging markets with dissimilar institutional frameworks. Although System GMM addresses severe endogeneity concerns, additional exogenous identification strategies, such as regulatory shocks or quasi-experimental designs, could further strengthen causal inference. Future research might broaden this agenda by examining textual overconfidence metrics derived from corporate communications, investigating heterogeneity across market-based and bank-based financial systems, or probing whether alternate behavioral traits, such as optimism, narcissism, or ambiguity aversion, interact similarly with macroeconomic shocks in shaping capital structure.

## **Declaration of generative AI and AI-assisted technologies in the manuscript preparation process**

During the preparation of this work, the author(s) used Grammarly for translation and to improve the English language quality of the text. The author(s) reviewed and edited the output as needed and take full responsibility for the content of the published article.

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**Table A1***Static panel data results and diagnostic tests for leverage*

|                       | (1)<br>OLS             | (2)<br>RE              | (3)<br>FE              |
|-----------------------|------------------------|------------------------|------------------------|
| <i>OCIndex</i>        | 0.001<br>(0.167)       | 0.003<br>(1.191)       | 0.005**<br>(2.194)     |
| <i>EPU</i>            | 0.013***<br>(10.496)   | 0.002<br>(1.081)       | -0.006**<br>(-2.336)   |
| <i>EPU * OCIndex</i>  | 0.001<br>(0.924)       | -0.000<br>(-0.414)     | -0.001*<br>(-1.693)    |
| <i>Size</i>           | 0.031***<br>(51.251)   | 0.044***<br>(42.680)   | 0.078***<br>(44.822)   |
| <i>ROA</i>            | -0.469***<br>(-37.266) | -0.388***<br>(-36.867) | -0.382***<br>(-34.974) |
| <i>Tang</i>           | 0.034***<br>(8.057)    | 0.051***<br>(9.459)    | 0.083***<br>(12.897)   |
| <i>NDTS</i>           | 0.028<br>(0.441)       | 0.278**<br>(4.273)     | 0.434***<br>(6.143)    |
| <i>Cash</i>           | -0.419***<br>(-62.905) | -0.219***<br>(-33.289) | -0.148***<br>(-20.628) |
| <i>Q Tobin</i>        | -0.004***<br>(-7.995)  | -0.003***<br>(-6.323)  | -0.000<br>(-0.945)     |
| <i>GDP</i>            | -0.022***<br>(-15.013) | -0.029***<br>(-11.136) | -0.093***<br>(-7.560)  |
| <i>_cons</i>          | 0.310***<br>(7.835)    | 0.256***<br>(3.559)    | 1.454***<br>(4.107)    |
| <b>Year FE</b>        | Yes                    | Yes                    | Yes                    |
| Observations          | 27190                  | 27190                  | 27190                  |
| R-Squared             | 0.318                  |                        |                        |
| Adj. R-Squared        | 0.318                  |                        |                        |
| R-sq within           |                        | 0.177                  | 0.194                  |
| R-sq overall          |                        | 0.272                  | 0.175                  |
| Breusch-Pagan (p-val) |                        | 0.000                  |                        |
| F-Test                |                        |                        | 0.000                  |
| Hausman (p-val)       |                        |                        | 0.000                  |
| Wald                  |                        |                        | 0.000                  |
| Wooldridge            |                        |                        | 0.000                  |

**Note:** t-statistics reported in parentheses. The Breusch-Pagan LM ( $\chi^2 = 40,848.31$ ), F-test (15.86) and Hausman ( $\chi^2 = 1,109.70$ ) tests are all significant at the 1% level, favoring the fixed effects specification over OLS and RE. The modified Wald  $\chi^2 = 3,3*10^{21}$  and Wooldridge (F = 1276.22) tests confirm the presence of heteroscedasticity and serial autocorrelation at the 1% significance level, underpinning the use of dynamic models and robust standard errors in subsequent sections. \* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01.\*