

# Flying under the radar: earnings management choices and anti-corruption

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## Abstract

**Purpose** – This study examines how anti-corruption pressure influences corporate earnings management practices in Vietnam, a country undergoing an intensive anti-corruption campaign.

**Design/methodology/approach** – This study employs a news-based anti-corruption index to measure anti-corruption intensity and investigates its impact on earnings management behavior among Vietnamese firms. Using a sample of non-financial listed companies in Vietnam, the study distinguishes between accrual-based and real earnings management (REM) by employing regression techniques with multiple robustness and endogeneity checks.

**Findings** – The results reveal a substitution effect: as anti-corruption pressure increases, firms reduce accrual-based earnings management (AEM) but increase REM, a form that is relatively harder to detect. This study suggests that in provinces with poorer local institutional quality, firms' expected political and detection costs differ, thereby altering their reallocation between AEM and REM as anti-corruption intensifies. Further analyses indicate that the impact of anti-corruption pressure on earnings management choices varies systematically with local institutional quality.

**Originality/value** – This study offers new insights into the impact of anti-corruption on firms' earnings management choices. This research contributes to the Economic Theory of Crime and Punishment and the Political Cost Theory while emphasizing the critical role of local institutional quality in shaping how firms respond to anti-corruption intensities. More broadly, our study develops a conceptual framework for understanding firm behavior under institutional pressure and offers guidance for designing more effective and context-sensitive anti-corruption policies.

**Keywords** Accruals, Anti-corruption, Earnings management, Institutional quality, Real activities

**Paper type** Research article

## 1. Introduction

Corruption remains a pervasive issue that undermines corporate transparency and economic stability, particularly in developing economies. In Vietnam, where anti-corruption initiatives have gained momentum in the recent decade, the impact of these efforts on corporate reporting behavior remains underexplored. While earnings management is a commonly employed tool for financial reporting manipulation, limited research exists on how anti-corruption measures influence this practice in the context of Vietnam, a developing socialist country with a unique political landscape. This paper aims to address this gap by examining the relationship between

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anti-corruption efforts and the choices of earnings management methods, offering insights into the effectiveness of governance reforms and their implications for fostering financial integrity and sustainable economic growth.

Vietnam's top-down anti-corruption campaign, known as the "blazing furnace", has been a key focus of the Communist Party of Vietnam (CPV) since 2013. The campaign originated from the highest echelons of political power in Vietnamese politics, particularly under the leadership of the former CPV General Secretary Nguyen Phu Trong and relied on centralized investigations and disciplined enforcement targeting senior officials, both at the central and provincial levels. The campaign targets corrupt high-ranking officials and business executives, resulting in approximately 168,000 CPV party members being disciplined and 7,390 CPV members being punished for corruption-related charges [1]. The campaign has extended its reach to provincial levels by dismantling local power networks and implementing institutional measures such as establishing anti-corruption steering committees in each province. While the campaign has demonstrated the government's commitment to combating corruption, it has also raised concerns about its impact on economic development and the decision-making processes at both macro-level and firm-level.

The current state of the literature on the economic impact of anti-corruption primarily focuses on how such government initiatives affect corporate outcomes, for instance, firm value (Xu, 2018), corporate profitability (Hoang *et al.*, 2022a, b; Nguyen, 2023), corporate innovation (Xu and Yano, 2017) and capital expenditure (Zhang *et al.*, 2019; Hoang *et al.*, 2025). In the literature, the limited attempts to examine corporate disclosure behavior under intensified anti-corruption include the study by Cao *et al.* (2018). By examining stock returns and bad news hoarding behavior of Chinese firms, Cao *et al.* (2018) find evidence that connected politicians under anti-corruption inspection have an influence on connected firms to suppress negative news. Hope *et al.* (2020) found that the financial reporting quality of Chinese firms improved after politically connected directors resigned following the 2012 anti-corruption reforms. The results, based on both accrual earnings management and real activity manipulation measures, highlight a significant and consistent effect of the campaign. Using the difference-in-differences approach, the study reveals notable changes in corporate disclosure practices in response to stronger anti-corruption efforts.

Different from the Chinese stock market perspective exploited by Cao *et al.* (2018) and the event-study setting in examining patterns of financial reporting by Hope *et al.* (2020), we focus on the financial reporting perspective of corporate response to the anti-corruption campaign in Vietnam using a news-based approach. Vietnam is relatively similar to China in terms of the political system structure and economy; however, it has a more decentralized power system and fiscal policy (Vu *et al.*, 2014) and a much smaller economy [2]. Our motivation for the news-based approach for capturing the sophisticated movements of the anti-corruption campaign in Vietnam relies on the fact that such developments do not follow a one-event setting as in the case of China (Cao *et al.*, 2018; Hope *et al.*, 2020). Appendix 1 shows the development of anti-corruption activities in Vietnam captured by the Anti-corruption Index by Hoang *et al.* (2022a, b).

We draw on the theoretical model of crime and punishment by Becker (1968) and corporate governance violations by Dyck *et al.* (2008) and its adapted specification reflecting corporate behavior under anti-corruption by Hoang *et al.* (2025) to develop our theoretical framework. The original model of Becker (1968) introduced a formal economic model of crime in which individuals choose whether to offend by comparing the expected benefits and the expected costs. Crime is thus treated as a rational response to incentives such as the probability of detection, the severity and form of punishment and expected private benefits. In our adaptation of the framework, which is later presented in Section 2, the choice of earnings management by a firm is a function of costs and benefits. That is, the firm will engage in earnings management if the total benefit of doing so is greater than its total cost. Assuming the total benefit of earnings management remains constant, intensified anti-corruption likely increases the total cost of earnings management via increased reputational costs and regulatory punishment if

exposed to the public. Therefore, firms choose to refrain from earnings management methods that are more easily detected and change to more sophisticated methods. We test this theoretical prediction using extensive empirical analysis on a sample of Vietnamese firms listed on the Vietnam stock exchanges from 2005 to 2019.

The empirical analysis yields several interesting findings. First, we find that Vietnamese firms refrain from engaging in accrual-based earnings management (AEM) when anti-corruption increases; however, they turn to another earnings management method that is less detectable: real-activities manipulation or real earnings management (REM). This strategic shift is empirically evident in our analysis and holds well after extensive controls and robustness checks. Moreover, our additional analysis identifies an important factor that moderates the impact of anti-corruption on earnings management decision-making: local institutional quality, which is proxied by the informal cost of doing business in the province where the firms locate.

Our study makes several distinct contributions to the existing literature. First, unlike prior studies that view the impact of anti-corruption as largely uniform across firms (e.g. [Cao et al., 2018](#); [Hope et al., 2020](#)), we show that intensified anti-corruption does not eliminate earnings management but instead reshapes firms' earnings management choices. Consistent with the substitution framework documented in the earnings management literature ([Cohen et al., 2008](#); [Zang, 2012](#)), our results indicate that firms tend to reduce more detectable AEM while reallocating manipulation efforts toward less transparent REM practices when anti-corruption pressure intensifies. Second, by combining the Economic Theory of Crime and Punishment ([Becker, 1968](#)) with Political Cost Theory ([Watts and Zimmerman, 1990](#)), we demonstrate that this substitution effect is not universal. Rather, it depends on firm-specific political exposure and institutional constraints, extending prior studies that implicitly assume homogeneous firm responses to anti-corruption initiatives ([Cao et al., 2018](#); [Hope et al., 2020](#); [Lei and Wang, 2019](#)). In particular, we show that state-ownership and local institutional quality act as important boundary conditions that shape firms' adjustment between AEM and REM under heightened political scrutiny. Third, by employing a news-based anti-corruption index ([Hoang et al., 2022a, b](#)), we conceptualize anti-corruption as long-horizon activities by the government rather than a one-off campaign or discrete policy shock, as often considered by previous studies employing event-study or difference-in-differences research designs ([Lei and Wang, 2019](#); [Da Silva Junior et al., 2025](#)). This approach allows us to capture the gradual, evolving and heterogeneous nature of anti-corruption enforcement in Vietnam, which is difficult to observe using conventional event-study of difference-in-differences designs commonly applied in prior research ([Cao et al., 2018](#); [Hope et al., 2020](#); [Lei and Wang, 2019](#)).

## 2. Theoretical framework and hypothesis development

### 2.1 Cost-benefit of earnings management under anti-corruption

Following [Dyck et al. \(2008\)](#), [Hoang et al. \(2025\)](#) and [Boubaker et al. \(2025\)](#), we adopt [Becker's \(1968\)](#) theoretical model of costs and benefits of corporate behavior as a framework to understand firms' earnings management choices under anti-corruption. In this framework, earnings management choice is considered as a function of costs and benefits related to earnings management. Specifically, firm manager only engages in earnings management if the expected private benefits of earnings management outweigh the total cost of earnings management, including the expected reputational cost (if exposed) and the expected punishment (if exposed).

$$E(\text{Benefits}) < \left( \sum_i p_i \times R\text{Cost}_i | i \text{ learns about it} \right) + (p \times P) \quad (1)$$

in which  $E(\text{Benefits})$  is the expected benefits from conducting earnings management, typically manifest in three incentives: financing, contracting and stock return incentives as commonly discussed in the literature;  $p_i$  stands for the probability that a group of financial information

users  $i$  detects earnings management from the firm;  $RCost_i|i$  learns about it is a conditional factor that represents the reputational cost for the firm in case  $p_i$  equals one;  $\pi$  is the probability of litigation or legal action on the firm;  $P$  stands for the punishment from stakeholders, enforcement, litigation or legal action that may take place regarding earnings management is exposed. Collectively,  $(\pi \times P)$  is the expected punishment and  $(\sum_i p_i \times RCost_i|i$  learns about it) is the expected reputational cost of earnings management.

While Becker's (1968) model identifies the economic motivation for deviance, it is unable to fully capture the political mechanism of transition economies such as Vietnam. To capture this, we incorporate Political Cost Theory (Watts and Zimmerman, 1978) into our model. This theory suggests that firms under the close observation of political segments – for example, large firms – have to deal with political costs. They might work out of fear of regulatory action, growing taxes and public opinion damage. Such political costs are amplified in the current circumstances of Vietnam's tightening anti-corruption campaign. As such, firms must weigh the economic costs and benefits of earnings management against the increased political costs of detection, which vary significantly depending on the firm's ownership structure and political visibility.

Under an intensifying anti-corruption campaign, there is an intensively increasing monitoring and scrutiny placed on firms and government officials via investigation and tighter governance practices at various levels. This means an increase  $p_i$  and  $\pi$ , which eventually leads to an increase in both expected reputational costs ( $RCost_i$ ) and expected punishment ( $\pi \times P$ ) on the right-hand side of the Inequality (1), i.e. the total cost of earnings management increases. Consequently, the incentive for conducting earnings management decreases.

The available options for earnings management, i.e. AEM versus REM, can influence the right-hand side of (1) by lowering the probability of earnings management practices being exposed,  $p_i$ . It is well recognized in the literature that REM is a more sophisticated earnings management practice and less detectable than AEM. By focusing more on REM and shifting the focus away from AEM, firms can lower the probability of being exposed to increasing scrutiny, thus lowering the total cost of earnings management. From this proposition, we suggest complementing testable hypotheses as follows:

*H1a.* Vietnamese firms engage less in AEM as anti-corruption intensifies.

*H1b.* Vietnamese firms engage more in REM as anti-corruption intensifies.

## 2.2 The role of local institutional quality

Local institutional quality plays a vital role in how firms respond to anti-corruption efforts, particularly regarding earnings management behavior. Firms located in more corrupt regions are often subject to weaker regulatory enforcement and greater information asymmetry, which facilitate opportunistic financial reporting (Chaney et al., 2011). These institutional weaknesses reduce the credibility of financial disclosures and encourage the use of earnings management as a strategic tool.

At the sub-national level, institutional variation significantly influences corporate responses to anti-corruption policies. Chen et al. (2011) highlight how differences in regional governance quality affect managerial behavior and reporting transparency. Specifically, Hoang et al. (2022a, b) find that firms in more corrupt areas are less likely to disclose CSR information voluntarily, reflecting their adaptation to local institutional conditions and the risk of scrutiny.

As anti-corruption campaigns intensify, firms in corruption-prone regions may perceive themselves as primary targets of enforcement. This leads to more pronounced behavioral shifts, such as reducing AEM and increasing REM, which are harder to detect. These strategic shifts indicate that local institutional quality moderates the relationship between anti-corruption intensity and earnings management practices, both in direction and magnitude.

We formulate this argument into two testable hypotheses as follows:

- H2a.* The negative impact of anti-corruption on AEM is stronger for firms in more corrupt regions.
- H2b.* The positive impact of anti-corruption on REM is stronger for firms in more corrupt regions.

### 3. Methodology and data

#### 3.1 Variable measurements

**3.1.1 Anti-corruption.** Following the recent literature on anti-corruption, there are two approaches to measuring anti-corruption. The first approach is the conventional approach that focuses on anti-corruption events and is typically applied in event studies using a dummy variable representing the periods before and during the anti-corruption events. However, this approach is not suitable for the case of Vietnam, in which anti-corruption intensity does not follow a clear time-series structure for an event study research design (see [Appendix 1](#)). The second approach to measuring anti-corruption intensity applies textual analysis of online newspaper article data to count the frequency of the anti-corruption-related content discussed in those news articles. This approach enables researchers to capture non-binary developments of the anti-corruption activities in a country reflected in public media. Following this approach, we adopt the [Hoang et al. \(2022a, b\)](#) news-based anti-corruption index that uses data from 129,154 news articles from three major online newspapers in Vietnam from 2005 to 2019 as the proxy for anti-corruption in Vietnam.

The index specifically aggregates news coverage reporting investigations, prosecutions of bribery cases and disciplinary actions against corrupt officials and related parties. Python-based text mining, bag-of-words approach and data crawling methods are employed to automatically extract and process anti-corruption content from three major online newspapers, including Vnexpress, Dantri and Nhandan, resulting in a monthly aggregated measure of anti-corruption activity over the study period. This approach demonstrates the dynamic developments of Vietnam's anti-corruption campaign, as illustrated in [Appendix 1](#). The 2005 start year of the data is the earliest of data availability for the construction of the index ([Hoang et al., 2022a, b](#)). To fit the monthly index data of the anti-corruption index to annual accounting data of Vietnamese firms, we take the annual mean of the monthly index (hereafter AACI) as the measure for anti-corruption intensity in Vietnam. We do not include data from the COVID-19 period (2020–2022) to isolate the strong, sophisticated impacts of the unprecedented pandemic on all aspects of corporate outcomes and behaviors.

**3.1.2 Accrual earnings management.** To proxy AEM, we estimate using three widely recognized discretionary accrual models: The Jones model ([Jones, 1991](#)), the modified Jones model ([Dechow et al., 1995](#)) and the performance-adjusted model ([Kothari et al., 2005](#)). We further distinguish between income-increasing and income-decreasing discretionary accruals following [Dechow et al. \(1995\)](#) and [Kothari et al. \(2005\)](#).

The Jones model (1991)

[Jones \(1991\)](#) developed a model to estimate non-discretionary accruals (NDA), assuming they are primarily driven by firm-specific factors such as changes in revenue ( $\Delta REV$ ) and property, plant and equipment (PPE). The model is specified as follows:

$$\frac{TA_{it}}{A_{it-1}} = \beta_0 \times \frac{1}{A_{it-1}} + \beta_1 \times \frac{\Delta REV_{it}}{A_{it-1}} + \beta_2 \times \frac{PPE_{it}}{A_{it-1}} + \varepsilon_{it} \quad (2)$$

where  $TA_{it}$  denotes the total accruals of firm  $i$  at the end of year  $t$ ;  $A_{it-1}$  denotes the firm's total assets at the end of year  $t-1$ ;  $\Delta REV_{it}$  is revenues of firm  $i$  in year  $t$  minus sales in year  $t-1$ ;

$PPE_{it}$  is gross property, plant and equipment of firm  $i$  at the end of year  $t$ .  $\beta_0, \beta_1$  and  $\beta_2$  are the estimated parameters.  $\varepsilon_{it}$  denotes the error term.

$$NDA_{it} = a_1 \times \frac{1}{A_{it-1}} + a_2 \times \frac{\Delta REV_{it}}{A_{it-1}} + a_3 \times \frac{PPE_{it}}{A_{it-1}} \quad (3)$$

where  $NDA_{it}$  is nondiscretionary accruals of firm  $i$  in year  $t$ .  $a_1, a_2$  and  $a_3$  are the parameters estimated using pooled OLS regression.

$$JDA_{it} = TA_{it} - NDA_{it} \quad (4)$$

The absolute value of the discretionary accrual proxy is used as the measure of AEM.

The modified Jones model (1995)

Dechow *et al.* (1995) proposed a modification of the Jones model to account for changes in accounts receivable, recognizing that managers could manage revenue recognition. The modified model estimates  $NDA$  based on  $\Delta REV$ ,  $PPE$  and adjusted for changes in receivables ( $\Delta REC$ ), reflecting depreciation and working capital requirements, following a three-step process.

$$\frac{TA_{it}}{A_{it-1}} = \beta_0 \times \frac{1}{A_{it-1}} + \beta_1 \times \frac{\Delta REV_{it} - \Delta REC_{it}}{A_{it-1}} + \beta_2 \times \frac{PPE_{it}}{A_{it-1}} + \varepsilon_{it} \quad (5)$$

where  $\Delta REC_{it}$  denotes changes in net receivables from year  $t-1$  to year  $t$  and other variables are the same as defined in Equation (2).

$$NDA_{it} = a_1 \times \frac{1}{A_{it-1}} + a_2 \times \frac{\Delta REV_{it} - \Delta REC_{it}}{A_{it-1}} + a_3 \times \frac{PPE_{it}}{A_{it-1}} \quad (6)$$

The discretionary accrual value ( $DDA_{it}$ ), an indicator of earnings management, is calculated by subtracting  $NDA_{it}$  from  $TA_{it}$ . The absolute value of the discretionary accrual proxy is the modified Jones model's measure of AEM.

Performance-matched discretionary accruals model by Kothari *et al.* (2005).

Kothari *et al.* (2005) argued that the modified Jones model overlooks firm performance factors such as return on assets ( $ROA$ ). They proposed an alternative model by incorporating  $ROA$  into the regression, following a three-step process:

$$\frac{TA_{it}}{A_{it-1}} = \beta_0 \times \frac{1}{A_{it-1}} + \beta_1 \times \frac{\Delta REV_{it}}{A_{it-1}} + \beta_2 \times \frac{PPE_{it}}{A_{it-1}} + \beta_3 \times ROA_{it-1} + \varepsilon_{it} \quad (7)$$

where  $ROA_{it-1}$  is  $ROA$  of firm  $i$  in year  $t$  and other variables are the same as defined in Equation (2).

$$NDA_{it} = a_1 \times \frac{1}{A_{it-1}} + a_2 \times \frac{\Delta REV_{it}}{A_{it-1}} + a_3 \times \frac{PPE_{it}}{A_{it-1}} + a_4 \times ROA_{it-1} \quad (8)$$

$$KDA_{it} = TA_{it} - NDA_{it} \quad (9)$$

Similarly, the absolute value of  $KDA$  is used as the main proxy for AEM proposed by Kothari *et al.* (2005). Empirically, the value of discretionary accruals can be either positive or negative and each signifies distinct earnings management strategies. A positive  $KDA$  value indicates income-increasing earnings management, achieved by artificially inflating earnings. In

contrast, a negative KDA value reflects income-decreasing earnings management, where managers deliberately lower earnings. Consequently, we further decompose discretionary accruals into income-increasing KDA and income-decreasing KDA.

**3.1.3 Real earnings management.** Regarding REM, we use Roychowdhury's (2006) and Cohen and Zarowin's (2010) models, which suggest that earnings management can take place through three real activities: sales, discretionary expenses and production costs.

#### *Abnormal production cost activities*

Production costs are defined as the sum of the cost of goods sold and the change in inventory during the year. The normal level of production costs is expressed as a linear function of contemporaneous sales (Roychowdhury, 2006; Cohen *et al.*, 2008; Cohen and Zarowin, 2010; Zang, 2012). Based on this approach, we estimate the following model for normal production costs.

$$AB\_PROD = \frac{PROD_{i,t}}{A_{i,t-1}} = a_0 \times \frac{1}{A_{i,t-1}} + a_1 \times \frac{REV_{i,t}}{A_{i,t-1}} + a_2 \times \frac{\Delta REV_{i,t}}{A_{i,t-1}} + a_3 \times \frac{\Delta REV_{i,t-1}}{A_{i,t-1}} + \epsilon_{i,t} \quad (10)$$

In Equation (10),  $PROD_{i,t}$  represents the total production costs of firm  $i$  in year  $t$ , computed as the sum of the cost of goods sold and the change in inventory.  $REV_{i,t}$  is the net revenue of firm  $i$  in the year  $t$ .  $\Delta REV_{i,t}$  is revenues of firm  $i$  in year  $t$  less revenues in year  $t-1$  and other variables are the same as defined in Equation (2).

The abnormal production cost ( $AB\_PROD$ ) is then computed as the difference between the actual values of production costs and the normal levels predicted from Equation (10). Higher levels of abnormal production costs suggest that firms may be overproducing by allocating fixed costs across a larger number of units, thereby reducing reported costs per unit and inflating profit margins.

#### *Abnormal discretionary expense activities*

Another proxy of REM is abnormal discretionary expenses. Following Roychowdhury (2006) and Cohen *et al.* (2008), we model discretionary expenses as follows:

$$AB\_DEXP = \frac{DEXP_{i,t}}{A_{i,t-1}} = a_0 \times \frac{1}{A_{i,t-1}} + a_1 \times \frac{REV_{i,t-1}}{A_{i,t-1}} + \epsilon_{i,t} \quad (11)$$

where  $DEXP_{i,t}$  represents the discretionary expenses of firm  $i$  in year  $t$ , defined as the sum of research and development (R&D), advertising and selling, general and administrative expenses.  $REV_{i,t-1}$  is the net revenue of firm  $i$  in the year  $t-1$ . A reduction in discretionary expenses, such as cutting R&D or advertising costs, may signal earnings management efforts to artificially enhance reported profits.

Abnormal discretionary expenses ( $AB\_DEXP$ ) are then computed as actual discretionary expenses minus the normal level of discretionary expenses calculated using the estimated coefficients from Equation (11).

#### (1) Aggregate measure of real earnings management

To quantify the overall impact of REM activities, we construct an aggregate REM metric by combining the two individual measures. Following Cohen and Zarowin (2010), the REM proxy is calculated as

$$REM = AB\_PROD + (-1) \times AB\_DEXP \quad (12)$$

This approach ensures that higher REM values reflect a more extensive earnings management through production cost manipulation and reductions in discretionary spending. By aggregating

these components, this metric provides a comprehensive measure of the REM. The higher the values of REM, the more likely that the firm is engaging in real-activity earnings management.

*3.1.4 Local institutional quality.* In the context of corruption and anti-corruption, we proxy local institutional quality using the degree of informal costs of doing business in the province where the firm's headquarters are located (*Informal Charges*). *Informal Charges* is a dummy variable, assigned a value of one if the province's sub-index of informal charges exceeds the cross-sectional median and zero otherwise. This sub-index is part of the Provincial Competitiveness Index (PCI) Survey and captures the prevalence of unofficial payments required by businesses. A higher value indicates greater informal pressure, which negatively impacts firm competitiveness and reflects lower institutional quality.

### 3.2 Empirical model

We use the following empirical model to test [H1a](#) and [H1b](#):

$$EM_{i,t} = \alpha + \beta AACI_{i,t} + \sum Control_{i,t} + \gamma_i + \delta_t + \varepsilon_{i,t} \quad (H1)$$

where  $EM_{i,t}$  is either the AEM proxy or REM proxy;  $\sum Control_{i,t}$  is a vector of control variables;  $\gamma_i$  is firm-fixed effect;  $\delta_t$  is time-fixed effect;  $\varepsilon_{i,t}$  is the error term of the model. *AACI* is the news-based anti-corruption index that captures the perceived intensity of anti-corruption in Vietnam, proposed by [Hoang et al. \(2022a, b\)](#). [Equation \(1\)](#) is estimated using the OLS estimator with the inclusion of multiple fixed effects by firm and year. For robustness checks, the firm-fixed effect can be substituted with industry-fixed effect and province-fixed effect to control for unobserved confounding factors at the industry and provincial levels.

To test [H2a](#) and [H2b](#), we augment Model ([H1a](#), [H1b](#)) by adding interaction terms between the *AACI* variable and the variable-of-interest:

$$EM_{i,t} = \alpha' + \beta' AACI_{i,t} + \gamma X_{i,t} + \vartheta (X \times AACI)_{i,t} + \sum Control_{i,t} + \gamma_i + \delta_t + \varepsilon_{i,t} \quad (H2-3)$$

in which  $X$  is the variable of interest, e.g. local institutional quality.

### 3.3 Data

Our sample consists of 3,631 firm-year observations from 499 listed Vietnamese firms during 2005–2019. Financial firms are excluded because they operate under different business models and are subject to regulated accounting standards, consistent with the earnings management literature ([Kothari et al., 2005](#); [Chaney et al., 2011](#); [Zang, 2012](#); [Boubaker et al., 2025](#)).

Firm-level financial data, including earnings management proxies and control variables, were obtained from the Vietstock database. The news-based anti-corruption index (*AACI*) is sourced from [Hoang et al. \(2025\)](#). Provincial competitiveness and informal business cost indices are drawn from the PCI Survey. Consistent with prior research, financial firms are excluded due to their distinct operational nature and regulatory requirements. Observations with missing values for key variables – including discretionary accrual measures, REM proxies and firm-level controls – are excluded. To mitigate the influence of extreme values, all continuous financial variables are winsorized at the top and bottom percentiles. [Table 1](#) provides summary statistics and the correlation matrix for key variables.

## 4. Empirical results and discussion

### 4.1 Descriptive statistics

[Table 2](#) reveals significant insights into earnings management practices among Vietnamese firms during the anti-corruption campaign. Discretionary accruals, as measured by *ABS\_KDA* (Kothari model), *ABS\_JDA* (Jones model) and *ABS\_DDA* (Dechow model), exhibit consistent averages of 0.100, 0.110 and 0.110, respectively, indicating moderate variability in earnings

**Table 1.** Variable descriptions

| Variable              | Description                                                                                                                                                                                                                               | Data source                             |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| ABS_KDA               | The absolute value of the ROA-matched discretionary accrual proxy proposed by <a href="#">Kothari et al. (2005)</a>                                                                                                                       | Vietstock                               |
| KDA                   | The ROA-matched discretionary accrual proxy proposed by <a href="#">Kothari et al. (2005)</a>                                                                                                                                             | Vietstock                               |
| Income-increasing KDA | The income-increasing component of KDA ( $KDA > 0$ )                                                                                                                                                                                      | Vietstock                               |
| Income-decreasing KDA | The income-decreasing component of KDA ( $KDA < 0$ )                                                                                                                                                                                      | Vietstock                               |
| ABS_JDA               | The absolute value of the discretionary accrual proxy proposed by <a href="#">Jones (1991)</a>                                                                                                                                            | Vietstock                               |
| ABS_DDA               | The absolute value of the Modified Jones' discretionary accrual proxy proposed by <a href="#">Dechow et al. (1995)</a>                                                                                                                    | Vietstock                               |
| AB_DEXP               | Abnormal discretionary expense proxy ( <a href="#">Roychowdhury, 2006</a> )                                                                                                                                                               | Vietstock                               |
| AB_PROD               | Abnormal production cost proxy ( <a href="#">Roychowdhury, 2006</a> )                                                                                                                                                                     | Vietstock                               |
| REM                   | Real-activities earnings management proxy, calculated following <a href="#">Cohen and Zarowin (2010)</a> : $AB\_PROD + (-1) * AB\_DEXP$                                                                                                   | Vietstock                               |
| ACI                   | The new-based anti-corruption index of Vietnam                                                                                                                                                                                            | <a href="#">Hoang et al. (2022a)</a>    |
| Firm size             | Natural logarithm of total assets                                                                                                                                                                                                         | Vietstock                               |
| Financial leverage    | Debt-to-assets ratio                                                                                                                                                                                                                      | Vietstock                               |
| Profitability         | Return-on-asset ratio, calculated by scaling net income/loss by average total assets                                                                                                                                                      | Vietstock                               |
| Fixed assets          | Net Property, Plant and Equipment scaled by total assets                                                                                                                                                                                  | Vietstock                               |
| Growth                | Change in firm sales scaled by the preceding period's sales                                                                                                                                                                               | Vietstock                               |
| Big4 auditor          | Dummy variable that equals one if the auditor firm is a Big4 auditor firm, zero otherwise                                                                                                                                                 | Vietstock                               |
| Private               | Dummy variable that equals one if there is no state ownership in the firm, zero otherwise                                                                                                                                                 | Vietstock                               |
| State                 | Dummy variable that equals one if there is five percent or more of state ownership in the firm, zero otherwise                                                                                                                            | Vietstock                               |
| Informal charges      | Dummy variable that equals one if the sub-index of informal charges (of the province the firm locates in) is higher than its cross-sectional median, zero otherwise. The index is included in the Provincial Competitiveness Index Survey | Provincial Competitiveness Index Survey |

**Note(s):** This table provides definitions of all variables used in the research

management. The net discretionary accruals (*KDA*) show a slight upward management with a mean of 0.021. In terms of *REM*, the mean is  $-0.021$ , suggesting mixed strategies, while abnormal discretionary expenses (*AB\_DEXP*) average is 0.052 and abnormal production costs (*AB\_PROD*) show a negative mean of  $-0.073$ , reflecting potential suppression of production activities for earnings management purposes.

Firm characteristics indicate a sample of medium to large firms (average firm size = 27.432) with low financial leverage (mean = 0.101) and moderate profitability (mean = 0.059). Fixed assets comprise approximately 19.9% of total assets, indicating a balanced asset structure. Big4 auditor firms are involved in 31.6% of firm-year observations in our sample, indicating that only nearly a quarter of firms have high audit quality.

#### 4.2 Baseline regression

We report the estimation results of the baseline model using multiple regression specifications in [Table 3](#). The analysis examines the relationship between anti-corruption intensity (*AACI*)

**Table 2.** Descriptive statistics

| Variable           | Obs   | Mean   | Std. Dev | Min    | Max    |
|--------------------|-------|--------|----------|--------|--------|
| ABS_KDA            | 3,631 | 0.100  | 0.103    | 0.000  | 0.603  |
| KDA                | 3,631 | 0.021  | 0.142    | −0.349 | 0.603  |
| ABS_JDA            | 3,631 | 0.110  | 0.109    | 0.000  | 0.627  |
| ABS_DDA            | 3,631 | 0.110  | 0.109    | 0.000  | 0.627  |
| AB_DEXP            | 3,631 | 0.052  | 0.094    | −0.086 | 0.427  |
| AB_PROD            | 3,631 | −0.073 | 0.176    | −0.628 | 0.391  |
| REM                | 3,631 | −0.021 | 0.137    | −0.714 | 0.503  |
| Firm size          | 3,631 | 27.432 | 1.425    | 23.687 | 30.885 |
| Financial leverage | 3,631 | 0.101  | 0.134    | 0.000  | 0.605  |
| Profitability      | 3,631 | 0.059  | 0.069    | −0.149 | 0.319  |
| Fixed assets       | 3,631 | 0.199  | 0.192    | 0.000  | 0.826  |
| Growth             | 3,631 | 0.175  | 0.634    | −0.784 | 4.234  |
| Big4 auditor       | 3,631 | 0.316  | 0.465    | 0.000  | 1.000  |
| Private            | 3,631 | 0.521  | 0.500    | 0.000  | 1.000  |
| State              | 3,631 | 0.479  | 0.500    | 0.000  | 1.000  |

**Table 3.** Baseline regression

| Variables          | (1)<br>Absolute<br>value of<br>KDA<br>(AEM) | (2)<br>Income-<br>increasing<br>KDA<br>(AEM) | (3)<br>Income-<br>decreasing<br>KDA<br>(AEM) | (4)<br>Real<br>earnings<br>management<br>(REM) |
|--------------------|---------------------------------------------|----------------------------------------------|----------------------------------------------|------------------------------------------------|
| <i>ACCI</i>        | −0.001***<br>(0.000)                        | −0.001***<br>(0.000)                         | 0.001***<br>(0.000)                          | 0.001***<br>(0.000)                            |
| Firm size          | 0.000<br>(0.006)                            | 0.001<br>(0.010)                             | 0.012<br>(0.008)                             | −0.056***<br>(0.007)                           |
| Financial leverage | 0.050*<br>(0.027)                           | 0.094**<br>(0.044)                           | 0.012<br>(0.033)                             | −0.045<br>(0.030)                              |
| Profitability      | 0.295***<br>(0.053)                         | 0.622***<br>(0.085)                          | 0.114**<br>(0.057)                           | −0.968***<br>(0.050)                           |
| Fixed assets       | −0.078***<br>(0.020)                        | −0.204***<br>(0.037)                         | −0.016<br>(0.022)                            | 0.015<br>(0.020)                               |
| Growth             | 0.010***<br>(0.004)                         | 0.014***<br>(0.005)                          | 0.009*<br>(0.005)                            | 0.005<br>(0.004)                               |
| Big4 auditor       | 0.007<br>(0.008)                            | 0.005<br>(0.013)                             | −0.011<br>(0.010)                            | 0.011<br>(0.009)                               |
| Firm FE            | Yes                                         | Yes                                          | Yes                                          | Yes                                            |
| Year FE            | Yes                                         | Yes                                          | Yes                                          | Yes                                            |
| Observations       | 3,631                                       | 1,924                                        | 1,622                                        | 3,631                                          |
| Adj R2             | 0.169                                       | 0.239                                        | 0.146                                        | 0.441                                          |

**Note(s):** Robust standard errors in parentheses (\*\*\* $p < 0.01$ , \*\* $p < 0.05$  and \* $p < 0.1$ )

and different measures of earnings management, including AEM and real-activities earnings management (REM).

The coefficient of *ACCI* remains negative at 1% significance level in Column (1) (absolute value of discretionary accruals) and Column (2) (income-increasing discretionary accruals) while remaining positive at 1% significance level in Column (3) (income-decreasing discretionary accruals). The results suggest that in response to intensive anti-corruption efforts, Vietnamese firms' discretionary accruals decrease, which is a sign of more constraints on AEM practices. These results, in columns (1), (2) and (3), indicate that firms reduce the

magnitude of their AEM, likely due to the heightened risk of being detected under stricter anti-corruption oversight. This finding aligns with the hypothesis that firms minimize exposure to regulatory scrutiny by avoiding detectable accounting practices and is consistent with prior research, such as [Zang \(2012\)](#), which posits that firms adjust earnings management tactics in response to increased regulatory pressures.

Interestingly, REM seems to react positively to increased *AACI*. The coefficient of *AACI* in Column (4) is positive at 1% significance level, indicating a positive association between REM practices and anti-corruption. The results suggest a significant negative relationship between anti-corruption intensity and AEM metrics, including Kothari's DA, the absolute value of KDA, income-increasing KDA and income-decreasing KDA. In contrast, Column (5) shows a significant positive relationship between *AACI* and *REM*, suggesting that firms increasingly rely on operational methods to manage earnings during periods of intensified anti-corruption. REM practices, such as altering production levels, discretionary spending, or the timing of sales, are less transparent and harder to detect than AEM. This behavior supports the hypothesis that firms shift from more detectable to less detectable forms of earnings management as a survival strategy under stricter regulation, consistent with [Cohen et al. \(2008\)](#), who documented a similar pattern following the Sarbanes-Oxley Act in the United States. These findings collectively highlight a shift in firms' earnings management strategies under different anti-corruption conditions. This pattern is consistent with prior studies showing that corruption-related behaviors often respond to institutional pressure through substitution rather than elimination as economic agents tend to shift toward less detectable alternatives when enforcement intensifies ([Nguyen and Liu, 2023](#)). In line with this view, firm-level evidence from Vietnam indicates that corruption induces firms to move away from formal and transparent mechanisms toward less visible practices, reflecting strategic behavioral adaptation rather than behavioral cessation ([Phan and Archer, 2020](#)).

#### 4.3 Robustness test

This section presents robustness checks to test the sensitivity of our findings to alternative variable definitions, model specifications and endogeneity issues.

[Table 4](#) re-examines the empirical findings using alternative variable measurements and estimation approaches. Column 1 applies the modified Jones model, and Column 2 uses the [Dechow and Dichev \(2002\)](#) accrual quality measure. For REM, Columns 3 and 4 employ abnormal discretionary expenses (*AB\_DEXP*) and abnormal production costs (*AB\_PROD*) based on [Roychowdhury \(2006\)](#). All results are consistent with the baseline. We also estimate a fixed-effect model in columns 5 and 6, with similar results. Bootstrapping with 1,000 replications confirms robustness, particularly for AEM. These results reinforce the reliability of our results. Firms appear to reduce AEM and increasingly rely on less detectable REM under anti-corruption pressure. This supports the findings of [Zang \(2012\)](#) and [Cohen et al. \(2008\)](#), highlighting both the effectiveness and limitations of anti-corruption initiatives.

To address potential endogeneity between anti-corruption and earnings management, we employ an instrumental variable (IV) approach in [Table 5](#). Since it is very difficult to find a good IV for *AACI* in relation to corporate earnings management, we resort to an advanced IV estimation technique using auto-generated heteroskedasticity-based instruments proposed by [Lewbel \(2012\)](#). [Lewbel \(2012\)](#) introduced an IV method that constructs instruments internally from a model's own data by exploiting the heteroskedasticity of the error terms, which allows identification of causal effects when no traditional external instruments are available. This approach generates instruments by multiplying the centered exogenous variables by the residuals from the first-stage regression, relying on the assumption that the error covariances vary systematically with the exogenous variables. The estimator follows a standard two-stage least squares process and is particularly useful in cross-sectional, panel, or time series settings where typical exclusion restrictions are not feasible. This method relies on higher moment conditions rather than traditional zero-coefficient exclusion restrictions; therefore, it allows identification when no traditional external instruments are available.

**Table 4.** Robustness tests

| Variables          | Alternative measures of AEM |                      | Alternative measure of REM |                      | Alternative fixed-effect setting |                      | Bootstrapping S.E. (1,000 replications) |                      |
|--------------------|-----------------------------|----------------------|----------------------------|----------------------|----------------------------------|----------------------|-----------------------------------------|----------------------|
|                    | (1)<br>ABS_JDA              | (2)<br>ABS_DDA       | (3)<br>AB_DEXP             | (4)<br>AB_PROD       | (5)<br>ABS_KDA                   | (6)<br>REM           | (7)<br>ABS_KDA                          | (8)<br>REM           |
| <i>AACI</i>        | −0.001***<br>(0.000)        | −0.001***<br>(0.000) | 0.001***<br>(0.000)        | 0.001***<br>(0.000)  | −0.001***<br>(0.000)             | 0.001***<br>(0.000)  | −0.001***<br>(0.000)                    | 0.001***<br>(0.000)  |
| Firm size          | 0.005<br>(0.007)            | 0.005<br>(0.007)     | −0.028***<br>(0.002)       | −0.030***<br>(0.008) | −0.005***<br>(0.002)             | −0.010***<br>(0.002) | 0.000<br>(0.007)                        | −0.010***<br>(0.002) |
| Financial leverage | 0.064**<br>(0.028)          | 0.064**<br>(0.028)   | 0.011<br>(0.008)           | −0.054<br>(0.033)    | 0.029*<br>(0.016)                | −0.082***<br>(0.016) | 0.050*<br>(0.028)                       | −0.082***<br>(0.016) |
| Profitability      | 0.366***<br>(0.055)         | 0.366***<br>(0.055)  | 0.005<br>(0.017)           | −0.954***<br>(0.053) | 0.126***<br>(0.035)              | −1.048***<br>(0.034) | 0.295***<br>(0.052)                     | −1.048***<br>(0.036) |
| Fixed assets       | −0.096***<br>(0.022)        | −0.096***<br>(0.022) | −0.004<br>(0.007)          | 0.004<br>(0.024)     | −0.079***<br>(0.011)             | −0.019*<br>(0.011)   | −0.078***<br>(0.021)                    | −0.019*<br>(0.011)   |
| Growth             | 0.007*<br>(0.004)           | 0.007*<br>(0.004)    | 0.001<br>(0.001)           | 0.005<br>(0.004)     | 0.018***<br>(0.004)              | −0.003<br>(0.004)    | 0.010**<br>(0.004)                      | −0.003<br>(0.004)    |
| Big4 auditor       | 0.012<br>(0.009)            | 0.012<br>(0.009)     | 0.008**<br>(0.003)         | 0.003<br>(0.010)     | −0.008*<br>(0.004)               | 0.014***<br>(0.005)  | 0.007<br>(0.008)                        | 0.014***<br>(0.005)  |
| Firm FE            | Yes                         | Yes                  | Yes                        | Yes                  | No                               | No                   | Yes                                     | Yes                  |
| Industry FE        | No                          | No                   | No                         | No                   | Yes                              | Yes                  | No                                      | No                   |
| Province FE        | No                          | No                   | No                         | No                   | Yes                              | Yes                  | No                                      | No                   |
| Year FE            | Yes                         | Yes                  | Yes                        | Yes                  | Yes                              | Yes                  | Yes                                     | Yes                  |
| Observations       | 3,631                       | 3,631                | 3,631                      | 3,631                | 3,631                            | 3,631                | 3,631                                   | 3,631                |
| Adj R2             | 0.181                       | 0.181                | 0.814                      | 0.586                | 0.090                            | 0.352                | 0.169                                   | 0.352                |

**Note(s):** Robust standard errors in parentheses (\*\*\* $p < 0.01$ , \*\* $p < 0.05$  and \* $p < 0.1$ )

**Table 5.** Instrumental variable estimation using [Lewbel's \(2012\)](#) heteroskedasticity-based instruments

|                                      | (1)<br>AEM                           | (2)<br>REM                           |
|--------------------------------------|--------------------------------------|--------------------------------------|
| <i>AACI</i>                          | $-0.001^{***}$<br>(0.000)            | $0.001^{***}$<br>(0.000)             |
| Firm size                            | 0.001<br>(0.006)                     | $-0.014^{***}$<br>(0.002)            |
| Financial leverage                   | $0.050^*$<br>(0.027)                 | $-0.070^{***}$<br>(0.016)            |
| Profitability                        | $0.295^{***}$<br>(0.053)             | $-1.020^{***}$<br>(0.031)            |
| Fixed assets                         | $-0.078^{***}$<br>(0.020)            | 0.006<br>(0.004)                     |
| Growth                               | $0.010^{***}$<br>(0.004)             | $-0.007$<br>(0.004)                  |
| Big4 auditor                         | 0.007<br>(0.008)                     | $0.012^{**}$<br>(0.005)              |
| Instrumented variable                | <i>AACI</i>                          | <i>AACI</i>                          |
| Instrumental variables               | Heteroskedasticity-based instruments | Heteroskedasticity-based instruments |
| First-stage <i>F</i> -test statistic | 133.96 <sup>***</sup>                | 46.860 <sup>***</sup>                |
| Firm FE                              | Yes                                  | Yes                                  |
| Year FE                              | Yes                                  | Yes                                  |
| Observations                         | 3,631                                | 3,631                                |
| R <sup>2</sup>                       | 0.076                                | 0.281                                |

**Note(s):** Robust standard errors in parentheses (<sup>\*\*\*</sup> $p < 0.01$ , <sup>\*\*</sup> $p < 0.05$  and <sup>\*</sup> $p < 0.1$ )

[Table 5](#) reports the regression results. Results show that *AACI* negatively affects AEM but positively affects REM, consistent with Political Cost Theory ([Watts and Zimmerman, 1990](#)). This suggests that firms shift from visible manipulation (AEM) to less detectable practices (REM) under anti-corruption pressure, aligning with prior findings ([Li et al., 2020](#)) on the role of institutional context in shaping earnings management. Since this IV estimator does not require reporting identification tests because it does not rely on traditional exclusion restrictions, we report the first-stage *F*-test statistics to check for instrument strength and to confirm the plausibility of the heteroskedasticity-based assumptions that underpin identification. The *f*-stats is large ( $p$ -values  $< 0.001$ ) and supports the validity of our IV estimation.

#### 4.4 The impact of local institutional quality

[Appendix 2](#) reports the regression results for testing hypotheses [H2a](#) and [H2b](#), i.e. the role of local institutions in the relationship between earnings management choices and anti-corruption. Using the province-level degree of informal charges of doing business from the PCI Survey as a proxy for local institutional quality, we find some interesting insights. On the one hand, the coefficient of the interaction term  $AACI \times \text{Informal charges}$  is negative at the 10% significance level in Column (1), suggesting that worsening local institutions intensify the negative impact of anti-corruption on AEM. On the other hand, the coefficient of the interaction term is positive and significant in Column (2), implying a moderating effect of local institutional quality on the negative impact of anti-corruption on REM.

These findings underscore the moderating role of local institutional quality in the link between anti-corruption intensity (*AACI*) and earnings management. Firms in more corrupt provinces significantly reduce AEM while increasing REM under heightened anti-corruption pressure. This is supported by the negative interaction between *AACI* and informal charges for AEM, consistent with the political cost hypothesis ([Watts and Zimmerman, 1990](#)), indicating a

shift away from more detectable forms of earnings management. Conversely, the positive interaction for REM (Column (2), [Appendix 2](#)) suggests a substitution effect, aligning with [Cohen and Zarowin \(2010\)](#) as firms resort to less transparent management strategies.

These results are consistent with agency theory ([Jensen and Meckling, 1976](#)) and resource dependence theory ([Pfeffer and Salancik, 1978](#)), suggesting strategic adaptation to regulatory risk in high-corruption regions. Supporting evidence from [Tian and Zhang \(2018\)](#) and [Chen et al. \(2011\)](#) reinforces this shift.

In regions characterized by low local institutional quality, firms tend to respond more strongly to anti-corruption campaigns. This is because weak institutional environments are associated with greater regulatory uncertainty and selective enforcement, which amplify firms' perceived political and legal risks. As anti-corruption pressure intensifies, firms operating in more corrupt regions therefore adjust their behavior more aggressively to mitigate potential regulatory scrutiny.

Specifically, these firms reduce AEM more sharply as such practices are more visible and easier to trace through accounting records. At the same time, they shift more strongly toward REM, which is less transparent and more difficult to monitor and subject to regulatory enforcement in environments with low local institutional quality. Consequently, anti-corruption efforts not only affect the direction of earnings management choices but also magnify the intensity of firms' responses in regions with weaker local institutions.

Therefore, the results confirm hypotheses [H2a](#) and [H2b](#), indicating that local institutional quality plays a pivotal role in amplifying firms' responses to anti-corruption pressure, thereby shaping their earnings management choices. The findings suggest that anti-corruption efforts not only influence the direction of earnings management but also intensify firms' behavioral adjustments across both accrual-based and REM, underscoring the need for policies that simultaneously address AEM and REM.

## 5. Conclusion and implications

This study investigates how anti-corruption intensity influences earnings management practices in Vietnamese listed firms during 2005–2019, focusing on AEM and REM. Using a news-based anti-corruption index, we show that stricter anti-corruption generally reduces AEM, but firms tend to substitute it with the less detectable REM. Local institutional quality plays an important moderating role. In provinces with higher corruption, firms tend to reduce AEM but increase REM in response to anti-corruption efforts.

From a policy perspective, these findings imply that while anti-corruption initiatives are effective in constraining more visible forms of earnings manipulation, they may also induce firms to shift toward less transparent REM. This pattern suggests that anti-corruption pressure does not necessarily harmonize financial reporting behavior across firms but may give rise to economically meaningful differences in how firms adjust their reporting strategies across local institutional quality. Accordingly, anti-corruption efforts need to be complemented by monitoring mechanisms that explicitly account for REM, particularly in environments characterized by weak local institutional quality. Improvements in local governance, therefore, appear to be a crucial institutional complement to national anti-corruption campaigns, as stronger provincial governance frameworks can help limit firms' reliance on less transparent REM and foster more reliable financial reporting. These findings also suggest that enforcement and supervisory frameworks may benefit from clearly distinguishing between AEM and REM, as these two forms respond differently to anti-corruption pressure. More targeted audit attention, together with better alignment between local and central oversight mechanisms, may contribute to improving monitoring effectiveness and enhancing transparency across the financial system. For investors, these results emphasize the need for careful financial statement analysis, particularly in provinces with weaker institutions or higher levels of corruption.

The study has two limitations. First, it relies on a news-based index to measure anti-corruption. While the news-based method is prominent in the emerging literature in

economics, the index not only captures the real anti-corruption developments in the country but also the perceived anti-corruption reflected in the public media. While perceived anti-corruption is not considered an error, it reflects certain noises in the text data that may not be avoided. Second, the findings of this study are generalizable only for countries with similar contexts to Vietnam and not to other countries. This suggests that future research may explore this direction and revisit the results in different contexts of study.

## Notes

1. For more details, see: <https://timesofindia.indiatimes.com/blogs/ChanakyaCode/vietnams-anti-corruption-campaign-progress-and-challenges/>, which cited the source from Vietnam Television Online (in Vietnamese): <https://vtv.vn/chinh-tri/trong-10-nam-hon-170-can-bo-cap-cao-bi-ky-luat-do-tham-nhung-2022063010241681.htm>
2. China's 2023 GDP is approximately \$17.8 trillion, while Vietnam's 2023 GDP is approximately \$429.7 billion. Data are retrieved from World Bank open database: <https://data.worldbank.org/>

## Supplementary material

The supplementary material for this article can be found online.

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