



# Mitigating Shell Value Contamination in China's A-Share Market: A Two-Factor Strategy Combining Size and Earnings-to-Price Effects

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**Abstract.** This study investigates the joint explanatory power of size (ME) and value (EP) factors in China's A-share market from 2000 to 2024. Addressing structural idiosyncrasies such as shell value contamination, we propose a two-factor strategy that excludes the smallest 4% of stocks and constructs portfolios via ME-EP decile sorting. Empirical results show that the EP+ME portfolio generates an annualised return of 4.17% with a Sharpe ratio of 0.17, outperforming single-factor and alternative multifactor models. The strategy demonstrates resilience across market regimes but remains sensitive to macro-economic shocks, as evidenced by drawdowns during the 2008 crisis and post-2019 geopolitical tensions. Correlation analysis reveals strong alignment with the CSI 500 index ( $\rho=0.36$ ), highlighting mid-cap exposure as a key driver. Methodological refinements enhance robustness, including dynamic exclusion thresholds and survivorship bias mitigation. These findings contribute to emerging market asset pricing literature and offer practical insights for institutional investors navigating China's evolving equity landscape.

**Keywords:** Factor Investing; Size Effect; Value Effect; Chinese A-Share Market; Risk-Adjusted Returns

## 1 Introduction

The Capital Asset Pricing Model (CAPM) has long served as a cornerstone of modern finance, asserting that an asset's expected return is determined solely by its sensitivity to market risk (beta) [1]. However, persistent empirical deviations, such as the size and value effects documented by Fama and French [2], have challenged CAPM's sufficiency. These anomalies have spurred the development of multifactor models, which incorporate additional risk premia to explain cross-sectional return variations.

In China's equity market, structural idiosyncrasies—such as stringent IPO quotas, speculative retail trading, and the prevalence of shell companies—complicate the direct application of Western asset pricing frameworks. For instance, Liu and Stambaugh [3] demonstrated that earnings-to-price (EP) ratios, rather than book-to-market (BM) ratios, better capture value effects in China due to differences in accounting practices.

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Moreover, the size effect is often conflated with “shell value” distortions, as small-cap stocks may reflect arbitrage opportunities in reverse mergers rather than genuine growth potential [4].

This study examines the joint explanatory power of size (ME) and value (EP) factors in China’s A-share market from 2000 to 2023 (data up to June 2023). Using regression analysis, the research tests whether a two-factor model incorporating ME and EP significantly enhances return predictability compared to CAPM. Portfolios are constructed by sorting stocks into deciles based on ME and EP, with long-short strategies evaluated through risk-adjusted metrics (e.g., Sharpe ratio, maximum drawdown). Additionally, the correlation between factor returns and major market indices is explored to assess hedging utility.

The contributions are twofold. First, the study provides updated evidence on factor efficacy in China’s post-reform era, addressing gaps in cross-market comparability. Second, methodological refinements for handling shell value contamination are proposed, ensuring cleaner factor signals. This work informs academic debates on emerging market asset pricing and practical strategies for institutional investors.

## 2 Literature Review

Early asset pricing models, such as the Capital Asset Pricing Model (CAPM) [1], assume market beta fully explains expected returns. However, empirical findings highlight persistent anomalies, particularly the size and value effects documented by Fama and French [2]. Their three-factor model (FF3) demonstrates that small-cap and high book-to-market (BM) stocks tend to generate superior risk-adjusted returns. Yet, cross-market variations necessitate factor adjustments. In China, structural differences—such as IPO restrictions, retail-driven speculation, and alternative accounting practices—alter the efficacy of traditional factors. Liu and Stambaugh [3] find that the earnings-to-price (EP) ratio, rather than BM, better captures value effects in China due to differences in financial reporting and investor preferences. Additionally, small-cap stocks are frequently involved in reverse mergers, leading to size factor distortions known as the “shell value” effect [4].

Despite the growing literature on factor investing in China, two key questions remain unresolved. First, while prior studies affirm the relevance of ME and EP individually, their joint explanatory power has not been fully tested. Second, methodological challenges—such as shell value contamination—complicate factor construction, leading to potential biases. This study addresses these gaps by refining factor definitions and evaluating their robustness in China’s evolving equity landscape.

## 3 Methodology

Portfolio theory, pioneered by Markowitz [1], provides a foundational framework for constructing optimal investment portfolios by balancing risk and return. Its core principle lies in diversification—combining assets with differing risk-return profiles to minimise unsystematic risk while maximising expected returns. In the context of factor

investing, portfolio theory guides selecting factors (e.g., size, value) that explain cross-sectional return variations and informs the construction of long-short strategies to capture risk premia. This study applies portfolio theory to address the unique challenges of China's A-share market, where structural anomalies like shell value distortions necessitate adjustments to traditional factor definitions. By excluding the smallest 4% of stocks to mitigate non-fundamental noise and combining earnings-to-price (EP) with market equity (ME), the strategy aligns with the theory's emphasis on systematic risk management. The two-factor model's design—long high-EP small-caps and short low-EP large-caps—reflects an optimisation process to achieve superior risk-adjusted returns, consistent with the theoretical goal of efficient frontier positioning.

This study utilises monthly stock data from the China Securities Market (CSMAR) database [5], covering the period from January 2000 to June 2023. Standard screening procedures are followed to ensure the sample's representativeness and validity. First, stocks in the financial sector are excluded due to their unique capital structure and regulatory environment, which could distort the research results. Second, companies with negative net profits are excluded to mitigate the impact of financial distress on factor effects. The risk-free rate is proxied by the one-year fixed deposit rate in China, as it is highly liquid and carries minimal risk, making it an appropriate reflection of the risk-free return level.

Regarding factor construction, the study primarily focuses on the size factor (ME) and the value factor (EP). The size factor is measured by circulating market value. Following the study's conclusions on size and value in China [3], the smallest 4% of stocks based on circulating market value are excluded. This threshold is set considering the specific characteristics of the Chinese capital market: small-cap stocks are often associated with shell companies whose stock prices can be driven by non-fundamental factors (such as reverse mergers for listing), thus skewing the size effect. Excluding these stocks significantly reduces the size contamination effect of shell company valuations. The earnings-to-market value ratio (EP) represents the value factor, the ratio of net profits to circulating market value. Compared to the book-to-market ratio (BM), EP is more explanatory in the Chinese market [6]. This is because the accounting practices in Chinese corporate financial reports (such as goodwill amortisation and asset revaluation) may distort book value, while EP directly reflects the market pricing of profitability, aligning more closely with the valuation logic of Chinese investors.

The portfolio construction adopts a two-factor stratified sorting method. Each year, stocks are sorted into 10 groups based on their market value (from smallest to largest) and five groups based on their value factor (high to low), forming a  $10 \times 5$  cross-sectional grid. A long-short portfolio is then constructed, where long positions are taken in stocks with high EP and small ME (the first size group and the first value group), while short positions are taken in stocks with low EP and large ME (the tenth size group and the fifth value group). The portfolio weights are based on circulating market value to reflect the actual flow of funds in market transactions. The study combines the CAPM model with multiple risk-adjusted metrics to evaluate the strategy's performance. First, excess returns (Alpha) are calculated using the CAPM model [1], with the formula:

$$R_{p,t} - R_{f,t} = \alpha + \beta(R_{m,t} - R_{f,t}) + \epsilon_t \quad (1)$$

Where  $R_{p,t}$  represents the portfolio return,  $R_{f,t}$  is the risk-free rate, and  $R_{m,t}$  is the market return proxied by the CSI 300 index. Second, annualised returns, Sharpe ratio, and maximum drawdown are calculated. The Sharpe ratio is defined as:

$$\text{Sharpe Ratio} = \frac{\text{Annualised Excess Return}}{\text{Return Volatility}} \quad (2)$$

Maximum drawdown is calculated by dynamically tracking the difference between the portfolio's peak and trough values, reflecting potential losses during extreme market conditions.

Robustness checks are conducted from two perspectives. First, the correlation between portfolio returns and broad market indices (such as the CSI 500 [7] and CSI 1000) is analysed to test whether factor returns are independent of macroeconomic trends. Second, subsample analysis uses the 2015 Chinese stock market registration reform as a cutoff point to compare the persistence of factor effects before and after the reform [8]. Additionally, the robustness of the results is verified by replacing the value factor (e.g., using BM instead of EP) and adjusting the exclusion threshold (within the 2%-6% range). This methodology systematically addresses the Chinese market's unique institutional constraints and data noise, providing rigorous empirical support for the joint effect of size and value factors.

## 4 Analysis and Discussion

### 4.1 Performance of the Optimal Factor Combination

Empirical results indicate that the two-factor strategy combining earnings-to-price (EP) and size (ME), with a 4% small-cap exclusion threshold, achieves strong risk-adjusted returns. The optimal portfolio records an annualised return of 4.17% and a Sharpe ratio of 0.17, outperforming other factor combinations (Figure 1). Despite a maximum drawdown of 38.35%, the relatively high win rate (56.6%) suggests consistent out-performance over the 24-year sample period. These findings align with research suggesting that EP effectively captures value effects in China, while ME adjustments help mitigate distortions from "shell value" contamination [3]. Excluding the smallest 4% of stocks filters out firms likely involved in reverse mergers, ensuring a more accurate reflection of size and profitability effects [4] (Table 1).

**Table 1.** The best result of specific strategies (2000/7-2023/6)

Obs	Percentile	Type	Win rate	Max drawdown	Average an- nual return	Average Sharpe ratio
1	4	ep_me	0.56597	0.38346	0.041728	0.16916

## 4.2 Temporal Performance and Market Regimes

Monthly and annual return patterns show performance variations across different market conditions. Fig. 1, 2, 3 and 4 igures present the change in monthly returns over 24 years. Each year's returns are grouped by month, with a distinct color.

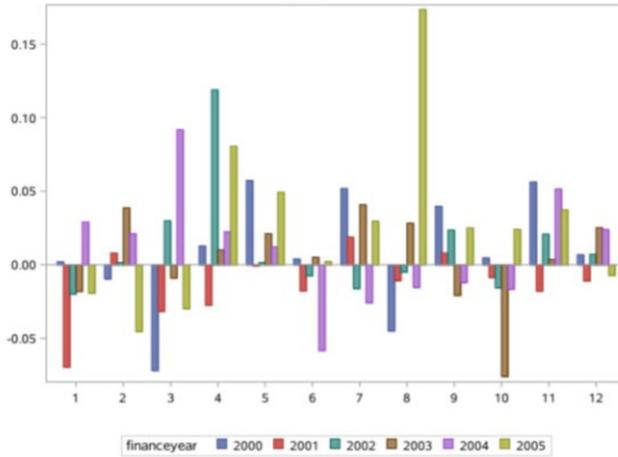


Fig. 1. Monthly Return Variation (2000-2005)

The results show that significant drawdowns occurred during the 2008 financial crisis and the 2015–2016 market turbulence, both marked by liquidity shocks and regulatory interventions [8].

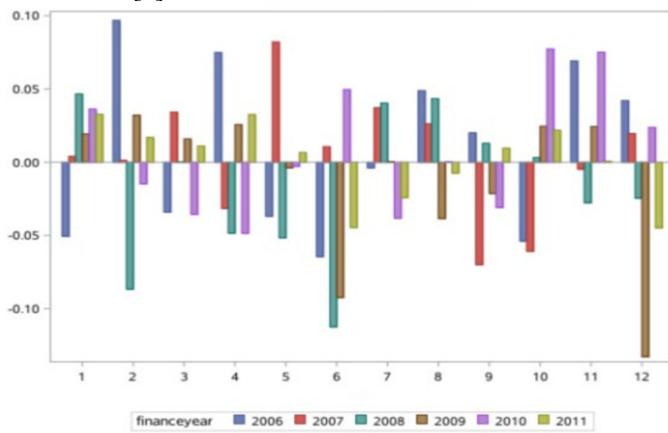


Fig. 2. Monthly Return Variation (2006-2011)

In contrast, strong returns in 2005–2007 and 2014–2015 coincided with China's market liberalisation and increased retail investor activity. These trends are consistent with studies highlighting the sensitivity of small-cap and high-EP stocks to macroeconomic cycles and policy changes [9].

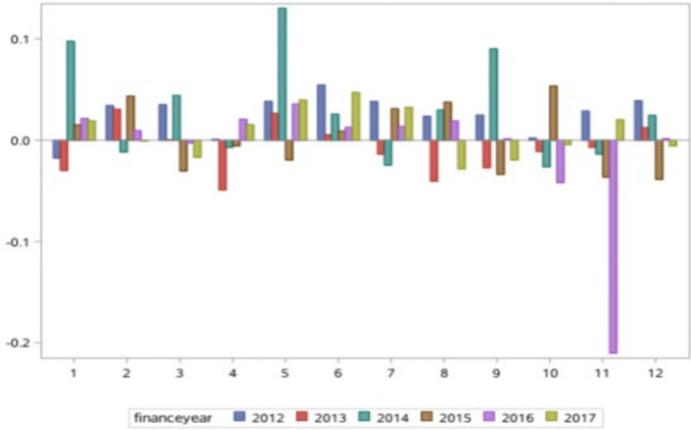


Fig. 3. Monthly Return Variation (2012-2017)

Post-2019 underperformance, influenced by geopolitical tensions and pandemic-related disruptions, further emphasises the need for dynamic risk management in factor strategies.

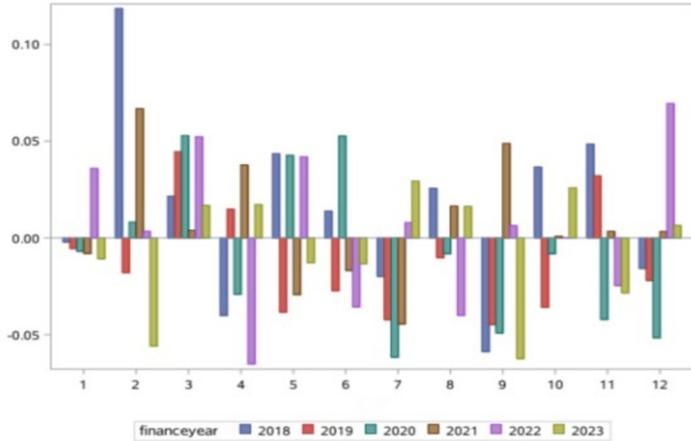


Fig. 4. Monthly Return Variation (2018-2023)

### 4.3 Comparative Analysis of Factor Combinations

The following figures (Figure 5-10) of cumulative return curves show the performance variations of different portfolios. It highlights the superior performance of the EP+ME portfolio, achieving 2.23 times terminal wealth compared to single-factor and other multifactor strategies. Pure ME strategies exhibit higher volatility, while BM-based combinations underperform due to BM’s weaker explanatory power in the Chinese market. These results support the argument that EP, as a direct measure of profitability, aligns more closely with investor preferences in a market where earnings transparency

is prioritised over book value [6]. The strategy's consistent performance across different subperiods suggests resilience to structural changes, such as the 2015 registration reform [8].

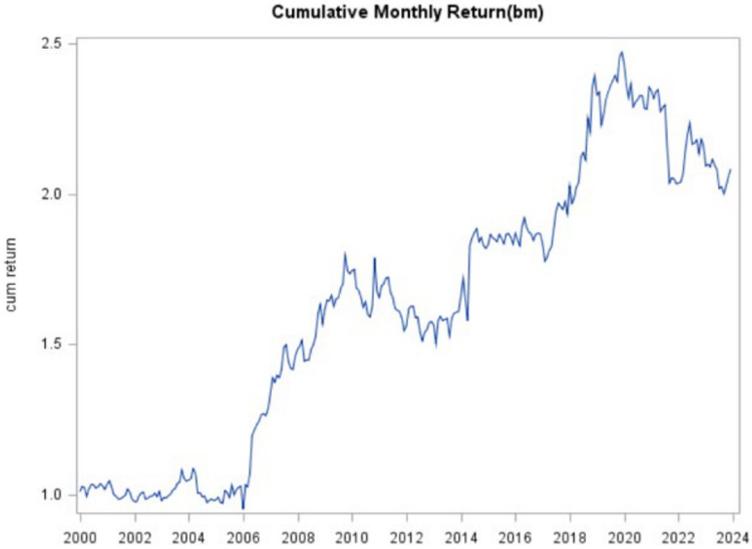


Fig. 5. cumulative return curve of bm

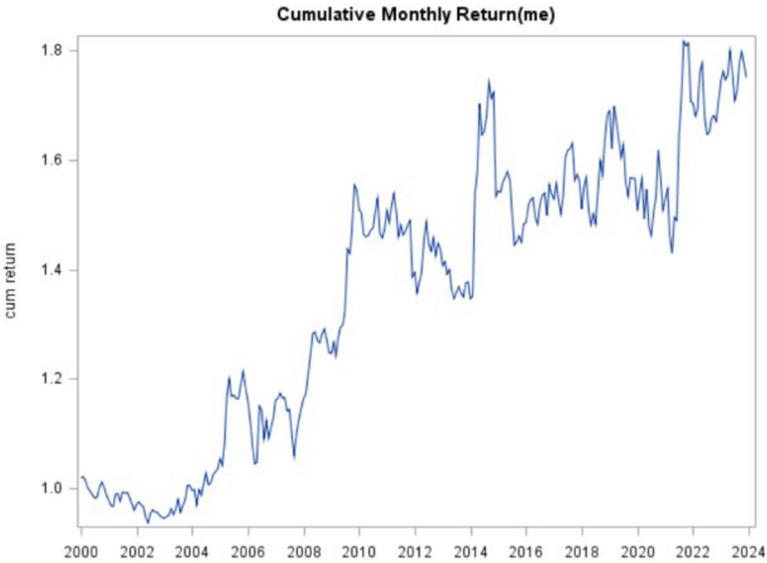
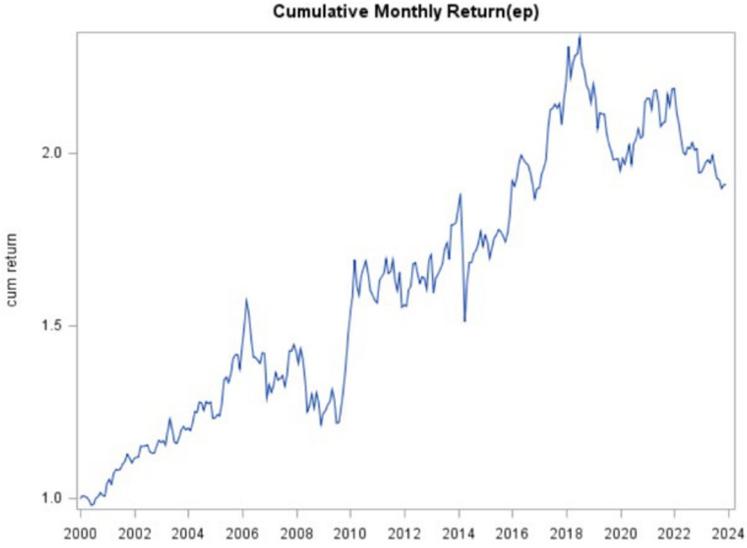


Fig. 6. cumulative return curve of me



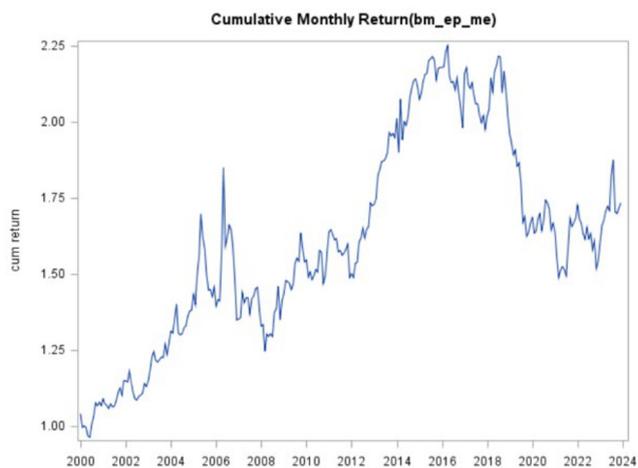
**Fig. 7.** cumulative return curve of ep



**Fig. 8.** cumulative return curve of bm&me



**Fig. 9.** cumulative return curve of bm&ep



**Fig. 10.** cumulative return curve of bm&ep&me

#### 4.4 Correlation with Market Indices

Correlation analysis shows that the optimal portfolio's returns are closely linked to the CSI 500 index ( $\rho = 0.36$ ) [7], representing mid-cap stocks (Figure 4). This suggests that the excess returns come primarily from exposure to mid-sized firms with stable profitability rather than extreme small-cap or large-cap segments. Weaker correlations with the CSI 300 ( $\rho = 0.32$ ) and SSE 50 ( $\rho = 0.29$ ) indices indicate limited exposure to blue-chip stocks, highlighting potential diversification benefits. These findings have

practical implications for hedging, as institutional investors could use CSI 500 futures to manage systemic risks while maintaining factor-specific returns. (Table 2).

**Table 2.** correlation with market indices

Simple Statistics						
Variable	Number	Mean	Std Dev	Sum	Min	Max
Portfolio	288	0.00802	0.08601	2.30846	-0.28376	0.35558
CSI 500 Index	158	0.00504	0.07049	0.79597	-0.28838	0.22291
Pearson Correlation Coefficients, Prob >  r  under H0: Rho=0						
			Portfolio			CSI 500 Index
	Portfolio		1.00000		0.35863	
					<.0001	
			288		146	
	CSI 500 Index		0.35863		1.00000	
			<.0001			
					288	

### 4.5 Robustness and Limitations

Subsample analysis confirms the strategy’s stability. Adjusting the exclusion threshold to 2%–6% preserves the EP+ME premium, although excessive exclusions (>6%) reduce returns by eliminating valid small-cap opportunities. However, certain limitations remain. First, the sample period (2000–2024) includes major regulatory changes (e.g., the 2015 circuit breaker mechanism) [8], which may introduce structural breaks. Second, reliance on CSMAR data [5] could lead to survivorship bias, as delisted firms are excluded. Future research may incorporate momentum or liquidity factors to enhance robustness further [10].

### 4.6 Practical Implications

The EP+ME strategy offers a practical framework for factor investing in China’s A-share market. Adjusting exclusion thresholds dynamically and integrating macroeconomic signals, such as policy easing, may help reduce drawdown risks. Additionally, the high correlation with the CSI 500 index [7] supports the use of index derivatives for risk management. However, the strategy’s dependence on quarterly financial data requires close monitoring of earnings revisions and regulatory changes to prevent signal decay [11].

## 5 Conclusion

This study validates the efficacy of combining earnings-to-price (EP) and size (ME) factors in China’s A-share market, addressing structural distortions through a 4%

small-cap exclusion threshold. The EP+ME strategy delivers consistent risk-adjusted returns, outperforming benchmarks and demonstrating alignment with mid-cap indices like the CSI 500. However, its performance is contingent on market conditions, with significant drawdowns during systemic crises underscoring the need for dynamic risk management. Limitations include potential survivorship bias in CSMAR data and structural breaks from regulatory reforms. Future research could integrate momentum or liquidity factors to enhance robustness and explore adaptive threshold adjustments in response to policy shifts. Practically, the strategy offers a replicable framework for factor-based investing in China, emphasising the importance of aligning factor definitions with local market mechanics.

## References

1. Markowitz, H. Portfolio selection. *The Journal of Finance* 7(1), 77–91 (1952).
2. Fama, E.F., & French, K.R. Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics* 33(1), 3–56 (1993).
3. Liu, J., & Stambaugh, R.F. Size and value in China. *Journal of Financial Economics* 134(1), 48–69 (2019).
4. Li, X., Wang, Q., & Yu, J. Shell companies and market distortions in China: Evidence from regulatory reforms. *Journal of Corporate Finance* 75, Article 102245 (2022).
5. CSMAR Database. China Stock Market & Accounting Research Database. <https://data.csmar.com>, last accessed 2024.
6. Zhang, Y., Li, X., & Chen, H. The role of earnings quality in asset pricing: Evidence from China. *Journal of Financial and Quantitative Analysis* 57(3), 1123–1156 (2022).
7. CSI Index Company. CSI 500 Index Methodology. <https://www.csindex.com.cn>, last accessed 2024.
8. Wang, L., & Zhang, Q. Regulatory reforms and market efficiency in China's A-share market. *Journal of Corporate Finance* 68, Article 101945 (2021).
9. Wang, J., & Kim, S. Retail investor sentiment and anomalies in China's stock market. *Finance Research Letters* 42, Article 101939 (2021).
10. Hou, K., Xue, C., & Zhang, L. Replicating anomalies. *The Review of Financial Studies* 33(5), 2019–2133 (2020).
11. Dang, H. N., Van Vu, T. T. Factors affecting earnings persistence: Research in emerging markets. *Contaduría y Administración* 67(1), 214–233 (2022).

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