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Factors and anomalies in the Vietnamese stock market☆

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ABSTRACT

We conduct a comprehensive analysis of factors and anomalies in the Vietnamese stock market. Our analysis indicates that the size effect is significant in Vietnam, and the earnings-to-price (EP) ratio outperforms the book-to-market ratio in capturing the value effect in Vietnam. Furthermore, we find that a three-factor model, which includes a market factor, a size factor, and an EP factor (the VN-3 model), outperforms the Fama-French three-factor model, but still leaves significant alphas for many anomalies. To enhance the explanatory power of the model, we introduce a Vietnamese four-factor model (the VN-4 model), which incorporates a factor based on twelve-month turnover into the VN-3 model. We find that the VN-4 model effectively explains most of the anomalies observed in the Vietnamese market.

Since the launch of "Doi Moi" ("renovation") reform in 1986, Vietnam has achieved notable economic achievements and has emerged as a leader in Asia's growth. Vietnam's GDP per capita surged by 16-fold from 1986 to 2021, reaching 3756 USD. Vietnam's relatively young stock market has also experienced fast growth and attracted increasing global investor interest, especially after the trade tensions between the United States and China. Although Vietnam has closely followed China's footsteps in its economic and capital market reform, its distinct economic structure and market regulation, such as a much more lenient capital control compared with China, make its stock market different from not only those in the developed countries but also other emerging markets.

In this paper, we provide a comprehensive analysis of cross-sectional return predictability in Vietnam from 2007 to 2022, with a particular emphasis on developing a factor model that can effectively account for cross-sectional returns and anomalies in the Vietnamese stock market. Factor models are at the core of empirical asset pricing. Assuming the correlation between any two assets is explained by systematic components, the factor model greatly simplifies the problem of finding risk-return relationship as well as portfolio construction by reducing the dimension of inputs from thousands of assets and trading strategies to just a small number of factors. In practice, identifying factors has been an empirical question, and different market environments have allowed for local versions of the factor models (Griffin, 2002; Fama and French, 2012).[1] This line of inquiry is particularly relevant when considering

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[1] For instance, the empirical study by Liu, Stambaugh, and Yuan (2019) underscores the challenges of directly applying a US model to the Chinese market.

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markets characterized by comparatively lower levels of integration with the global market, as is the case of Vietnam.

We begin with examining size and value factors, which have been documented to span the space of equity returns in the U.S. (Fama and French, 1993), in China (Liu et al., 2019), and globally (Fama and French, 1998). We first repeat the procedures in Fama and French (1993) to test the significance of the size and value effects in the Vietnamese stock market.[2] Similar to the U.S. but unlike China, we find a significant size effect in Vietnam, where small-cap stocks earn significantly higher future returns than large-cap stocks. The disparity in the size effect between Vietnam and China could be attributed to the smaller impact from shell value on returns of small-cap stocks in the Vietnam relative to China, since Vietnam's IPO procedures are generally considered to be less stringent compared to those in China.

Next, we follow the literature (e.g., Fama and French, 1993; Liu et al., 2019) and identify the most effective measure for capturing the value effect. We run a horse race among candidate valuation ratios, namely book-to-market ratio (BM), earnings-to-price ratio (EP), and cash-flow-to-price ratios (CP). We find that the EP ratio subsumes the other value metrics in the Fama-Macbeth regression that include all valuation ratios. Based on this finding, we use EP rather than BM (Fama and French, 1993) in constructing the value factor.

We then examine a Vietnamese three-factor (VN-3) model including the market factor, size factor, and value factor based on EP. The market factor has an average premium of 9.01% per annum, which is statistically insignificant due to the high volatility of Vietnamese stock market.[3] The size and value factors have average premiums of 8.64% and 5.78% per annum. We show that VN-3 model outperforms the model formed by replicating the Fama-French three factor model (FF-3) in Vietnam. Specifically, the VN-3 model effectively prices the FF-3 size and value factors, whereas the FF-3 model prices only the VN-3 size factor but not the VN-3 value factor. Furthermore, the Gibbons, Ross, and Shanken (GRS) test, which assesses one model's ability to price the factors of another model, also shows that the VN-3 model outperforms the FF-3 model.

Next, we examine the ability of the VN-3 model to explain anomalies in the Vietnamese stock market. Given the relatively limited anomaly literature specific to Vietnam compared to the US or Chinese stock markets, we compile a comprehensive list of anomalies, including ones reported for Vietnam as well as those well-documented for the US and China.[4] Specifically, we constructed 21 anomalies that fall into eleven categories: beta, size, volatility, idiosyncratic volatility, turnover, reversal, momentum, 52-week high, value, profitability, and investment. We use both unconditional sorts and size-neutral sorts and calculate the long-short returns using quintile portfolios sorted on the corresponding anomaly metrics. We focus on the size-neutral sort as the correlation between an anomaly variable and size could obscure an anomaly's effect in an unconditional sort.

We find that out of the 21 anomalies, nine anomalies have significant CAPM alphas in the Vietnamese stock market, and they fall into seven categories including size, idiosyncratic volatility, illiquidity, turnover, 52-week high, value, and profitability. When we use the VN-3 model to explain the anomalies in Vietnam, we find the VN-3 model does not do well in explaining the anomalies. Specifically, almost all of the anomalies with significant CAPM alphas continue to have significant VN-3 alphas, with the exception of size and value effect. Therefore, the VN-3 model only helps explain size and value anomalies in Vietnam.

To enhance the explanatory power of the factor model for cross-sectional returns and anomalies in Vietnam, we investigate the incorporation of a fourth factor based on twelve-month turnover into the VN-3 model following a thorough search for the optimal factor in terms of its ability to explain cross-sectional anomalies through a process of trial and error. High turnover could proxy for heightened investor speculation (attention) or high liquidity; both are consistent with significantly low future returns as documented in the Vietnamese stock market. We refer to the four-factor model that includes a market factor, a size factor, an EP factor, and a turnover factor the VN-4 model (Vietnamese four-factor model). We find that the VN-4 model has a much better explanatory power for anomalies than the VN-3 model. Specifically, the VN-4 alphas are insignificant for all anomalies except the two based on one-month abnormal turnover and reversal. To strengthen the robustness of our findings, we extend our analysis by conducting the Fama-Macbeth regressions of weekly stock returns on anomaly metrics, while controlling for the four characteristics in the VN-4 model (i.e., beta, size, EP, and turnover). The results from these regressions mirror those observed in the sorting analysis and lend further credibility to our conclusions.[5]

In order to understand the source of the explanatory power of the turnover factor, we conduct two further investigations to disentangle the explanations based on stock liquidity and stock overpricing caused by investor speculation or attention (Lee and Swaminathan, 2000; Lou and Shu, 2017). We observe that, unlike developed markets where turnover is significantly higher among larger cap stocks, turnover ratio has a significantly negative correlation of −0.09 with market cap in Vietnam. Given that Vietnamese stock market is dominated by individual investors and that short-selling is prohibited, this negative correlation provides suggestive evidence that turnover might be driven by speculative trading from individual investors, which causes overpricing and in turn lower future returns.

We conduct two formal tests to examine this prediction. First, we construct a direct measure of stock liquidity based on bid-ask spread, and then perform a Fama-Macbeth regression of weekly stock returns on bid-ask spread and turnover. We find that a high bid-ask spread leads to high future returns. However, when we include both bid-ask spread and turnover in the same regression,

[2] Because Vietnamese stock market has a relatively short history, we focus on weekly stock returns for our analysis to increase statistical power and test precision. The results using monthly returns have similar signs but reduced statistical significance (provided in the Appendix).

[3] Similarly, Chinese market factor is also statistically insignificant (Liu, Stambaugh, and Yuan, 2019).

[4] Many studies show that anomalies identified in the US market also exist in many other markets (e.g., Jegadeesh and Titman,1993; Fama and French, 1998; Rouwenhorst, 1998; Titman, Wei, and Xie, 2004).

[5] We also conduct robustness test that compares our VN-4 model with the Fama-French five factor model (FF-5). As discussed later in the paper, we find that the VN-4 model more effectively explains anomalies in Vietnam than the FF-5 model.

turnover subsumes the explanatory power of bid-ask spread. In the second test, we conduct subsample analysis to investigate how the strength of return predictability of turnover varies with limits-to-arbitrage. We find the alpha associated with turnover concentrates among stocks with higher degree of limits-to-arbitrage, characterized by smaller size and lower institutional ownership. Taken together, the explanatory power of the fourth factor, turnover, is unlikely to be a result of liquidity premium. Instead, the relation between stock liquidity and return is likely a manifestation of the relation between turnover and return.

Finally, we examine two types of shareholders that play a crucial role in Vietnam's economy and capital market: Institutional investors, and government shareholders. We find that institutional ownership in listed companies in Vietnam has remained stable, accounting for approximately 20% of total shares. Additionally, the level of institutional ownership does not significantly predict future returns but change in institutional ownership has a significantly positive relation with future returns. Specifically, a one-percentage increase in institutional ownership is associated with 0.21% higher weekly returns. This finding shows that, like in the developed market (e.g., Gompers and Metrick, 2001; Sias et al., 2006; Griffin et al., 2011), institutional investors have either information advantage or a superior ability to analyze public information (sophistication) in Vietnam.

We further analyze state ownership, and find that SOEs account for approximately 16% of total listed firms in Vietnam, with a majority of these being large companies, comprising 30% of the total market capitalization. As a result of Vietnam's privatization reform, the percentage of SOEs from around 20% in the early years to <10% in 2022. Individual ownership dominates the Vietnamese listed firms, increasing from 59% in 2007 to 66% in 2022. We find that neither SOE dummy nor SOE ownership has a significant relationship with stock returns.

Our paper makes several contributions to the literature. First, we are the first to conduct such a comprehensive study on the factors and anomalies in the Vietnamese stock market from 2007 to 2022. As discussed in the literature review, previous studies on the Vietnamese stock market have primarily concentrated on the return predictability of a limited spectrum of one or two firm characteristics. Moreover, these prior investigations have commonly been constrained by shorter sample periods and a narrower coverage of stocks.

Second, we develop a VN-4 factor model that effectively accounts for most of the prevailing return anomalies in the Vietnamese stock market. The rapid growth of the Vietnamese economy and its accompanying stock market has attracted considerable interest from both investors and researchers. Our findings provide a useful benchmark factor model for future studies on the Vietnamese stock market, particularly those focused on the investigation of financial asset pricing and the formulation of investment strategies.

Third, our results suggest that the exploratory power of factor models and factors choice are different across different markets, underscoring the importance and necessity for developing local versions of factor model, particularly for markets that are underdeveloped and with a high degree of market segmentation. Additionally, our study complements Liu et al. (2019) and emphasizes the importance of turnover in explaining the cross-sectional returns in developing markets such as China and Vietnam.

1. Institutional background and literature review

1.1. Institutional background

Vietnamese stock market is comprised of two stock exchanges located in its two largest cities: The Ho Chi Minh Stock Exchange (HOSE) launched on July 20th, 2000, and the Hanoi Stock Exchange (HNX) launched on August 3rd, 2005. Both exchanges are regulated by the State Securities Commission (SSC) in Vietnam. At the end of 2021, the Vietnam Stock Exchange (VNX) was established through the merger of HNX and HOSE.[6] Starting from 2023, all stocks listed in HNX will be transferred to HOSE, which will become Vietnam's sole stock exchange. However, HNX will continue to operate as Vietnam's primary bond exchange and also offer other investment vehicles such as investment funds and derivatives. In order to be listed on HOSE, companies are required to have a minimum registered capital of 120 billion VND (equivalent to USD 5.11 million in 2022) and positive profits in the two years preceding the year of registration. Firms listed on HNX are smaller, with a minimum registered capital of 30 billion VND and positive profit in the year before registration.[7]

Similar to other emerging markets, Vietnamese stock markets are primarily owned and traded by Vietnamese individual investors (Nguyen et al., 2017). Individual investors have been documented to be short-term speculators, lacking professional knowledge, and exhibiting strong herd-following behavior in the Vietnamese market (e.g., My and Huy, 2021; Nguyen et al., 2017). Due to the large fraction of inexperienced investors, strict price limits have been imposed on the two Vietnamese stock exchanges to serve as a market stabilization mechanism. On HOSE, newly listed stocks have a 40% price limit on the first trading day and a daily price limit of 7% on subsequent trading days. On HNX, there is no price limit on the first trading day and a daily price limit of 10% on subsequent trading days.[8] Vietnam's stock market does not allow short sales, which some argue could contribute to upward price manipulation (Nguyen et al., 2017).

Fig. 1 provides an overview of the Vietnamese stock market. Panels A to D plot the number of public-listed firms, market value, trading volume, and turnover ratio for HOSE and HNX in each year from 2007 to 2022, respectively. Panel A shows that the total number of listed firms in Vietnam grows from <100 in 2007 to >800 in 2022. Additionally, the number of firms listed on HOSE has

[6] VNX operates under a parent-subsidiary model, where it serves as the parent company holding 100% of the shares of both HOSE and HNX.

[7] Since 2009, Vietnamese companies can also register and trade on the OTC market (UPCoM) of the HNX. Our study does not include stocks traded on the UPCoM market due to the significantly different nature of OTC markets and exchanges in terms of market structure and regulations.

[8] In 2013, the price limits increased from 5% to 7% for the HOSE and from 7% to 10% for the HNX.

been similar to that for HNX. The Vietnamese market has fewer than ten listed firms before 2004, and the total market capitalization is <1% of the nation's GDP (Nguyen et al., 2017). After the stock market boom from 2005 to 2007, the stock market capitalization reached around 30% of the GDP. Panel B shows that total market value and trading volume also increase dramatically from 2007 to 2022. The total market value is only 125 trillion VND in 2007 and peaks in 2021 with a market value of >6000 trillion VND (equivalent to 260.08 billion USD). Likewise, Panel C shows that the trading volume was below 10 trillion VND in 2007, but has since surged to over 6000 trillion VND in 2021. As HOSE only allows large firms to list, it has a significantly higher total market value and trading volume than HNX. Meanwhile, Panel D shows that HNX has a higher turnover ratio than HOSE, implying more active trading in smaller stocks. The turnover ratios of both exchanges are comparable to those in the U.S. and are positively correlated with market returns, similar to the U.S. market (Karpoff, 1987).

Fig. 2 plots the time series of the VN index (HOSE) and HNX index during the sample period, along with the S&P 500 index and Shanghai Composite index (Shanghai Stock Exchange) for comparison. VN index and HNX index move largely in parallel and have a correlation coefficient of 0.81. The global financial crisis and Vietnam's efforts to contain inflation through tight monetary policy result in an over 80% drop in stock prices in 2007 and 2008. The market recovered slowly afterwards. In 2021, the total stock market capitalization is approximately 76% of the nation's GDP. Interestingly, the Vietnamese stock market has a modest correlation of around 0.40 with the U.S. market, while the correlation with Chinese stock markets is only around 0.20 despite the close economic relationship and geographic proximity between Vietnam and China,

1.2. Literature review

Our study is related to the literature on factors and anomalies in the Vietnamese stock market. Several studies have evaluated the effectiveness of factor models in the Vietnamese stock market. Phong and Hoang (2012) show that the Fama-French three-factor model is superior to the CAPM model. Using daily average trading volume and turnover over one-month as two measures of stock liquidity, Hoang et al. (2013) find that the Fama-French three-factor model combined with a liquidity factor more effectively explain stock returns in the Vietnamese stock market than CAPM and Fama-French three-factor model. Ryan et al. (2021) find that the Fama–French five-factor model has a higher explanatory power than the Fama-French three-factor model in the period of 2007 to 2015.

Compared to previous studies, we use a much larger sample and a longer sample period, conduct much more comprehensive analyses, and propose a new factor model. First, previous studies use relatively short sample periods such as 2007 to 2011 and 2007 to 2015, and cover a relatively small portion of Vietnamese stock universe. In contrast, our sample period starts from July 2007 to June 2022, and our sample includes >85% of the public listed firms in the Vietnamese stock market.[9] Second, previous studies use GMM regressions or size-neutral portfolio sorting, while we use a variety of empirical methods including unconditional portfolio sorting, size-neutral portfolio sorting, Fama-Macbeth regression, and GRS tests. Third, we aimed to explore and propose a factor model that is suitable for the Vietnamese stock market rather than testing existing factor models as in the previous studies.

Previous studies have also examined stock return anomalies in the Vietnamese stock market but have produced mixed results due to the choices of factor model, empirical method (e.g., portfolio sorting vs. Fama-Macbeth regression), and sample. First, a consensus has not been reached on whether there is stock return momentum in the Vietnamese market. Using data from June 2007 to October 2015, Vo and Truong (2018) find that a momentum strategy with a six-month formation period and a nine-month holding period is profitable. However, Nguyen (2012) finds that after controlling for Fama-French three factors, stock return momentum only exists in the horizon of future one week. Furthermore, Fang et al. (2017) show that there is no stock return momentum in Vietnam from 2009 to 2014. Hoang and Phan (2019) also find that the momentum factor is insignificant in the Vietnam stock market.

Second, the evidence on the relation between stock liquidity measures and future returns is also mixed. Hoang et al. (2013) find a positive relationship between two stock liquidity measures, namely trading volume and one-month turnover, and stock return. Using turnover ratio as a liquidity measure, Batten and Vo (2014) find a positive relationship between liquidity and stock return during financial crisis, contradicting the negative relation typically documented in the developed markets. Using the three-month average turnover ratio, three-month average trading volume, and the Amidhud illiquidity measure, Vo and Bui (2016) find a positive relationship between stock liquidity and stock return between 2009 and 2012. In contrast, Hoang and Phan (2019) find a negative relation between liquidity and future stock returns using one-year turnover ratio, one-year average trading volume, and the Amidhud illiquidity measure.

Third, previous studies have also documented a significant short-term stock return reversal (Tran and Nguyen, 2015), a nominal price anomaly (Hoang et al., 2020), and an accrual anomaly (Dang and Tran, 2019) in the Vietnamese stock market. Tran and Nguyen (2015) find that there is no relationship between idiosyncratic volatility and stock return in Vietnam. Seasonality effects such as the January effect is also found in the Vietnam stock market (Luu et al., 2016; Thach et al., 2019).[10] Our study differs from these works not only in its large sample size and comprehensive analyses, but also in its purpose to explain these anomalies using our proposed factor model.

[9] For example, the Vietnamese stock market has 850 publicly listed firms in 2021, and our sample includes 720 of them.

[10] Truong and Friday (2021) show that the January effect disappears if Lunar New Year is also in January, due to investors' selling pressure to consume and celebrate New Year.

2. Data and sample construction

2.1. Data and sample construction

We obtain the stock data of Vietnamese public firms from the Datastream database, which contains daily stock price, return index, trading volume, and number of shares outstanding. Daily return is computed as the percentage change in return index from Datastream. Weekly return is derived from the cumulative daily return from the close-of-the-market Wednesday to the close-of-the-market the following Wednesday. We obtain the sample firms' financial data from the Worldscope database.

We start with all common stocks listed in HOSE and HNX from July 2007 to June 2022, with the exception of firms that are on the OTC market (UPCoM) of the HNX exchange. Our sample begins from 2007, as it allows for sufficient observations to construct portfolios. As the Vietnamese stock market has a relatively short history, we focus on weekly stock returns for our main sample to

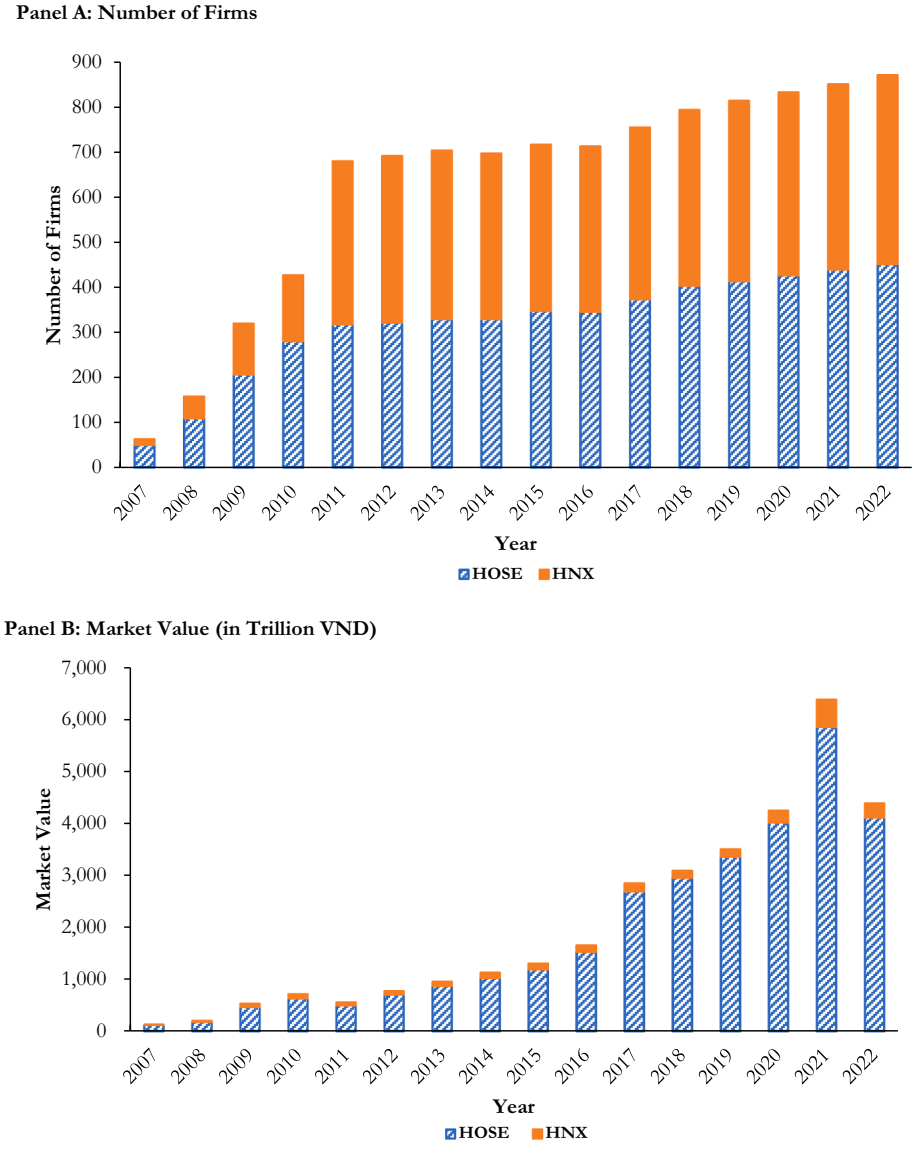

Fig. 1. Overview of the vietnamese stock market.
This figure presents an overview of the Vietnamese stock market. Panel A plots the number of publicly-listed firms in Ho Chi Minh stock exchange (HOSE) and Ha Noi stock exchange (HNX) from 2007 to 2022. Panels B to D plot the total market value, trading volume, and turnover ratio, respectively. Market value for a stock is calculated as the stock price multiplied by the total number of shares outstanding, measured at the end of December for each year. Trading volume for a stock is calculated as the sum of daily trading volume of a year, where daily trading volume is the share volume of a day multiplied by the stock price. Turnover ratio for a year is calculated as the trading volume divided by the total market value. Detailed variable definitions are provided in the Appendix A.

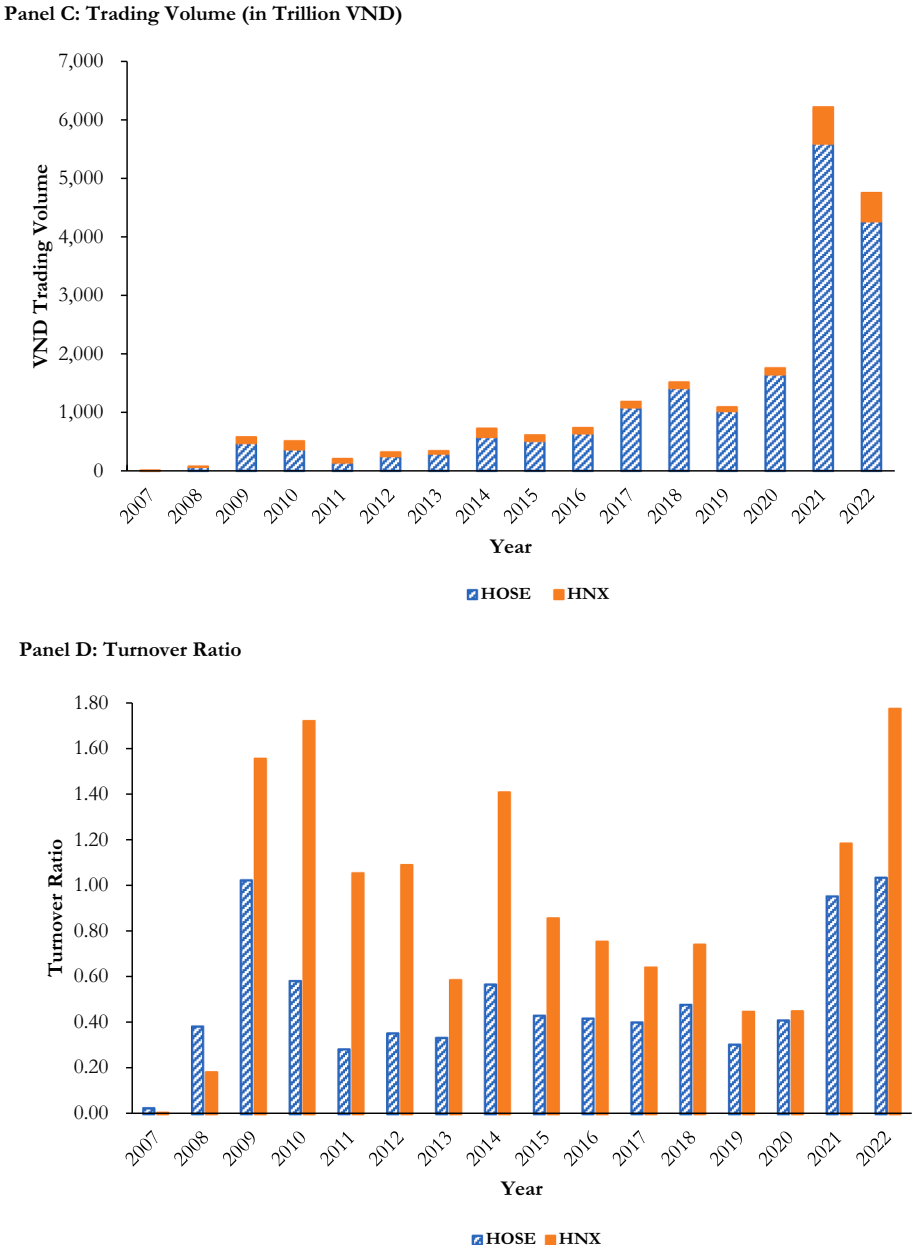

Fig. 1. (*continued*).

increase statistical power and test precision. To ensure the robustness of our findings, we have also conducted the main analysis using monthly stock returns. We find these results align qualitatively with the results based on weekly stock returns and report them in Tables A3 to A6 of the Appendix B.

To obtain the risk-free rate, we follow the literature (e.g., Hoang and Phan, 2019; Ryan et al., 2021) and collect the annual one-week interbank offer rate (VINBOR) from the website of the State Bank of Vietnam.[11] In addition, we collect information on institutional and government ownerships from Vietstock.vn. Since Vietstock.vn does not classify the categories of institutional investors, we manually review the names of the institutions to separate them into government entities and financial institutions. We then aggregate all shares held by financial institutions to calculate institutional ownership for a firm. We also aggregate the ownership from

[11] Some studies on Vietnamese stock market use government bond yield as a measure of risk-free rate. However, Vietnamese treasury bonds are not traded continuously, which may lead to missing values. In contrast, VNIBOR offers continuously updated rates.

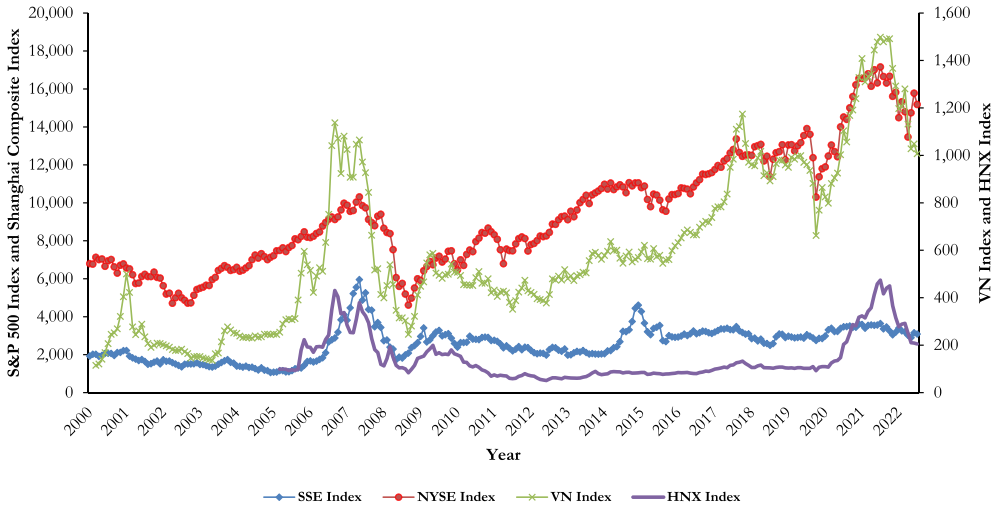

Fig. 2. Time series of stock market indices.
This figure shows the time-series of four stock market indices: S&P 500 Index, Shanghai Composite index for the Shanghai Stock Exchange, VN-index for the Ho Chi Minh Stock Exchange, and HNX-index for the Hanoi Stock Exchange. The sample period is from January 2000 to December 2022.

all government entities to obtain the state ownership for a firm. Shares held by investors other than institutions and government entities are counted towards individual investors. We classify a firm as an SOE if its state ownership exceeds 50%.

2.2. Summary statistics

Table 1 reports summary statistics for the characteristics of publicly-listed firms in Vietnam. The definitions of these variables are provided in the Appendix A. Panel A of Table 1 displays the time-series average of the cross-sectional means for a battery of firm characteristics from July 2007 to June 2022. We observe that firms listed in Vietnamese stock market on average are much smaller than their counterparts in the U.S. market. Specifically, the average market equity for Vietnamese firms is 3.12 trillion VND (equivalent to 131.0 million USD), while the average total asset for these firms is 5.29 trillion VND (equivalent to 222.1 million USD). Despite the relatively small size of the Vietnamese listed firms, the average trading volume of 40 billion VND (equivalent to 1.7 million USD) and turnover of 2.04% demonstrate a comparable level of trading activity to firms in the US market. In terms of other key metrics, Vietnamese firms have an average book-to-market ratio of 1.22, ROA of 0.06, leverage ratio of 0.22, Tobin's Q of 0.96, and CAPX of 0.05. Notably, Vietnamese firms tend to distribute a significant portion of their earnings as dividends, as indicated by an average dividend payout ratio of 0.47.

Panel B of Table 1 presents annual summary statistics, which shows a significant expansion in the Vietnamese stock market. The number of listed firms increases from 177 in 2007 to 733 in 2021 and that the total market equity of all listed firms in the sample increases from 412.0 trillion VND (equivalent to 17.3 billion USD) in 2007 to 6393.4 trillion VND (equivalent to 268.4 billion USD) in 2021. Additionally, average total assets of listed firms exhibit an upward trend over the sample period, reflecting the growth of Vietnamese economy. Other variables such as book-to-market ratio, ROA, leverage ratio, and dividend payout ratio demonstrate a relatively stable trend over our sample period.

Panel C of Table 1 reports the Pearson pairwise correlation matrix for the firm characteristics. Most of the correlations are consistent with those in the U.S. market. Exceptionally, there is a significantly negative correlation of −0.09 between firm size and turnover ratio, which is vastly different from the strongly positive relation between turnover and firm size in the developed markets. This result suggests that turnover ratio for Vietnamese firms may reflect speculative trading rather than stock liquidity.

3. Vietnamese three factor model

3.1. Value factor

Value effect, the tendency of value stocks to outperform the growth stocks in the long term, has been documented pervasively in the U.S. and international markets (Basu, 1983; Fama and French, 1992, 1998). We examine value effect in the Vietnamese stock market by applying the methodology in Fama and French (1992) and Liu et al. (2019) to create a value factor using Vietnamese stocks.

Our first step is to identify a valuation ratio that exhibits the strongest value effect among the commonly used valuation ratios, which include book-to-market ratio (BM), earnings-to-price ratio (EP), and cash flow-to-price (CP). We perform firm-level Fama-MacBeth regressions of weekly stock returns on size, beta, and valuation ratios. We measure size as the natural logarithm of market equity and estimate beta using daily returns from the past 20 trading days and apply lag correction as in Dimson (1979) and Liu et al. (2019). Following Fama and French (1992), we construct two valuation metrics based on *EP*: *EP+* and *D(EP < 0)*. *EP+* equals *EP* when

Table 1
Summary statistics.

Panel A: Summary statistics

	Mean	Std.	P10	P25	Med.	P75	P90
ME	3.12	10.90	0.06	0.13	0.37	1.26	4.73
Return	0.00	0.06	−0.06	−0.03	−0.00	0.03	0.07
VNDTrdVol	0.04	0.10	0.00	0.00	0.00	0.02	0.10
Turnover (%)	2.04	3.06	0.09	0.26	0.83	2.43	5.60
BM	1.22	0.80	0.45	0.67	1.02	1.54	2.20
Asset	5.29	22.76	0.11	0.23	0.62	1.79	5.60
ROA	0.06	0.07	0.01	0.02	0.05	0.09	0.14
Leverage	0.22	0.19	0.00	0.04	0.19	0.36	0.50
TobinQ	0.96	0.59	0.44	0.61	0.82	1.13	1.64
Cash	0.09	0.10	0.01	0.02	0.05	0.12	0.21
Capx	0.05	0.07	0.00	0.01	0.03	0.07	0.15
PPE	0.24	0.22	0.02	0.07	0.18	0.36	0.57
Dividend	0.03	0.04	0.00	0.00	0.01	0.04	0.07
Payout	0.47	0.95	0.00	0.00	0.27	0.61	0.96
OP	0.23	0.24	0.02	0.09	0.19	0.31	0.47
NetProfitMargin	0.09	0.19	0.01	0.02	0.05	0.12	0.27

Panel B: Yearly summary statistics

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
#Firms	177	239	347	488	528	535	538	547	581	605	661	695	704	720	733
TOTME	412.0	192.8	568.8	685.7	527.7	736.8	920.4	1098.7	1274.0	1632.4	2941.0	3164.4	3613.6	4358.6	6393.4
TOTVNDTrdVol	236.8	152.5	533.9	447.6	173.2	226.5	269.4	585.4	510.9	592.1	995.5	1252.3	817.3	1482.8	5757.0
TOTTurnover (%)	57.48	79.10	93.86	65.28	32.82	30.74	29.27	53.28	40.10	36.27	33.85	39.57	22.62	34.02	57.48
BM	0.33	0.69	0.81	0.67	1.33	1.71	1.68	1.23	1.15	1.15	1.13	1.19	1.24	1.36	0.94
Asset	0.83	1.25	2.18	2.13	2.23	2.98	3.49	3.63	3.86	3.25	4.02	4.81	5.03	5.89	5.65
ROA	0.09	0.09	0.07	0.08	0.08	0.06	0.05	0.05	0.06	0.06	0.06	0.06	0.05	0.05	0.04
Leverage	0.23	0.22	0.22	0.22	0.21	0.21	0.22	0.21	0.21	0.21	0.21	0.22	0.22	0.21	0.21
TobinQ	2.27	1.32	1.08	1.17	0.77	0.66	0.69	0.83	0.88	0.95	0.97	0.91	0.87	0.80	1.03
Cash	0.14	0.18	0.14	0.17	0.15	0.14	0.14	0.15	0.16	0.16	0.16	0.15	0.15	0.15	0.15
Capx	0.05	0.07	0.08	0.06	0.06	0.05	0.04	0.04	0.04	0.05	0.05	0.05	0.04	0.04	0.03
PPE	0.26	0.26	0.26	0.24	0.24	0.25	0.24	0.23	0.22	0.24	0.24	0.23	0.23	0.23	0.22
Dividend	0.20	0.16	0.42	0.24	0.25	0.38	0.49	0.46	0.45	0.43	0.44	0.45	0.53	0.51	0.51
Payout	0.02	0.01	0.03	0.02	0.02	0.02	0.03	0.02	0.02	0.03	0.03	0.02	0.03	0.02	0.02
OP	0.33	0.25	0.24	0.27	0.25	0.22	0.19	0.19	0.21	0.22	0.21	0.21	0.21	0.20	0.18
NetProfitMargin	0.11	0.12	0.08	0.13	0.11	0.07	0.07	0.07	0.09	0.09	0.09	0.10	0.09	0.09	0.08

Panel C: Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
ME(1)	1.00															
Return (2)	**0.02**	1.00														
VNDTrdVol (3)	**0.58**	**0.04**	1.00													
Turnover (4)	**−0.09**	**0.07**	**0.31**	1.00												

(*continued on next page*)

Table 1 (*continued*)

Panel C: Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
BM (5)	**−0.23**	**0.00**	**−0.18**	**0.12**	1.00											
Asset (6)	**0.70**	0.00	**0.49**	**−0.07**	**−0.13**	1.00										
ROA (7)	**0.06**	**0.00**	**0.02**	**−0.10**	**−0.38**	**−0.09**	1.00									
Leverage (8)	**−0.03**	**−0.01**	**0.02**	**0.01**	−0.02	**0.00**	**−0.28**	1.00								
TobinQ (9)	**0.24**	**−0.01**	**0.14**	**−0.09**	**−0.37**	**−0.07**	**0.55**	**0.02**	1.00							
Cash (10)	**0.05**	**0.00**	**0.06**	**−0.03**	**−0.15**	**0.07**	**0.23**	**−0.32**	**0.14**	1.00						
Capx (11)	**0.00**	**0.00**	**−0.00**	**0.00**	**−0.11**	**−0.05**	**0.10**	**0.17**	**0.14**	**−0.06**	1.00					
PPE (12)	**−0.05**	0.00	**−0.08**	**−0.08**	**−0.01**	**−0.09**	**0.02**	**0.30**	**0.14**	**−0.21**	**0.45**	1.00				
Dividend (13)	**0.01**	0.00	**−0.07**	**−0.15**	**−0.24**	**−0.10**	**0.56**	**−0.26**	**0.41**	**0.17**	**0.04**	**0.05**	1.00			
Payout (14)	−0.03	**0.00**	−0.07	−0.08	0.02	−0.03	**−0.01**	**−0.02**	−0.02	0.00	0.00	**0.02**	0.41	1.00		
OP (15)	**0.26**	**0.00**	**0.14**	**−0.12**	**−0.22**	**0.39**	**0.35**	**0.06**	**0.13**	**0.10**	**0.14**	**0.12**	**0.17**	**−0.03**	1.00	
NetProfitMargin (16)	**0.12**	**0.00**	**0.14**	**−0.01**	**−0.09**	**0.08**	**0.53**	**−0.14**	**0.26**	**0.10**	**0.01**	**0.02**	**0.19**	−0.01	**0.05**	1.00

Panel A reports the time-series averages of the weekly cross-sectional means of characteristics of Vietnamese publicly-listed firms from July 2007 to June 2022. *ME* is market equity. *Return* is weekly stock return. VND trading volume, *VNDTrdVol* is stock price multiplied by trading volume. *Turnover* is the weekly total VND trading volume scaled by market equity at the end of the week. *BM* is book equity scaled by market equity. *Asset* is total assets. *ROA* is net income scaled by total assets. *Leverage* is total debt scaled by total assets. *TobinQ* is market equity plus total debt, all scaled by total assets. *Cash* is cash scaled by total assets. *Capx* is capital expenditures scaled by total assets. *PPE* is property, plant and equipment scaled by total assets. *Payout* is total cash dividends paid scaled by net income. *Dividend* is total cash dividends paid scaled by total assets. Operating profitability, *OP* is revenue minus cost of goods sold, minus selling, general, and administrative expenses, minus interest expense, all scaled by book equity. *NetProfitMargin* is net income scaled by revenue. Panel B reports market-level summary statistics for the sample years. *#Firms* is the total number of firms listed in HOSE and HNX exchange in the year. *TOTME* is the sum of market equity of all firms at the end of each year. *TOTVNDTrdVol* is the sum of VND trading volume of all firms in each year. *TOTTurnover* is the yearly of VND trading volume scaled by ME. The rest of the variables are the cross-sectional mean in each year. The beginning year (2007) and the end year of our sample (2022) each contains only six months. For the market-level characteristics to be comparable, we multiple VND trading volume and *Turnover* in 2007 and 2022 by two. *ME, VNDTrdVol, TOTME*, *TOTVNDTrdVol* and *Asset* are measured in trillion VND. Panel C reports the weekly times-series average of pairwise pearson correlation coefficients among the characteristics. Coefficients with a significance level above 10% are displayed in bold. Detailed variable definitions are provided in the Appendix A.

Table 2
Fama–MacBeth regressions of stock returns on beta, size, and valuation ratios.

	(1)	(2)	(3)	(4)	(5)	(6)
Beta	0.06		0.07**	0.07**	0.07**	0.08**
	(1.59)		(2.12)	(2.10)	(2.00)	(2.24)
ln(ME)		−0.11***	−0.10***	−0.10***	−0.11***	−0.10***
		(−4.83)	(−4.82)	(−4.50)	(−4.79)	(−4.43)
BM			0.01			−0.01
			(0.34)			(−0.23)
EP^+				0.56*		0.72**
				(1.86)		(2.08)
D(EP < 0)				0.10		0.08
				(1.15)		(1.02)
CP^+					0.15	0.11
					(1.23)	(0.90)
D(CP < 0)					−0.04	−0.03
					(−1.03)	(−1.00)
Ave. #Obs.	366	366	366	366	366	366
R^2	0.017	0.015	0.045	0.046	0.041	0.065

This table reports stock-level Fama-Macbeth regressions of stocks returns on stock characteristics. The main variables of interest include various valuation ratios including book-to-market ratio, earnings-to-price ratio and cash flow-to-price ratio. EP^+ equals the positive values of earnings-to-price, and zero otherwise. *D(EP < 0)* equals one if earnings are negative, and zero otherwise. CP^+ and *D(CP < 0)* are similarly defined. All regressions also control for market beta and natural logarithm of market equity. Our sample period is from July 2008 to June 2022. All t-statistics are based on Newey-West standard errors with six lags. Detailed variable definitions are in the Appendix A.

Table 3
Summary statistics for three factors.

							Correlations		
	Mean	Std.	P25	Med.	P75	t-stat.	MKTRF	SMB	VMG
MKTRF (%)	9.01	175.75	−75.25	18.49	104.50	1.38	1.00		
SMB (%)	8.64	114.87	−54.92	9.98	73.59	2.03	−0.24	1.00	
VMG (%)	5.78	89.20	−52.64	6.21	64.28	1.75	−0.18	−0.13	1.00

This table reports summary statistics and correlations for the annualized weekly three factors: market, size and value factors. We obtain annualized returns by multiplying the weekly return by 52. Market factor (MKTRF) is the weekly value-weighted excess return on the market portfolio constructed based on all stocks in our sample. Risk free rate is one-week interbank offer rate. Size (SMB) and Value (VMG) factors are constructed using the 6 value-weight portfolios formed on size and EP ratio. The six portfolios, which are constructed at the end of each June, are the intersections of 2 portfolios formed on market equity and 3 portfolios formed on the EP ratio. The size breakpoint is the median market equity at the end of June of year *t*. The EP is the ratio of net profit in year t-1 scaled by the product of year-end's close price and total shares in year t-1. The EP breakpoints are the 30th and 70th percentiles. SMB is the average return on the three small portfolios minus the average return on the three big portfolios. VMG is the average return on the two value portfolios minus the average return on the two growth portfolios. There are 727 weeks during the sample period. Detailed variable definitions are in the Appendix A.

EP is positive, and zero otherwise. *D(EP < 0)* is a dummy variable that equals one when *EP* is negative, and zero otherwise. Similarly, we construct *CP+* and *D(CP < 0)* based on the cash flow-to-price ratio.

Table 2 presents the results of Fama-Macbeth regressions using Vietnamese stocks from July 2008 to June 2022. The regression results reveal a consistently positive and statistically significant coefficient for beta across all models, except when assessed in the univariate regression, where the coefficient exhibits marginal insignificance. Meanwhile, size has a negative coefficient across all models and is statistically significant at the 1% level, indicating that small stocks have higher average returns than large stocks in the Vietnamese market. Models (3) to (5) include one set of the valuation ratios (BM, EP, and CP) into each regression. The results reveal that only the EP ratio shows a positive and significant coefficient with a t-statistic of 1.86. Further, when we include all three valuation ratios in the regression analysis as a horse race (Column (6)), the results show that EP dominates other two ratios with a t-statistic of 2.08, while t-statistics for BM and CP are only −0.23 and 0.90 respectively. These findings indicate that the EP ratio emerges as a more robust valuation measure than BM and CP in explaining the cross-section returns in the Vietnamese market. Therefore, we construct the value factor in Vietnam using the EP ratio.

3.2. Three-factor model

In this section, we explore the construction of a Vietnamese three-factor model, the VN-3 model. Motivated by the existing literature and especially the Fama-French three-factor model, we include the market, size, and value factors in our model.

We construct our market factor as the weekly value-weighted return on a portfolio that includes all stocks in our sample, in excess of the one-week interbank offer rate (VINBOR). To construct our size and value factors, we follow the methodology proposed by Fama

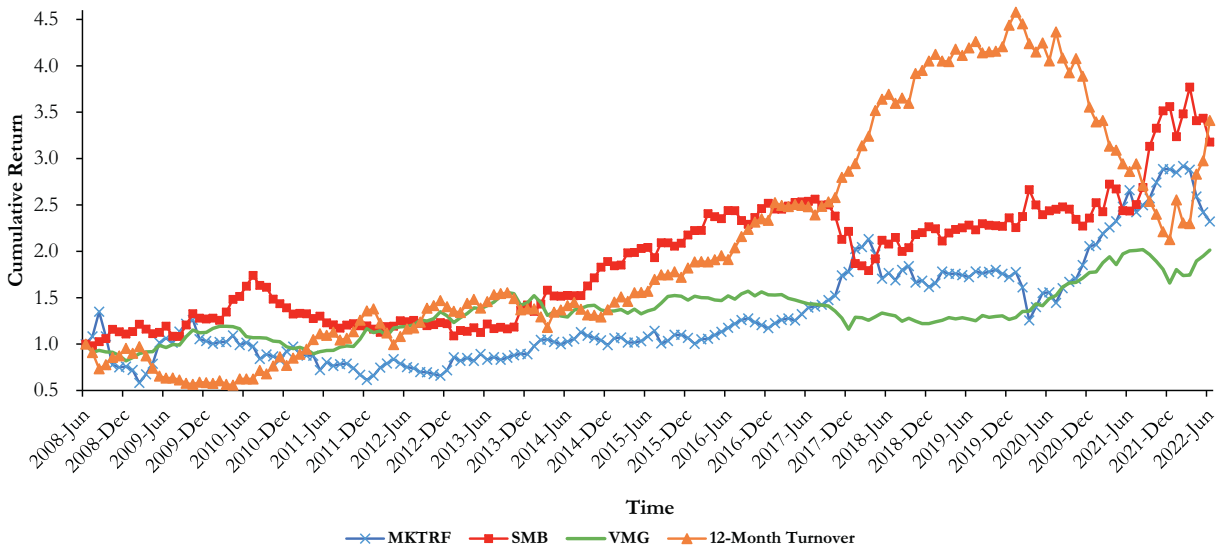

Fig. 3. Cumulative stock returns of weekly market, size, value, and turnover factors in the Vietnamese stock market.
This figure plots the cumulative returns of weekly market, size, value, and turnover factors in the Vietnamese stock market from July 2008 to June 2022. Market factor (MKTRF) is the weekly value-weighted excess return on the market portfolio constructed based on all stocks in our sample. Risk free rate is one-week interbank offer rate. Size (SMB), Value (VMG), and Turnover factors are constructed using the value weighted returns of six portfolios two dimensionally sorted into two groups of size (market equity) and three groups of EP-ratio or 12-Month Turnover. The six portfolios are constructed at the end of each June. The size breakpoint is the median market equity at the end of June of year *t*. EP ratio is net profit of year t-1 scaled by market capitalization at the end of year t-1. 12-Month Turnover is measured as the average daily turnover for the past 250 trading days, where daily turnover is daily trading volume scaled by total shares outstanding. The EP and 12-Month Turnover breakpoints are the 30th and 70th percentiles. SMB is the average value-weighted returns of the three small-size portfolios minus the average value-weighted returns of the three large-size portfolios. VMG is the average value-weighted returns of the two value portfolios minus the average value-weighted return of the two growth portfolios. Turnover factor is the average value-weighted returns of the two high turnover portfolios minus the average value-weighted returns of the two low turnover portfolios. Detailed variable definitions are provided in the Appendix A.

Table 4
Abilities of VN-3 and FF-3 models to explain each other's size and value factors.

	Factor Model	
	VN-3	FF-3
Alpha		
SMB_{FF3}	−0.02	
t-statistic	(−0.44)	
HML_{FF3}	−0.04	
t-statistic	(−0.52)	
SMB_{VN3}		0.02
t-statistic		(0.78)
VMG_{VN3}		0.13
T-statistic		(1.92)
GRS F-statistics		
SMB_{FF3}, HML_{FF3}	2.05	
p-value	(0.129)	
SMB_{VN3}, VMG_{VN3}		5.37
p-value		(0.005)

This table compare abilities of VN-3 and FF-3 models to explain each other's size and value factors. The top panel presents a factor's estimated weekly alpha with respect to the other model. T-statistics are reported in parentheses based on Newey-West standard errors with six lags. The bottom panel reports the GRS F-test of whether a model produces zero alphas for the factors of the other model with *p* -value reports in parentheses. The sample period is from July 2008 to June 2022.

and French (1993).[12] Specifically, we group firms into two size categories, small (S) and big (B), each week from July of year t to June of year t + 1. The size breakpoint is determined as the median market equity at the end of June of year t. Additionally, we classify firms into three value categories, value (V), middle (M), and growth (G), based on their EP ratio in year t-1, with the 30th and 70th percentiles serving as the breakpoints. Building on the results from the previous subsection, we introduce a Vietnam-specific feature into the three-factor model by utilizing the EP ratio to construct value factor. Our size factor, SMB_{VN3}, is computed as the average return on the three small portfolios minus the average return on the three big portfolios. Similarly, our value factor, VMG_{VN3}, is determined as the average return on the two value portfolios minus the average return on the two growth portfolios.

$$SMB_{VN3} = 1/3 \times (S/V + S/M + S/G) - 1/3 \times (B/V + B/M + B/G),$$

$$VMG_{VN3} = 1/2 \times (S/V + B/V) - 1/2 \times (S/G + B/G).$$

Table 3 presents the distributions of Vietnam's weekly three factors from July 2008 to June 2022.[13] The average of market factor is 0.173%, equivalent to an annualized return of 9.01%, and it has an insignificant t-statistic of 1.38. The lack of statistical significance in the market factor may be attributed to two reasons. First, there is a sharp decline in market return in 2022 due to the COVID-19 outbreak in Vietnam, as depicted in Fig. 3. Second, there is a high volatility of the market factor, as evidenced by its annualized standard deviation of 175.75%. It is worth noting that the market factor in China also exhibits statistical insignificance, as documented by Liu et al. (2019). The average weekly returns of SMB_{VN3} and VMG_{VN3} are 0.166% and 0.111%, which are equivalent to annual returns of 8.64% and 5.78%. Both factors are statistically significant, with t-statistics of 2.03 and 1.75.

Panel B of Table 3 presents the correlations between the factors. Notably, in Vietnam, there exists a negative correlation between the market factor and the size factor, which differs from the U.S. and China markets. Conversely, similar to the U.S., the market and value factors demonstrate a negative correlation in Vietnam. Moreover, the size and value premiums also exhibit a modest negative correlation.

3.3. Compare the VN-3 model with the FF-3 model

The main difference between our VN-3 model and the widely used Fama-French three-factor model is that the VN-3 model employs EP to construct the value factor (VMG), whereas the FF-3 model uses the book-to-market ratio to construct the value factor (HML). In this subsection, we compare the VN-3 and FF-3 models to determine whether one set of factors can outperform the other in terms of explanatory power. We construct the FF-3 size and value factors using the 6 value-weight portfolios (S/H, S/M, S/L, B/H, B/M, B/L) formed on size and BM ratio using the same universe of stocks as our VN-3 model. The size breakpoint is the median market equity at the end of June of year t and the BM breakpoints are the 30th and 70th percentiles. SMB_{FF3} is the average return on the three small portfolios minus the average return on the three big portfolios. HML_{FF3} is the average return on the two high portfolios minus the average return on the two low portfolios. The market factor is the same as in the VN-3 model.

$$SMB_{FF3} = 1/3 \times (S/H + S/M + S/L) - 1/3 \times (B/H + B/M + B/L),$$

$$HML_{FF3} = 1/2 \times (S/H + B/H) - 1/2 \times (S/L + B/L).$$

Panel A of Table 4 presents the alphas and t-statistics of size and value factors in one model with respect to the other model. We find that the VN-3 model significantly outperforms the FF-3 model in Vietnam. Specifically, the VN-3 alpha of SMB_{FF3} is only −2 bps per week, with a t-statistic of −0.44, and the VN-3 alpha of HML_{FF3} is -4 bps, with a t-statistic of −0.52. These results indicate that the VN-3 model exhibits robust explanatory power for the FF-3 size and value factors. In contrast, FF-3 alphas of SMB_{VN3} and VMG_{VN3} are 2 bps and 13 bps, respectively (t-statistics 0.78 and 1.92), suggesting that the FF-3 model fails to explain the value factor of VN-3.

Furthermore, we conduct GRS tests (Gibbons et al., 1989) to determine whether each model's size and value factors jointly have zero alphas with respect to the other model. Panel B of Table 4 shows that the test fails to reject the null hypothesis of jointly zero VN-3 alphas for SMB_{FF3} and HML_{FF3}, with a *p*-value of 0.129. In contrast, the test rejects the null hypothesis of jointly zero FF-3 alphas for SMB_{VN3} and VMG_{VN3}, with a p-value of 0.005. Therefore, the results of the GRS tests also show that the VN-3 model outperforms the FF-3 model in Vietnam.

Recent literature (Fama and French, 2015; Hou et al., 2015) has highlighted the importance of investment and profitability factors in the evaluation of stock returns. We further explore whether our VN-3 model is capable of capturing these additional factors. In Table A1 of Appendix B, we demonstrate that our VN-3 model is capable of explaining most FF-5 factors by leaving insignificant alpha, except for the profitability factor (RMW). The GRS test fails to reject the null hypothesis of jointly zero VN-3 alphas for SMB_{FF5}, HML_{FF5}, CMA_{FF5} and RMW_{FF5}, with a p-value of 0.337. This indicates that the VN-3 model not only captures the factors included in the original Fama and French (1993) model but also outperforms the FF-5 model in Vietnam.

[12] Liu, Stambaugh, and Yuan (2019) construct the size factor in China by excluding the smallest 30% of firms, as they were considered potential shells in reverse mergers to bypass stringent IPO constraints. We include all Vietnamese stocks in our size factor construction, as the IPO constraints in our study setting are not as severe as in China (Chanthavong, 2020). Hence, the potential value of being a shell company is much lower.

[13] Our weekly and monthly VN-3 VN-4 and FF-3 factors from July 2008 to June 2022 can be downloaded at: https://drive.google.com/drive/folders/1-Cp31u3k7rG2vWhhvyPMgVxtESxbOqS0?usp=sharing.

Table 5
CAPM alphas and betas for anomalies.

Panel A: Unconditional sorts

Category	Anomaly	R	α	β	t(R)	t(α)	t(β)
Beta	Beta	0.04	−0.04	0.43	0.29	−0.28	7.30
Size	Market Equity	−0.27	**−0.32**	0.25	−1.96	**−2.30**	−3.92
Volatility	One-month Volatility	0.11	0.04	0.39	0.62	0.24	6.79
Volatility	Max Volatility	0.32	**0.27**	0.28	1.98	**1.80**	4.77
Idiosyncratic Volatility	IVol	−0.09	−0.09	−0.02	−0.55	−0.53	−0.38
Idiosyncratic Volatility	IVol_FF3	−0.03	−0.03	−0.03	−0.21	−0.18	−0.65
Illiquidity	Illiquidity	0.00	0.09	−0.51	0.05	1.09	−9.33
Turnover	12-Month Turnover	−0.09	−0.15	0.38	−0.59	−1.18	5.96
Turnover	1-Month Abn. Turnover	0.39	**0.31**	0.45	3.21	**2.94**	9.93
Reversal	Reversal	0.26	**0.28**	−0.13	1.51	**1.70**	−1.45
Momentum	Momentum	0.14	0.16	−0.11	0.81	0.97	−1.33
52-week high	52-Week High	0.29	**0.35**	−0.34	1.69	**2.23**	−5.44
Value	EP	0.21	**0.21**	0.02	1.83	**1.83**	0.34
Value	BM	0.14	0.13	0.03	1.02	0.98	0.55
Value	CP	−0.06	−0.05	−0.04	−0.57	−0.51	−0.71
Profitability	ROA	−0.05	−0.01	−0.28	−0.40	−0.04	−5.60
Profitability	ROE	0.13	0.15	−0.10	0.99	1.14	−2.03
Profitability	OP	0.22	**0.21**	0.06	1.83	**1.77**	1.26
Profitability	GP	0.10	0.15	−0.27	0.81	1.27	−4.84
Investment	Asset Growth	0.00	−0.01	0.08	0.02	−0.11	1.60
Investment	Equity Growth	−0.07	−0.09	0.10	−0.79	−1.01	2.47

Panel B: Size-neutral Sorts

Category	Anomaly	R	α	β	t(R)	t(α)	t(β)
Beta	Beta	0.09	0.02	0.41	0.87	0.23	9.00
Volatility	One-month Volatility	−0.03	−0.10	0.40	−0.27	−1.07	11.2
Volatility	Max Volatility	0.01	−0.04	0.31	0.15	−0.47	7.74
Idiosyncratic Volatility	IVol	−0.12	**−0.14**	0.12	−1.46	**−1.74**	3.82
Idiosyncratic Volatility	IVol_FF3	−0.12	−0.13	0.04	−1.40	−1.47	1.29
Illiquidity	Illiquidity	0.11	**0.19**	−0.47	1.20	**2.48**	−9.04
Turnover	12-Month Turnover	−0.18	**−0.27**	0.49	−1.31	**−2.35**	9.14
Turnover	1-Month Abn. Turnover	0.30	**0.24**	0.39	3.09	**2.70**	11.84
Reversal	Reversal	−0.21	−0.20	−0.06	−1.45	−1.42	−0.92
Momentum	Momentum	0.13	0.14	−0.08	1.01	1.16	−1.39
52-week high	52-Week High	0.27	**0.33**	−0.37	1.85	**2.49**	−7.66
Value	EP	0.17	**0.18**	−0.09	2.02	**2.23**	−2.85
Value	BM	0.10	0.08	0.09	0.87	0.74	1.77
Value	CP	0.08	0.09	−0.01	1.25	1.29	−0.43
Profitability	ROA	0.02	0.06	−0.23	0.15	0.58	−6.34
Profitability	ROE	0.18	**0.21**	−0.14	1.64	**1.92**	−2.72
Profitability	OP	0.12	0.13	−0.05	1.18	1.3	−1.30
Profitability	GP	0.13	**0.18**	−0.30	1.19	**1.84**	−6.16
Investment	Asset Growth	0.02	0.01	0.03	0.21	0.15	0.91
Investment	Equity Growth	−0.06	−0.06	0.01	−0.84	−0.86	0.33

This table reports the average weekly long-short return spread (R), CAPM alpha (α) and CAPM beta (β) for each of 21 anomalies. Panel A reports results for unconditional sorts. For each anomaly, we first sort all firms into quintile portfolios and calculate value weighted portfolio returns. The long (short) leg of an anomaly is the top (bottom) quintile sorted by the anomaly measure. Panel B reports results for use size-neutral sorts. We first sort firms into two groups by the market value in June. Within each size group, we then create quintile portfolios sorted by the anomaly variable. Finally, we form the quintile portfolios for each anomaly by pooling the stocks in a given anomaly quintile across the two size groups. Size anomaly is omitted in Panel B. Our sample period is from July 2008 to June 2022. All t-statistics are based on Newey-West standard errors with six lags. Bold is used for alphas that are statistically significant at 0.10 level. Detailed variable definitions are in the Appendix A.

4. Factors and anomalies

In the previous section, we demonstrated the effectiveness of our VN-3 model in pricing the FF-3 factors formed by replicating the Fama and French (1993) approach in Vietnam. In this section, we shift our focus to investigate the performance of our VN-3 model in explaining a set of anomalies observed in the Vietnamese stock market. We first construct a comprehensive set of 21 anomalies that are well documented in the current literature and re-examine them using our sample of Vietnamese stocks. We then examine how well these anomalies can be explained by the VN-3 model.

Table 6
VN-3 factor alphas and factor loadings for anomalies.

Panel A: Unconditional sorts

Category	Anomaly	α	β_{MKT}	β_{SMB}	B_{VMG}	t(α)	t(β_{MKT})	t(β_{SMB})	t(β_{VMG})
Beta	Beta	−0.02	0.42	−0.03	−0.07	−0.17	6.02	−0.29	−0.69
Size	Market Equity	−0.05	0.04	−1.16	−0.33	−0.79	−1.66	−29.3	−6.57
Volatility	One-month Volatility	−0.12	0.51	0.70	0.16	−0.74	7.96	6.86	1.55
Volatility	Max Volatility	0.08	0.43	0.76	0.32	0.65	7.87	9.05	2.86
Idiosyncratic Volatility	IVol	−0.23	0.10	0.65	0.15	−1.61	1.75	7.02	1.36
Idiosyncratic Volatility	IVol_FF3	−0.16	0.07	0.60	0.12	−1.05	1.42	6.88	1.11
Illiquidity	Illiquidity	−0.05	−0.40	0.59	0.26	−0.77	−10.19	15.35	6.64
Turnover	12-Month Turnover	**−0.39**	0.56	0.91	0.49	**−3.78**	8.79	11.11	4.59
Turnover	1-Month Abn. Turnover	**0.34**	0.43	−0.09	−0.08	**3.15**	9.43	−1.14	−0.86
Reversal	Reversal	0.26	−0.11	0.13	−0.05	1.62	−1.12	−0.98	−0.58
Momentum	Momentum	0.21	−0.15	−0.25	−0.00	1.29	−1.61	−2.02	−0.01
52-week high	52-Week High	**0.42**	−0.40	−0.31	−0.14	**2.84**	−5.74	−2.28	−1.15
Value	EP	−0.01	0.18	0.38	1.14	−0.11	5.40	5.40	14.28
Value	BM	−0.12	0.23	1.01	0.49	−1.24	3.68	14.12	5.53
Value	CP	−0.03	−0.06	−0.13	0.05	−0.31	−0.97	−2.68	0.73
Profitability	ROA	−0.01	−0.28	−0.17	0.29	−0.08	−5.24	−2.15	4.13
Profitability	ROE	**0.22**	−0.16	−0.54	0.26	**1.94**	−3.17	−8.83	3.50
Profitability	OP	**0.36**	−0.06	−0.61	−0.18	**3.43**	−1.03	−7.45	−2.20
Profitability	GP	0.15	−0.27	−0.20	0.27	1.36	−4.76	−2.96	3.48
Investment	Asset Growth	0.10	−0.00	−0.42	−0.21	0.95	−0.04	−5.63	−2.19
Investment	Equity Growth	−0.06	0.08	−0.17	0.09	−0.74	2.13	−2.91	1.26

Panel B: Size-neutral sorts

Category	Anomaly	α	β_{MKT}	β_{SMB}	β_{VMG}	t(α)	t(β_{MKT})	t(β_{SMB})	t(β_{VMG})
Beta	Beta	−0.03	0.45	0.23	0.04	−0.35	9.01	3.81	0.50
Volatility	One-month Volatility	**−0.18**	0.47	0.47	−0.04	**−2.33**	10.64	7.29	−0.57
Volatility	Max Volatility	−0.13	0.38	0.46	−0.02	−1.61	9.23	7.75	−0.34
Idiosyncratic Volatility	IVol	**−0.21**	0.17	0.37	−0.07	**−2.75**	4.32	5.89	−0.94
Idiosyncratic Volatility	IVol_FF3	**−0.19**	0.09	0.34	0.00	**−2.40**	3.03	5.99	0.06
Illiquidity	Illiquidity	**0.16**	−0.44	0.08	0.15	**2.01**	−7.66	1.25	2.99
Turnover	12-Month Turnover	**−0.45**	0.64	0.79	0.27	**−4.94**	10.07	10.04	3.14
Turnover	1-Month Abn. Turnover	**0.20**	0.42	0.18	0.01	**2.29**	11.91	3.44	0.12
Reversal	Reversal	**−0.24**	−0.03	0.21	−0.01	**−1.75**	−0.41	2.23	−0.09
Momentum	Momentum	0.15	−0.09	−0.09	0.08	1.25	−1.25	−0.83	0.73
52-week high	52-Week High	**0.38**	−0.41	−0.27	0.06	**2.97**	−6.81	−2.36	0.49
Value	EP	0.06	−0.01	−0.02	1.02	1.56	−0.42	−0.73	20.33
Value	BM	−0.05	0.20	0.58	0.18	−0.55	2.97	8.16	2.36
Value	CP	0.08	−0.01	−0.03	0.08	1.25	−0.30	−0.60	1.54
Profitability	ROA	0.05	−0.23	−0.24	0.43	0.60	−6.06	−6.07	8.09
Profitability	ROE	**0.23**	−0.17	−0.41	0.43	**2.63**	−2.64	−7.31	6.48
Profitability	OP	**0.18**	−0.10	−0.42	0.26	**2.22**	−1.80	−6.77	3.98
Profitability	GP	**0.21**	−0.32	−0.33	0.29	**2.45**	−6.14	−5.80	4.77
Investment	Asset Growth	0.04	0.00	−0.12	−0.06	0.61	0.09	−2.63	−0.79
Investment	Equity Growth	−0.06	0.01	−0.00	0.03	−0.91	0.40	−0.03	0.63

This table reports the Vietnamese three-factor alpha and factor loadings for each of 21 anomalies. Alpha and beta loadings are estimated in a regression model where the dependent variable is each anomaly's weekly long-short return spread and the independent variables are market excess return (MKTRF), size factor (SMB) and value factor (VMG). Panel A reports results for unconditional sorts. For each anomaly, we first sort all firms into quintile portfolios and calculate value weighted portfolio returns. The long (short) leg of an anomaly is the top (bottom) quintile sorted by the anomaly measure. Panel B reports results for use size-neutral sorts. We first sort firms into two groups by the market value in June. Within each size group, we then create quintile portfolios sorted by the anomaly variable. Finally, we form the quintile portfolios for each anomaly by pooling the stocks in a given anomaly quintile across the two size groups. Size anomaly is omitted in Panel B. Our sample period is from July 2008 to June 2022. All t-statistics are based on Newey-West standard errors with six lags. Bold is used for alphas that are statistically significant at 0.10 level. Detailed variable definitions are in the Appendix A.

4.1. Anomalies in Vietnam

Given the relatively limited anomaly literature on the Vietnamese stock market compared to the more extensively studied U.S. or Chinese stock markets, as well as the controversies due to differences in sample selection, variable construction, and empirical methodology, we first compile a comprehensive list of anomalies based on our sample of Vietnamese stocks from 2007 to 2022. The list includes anomalies documented for Vietnam, as well as those well-documented for the U.S. and China. These anomalies fall into eleven categories: beta, size, volatility, idiosyncratic volatility, turnover, reversal, momentum, 52-week high, value, profitability, and investment. We use the CAPM to classify the anomalies as significant or not in the Vietnamese stock market.

Table 7
VN-4 factor alphas and factor loadings for anomalies.

Panel A: Unconditional sorts

Category	Anomaly	α	β_{MKT}	β_{SMB}	β_{VMG}	β_{UMP}	t(α)	t(β_{MKT})	t(β_{SMB})	t(β_{VMG})	t(β_{UMP})
Beta	Beta	0.14	0.21	−0.28	−0.14	−0.34	1.08	2.79	−2.90	−1.43	−4.45
Size	Size	−0.01	−0.03	−1.24	−0.23	−0.03	−0.18	−1.09	−29.27	−4.75	−0.63
Volatility	One-month Volatility	0.11	0.23	0.41	0.00	−0.57	0.78	3.10	3.95	0.00	−7.27
Volatility	Max Volatility	0.02	0.37	0.74	0.26	0.30	0.16	5.98	8.18	2.43	3.50
Idiosyncratic Volatility	IVol	−0.13	−0.02	0.56	0.05	−0.28	−0.97	−0.29	6.25	0.46	−4.28
Idiosyncratic Volatility	IVol_FF3	−0.06	−0.04	0.51	0.02	−0.27	−0.45	−0.77	6.30	0.24	−4.01
Illiquidity	Illiquidity	−0.09	−0.33	0.66	0.22	0.04	−1.33	−6.43	13.5	5.23	1.19
Turnover	12-Month Turnover	0.08	−0.02	0.22	0.21	−1.07	1.28	−0.60	3.16	3.31	−20.61
Turnover	1-Month Abn. Turnover	**0.37**	0.39	−0.14	−0.09	−0.07	**3.34**	6.33	−1.70	−0.91	−0.98
Reversal	Reversal	0.19	−0.01	0.22	−0.04	0.17	1.02	−0.10	1.88	−0.41	1.54
Momentum	Momentum	0.08	0.00	−0.02	0.08	0.24	0.52	0.00	−0.19	0.61	1.95
52-week high	52-Week High	0.13	−0.04	0.15	0.01	0.63	0.95	−0.52	1.13	0.13	7.01
Value	EP	0.12	0.02	0.20	1.07	−0.28	1.50	0.52	2.65	13.85	−4.60
Value	BM	0.08	−0.02	0.77	0.31	−0.56	0.87	−0.31	12.03	4.22	−8.45
Value	CP	−0.05	−0.03	−0.13	0.07	0.06	−0.47	−0.66	−1.98	1.05	1.09
Profitability	ROA	−0.15	−0.10	0.04	0.37	0.31	−1.27	−1.84	0.42	5.40	5.30
Profitability	ROE	0.06	0.04	−0.32	0.38	0.40	0.46	0.93	−5.29	5.45	6.39
Profitability	OP	**0.20**	0.14	−0.42	−0.06	0.40	**1.87**	3.15	−6.53	−0.84	6.34
Profitability	GP	−0.01	−0.06	0.03	0.36	0.38	−0.10	−1.06	0.37	4.95	7.45
Investment	Asset Growth	0.03	0.08	−0.32	−0.14	0.17	0.27	1.10	−3.55	−1.56	2.55
Investment	Equity Growth	−0.06	0.07	−0.19	0.11	0.02	−0.67	1.52	−2.63	1.44	0.24

Panel B: Size-neutral sorts

Category	Anomaly	α	β_{MKT}	β_{SMB}	β_{VMG}	β_{UMP}	t(α)	t(β_{MKT})	t(β_{SMB})	t(β_{VMG})	t(β_{UMP})
Beta	Beta	0.13	0.24	−0.00	−0.05	−0.36	1.46	5.56	−0.03	−0.81	−6.05
Volatility	One-month Volatility	0.01	0.23	0.22	−0.17	−0.47	0.19	6.53	4.36	−2.52	−10.13
Volatility	Max Volatility	0.02	0.21	0.27	−0.13	−0.35	0.21	4.70	3.91	−1.82	−6.98
Idiosyncratic Volatility	IVol	−0.11	0.05	0.27	−0.14	−0.25	−1.49	1.36	4.87	−2.01	−4.79
Idiosyncratic Volatility	IVol_FF3	−0.13	0.02	0.27	−0.05	−0.16	−1.60	0.56	5.13	−0.80	−3.30
Illiquidity	Illiquidity	−0.02	−0.20	0.34	0.21	0.41	−0.35	−4.17	7.47	5.92	10.4
Turnover	12-Month Turnover	0.02	0.05	0.11	0.00	−1.08	0.62	2.81	4.35	0.01	−49.32
Turnover	1-Month Abn. Turnover	**0.28**	0.31	0.05	−0.04	−0.19	**3.37**	7.86	1.12	−0.49	−3.76
Reversal	Reversal	**−0.30**	0.05	0.29	−0.00	0.12	**−1.86**	0.79	3.22	−0.04	1.31
Momentum	Momentum	0.11	−0.03	0.01	0.11	0.07	0.88	−0.55	0.12	0.97	0.77
52-week high	52-Week High	0.11	−0.07	0.15	0.20	0.59	0.94	−1.16	1.13	1.89	7.64
Value	EP	0.05	0.00	−0.01	1.02	0.01	1.45	0.09	−0.27	20.63	0.76
Value	BM	0.13	−0.03	0.36	0.05	−0.46	1.34	−0.60	6.02	0.76	−7.45
Value	CP	0.09	−0.02	−0.05	0.08	0.00	1.30	−0.43	−0.84	1.54	0.03
Profitability	ROA	−0.04	−0.12	−0.14	0.49	0.22	−0.5	−3.38	−2.93	9.82	6.01
Profitability	ROE	0.10	0.01	−0.25	0.52	0.35	0.96	0.16	−4.62	9.00	5.97
Profitability	OP	0.02	0.10	−0.23	0.36	0.38	0.27	2.49	−5.12	6.24	7.23
Profitability	GP	0.02	−0.08	−0.08	0.40	0.45	0.28	−1.97	−1.43	8.13	10.17
Investment	Asset Growth	0.01	0.04	−0.07	−0.04	0.08	0.10	1.03	−1.14	−0.47	1.86
Investment	Equity Growth	−0.07	0.03	0.01	0.04	0.03	−1.06	0.84	0.34	0.74	1.00

This table reports the Vietnamese three-factor and a twelve-month turnover factor alpha and factor loadings for each of 21 anomalies. Alpha and beta loadings are estimated in a regression model where the dependent variable is each anomaly's weekly long-short return spread and the independent variables are market excess return (MKTRF), size factor (SMB), value factor (VMG) and turnover factor (Unpopular miuns Popular, UMP). Panel A reports results for unconditional sorts. For each anomaly, we first sort all firms into quintile portfolios and calculate value weighted portfolio returns. The long (short) leg of an anomaly is the top (bottom) quintile sorted by the anomaly measure. Panel B reports results for use size-neutral sorts. We first sort firms into two groups by the market value in June. Within each size group, we then create quintile portfolios sorted by the anomaly variable. Finally, we form the quintile portfolios for each anomaly by pooling the stocks in a given anomaly quintile across the two size groups. Size anomaly is omitted in Panel B. Our sample period is from July 2008 to June 2022. All t-statistics are based on Newey-West standard errors with six lags. Bold is used for alphas that are statistically significant at 0.10 level. Detailed variable definitions are in the Appendix A.

We use both unconditional and size-neutral sorts to compute alphas. In the unconditional sorts, we first sort all firms into quintile portfolios based on the anomaly measure and calculate value-weighted portfolio returns. The top quintile represents the long leg, while the bottom quintile represents the short leg of an anomaly. We compute the long-short return spread for each anomaly by longing the top quintile and shorting the bottom quintile.

However, given Vietnam's significant size premium, the correlation between an anomaly variable and size could obscure an anomaly's effect in an unconditional sort. Therefore, we also conduct size-neutral sorts, where we sort firms into two groups based on their market value in June and then create quintile portfolios for each size group based on the anomaly variable. Finally, we form the quintile portfolios for each anomaly by pooling the stocks in a given anomaly quintile across the two size groups. The long-short

Table 8
Portfolio returns sorted on anomalies.

Panel A: Alphas under the VN-3 Model

Anomalies	Low	2	3	4	High	H-L
Beta	−0.02	−0.02	0.05	−0.02	−0.05	−0.03
	(−0.46)	(−0.43)	(1.17)	(−0.45)	(−1.11)	(−0.35)
One-month Volatility	0.05	−0.00	−0.04	0.01	−0.13**	−0.18**
	(1.40)	(−0.09)	(−0.97)	(0.29)	(−2.06)	(−2.33)
Max Volatility	0.02	0.04	−0.01	−0.04	−0.11*	−0.13
	(0.42)	(1.03)	(−0.18)	(−0.84)	(−1.93)	(−1.61)
IVol	0.06*	0.03	−0.00	−0.01	−0.15**	−0.21***
	(1.86)	(0.73)	(−0.09)	(−0.25)	(−2.28)	(−2.75)
IVol_FF3	0.03	0.01	−0.01	0.05	−0.16**	−0.19**
	(0.87)	(0.22)	(−0.18)	(0.75)	(−2.43)	(−2.40)
Illiquidity	−0.12***	0.01	0.07	0.03	0.04	0.16**
	(−3.21)	(0.24)	(1.44)	(0.60)	(0.77)	(2.01)
12-Month Turnover	0.14***	0.11***	−0.01	−0.14***	−0.32***	−0.45***
	(3.07)	(2.69)	(−0.32)	(−2.60)	(−4.81)	(−4.94)
1-Month Abnormal Turnover	−0.17***	−0.06	−0.01	0.01	0.03	0.20**
	(−3.01)	(−1.21)	(−0.30)	(0.13)	(0.59)	(2.29)
Reversal	0.14*	−0.02	−0.01	−0.03	−0.10	−0.24*
	(1.93)	(−0.49)	(−0.35)	(−0.63)	(−1.28)	(−1.75)
Momentum	−0.11	−0.10**	0.05	0.01	0.04	0.15
	(−1.51)	(−2.07)	(1.18)	(0.27)	(0.65)	(1.25)
52-Week High	−0.19**	−0.17***	−0.06	−0.02	0.19***	0.38***
	(−2.20)	(−3.09)	(−1.44)	(−0.36)	(3.22)	(2.97)
EP	−0.08*	0.01	0.01	−0.02	−0.03	0.06
	(−1.79)	(0.27)	(0.28)	(−0.62)	(−0.67)	(1.56)
BM	−0.02	0.05	−0.02	−0.00	−0.07	−0.05
	(−0.39)	(1.24)	(−0.34)	(−0.08)	(−0.93)	(−0.55)
CP	−0.12**	−0.06	0.01	0.08*	−0.04	0.08
	(−2.37)	(−1.52)	(0.25)	(1.75)	(−0.92)	(1.25)
ROA	0.01	−0.03	−0.07*	−0.00	0.05	0.05
	(0.16)	(−0.56)	(−1.72)	(−0.02)	(1.22)	(0.60)
ROE	−0.16***	−0.00	−0.02	0.03	0.07	0.23***
	(−2.64)	(−0.06)	(−0.43)	(0.98)	(1.60)	(2.63)
OP	−0.12**	−0.00	−0.10**	0.08*	0.06	0.18**
	(−2.03)	(−0.02)	(−2.18)	(1.76)	(1.59)	(2.22)
GP	−0.07	−0.01	−0.08*	0.00	0.14***	0.21**
	(−1.26)	(−0.36)	(−1.88)	(0.05)	(2.82)	(2.45)
Asset Growth	−0.08	0.05	0.02	0.02	−0.04	0.04
	(−1.62)	(1.21)	(0.52)	(0.54)	(−0.91)	(0.61)
Equity Growth	0.19	0.20	0.22*	0.25**	0.13	−0.06
	(1.46)	(1.47)	(1.79)	(2.08)	(0.96)	(−0.91)

Panel B: Alphas under the VN-4 model

Anomalies	Low	2	3	4	High	H-L
Beta	−0.05	−0.04	0.08**	0.04	0.08	0.13
	(−0.91)	(−1.03)	(2.14)	(1.02)	(1.62)	(1.46)
One-month Volatility	0.01	−0.00	−0.01	0.12**	0.02	0.01
	(0.22)	(−0.01)	(−0.24)	(2.41)	(0.38)	(0.19)
Max Volatility	−0.01	0.08*	0.02	0.01	0.00	0.02
	(−0.28)	(1.85)	(0.53)	(0.22)	(0.09)	(0.21)
IVol	0.06*	0.07*	0.02	0.05	−0.05	−0.11
	(1.85)	(1.88)	(0.43)	(0.84)	(−0.80)	(−1.49)
IVol_FF3	0.04	0.06*	0.01	0.12*	−0.09	−0.13
	(1.06)	(1.65)	(0.16)	(1.90)	(−1.40)	(−1.60)
Illiquidity	−0.00	0.07	0.10**	0.01	−0.03	−0.02
	(−0.07)	(1.50)	(1.97)	(0.16)	(−0.47)	(−0.35)
12-Month Turnover	0.01	0.05	0.05	0.03	0.03	0.02
	(0.19)	(1.19)	(1.35)	(0.72)	(0.80)	(0.62)
1-Month Abnormal Turnover	−0.19***	−0.02	0.03	0.06	0.10**	0.28***
	(−3.49)	(−0.48)	(0.90)	(1.46)	(1.99)	(3.37)
Reversal	0.23***	0.03	0.02	−0.01	−0.07	−0.30*
	(2.65)	(0.66)	(0.44)	(−0.22)	(−0.85)	(−1.86)
Momentum	−0.03	−0.04	0.09*	0.06	0.08	0.11
	(−0.40)	(−0.77)	(1.93)	(1.23)	(1.29)	(0.88)
52-Week High	0.03	−0.05	−0.01	−0.01	0.14**	0.11

(*continued on next page*)

Table 8 (*continued*)

Panel B: Alphas under the VN-4 model						
Anomalies	Low	2	3	4	High	H-L
	(0.43)	(−0.99)	(−0.29)	(−0.22)	(2.39)	(0.94)
EP	−0.02	0.06	0.05	0.04	0.03	0.05
	(−0.54)	(1.57)	(1.21)	(0.95)	(0.78)	(1.45)
BM	−0.03	0.10**	0.06	0.10**	0.10	0.13
	(−0.61)	(2.38)	(1.30)	(2.11)	(1.53)	(1.34)
CP	−0.03	−0.02	0.05	0.07	0.05	0.09
	(−0.74)	(−0.46)	(0.91)	(1.51)	(1.02)	(1.30)
ROA	0.08**	0.02	0.02	0.02	0.05	−0.04
	(1.96)	(0.52)	(0.38)	(0.62)	(0.98)	(−0.50)
ROE	−0.03	0.05	0.02	0.04	0.06	0.10
	(−0.51)	(1.09)	(0.52)	(1.12)	(1.25)	(0.96)
OP	0.03	0.04	−0.05	0.07	0.05	0.02
	(0.54)	(0.73)	(−1.26)	(1.58)	(1.37)	(0.27)
GP	0.07	0.03	−0.09**	0.03	0.09*	0.02
	(1.50)	(0.75)	(−2.21)	(0.66)	(1.81)	(0.28)
Asset Growth	−0.01	0.10**	0.05	0.04	−0.00	0.01
	(−0.23)	(2.18)	(1.15)	(1.17)	(−0.10)	(0.10)
Equity Growth	0.22*	0.21	0.25**	0.28**	0.15	−0.07
	(1.73)	(1.61)	(2.02)	(2.22)	(1.14)	(−1.06)

This table presents value-weighted portfolio returns sorted by each of 21 anomaly variables. We first sort firms into two groups by the market value. Within each size group, we then create quintile portfolios sorted by the anomaly variable. Finally, we form the quintile portfolios for each anomaly by pooling the stocks in a given anomaly quintile across the two size groups. The portfolios for July of year t to June of $t + 1$ are constructed based on characteristics in June of year t. Panel A reports alphas based on the VN three-factor model for anomaly quintile portfolios as long as the difference between the top and bottom quintiles. Panel B reports alphas based on the VN four–factor model for anomaly quintile portfolios as long as the difference between the top and bottom quintiles. T-statistics based on Newey-West robust standard errors with six lags are reported in parentheses. ***, **, and *** represent statistical significance at the 0.01, 0.05, and 0.10 levels. The sample period is from July 2008 to June 2022. Detailed variable definitions are in the Appendix A.

Table 9
Fama-Macbeth regression on anomalies.

Anomalies	Coefficient	t-stats
Beta	**0.11**	**2.48**
Size	**−0.08**	**−3.39**
EP	**0.83**	**2.24**
12-Month Turnover	**−0.25**	**−2.92**
One-month Volatility	4.16	1.18
Max Volatility	1.06	0.66
IVol	−0.01	−0.26
IVol_FF3	0.00	0.01
Illiquidity	−0.47	−1.27
1-Month Abnormal Turnover	**0.13**	**2.32**
Reversal	**−2.95**	**−3.06**
Momentum	−0.03	−0.31
52-Week High	0.37	1.35
BM	0.09	1.43
CP	−0.00	−0.03
ROA	−0.45	−0.95
ROE	0.24	1.10
OP	0.08	0.79
GP	0.07	0.36
Asset Growth	−0.11	−1.03
Equity Growth	−0.03	−0.52

This table reports Fama-Macbeth regressions of weekly stock returns on each of 21 anomaly variables. The dependent variable is stock return in week *t*. The main independent variable of interest is the anomaly measure in week *t-1*. We also control for the following firm characteristics: *Beta*, the natural logarithm of market capitalization *Ln(ME)*, earnings-to-price ratio *EP*, and *12-Month Turnover*. We do not control for *Beta*, *Ln(ME)*, *EP* or *12-Month Turnover* for the Beta, Size, EP or 12-Month Turnover anomaly respectively. For brevity, we only report the coefficient on the anomaly variable as long as associated t-stats based on Newey-West standard errors with six lags. Bold is used for coefficients that are statistically significant at 0.10 level. The sample period is from July 2007 to June 2022. Detailed variable definitions are in the Appendix A.

Table 10
Fama-Macbeth regression on bid-ask spread and turnover.

	(1)	(2)	(3)	(4)
Bid-Ask Spread	5.62**		−0.73	−2.11
	(2.36)		(−0.11)	(−1.09)
12-Month Turnover		−0.17**	−0.15**	−0.26***
		(−2.03)	(−2.03)	(−3.43)
Beta			0.10*	0.07*
			(1.68)	(1.90)
ln(ME)				−0.10***
				(−4.08)
EP				0.18
				(0.38)
Ave. #Obs.	293	293	293	293
R-squared	0.021	0.036	0.065	0.087

This table reports Fama-Macbeth regressions of weekly stock returns on bid-ask spread and turnover. The dependent variable is the stock return in week *t*. The main independent variables include *Bid-Ask Spread, and 12-Month Turnover*. *Bid-ask spread* is calculated as the difference between the ask price and the bid price scaled by the midpoint of the closing ask and bid prices, averaged over the past 20 trading days. *12-Month Turnover* is measured as the average daily turnover for the past 250 trading days, where daily turnover is daily trading volume scaled by total shares outstanding. T-statistics based on Newey-West robust standard errors with six lags are reported in parentheses. ***, **, and *** represent statistical significance at the 0.01, 0.05, and 0.10 levels. The sample period is from July 2008 to June 2022. Detailed variable definitions are in the Appendix A.

strategy for size-neutral sorts is the same as the unconditional sorts, using top and bottom quintiles.

Table 5 presents the results for the 21 anomalies investigated in this study, with Panel A showing the unconditional sort results and Panel B presenting the size-neutral sort results (excluding the size anomaly).[14] Notably, the results under unconditional and size-neutral sorts differ for a couple of measures, indicating the impact of correlation between an anomaly variable and size on anomaly performance. Therefore, we focus on the size-neutral conditional sorts for our analysis.

We find that the momentum and investment anomalies, which produce significant CAPM alphas in the US, do not do so in Vietnam using either unconditional or size-neutral sorting. The estimated weekly alphas for these anomalies are economically small and statistically insignificant. However, we confirm the presence of the size and value premium under the CAPM model. The weekly size alpha is −0.32% and the weekly EP alpha using size-neutral sorts is 0.18%.

Similar to the U.S. market, we observe significant alphas associated with 1-month abnormal turnover and 52-week high under both unconditional or size-neutral sorts. In addition, we also find evidence of a profitability alpha in the Vietnamese market, ranging from 0.18% to 0.21% for different profitability measures.

While we do not find evidence of a total volatility effect in Vietnam, we observe a significant idiosyncratic volatility effect using the size-neutral conditional sorts with a weekly alpha of −0.14%. The estimated illiquidity alpha is 0.19% under the size-neutral sorts, but only 0.09% under the unconditional sorts. Likewise, the 12-month turnover exhibits a significant −0.27% alpha under the size-neutral sorts but an insignificant alpha under the unconditional sorts. The negative correlation between size and turnover, as shown in Table 1 Panel C, may explain the different results under unconditional and size-neutral sorts. Specifically, since high illiquidity and low turnover stocks tend to be large firms, the size effect offsets the alphas associated with illiquidity or turnover in unconditional sorts.

4.2. Explain anomalies using the VN-3 model

In this section, we investigate whether our VN-3 model can account for anomalies in the Vietnamese stock market. Specifically, we employ a regression model where the dependent variable is each anomaly's monthly long-short return spread, and the independent variables are market factor, size factor, and value factor computed based on EP. Our findings are presented in Table 6, which displays the VN-3 alpha and factor loadings for each of the 21 anomalies. We report results for both unconditional sorts in panel A and size-neutral sorts in panel B.

The results of our analysis show that all anomalies with a significant alpha under the CAPM model still have a significant alpha under the VN-3 model, with the exception of the EP anomaly, as shown in Panel B of Table 6. In addition, one-month volatility, idiosyncratic volatility based on three factors model, reversal, and OP become significant under the VN-3 model.

Similarly, under unconditional sorts, the size and EP factors become insignificant, while ROE and 12-month turnover become significant. Other anomalies, such as 1-month turnover, 52-week high, and OP, that have a significant alpha under the CAPM model, still have a significant alpha under the VN-3 model. Therefore, although the VN-3 model performs well in explaining the FF-3 factors in

[14] Since the size effect is controlled for by size-neutral sorts, we omit the size anomaly in Panel B.

Table 11
Twelve-month turnover, limits-to-arbitrage, and portfolio returns.

Twelve-month Turnover						
	Low	2	3	4	High	H-L
Panel A: Subgroup Analysis Based on Firm Size						
Small Size	0.20***	0.21***	0.06	−0.15***	−0.37***	−0.57***
	(3.48)	(3.45)	(0.99)	(−2.60)	(−5.01)	(−5.53)
Large Size	0.07	0.02	−0.09	−0.13*	−0.26***	−0.34***
	(1.27)	(0.38)	(−1.62)	(−1.85)	(−3.13)	(−2.95)
					Diff-in-Diff	−0.23**
						(−2.00)
Panel B: Subgroup Analysis Based on Institutional Ownership						
Low IO	0.19	−0.07	−0.02	−0.21**	−0.46***	−0.65***
	(1.50)	(−0.80)	(−0.23)	(−2.39)	(−4.91)	(−4.04)
High IO	0.07	0.11	−0.05	−0.09	−0.19**	−0.26**
	(0.86)	(1.33)	(−0.61)	(−1.43)	(−2.54)	(−2.25)
					Diff-in-Diff	−0.39**
						(−2.22)

This table presents weekly value-weighted VN-3 factor portfolio alphas of double-sorted portfolios first by twelve-month turnover and then by a degree of limits-to-arbitrage measure, which is proxied by firm size in Panel A and institutional ownership in Panel B. Each week, stocks are first sorted into two groups based on the median limits-to-arbitrage proxy in June of year t. Within each limits-to-arbitrage group, we then sort stocks into five groups based on twelve-month turnover in week t-1. We calculate the weekly value-weighted returns of these two-dimensional portfolios and then compute alphas using the VN-3 model, which includes market, size, and value factors. Additionally, we calculate the diff-in-diff VN-3 alpha of the H-L between the low and high limits-to-arbitrage groups. Our sample period is from July 2008 to June 2022. All t-statistics are based on Newey-West standard errors with six lags. Bold is used for alphas that are statistically significant at 0.10 level. Detailed variable definitions are in the Appendix A.

Vietnam, it has limited power to explain most anomalies observed in the Vietnamese stock market.[15]

5. A four-factor model in Vietnam

5.1. Explain anomalies using the VN-4 model

Given the presence of significant VN-3 alphas for a dozen anomalies, we explore the addition of a fourth factor based on turnover. High turnover could be associated with either high investor speculation (attention) or high liquidity, both of which are particularly relevant factors in the context of Vietnam's stock market. Investor disagreement and speculation are particularly important given the dominance of unsophisticated individual investors, who account for >80% of the total trading volume in Vietnam (Nguyen et al., 2017).

To construct our fourth factor, we utilize the twelve-month turnover ratio, which is the average daily turnover ratio over the past year. The turnover factor is constructed in the same manner as our value factor, neutralized with respect to size. We then add this turnover factor into the VN-3 model and refer to it as the VN-4 factor.

Table 7 reports VN-4 factor model alpha and factor loadings for each of the 21 anomalies, where Panel A presents the results using unconditional sorts and Panel B presents those using size-neutral sorts. In Panel B of Table 7, nine out of the eleven significant VN-3 alphas become insignificant under size-neutral sorts after adding the turnover factor. The only two anomalies that survived are one-month abnormal turnover and reversal. Furthermore, the average VN-4 alpha for the eleven originally significant VN-3 anomalies is a small 0.10%, with an average t-statistic of 1.08.

Panel A of Table 7 also yields similar improvements of VN-4 model with unconditional sorts, where the only significant VN-4 alphas are one-month abnormal turnover and OP. In summary, the results in Table 7 indicate that VN-4 accommodates most of the anomalies and also lowers the average magnitude of all the significant alphas under VN-3.

We further present VN-3 and VN-4 alphas for each quintile in Panels A and B of Table 8, respectively. Panel B shows that the two anomalies that survive the VN-4 model, namely, one-month abnormal turnover and reversal, have largely monotonic returns across the quintiles. The top quintile of one-month abnormal turnover has a significantly positive alpha of 0.10% per week, and the bottom quintile has a significantly negative alpha of −0.19% per week. Additionally, the reversal anomaly is mainly attributable to the long leg, where the bottom quintile earns a significantly positive return of 0.23% per week.

To validate the sorting analysis, we perform Fama-Macbeth regressions of weekly stock returns on anomaly metrics while

[15] As mentioned in the previous section, we demonstrated that the VN-3 model is capable of explaining factors of the FF-5 model. In line with these results, we also find that neither FF-5 nor the EP-adjusted FF-5 model can effectively explain a significant number of anomalies observed in the Vietnamese stock market. Specifically, in Table A2 of Appendix B, we present evidence that both models fail to explain several well-documented anomalies, including idiosyncratic volatility, illiquidity, turnover, 52-week high, and profitability, among others.

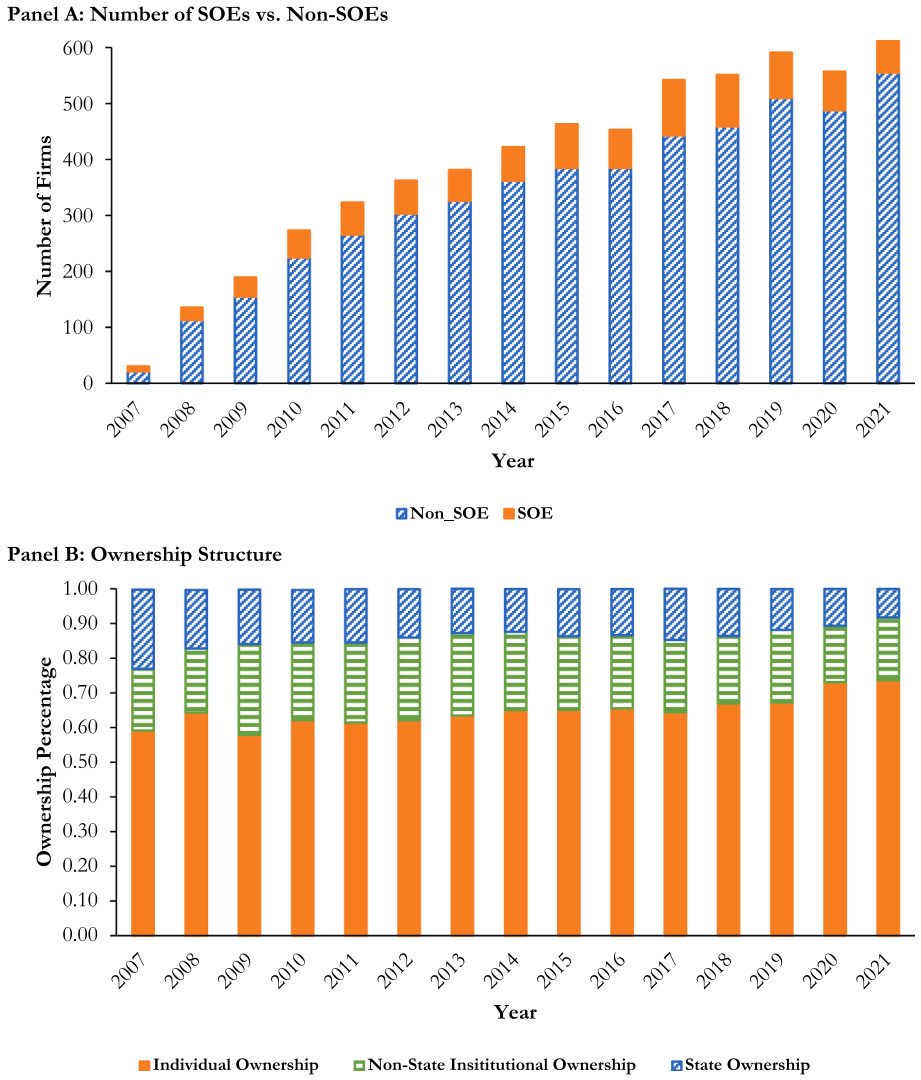

Fig. 4. This figure presents the ownership structure of publicly-listed firms in the Vietnamese stock market from 2007 to 2021. Panel A displays the number of State-owned enterprises (SOEs) listed on the Vietnamese stock market, where a SOE is defined as a company in which government entities hold over 50% of the total shares outstanding. Panel B illustrates the time-series averages of the cross-sectional means of individual ownership, non-state institutional ownership, state ownership for our sample firms between 2007 and 2021.

controlling the four characteristics in the VN-4 model (i.e., beta, size, EP, and turnover). In Table 9, we find that the coefficients are significant at 5% level for beta (t-statistic 2.48), size (t-statistic −3.39), EP (t-statistic 2.24), and twelve-month turnover (t-statistic −2.92). These results are in line with our previous findings that the size, value, and turnover factors have significant long-short returns. The coefficients for the anomaly metrics are mostly insignificant, with the exception of one-month turnover (t-statistic 2.32) and reversal (t-statistic −3.06), which also support our previous finding that most anomalies except one-month turnover and reversal are explained by the VN4-model.

To summarize, the results using Fama-Macbeth regressions reinforce the sorting analysis, indicating that the four factors in the VN-4 model are effective in accounting for the anomalies observed in Vietnam.

5.2. Is the turnover factor driven by liquidity premium or mispricing?

In order to understand the source of explanatory power of the turnover factor, we conduct two tests to further disentangle the explanations based on stock liquidity and stock overpricing caused by investor speculation or attention (Lee and Swaminathan, 2000; Lou and Shu, 2017). In the first test, we construct a direct measure of stock liquidity based on bid-ask spread, and then perform a Fama-Macbeth regression of weekly stock returns on bid-ask spread and turnover. We first conduct Fama-Macbeth regression of weekly stock returns on bid-ask spread. Model (1) of Table 10 shows that high bid-ask spread leads to high future returns, which seems to be

Table 12
Fama-Macbeth regression on state and institutional ownership.

Panel A: State and institutional ownerships

	(1)	(2)	(3)	(4)	(5)	(6)
SOE Dummy	0.02			0.00		
	(0.42)			(0.05)		
SOE Ownership		0.08			0.03	
		(0.87)			(0.32)	
Institutional Holdings			0.05			−0.00
			(0.67)			(−0.05)
Beta				0.14**	0.14**	0.14**
				(2.55)	(2.52)	(2.52)
ln(ME)				−0.07***	−0.07***	−0.08***
				(−3.00)	(−2.97)	(−3.08)
EP				−0.05	−0.06	−0.22
				(−0.11)	(−0.13)	(−0.47)
12-Month Turnover				−0.19*	−0.18*	−0.20**
				(−1.90)	(−1.89)	(−2.10)
Ave. #Obs.	191	191	191	191	191	191
R^2	0.009	0.010	0.011	0.096	0.096	0.097

Panel B: Change in state and institutional ownerships.

	(1)	(2)	(3)	(4)
ΔSOE Ownership	−0.07		−0.08	
	(−0.62)		(−0.74)	
ΔInstitutional Ownership		0.24***		0.21**
		(2.91)		(2.42)
Beta			0.13**	0.13**
			(2.51)	(2.52)
ln(ME)			−0.08***	−0.08***
			(−2.93)	(−3.11)
EP			−0.19	−0.18
			(−0.41)	(−0.40)
12-Month Turnover			−0.19*	−0.19*
			(−1.92)	(−1.96)
Ave. #Obs.	191	191	191	191
R^2	0.009	0.009	0.104	0.103

This table reports Fama-Macbeth regressions of weekly stock returns on state and institutional ownership. Panel A reports Fama-Macbeth regressions of weekly stock returns on state and institutional ownership. The dependent variable is the stock return in week *t*. The main independent variables include *SOE Dummy*, *SOE Ownership*, *and Institutional Ownership*. *SOE Dummy* is a dummy variable that equals one if government entities hold >50% of the shares. *SOE Ownership* is the percentage of shares held by government entities. *Institutional Ownership* are the percentage of shares held by non-state institutional investors. In column (4), (5), and (6), we further control for beta, size, EP and twelve-month turnover. Panel B reports Fama-Macbeth regressions of weekly stock returns on change in state and institutional ownership. The main independent variables include *ΔSOE Ownership* and *ΔInstitutional Ownership*. *ΔSOE Ownership* is the difference between percentage of shares held by government entities in year t and year t-1. *ΔInstitutional Ownership* is similarly defined as *ΔSOE Ownership*. In column (3) and (4), we further control for beta, size, EP and twelve-month turnover. T-statistics based on Newey-West robust standard errors with six lags are reported in parentheses. ***, **, and *** represent statistical significance at the 0.01, 0.05, and 0.10 levels. The sample period is from July 2008 to June 2022. Detailed variable definitions are in the Appendix A.

consistent with the liquidity hypothesis. However, when we include both bid-ask spread and turnover in Model (3) of Table 10, turnover subsumes the explanatory power of bid-ask spread. This result holds when we control for beta, size, and EP in Model (4). Therefore, the explanatory power of the fourth factor, turnover, is unlikely to be a result of liquidity premium. Instead, the relation between stock liquidity and return is likely a manifestation of the relation between turnover and return.

In the second test, we proceed with a double sorting analysis to gauge the strength of return predictability of turnover for stocks with varying degree of limits-to-arbitrage. If the return predictability of turnover stems from speculative trading and resulted mis-pricing, we expect it to be more pronounced for stocks with elevated limits-to-arbitrage. We employ two commonly-used proxies for the degree of limits-to-arbitrage: firm size and institutional ownership. We first divide stocks into two groups based on the median of limits-to-arbitrage measure, and then within each group, we further segregate stocks into quintile portfolios according to their past 12-month turnover. We present the VN-3 alpha for each portfolio, the difference between the top and bottom twelve-month turnover quintile portfolios, alongside with the diff-in-diff between low and high limits-to-arbitrage groups. In Table 11, it can be observed that the return predictability of 12-month turnover is most pronounced for stocks with smaller size and lower institutional ownership, with both diff-in-diffs significant at 5% level, suggesting that the turnover factor's explanatory power in returns is likely attributed to

speculative trading-induced overpricing.

Overall, our findings suggest that turnover is an important factor in explaining anomalies in the Vietnamese stock market, and that it might capture a source of investor speculation (mispricing) that is not captured by the other three factors in our VN-4 model.

6. Institutional and government ownerships

Despite the dominance of unsophisticated individual investors in the trading activity of the Vietnamese stock market, institutional investors and state shareholders play a crucial role in Vietnam's economy and capital market given Vietnam's state-led capitalist economic system. Due to the unique and significant role of state-owned enterprises (SOEs) in the country's capital markets, we devote this section to exploring the impact of ownership structure on stock returns in Vietnam.

Panel A of Fig. 4 illustrates the number of SOEs and non-SOEs in the Vietnamese stock market. We find that SOEs account for approximately 16% of total listed firms in Vietnam, with a majority of these being large companies, comprising 30% of the total market capitalization. Similar to China, Vietnam has implemented a privatization reform program called the "Equitization Program", leading to a decline in the percentage of SOEs from around 20% in the early years to <10% in 2022. Furthermore, Panel B of Table 4 presents the levels of state ownership, institutional ownership, and individual ownership over our sample period, which also shows a decline in the average SOE ownership from 23% in 2007 to 8% in 2022, while individual ownership has increased from 59% to 66%. Additionally, Panel B shows that institutional ownership in listed companies in Vietnam has remained stable, accounting for approximately 20% of total shares.

Given the highly concentrated state ownership of SOEs, their financial opacity, and lack of corporate governance mechanisms, their return pattern could potentially differ from that of non-SOEs (e.g., Dewenter and Malatesta, 2001; Farinos et al., 2007; Griffin et al., 2022). Panel A of Table 12 presents the results of the Fama-Macbeth regression of weekly stock return on state ownership. We find that neither SOE dummy nor SOE ownership has a significant relation with stock returns. Panel B of Table 12 reports the results for the change in SOE ownership, which shows that the change in SOE ownership does not predict future returns either.

Next, we examine the relation between institutional ownership and stock returns. Prior literature has documented the significant impact of institutional ownership level and change on stock returns due to their private information and distinct demand for asset characteristics (e.g., Gompers and Metrick, 2001; Sias et al., 2006). Panel A of Table 12 shows that the level of institutional ownership does not significantly predict future returns. However, Panel B of Table 12 reveals that the change in institutional ownership has a significant relation with future returns. The coefficient of 0.21% in model (4) suggests that a 1% increase in institutional ownership is associated with 21 bps higher weekly returns. This observation could be attributed to institutional investor's information advantage or superior ability to analyze public information (sophistication), which warrants further investigation.

7. Conclusion

This paper provides a comprehensive analysis of cross-sectional stock returns and anomalies in Vietnam. We aim at developing a factor model that can effectively explain the cross-section of stock returns and anomalies in Vietnamese stock market.

We first examine the size factor based on firms' market capitalizations, and find a significant size effect in Vietnam. Specifically, small-cap stocks earn significantly higher future returns than large-cap stocks. Next, we examine various value metrics including book-to-market ratio (BM), earnings-to-price ratio (EP), and cash-flow-to-price ratios (CP). We find that EP subsumes the other value metrics in Vietnam and therefore use EP rather than BM to construct a value factor.

We construct a Vietnamese three-factor (VN-3) model that includes the market factor, size factor, and value factor based on EP. This model outperforms the Fama-French three-factor model (FF-3, Fama and French, 1993) in Vietnam. Specifically, the VN-3 model prices the FF-3 size and value factors well, whereas FF-3 fails to price the VN-3 value factor.

Next, we construct 21 anomalies that fall into eleven categories: beta, size, volatility, idiosyncratic volatility, turnover, reversal, momentum, 52-week high, value, profitability, and investment. Out of these anomalies, nine have significant CAPM alphas in the Vietnamese stock market, and they fall into seven categories including size, idiosyncratic volatility, illiquidity, turnover, 52-week high, value, and profitability. When we use the VN-3 model to explain these anomalies, almost all of the anomalies with significant CAPM alphas continue to have significant VN-3 alphas, with the exception of size and value effect. Therefore, the VN-3 model does not do a good job explaining anomalies in Vietnam.

We then investigate the incorporation of a fourth factor based on twelve-month turnover into the VN-3 model, and construct the VN-4 model (Vietnamese four-factor model) that includes the three VN-3 factors and a turnover factor. Interestingly, the VN-4 model has a much better explanatory power for anomalies than the VN-3 model. Specifically, the VN-4 alphas are insignificant for all anomalies except the two based on one-month abnormal turnover and reversal. These results hold when we corroborate the sorting analysis with Fama-Macbeth regression analyses. Further evidence suggests that the turnover factor may be driven by investor speculation (attention) and the associated overpricing rather than liquidity premium.

Finally, we examine how institutional and government ownerships are related to future returns. While the level of institutional ownership does not significantly predict future returns, change in institutional ownership has a significantly positive relation with future returns, indicating institutional advantage in Vietnam like the rest of the world. Additionally, we find that state ownership has no significant relation with stock returns.

We provide a comprehensive study on the factors and anomalies in the Vietnamese stock market, as well as a VN-4 factor model that explains most of the return anomalies in Vietnamese stock market. Our study illustrates the importance of developing country-specific factor models especially for the developing markets. Additionally, our study, together with Liu et al. (2019) demonstrates the critical

role of turnover in explaining the cross-sectional returns in developing markets such as China and Vietnam.

Appendix A. Variable and anomaly definitions

Panel A: Variable definition

Variable	Definition
Bid-ask spread	The difference between the ask price and the bid price scaled by the midpoint of the closing ask and bid prices.
BM	Book equity scaled by market equity.
BookEquity	Common equity plus deferred taxes, minus preferred stock.
Capx	Capital expenditures, scaled by total assets.
Cash	Cash, scaled by total assets.
CP	Change in cash between year t and year t-1, scaled by market equity in year-end t-1.
CP+	Equals the positive values of CP, and zero otherwise.
D(CP < 0)	Dummy variable that equals one if CP is negative, and zero otherwise.
D(EP < 0)	Dummy variable that equals one if EP are negative, and zero otherwise.
Dividend	Total cash dividends paid, scaled by total assets.
EP	Net income, scaled by market equity.
EP+	Equals the positive values of EP, and zero otherwise.
NetProfitMargin	Net income scaled by revenue.
Institutional Ownership	Percentage of shares held by institutional investors.
Leverage	Total debt, scaled by total assets.
OP	Revenue minus cost of goods sold, minus selling, general, and administrative expenses, minus interest expense, scaled by book equity.
Payout	Total cash dividends paid, scaled by net income.
PPE	Property, plant, and equipment, scaled by total assets.
ROA	Net income, scaled by total assets.
ROE	Net income, scaled by book equity.
SOE Dummy	Dummy variable that equals one if government entities hold >50% of the shares.
SOE Ownership	SOE Ownership is the percentage of shares held by government entities.
TobinQ	Market equity plus total debt, scaled by total assets.
TOTME	Sum of market equity of all firms at the end of each year.
TOTVNDTrdVol	Sum of VND trading volume of all firms in each year.
Turnover	VND trading volume scaled by market equity.
VNDTrdVol	Trading volume multiplied by close stock price.
Δ Institutional Ownership	The difference between percentage of shares held by institutional investors in year t and year t-1.
ΔSOE Ownership	The difference between percentage of shares held by government entities in year t and year t-1.

Panel B: Anomaly definition

Anomaly	Definition
Beta	Following Scholes and Williams (1997) and Liu et al. (2019), the market beta of stock i in month t is the sum of β_1 to β_5,which are estimated using the equation below. Risk free rate is the overnight interbank interest rate. $R_{i,d} - r_{f,d} = \alpha_i + \beta_{1,i}(R_{m,d-2} - r_{f,d-2}) + \beta_{2,i}(R_{m,d-1} - r_{f,d-1}) + \beta_{3,i}(R_{m,d} - r_{f,d})$ $+\beta_{4,i}(R_{m,d+1} - r_{f,d+1}) + \beta_{5,i}(R_{m,d+2} - r_{f,d+2}) + \varepsilon_{i,d}$ $R_{i,d}$ is the return of stock i on day d, $r_{f,d}$ is the risk-free rate on day d, $R_{m,d}$ is the market return on day d. Beta is estimated using the daily return of the past 20 trading days.
One-month Volatility	One-month volatility is the standard deviation of daily returns of the past 20 trading days.
Max Volatility	MAX Volatility is the highest daily return of the past 20 trading days.
IVol	Idiosyncratic volatility is estimated using the following two equations: $R_{i,d} - r_{f,d} = \alpha_i + \beta_i(R_{m,d} - r_{f,d}) + \varepsilon_{i,d}$ $IVol_{i,t} = SQRT[Var(\varepsilon_{i,d})]$ The idiosyncratic volatility of stock i in month t is the standard deviation of $\varepsilon_{i,d}$ of the past 20 trading days.
IVol_FF3	FF-3 Idiosyncratic volatility is estimated using the following two equations: $R_{i,d} - r_{f,d} = \alpha_i + \beta_{1,i}(R_{m,d} - r_{f,d}) + \beta_{2,i}SMB + \beta_{3,i}HML + \varepsilon_{i,d}$ $IVol\_FF3_{i,t} = SQRT[Var(\varepsilon_{i,d})]$ IVol_FF3 of stock i in month t is the standard deviation of $\varepsilon_{i,d}$ of the past 20 trading days.
Illiquidity	Following Amihud (2002), illiquidity on day t is calculated as: $Illiquidity_t = \lvert ret_t \rvert / Volume_t$ $Volume_t$=Volume×close/1,000,000,000 Where $\lvert ret_t \rvert$ is the absolute return on day t, and $volume_t$ is the dollar trading volume on day t. Illiquidity is measured as the average daily illiquidity of the past 20 trading days.
12-Mon. Turn.	12-month turnover is measured as the average daily share turnover for the past 250 trading days. Where daily turnover is calculated as share trading volume divided by total shares outstanding.
1-Mon. AbnTurn.	One-month abnormal turnover is the average daily turnover of the past 20 trading days scaled by average daily turnover of the past 250 trading days.
Reversal	The reversal in week t is measured as cumulatuve daily stock return in week t-1.

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Panel B: Anomaly definition	
Anomaly	Definition
Momentum	Momentum is the cumulative return from month t-12 to month t-2. To calculate momentum, we require a return that is non-missing for >6 months.
52-week high	Following George and Hwang (2004), a 52-week high is defined as close price at the end of week t, scaled by the highest price over the past 250 trading days.
Anomaly	Definition
EP	Net income, scaled by market equity.
CP	Change in cash between year t and year t-1 and scaled by market equity in year-end t-1.
BM	BM is the book-to-market ratio.
ROA	ROA is net income scaled by total assets.
ROE	ROE is net income scaled by book equity.
OP	OP is revenue minus cost of goods sold, minus selling, general, and administrative expenses, minus interest expense, all scaled by book equity.
GP	Gross profit is revenue minus cost of goods sold scaled by total assets.
Asset growth	Asset growth is the change in total assets from the fiscal year-end t-2 to the fiscal year-end t-1, scaled by total assets at the fiscal year-end t-2.
Equity Growth	Equity growth is the change in book equity from the fiscal year-end t-2 to the fiscal year-end t-1, scaled by book equity at the fiscal year-end t-2.

Appendix B. Additional results

Table A1
Abilities of the VN-3, VN-4, and FF-5 models to explain each other's factors.

	Factor Model		
	VN-3	VN-4	FF-5
Alpha			
SMB_{FF5}	−0.02	−0.01	
t-statistic	(−0.09)	(−0.42)	
HML_{FF5}	−0.04	0.10	
t-statistic	(−0.52)	(1.26)	
CMA_{FF5}	0.01	0.01	
t-statistic	(0.09)	(0.15)	
RMW_{FF5}	0.14	0.03	
t-statistic	(1.94)	(0.38)	
SMB_{VN3}			0.01
t-statistic			(0.27)
VMG_{VN3}			0.05
t-statistic			(0.92)
SMB_{VN4}			0.04
t-statistic			(2.13)
VMG_{VN4}			0.05
t-statistic			(0.92)
LMI_{VN4}			0.38
t-statistic			(5.55)
GRS F-statistics			
SMB_{FF5}, HML_{FF5}, CMA_{FF5}, RMW_{FF5}	1.16	0.89	
p-value	(0.337)	(0.468)	
SMB_{VN3}, VMG_{VN3}			1.16
p-value			(0.316)
SMB_{VN4}, VMG_{VN4}, LMI_{VN4}			10.29
p-value			(1.32×10^{-6})

This table compares abilities of the VN-3, VN-4, and FF-5 models to explain each other's factors. The top panel presents a factor's estimated weekly alpha with respect to the other model. VN-3 includes factors of market, size (SMB), and EP (VMG). VN-4 includes factors in VN-3 and additionally twelve-month turnover (UMP). T-statistics are reported in parentheses based on Newey-West standard errors with six lags. The bottom panel reports the GRS F-test of whether a model produces zero alphas for the factors of the other model with *p* -value reports in parentheses. The sample period is from July 2008 to June 2022.

Table A2
FF-5 factor alphas and factor loadings for anomalies.

Panel A: Fama-French five-factor model

Category	Anomaly	α	β_{MKT}	β_{SMB}	β_{HML}	β_{RMW}	β_{CMA}	t(α)	t(β_{MKT})	t(β_{SMB})	t(β_{HML})	t(β_{RMW})	t(β_{CMA})
Beta	Beta	−0.03	0.45	0.23	0.06	0.02	−0.09	−0.39	8.25	2.88	0.97	0.16	−1.28
Volatility	1-Mon. Volatility	**−0.13**	0.44	0.29	0.18	0.10	−0.32	**−1.74**	11.45	4.42	3.16	1.72	−4.07
Volatility	Max Volatility	−0.12	0.38	0.42	0.09	−0.07	−0.10	−1.49	8.30	5.90	1.35	−1.14	−1.27
Idio. Volatility	IVol	**−0.15**	0.13	0.17	0.18	0.04	−0.32	**−1.98**	3.72	2.92	2.90	0.67	−4.41
Idio. Volatility	IVol_FF3	**−0.15**	0.06	0.20	0.11	0.09	−0.22	**−1.87**	1.93	3.64	2.09	1.33	−3.27
Illiquidity	Illiquidity	**0.15**	−0.41	0.22	−0.17	0.09	0.10	**1.91**	−8.41	3.28	−3.76	1.77	1.93
Turnover	12-Mon. Turn.	**−0.38**	0.54	0.48	0.48	−0.12	−0.22	**−4.54**	10.84	6.48	6.58	−1.85	−2.67
Turnover	1-Mon. AbnTurn.	**0.22**	0.42	0.15	−0.00	0.16	−0.08	**2.49**	11.29	2.71	−0.04	1.86	−0.98
Reversal	Reversal	**−0.25**	0.01	0.31	−0.12	0.06	0.03	**−1.93**	0.08	2.68	−1.27	0.59	0.24
Momentum	Momentum	0.16	−0.13	−0.19	0.22	−0.24	0.06	1.31	−1.87	−1.70	2.23	−2.52	0.60
52-week high	52-Week High	**0.36**	−0.41	−0.23	−0.03	0.18	0.02	**2.70**	−6.75	−1.77	−0.31	1.88	0.17
Value	EP	0.08	−0.09	0.04	0.29	−0.34	0.54	1.21	−3.41	0.78	5.47	−6.42	8.99
Value	BM	−0.00	0.04	0.04	0.94	0.05	−0.07	−0.03	3.01	1.88	35.78	1.53	−1.79
Value	CP	0.08	−0.01	0.04	−0.08	−0.24	0.02	1.36	−0.29	0.84	−2.27	−4.02	0.62
Profitability	ROA	0.06	−0.25	−0.12	−0.10	−0.29	0.24	0.74	−6.82	−2.21	−2.05	−4.35	4.22
Profitability	ROE	**0.17**	−0.13	−0.09	−0.22	−0.34	0.61	**2.48**	−3.56	−2.06	−4.50	−6.21	10.26
Profitability	OP	0.05	−0.04	−0.12	−0.08	−0.12	0.89	1.21	−2.02	−3.82	−2.43	−3.49	18.2
Profitability	GP	**0.15**	−0.29	−0.09	−0.18	−0.08	0.53	**2.15**	−7.98	−1.73	−3.18	−1.43	8.91
Investment	Asset Growth	0.06	−0.01	−0.09	−0.06	−0.57	−0.18	1.02	−0.67	−2.15	−1.69	−8.00	−4.24
Investment	Equity Growth	−0.06	0.01	0.01	0.01	−0.07	0.04	−1.01	0.35	0.31	0.23	−1.65	0.92

Panel B: EP Adjusted Fama-French five-factor model

Category	Anomaly	α	β_{MKT}	β_{SMB}	β_{VMG}	β_{RMW}	β_{CMA}	t(α)	t(β_{MKT})	t(β_{SMB})	t(β_{VMG})	t(β_{RMW})	t(β_{CMA})
Beta	Beta	−0.03	0.45	0.26	−0.03	0.02	−0.09	−0.4	8.66	3.53	−0.41	0.18	−1.21
Volatility	1-Mon. Volatility	**−0.13**	0.45	0.36	0.03	−0.39	0.15	**−1.73**	11.42	5.61	0.41	−5.30	2.50
Volatility	Max Volatility	−0.11	0.38	0.45	−0.10	−0.08	−0.08	−1.48	8.70	6.98	−1.38	−1.00	−1.27
Idio. Volatility	IVol	**−0.15**	0.15	0.25	0.01	0.10	−0.39	**−1.96**	4.15	4.11	0.20	1.53	−6.02
Idio. Volatility	IVol_FF3	**−0.15**	0.07	0.24	0.05	0.13	−0.27	**−1.90**	2.34	4.22	0.80	1.83	−4.34
Illiquidity	Illiquidity	**0.14**	−0.43	0.13	0.07	0.02	0.18	**1.68**	−8.29	1.93	1.33	0.38	3.29
Turnover	12-Mon. Turn.	**−0.38**	0.61	0.64	0.30	−0.48	0.06	**−4.36**	11.12	8.97	3.35	−5.65	0.82
Turnover	1-Mon. AbnTurn.	**0.21**	0.42	0.14	0.02	−0.07	0.16	**2.46**	11.82	2.55	0.26	−0.90	1.69
Reversal	Reversal	**−0.26**	−0.02	0.25	−0.10	0.14	−0.03	**−1.96**	−0.32	2.31	−0.98	1.02	−0.27
Momentum	Momentum	0.16	−0.09	−0.09	0.11	−0.13	−0.09	1.37	−1.36	−0.81	0.96	−1.34	−0.85
52-week high	52-Week High	**0.36**	−0.40	−0.25	0.06	0.03	0.16	**2.71**	−6.62	−1.91	0.46	0.31	1.72
Value	EP	0.04	0.00	0.04	0.96	0.14	−0.10	1.01	0.11	1.74	17.81	4.19	−1.80
Value	BM	0.03	0.18	0.39	0.35	0.44	−0.60	0.34	4.25	6.50	5.44	8.15	−8.65
Value	CP	0.08	−0.02	0.00	0.03	0.05	−0.26	1.23	−0.54	0.02	0.51	1.46	−4.40
Profitability	ROA	0.03	−0.23	−0.20	0.37	−0.27	0.18	0.40	−6.65	−4.69	7.31	−4.94	3.73
Profitability	ROE	**0.15**	−0.14	−0.20	0.21	−0.39	0.65	**2.14**	−3.58	−5.29	3.86	−8.01	9.30
Profitability	OP	0.05	−0.05	−0.15	−0.02	−0.14	0.93	1.17	−2.54	−4.68	−0.37	−4.02	26.88
Profitability	GP	**0.14**	−0.30	−0.18	0.13	−0.13	0.57	**1.92**	−8.34	−3.76	2.61	−2.23	10.68
Investment	Asset Growth	0.06	−0.03	−0.11	−0.07	−0.59	−0.14	1.07	−1.14	−2.61	−1.16	−8.43	−3.77
Investment	Equity Growth	−0.06	0.01	0.01	0.01	−0.07	0.03	−1.00	0.38	0.36	0.19	−1.59	0.91

This table reports the Fama-French five factor alpha and factor loadings for each of 21 anomalies. In Panel A, alpha and beta loadings are estimated in a regression model where the dependent variable is each anomaly's weekly long-short return spread and the independent variables are market excess return (MKTRF), size factor (SMB), value factor (HML), profitability factor (RMW) and investment factor (CMA). In Panel B, we use EP as the value factor, and other factors are the same with Panel A. We first sort firms into two groups by the market value in June. Within each size group, we then create quintile portfolios sorted by the anomaly variable. Finally, we form the quintile portfolios for each anomaly by pooling the stocks in a given anomaly quintile across the two size groups. Our sample period is from July 2008 to June 2022. All t-statistics are based on Newey-West standard errors with six lags. Bold is used for alphas that are statistically significant at 0.10 level. Detailed variable definitions are in the Appendix A.

Table A3
Summary statistics for monthly three factors.

							Correlations		
	Mean	Std.	P25	Med.	P75	t-stat	MKTRF	SMB	VMG
MKTRF (%)	7.84	91.11	−47.54	10.15	58.33	1.12	1.00		
SMB (%)	7.01	62.47	−33.08	2.22	41.92	1.46	−0.15	1.00	
VMG (%)	5.99	46.44	−18.77	1.17	36.13	1.67	0.00	−0.18	1.00

This table reports summary statistics and correlations for the monthly three factors: market, size and value factors. We obtain annualized returns by multiplying the monthly return by 12. Market factor (MKTRF) is the monthly value-weighted excess return on the market portfolio constructed based on all stocks in our sample. Risk free rate is one-month interbank offer rate. Size (SMB) and Value (VMG) factors are constructed using the 6 value-weight portfolios formed on size and EP ratio. The six portfolios, which are constructed at the end of each June, are the intersections of 2 portfolios formed on market equity and 3 portfolios formed on the EP ratio. The size breakpoint is the median market equity at the end of June of year *t*. The EP is the ratio of net profit in year t-1 scaled by the product of year-end's close price and total shares in year t-1. The EP breakpoints are the 30th and 70th percentiles. SMB is the average return on the three small portfolios minus the average return on the three big portfolios. VMG is the average return on the two value portfolios minus the average return on the two growth portfolios. There are 168 months during the sample period. Detailed variable definitions are in the Appendix A.

Table A4
CAPM alphas and betas for monthly anomalies.

Category	Anomaly	R	α	β	t(R)	t(α)	t(β)
Beta	Beta	0.66	0.37	0.45	1.33	0.84	5.09
Volatility	One-month Volatility	−0.13	−0.35	0.33	−0.29	−0.79	4.88
Volatility	Max Volatility	0.19	0.01	0.28	0.48	0.02	5.68
Idiosyncratic Volatility	IVol	−0.53	**−0.56**	0.04	−1.60	**−1.73**	0.74
Idiosyncratic Volatility	IVol_FF3	−0.43	−0.40	−0.05	−1.42	−1.28	−0.94
Illiquidity	Illiquidity	0.01	0.31	−0.47	0.02	0.81	−6.37
Turnover	12-Month Turnover	−0.48	−0.89	0.63	−0.71	−1.60	7.98
Turnover	1-Month Abn. Turnover	0.53	0.51	0.04	1.54	1.47	0.86
Reversal	Reversal	0.53	0.53	0.00	1.47	1.51	0.04
Momentum	Momentum	0.49	0.69	−0.31	0.86	1.22	−2.86
52-week high	52-Week High	1.25	**1.63**	−0.58	1.75	**2.39**	−7.02
Value	EP	0.71	**0.68**	0.04	1.73	**1.71**	0.70
Value	BM	0.55	0.46	0.15	0.98	0.86	1.74
Value	CP	0.43	0.43	−0.00	1.53	1.61	−0.01
Profitability	ROA	0.07	0.22	−0.22	0.16	0.46	−4.11
Profitability	ROE	0.81	**0.88**	−0.10	1.63	**1.79**	−1.19
Profitability	OP	0.43	0.49	−0.09	0.85	1.04	−0.98
Profitability	GP	0.42	0.63	−0.32	0.84	1.38	−5.15
Investment	Asset Growth	0.12	0.09	0.05	0.34	0.27	0.62
Investment	Equity Growth	−0.13	−0.20	0.12	−0.45	−0.75	2.84

This table reports the average monthly long-short return spread (R), CAPM alpha (α) and CAPM beta (β) for each of 20 anomalies using the use size-neutral sorts. For each anomaly, we first sort firms into two groups by the market value in June. Within each size group, we then create quintile portfolios sorted by the anomaly variable. Finally, we form the quintile portfolios for each anomaly by pooling the stocks in a given anomaly quintile across the two size groups. Our sample period is from July 2008 to June 2022. All t-statistics are based on Newey-West standard errors with six lags. Bold is used for alphas that are statistically significant at 0.10 level. Detailed variable definitions are in the Appendix A.

Table A5
VN-3 Factor alphas and factor loadings for monthly anomalies.

Category	Anomaly	α	β_{MKT}	β_{SMB}	β_{VMG}	t(α)	t(β_{MKT})	t(β_{SMB})	t(β_{VMG})
Beta	Beta	0.27	0.47	0.23	−0.10	0.63	5.56	1.93	−0.81
Volatility	One-month Volatility	−0.61	0.38	0.50	−0.11	−1.55	6.08	5.56	−0.57
Volatility	Max Volatility	−0.20	0.31	0.34	−0.03	−0.65	6.58	4.57	−0.20
Idiosyncratic Volatility	IVol	**−0.77**	0.07	0.38	−0.06	**−2.97**	1.20	3.97	−0.39
Idiosyncratic Volatility	IVol_FF3	**−0.62**	−0.01	0.33	−0.00	**−2.34**	−0.30	4.34	−0.01
Illiquidity	Illiquidity	0.18	−0.46	0.08	0.16	0.43	−6.45	1.40	2.05
Turnover	12-Month Turnover	**−1.44**	0.71	0.79	0.07	**−3.45**	13.17	6.69	0.50
Turnover	1-Month Abn. Turnover	0.56	0.03	−0.09	0.02	1.60	0.64	−1.30	0.17
Reversal	Reversal	0.47	0.01	0.05	0.05	1.32	−0.09	−0.40	−0.39
Momentum	Momentum	0.77	−0.32	−0.12	−0.02	1.40	−2.73	−0.60	−0.08
52-week high	52-Week High	**1.91**	−0.62	−0.41	−0.03	**2.78**	−8.31	−4.04	−0.16
Value	EP	0.21	0.04	−0.03	0.99	1.14	1.25	−0.76	12.38
Value	BM	−0.02	0.20	0.57	0.22	−0.06	1.69	4.32	1.13
Value	CP	0.29	0.00	0.02	0.25	1.10	0.02	0.33	3.37
Profitability	ROA	0.22	−0.26	−0.34	0.44	0.57	−5.43	−4.69	5.09
Profitability	ROE	**0.99**	−0.15	−0.47	0.39	**2.71**	−1.41	−4.21	2.37
Profitability	OP	0.62	−0.13	−0.40	0.25	1.63	−1.05	−2.82	1.89

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Table A5 (*continued*)

Category	Anomaly	α	β_{MKT}	β_{SMB}	β_{VMG}	t(α)	t(β_{MKT})	t(β_{SMB})	t(β_{VMG})
Profitability	GP	**0.69**	−0.36	−0.34	0.34	**1.78**	−4.87	−3.36	3.13
Investment	Asset Growth	0.15	0.04	−0.09	0.00	0.44	0.48	−1.04	0.02
Investment	Equity Growth	−0.16	0.11	−0.12	0.07	−0.63	2.54	−1.92	0.66

This table reports the monthly Vietnamese three-factor alpha and factor loadings for each of 20 anomalies using the use size-neutral sorts. Alpha and beta loadings are estimated in a regression model where the dependent variable is each anomaly's monthly long-short return spread and the independent variables are market excess return (MKTRF), size factor (SMB) and value factor (VMG). For each anomaly, we first sort firms into two groups by the market value in June. Within each size group, we then create quintile portfolios sorted by the anomaly variable. Finally, we form the quintile portfolios for each anomaly by pooling the stocks in a given anomaly quintile across the two size groups. Our sample period is from July 2008 to June 2022. All t-statistics are based on Newey-West standard errors with six lags. Bold is used for alphas that are statistically significant at 0.10 level. Detailed variable definitions are in the Appendix A.

Table A6
VN-4 factor alphas and factor loadings for monthly anomalies.

Category	Anomaly	α	β_{MKT}	β_{SMB}	β_{VMG}	β_{UMP}	t(α)	t(β_{MKT})	t(β_{SMB})	t(β_{VMG})	t(β_{UMP})
Beta	Beta	**0.88**	0.19	−0.12	−0.15	−0.43	**1.73**	1.99	−1.21	−0.99	−2.43
Volatility	One-month Volatility	0.14	0.02	0.11	−0.18	−0.58	0.44	0.38	1.16	−0.97	−6.68
Volatility	Max Volatility	0.34	0.06	0.07	−0.08	−0.42	1.22	0.85	0.78	−0.46	−7.64
Idiosyncratic Volatility	IVol	−0.56	−0.02	0.31	−0.10	−0.20	−1.5	−0.23	3.49	−0.63	−1.46
Idiosyncratic Volatility	IVol_FF3	−0.32	−0.15	0.19	−0.04	−0.24	−0.78	−1.56	2.1	−0.33	−1.86
Illiquidity	Illiquidity	−0.37	−0.17	0.38	0.17	0.41	−1.11	−2.03	7.1	2.85	7.13
Turnover	12-Month Turnover	−0.05	0.05	0.07	−0.04	−1.06	−0.34	1.21	1.4	−0.82	−26.03
Turnover	1-Month Abn. Turnover	0.52	0.04	−0.08	0.03	0.04	1.42	0.71	−0.91	0.28	0.78
Reversal	Reversal	0.43	0.03	0.07	0.05	0.03	1.08	0.42	0.48	0.36	0.29
Momentum	Momentum	0.46	−0.18	0.08	0.01	0.20	0.66	−1.58	0.47	0.05	0.7
52-week high	52-Week High	0.98	−0.18	0.11	0.04	0.67	1.39	−1.46	0.69	0.22	3.64
Value	EP	0.27	0.00	−0.06	1.00	−0.05	1.55	0.01	−1.02	12.31	−1.24
Value	BM	0.40	0.01	0.41	0.16	−0.38	0.74	0.1	2.9	0.87	−1.99
Value	CP	0.15	0.07	0.10	0.26	0.10	0.5	0.68	1.16	3.63	1.21
Profitability	ROA	−0.04	−0.15	−0.22	0.48	0.21	−0.09	−2.21	−2.46	5.57	2.84
Profitability	ROE	**0.94**	−0.14	−0.51	0.43	0.10	**1.69**	−1.82	−4.16	2.52	0.52
Profitability	OP	0.54	−0.09	−0.43	0.29	0.13	0.94	−1.04	−3.12	2.08	0.59
Profitability	GP	0.29	−0.17	−0.17	0.38	0.33	0.74	−2.61	−1.4	3.73	2.83
Investment	Asset Growth	−0.17	0.19	0.08	0.02	0.23	−0.46	1.86	0.84	0.15	3.44
Investment	Equity Growth	−0.15	0.10	−0.15	0.08	0.01	−0.58	2.25	−2	0.72	0.29

This table reports the monthly Vietnamese three-factor and a twelve-month turnover factor alpha and factor loadings for each of 20 anomalies using the use size-neutral sorts. Alpha and beta loadings are estimated in a regression model where the dependent variable is each anomaly's monthly long-short return spread and the independent variables are market excess return (MKTRF), size factor (SMB), value factor (VMG) and turnover factor (UMP). For each anomaly, we first sort firms into two groups by the market value in June. Within each size group, we then create quintile portfolios sorted by the anomaly variable. Finally, we form the quintile portfolios for each anomaly by pooling the stocks in a given anomaly quintile across the two size groups. Our sample period is from July 2008 to June 2022. All t-statistics are based on Newey-West standard errors with six lags. Bold is used for alphas that are statistically significant at 0.10 level. Detailed variable definitions are in the Appendix A.

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