Enhancing Momentum Strategy with Insider Transaction Information in the Stock Exchange of Thailand

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ยกระดับกลยุทธ์โมเมนตัมด้วยกิจกรรมซื้อขายของบุคคลวงในในตลาดหลักทรัพย์แห่งประเทศไทย

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วิทยานิพนธ์ฉบับนี้ นำเสนอแนวทางใหม่ในการยกระดับกลยุทธ์โมเมนตัมในตลาดหลักทรัพย์แห่งประเทศไทย โดยผสมผสานกลยุทธ์โมเมนตัมแบบดั้งเดิมที่มุ่งเน้นไปที่ผลตอบแทนในอดีต เข้ากับข้อมูลเชิงลึกจากกิจกรรมซื้อขายของบุคคลวงในที่เปิดเผยผ่านแบบฟอร์ม SEC 59-2 แนวทางแบบควบคู่นี้มีจุดวัตถุประสงค์เพื่อสร้างพอร์ตการซื้อขายที่แข็งแกร่ง โดยทำการซื้อหลักทรัพย์ที่ให้ผลตอบแทนสูงในอดีตซึ่งได้รับการสนับสนุนโดยการซื้อจากบุคคลวงใน และทำการขายหลักทรัพย์ที่ให้ผลตอบแทนต่ำในอดีตพร้อมกับการขายของบุคคลวงใน โดยบทวิเคราะห์นี้ครอบคลุมช่วงเวลาตั้งแต่มกราคม 2559 ถึงธันวาคม 2565 ซึ่งรวมถึงช่วงที่ตลาดหลักทรัพย์แห่งประเทศไทยเกิดสภาวะตกต่ำจากการประสบวิกฤติที่เกิดจากการระบาดของ COVID-19

สิ่งที่น่าสนใจของการศึกษาในครั้งนี้คือ การค้นพบศักยภาพของการใช้ข้อมูลกิจกรรมซื้อขายของบุคคลวงในเพื่อสร้างพอร์ตการซื้อขายที่สามารถคาดการณ์การเคลื่อนไหวของหุ้นในอนาคตได้ นอกจากนี้การบูรณาการข้อมูลกิจกรรมซื้อขายของบุคคลวงในเข้ากับกลยุทธ์โมเมนตัมช่วยปรับปรุงประสิทธิภาพของพอร์ตโฟลิโอในแง่ของผลตอบแทนที่แข็งแกร่งขึ้นทั้งในระยะสั้นและระยะยาว น่าเสียดายที่เรายังไม่สามารถระบุวิธีแก้ปัญหาเพื่อทำให้กลยุทธ์โมเมนตัมที่ถูกยกระดับนี้นี้มีความยืดหยุ่นในช่วงวิกฤตที่ตลาดตกต่ำ ซึ่งอาจนำไปสู่การล่มสลายของโมเมนตัมได้

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This study introduces a novel approach to enhancing the momentum strategy in the Thai stock market. We combine the traditional momentum strategy, focusing on historical performance, with insights from insider transactions disclosed via SEC 59-2 forms. This dual approach aims to construct robust trading portfolios, with long positions in high-performing stocks backed by recent insider purchases and short positions in underperforming stocks accompanied by recent insider sales. Notably, our analysis spans the period from January 2016 to December 2022, encompassing the tumultuous era of the COVID-19-induced Thai stock market crashes.

Interestingly, we discovered the potential of using insider transaction information to construct trading portfolios capable of predicting future stock movements. Moreover, the integration of insider transaction data with the momentum strategy improved our portfolio's performance in terms of stronger returns and increased robustness over time. Regrettably, we have not yet identified a solution to make this momentum strategy resilient during market crash periods, which can lead to momentum crashes.

Field of Study:	Finance	Student's Signature .....
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CHAPTER 1
INTRODUCTION

1.1 Background and significance of the problem

Momentum strategies form a crucial part of this study. Traced back to the work of Jegadeesh and Titman (1993), momentum strategies operate on the premise of trend continuation, whereby securities exhibiting strong past performance are expected to continue their upward trajectory, and those with poor past performance are likely to continue underperforming. This approach primarily focuses on past price trends, buying 'winners' and selling 'losers'. Momentum strategies have been a very popular topic since then. Many studies have tried to explain the mechanism of this strategy in generating profitability. For example, Jegadeesh and Titman (1993) and Carhart (1997) applied risk-based approach to explain this phenomenon, unfortunately, this approach cannot fully explain this. Jegadeesh and Titman (2001) explained the momentum profits is supported by the behavioral model approach as the profits arise from delayed overreactions that eventually reverse. Some study tries to extend momentum strategies to other spectrum, Asness et al. (2013) found evidence of momentum in a variety of asset classes and markets. In the past decades, momentum strategies have been developed and modified to enhance the ability to generate profits (Hanauer & Windmüller, 2023).

However, these strategies can be prone to sudden reversals, particularly during volatile market conditions, leading to potential losses. Despite the potential profits from momentum strategies, they do not always yield positive returns. Certain market conditions can lead to significant losses. Building on the understanding of momentum strategies, it is also critical to consider the risks they pose. In a notable study, Daniel and Moskowitz (2016) shed light on the phenomenon of 'momentum crashes' referring to the periods when momentum strategies generate negative returns. These crashes tend to occur during periods of high market volatility and following market

declines, coinciding with market rebounds. They are particularly pronounced in what the authors refer to as ‘panic states’.

In light of the potential challenges associated with momentum strategies, notably the risk of ‘momentum crashes’ during periods of high market volatility, it is crucial to explore avenues that could enhance the effectiveness of these strategies. One such avenue involves the integration of additional predictive factors, which could potentially improve the strategies' predictive power and profitability. A particularly promising source of such predictive factors is insider transaction information.

The interaction between insider trading and financial markets has always been a focal point of interest, primarily due to the unique insights it can provide into a company's prospects. Corporate insiders, by virtue of their positions, have privileged access to company specific information. Studies indicate that such trading typically results in abnormal returns (Seyhun, 1992). These unusual profits can be attributed to the utilization of insider information (Givoly & Palmon, 1985; Seyhun, 1986). Their trading activities informed by this knowledge may not only offer them a personal advantage but also reflect the firm's future trajectory and may reveal the internal information that a corporate insider held (Jenter, 2005; Lakonishok & Lee, 2001). While the conduct of insider trading has been extensively studied in developed markets like the U.S., a marked research gap exists in the context of emerging markets, such as Thailand, where the regulatory environment and litigation risk differ (La Porta et al., 2000).

Insider trading, both in terms of active trading and periods of silence, can be rich in informational value. Active insider trading often signals insiders' perceptions of the company's future performance. Conversely, insider silence, where there is an absence of trading activity, can also convey informative signals about the firm's prospects and provide indirect signals about future price movements.

This study proposes to explore the possibility of enhancing momentum strategies by incorporating insider trading information by to rationally hypothesizing and investigating its potential based on theory and empirical evidence. By considering not only past price trends but also the informational value of insider trading, it is proposed that a more holistic view of a stock's prospects could be achieved.

Furthermore, in volatile market environments where momentum strategies typically falter, the inclusion of insider trading information could potentially provide a stabilizing factor. It could assist in identifying stocks likely to rebound or continue underperforming, thereby helping mitigate potential losses.

Within the scope of this study, it is important to elucidate the concept of 'insider trading.' Insider trading, as referred to in this context, does not imply illicit transactions or the use of confidential information for personal gain. Instead, it denotes the lawful buying and selling activities of individuals who hold influential positions within a company, such as CEOs, board members, or other senior management members. These insiders possess a unique and nuanced understanding of the company's workings, operations, and potential future trajectory, which can be reflected in their personal trading decisions. Under Thai regulation, these insiders are required to disclose their trading activities publicly via the Securities and Exchange Commission, Thailand (SEC) 59-2 form, ensuring transparency. It is the insights gleaned from this publicly available information, combined with the momentum strategies, that this study seeks to harness.

1.2 Objective

The first objective of this study is to examine the informativeness of insider trading activities (buying, selling) in the context of the Thai stock market. This includes studying the performance of stocks following insiders' actions and constructing an insider portfolio.

The second objective of this study is to develop and evaluate momentum strategies that incorporate insider trading information, specifically for both buy and sell signals. This involves creating a refined approach to stock selection and portfolio management, wherein stock insiders have bought from both past winner and loser momentum portfolios and are selected for a long position, and the stocks that insiders have sold from both past winner and loser momentum portfolios are selected for a short position.

The third objective of this thesis is to investigate the performance of momentum strategies incorporating insider transaction information during market

panic, such as momentum crashes. This includes analyzing the time-varying behavior of these strategies during turbulent market conditions.

1.3 Research Hypothesis

Hypothesis 1: Insider trading activities (buy and sell) are informative regarding stock performance in the Thai stock market, with insider buys being more informative.

Insider buys are typically motivated by an insider's belief in the company's future prospects, as they invest their own money expecting a return. On the other hand, insider sells can be driven by various motives, such as liquidity needs or diversification needs (Cohen et al., 2012), making them less informative. Therefore, insider buys are considered more informative about the stock's future performance.

Hypothesis 2: Momentum strategies that incorporate insider trading information can generate higher return than conventional momentum strategy.

The integration of insider trading information into momentum strategies, specifically insider buy and sell signals, can lead to superior investment performance. Consider that when the insider buys or sells the stock, it can reflect insiders' confidence or lack thereof in a stock's future performance (Seyhun, 1986). Coupled with momentum investing, which focuses on buying stocks with an upward price trend, this combination offers a refined approach to stock selection. This strategy targets not just stocks exhibiting momentum (both past winners and losers) but also those displaying insider confidence or skepticism, as indicated by their buying, or selling activities.

Hypothesis 3: Enhancing momentum strategies with insider information can generate abnormal return even in the period of market panic.

During momentum crashes, when past loser stocks tend to outperform past winner stocks (Daniel & Moskowitz, 2016), momentum strategy incorporating insider transaction information is hypothesized to exhibit resilience and potentially positive returns. The reason behind this is twofold. Firstly, by taking a long position in past

loser stocks which insiders choose to buy, the strategy stands to benefit from the impending reversal during a momentum crash. Insiders buying into these stocks suggest their confidence in the stocks' potential for rebound. Secondly, by taking a short position in past loser stocks which insiders choose to sell, the strategy capitalizes on stocks that are likely to continue underperforming, even in a momentum crash scenario. Essentially, the strategy leverages insiders' informed decisions to balance the portfolio effectively during momentum crashes, potentially sustaining or even enhancing its performance despite market downturns.

1.4 Significance of the study

By analyzing the performance of stocks following insiders' actions, this in-depth analysis aims to shed light on the motivations underlying insider activities, whether they involve active trading or deliberate periods of inactivity. The contribution of this objective is seeking to enhance the existing literature on insider trading in the Thai stock market by providing a comprehensive understanding of insider motives behind buying, selling, or remaining silence. This study fills the knowledge gap about the stocks that were not traded by the insider. The findings of this objective will strengthen the overall understanding of the dynamics at play in insider trading and its effects on the Thai stock market.

By integrating insider trading information into momentum strategies, this strategy incorporates the dual dynamics of momentum investing and insider trading insights to enhance stock picking and manage the portfolio and could be able to contributes to the existing body of knowledge and could be able to potentially achieve a number of significant benefits. The first is enhanced stock selection. Traditional momentum strategies rely primarily on past price trends, buying securities that have shown strong performance and selling those with poor performance. However, this approach does not consider the potential informational value of insider trading. By incorporating insider trading activity and inactivity into the selection process, we could identify stocks that not only have shown strong price trends but also have been targeted by insiders. This could provide a more holistic perspective on a stock's prospects, resulting in a more refined and potentially more effective selection process.

Secondly, these enhanced momentum strategies could potentially improve portfolio performance. Insider trading information, reflecting the informed perspectives of insiders, could provide early signals of a stock's future performance. By acting on these signals, investors could adjust their positions ahead of the broader market, potentially capturing superior returns. Moreover, during periods of market panic, when momentum strategies typically suffer, insider trading information could serve as a stabilizing factor, helping to identify stocks that are likely to rebound or continue underperforming and limit the losses. The Thai stock market offers a particularly advantageous environment for this research. Unlike in the U.S., where regulations and litigation risks place constraints on insider trading, the Thai market allows insiders to trade more freely. This freedom means that insider trading activity and inactivity in Thailand may be more indicative of insiders' true beliefs about their companies' prospects. This could, in turn, make the signals from insider trading more reliable and actionable for investors. Furthermore, the relatively unexplored nature of this topic in the Thai market provides a rich opportunity for novel research and discovery.

In relation to the Efficient Market Hypothesis (EMH), this study carries the potential to provide academic contribution on the perspectives of market efficiency, particularly within the context of an emerging market like Thailand. The EMH posits that all available information is fully reflected in stock prices. However, the ability of insiders to earn abnormal returns, as well as the momentum strategies, stands as a challenge to this theory. Firstly, by examining the performance of stocks following insider transactions, this study indirectly investigates the strong form of EMH, which asserts that even non-public, insider information is reflected in stock prices. If insiders in the Thai market can achieve abnormal returns by trading on their private information, it would suggest a departure from strong-form efficiency. Secondly, the proposed approach of integrating insider trading information into momentum strategies also holds implications for the weak form of EMH. The weak form of EMH argues that past price information is fully reflected in stock prices, meaning that technical analysis and trading rules based on past prices (such as momentum strategies) should not lead to abnormal returns. However, if the enhanced momentum strategy proposed in this study does yield higher returns, it could provide additional evidence against weak-form efficiency.

CHAPTER 2
LITERATURE REVIEW

2.1 Momentum strategies

2.1.1 Introducing momentum strategies

Momentum strategies was first introduced by Jegadeesh and Titman (1993) who discovered that by investing in securities that had demonstrated strong performance in the past 3 to 12 months and selling those that had shown poor performance, investors could achieve abnormal returns. Notably, these returns are not attributable to systematic risk or delayed stock price reactions to common factors, but possibly to delayed reactions to firm-specific information. However, the profitability of these strategies diminishes over time, suggesting their efficacy is time dependent. The study also notes dynamic returns around earnings announcements for past winners and losers, challenging traditional notions of return reversals and return persistence. The paper underscores the need for further research to elucidate the precise mechanism behind the observed trends, potentially involving investor behavior and market reactions.

There are numbers of literature that studied about the abnormal return generated from momentum strategy. Fama and French (1996) provides a critical examination of the anomalies observed in stock returns in relation to firm characteristics such as size, earnings/price ratio, cash flow/price ratio, book-to-market equity, past sales growth, long-term past return, and short-term past return. While these patterns seem to contradict the predictions of the Capital Asset Pricing Model (CAPM), the authors argue that they largely vanish under a three-factor model. This finding suggests that the observed anomalies may be consistent with rational pricing models such as the Intertemporal CAPM (ICAPM) or the Arbitrage Pricing Theory (APT), although irrational pricing and data issues are also proposed as potential explanations. Despite the three-factor model's success, it fails to account for the continuation of short-term returns as known as momentum strategies.

The mystery under the abnormal return that momentum strategies generate remains unsolved until Jegadeesh and Titman (1993), researchers who originate the momentum strategies unfolded the reason behind this abnormal return and why this return cannot be explained by risk-based model. Jegadeesh and Titman (2001) discuss the behavioral models which suggest that momentum profits may be due to delayed overreactions that are later corrected. The study confirms that the momentum profits observed in the 1990s were consistent with earlier findings, implying these were not merely results of data snooping bias.

In the context of emerging markets, Butt et al. (2021) explores the cross-sectional and time-series properties of momentum returns in 19 emerging markets. The study finds that overall momentum profits are lower in these markets, which can be explained by the negative relationship between momentum returns and the market factor in down market states. However, risk management of momentum can increase returns, Sharpe ratios, and asset pricing model alphas by reducing exposure to the market factor. The study also reveals that momentum returns are lower in risk averse emerging markets, with momentum crashes typically occurring during periods of high-risk aversion.

2.1.2 Enhancing momentum strategies

Momentum strategies have been developed and enhanced from time to time. According to the study by Barroso and Santa-Clara (2015) found that unconditional momentum has a far-from-normal distribution, with substantial crash risk which has highly variable but can be predicted over time. They develop a constant volatility-scaled momentum strategy, with the effective management of the risks can eliminate exposure to crashes and significantly increases the strategy's Sharpe ratio. Daniel and Moskowitz (2016) proposes a dynamic momentum strategy that uses bear market indicators and ex ante volatility estimates to forecast the conditional mean and variance of momentum strategies. This strategy approximately doubles the alpha and Sharpe ratio of a static momentum strategy. In 2021, the semi-constant volatility-scaled momentum strategy has been further developed by Wang et al. (2021), they found that the profits from momentum strategies are more pronounced when arbitrage

capital is scarcer and market liquidity is lower, and that both the level and persistence of anomaly returns are positively related to idiosyncratic volatility. These findings suggest that market conditions and idiosyncratic volatility can significantly influence the performance of momentum strategies that exploit the persistence of anomaly returns.

The aforementioned strategies are strategies that enhance momentum strategies by it’s volatility which is not the only way to enhance. Yang and Zhang (2019) focuses on the influence of stocks with extreme absolute strength on momentum portfolios' performance. The study reveals that such stocks possess high volatility and a high probability of losing momentum and finds that excluding these volatile stocks from traditional momentum portfolios significantly enhances their performance by reducing volatility and increasing the average return in many cases. This strategy is especially beneficial for portfolios with long formation periods and holding periods. Blitz et al. (2020) establishes that idiosyncratic momentum strategies generate similar average returns to conventional momentum strategies, but with half the volatility. This suggests that idiosyncratic momentum is a separate factor that expands the efficient frontier of existing asset pricing factors. The research also highlights that idiosyncratic momentum profits remain positive following both bull and bear markets, suggesting that the returns are not significantly impacted by market dynamics. This opposes the overconfidence and overreaction explanations for the anomaly. Moreover, the exposure to non-linear crash risk is substantially lower in idiosyncratic momentum than in total return momentum. Byun and Jeon (2023) investigates the issue of large drawdowns, or "momentum crashes," experienced by momentum strategies during market rebounds. It identifies increased investor speculation towards stocks far from their 52-week highs as a partial explanation for these crashes. When momentum strategies are revised to be neutral to the 52-week high effect, the likelihood of momentum crashes is significantly reduced, and the revised strategy exhibits more stable returns across various market states. This revised strategy also outperforms the conventional strategy in terms of Sharpe ratio across different sub-periods and international stock markets.

2.1.3 Risks of momentum strategies

Daniel and Moskowitz (2016) investigates the inconsistent performance of momentum strategies across various asset classes. The study finds that these strategies, despite providing strong positive average returns, can suffer prolonged periods of negative returns - momentum crashes - particularly during market panic states, post-market declines, or high-volatility periods. These crashes are somewhat predictable and coincide with market rebounds. The paper introduces a dynamic momentum strategy based on momentum's mean and variance forecasts, which significantly improves the alpha and Sharpe ratio compared to a static strategy. While different explanations for these phenomena, such as compensation for crash risk, volatility risk, and other factor risks, were considered, none fully accounted for the observed results.

2.2 Insider transactions

A significant amount of literature tries to document how corporate insiders exploit their private information by conducting insider trading. Givoly and Palmon (1985) indicate that a significant portion of the abnormal performance observed in insider trading can likely be ascribed to price changes stemming from the information disclosed through the trades themselves not the subsequent disclosure of specific news about the company that insiders might have prior knowledge of. The study of Seyhun (1986) demonstrates that insiders can predict abnormal future stock price changes, buying stock prior to an abnormal price increase and selling before an abnormal decline. Different insiders have varying degrees of information quality, with those more knowledgeable about the firm's overall affairs, such as board chairmen or officer-directors, being more successful predictors of future abnormal stock price changes. Lakonishok and Lee (2001) found that valuable information from insider activity is initially overlooked by the market. Aggregate insider trading appears to predict market movements, and this ability is partially explained by the finding that insiders act as contrarian investors. Insider trading information remains beneficial even after adjusting for the predictive power of simple contrarian strategies.

The informativeness of insider buys and sells are not equivalent. Jenter (2005) found that insider transactions are informative, especially insider purchases considering the fact that insiders' buys and sells actions are driven by different motive. While insider buys are motivated by insider's valuation, but many insider sales are motivated by liquidity or diversification needs (Cohen et al., 2012). (Hsieh et al., 2023) indicates that insider buying is found to be more significant than selling, with top insiders' trades containing more valuable information. Evidence shows that the profitability from insider sales is limited by high regulations in the U.S., Ke et al. (2003) document the lack of abnormal return in insider sales compare to the abnormal return from insider purchases, conclude that this is due to legal constraint in the U.S. stock market where the risk for legal persecution from opportunistic insider sales is considerably higher than opportunistic insider purchases.

In our study, we argue that in the stock market of Thailand the information contain in insider trading activity is not the same as in the U.S. stock markets. As, the regulation and litigation risk in Thailand are relatively low comparing to the U.S. (La Porta et al., 2000), corporate insiders in Thailand can conduct their trading transactions relatively freely which will enable corporate insiders in Thailand to be able to sell their stocks when they acquire negative information and anticipate stock's price to drop without fear of being litigated. Evidence in Thailand also suggest that corporate insiders in the Thai stock market earn abnormal returns from conducting sales transaction on their stocks (Ingkasit & Leemakdej, 2018).

Considering insider inactivity (silence), insider silence also contains valuable information about a firm's future performance. DeVault et al. (2022) examined whether investor decisions not to trade certain stocks carry informative value. Their findings revealed that portfolios of insider transaction contain information about non-traded securities. The not-sold stocks tend to outperform the not-bought stocks on average. This phenomenon can be attributed to liquidity-driven selling actions, which also explained why insider-sale strategies underperform or are less informative than insider-buy strategies. When insiders need liquidity, they may be forced to sell stocks even if those stocks are undervalued. However, stocks that have not been sold, or not-sold stock, during that period may signal an even greater degree of undervaluation.

The study by Hong and Li (2019) provides evidence that investors often overlook the importance of an absence of activity, specifically focusing on insider silence after routine stock trading. The paper suggests that routine insiders, who possess private information not yet reflected in stock prices, strategically choose to cease trading activity. The research finds that a sudden halt in selling activity by insiders predicts positive future returns and improvement in fundamentals, whereas the abrupt stop of purchasing predicts negative returns. Gao et al. (2021) studies into the concept of insider silence, characterized by periods without insider trading, hypothesizing that this inactivity signifies the anticipation of unfavorable corporate news. The paper proposes that insiders strategically avoid selling their company shares when they foresee bad news to evade litigation risk, and similarly, they would not buy if they predicted poor prospects. As such, they remain inactive or 'silent'. The study discovers that future stock returns are substantially lower after periods of insider silence compared to following insider net selling. This pattern is more prominent among companies with increased litigation risk. The researchers examined two quasi-natural experiments where changes in law caused shifts in shareholder litigation risks for insiders. They found that with heightened litigation risks, stocks of companies where insiders remain silent significantly underperform compared to other stocks. This underscores the potential predictive value of periods of inactivity or 'insider silence' in the financial markets.

2.3 Momentum strategies with insider information

DeVault et al. (2022) provide indirect evidence supporting the integration of insider activity and momentum strategies. Their research indicates that combining the ‘not-sold’ signal a form of insider inactivity with past winners (a component of momentum strategies) yields profitable outcomes. Specifically, the portfolio comprised of not-sold stocks that are also past winners demonstrates considerable profitability, even after accounting for trading costs. This finding suggests that insider activity information, when integrated with momentum strategies, has the potential to enhance portfolio performance.

CHAPTER 3
DATA

In this study, our definition of "insiders" includes those individuals who are obligated to submit changes in their securities and derivatives holdings via Form 59. These individuals can range from directors and executive managers, to auditors, interim administrators, planners, and plan administrators. As per the regulations of the Securities Exchange Commission (SEC), these insiders are required to report changes in security holdings pertaining not only to themselves but also to their spouses, offspring, and any corporations holding more than 30% of the voting shares. The types of reported activities include buying, selling, transferring, and accepting transfers.

Since corporate insiders in Thailand are obliged to report their trading transactions to SEC in 59-2 form within three days after the trading date with no exception we are able to obtain the following information. (1) Reporter's name and positions (2) Transaction date (3) Types, volume, and average price of securities. In 59-2 form, the reported securities ins include common stock, warrants and convertible debentures and for the method of acquisition, it includes buying, selling, transferring, receiving, and converting. (4) Company name. We handily gathered the data from the 59-2 form submissions spanning from January 2016 to December 2022. The stocks are first considered as a part of insider portfolio when it first entered 59-2 form in out sample period.

However, for the purposes of this study, we narrowed our focus to the transactions involving common stock, specifically with respect to buying and selling actions. We have opted to exclude firms operating within the financial sector from our analysis. This is due to the fact that these firms are subject to extensive regulatory oversight and function under distinct rules and constraints compared to businesses in other industries. The rules governing insider trading within financial firms can be stricter and more convoluted, making the interpretation of transaction data more challenging. Moreover, the business model of a financial firm diverges significantly

from those in other sectors. Such differences can potentially impact the patterns and motivations behind insider trading.

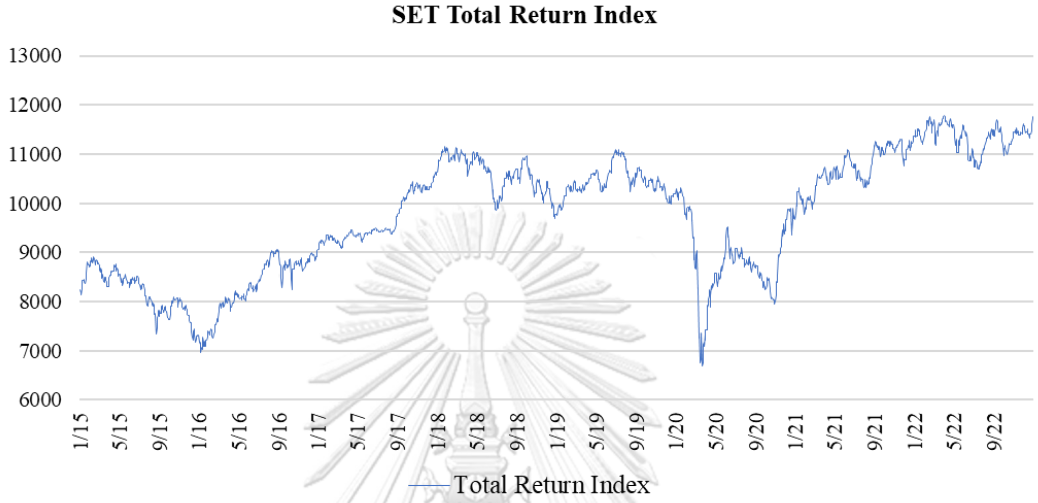
Table 3-1 Data selection procedure
This table demonstrates the sample selection before reaching the final dataset. The first column shows the selection process, and the second column shows the remaining transactions after the selections. The final dataset contains 30,868 transactions divided into 22,065 purchasing transactions, accounting for 70% of the total, and 8,803 selling transactions representing the remaining 30%. The data spans across a total of 501 companies in SET.

Sample selection	Remaining transactions
Initial number of observations	37,332
Excluding firms in financial industry	34,904
Include only common stocks	31,950
Include only buy and sell	30,868

This study gathers data from all stocks listed on the Stock Exchange of Thailand (SET) between January 2016 to December 2022 from the Bloomberg terminal. The obtained data is as follows. (1) SET total return index. SET total return index is used to determine the market return and use it as benchmark against the return of the developed strategies in this study. Additionally, it helps ascertain periods before, during, and after the market crisis—specifically referring to the COVID-19 crisis, a period marked by heightened market panic and uncertainty. (2) Daily and monthly total return index of each individual stock listed in SET. (3) Daily and monthly market capitalization of each individual stock listed in SET. This study requires market capitalization for 2 purposes. First, it is used for security allocation via a market capitalization-weighted approach. Second, it is utilized as a measure of the security's size, functioning as one of the risk adjustment factors according to the Fama and French (1993) 3-factor model. (4) Monthly market-to-book ratio of each individual stock listed in SET. Market-to-book ratio will also be use as one of the risk

adjustments factors based the Fama and French (1993) 3-factor model. (5) Monthly total return index of one-month Thai treasury bills as a proxy for risk-free rate.

Figure 3-1 SET total return index
This figure illustrates the daily total return index of SET from January 2015 to December 2022.



In this study, we seek to investigate the performance of the enhanced momentum strategy with insider transaction information in different time periods which separated in to 2 subperiods which are the period of pre-crisis, denoting the time before the market decline initiated by the COVID-19 pandemic in April 2020. Secondly, the post-crisis phase, encapsulating the period of market recovery from April 2020 onwards.

3.1 Factors construction

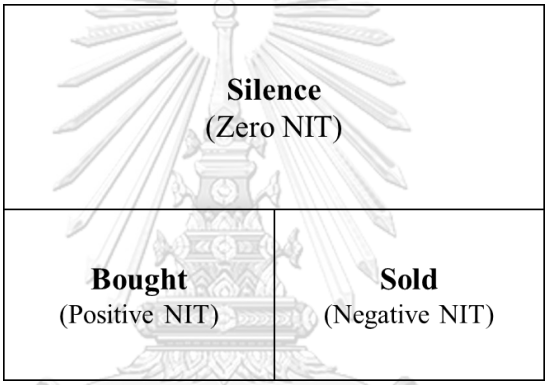
3.1.1 Insider portfolio construction

In order to classify insider trading activities, the Net Insider Transaction (NIT) is utilized as a measure, which is calculated based on the insider transactions that have occurred within the past six months. Considering portfolio constructing in month t, the NIT_t is determined by subtracting the total number of shares sold by insiders within the past period ($month\ t-1$ to $\mathrm{t}-\mathrm{k}$) from the total number of shares bought by insiders during the same period, as shown in the Equation (1).

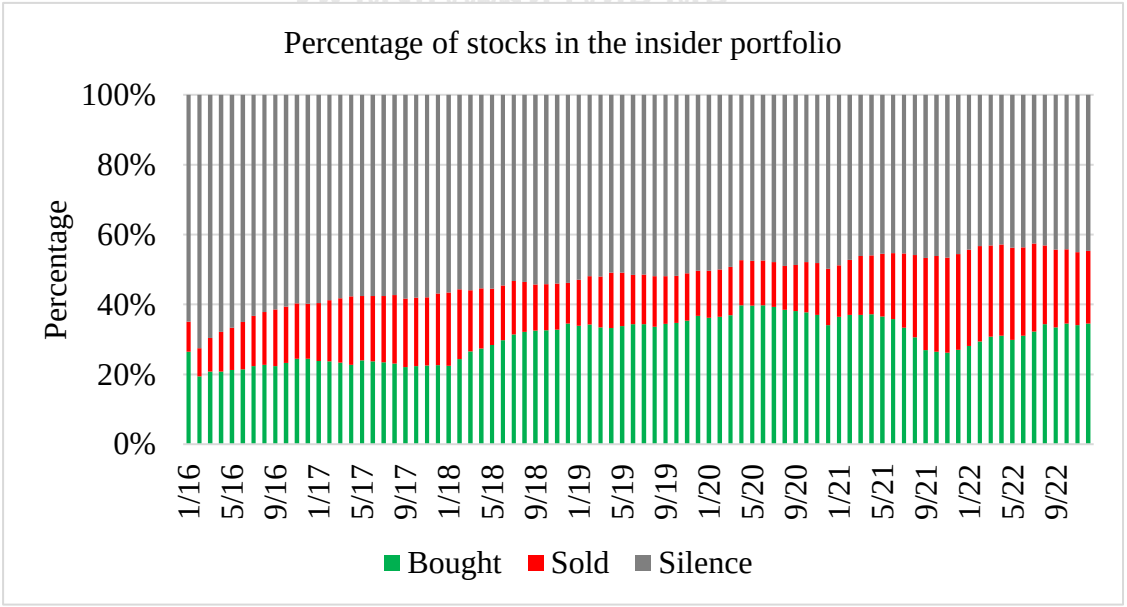
$$\mathrm{NIT}_t = \#shares\ insider\ buy_{\mathrm{t-1,t-k}} - \#shares\ insider\ sell_{\mathrm{t-1,t-k}} \quad (1)$$

A positive NIT value indicates a net buy, while a negative NIT value indicates a net sell. Stock with positive NIT will be classified as 'Bought' and stock with negative NIT will be classified as 'Sold'. However, in cases where there have been no insider trading transactions within the past period, the stocks are classified as 'Silence' as indicated in **Figure 3-2**.

Figure 3-2 Classification of stocks based on the Net Insider Transaction (NIT)
This figure illustrates the 3 types of stock classified from the Net Insider Transaction (NIT). Where 'Bought' represents the stocks with positive NIT, 'Sold' represents the stocks with negative NIT, and silence represents stock with zero NIT.



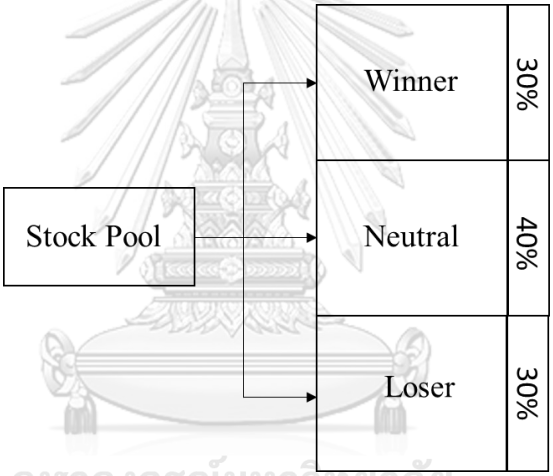
Error! Reference source not found. ***Percentage of stocks in the insider portfolio***
Illustrates the percentage of stocks in the insider portfolio from January 2016 to December 2022.



3.1.2 Momentum portfolio construction

Constructing traditional momentum portfolio following Daniel and Moskowitz (2016) by ranking the cumulative returns of stocks from 12 months before to 1 months before the formation date. Consider that the top 30th percentile stocks are the Winner, and the bottom 30th percentile stocks as the Loser as in **Figure 3-3**.

Figure 3-3 Momentum portfolio construction
This diagram illustrates the formation of momentum portfolio by using the return of stocks in the Stock Exchange of Thailand (SET) in the past 12 months to 1 month before the portfolio formation date. The stocks in SET that yield the highest return in the first 30th percentile represent high performance stocks and identified as Winner while the stock with poor performance at the bottom 30th percentile is identified as Loser.



3.1.3 SMB, HML factor construction for CAPM Three Factors Model

The Fama and French (1993) 3-factor model extends the traditional Capital Asset Pricing Model (CAPM) to include two additional factors, small-minus-big (SMB) and high-minus-low (HML), to better explain stock returns. These additional factors reflect risk associated with company size and value characteristics that are not captured by the CAPM's market risk factor alone. The SMB factor is constructed based on the size (market capitalization) of a company. Firms are sorted into two groups: small (S) and big (B). The cutoff for these groups is the median market capitalization of firms. This factor is meant to capture the size effect, which is the observation that smaller firms tend to outperform larger ones, after adjusting for risk. The SMB factor is then calculated as in Equation (2). The HML factor is constructed

based on the book-to-market equity ratio of a company. Firms are sorted into two groups: high (H) and low (L) book-to-market ratio. The stocks with the highest book-to-market above 70th percentile is considered high (H) while the stocks with book-to-market below 30th percentile us considered low (L). This factor captures the value effect, which is the tendency of companies with high book-to-market ratios (value stocks) to outperform those with low book-to-market ratios (growth stocks). The HML factor can be calculated from the Equation (3).

Figure 3-4 Portfolio classification for Fama-French factors construction
This diagram illustrates the classification of stocks based on Fama-French. Stocks are classified in to 6 group, SH—small size with high B/M, SM—small size with medium B/M, SL—small size with low B/M, LH—large size with high B/M, LM—large size with medium B/M, and LL—large size with low B/M

		B/M		
		High (Above 70th percentile)	**Medium**	**Low** (Below 30th percentile)
Size	**Small** (Below median)	SH	SM	SL
	Large (Above median)	LH	LM	LL

$$SMB_t = \frac{(r_{SH,t} + r_{SM,t} + r_{SL,t}) - (r_{LH,t} + r_{LM,t} + r_{LL,t})}{3} \quad (2)$$

$$HML_t = \frac{(r_{SH,t} + r_{LH,t}) - (r_{SL,t} + r_{LL,t})}{2} \quad (3)$$

Where SMB_t is small minus big factor at month t, HML_t is high minus low factor at month t, $r_{SH,t}$ is monthly return of stock listed in small size with high B/M at month t, $r_{SM,t}$ is monthly return of stock listed in small size with medium B/M at month t, $r_{SL,t}$ is monthly return of stock listed in small size with low B/M at month t, $r_{LH,t}$ is monthly return of stock listed in large size with high B/M at month t, $r_{LM,t}$ is monthly return of stock listed in large size with medium B/M at month t, and $r_{LL,t}$ is monthly return of stock listed in large size with low B/M month t.

Table 3-2 Descriptive statistic for regression

This table provides descriptive statistic of the monthly data spanning from January 2016 to December 2022 (84 months) used for the following regression: Market Model, Fama-French 3-Factors Model, and Fama-French-Carhart 4-Factors Model. The variables included in the table are (1) Return of SET market ($R_{m,t}$) (2) Monthly total return index of one-month Thai treasury bills as a proxy for risk-free rate ($R_{f,t}$) (3) small minus big portfolio return ($R_{SMB,t}$) (4) small size portfolio return ($R_{small,t}$) (5) big size portfolio return ($R_{big,t}$) (6) high minus low portfolio return ($R_{HML,t}$) (7) high book-to-market portfolio return ($R_{high,t}$) (8) low book-to-market portfolio return ($R_{low,t}$) (9) winner minus loser portfolio return ($R_{WML,t}$) (10) winner portfolio return ($R_{winner,t}$) (11) loser portfolio return ($R_{loser,t}$).

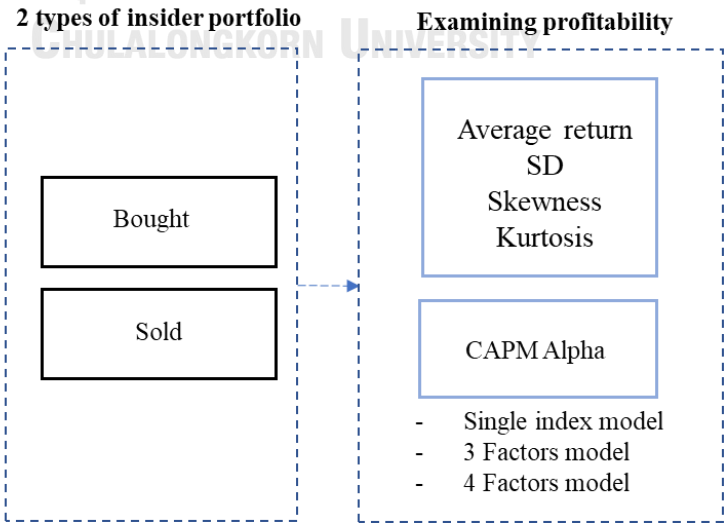
	Count	Mean	Max	Min	Median
$R_{m,t}$	84	0.60%	19.00%	-16.70%	0.59%
$R_{f,t}$	84	0.09%	0.21%	-0.01%	0.11%
$R_{SMB,t}$	84	-0.67%	10.75%	-7.50%	-0.85%
$R_{small,t}$	84	-0.23%	17.82%	-17.51%	-0.50%
$R_{big,t}$	84	0.44%	21.19%	-19.55%	0.34%
$R_{HML,t}$	84	-0.96%	8.18%	-11.43%	-0.92%
$R_{high,t}$	84	-0.38%	22.17%	-22.31%	-0.63%
$R_{low,t}$	84	0.58%	18.12%	-14.41%	0.54%
$R_{WML,t}$	84	1.28%	40.18%	-25.98%	-1.14%
$R_{winner,t}$	84	1.71%	40.08%	-18.83%	-0.72%
$R_{loser,t}$	84	0.43%	34.05%	-17.23%	0.99%

CHAPTER 4
METHODOLOGY

4.1 Examining informativeness of insider trading activity in Thailand

Following the first objective of this study, to examine the informativeness of insider trading activity in Thailand, we construct 2 types of insider portfolios (Bought and Sold) based on insider transaction activities. We also tested 2 types of portfolio formation includes the one that utilize past 3 months insider transaction information to construct the portfolio and the one with past 6 month. We are considering various types of portfolios holding period: monthly, quarterly, and semiannually, with corresponding portfolio rebalancing at the end of each respective period. The conceptual framework is depicted in ***Figure 4-1***.

Figure 4-1 Conceptual framework for examining profitability of insider portfolio
This diagram provides a conceptual framework for analyzing the profitability of two different insider portfolios: Bought and Sold. These portfolios are classified according to insider transaction activities or NIT. Returns from these portfolios are subject to two forms of analysis. The first approach is to compute statistical variables of the portfolios including average return, standard deviation, skewness, and kurtosis. The second approach is to examine abnormal returns through calculating the CAPM alpha by considering Fama-French Single index model. CAPM 3-factors model CAPM 4-factores model as risk-adjusted instrument.



We will investigate the behavior of our return distribution by observing the average annual return, standard deviation, skewness, and kurtosis.

Another approach to investigate abnormal return is through CAMP alpha. By following Market Model by Sharpe (1964), the model uses a single factor (the market return) to explain a portfolio's return. The alpha from this model measures the portion of the portfolio's return that cannot be explained by the market return. The alpha of each portfolio can be observed by regress the monthly return in the model shown in Equation (4).

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_1\left(R_{m,t} - R_{f,t}\right) + \varepsilon_{i,t} \quad (4)$$

Where $R_{i,t} - R_{f,t}$ is the monthly return of portfolio i in excess of the risk-free rate at time t. $R_{m,t} - R_{f,t}$ is the excess return of market at time t and β_1 is the sensitivity of the portfolio's excess return to the excess return of market. α_i represents the average abnormal return of portfolio i, independent of the return in the market. Essentially, a positive α_i indicates that the portfolio has outperformed the market, after adjusting for market risk, whereas a negative α_i suggests underperformance.

In addition to the aforementioned measures, the study will also employ the Fama-French Three-Factor Model (Fama & French, 1993) for examining abnormal returns. This model extends the Capital Asset Pricing Model (CAPM) by adding two additional factors – size (SMB, or 'Small Minus Big') and book-to-market value (HML, or 'High Minus Low') – to account for the observed systematic risks associated with these factors. The model will allow the investigation of whether the portfolio's returns can be explained not only by the market return but also by these two additional factors. The alpha from this model will indicate the portion of the portfolio's return that cannot be explained by the market return, size effect, or book-to-market effect. The alpha of each portfolio can be estimated by fitting the monthly returns to the model shown in Equation (5).

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_1\left(R_{m,t} - R_{f,t}\right) + \beta_2(SMB_t) + \beta_3(HML_t) + \varepsilon_{i,t} \quad (5)$$

Where $R_{i,t} - R_{f,t}$ is the return of portfolio i in excess of the risk-free rate at time t. α_i is the average abnormal return of portfolio i. $R_{m,t} - R_{f,t}$ is the excess return of market. SMB_t and HML_t are the size and book-to-market factors at time t, respectively. β_1, β_2, and β_3 are the sensitivity of the portfolio's excess return to the excess return of market, SMB_t and HML_t factors respectively.

In the context of **Hypothesis 1** of this study which states that insider trading activities (buy and sell) are informative regarding stock performance in the Thai stock market, with insider buys being more informative. When looking at insider buys, a consistently positive and significance alpha in the Bought portfolio would provide evidence supporting this hypothesis that insider buying activities are informative regarding future stock performance. Essentially, this would mean that these stocks, which insiders have chosen to invest in, are generating returns above and beyond what could be expected given market trends and risk levels. This outperformance could be taken as a signal of the insiders' accurate foresight and knowledge about the company's prospects. Comparatively, in order to conclude that stock that insider choose to sell is less informative than those they choose to buy, alpha from Sold portfolio should appears to be close to zero. This would indicate that the stocks insiders chose to sell performed roughly in line with the market, or slightly underperformed it after adjusting for risk and could be interpreted as insider selling not providing a strong predictive signal about the future performance of the stocks. However, the negative alpha of Sold portfolio can suggest that the stocks insiders chose to sell are on average underperforming the market after adjusting for risk. This underperformance could be interpreted as the stocks being overvalued at the time insiders decided to sell, followed by a subsequent price correction (drop) that brings their performance below the market average. In this case, the act of selling by the insiders can be viewed as a bearish signal, suggesting they believed the stocks were overvalued and likely to decline in the future. Thus, consistent negative alpha in the Sold portfolio could provide evidence that insider selling is indeed informative about future stock performance, albeit in a different way than insider buying.

4.2 Examining performance of momentum strategies incorporated insider trading information

The second objective of this study is to develop and evaluate a momentum strategy that is enhanced by incorporating insider trading information. To achieve this goal, we need to carry out two important tasks. The first task is to build a momentum portfolio that takes into account insider trading activity. This means we choose stocks that not only have strong momentum in their returns, but also have significant insider trading involvement. The second task is to evaluate the performance of the strategy we've developed.

When formulating momentum strategies that incorporate insider trading information, the portfolio construction process can be outlined as follows. Initially, stocks with significant historical high and low returns are identified, aligning with the conventional momentum strategy that evaluates past stock performance. As outlined in section 3.1.2 of this study, stocks are classified into two main groups: past winners and past losers. Subsequently, the insider trading activity within these two groups of stocks is examined in detail. This step entails a meticulous review of disclosed insider transaction data obtained from SEC 59-2 forms.

Within each category of past winners and past losers, a further selection process is conducted by cross-referencing the stocks with those present in the 'Bought' or 'Sold' portfolios specified in section 3.1.1 of this study. Stocks that appear in both the 'Winner' and 'Bought' portfolios simultaneously are categorized as stocks bought by insiders from the Winner portfolio. Conversely, stocks that lie in both the 'Loser' and 'Sold' portfolios simultaneously are classified as stocks sold by insiders from the Loser portfolio. This results in a portfolio that combines the momentum strategy with insights derived from insider trading activity.

To be precise, this study focuses on analyzing two distinct groups of stocks to achieve the second objective. These groups are defined as follows:

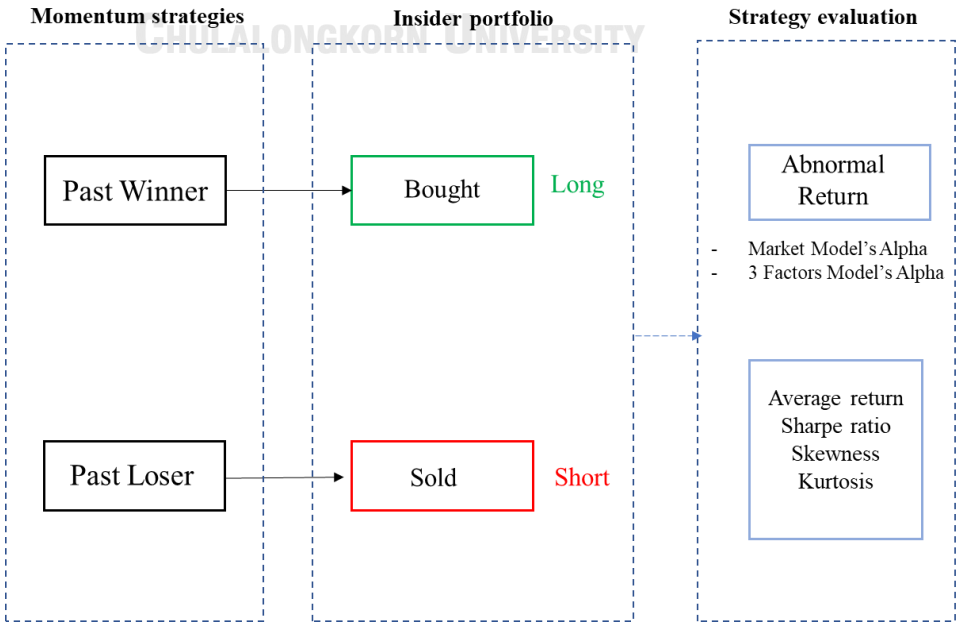
1. Stocks bought by insiders from the Winner portfolio.
2. Stocks sold by insiders from the Loser portfolio.

Our strategy entails taking a long position in stocks from Group 1 and a short position in stocks from Group 2. This approach is grounded in the assumption that insiders possess valuable information regarding the future performance of their companies, and their trading activities can serve as profitable trading signals. **Figure 4-2**. illustrates the conceptual framework employed to accomplish the second objective of this study.

By employing this enhanced methodology, our study aims to provide a rigorous analysis that integrates the momentum strategy with insider trading insights, thereby contributing to the understanding of effective investment strategies in the financial markets.

Figure 4-2 Conceptual framework for examining profitability of momentum strategy incorporated insider transactions information

This diagram outlines the methodology for constructing and examining performance of a momentum strategy that integrates insider trading information. The process starts by creating momentum portfolios, which are divided into past winner and loser portfolios. Insider activity is then incorporated by further refining each momentum portfolio based on insider transactions. This strategy involves taking long positions in the 'Bought' stocks (stocks with a positive NIT) from the past winner categories in the momentum portfolio. Simultaneously, it recommends short positions in the 'Sold' stocks (stocks with a negative NIT) the past loser groups of the momentum portfolio. The evaluation of this strategy is based on 2 approaches. First is though the alpha of CAPM in single index model and 3-factors model for the risk-adjustment. Another approach is through performance metrics evaluation which are average return, Sharpe ratio, skewness, and kurtosis.



This study including the analysis of 3 difference holding period including 1 month, 3 months, and 6 months to see the effect of momentum and insider in the longer term.

We evaluate the performance of this strategy by calculating the average monthly return (Equation (6)), Sharpe ratio (Equation (7)), skewness (Equation (8)), and kurtosis (Equation (9)). The average monthly return gives us an overall measure of the profitability of the strategy, while the Sharpe ratio allows us to assess the risk-adjusted performance. Skewness and kurtosis are used to assess the symmetry and tail risks of the return distribution.

$$Average\ return\ (\%) = \frac{1}{t}\sum_{t=1}^{t} R_{p,t} \qquad (6)$$

Where $R_{p,t}$ is the monthly return of portfolio of t^{th} month.

$$Sharpe\ ratio = \frac{\mathrm{E}[r_p] - r_f}{\sigma_p} \qquad (7)$$

Where $\mathrm{E}[r_p]$ is the expected return of portfolio, r_f is the risk-free rate, and σ_p is the standard deviation of portfolio.

$$Skewness = \mathrm{E}[R^3] = \frac{\mathrm{E}\left[\left(R_{p,t} - \mu_p\right)^3\right]}{\sigma_p^3} \qquad (8)$$

Where μ_p is the mean monthly return of portfolio.

$$Kurtosis = \mathrm{E}[R^4] = \frac{\mathrm{E}\left[\left(R_{p,t} - \mu_p\right)^4\right]}{\sigma_p^3} \qquad (9)$$

Based on **Hypothesis 2**, we anticipate that momentum strategies incorporating insider trading information will outperform conventional momentum strategies in a few key areas. Firstly, we anticipate a significant rise in the average monthly return (Equation (6)), driven by the additional insights provided by insider trading activities.

These activities are believed to offer predictive power regarding the future performance of stocks, enhancing the strategy's profitability. Secondly, we expect a higher Sharpe ratio (Equation (7)) signifying a superior risk-adjusted performance. In essence, this suggests that our strategy, for each unit of risk undertaken, should yield a higher return relative to a conventional momentum strategy. Thirdly, consider that momentum strategy can generates positive return but with negative skewness (Brunnermeier et al., 2008), by incorporating insider transaction in to momentum strategy, we expect less-negative skewness (Equation (8)), indicative of more instances of higher positive returns than would be expected in conventional momentum strategy. This forecast supports the notion that integrating insider trading information creates an asymmetric return distribution with a higher likelihood of substantial gains. Lastly, we would like the kurtosis (Equation (9)) of our strategy to be similar to or lower than that of the conventional strategy. This would suggest that extreme returns are not more probable than under the conventional strategy. However, if kurtosis is higher, it should be interpreted cautiously, as it could imply higher risks associated with the insider-informed strategy.

These expectations are grounded in our hypothesis and need to be empirically verified. They also rely on the assumption that insider trading activities provide meaningful and actionable information about the future performance of stocks, over and above the information typically considered in conventional momentum strategies.

We also calculate CAPM alphas using both the single-index model and the Fama-French three-factor model to control for risks by the models shown in Equation (4) and Equation (5).

4.3 Examine the time-varying behavior of momentum strategy incorporating insider transaction information

The third objective of this research is to assess the performance of momentum strategies that integrate insider transaction data during turbulent periods in the market, specifically, during momentum crashes. This analysis aims to uncover how these refined strategies behave and hold up during such volatile market conditions.

The initial phase of this examination requires conducting a time-varying beta analysis on the conventional momentum strategy, following the method outlined by Daniel and Moskowitz (2016). This involves evaluating the dynamic market sensitivities of the past winners and losers in the momentum deciles over a 126-day rolling window, with a 10-days lag as indicated in Equation (10).

$$\tilde{r}_{i,t} = \beta_0 \tilde{r}^e_{m,t} + \beta_1 \tilde{r}^e_{m,t-1} + \cdots + \beta_{10} \tilde{r}^e_{m,t-10} + \epsilon_{i,t} \qquad (10)$$

Where $\tilde{r}_{i,t}$ is the return on portfolio in day t, $\tilde{r}^e_{m,t}, \tilde{r}^e_{m,t-1}, \ldots \tilde{r}^e_{m,t-10}$ is the market return one-day to ten-day lagged respectively.

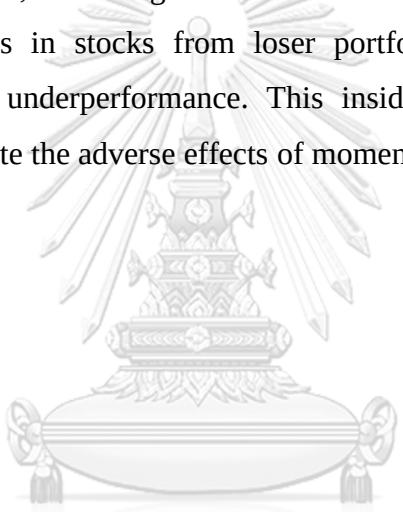
Crucially, this analysis involves running the regression in Equation (10) twice, each time using a distinct set of returns. The first run of the regression uses the daily returns of past winners, yielding a set of beta values that reflect the market sensitivity of these stocks. The second run of the regression uses the daily returns of past losers, producing another set of beta values that provide insight into the market sensitivity of these stocks. This double application of the regression allows for a direct comparison of the market sensitivities of past winners and losers, aiding in the identification of momentum crash periods in the conventional momentum strategy.

The conventional momentum strategy operates by holding long positions in past winners and short positions in past losers. During market recoveries, past losers frequently rebound stronger than past winners. When the sum of betas (β_0, β_1, …, β_{10}) of past losers overtakes that of past winners, this inversion in performance marks a momentum crash in the traditional approach. By utilizing the time-varying beta analysis, we can identify these momentum crash periods within the conventional momentum strategy.

However, due to the distinct design of the momentum strategy that incorporates insider transaction activity, the interpretation of a momentum crash necessitates modification. In the context of this strategy, a crash is considered to occur when the stocks insiders have sold outperform the ones they have bought. Therefore, two separate time-varying beta analyses (Equation (10)) will be carried out to accommodate this adjustment: one for the stocks insiders bought from past winner

pools and another for the stocks insiders sold from past loser pools. These beta sets differ from the conventional ones, reflecting the unique investment positions based on insider transactions. In this scenario, the refined momentum strategy will be considered to have crashed when the aggregate of betas for the stocks insiders sold surpasses that for the stocks insiders bought.

The enhanced momentum strategy, which integrates insider trading data, might offer unique resilience during market turbulence. It diverges from conventional strategies by utilizing insider trading data as an additional layer of filtration on top of past performance. It establishes long positions in stocks from past winner portfolios that insiders have bought, indicating insiders' confidence in these stocks. Conversely, it takes short positions in stocks from loser portfolios that insiders have sold, suggesting anticipated underperformance. This insider-informed selection process could potentially mitigate the adverse effects of momentum crashes.



CHAPTER 5
Empirical Result

5.1 The analysis of informativeness of insider trading activity

In this section, we delve into the analysis of portfolio performance constructed based on insider buying and selling activities. The portfolio construction process has been outlined in **section 3.1.1** for reference. Our analysis centers on observing the insider transaction activity over the past 3 months, a key timeframe for assessing recent trends. The portfolio construction methodology involves utilizing the concept of *Net Insider Transaction (NIT)* to identify stocks impacted by insider buying and selling. Specifically, stocks exhibiting positive *NIT* within the past 3-month observation window are designated as those bought by insiders. These stocks are strategically allocated to the 'Bought' portfolio. Conversely, stocks characterized by negative *NIT* values represent those sold by insiders, consequently finding their place in the 'Sold' portfolio. This approach allows us to distinguish between the positive and negative actions taken by insiders, forming the basis for our subsequent analyses. In our analytical journey, we meticulously investigate the performance of the 'Bought' and 'Sold' portfolios across various holding periods. By considering monthly, quarterly, and semiannually holding periods, we gain a comprehensive understanding of the portfolio dynamics and their responses to the market. This multifaceted approach enables us to ascertain how the portfolios fare over short-term and more extended investment horizons. We also extend our analysis by extending the observation window for past insider transactions. We extended our analysis by considering two distinct observation windows: one spanning the past 3 months and the other covering the past 6 months. This deliberate expansion allowed us to gain deeper insights into the robustness of insider transaction information in constructing trading portfolios, affirming its potential as an informative factor for our strategy.

5.1.1 Examine insider portfolio with past 3-month insider activity information

Table 5-1 provides a comprehensive overview of the performance of the 'Bought' and 'Sold' portfolios, skillfully constructed using the past 3-month insider activity data. 'Bought' portfolio consists of stocks that represent positive *NIT* during the past 3-month and 'Sold' portfolio consists of stocks that represent negative *NIT* during the past 3-month. Our portfolio weighting methodology employs the value-weighted approach to ensure comprehensive representation.

Table 5-1 Summary of the performance of insider portfolio constructed with past 3-month insider activity information.
This table presents the portfolio returns of trading strategies associated with past 3-month insider transaction activity. Portfolios are formed based on the insider trading activity over the prior 3 months. The 'Bought' and 'Sold' portfolios include stocks that insiders have bought or sold in the past period respectively. Panel A shows the statistical variable of the insider's portfolios including the average monthly return in the percentage form, excess market return, standard deviation, Sharpe ratio, skewness, and kurtosis. Panel B shows the alpha captured from the Market Model represents the abnormal return over the market. Panel C shows the alpha captured from the Fama-French 3-Factors Model represents the abnormal return over the market, firm size, and firm value. Panel D shows the alpha captured from the Fama-French-Carhart 4-Factors Model represents the abnormal return over the market, firm size, firm value, and the stock's past performance. T-statistics are reported in parentheses.

Panel A: Statistical variable

		Past 3-months	
		Holding Period	
Portfolio		1	3
Bought	Average Return	0.95%	1.27%***
		(1.71)	(2.77)
	Excess market return	0.35%*	0.67%*
		(1.84)	(1.95)
	Standard Deviation	5.12%	5.62%
	Sharpe ratio	0.58	0.73
	Skewness	1.84	1.50
	Kurtosis	8.38	5.59
Sold	Average Return	0.66%	0.80%*
		(1.24)	(1.77)
	Excess market return	0.06%	0.20%
		(0.37)	(0.95)
	Standard Deviation	4.92%	5.54%
	Sharpe ratio	0.40	0.44
	Skewness	0.14	0.71
	Kurtosis	3.57	3.38

Panel B: Market Model alpha

	Past 3-month Holding Period	
Portfolio	1	3
Bought	0.21%	0.69%
	(1.01)	(1.52)
Sold	0.06%	0.09%
	(0.31)	(0.30)

Panel C: Fama-French 3-Factors Model alpha

	Past 3-month Holding Period	
Portfolio	1	3
Bought	0.22%	0.21%
	(0.94)	(0.40)
Sold	-0.17%	-0.24%
	-(0.74)	-(0.76)

Panel D: Fama-French-Carhart 4-Factors Model alpha

	Past 3-month Holding Period	
Portfolio	1	3
Bought	0.21%	0.21%
	(0.71)	(0.41)
Sold	-0.35%	-0.25%
	-(1.50)	-(0.77)

In *Panel A*, we illuminate the statistical variable of the insider's portfolios. The average annual returns accomplished by these portfolios, offering insights into their effectiveness across a range of holding periods. The 'Bought' portfolio displays a consistent ability to generate returns of notable statistical significance, a trend that holds true across a spectrum of holding periods, spanning both monthly and quarterly timeframes. Impressively, the 'Bought' portfolio records positive and statistical significance average monthly returns of 0.95% and 1.27% (11.42% and 15.22% annually) for the monthly and quarterly holding period, respectively. Echoing the strength of its 'Bought' counterpart, the 'Sold' portfolio demonstrates positive average monthly returns that show weaker statistical significance than the 'Bought' portfolio

with 0.66% monthly return (7.92% annually) during the monthly holding period, further with a substantial 0.80% average monthly return (9.58% annually) for the quarterly holding period. The standard deviation, both the 'Bought' and 'Sold' portfolios exhibit similar patterns. The standard deviation slightly increases during longer holding periods, indicating a higher level of risk associated with portfolio rebalancing within extended windows. The 'Bought' portfolio yields a standard deviation of 5.12% for the monthly holding period and 5.62% for the quarterly holding period. Similarly, the 'Sold' portfolio records standard deviations of 4.92% and 5.54% for the monthly and quarterly holding periods, respectively. Despite the similar standard deviation yields, the 'Bought' portfolio generates higher average returns, leading to a superior Sharpe ratio. Specifically, the 'Bought' portfolio achieves Sharpe ratios of 0.58 and 0.73 for the monthly and quarterly holding periods, while the 'Sold' portfolio's Sharpe ratios reach 0.40 and 0.44 for the corresponding periods. The result also suggest that the ‘Bought’ Portfolio can generates higher and more significance excess market return than the ‘Sold’ Portfolio which indicates the ability to generate abnormal return over the market with the ‘Bought’ portfolio generates monthly excess market return of 0.35% (4.21% annually) with t-statistic of 1.84 and 0.67% (8.27% annually) with t-statistic of 1.95 respectively for monthly and quarterly holding period while the ‘Sold’ portfolio generate the monthly excess market return of 0.06% (0.72% annually) with t-statistic of 0.37 and 0.20% (2.39% annually) with t-statistic of 0.95 for the monthly and quarterly holding period respectively. Analyzing return distributions, both insider portfolios display slightly positive skewness, indicating that the return means are slightly biased towards the right side of the distribution—suggesting a propensity for positive returns. The 'Bought' portfolio exhibits skewness values of 1.84 and 1.50 for the monthly and quarterly holding periods, respectively, while the 'Sold' portfolio's skewness measures 0.14 and 0.71 for the corresponding periods. Moreover, the kurtosis metric gauges the intensity of extreme values at the distribution's tail. The 'Bought' portfolio indicates a higher potential for extreme values, with kurtosis values of 8.38 and 5.59 for the monthly and quarterly holding periods, respectively. Conversely, the 'Sold' portfolio reflects lower potential for extreme values, boasting kurtosis values of 3.57 and 3.38—approximating the kurtosis of a normal distribution (3).

Examining the abnormal return relative to the market as revealed by the Fama-French 3-Factors Model in *Panel B*, we discern a clear trend. The 'Bought' portfolio continues to surpass the performance of the 'Sold' portfolio. Impressively, during the monthly holding period, the 'Bought' portfolio exhibits an abnormal return of 0.21% (2.53% annually), further strengthening this lead with an even more remarkable 0.69% (8.30% annually) abnormal return during the quarterly holding period. Meanwhile, the 'Sold' portfolio displays relatively more modest results under the same model. It achieves an abnormal return of 0.06% (0.76% annually) for the monthly period and a slightly improved 0.09% (1.03% annually) for the quarterly period. This finding accentuates the sustained advantage held by the 'Bought' portfolio in generating abnormal returns over the 'Sold' portfolio, a testament to its consistent performance dynamics.

Panel C presents the ability to generate abnormal return of the portfolios when controlling market risk, firm size, and firm value. We found that the ‘Bought’ portfolio still outperformed the ‘Sold’ portfolio with the ‘Sold’ portfolio being less significance, this conclusion is held in both monthly and quarterly holding period.

Panel D explores the alpha or abnormal return gleaned from the Fama-French-Carhart 4-Factors Model. This robust model not only considers market, size, and value factors but also embraces the influence of past performance or momentum. Once again, the 'Bought' portfolio asserts its dominance, outperforming the 'Sold' portfolio across both monthly and quarterly holding periods.

5.1.2 Examine insider portfolio with past 6-month insider activity information

Table 5-2 provides a comprehensive overview of the performance of the 'Bought' and 'Sold' portfolios, skillfully constructed using the past 6-month insider activity data. The ‘Bought’ portfolio consists of stocks that represent positive *NIT* during the past 6-month and ‘Sold’ portfolio consists of stocks that represent negative *NIT* during the past 3-month. Our portfolio weighting methodology employs the value-weighted approach to ensure comprehensive representation.

Table 5-2 Summary of the performance of insider portfolio constructed with past 6-month insider activity information.

This table presents the portfolio returns of trading strategies associated with past 6-month insider transaction activity. Portfolios are formed based on the insider trading activity over the prior 6 months. The 'Bought' and 'Sold' portfolios include stocks that insiders have bought or sold in the past period respectively. Panel A shows the statistical variable of the insider's portfolios including the average monthly return in the percentage form, excess market return, standard deviation, Sharpe ratio, skewness, and kurtosis. Panel B shows the alpha captured from the Market Model represents the abnormal return over the market. Panel C shows the alpha captured from the Fama-French 3-Factors Model represents the abnormal return over the market, firm size, and firm value. Panel D shows the alpha captured from the Fama-French-Carhart 4-Factors Model represents the abnormal return over the market, firm size, firm value, and the stock's past performance. T-statistics are reported in parentheses.

Panel A: Statistical variable

		Past 6-months		
		Holding Period		
Portfolio		1	3	6
Bought	Average Return	1.04%*	0.91%	0.84%
		(1.80)	(1.59)	(1.41)
	Excess market return	0.37%	0.24%	0.17%
		(0.70)	(0.41)	(0.29)
	Standard Deviation	5.32%	5.28%	5.47%
	Sharpe ratio	0.62	0.54	0.47
	Skewness	1.64	1.63	1.49
	Kurtosis	6.59	8.26	7.95
Sold	Average Return	0.91%	0.74%	0.66%
		(1.59)	(1.19)	(1.04)
	Excess market return	0.24%	0.07%	-0.01%
		(0.42)	(0.12)	-(0.01)
	Standard Deviation	5.26%	5.72%	5.86%
	Sharpe ratio	0.54	0.39	0.34
	Skewness	0.40	0.12	0.04
	Kurtosis	3.30	3.26	4.10

Panel B: Market Model alpha

	Past 6-month		
	Holding Period		
Portfolio	1	3	6
Bought	0.42%	0.18%	0.09%

	(1.15)	(1.01)	(0.47)
Sold	0.22%	0.00%	-0.10%
	(0.85)	(0.00)	-(0.33)

Panel C: Fama-French 3-Factors Model alpha

	Past 6-month Holding Period		
Portfolio	1	3	6
Bought	0.07%	0.07%	0.02%
	(0.16)	(0.34)	(0.11)
Sold	-0.09%	-0.27%	-0.49%
	-(0.30)	-(0.85)	-(1.50)

Panel D: Fama-French-Carhart 4-Factors Model alpha

	Past 6-month Holding Period		
Portfolio	1	3	6
Bought	0.08%	0.08%	0.03%
	(0.18)	(0.38)	(0.14)
Sold	-0.09%	-0.28%	-0.50%
	-(0.34)	-(1.00)	-(1.71)

Panel A brings into focus the statistical attributes defining the insider portfolios. It provides insight into the average annual returns of both the 'Bought' and 'Sold' portfolios across a range of holding periods, including monthly, quarterly, and semiannual durations. The results distinctly underscore the 'Bought' portfolio's exceptional performance, consistently outshining the 'Sold' portfolio across the entire spectrum of holding periods. The 'Bought' portfolio emerges as the standout performer, showcasing average monthly returns of 1.04%, 0.91%, and 0.84% (12.48%, 10.92%, and 10.07% annually) for the monthly, quarterly, and semiannual holding periods, respectively. In contrast, the 'Sold' portfolio delivers average monthly returns of 0.91%, 0.74%, and 0.66% (10.89%, 8.89%, and 7.92% annually) for the

corresponding holding periods. These outcomes reaffirm not only the 'Bought' portfolio's ability to yield higher returns but also its capacity for sustained performance. This is evidenced by its higher statistical significance, as indicated by the t-statistical value. In terms of risk exposure, both portfolios exhibit similarity in their standard deviation across all holding periods. Specifically, the 'Bought' portfolio displays standard deviations of 5.32%, 5.28%, and 5.47% for the monthly, quarterly, and semiannual periods, respectively. Conversely, the 'Sold' portfolio records standard deviations of 5.26, 5.72%, and 5.86% for the same respective periods. Despite this parallel in standard deviation, the 'Bought' portfolio gains a strategic edge in terms of the Sharpe ratio. With its higher returns, the 'Bought' portfolio achieves Sharpe ratios of 0.62, 0.54, and 0.47 for the monthly, quarterly, and semiannual periods, whereas the 'Sold' portfolio's Sharpe ratios are 0.54, 0.39, and 0.34. In the sense of the excess market return, both ‘Bought’ and ‘Sold’ cannot generate statistical significance excess market return in this insider portfolio that incorporates past 6-month aggregate insider transaction. It is still noticeable that the ‘Bought’ Portfolio can generate higher excess market return than the ‘Sold’ portfolio. Turning to return distribution, both portfolios demonstrate positive skewness, indicating a bias towards positive returns. Moreover, the 'Bought' portfolio's return distribution exhibits a 'fat-tail' behavior, highlighted by larger kurtosis values exceeding 3. In contrast, the 'Sold' portfolio's distribution tail aligns more closely with the normal distribution, reflected by kurtosis values hovering around 3.

Panel B presents the noteworthy abnormal returns of the insider portfolios, captured via the alpha derived from the Market Model regression. The findings illuminate that the 'Bought' portfolio effectively generates abnormal returns even after accounting for market risk, with percentages of 0.42%, 0.18%, and 0.09% (5.06%, 2.19%, and 1.11% annually) for the monthly, quarterly, and semiannual holding periods, respectively. The return from the 'Bought' portfolio exhibits a gradual decrease over time, mirroring a slight decline in significance level. This decline in significance is evident in the diminishing t-statistics, which stand at 1.15, 1.01, and 0.47 for the monthly, quarterly, and semiannual holding periods, respectively. This trend suggests that while the 'Bought' portfolio maintains its ability to generate abnormal returns, these returns become less pronounced and statistically significant

over longer holding periods. On the other hand, the 'Sold' portfolio's returns exhibit limited statistical significance. The associated t-statistics of 0.85, 0.00, and -0.33 for the monthly, quarterly, and semiannual holding periods, respectively, indicate challenges in interpreting the abnormal return through the alpha of the Market Model for the 'Sold' portfolio. This outcome highlights the complexities inherent in deriving consistent abnormal returns for the 'Sold' portfolio under the market Model framework.

Panel C delves into the insightful analysis of alpha within the insider portfolios, a product of regressing against the Fama-French 3-Factors Model. This provides a window into the portfolios' potential to generate abnormal returns once we account for market risk, firm size, and firm value. The findings shine a light on the capabilities of the 'Bought' portfolio to yield positive abnormal returns. This is evident through the positive alpha it exhibits. In contrast, the 'Sold' portfolio demonstrates a negative alpha, suggesting challenges in generating consistent returns beyond what can be explained by market risk, firm size, and firm value factors. Despite these trends, it's important to note that neither the 'Bought' nor the 'Sold' portfolio achieves statistical significance across all holding periods. As such, while the 'Bought' portfolio displays potential in generating positive abnormal returns, and the 'Sold' portfolio reflects a struggle in this regard, the data does not attain a level of statistical significance in support of these conclusions. In essence, the Fama-French 3-Factors Model doesn't offer a clear perspective on the return patterns within the insider portfolios under examination. The intricate interplay of market risk, firm size, and firm value complicates the interpretive landscape, leading to outcomes that do not reach statistical significance within various holding periods.

Panel D unveils the outcomes of regressing portfolio returns using the Fama-French-Carhart 4-Factors Model. Notably, the results indicate non-statistically significant returns for both the 'Bought' and 'Sold' portfolios. This finding implies that the abnormal return of the insider portfolios cannot be effectively captured when considering simultaneous control for market risk, firm size, firm value, and the historical performance of the firm. This observation underscores the complex interplay of factors that come into play when seeking to explain the abnormal returns

generated by these portfolios. The inclusion of a comprehensive set of variables in the Fama-French-Carhart 4-Factors Model highlights the intricate nature of abnormal returns within the context of insider portfolios, further emphasizing the multifaceted dynamics at play.

The analysis conducted in this s***ection 5.1*** aimed to assess the value of insider transaction information within the Thai stock market for portfolio construction. The findings reveal that constructing trading portfolios based on insider transaction data is indeed viable and promising. Over the sample period from January 2016 to December 2022. We construct the insider portfolios according to 2 types of observation windows including the portfolios that utilize past 3-month insider transaction information and the one with past 6-month insider transaction information. The driver behind these 2 different observing windows was to confirm the robustness of the informativeness of insider transaction activity in order to construct the trading portfolio. The result indicates that consistently positive returns were generated from both the 'Bought' and 'Sold' portfolios. Notably, the 'Bought' portfolio consistently outperformed the 'Sold' portfolio by approximately 3% to 5% in terms of returns. Importantly, this positive performance was robust across different portfolio formation methods, including those incorporating past 3-month and past 6-month insider transaction information. The positive returns were also consistent across varying holding periods, encompassing monthly, quarterly, and semiannual durations. These results align with prior research, such as the work by Yang and Zhang (2019), which similarly demonstrated the capacity of both 'Bought' and 'Sold' portfolios to generate positive returns across various holding periods. We also find that while the ‘Sold’ portfolio experience difficulty in generating excess return over the market, the ‘Bought’ portfolio can generate noticeable amount of excess return over the market. This is also confirmed through the alpha regressed from the Market Model which indicates that ‘Bought’ portfolio can generates higher and more statistical significance abnormal return than the ‘Sold’ portfolio. However, in the sense of the excess market return, the result is statistical significance for those of the portfolio construct with past 3-month insider transaction information. Our result consistent with our **Hypothesis 1**: Insider trading

activities are informative regarding stock performance in the Thai stock market, with insider buys being more informative. When insider is buying, they aimed to make profit in their investment (Jenter, 2005; Lakonishok & Lee, 2001), but insider sells may be driven by other reasons such as liquidity needs or diversification needs (Cohen et al., 2012), making them less informative. It is important to note that while the Fama-French 3-Factors Model and Fama-French-Carhart 4-Factors Model regressions did not yield statistically significant outcomes, it remained evident that the 'Bought' portfolio was capable of generating positive abnormal returns over these models, whereas the 'Sold' portfolio did not achieve the same outcome. The lack of significance level may indicate that the return of the insider's portfolios is all explained by the factors controlled by the model. These findings collectively underscore the potential of insider transaction information as a valuable resource for constructing portfolios and making informed investment decisions within the Thai stock market. In comparing the insider portfolios utilizing past 3-month and 6-month aggregated insider transaction information, our analysis indicates a noteworthy trend. Specifically, the portfolios constructed using the 6-month aggregate transaction data exhibit reduced statistical significance. This observation leads us to an intriguing conclusion: over longer observation windows, it appears that the information derived from insider transactions becomes progressively absorbed by the broader market.

5.2 The analysis of enhanced momentum strategy with insider transaction information

This section presents a comprehensive analysis of the enhanced momentum strategy, incorporating insider transaction activity when insiders are active (when insider is buying or selling). The portfolio construction method employed in this study follows the tercile momentum approach. Subsequently, the portfolios are refined by applying additional filters based on cumulative past insider transaction described in the ***section 4.2***. In this analysis, we investigate the impact of utilizing both a past 3-month and a past 6-month cumulative insider transaction period to discern potential differences in the strategy's effectiveness and explore the sensitivity of the strategy to short-term and long-term insider activity along with the robustness of the strategy.

5.2.1 Enhancing momentum strategy with past 3-month insider transaction information

Consider the analysis of the enhanced momentum strategy with the active involvement of insiders, including their buying and selling activities. ***Table 5-3*** presents the statistical results of the enhanced momentum portfolio, which involves taking long positions in past winning stocks that have been bought by insiders within the past 3 months and short positions in past losing stocks that have been sold by insiders during the same period. The portfolio is evaluated over two holding periods: monthly and quarterly.

Table 5-3 Summary statistical analysis of enhanced momentum portfolio with past 3-month insider activity information

The table presents a statistical analysis of an enhanced momentum portfolio based on past 3-month insider transaction activities from January 2016 to December 2022. The strategy involves long positions in past winner stocks bought by insiders and short positions in past loser stocks sold by insiders in the past 3 months. Statistical measurements include (1) Average monthly return in percentage, (2) Standard Deviation, (3) Sharpe Ratio, (4) Skewness, and (5) Kurtosis for both monthly (Panel A) and quarterly (Panel B) holding periods. These metrics offer valuable insights into the portfolio's performance, risk, and return distribution. T-statistics of the average annual returns are reported in parentheses.

	Past 3-months
	Winner-Bought minus Losers-Sold
Panel A: Monthly Holding Period	
Average Return	0.55%
	(1.09)
Standard Deviation	6.13%
Sharpe ratio	0.26
Skewness	-1.02
Kurtosis	4.46
Panel B: Quarterly Holding Period	
Average Return	0.64%*
	(1.68)
Standard Deviation	5.99%
Sharpe ratio	0.31
Skewness	-0.41
Kurtosis	0.92

Panel A reports the statistical analysis of the enhanced momentum portfolio on a monthly basis. The portfolio yields an average monthly return of 0.55% (6.55% annually), suggesting profitability on a monthly basis. However, the substantial standard deviation of 6.13% indicates high volatility, reflecting considerable risk inherent to this strategy. The Sharpe ratio of 0.26 points to positive risk-adjusted returns over the risk-free rate, although it is somewhat modest. A skewness of -1.02 indicates a distribution with a heavier left tail, suggesting the returns are more prone to extreme negative values. Additionally, a kurtosis of 4.46 implies that the return distribution exhibits fat tails, indicating a higher probability of extreme returns.

Panel B presents the results of the portfolio over a quarterly holding period. The average monthly return improves to 0.64% (7.63% annually) with a t-statistic of 1.68 reflecting the statistical significance of the return at 10%, representing a superior performance compared to the monthly holding period. The standard deviation decreases to 5.99%, illustrating somewhat reduced volatility. A Sharpe ratio of 0.31 indicates an increased risk-adjusted return, suggesting better compensation for the risk taken on. The skewness of -0.41, though still negative, is closer to zero, reflecting a less skewed return distribution. Importantly, the kurtosis of 0.92 implies that the return distribution contains fewer extreme values compared to the monthly period.

The results suggest that the enhanced momentum strategy with insider trading data is more effective with a quarterly holding period compared to a monthly one. The quarterly holding period showcases a higher average return, superior risk-adjusted returns (higher Sharpe ratio), and relatively lower volatility (lower standard deviation). Moreover, the return distribution is closer to a normal distribution, implying a reduced likelihood of extreme returns.

Considering another approach of investigating the performance of the strategy, ***Table 5-4*** present the results of the Market Model and the Fama-French 3-Factor Model, to examine risk-adjusted returns.

Table 5-4 Summary of regressions of enhanced momentum portfolio with past 3-month insider activity information

This table presents the result of the Market Model and Fama-French 3-Factors Model regressions of an enhanced momentum portfolio based on past 3-month insider transaction activities from January 2016 to December 2022. The strategy involves long positions in past winner stocks bought by insiders and short positions in past loser stocks sold by insiders in the past 3 months. The regression includes 2 types of different holding periods which are monthly (Panel A) and quarterly (Panel B) holding period. t-statistics are reported in parentheses.

	Past 3-months	
	Winner-Bought minus Losers-Sold	
	Market Model	3-Factors Model
Panel A: Monthly Holding Period		
Alpha	0.75%	-0.16%
	(1.54)	-(0.24)
Market Premium	-0.59***	-0.55***
	-(4.66)	-(4.21)
SMB		-0.45*
		-(1.92)
HML		-0.61**
		-(2.58)
Panel B: Quarterly Holding Period		
Alpha	0.79%*	0.14%
	(1.75)	(0.21)
Market Premium	-0.48***	-0.42***
	-(3.75)	-(3.16)
SMB		-0.22
		-(0.92)
HML		-0.47**
		-(1.97)

During the monthly holding period *(Panel A)*, the alpha value in the Market Model represents the abnormal return generated monthly is positive 0.75% (9.05% annually) with the t-statistic of 1.54. While the alpha of the 3-Factors Model is around -0.16% (-1.92% annually) but with poor t-statistic of -0.24. The market premium coefficients for both models are negative and highly significant, with the Market Model coefficient being -0.59 and the 3-Factor Model coefficient being -0.55. This suggests that the strategy's returns are negatively impacted by overall market movements. The SMB and HML coefficients in the 3-Factor Model are both negative. The SMB coefficient is statistically significant at -0.45 (t-statistic of -1.92), indicating

that the strategy performs relatively better in larger stocks compared to smaller stocks. The HML coefficient is significant at -0.61 (t-statistic of -2.58), implying that the strategy performs relatively better in growth stocks compared to value stocks.

Moving on to the quarterly holding period *(Panel B)*, the Market Model alpha remains positive at around 0.79% monthly (9.52% annually), with a t-statistic of 1.75, indicating statistical significance. The 3-Factor Model alpha is around 0.14% monthly (1.73% annually), but it lacks statistical significance with a t-statistic of 0.21. The market premium coefficients for both models are negative and highly significant, with the Market Model coefficient being -0.48 and the 3-Factor Model coefficient being -0.42. This reaffirms that the strategy's returns continue to be influenced by overall market movements during the quarterly period. Unlike the monthly period, the SMB coefficient in the 3-Factor Model lacks statistical significance (t-statistic of -0.22), suggesting that the size factor has a relatively weaker influence on the strategy's performance during the quarterly period. However, the HML coefficient remains significant at -0.47 (t-statistic of -1.97), indicating the strategy's continued preference for growth stocks over value stocks.

In summary, the enhanced momentum strategy with past 3-month cumulative insider transactions displays positive alphas in both the monthly and quarterly holding periods, with statistical significance observed mainly for the quarterly period. The strategy's returns are negatively impacted by market movements, and its performance leans towards large stocks rather than small stocks and growth stocks rather than value stocks.

5.2.2 Enhancing momentum strategy with past 6-month insider transaction information

The preceding sections of this study have evaluated an enhanced momentum strategy, which incorporates insider transaction data from the prior 3 months. We took long positions in stocks demonstrating past winning performance and had been subject to insider buying activity within the past three months. In contrast, we took short positions in the past, losing stocks that insiders had sold within the same period.

To further enrich this study and test the robustness of our initial findings, we now seek to extend the insider transaction window from three to six months. This extension aims to capture more sustained or significant insider sentiment about a particular stock.

Table 5-5 presents a comprehensive statistical analysis of an enhanced momentum portfolio, focusing on past 6-month insider transaction activities spanning from January 2016 to December 2022. The strategy involves taking long positions in stocks that demonstrated winning performance over the past 12 months and were bought by insiders during the past 6-month period. Simultaneously, short positions are taken in stocks that performed poorly in the same window and were sold by insiders. To assess the portfolio's performance and risk characteristics, the analysis includes several key statistical measurements for three different holding periods: monthly, quarterly, and semiannually.

Table 5-5 Summary statistical analysis of enhanced momentum portfolio with past 6-month insider activity information

The table presents a statistical analysis of an enhanced momentum portfolio based on past 6-month insider transaction activities from January 2016 to December 2022. The strategy involves long positions in past winner stocks bought by insiders and short positions in past loser stocks sold by insiders in the past 6 months. Statistical measurements include (1) Average monthly return in percentage, (2) Standard Deviation, (3) Sharpe Ratio, (4) Skewness, and (5) Kurtosis for both monthly (Panel A), quarterly (Panel B), and semiannually (Panel C) holding periods. These metrics offer valuable insights into the portfolio's performance, risk, and return distribution. t-statistics of the average annual returns are reported in parentheses.

	Past 6-months
	Winner-Bought minus Losers-Sold
Panel A: Monthly Holding Period	
Average Return	0.44
	(0.93)
Standard Deviation	6.61%
Sharpe ratio	0.19
Skewness	-1.04
Kurtosis	2.86
Panel B: Quarterly Holding Period	
Average Return	0.60
	(1.22)
Standard Deviation	6.03%
Sharpe ratio	0.29

Skewness	-0.27
Kurtosis	0.16
Panel C: Semiannually Holding Period	
Average Return	0.55
	(0.98)
Standard Deviation	6.82%
Sharpe ratio	0.23
Skewness	-0.93
Kurtosis	1.74

For the monthly holding period *(Panel A)*, the average monthly return of the portfolio is reported to be 0.44% (5.25% annually) with a standard deviation of 6.61% However, it is important to note that the return's statistical significance is not established (t-statistic = 0.87). The Sharpe ratio of 0.19. The negatively skewed distribution (skewness = -1.04) indicates a higher likelihood of experiencing extreme negative returns compared to extreme positive returns, and the kurtosis value of 2.86 signifies that the distribution possesses fatter tails than a normal distribution, implying a higher probability of extreme returns.

In the quarterly holding period *(Panel B)*, the portfolio exhibits an improved average return of 0.60% (7.18% annually) with slightly lower standard deviation (6.03%) compared to monthly holding basis. Although the t-statistic of 1.22 for the quarterly holding period does not meet the conventional threshold for statistical significance, it still holds practical importance and provides meaningful insights. T-statistic of 1.22 for the quarterly return may not meet traditional thresholds for statistical significance, it could still be viewed as providing some evidence, albeit weaker, of a non-random pattern in returns that could be utilized in investment decision-making. In this quarterly holding period, the portfolio yields the Sharpe ratio of 0.29 signifies a more favorable risk-adjusted return compared to the monthly period, providing better compensation for the risk taken. Furthermore, the distribution's negatively skewed nature (skewness = -0.27) suggests a slight propensity for more extreme negative returns, although this effect is less pronounced than in the monthly period. Importantly, the kurtosis value of 0.16 indicates few extreme values of the return distributions.

Finally, for the semiannually holding period *(Panel C)*, the average return is 0.55% (6.56% annually), with a t-statistic of 0.98, implying that the return may not be statistically significant. The standard deviation increases to 23.62%, suggesting that the portfolio's risk increases again over this holding period. The Sharpe ratio is 0.23, showing a slight reduction in risk-adjusted performance from the quarterly to the semiannual period. The skewness is -0.93, indicating a return to more negative skewness similar to the monthly period. The kurtosis also increases to 1.74 but remains below 3, indicating fewer extreme returns than a normal distribution.

In summary, the strategy shows an increase in average returns as the holding period increases from monthly to quarterly, but then a decrease when moving to a semiannual holding period. However, none of the returns are statistically significant. The risk, as indicated by the standard deviation, decreases slightly from the monthly to the quarterly holding period, but then increases for the semiannual period. The risk-adjusted performance, as measured by the Sharpe ratio, improves from the monthly to the quarterly period but then deteriorates in the semiannual period. Skewness is consistently negative, suggesting a tendency for larger decreases than increases in returns. Finally, kurtosis is consistently below 3, indicating fewer extreme returns than a normal distribution in all periods.

The following part of the results ***(Table 5-6)*** presents a regression analysis of the enhanced momentum portfolio using both the Market Model and the Fama-French 3-Factor Model. The Market Model considers only the market premium as a factor, while the 3-Factor Model incorporates three factors: market premium, SMB (Small Minus Big) factor, and HML (High Minus Low) factor. The data is examined for three different holding periods: monthly, quarterly, and semiannually.

Table 5-6 Summary of regression of enhanced momentum portfolio with past 6-month insider activity information

This table presents the result of the Market Model and Fama-French 3-Factors Model regressions of an enhanced momentum portfolio based on past 6-month insider transaction activities from January 2016 to December 2022. The strategy involves long positions in past winner stocks bought by insiders and short positions in past loser stocks sold by insiders in the past 3 months. The regression includes 2 types of

different holding periods which are monthly (Panel A), quarterly (Panel B) and semiannually (Panel C) holding period. T-statistics are reported in parentheses.

	Past 6-months	
	Winner-Bought minus Losers-Sold	
	Market Model	3-Factors Model
Panel A: Monthly Holding Period		
Alpha	0.56%	-0.21%
	(0.88)	-(0.29)
Market Premium	-0.43***	-0.39***
	-(3.20)	-(2.75)
SMB		-0.35
		-(1.39)
HML		-0.54**
		-(2.08)
Panel B: Quarterly Holding Period		
Alpha	0.70%	-0.01%
	(1.11)	-(0.02)
Market Premium	-0.38***	-0.34**
	-(2.87)	-(2.43)
SMB		-0.32
		-(1.27)
HML		-0.50*
		-(1.94)
Panel C: Semiannually Holding Period		
Alpha	0.65%	-0.25%
	(0.90)	-(0.31)
Market Premium	-0.39**	-0.28*
	-(2.56)	-(1.80)
SMB		-0.20
		-(0.72)
HML		-0.74**
		-(2.57)

For the monthly holding period *(Panel A),* both the Market Model and 3-Factor Model show positive alpha values (0.56% for Market Model, -0.21% for 3-Factor Model), suggesting some excess returns not explained by the chosen factors. However, these alpha values are not statistically significant, with t-statistics below the threshold of 1.65. The market premium factor has a significant negative effect on the portfolio's returns in both models, with beta values around -0.40, indicating that the portfolio tends to underperform when the market performs well and vice versa. The

SMB factor does not show a significant impact on the portfolio's returns. The HML factor, however, has a negative impact on the portfolio's returns, and it is statistically significant in the 3-Factor Model (t-statistic = -2.08).

For the quarterly holding period *(Panel B)*, the alpha values remain positive (0.70% for Market Model, -0.01% for 3-Factor Model), suggesting some excess returns not captured by the factors. However, these alpha values are not statistically significant. The market premium factor continues to have a significant negative effect on the portfolio's returns in both models, with beta values similar to those in the monthly holding period. The SMB factor remains insignificant with t-statistics below 1.65. The HML factor negatively impacts the portfolio's returns and is statistically significant in the 3-Factor Model (t-statistic = -1.94).

Considering semiannually holding period *(Panel C)*, the alpha values are positive (0.65% for Market Model, -0.25% for 3-Factor Model), indicating some excess returns not accounted for by the factors, these alpha values are not statistically significant. The market premium factor continues to have a significant negative effect on the portfolio's returns in both models, with beta values similar to the previous holding periods. The SMB factor remains insignificant. The HML factor negatively impacts the portfolio's returns and is statistically significant in the 3-Factor Model (t-statistic = -2.57).

The results show that the Market Premium factor consistently and significantly influences the portfolio's returns across all holding periods. The SMB factor does not have a significant effect, and the HML factor has a negative impact, being statistically significant in some periods. However, the alpha values are positive but not statistically significant, indicating some potential for excess returns not captured by the chosen factors. It is essential to interpret these results cautiously, considering that they are based on historical data and past performance might not predict future outcomes. Additionally, other unmeasured factors may also influence the portfolio's performance. Therefore, these findings should be complemented by other relevant information and used prudently in making investment decisions.

5.2.3 Comparing enhanced momentum strategy when insider is active to the traditional momentum strategy and the sub-period analysis

In this section, we conduct a comparative analysis of two investment strategies: the enhanced momentum strategy and the traditional momentum portfolio. The primary goal is to assess their respective performances and identify the strategy that shows the most promising outcomes. The traditional momentum portfolio, known as the tercile momentum portfolio, is utilized as the benchmark for this evaluation. The construction of the traditional momentum portfolio involves selecting the top 30^{th} percentile of stocks with the highest returns as the winners, while the bottom 30^{th} percentile comprises the loser stocks Furthermore, to provide a deeper understanding of the strategies' effectiveness under varying market dynamics, our analysis incorporates a sub-period analysis, meticulously examining both the pre-crisis and post-crisis periods. In particular, the COVID-19 crisis serves as the pivotal focal point of this study, given its significant impact on global markets. Throughout our period of analysis, which spans from January 2016 to December 2022, we divide the sample period into two distinct sub-periods: the pre-crisis period (January 2016 to April 2020) and the post-crisis period (April 2020 to December 2022). Considering different market conditions during these sub-periods, we aim to gain profound insights into how each strategy performs under varying economic and financial circumstances. This methodological approach enhances the robustness of our findings and enables us to develop a comprehensive understanding of the strategies' resilience and adaptability to market disruptions. The examination of performance during both stable and turbulent market conditions.

Table 5-7, Table 5-8, and Table 5-9 presents the result of regression through Market Model of the enhanced momentum strategy and compare the result with the traditional tercile momentum strategy in the sub-period basis which include the period when market doing normally or the pre-crisis period (January 2016 to April 2020) and the period when market recovery from COVID-19 event or the post-crisis period (April 2020 to December 2022).

Table 5-7 Summary of subperiod Market Model regression of monthly holding period of traditional momentum and enhanced momentum portfolio with insider transaction information

This table presents the result of the Market Model regression of an enhanced momentum portfolio that rebalance monthly and constructed based on past 3-month and past 6-month insider transaction activities in 2 subperiod including the period of pre-crisis (January 2016 to April 2020) which shows in Panel A and post-crisis (April 2020 – December 2022) which shows in Panel B and compare the result with the tercile traditional momentum strategy. The Alphas are reported in average monthly percentage format. T-statistics are reported in parentheses.

Monthly Holding Period

	Momentum WML	Past 3-months	Past 6-months
		Winner Bought minus Loser Sold	Winner Bought minus Loser Sold
Panel A: Pre-crisis			
Alpha	1.19%**	1.43%*	1.39%*
	(2.25)	(1.78)	(1.90)
Market Premium	-0.31**	-0.49**	-0.34*
	-(2.48)	-(2.13)	-(1.91)
Panel B: Post-crisis			
Alpha	-0.51%	-0.30%	-0.72%
	-(0.51)	-(0.34)	-(0.60)
Market Premium	-0.65***	-0.61***	-0.45**
	-(2.83)	-(2.87)	-(2.04)

Table 5-8 ***Summary of subperiod Market Model regression of quarterly holding period of traditional momentum and enhanced momentum portfolio with insider transaction information***

This table presents the result of the Market Model regression of an enhanced momentum portfolio that rebalance quarterly and constructed based on past 3-month and past 6-month insider transaction activities in 2 subperiod including the period of pre-crisis (January 2016 to April 2020) which shows in Panel A and post-crisis (April 2020 – December 2022) which shows in Panel B and compare the result with the tercile traditional momentum strategy. The Alphas are reported in average monthly percentage format. T-statistics are reported in parentheses.

Quarterly Holding Period

	Momentum WML	Past 3-months	Past 6-months
		Winner Bought minus Loser Sold	Winner Bought minus Loser Sold
Panel A: Pre-crisis			
Alpha	0.68%	1.43%*	1.61%**
	(1.49)	(1.76)	(1.98)
Market Premium	-0.32***	-0.41**	-0.33*
	-(2.91)	-(2.09)	-(1.71)

Panel B: Post-crisis			
Alpha	-0.62%	-0.22%	-0.83%
	-(0.58)	-(0.24)	-(0.82)
Market Premium	-0.41**	-0.49***	-0.34*
	-(2.12)	-(2.95)	-(1.87)

Table 5-9 ***Summary of subperiod Market Model regression of semiannually holding period of traditional momentum and enhanced momentum portfolio with insider transaction information***

This table presents the result of the Market Model regression of an enhanced momentum portfolio that rebalance semiannually and constructed based on 6-month insider transaction activities in 2 subperiod including the period of pre-crisis (January 2016 to April 2020) which shows in Panel A and post-crisis (April 2020 – December 2022) which shows in Panel B and compare the result with the tercile traditional momentum strategy. The Alphas are reported in average monthly percentage format. T-statistics are reported in parentheses.

Semiannually Holding Period		
	Momentum WML	Past 6-months
		Winner Bought minus Loser Sold
Panel A: Pre-crisis		
Alpha	0.44%	1.65%*
	(0.93)	(1.93)
Market Premium	-0.34**	-0.20
	-(2.45)	-(0.98)
Panel B: Post-crisis		
Alpha	-0.85%	-0.78%
	-(0.71)	-(0.60)
Market Premium	-0.39*	-0.48**
	-(1.82)	-(2.05)

In this analysis, we have discovered a noteworthy trend in both pre-crisis and post-crisis periods: both the traditional momentum strategy and the enhanced momentum strategy exhibit a negative correlation with the market which in lines with the study of Blitz et al. (2011) which shows that momentum strategy has negative correlation with market. An intriguing observation is that the Alphas of all models, including the traditional and enhanced momentum strategies, are positive and statistically significant during the pre-crisis period. However, in the post-crisis period, these Alphas become negative and lack statistical significance. This may point to a pronounced phenomenon of momentum crashes in both strategies during the market recovery phase after the crisis.

Furthermore, it is noteworthy that the enhanced momentum strategy generates abnormal returns, represented by Alphas, which are not only higher but also more statistically significant than those of the traditional momentum strategy during periods of normal market behavior.

Table 5-10, ***Table 5-11***, and ***Table 5-12*** presents the result of regression through Fama-French 3 Factors Model of the enhanced momentum strategy and compare the result with the traditional tercile momentum strategy in the sub-period basis which include the pre-crisis period (January 2016 to April 2020) and the post-crisis period (April 2020 to December 2022).

Table 5-10 Summary of subperiod Fama-French 3 Factors Model regression of monthly holding period of traditional momentum and enhanced momentum portfolio with insider transaction information

This table presents the result of the Fama-French 3 Factors Model regression of an enhanced momentum portfolio that rebalance monthly and constructed based on past 3-month and past 6-month insider transaction activities in 2 subperiod including the period of pre-crisis (January 2016 to April 2020) which shows in Panel A and post-crisis (April 2020 – December 2022) which shows in Panel B and compare the result with the tercile traditional momentum strategy. The Alphas are reported in average monthly percentage format. T-statistics are reported in parentheses.

Monthly Holding Period

	Momentum WML	Past 3-months	Past 6-months
		Winner Bought minus Loser Sold	Winner Bought minus Loser Sold
Panel A: Pre-crisis			
Alpha	-0.73%	-1.57%	-1.26%
	-(1.11)	-(1.61)	-(1.39)
Market Premium	-0.31***	-0.39**	-0.32
	-(2.58)	-(2.18)	-(1.95)
SMB	-0.88***	-1.35***	-1.21***
	-(3.49)	-(3.59)	-(3.46)
HML	-0.75***	-1.14***	-1.05***
	-(3.14)	-(3.20)	-(3.18)
Panel B: Post-crisis			
Alpha	-1.27%	-0.25%	-1.06%
	-(1.30)	-(0.26)	-(0.83)
Market Premium	-0.47***	-0.63***	-1.34
	-(2.62)	-(2.78)	-(1.34)
SMB	0.35	0.33	0.57
	(1.10)	(1.03)	(1.34)
HML	-0.33	-0.01	0.13
	-(1.10)	-(0.03)	(0.32)

Table 5-11 Summary of subperiod Fama-French 3 Factors Model regression of quarterly holding period of traditional momentum and enhanced momentum portfolio with insider transaction information

This table presents the result of the Fama-French 3 Factors Model regression of an enhanced momentum portfolio that rebalance quarterly and constructed based on past 3-month and past 6-month insider transaction activities in 2 subperiod including the period of pre-crisis (January 2016 to April 2020) which shows in Panel A and post-crisis (April 2020 – December 2022) which shows in Panel B and compare the result with the tercile traditional momentum strategy. The Alphas are reported in average monthly percentage format. T-statistics are reported in parentheses.

Quarterly Holding Period

	Momentum WML	Past 3-months	Past 6-months
		Winner Bought minus Loser Sold	Winner Bought minus Loser Sold
Panel A: Pre-crisis			
Alpha	-1.05%*	-1.06%	-1.23%
	-(1.89)	-(1.00)	-(1.21)
Market Premium	-0.32***	-0.39**	-0.32*
	-(3.18)	-(2.05)	-(1.73)
SMB	-0.82***	-1.14***	-1.30***
	-(3.85)	-(2.79)	-(3.31)
HML	-0.64***	-0.99***	-1.13***
	-(3.14)	-(2.58)	-(3.03)
Panel B: Post-crisis			
Alpha	-1.59%	-0.62%	-1.13%
	-(1.58)	-(0.68)	-(1.12)
Market Premium	-0.17	-0.33	-0.19
	-(0.94)	-(1.98)	-(1.02)
SMB	0.52	0.71**	0.78**
	(1.58)	(2.36)	(2.37)
HML	-0.38	0.18	0.30
	-(1.22)	(0.62)	(0.97)

Table 5-12 Summary of subperiod Fama-French 3 Factors Model regression of semiannually holding period of traditional momentum and enhanced momentum portfolio with insider transaction information

This table presents the result of the Fama-French 3 Factors Model regression of an enhanced momentum portfolio that rebalance semiannually and constructed based on 6-month insider transaction activities in 2 subperiod including the period of pre-crisis (January 2016 to April 2020) which shows in Panel A and post-crisis (April 2020 – December 2022) which shows in Panel B and compare the result with the tercile traditional momentum strategy. The Alphas are reported in average monthly percentage format. T-statistics are reported in parentheses.

Semiannually Holding Period

	Momentum WML	Past 6-months Winner Bought minus Loser Sold
Panel A: Pre-crisis		
Alpha	-1.43%**	-1.01%
	-(2.56)	-(0.92)
Market Premium	-0.32***	-0.15
	-(3.14)	-(0.73)
SMB	-0.82***	-1.11***
	-(3.84)	-(2.61)
HML	-0.78***	-1.22***
	-(3.81)	-(3.05)
Panel B: Post-crisis		
Alpha	-1.99%*	-1.56%
	-(1.77)	-(1.22)
Market Premium	-0.16	-0.24
	-(0.76)	-(1.01)
SMB	0.27	0.84
	(0.73)	(1.99)
HML	-0.68*	-0.03
	-(1.93)	-(0.07)

In this analysis, on average, the enhanced momentum strategy and traditional momentum strategy could not be able to generate positive and statistical significance abnormal return through the Fama-French 3 Factors model which in represents the return after controlling for Market premium, size of stocks, and value of stocks even in the pre-crisis period. This negative alpha with a lack of statistical significance in the model generally indicates that the investment isn't generating excess returns above what is expected based on market risk, size, and value factors, and this underperformance is not statistically significant, implying it could be due to random chance.

Table 5-13 presents the sub-period analysis of the monthly holding period portfolio of the enhanced momentum strategy when insider is active with past 3-month and past 6-month insider transaction activity compared to the traditional tercile momentum portfolio.

Table 5-13 Subperiod analysis of monthly holding period of traditional momentum and enhanced momentum portfolio with insider transaction information

This table shows the summary of the monthly portfolio including the traditional tercile momentum portfolio and the enhanced momentum portfolio by using past 3-month and past 6-month insider transaction activity information. The analysis includes the subperiods analysis divided into pre-crisis which is the period between January 2016 to April 2020 and post-crisis period which is the period between April 2020 to December 2022. Statistical measurements include (1) Average monthly return in percentage, (2) Standard Deviation, (3) Sharpe Ratio, (4) Skewness, and (5) Kurtosis T-statistics of the average annual returns are reported in parentheses.

Monthly Holding Period

	Momentum WML	Past 3-months	Past 6-months
		Winner Bought minus Loser Sold	Winner Bought minus Loser Sold
Panel A: Pre-crisis			
Average Return	1.31%***	1.29%*	1.33%**
	(2.75)	(1.83)	(2.08)
Standard Deviation	3.99%	5.87%	5.34%
Sharpe ratio	1.03	0.69	0.78
Skewness	-0.08	-0.08	-0.02
Kurtosis	0.31	0.67	0.02
Panel B: Post-crisis			
Average Return	-1.35%**	-0.89%	-1.24%
	-(2.15)	-(1.19)	-(1.51)
Standard Deviation	6.28%	6.23%	6.68%
Sharpe ratio	-0.77	-0.52	-0.65
Skewness	-1.34	-2.43	-1.74
Kurtosis	2.59	9.28	3.42

During the pre-crisis period *(Panel A),* our analysis reveals that the traditional momentum portfolio outperforms both the enhanced momentum portfolios, employing past 3-months and past 6-months insider activity information, across

several key metrics which are annual average return, return significance, standard deviation, and Sharpe ratio. Although the performance differences among the three portfolios are not much diverges from each other, the enhanced momentum portfolio with past 6-months insider activity information exhibits the highest monthly return, averaging at 1.33% (15.96% annually), followed closely by the traditional tercile momentum portfolio at 1.31% (15.72% annually), and the enhanced momentum portfolio with past 3-months insider activity information at 1.29% (15.46% annually). Significance testing confirms that all three portfolios' returns are statistically significant. Notably, the traditional momentum portfolio demonstrates the highest significance with a t-statistic of 2.75, followed by the enhanced momentum portfolio with past 6-months insider activity information at a t-statistic of 2.08, and the enhanced momentum portfolio with past 3-months insider activity information at a t-statistic of 1.83. Regarding risk metrics, the traditional momentum portfolio exhibits the lowest standard deviation at 3.99% annually, while the enhanced momentum portfolio with past 6-months insider activity information and the enhanced momentum portfolio with past 3-months insider activity information have standard deviations of 5.34% and 5.87%, respectively. Furthermore, the Sharpe ratio, which gauges the risk-adjusted returns, favors the traditional momentum portfolio, yielding a ratio of 1.03. In comparison, the enhanced momentum portfolio with past 6-months insider activity information and the enhanced momentum portfolio with past 3-months insider activity information achieve Sharpe ratios of 0.78 and 0.69, respectively. Regarding the shape of the return distribution, all portfolios exhibit slightly negatively skewed distributions, with the enhanced momentum portfolio employing past 6-months insider activity information showing the least negative skewness (skewness = -0.02). Additionally, all portfolios demonstrate thin tails, as indicated by a Kurtosis value below 3.

During the post-crisis period *(Panel B),* our analysis reveals a challenging landscape for all portfolios, including both the traditional tercile momentum portfolio and the enhanced momentum portfolio. Unfortunately, all these portfolios generated negative annual returns during this phase. Among these portfolios, the traditional tercile momentum portfolio performed the worst, posting an average annual return of -16.24%. It was closely followed by the enhanced momentum portfolio with past 6-

month insider transaction information, which yielded an annual return of -1.24% (-14.86% annually). Comparatively, the enhanced momentum portfolio with past 3-month insider transaction information performed slightly better, with an annual return of -0.89% (-10.67% annually). In terms of the skewness of return distributions, it's noteworthy that during this post-crisis period, the distributions for all three momentum portfolios became even more negatively skewed compared to the period before the crisis. This suggests a greater bias toward negative returns. Additionally, the enhanced momentum portfolio with past 3-month insider transaction information displayed an exceptionally high kurtosis value (Kurtosis = 9.28). This signifies a very high level of risk in the tail of the return distribution, indicating that extreme events or outliers may pose significant challenges to the portfolio's performance during this period.

Table 5-14 presents the sub-period analysis of the quarterly holding period portfolio of the enhanced momentum strategy when insider is active with past 3-month and past 6-month insider transaction activity compared to the traditional tercile momentum portfolio.

Table 5-14 Subperiod analysis of quarterly holding period of traditional momentum and enhanced momentum portfolio with insider transaction information

This table shows the summary of the quarterly portfolio including the traditional tercile momentum portfolio and the enhanced momentum portfolio by using past 3-month and past 6-month insider transaction activity information. The analysis includes the subperiods analysis divided into pre-crisis which is the period between January 2016 to April 2020 and post-crisis period which is the period between April 2020 to December 2022. Statistical measurements include (1) Average monthly return in percentage, (2) Standard Deviation, (3) Sharpe Ratio, (4) Skewness, and (5) Kurtosis T-statistics of the average annual returns are reported in parentheses.

Quarterly Holding Period

	Momentum WML	Past 3-months	Past 6-months
		Winner Bought minus Loser Sold	Winner Bought minus Loser Sold
Panel A: Pre-crisis			
Average Return	0.70%*	1.53%*	1.52%**
	(1.72)	(1.88)	(2.16)
Standard Deviation	3.41%	6.00%	5.89%
Sharpe ratio	0.59	0.71	0.82
Skewness	-0.06	0.04	-0.13
Kurtosis	-0.38	-0.40	-0.35

Panel B: Post-crisis			
Average Return	-1.09%*	-0.79%	-1.17%*
	-(1.79)	-(1.18)	-(1.73)
Standard Deviation	6.07%	5.61%	5.68%
Sharpe ratio	-0.64	-0.52	-0.74
Skewness	-0.66	-1.55	-0.79
Kurtosis	0.18	3.06	0.81

In this quarterly holding approach during pre-crisis period *(Panel A),* the performance of the traditional momentum portfolio experienced a significant drop to 8.04% with a statistical significance of 10%. In contrast, both enhanced momentum portfolios maintained their strong performance, with the enhanced momentum portfolio utilizing past 6-month insider activity information achieving a return of 1.52% (18.25% annually) with a t-statistic of 2.16, and the enhanced momentum portfolio utilizing past 3-month insider activity information achieving a return of 1.53% (18.37%) with a t-statistic of 1.88. Regarding risk metrics, the standard deviation of the enhanced momentum portfolios slightly increased to 6.00% and 5.89% for the portfolios utilizing past 3-month and past 6-month insider activity information, respectively. In comparison, the traditional momentum strategy exhibited a lower standard deviation of 3.41%. The Sharpe ratio, which assesses the risk-adjusted returns, showed modest improvements for both enhanced momentum strategies, reaching 0.82 for the portfolio utilizing past 6-month insider activity information, and 0.71 for the portfolio utilizing past 3-month insider activity information. In contrast, the Sharpe ratio of the traditional momentum portfolio experienced a significant decline, falling to 0.59. The shape of the return distribution for all three portfolios during the quarterly holding period remained consistent with that of the monthly holding period. The distributions exhibited negative skewness and a kurtosis value of less than 3, indicating a lower probability of extreme values.

During the post-crisis period *(Panel B),* our analysis reveals a challenging environment where none of the three portfolios were able to generate positive returns. Instead, they all experienced negative average annual returns. Among these portfolios, the one that fared the best in terms of limiting losses was the enhanced momentum strategy with past 3-month insider transaction information. It posted the least negative

average annual return, with a value of -0.79% (-9.51% annually). In contrast, the traditional tercile momentum portfolio and the enhanced momentum portfolio with past 6-month insider transaction information faced more substantial losses, with returns of -1,09% (-13.04% annually) and -1.17% (-14.10% annually), respectively.

Table 5-15 presents the sub-period analysis of the semiannually holding period portfolio of the enhanced momentum strategy when insider is active with past 6-month insider transaction activity compared to the traditional tercile momentum portfolio.

Table 5-15 Subperiod analysis of semiannually holding period of traditional momentum and enhanced momentum portfolio with insider transaction information

This table shows the summary of the semiannually portfolio including the traditional tercile momentum portfolio and the enhanced momentum portfolio by past 6-month insider transaction activity information. The analysis includes the subperiods analysis divided into pre-crisis which is the period between January 2016 to April 2020 and post-crisis period which is the period between April 2020 to December 2022. Statistical measurements include (1) Average monthly return in percentage, (2) Standard Deviation, (3) Sharpe Ratio, (4) Skewness, and (5) Kurtosis T-statistics of the average annual returns are reported in parentheses.

Semiannually Holding Period

	Momentum WML	Past 6-months
		Winner Bought minus Loser Sold
Panel A: Pre-crisis		
Average Return	0.37%	1.56%**
	(0.91)	(2.14)
Standard Deviation	3.44%	6.11%
Sharpe ratio	0.25	0.82
Skewness	-0.18	-0.69
Kurtosis	0.23	1.35
Panel B: Post-crisis		
Average Return	-1.19%*	-1.37%
	-(1.77)	-(1.56)
Standard Deviation	6.77%	7.34%
Sharpe ratio	-0.63	-0.67
Skewness	-0.58	-1.17
Kurtosis	0.50	1.84

During the pre-crisis period *(Panel A)* with semi-annual holding portfolios. The traditional momentum portfolio fails to generate statistically significant returns, with an average monthly return of 0.37% (4.49% annually) and a corresponding t-statistic of 0.91. In contrast, the enhanced momentum portfolio utilizing past 6-month insider activity information continues to exhibit positive and statistically significant profitability, boasting an average monthly return of 1,56% (18.76% annually) with a t-statistic of 2.14. Moreover, the enhanced momentum portfolio maintains a steady Sharpe ratio of 0.82, underscoring its capacity to deliver risk-adjusted returns despite market uncertainties. The return distribution pattern remains consistent, characterized by slightly negative skewness (skewness = -0.69) and a scarcity of extreme values, evident by a kurtosis value below 3.

During the post-crisis period *(Panel B)*, our analysis reveals that neither the traditional momentum strategy nor the enhanced momentum strategy is able to overcome the market turbulence and generate positive and statistically significant returns. The enhanced momentum portfolio with past 6-month insider transaction information performed even worse than the traditional momentum portfolio with the average monthly return of -1.19% (-16.41% annually) compared to the traditional momentum portfolio at -1.37% (-14.34% annually). The challenging market conditions during this period seem to have impacted both strategies, leading to suboptimal performance and an inability to achieve profitable and statistically significant results.

In conclusion, the comparative analysis of the enhanced momentum strategy and the traditional momentum portfolio reveals distinct performance characteristics across various holding periods and market conditions. During the pre-crisis period, the enhanced momentum strategy exhibits consistent statistical significance in generating positive returns, outperforming the traditional momentum portfolio in terms of both average returns and risk-adjusted metrics in the longer holding period. Though in the monthly holding period, the traditional momentum can outperform both of the enhanced momentum portfolio including the one that utilized past 3-month insider activity information and the one with past 6-month insider activity information in terms of the lower volatility (lower standard deviation) and higher Sharpe ratio,

however in terms of the average annual return, the traditional momentum portfolio generates approximately the same as both of the enhanced strategy with the average return around 15% in the monthly holding period basis. In the other hand, considering in the longer holding period, the enhanced momentum portfolios both the one that utilized past 3-month insider activity information and the one with past 6-month insider activity information perform dramatically better than the traditional momentum portfolio in the quarterly holding period with the consistent return similarly to the return they generate in the monthly holding period. For the enhanced momentum strategy that utilized the past 6-month insider activity information, it's return in the semiannually period still significance and outperform the traditional momentum strategy with the high significance return at around 18%. Our findings align with those Blitz et al. (2011), who demonstrated that the total returns of the traditional momentum strategy tend to diminish when held over longer periods. Notably, the traditional momentum strategy exhibits its strongest performance within the monthly holding period. The incorporation of insider transaction activity enhances the strategy's resilience and adaptability, contributing to its robust performance during stable market conditions. However, the post-crisis period poses challenges for both strategies. The market turbulence and uncertainties during this period adversely impacted the performance of both portfolios, leading to negative returns.

To conclude the result in this **section 5.2** addresses the second objective of our study: to develop and evaluate momentum strategies enhanced by insider trading information. Over the full sample period from January 2016 to December 2022, our enhanced momentum strategy, incorporating insider transaction data, consistently generates positive returns. This outcome holds true regardless of the portfolio formation method, whether using past 3-month or past 6-month insider transaction data, and across various holding periods, including monthly, quarterly, and semiannually. However, it's worth noting that while the average returns are positive, they don't consistently reach strong levels of statistical significance. Among these portfolios, the one utilizing past 3-month insider transaction data and holding quarterly exhibits the highest average return and the strongest statistical significance.

The lack of statistical significance in our full sample analysis might be attributed to the inclusion of the COVID-19 market crashes in April 2020, which led to momentum crashes during the market's recovery phase. Regression analysis using the Market Model indicates a negative relationship between our enhanced momentum strategy and the market, potentially contributing to the momentum crashes during the recovery period. Therefore, we conducted a sub-period analysis to gain deeper insights.

In the period before the COVID-19 crisis (January 2016 to April 2020), our enhanced momentum strategy demonstrates robust performance. It generates positive and statistically significant average returns close to the traditional tercile momentum portfolio in the monthly holding period and outperforms the traditional momentum portfolio in the quarterly and semiannual holding periods. This indicates its ability to consistently enhance the momentum strategy.

However, in the period after the COVID-19 (April 2020 to December 2022), when the market had largely recovered, both the traditional and enhanced momentum strategies fail to outperform the market. They exhibit negative average returns and a lack of statistical significance. These results align with our findings from the Market Model regression, highlighting a negative correlation with the market. Consequently, during the market's recovery phase, our strategies face challenges.

One of the limitations of the traditional momentum strategy is its inherent negative skewness, which suggests a greater likelihood of encountering extreme negative returns. Interestingly, our enhanced momentum strategy, while effective in other aspects, did not alleviate this issue, as indicated by the persistently negative skewness in its return distribution.

5.3 The analysis of the time-varying behavior of momentum strategy incorporating insider transaction information

In this section, we employed the analysis of the time-varying behavior of the enhanced momentum strategy with insider transaction information and the traditional deciles momentum strategy. This analysis focuses on the 126-days rolling regression of the daily return of the winner and loser portfolio (Winer-Bought and Loser-Sold

portfolio for the enhanced momentum strategy) with 10-days lags market return. The procedure is mentioned in ***section 4.3***. The objective of the regression is to investigate how the portfolios react corresponded to the market during the period of crisis (COVID-19) which can refer to the evidence of momentum crashes. The result is shown in **We have** divided this recovery phase into two distinct sub-periods: the first recovery stage spans from April 2020 to October 2020, representing the initial phase of the market rebound, while the second recovery stage encompasses the period from October 2022 onwards, signifying the latter half of the recovery process.

Figure 5-1. We have divided this recovery phase into two distinct sub-periods: the first recovery stage spans from April 2020 to October 2020, representing the initial phase of the market rebound, while the second recovery stage encompasses the period from October 2022 onwards, signifying the latter half of the recovery process.

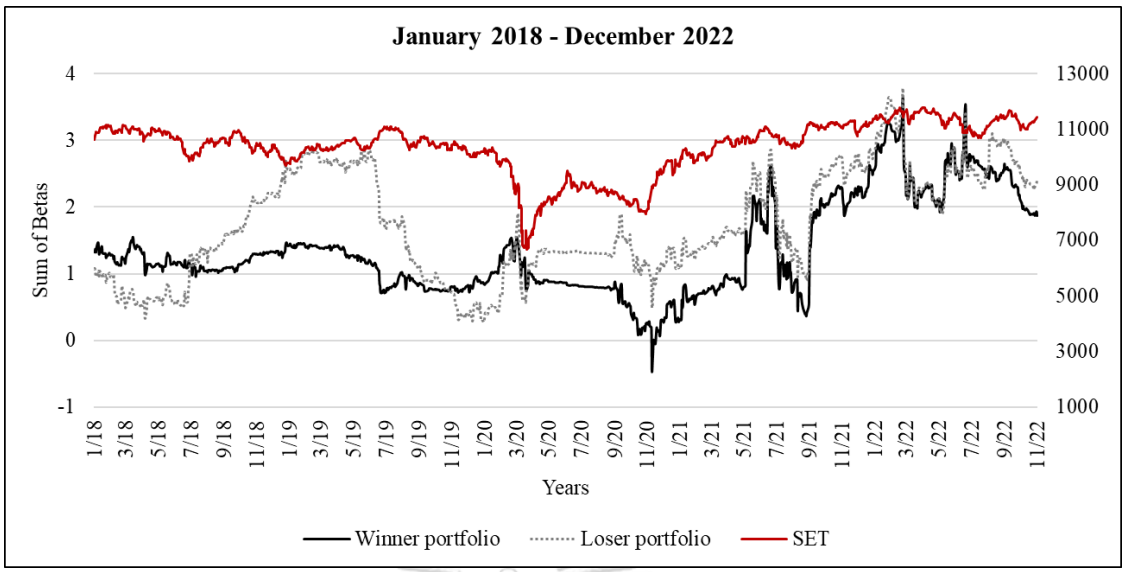
Figure 5-1 Summation of portfolio's betas of 126-days rolling regression with 10-days lags market return

This figure illustrates the summation of the betas of the portfolio return as a result of 126-days rolling regression with 10-days lag market return from January 2018 to December 2022 on the left-hand side axis. The black solid line represents the betas summation of the Winner (Winner-Bought) portfolio, the black dash line represents the betas summation of the Loser (Loser-Sold) portfolio. The regression is as follows:

$$\tilde{r}_{i,t} = \beta_0 \tilde{r}^{e}_{m,t} + \beta_1 \tilde{r}^{e}_{m,t-1} + \cdots + \beta_{10} \tilde{r}^{e}_{m,t-10} + \epsilon_{i,t}$$

The axis on the right-hand side shows the daily total return index of SET presented in the red solid line. The figure presents the Winner and Loser portfolios in Panel A and the Winner-Bought and Loser-Sold portfolios in Panel B.

Panel A: Winner and Loser portfolios



Panel B: Winner-Bought and Loser-Sold portfolios

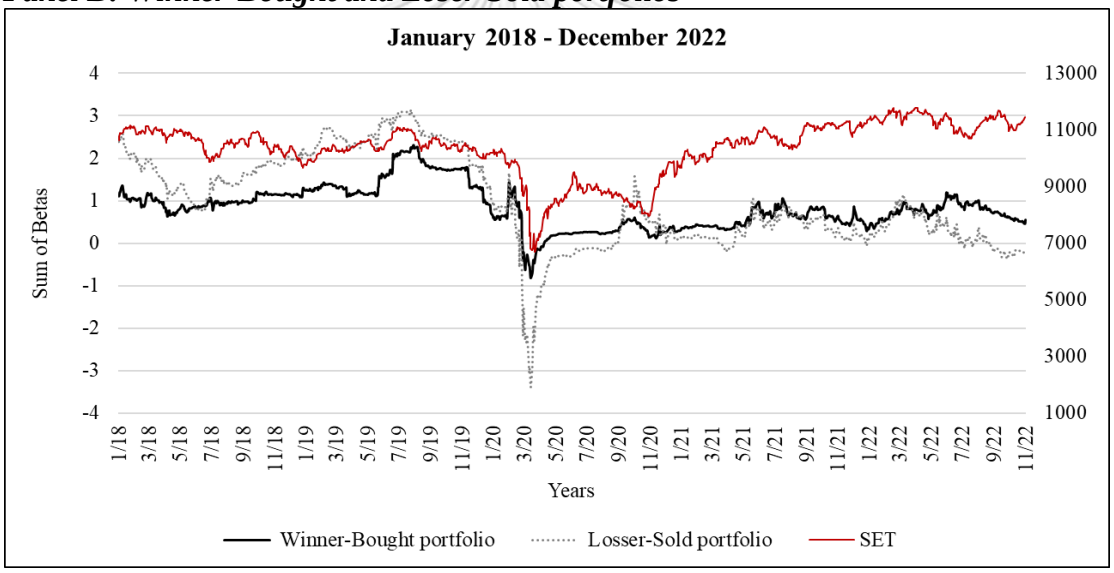


Table 5-16 presents the ten worst monthly returns for both the traditional decile momentum strategy (Winner minus Loser) in *Panel A* and the enhanced momentum strategy incorporating past 3-month insider transaction information (Winner-Bought minus Loser-Sold) in *Panel B.* Both portfolios consider monthly rebalancing, and the observation period spans from January 2018 to December 2022. To investigate the causes behind the decline in returns for these portfolios, we mark the days that portfolio generate negative return while the market is positive (recovery), the date between April 2020 and October 2020 with an asterisk (*) representing the loss of the strategy in the first half of market recovery and those from

October onwards 2022 with (†) to represent the loss of the strategy in the second half of the market recovery period.

Table 5-16 Worst monthly return

This table lists the 10 worst monthly returns to the traditional decile momentum portfolio (Winner-minus-Loser) in Panel A over the period of January 2018 to December 2022 and the 10 worst monthly returns to the enhanced momentum portfolio with past 3-month insider transaction information (Winner-Bought minus Loser-Sold) in Panel B. The dates between April 2020 and October 2020 are marked with an asterisk (∗) to represent the first half of market recovery period, those from October 2022 onwards are marked with (†) as to represent the second half of market recovery period. All numbers in the table are in percentages.

Panel A Worst monthly momentum portfolio returns

Rank	Month	Winner minus Loser	Market
1	2022-08†	-25.98	4.53
2	2020-12†	-25.56	2.96
3	2020-05*	-17.15	3.41
4	2021-10†	-14.33	1.14
5	2022-07†	-13.53	0.53
6	2019-12	-11.00	-0.48
7	2022-06†	-10.51	-5.71
8	2019-02	-9.94	0.97
9	2021-04†	-8.67	0.22
10	2020-09†	-8.57	-5.47

Panel B Worst monthly enhanced momentum portfolio returns

Rank	Month	Winner-Bought minus Loser-Sold	Market
1	2020-12†	-27.26	2.96
2	2019-02	-12.84	0.97
3	2018-08	-7.91	1.74
4	2021-09†	-7.70	-1.62
5	2021-11†	-7.23	-3.25
6	2020-06*	-5.88	-0.26
7	2021-01†	-5.10	1.24
8	2021-07†	-4.77	-4.11
9	2018-10	-4.27	-4.82
10	2020-01	-4.04	-5.39

For the traditional decile momentum strategy (**Figure 5-1** *Panel A*), following the market drop in April 2020, the betas of the Winner portfolio begin to fall below those of the Loser portfolio. This suggests that after the initial market drop and the subsequent recovery (post-April 2020), the Loser stocks from the traditional momentum portfolio became more sensitive to market movements than the Winner stocks. This led to the Loser stocks outperforming the Winner stocks during the market recovery period. This is supported by ***Table 5-16*** *Panel A*, which shows that in May 2020, the return from the traditional momentum portfolio was -17.15%, while the market generated a positive return of 3.41%. Conversely, for the enhanced momentum portfolio with past 3-month insider transaction information (**Figure 5-1** *Panel B*), the betas of the Winner-Bought stocks remain higher than those of the Loser-Sold stocks after the market drop in April 2020. This implies that during the market recovery, the Winner-Bought stocks exhibited a positive relationship with the market, causing them to outperform the Loser-Sold portfolio. This observation is further supported by the data in ***Table 5-16*** *Panel B*, which shows no significant drop in the return of the enhanced momentum portfolio during that period.

Focusing on the second half of market recovery from October 2020 onwards, in the case of the traditional decile momentum portfolio, the betas of the Winner stocks continue to trail behind those of the Loser stocks. This results in the Loser stocks outperforming the Winner stocks during the recovery phase. This aligns with ***Table 5-16*** *Panel A*, which shows numerous substantial losses for the traditional momentum portfolio during this period. For example, in December 2020, the traditional decile momentum portfolio generated a return of -25.56% while the market generates the positive return of 2.96%, marking the second-largest loss in the portfolio's performance from January 2018 to December 2022. In contrast, for the enhanced momentum portfolio with insider transaction information, following the second half of market recovery in September 2022, the betas of the Winner-Bought and Loser-Sold stocks start to intersect and fluctuate alongside each other. This intersection of betas and the subsequent fluctuations led to crashes in the enhanced momentum portfolio with insider transaction information, resulting in significant losses. For instance, in December 2020, the enhanced momentum strategy suffered its

largest loss during the observed period, with a return of -27.26% while the market generates the positive return of 2.96%.

In summary, this section provides a detailed analysis of how the enhanced momentum strategy with insider transaction information and the traditional deciles momentum strategy reacted to market events, particularly during the COVID-19 crisis. The results shows that the traditional momentum strategy started to crash after the first market drop while the enhanced momentum strategy still hold its momentum during that period, however, the enhanced momentum strategy starts to falter in the longer time span. Nevertheless, the enhanced momentum strategy still experiences smaller loss during the crashes period as compared in ***Table 5-16***.

CHAPTER 6
Conclusion

This study aims to investigate the performance of the portfolio constructed by using insider transaction information, and the ability of it to enhance the existing traditional momentum portfolio in the context of Thai stock market. It includes the method of constructing the portfolio in different information windows like using past

3 months insider transaction information of use past 6 months insider transaction information to construct the portfolio, we also examine the performance of our strategy in various holding periods. The time frame of our analysis includes the period between January 2016 to December 2022 which includes the period of market panic as the effect of COVID-19 crisis, leading us the opportunity to evaluate our strategy in the period of market volatile.

Our study demonstrates the feasibility of constructing trading portfolios using publicly disclosed insider transaction data, as mandated by SEC regulations through the 59-2 form. We base our insider portfolios on net transaction activity within a defined past period. Notably, our 'Bought' portfolio, comprising stocks acquired by insiders in that past period, consistently yields positive returns across various holding periods. This holds true for both portfolios, whether they include past 3-month or past 6-month insider transaction data. In the case of our 'Sold' portfolio, representing stocks divested by insiders in the past period, it also generates positive returns, albeit somewhat lower than those of the 'Bought' portfolio. By investigating the abnormal return through the Market Model, the result suggested that the Sold portfolio generates lower and less significant abnormal return compared to the bought portfolio. It is worth nothing to apply the Fama-French 3-Factors Model and Fama-French-Carhart 4-Factors Model to capture the abnormal return as it shown lack of statistical significance results. Interestingly, Scott and Peter (2004) suggest that stocks sold by insiders can indeed yield positive returns in subsequent periods. Additionally, Ke et al. (2003) argue that insider selling tends to be more regulated and scrutinized than insider buying, which may explain these positive return Sold portfolio observed. Our findings collectively underscore the potential of insider transaction data as a valuable resource for informed portfolio construction and investment strategies. The result turns out according to our hypothesis that the insider transaction both buying and selling is informative as the insider buys are more informative reflecting in high portfolio return and statistical significance level.

Our second objective, which aimed to enhance the traditional momentum portfolio with insider transaction information, has proven successful. We've achieved this by taking long positions in stocks that were past winners and have been bought by

insiders, while shorting stocks that were past losers and have been sold by insiders. This enhanced momentum strategy consistently generates positive returns across various holding periods. In contrast, the traditional tercile momentum strategy achieves its highest returns with monthly rebalancing, but experiences performance drops in longer holding periods. Support for our approach comes from. DeVault et al. (2022) who indicate the potential of combining insider transaction data with momentum strategies to improve their effectiveness. Furthermore, our enhanced momentum strategy retains its effectiveness when controlling market risk, evident through its ability to produce positive abnormal returns in the Single Index Model. However, statistical significance is not observed when applying the Fama-French 3-Factors Model. It's worth noting that during periods of market turmoil, such as the COVID-19-induced downturn, both our enhanced momentum strategy and the traditional tercile momentum strategy struggle, resulting in negative returns. This highlights the impact of external market conditions on portfolio performance.

Our examination of the time-varying behavior of the enhanced momentum strategy, conducted in alignment with the methodology outlined by (Daniel & Moskowitz, 2016). During the initial market downturn in April 2020, while the traditional momentum strategy faltered and experienced what is commonly referred to as a "momentum crash," the enhanced momentum strategy showcased resilience. It demonstrated a capacity to weather the storm without undergoing a similar downturn, indicating its robustness in the face of market turbulence. However, the narrative shifted during the second market drop in November 2020. At this juncture, the enhanced momentum strategy encountered challenges, particularly regarding the stocks in the short position (representing past loser stocks that had been sold by insiders). These loser stocks exhibited a heightened correlation with the market during the recovery phase, resulting in their outperformance relative to the winning stocks in the portfolio. Consequently, this period presented difficulties for the enhanced momentum strategy causing the momentum of the stocks in the enhanced portfolio to crash.

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