The Anomalies of SIN Stocks Based on CAPM and Fama-French Models: Evidence from Asia-Pacific Region

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Abstract

This paper examines the existence of abnormal return (anomalies) in SIN stocks using 101 SIN stocks from 8 Asia-Pacific countries, compassing the period from July 2009 to June 2019 and regressed with 3 different asset-pricing models: CAPM, FF3FM and FF5FM. The robustness of the models is also tested separately in studying the viability of the asset-pricing models in capturing the performance of SIN stocks. The authors find that SIN anomalies exist in 3 out of 8 Asia-Pacific countries: Australia, China and India while FF3FM is found to be the best model among the asset-pricing models in capturing the abnormal returns of SIN stocks with lower pricing errors as compared to the other two models. The findings provide new perspective on SIN stocks in the context of investment by contributing to the existing literature, in proving that SIN anomalies do hold in certain Asia-Pacific regions despite the cultural and ideological difference compared to most tested geographical region like the United States and Europe.

Keywords **:** *Anomalies; Abnormal Excess Return; Capital Asset Pricing Model; Fama-French model; SIN stocks; Vice stocks*

I. INTRODUCTION

The definition of SIN stock has been emphasised in many studies [1] [2] [3], which regard SIN companies in a variation of industry that fail to meet the desirable standard for the wellbeing in overall, or producing goods and services that could harm the society. As many scholars have opted the categories of SIN industry based on their belief, other studies have employed broader classifications and included adult entertainment [4] [5], military [6], firearms [7] nuclear power [8], biotech [4], and oil and cement [3]. Thus, there is no unique definition of SIN stocks, however, relying on previous researches, derived a consensus that alcohol, gambling and tobacco or known as the "triumvirate of SIN", are commonly classified as the "SIN" industry which will be the focus of this paper.

Numerous precedent studies conducted have provided findings of the positive excess return in SIN stocks [1] [2] [4] [10] [11] [12] [13]. Despite the empirical evidence, many institutional investors have circumvented the composition of SIN stocks to be included into their portfolio, in order to avoid any association with these stocks. In the study of Hong and Kacperczyk (2007), institutional investors have significant price effect in SIN stocks, and they are deemed to be constantly under the social norm pressure. Institution investors such as pension, insurance, religious and universities funds who position fund into "unethical" business such as the investment in SIN stocks, would expose to public scrutiny in return on the condemnation for such participation. For that, the sell-side analyst which tend to cater research and valuation reporting to the institutional investors would reduce their analysis coverage into SIN stocks. As SIN stocks are less followed by the sell-side analysts, arbitrage opportunity arises whereby individual investors whom are willing to hold SIN stocks which are against the social norm would earn excess return.

One of the remarkable features of SIN industries is that it is subjected to the high threshold for new competitors to enter the market [4]. Due to the controversial product and service, legislation is stringent and authorities are reluctant to issue additional licensing. Therefore, in most countries the SIN industries are relatively oligopolistic or monopolistic in market concentration. However, this monopolism is primarily induced due to national health issues in protecting consumers as well as

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reducing consumption on addictive products and services in order to uphold the wellbeing of citizen.

Contradict to the profit orientation of sinful stocks, the double-bottom-investing commonly referred to as Socially Responsible Investing (SRI) has displayed vulnerability in the SIN investment orientation. As global recognition awakens toward the societal roles of financial institution, the adoption of libertarianism in social governance has implicitly shifted the social responsibility into the private sectors. Socially Responsible Investing (SRI) has become part of the popular trend in the wake of deregulated liberalisation and financial institutions considered leverage into fiduciary responsibility as a quality trait aside from profitability [14] [15].

The interest in this study embarked, due to the conservatism in Asia-Pacific regions where most countries have less liberal and more stringent towards the SIN companies, which potentially magnetised into lawsuit as well as changing enactment that could cause unprecedented losses in SIN related industry. As presented, an overwhelming majority in the studies of SIN stocks have reflected SIN stocks to be a risky asset. Assuming that SIN stocks are risker, whereby abnormal returns do exist in majority of SIN industry in liberal United States, as SIN stock is considerably flourish in a liberty policies region or higher ease of doing business from a more matured market.

This paper intents to further explore SIN stocks into Asia-Pacific countries for several reasons. Firstly, the economies policies of Asia-Pacific have vibrantly changed, as few nations are in the verge of moving toward developed nation, for that, market dynamic in this region is worth the attention. Secondly, cultural and ideologies differences among the Asia-Pacific regions and contrast from the United States are apparently vast and diverse, whereby some countries within the Asia-Pacific regions like Malaysia is poised as an Islamic state nation and has incorporated religious principles in its legislation, however the triumvirate of SIN companies coexisted. Thirdly, due to the deregulation of financial market in Asia-Pacific nations, it has become a strategic platform for international investors and mutual funds anticipating in diversification of portfolio. Therefore, given that the arrays of unique features of Asia-Pacific, it would provide a good experimental setting by imploring the anomalies of SIN stocks which have much discrepancies in regards to ethical issues.

The emergence of Socially Responsible Investing (SRI) asserted pressure into the SIN industry which the nature of business is against the social norm. As investors begin to diverge from sinful act and become more rational on the social ethically investing, thereby creating demand on socially responsible stocks and shunning away from SIN stocks. Thus, with integration of SRI into investment strategy and diverging investors' perspective in sinful companies, this paper implores contemporary experimental setting into SIN industry in search of whether the abnormal returns still hold. As no previous studies have shed lights on SIN stocks in Asia-Pacific, this paper evaluates the presence of SIN anomalies in Asia-Pacific region and may bring significance to investors especially those planning to shun away from SIN stocks.

Besides, to capture the anomaly of excess return in SIN stocks, three major assets pricing models will be employed; Capital Assets Pricing Model – CAPM [16], Fama and French Three-Factor model [17] and Fama and French Five-Factor model [18]. At least for more than thirty years, CAPM has dominated the finance literature by providing simple and straightforward relationship between systematic risk and return. However, the CAPM model has subjected to vast criticisms in reporting that the market beta alone is not effective in explaining the cross sectional of expected return on stocks. By following this study, testing for the three standard assets pricing models (CAPM, FF3FM and FF5FM) and fitness of models will be conducted in relevancy of capturing the anomalies of SIN stocks.

II. LITERATURE REVIEW

A. SIN Anomalies

Numerous empirical studies into the financial performance of SIN companies, concluded that SIN investors could benefited from the abnormal risk-adjusted returns.

Salaber (2007) conducted study on the performance of SIN stocks in 18 countries within the European regions by aligning a portfolio with 158 sin stocks over the period of 1975 to 2006. In his research, CAPM and Fama and French Three-Factors model was employed to measure the performance of SIN stocks, it was found that portfolio which excluded SIN stocks were underperform as compared to SIN portfolios. Portfolio with the constituent of SIN stocks grows at the additional 4% as compared to sin-free portfolios. According to Salaber (2007), SIN stock's abnormal return could also be emerged from the litigation risk which associated from the products and services produced. Higher litigation

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problem may be encountered from the level of exposure based on the nature of business, consequently due to the punitive costs from lawsuits and cost of legal experts.

Besides, Kempf and Osthoff (2007) studies in Socially Responsible Investing from the period of 1991 to 2004 in S&P 500 and DS 400 has segregated the stocks according to "high-rated" (SRI) and "low-rated" (SIN). Rating was based on the SRI scores retrieved from KLD Research and Analytics. Aligning in portfolios of these two segregations, long-short strategy was established for each portfolio. To measure the performance, studies employed the four-factors Carhart model with time-series on monthly basis. As the results shows that SIN firms that produce controversial products have abnormal return. Results for the size and value effect show similar pattern as Salaber (2007), however, HML was not significant.

Compassing across 21 nations from 1970 to 2007, a portfolio constituting a wide range of SIN sectors which comprises gambling, tobacco, alcohol, biotech, defence, and adult entertainment industries was conducted by Fabozzi, Ma, and Oliphant (2008). Their studies concluded that SIN portfolio outperforms against the market on both raw and beta adjusted basis, respectively by 3 percent and 6 percent. In Fabozzi, Ma, and Oliphant (2008) studies, abnormal return on SIN stocks could poised from the monopolistic power, due to the high degree barrier of entry in SIN industries and sensitive to the shifting political influences, for that SIN companies that managed to survive all odds would strive to earn excess return.

Hong and Kacperczyk (2007) state that SIN stock within the period 1926 to 2004 had relatively high expected return, even after controlling the beta, market capitalisations (size), value (book-to-market) and momentum. In addition, the results show no existence of size effect but only value effect which consistent to Salaber (2007) and Kempf and Osthoff (2007). It was found that SIN stocks significantly outperform its comparable stocks by an additional of 4.5% annually. Hong and Kacperczyk (2007) identified that reputation risk premium arises on a company that do not follow the social norm, and thus majority of investor would avoid them. institution which subjected to social norm pressure for instance banks, insurances companies, pension funds and universities has a low exposure. Based on Hong and Kacperczyk (2007) findings shows an approximately 18% lower on the institutional ownership in SIN related stocks. Consequently, the marketable of SIN stocks has also affected by sell-side analyst who has lesser coverage on it, as the purpose to comply with institutional investors demand. This indicate limited risk sharing for investor who willing to hold SIN stocks as a result causing the price of SIN stock to be lowered and systematically under-priced. Thus, investor who willing to hold SIN stocks and acting against the social norm would be expected to earn abnormal return from the undertaking of reputation risk premium [2] [4] [5] [12].

In line to the studies of Kempf and Osthoff (2007), Statman and Glushkov (2009) in investigating the performance of Socially Responsible Investing that has included SIN portfolios for comparison. Their studies analyses SRI and SIN stocks returns which found that the inclusion of SIN stocks in portfolio is consistent with the hypothesis of "doing good but not well", as results shows that SRI stock underperformed the shunned stocks. Continuously, similar studies in SRI and controversial investing has also conducted by Derwall, Koedijk, and Ter-Horst (2011) that SIN stocks' abnormal return are consistently positive and constant across four different periods from 1992 to 2008, at the interval of increasing order on two years for each sub periods study starting from 2004. Thus, results show the existence of abnormal return in SIN stocks as assimilate to the findings of Kempf and Osthoff (2007) and Statman and Glushkov (2009).

Kim and Venkatachalam (2011) investigate the information risks in SIN stocks as the potential determinants to explain the abnormal return, suggesting two contrasting behaviour derived from SIN companies regarding the financial reporting quality. Firstly, due to the high degree of scrutiny, SIN companies extensive financial resources and financial performance could draw the attention of potential plaintiff. This heightened the awareness of public interest in acknowledging the activities of SIN companies, might intensify SIN companies to be less transparent which lead to a lower quality of financial reporting. Whereby, tallies the claims of Kim and Venkatachalam (2011) that information risk attributed from inferior quality of reporting in explaining the abnormal return from the previous studies. In contrast, it is conceivable that SIN stock could have an incentive to reveal a better reflection on information symmetric in order to overcome investor confidence, for that, SIN companies would exhibit a better quality in its financial statements [2].

Richey (2014) examine the performance of US sin stocks from the period 2007 to 2013 by employing CAPM, Fama and French Three-Factor Model and four-factors Carhart model. The study comprises

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two subperiod respectively the bear and bull markets with SIN portfolios which classified firms that sell irresponsible product such as alcohol, gaming, tobacco and defence. The full period of study shows positive abnormal return but was statistically insignificant. In addition, SIN stocks during the Bull market period has generated positive alpha but during the bear market period abnormal return was absence and both was statistically significant. Regression results has also showed the segregation of SIN industry (alcohol, tobacco, gaming and gaming industry), where size and value effect exist, and majority sectors have abnormal return in multi-factors model.

Investors sentiment is also considered a potential source to identify the abnormal return in SIN stock [19]. The evidence suggests that investor sentiment-noise trading as one of the determinants for SIN stock return [20], as studies shows that SIN stocks has relatively expose to a lower level of analyst coverage, leading the consequential of stock unevaluated and more noise trading. Liston (2016) utilised CAPM, FF3FM and four-factor Carhart to evaluate both the institutional and retail investor sentiment in explaining the overperformance of SIN stocks. Findings shows that after comprising both retail and institutional investor sentiment, the abnormal return has diminished, as Jensen's alpha becomes insignificant. As in multifactor regression, factors results have shown the existence of size and value effect in assets pricing models with or without sentiment. Nevertheless, Liston (2016) results has revealed that assets pricing model without investors sentiment (CAPM, FF3FM and the four-factors Carhart) has shown positive alpha which the latest model Carhart and CAPM employed shows statistically significant. Therefore, neglected the effect of higher risk adjusted return of SIN stocks by the investor sentiment.

Blitz and Fabozzi (2017) study in SIN stocks anomalies comprises four sectors, alcohol, gaming, tobacco and weapon from United States, Japan, Europe and global developed market. Each region was analysed separately for its longest available sample period and findings from time-series regression does show different subperiod for US in exhibiting a comparative in results from other regions. For the proxy of factors, Blitz and Fabozzi (2017) utilised readily extracted information extracted from online database of Kenneth French websites. Nevertheless, theirs study are in line with existing literature in exhibiting positive abnormal return with preceding models such as CAPM, FF3FM, Carhart as well as the extension of BAB factor. However, after using FF5FM model, the abnormal return diminishing and particularly to global developed market, Europe and United States from the period of 1990 to 2016, alpha was negative.

It is obvious that there is a lack of studies in SIN stocks performance within the Asia-Pacific regions. Most of the predecessor focused only on U.S or developed market. In terms of geographical samplings, closest study lies on Fabozzi, Ma and Oliphant (2008) whereby several Asia-Pacific nations were mentioned in their sampling. With the raising concerns on data mining, the first contribution is to provide an out-of-samples test, in investigating across the Asia-Pacific regions' SIN stocks as well as adding a comparative evidence with multi-countries: Australia, China, Hong Kong, India, Japan, Malaysia, Philippines, South Korea.

Besides, most of the asset pricing models employed in previous studies are dated. Empirical tests in the existing literature have used CAPM, FF3FM and Carhart 4-factor to study the SIN anomalies but this paper expands the test capacity by including the most recent multi factor model – Five-Factor model that was firstly introduced by Fama and French in 2015. It should be noted that the study of Blitz and Fabozzi (2017) has the inclusion of FF5FM but the factors were proxied and extracted. This study constructs the Fama and French (1993, 2005) factors namely the SMB, HML, RMW and CMA factors, in the light of achieving accuracy and unbiased factors for each regression. Regional index factors can be obtained from Kenneth-French website, as data retrieved from the website is readily available and could ease the process of research. However, market may not be integrated across each nation and SIN stocks which are considered as a niche industry may not be suitable in using the index factors. Thus, this study constructed the portfolios separately for each selected multisampling countries.

B. Asset-Pricing Model

Although CAPM was a revolutionary model that inevitably been proven in history of finance, many empirical studies were conducted by many scholars [21] [22] [23] in capital market theories which in turn challenged the validity of CAPM model.

Past numbers of empirically studies has shown an overwhelmingly on rejection rather than acceptance of the validity of CAPM model. As more recent studies have also developed comparative empirical measure between multifactor models with CAPM. Particularly, in contrast with Fama and French Three Factors model (FF3FM), whereby multiples studies [17] [23] [24] [25] can be observed in literatures

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which FF3FM has shadowed the existence of CAPM. In addition, they have proposed that FF3FM provide more explanatory power for the asset returns, as well as addressing the limitation of CAPM as the latter could only capture the risk factors which deemed to be inadequate. Market risk premium is the risk factors interpreted in single factors model of CAPM and has often be the central area of discussion. In short, a risk-adverse investor should be compensated with excess return for the additional risk in accordance with Beta. Nevertheless, many scholars have doubted the precision of the single factor model in explaining the risk-return relationship as they proposed that the single factors might have some incomplete information in relaying to security returns.

From the empirical findings above [18] [26] [27] [28] [29] [30], it can be observed that most studies of FF5FM in the finance has been tested and proven its superiority over the preceding models (CAPM and FF3FM). However, some scholars likewise Singh and Yadav (2015) have suggested that the four-factor model fare better result than FF5FM. Though the FF5FM is considered a ground breaking model in the asset pricing literature, some studies as shown has found that the FF5FM still not able to fully capture the variation of stock return Fama and French (2017) and Roy and Shijin (2019). For that, the discovery of a better asset pricing model is still ongoing.

At the methodological point of view, Huang (2018) has revealed that the explanatory power of FF5FM was not stable. However, the results were not conclusive as more studies is needed to perform in different stock markets in order to validate this finding. Furthermore, although Fama and French (2015) used the portfolio return as the proxy of dependent variables in test, similar results has supported the FF5FM by Huang (2018) who used individual stocks return as dependent variables instead of portfolio returns. This implied that, both individual and portfolio return can be used in the testing of FF5FM. However, this is not conclusive as well, more studies are needed to perform the individual stocks in other stocks market. In making comparative test on the asset pricing models, some studies have employed the GRS test and others would use the Adjusted R-squared as well, nevertheless results shows that majority of studies have proven the superiority of FF5FM over the preceding models (CAPM and FF3FM).

III. RESEARCH METHODOLOGY

The study of SIN stocks in this thesis is compassing over the period of June 2009 to July 2019, a 10-year study period employed for Asia-Pacific region which comprises the following countries: Malaysia, Philippines, South Korea, Hong Kong, China (Mainland), Australia, Japan and India. Initially, 167 firms were extracted from the Eikon Datastream database under the classification sectors of “Brewery”, “Wine Distiller”, “Gambling” and “Tobacco”, however after screening the availability of data for each firm, the sampling has been reduced to 101 firms.

The enlistment criteria for the selected countries is due to the sufficient data exhibited to study the SIN industry in Asia-Pacific regions. Although several nations such as Indonesia, Singapore, Thailand, Taiwan and Pakistan have SIN companies operating within the nations, but the inclusion of those nations for this study has been removed due to the limited number of SIN firms listed in its respective stock exchanges from the period of June 2009 to July 2019. Sufficient stocks samplings are required for each nation as the construction and reconstruction of portfolio will be performed in accordance with the portfolios construction method of Fama and French (2015) to obtain the explanatory variables.

Despite the studies of SIN stocks performance in Asia-Pacific regions, this paper will also narrow the studies into each sampling nations. Asia-Pacific region which bounded by the respective eight countries will be segregated and studied individually for further evaluation to obtain an overview of SIN performance according to each nation. Thus, all available SIN stocks from the period 2009 to 2019 were obtained for each nation for the study of SIN performance.

While screening for SIN stocks, it is to be noted that SIN industries is considered radically limited in samplings, especially in conservative regions likewise the Asia-Pacific regions with different ideology, cultural and religious backgrounds in every nation. Samplings of SIN stocks poised scarcity in many countries as well as absences. Taking the Tobacco sector for instance, only 1 stock can be found in Malaysia, Japan, Hong Kong, Philippines, South Korea, Sri Lanka and Indonesia in Asia-Pacific regions through the process of data collecting from Thomson Reuters Eikon Database. This is because, the SIN industry has a different and unique nature of business, which produces goods and services that are deemed against the social norm which thus leads to further restriction of licensing from each nation’s authority.

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For the factors construction of Fama and French Five-Factor model, to avoid any errors several filtration steps are required as in the similar fashion of Fama and French (1993, 2005).

Firstly, accounting data must be available for fiscal years t-1 and t-2. In the construction of portfolio, total asset of the firm was used to sort the investment factor (CMA) thus it is vital to ensure availability of accounting report for the past two fiscal years, in order to avoid any insufficient report that could distort the process of sorting.

Secondly, excluding negative book-to market firms. Without excluding these types of firms could lead to bias and irrational segregation when sorting the portfolio, as firms could be categorised into portfolio which in nature they are not. By excluding firms with negative book value, this could avoid extreme value. Whereby, the inclusion of negative book value would eventually lead to the categorisation of negative operating profit into positive operating profit when sorting the profitability factor (RMW).

The collection of data for this study is retrieved from secondary sources. Data extraction was obtained from several official platforms such as central banks of each country and Thomson Reuters Eikon DataStream. Nevertheless, no direct input was found for the explanatory variables, respectively the SMB, HML, RMW and CMA, as complex construction of portfolios is involved to calculate the value of explanatory variables. Hence, each explanatory variable must be computed manually which follows the portfolio construction methodology of Fama and French (2015). The extraction of raw data consisting of all common stocks were selected according to the Eikon DataStream sector classification of "gambling", "brewery", "wine distiller" and "tobacco". Besides, 3-month Treasury Bill is used as the proxy of risk-free rate for each country whereas similar proxy such as other available 3-month yield was used for countries without the 3-month Treasury Bill for Australia, China and South Korea.

The model specifications for the 3 standard asset-pricing models namely CAPM, FF3FM, FF5FM respectively are as follows:

$$SinR_{i,t} = \alpha_i + \beta_i\, MRP_t + \varepsilon_{i,t} \quad (1)$$

$$SinR_{i,t} = \alpha_i + \beta_{1i}\, MRP_t + \beta_{2i}\, SMB_t + \beta_{3i}\, HML_t + \varepsilon_i \quad (2)$$

$$SinR_{i,t} = \alpha_i + \beta_{1i}\, MRP_t + \beta_{2i}\, SMB_t + \beta_{3i}\, HML_t + \beta_{4i}\, RMW_t + \beta_{5i}\, CMA_t + \varepsilon_{i,t} \quad (3)$$

Where,

$SinR_{i,t}$ = Risk-Adjusted Sin Stocks Returns at Period t ($R_{i,t} - R_{f,t}$)

MRP_t = Excess Return on the Market ($R_{m,t} - R_{f,t}$)

SMB_t = Size effect (Small Minus Big) is the average return on the nine small stock portfolios minus the average return on the nine big stock portfolios

HML_t = Value effect (High Minus Low) is the average return on the two value portfolios minus the average return on the two growth portfolios

RMW_t = Profitability (Robust Minus Weak) is the average return on the two robust operating profitability portfolios minus the average return on the two weak operating profitability portfolios

CMA_t = Investment growth (Conservative Minus Aggressive) is the average return on the two conservative investment portfolios minus the average return on the two aggressive investment portfolios

α_i = Abnormal Excess Returns

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β_{1i} = Coefficient of MRP (indication for the portfolios tilted according to market risk)

β_{2i} = Coefficient of SMB (indication for the portfolios tilted according to size)

β_{3i} = Coefficient of HML (indication for the portfolios tilted according to value)

β_{4i} = Coefficient of RMW (indication for the portfolios tilted according to profitability)

β_{5i} = Coefficient of CMA (indication for the portfolios tilted according to investment growth)

$\varepsilon_{i,t}$ = Random Error Term

IV. RESULT AND DISCUSSION

The results of equally weighted portfolio for multi-countries are summarised in Table 1 regressed with 3 different asset-pricing models. The first model (CAPM) has only one factor, which is the market risk premium (MRP). Subsequently, second model (FF3FM) has two additional factors which extended from the first model, with size (SMB) and value (HML) risk premium. Following with the third model (FF5FM) which will be the main model of this study has two additional factors extended from the preceding model, with profitability (RMW) and investment (CMA) risk premium.

As discussed in Literature Review, it was found that majority of studies that SIN stocks have positive abnormal return. Using the similar standard asset-pricing models used by the previous researchers in the study of SIN stocks' performance with equally weighted portfolios, comparable results can be observed as majority of the selected multisampling SIN stocks have abnormal return but not all are statistically significant. For CAPM, all countries have positive alpha, half of the multisampling countries (Australia, China, India and Malaysia) from CAPM have statistically significant abnormal return. Similarly, all the multisampling countries have abnormal return, but only three are statistically significant (Australia, China and India). Therefore, it can be observed that all the sampling countries have abnormal return, when regressed with CAPM and FFFM, simply that only few are statistically significant. However, it can be found that consistent results in showing the existence of abnormal returns do present in Australia, China and India.

The turning point of the result in SIN abnormal return arise from the FF5FM, which is the main model in this study. Results from the FF5FM seems to have contradicted empirical evidence when compared to the preceding models, where there is no evidence of abnormal return to prove the anomalies. In fact, half of the multisampling nations after regressing with the FF5FM, the alpha has altered to negative value, out of the eight sampling countries, only three alphas (Hong Kong, India and Malaysia) are with significant results (0.0186, 0.0434 and -0.0102).

Results shown in the FF5FM is not convincing to prove the existence of SIN anomalies in Asia-Pacific regions because the alpha value is too close to zero or to be interpreted as zero. Thereby, the study of SIN abnormal return in this study has contradicted findings from the previous researchers [1] [2] [4] [10] [11] [12] [13], mainly due to the employment of FF5FM and out-of-sample into the study of SIN companies in this paper.

Three standard asset pricing models with mixed results are presented above yet the results are not conclusive to prove whether the SIN anomalies exist in Asia-Pacific regions. In that case, this study has employed the viability test for the three models (CAPM, FF3FM and FF5FM) which utilised the traditional "Goodness-of-Fit" by using the adjusted R-squared as well as Gibson-Ross-Shaken (GRS) test in selecting the most appropriate model to capture the excess returns in SIN stocks.

The second objective of this study is to evaluate the validity of these three asset pricing models in explaining the SIN stocks return. Samples that introduced into the model, to a certain degree it must be able to have descriptive power in explaining the variation of samples return, thus the model can be considered more meaningful. The degree which give the explanatory power represented by the adjusted R-squared which shown in Table 2. The R^2 indicates the percentage of the independent variables in explaining the dependant variables, which is a useful measurement in the "goodness-of-fit" especially in multiple regression analyses. The closer the R^2 and adjusted R^2 to 1.00 indicates higher explanatory power, as the opposite, if the R^2 and adjusted R^2 close to 0.00, the model is not fit or has low explanatory power. Based on the R^2 and adjusted R^2

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Table 1

	CAPM			FF3FM					FF5FM						
	Constant	***MRP***	***AdjR***	***Constant***	***MRP***	***SMB***	***HML***	***AdjR***	***Constant***	***MRP***	***SMB***	***HML***	***RMW***	***CMA***	***AdjR***
Australia	0.0699*	1.9677***	0.0666	0.0195***	1.2202***	0.4992***	0.0177	0.9477	-0.0010	0.7753***	0.5787***	0.0459	-0.0063	-0.0572***	0.9788
	(1.75)	(2.81)		(2.85)	(7.99)	(44.00)	(0.41)		(-0.21)	(7.70)	(21.78)	(1.46)	(-0.23)	(-2.06)	
China	0.1022***	3.4206***	0.5734	0.1027***	3.3804***	0.1015	-0.2142**	0.5811	0.0152	0.9830***	0.8001***	-0.2897***	-0.1121	-0.1920**	0.8365
	(5.25)	(12.69)		(5.26)	(11.51)	(0.97)	(-2.02)		(1.09)	(3.83)	(12.23)	(-3.79)	(-1.25)	(-2.41)	
Hong Kong	0.0282	2.4008***	0.3724	0.0292	2.6841***	0.3007**	-0.0714	0.504	0.0186**	1.8577***	0.5139***	-0.0469	-0.0711	-0.0106	0.7584
	(1.26)	(11.33)		(1.70)	(13.04)	(2.54)	(-1.22)		(2.02)	(10.20)	(11.76)	(-1.3)	(-1.77)	(-0.27)	
India	0.1010***	2.2921***	0.3764	0.1145***	2.2050***	0.4025***	0.1920***	0.5664	0.0434***	1.3311***	0.6065***	0.1595***	0.0643	0.0228	0.8158
	(5.17)	(8.53)		(6.46)	(9.81)	(7.03)	(3.06)		(3.54)	(8.43)	(15.38)	(3.46)	(1.39)	(0.66)	
Japan	0.0011	1.7316***	0.5864	0.0008	1.6849***	0.2841***	-0.0039	0.6544	0.0009	1.0350***	0.5478***	-0.0238	-0.0559	0.0252	0.8293
	(0.16)	(13.03)		(0.13)	(13.33)	(5.02)	(-0.07)		(0.21)	(10.03)	(12.96)	(-0.57)	(-1.14)	(0.58)	
Malaysia	0.01304*	1.3843***	0.3282	0.0042	1.1763***	0.3762***	0.01588	0.5924	-0.0102**	0.7369***	0.5504***	0.0265	0.1116**	0.0369	0.8184
	(1.84)	(5.33)		(0.84)	(5.73)	(7.57)	(0.19)		(-2.14)	(4.50)	(10.05)	(0.53)	(2.19)	(1.03)	
Philippines	0.0063	0.4472**	0.0365	0.0008	0.4501**	0.0216	0.1535	0.0971	-0.0091	0.4373***	0.3250***	0.1723	0.0935	0.0004	0.3194
	(0.69)	(2.35)		(0.09)	(2.51)	(0.17)	(1.19)		(-1.28)	(3.10)	(3.90)	(1.19)	(1.64)	0.00	
South Korea	0.0044	0.7870***	0.1864	0.0018	0.7599***	0.2618***	0.03003	0.3041	-0.0091	0.4373***	0.3250***	0.1723***	0.0935**	0.0004	0.6631

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results presented in Table 2, it is obvious that the evolution of the asset pricing models does not just increase the number of factors, but has also increased the explanatory power to a high degree, where drastic changes in both R-Squared and Adjusted R-Squared can be observed since CAPM to FF5FM.

Table 2

		CAPM	*FF3FM*	*FF5FM*
Australia	*R-squared*	0.0744	0.949	0.9797
	Adj R-squared	0.0666	0.9477	0.9788
China	*R-squared*	0.577	0.5917	0.8434
	Adj R-squared	0.5734	0.5811	0.8365
Hong Kong	*R-squared*	0.3776	0.5165	0.7685
	Adj R-squared	0.3724	0.504	0.7584
India	*R-squared*	0.3816	0.5773	0.8236
	Adj R-squared	0.3764	0.5664	0.8158
Japan	*R-squared*	0.5899	0.6631	0.8365
	Adj R-squared	0.5864	0.6544	0.8293
Malaysia	*R-squared*	0.3338	0.6027	0.826
	Adj R-squared	0.3282	0.5924	0.8184
Philippines	*R-squared*	0.0446	0.1198	0.348
	Adj R-squared	0.0365	0.0971	0.3194
South Korea	*R-squared*	0.1932	0.3216	0.6773
	Adj R-squared	0.1864	0.3041	0.6631

Notes: *This table presents the results of R-Squared and Adjusted R-Squared for SIN stocks in 8 Asia-Pacific countries from the study period of June 2009 to July 2019. There are a total of 120 monthly equal-weighted portfolio returns in excess of the risk free rate (measured as the yield on 3-month local Treasury Bills) with using 3 standard asset-pricing models: CAPM, FF3FM, FF5FM.*

Table 3 exhibits the results of Gibson-Ross-Shaken test (GRS) of Gibson, Ross and Shaken (1989) in testing the intercepts of each regression model from the 2x3 individual portfolios and combination of factors. A cross-sectional method was employed in measuring the intercepts of all 18 individual portfolios for each model on every multi-samples country to obtain the GRS statistic results as presented below. If an asset pricing model is able to capture completely the expected return, intercept would be indistinguishable from zero of an asset pricing models of the excess return.

The p-value of the GRS, in short named after pGRS, gives indications of the significatory of the model's intercepts in jointly rejecting the null hypothesis whereby Ho: alphas = 0. Thus, in order to acknowledge the models in capturing completely the expected return, the pGRS is taken into consideration. Half of the pGRS results (4 out of 8) of FF3FM and CAPM rejected the null hypothesis. On the other hand, which is already been expected, based on the GRS statistical results, FF5FM has pGRS equals to zero except Japan's FF5FM. In short, the GRS test statistic says that all FF5FM models are incomplete description of the expected return. Contrarily, GRS test for the FF3FM shows that half of the sampling countries (Hong Kong, Japan, Philippines and South Korea) are able to capture the expected return of SIN stocks. Even though, the remaining countries (Australia, China, India and Malaysia) are rejected at the confidence level of 95%, still the FF3FM GRS statistic values (fGRS) are the lowest among all 3 models and closer to 0, hence FF3FM is a better model to capture and explain the SIN stocks return than the standard CAPM and FF5FM.

Table 3

	Avg. alpha	fGRS	pGRS	Avg Adj. R^2
Panel A: Australia EWP				
FF5FM	-0.0010	24.4145	0.0000***	0.4677
FF3FM	0.0195	1.8348	0.0311**	0.3338
CAPM	0.0699	2.1504	0.0088***	0.1147
Panel B: China EWP				
FF5FM	0.0152	59.8162	0.0000***	0.6987
FF3FM	0.1027	2.1338	0.0095***	0.5253
CAPM	0.1022	2.3678	0.0036***	0.4164
Panel C: Hong Kong EWP				
FF5FM	0.0186	5.3516	0.0000***	0.5361
FF3FM	0.0292	0.7079	0.7957	0.3837
CAPM	0.0282	0.7262	0.7771	0.1761
Panel D: India EWP				
FF5FM	0.0434	42.4245	0.0000***	0.5553
FF3FM	0.1145	3.4185	0.0000***	0.3925
CAPM	0.1099	3.4992	0.0000***	0.1968
Panel E: Japan EWP				
FF5FM	0.0009	0.3717	0.9902	0.6146
FF3FM	0.0008	0.4635	0.9675	0.5045
CAPM	0.0011	0.6939	0.8099	0.3301
Panel F: Malaysia EWP				
FF5FM	-0.0102	223.3381	0.0000***	0.5698
FF3FM	0.0042	2.8357	0.0005***	0.4076
CAPM	0.0130	3.2554	0.0001***	0.1351
Panel G: Philippines EWP				
FF5FM	-0.0091	16.1073	0.0000***	0.4609
FF3FM	0.0008	0.7884	0.7090	0.3009
CAPM	0.0063	1.0864	0.3767	0.0112
Panel H: South Korea EWP				
FF5FM	-0.0087	49.2430	0.0000***	0.4484
FF3FM	0.0018	1.2529	0.2362	0.2902
CAPM	0.0044	1.5969	0.0749*	0.0716

Notes: ** indicates 10% significance level, ** indicates 5% significance level and *** indicates 1% significance level. Model performance statistics for test of CAPM, FF3FM and FF5FM; July 2009-June 2019, 120 months. Tests the ability of CAPM, FF3FM and FF5FM to explain monthly excess returns jointly on 2x3 individual portfolios S/L, B/L, S/N, B/N, S/H, B/H, S/W, B/W, S/N, B/N, S/R, B/R, S/A, B/A, S/M, B/M, S/R, B/R. The probability value of GRS (pGRS) testing whether the expected values of estimates reject the models as well as the average R-squared on each model explanatory power. Results represented in each panel according to multi sampling countries of the Asia-Pacific regions.*

However, the interest of this study has also laid on the explanatory power of the combination of factors in explaining the expected returns of the SIN stocks. As the GRS test has also jointly regressed each individual portfolio, a cross sectional adjusted R-squared could provide an insight of the descriptive power on the inclusion of additional variables through the extension of multifactor models, respectively the FF3FM and the main model used on this paper namely the FF5FM. Interesting and consistent results can be observed on the average adjusted R-squared in the jointly test. Average adjusted R-squared has consistently improved from every extension of the model. Some countries (Philippines and South Korea) even have drastic change from the traditional single factor model. The results are not merely consistent in the improvement of R-squared from the cross-sectional of joint tests for all individual portfolios, however on the equally weighted portfolios, similar degree of improvement

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in adjusted R-squared can be observed as well. Indicating a better descriptive power for the independent variables on the dependant variables when Fama and French (1993, 2015) extended the models.

Using the metrics adjusted R-squared of "Goodness-of-Fit" in study to find the explanatory power of each model's equally weighted portfolios for the selected eight multisampling countries. Consistent result can be found, where the adjusted R-squared improved tremendously from CAPM to FF5FM (FF5FM, adj.R^2 > FF3FM, adj.R^2 > CAPM, adj.R^2). With additional controlling factors added by Fama and French (1993 and 2015), the combination of the independent variables gives better explanatory power to the dependant variable. Findings are consistent with Fama and French (2015), Singh and Yadav (2015), Erdinc (2017), Fama and French (2017), Huang (2019), Roy and Shijin (2019), where FF5FM has been tested and proven its superiority over the preceding models (CAPM and FF3FM).

Apart from the equally weighted portfolios' adjusted R-squared of "goodness of fit" to test the viability of model, GRS test employed in this study also aid the selection of best model. It was found that GRS results on FF5FM are not compelling. The GRS test statistics suggest that all FF5FM models are incomplete description of the expected return except for Japan, which tally to previous GRS result from previous study [30] [31] [32]. However, the interest in this study has also laid on the explanatory power of the combination factors in explaining the expected returns of the SIN stocks, in search for the viability of the models. As mentioned from time-series of the equally weighted portfolios show desirable explanatory power in FF5FM, similar degree of improvement in GRS adjusted R-squared were found Table 3.

Unexpectedly, the GRS test is in favour of the FF3FM, as half of the sampling countries (Hong Kong, Japan, Philippines and South Korea) are able to capture the expected return of SIN stocks using FF3FM. Even though the remaining countries (Australia, China, India and Malaysia) are rejected at the confidence level of 95%, still FF3FM GRS test statistic values are the lowest and hence better than the traditional CAPM and FF5FM. Indicating that, there are less pricing errors in FF3FM as compare to the other two models.

Nevertheless, it can be observed in the factor analysis that the statistic values for SMB have improved after capturing the controlling factors of profitability and investment in majority of the sampling countries. In addition, explanatory power for the FF5FM which is measured by the metric of adjusted R-squared has steadily increased and has shown superiority of the explanatory power over the preceding models. For that, the combination variables of the Fama and French (2015) model have a strong impact on the improvement of adjusted R-squared in this study. On the contrary, the FF5FM failed in fully capture the variation return of SIN stocks. Instead, FF3FM has overruling result in GRS test deemed to be the closest and best model in complete description of SIN stocks return.

V. CONCLUSION

To reiterate, this study implores three different asset pricing models to identify the abnormal return "anomalies" of SIN stocks in Asia-Pacific regions. The results can be observed beginning with FF3FM, after controlling the additional factors of size and value, majority of the excess return remains, all the sampling countries have positive alpha. In addition, when regressed with FF5FM which exposed to the controlling factors of the two additional variables added by Fama and French (2015), the alpha value diminished greatly in multi-countries samples within the Asia-Pacific regions. Whereby, half of the represented countries (Australia, Malaysia Philippines and South Korea) constantly have exhibited negative alpha value in FF5FM. The findings in this paper has shown the evidence of the diminishing in abnormal return when regressed with FF5FM, by means of alpha value close to zero or negative. However, that does not prove that the anomalies do not exist in Asia-Pacific regions. This is because the FF5FM is not conclusive. As mentioned, FF5FM was rejected by the GRS test, which is this model has failed to fully capture the variation of SIN stocks return. For that, FF5FM is not the best asset pricing model in relevancy to SIN stocks.

On the other hand, the FF3FM in all sampling countries has provided much appealing GRS results in fully capturing the variation of SIN stocks return. As the results of this paper have a practical implication on abnormal return of SIN stocks and previous researchers in affirming the existence of such anomalies lies in SIN stocks, the intercept value (alpha) is vital in this study. For that, GRS test weighted heavily in the viability on choosing the best model whereby, the FF3FM stands out from among all three asset pricing models. Results found in FF3FM in all countries have positive alpha value. Thus, implying that abnormal return does hold for SIN stocks in Asia-Pacific, which indicates that investors whom are willing to hold on to SIN stocks would obtain additional payoff from compensating the risk attained in SIN stocks. In short, this paper found evidences on the existence of SIN anomalies in some Asia-Pacific countries. As empirical evidence in this study proves the viability of FF3FM in relevancy in measuring the performance of SIN

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stocks. All the multisampling countries regressed with FF3FM have abnormal return, three samplings nation alphas have statistically significant (Australia, China and India).

According to the results of this study, the findings provide new perspective on SIN stocks in the context of investment. Adding into the existing literature, in proving the SIN anomalies do hold in some Asia-Pacific countries even though the cultural and ideology varies compared to most tested geographical region likewise the United States and Europe. Particularly in providing the coverage of SIN anomalies into the Asia-Pacific regions and proving the common idea that SIN stock indeed generates abnormal return. As through the study of this paper, investors could determine whether the inclusion of SIN stocks is worthwhile to widen the spectrum of their portfolio in attaining excess return. In other words, it can be said that investors would change their attitude towards SIN stocks by holding it while other investors shunning away from it and thereby, earning abnormal returns as a compensation of risk attained.

Besides, by looking at the results of FF5FM and FF3FM, it shows another new idea on the abnormal return being conveyed. For that, choosing the right model is vital. In this study, test has been conducted in proving the viability on every asset pricing model which is suitable to capture the variation of SIN stocks return, likewise the FF3FM. This paper also shed lights onto standard multifactor asset pricing models, imploring that the investor, policy maker or fund manager could adopt the FF3FM that has the most complete explanation of SIN return as compared to the preceding models. Potentially, the FF3FM would be able to provide a better analysis and accurate results which aid the process of decision making. Although the setup for multifactor model in portfolios construction can be hassle and time consuming but empirical results do reveal interesting findings. For a more meaningful result, it is encouraged that investors, policy maker, fund managers as well as academicians to employ different models in analysis as varying findings may be obtained, as in this paper has produced varying results retrieved from each model employed.

Nonetheless, the definition of SIN companies has constantly changed over time. Because of this dynamic attribution on the view on sin, we find it important to keep the field of research updated with performance measurement studies to track the future development. Besides from the ambiguity on the SIN stock definition, information and data were insufficient to measure as the whole industry, unlike in United States, variation of SIN stocks and new-found SIN companies kept emerging. Many countries in the Asia-Pacific regions, only have a few prominent players in this sinful industry, due to the licensing issue and public sentiment toward the SIN industry which is usually oligopoly and some heading toward monopoly. Thus, results regenerated in this paper could just be a fraction of puzzle to determine the existence of abnormal return in SIN stocks.

Besides, the standard of unethical is dynamic, thus new label of unethical industry could be introduced. Medical science research has proven that dietary with sugar is in connection with various types of development in cancer [31]. Not to mention that sugar is indeed a cause to diabetes which becomes a common knowledge for the public understanding. The intake could tremendously affect the health of a person which may lead to many diseases as result, thereby compromise the standard of well-being. For that, sugar or addictive industry should perhaps be included as the subsequent sinful stock.

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