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SIN STOCK TRADING STRATEGIES: EVIDENCE FROM BEVERAGE, FOOD AND TOBACCO SECTOR IN COLOMBO STOCK EXCHANGE, SRI LANKA

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Abstract

Sin stocks are expected to yield high returns and many scholars have tested whether sin stocks would generate positive significant premiums by employing various asset pricing models such as capital asset pricing model and its multi-factor versions. This study has employed the Fama -French five-factor asset pricing model to test two trading strategies using sin stocks. One is taking a long position in sin stocks only. Another is the long-short strategy between sin and non-sin stocks. Thirteen stock portfolios have been created to test the above two strategies based on the industry and firm size where the latter is measured by the market capitalization. Both trading strategies have generated mixed results but not significant alphas for a single trading strategy at least. These findings imply that the formation of trading strategies using sin stocks will not yield positive results in the Sri Lankan context. However, this study has the limitations of the existence of a handful number of sin stocks only in the Beverage, Food, and Tobacco sector in Sri Lanka's single stock exchange and the impact of the crisis in Sri Lanka on capital markets during the study period.

Keywords: Sin Stocks, Asset Pricing, Five-factor Model, Sri Lanka
JEL Classification: G 15

1 Introduction

The word “sin” comes from the Germanic root phrase for “to be guilty” which is also where the old English word “synn” comes from (Burton-Edwards, 2011). The term “sin” is used in religious contexts to describe the condition of having committed a transgression and being cut off from God or another divine being. It is frequently viewed as a moral error or a

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transgression against a God or Gods. Sin stocks are the stocks of companies that operate in industries that are deemed to be ethically or socially contentious. Sin stocks are commonly observed in industries that engage in activities that are condemned by a portion or majority of society as they are perceived to generate profits by taking advantage of human vulnerabilities and shortcomings. The sin industries encompass sectors such as alcohol, tobacco, gambling, sex-related enterprises, weapons producers, and the military (Kenton, 2022). "Sin stocks" is the term that is most commonly used to refer to these equities while other names for them include "vice stocks", "shunned stocks", "controversial stocks" and "unethical stocks" (Blitz & Fabozzi, 2017). The concept of sin stocks has broadened to include businesses that negatively affect society or the environment or have bad governance practices against with the growing emphasis on corporate social responsibility and sustainable investing. This view can include companies that have high greenhouse gas emissions, violations of labor rights, or have a history of discrimination or corruption. According to Blitz and Fabozzi (2017), some investors would regard sin stocks as a potentially successful investment option because companies in these industries typically have consistent cash flows and solid market positions. Despite the controversy, they are profitable and have the potential to provide investors with reliable returns.

In the context of Sri Lanka, there is no official list of sin companies or other types of businesses or industries that are considered as having ethically dubious practices. However, several industries may be regarded as sin such as alcohol and tobacco. There are three companies in the alcohol industry and one company in the tobacco industry listed in the beverage, food, and tobacco (BFT) sector in Sri Lanka's only stock exchange, the Colombo Stock Exchange (CSE). This study has been limited only to the BFT sector and the reason for such a limitation is that all four companies mentioned above are classified in the BFT sector. There were 45 companies under the BFT sector of CSE as of 31st December 2022 including four companies that were classified as sin stocks. All four sin companies represent 32 percent of the market capitalization of the BFT sector as of 31st December 2022. It is important to note that just because these companies are involved in industries perceived as sinful by some, it doesn't necessarily mean that they engage in any immoral or illegal activities. Nevertheless, it is important to recognize that these businesses make a valuable contribution to the economy by providing employment opportunities and contributing to the nation's overall economic growth. On the other hand, it is essential to keep in mind that the

categorization of a business sector as sinful is frequently dependent on the point of view of a society's culture and may be different in other countries.

As an early notable work in this area, Hong and Kacperczyk (2009) found that sin stocks yield high expected returns compared to other similar non-sin stocks due to higher litigation risks emerged by social norms. Hong and Kacperczyk (2009); Fabozzi, Ma and Oliphant (2008); Blitz and Fabozzi (2017) emphasized that other factors cause sin stock premium are investor aversion, market inefficiencies, limited analyst coverage and large dividend payouts by these controversial businesses. Institutional investors with the strategies of socially responsible investing tend to avoid sin stocks. It causes a decrease in demand and lower prices that ultimately results a higher expected returns for these stocks. Further, a majority of the investor population avoids sin stocks and it creates market inefficiencies where remaining investors can exploit the opportunity for higher capital gains. Another reason for the existence of sin stock premium is lower analyst coverage. In a situation where a majority of analysts doesn't cover sin stocks, it leads to a mispricing and would be a good opportunity for arbitrageurs to earn abnormal returns. Another important point is that many sin businesses pay large dividend payouts for shareholders consistently. For an example, the tobacco company listed in the Colombo Stock Exchange paid 100 percent dividend payout in 2023. Therefore it is a timely need to research on sin stock premium considering all above facts. Further, it is very important for investors to study this phenomenon in formulating their investment strategies. Professionals in the finance industry such as stock brokers, research analysts and portfolio managers also could incorporate and consider sin stock premium in to their investment strategies and operations. Further, they can advise their clients in setting up investment policy statements. This paper investigates whether sin stocks could be used to form successful trading strategies that ensure higher returns for investors in frontier markets like Sri Lanka. Salaber (2007); Blitz and Fabozzi (2017); Richey (2017); Yang and Wei (2020); Han, Li and Onishchenko (2021), Bauckloh, Beyer and Klein (2022) applied popular asset pricing models such as capital asset pricing model (CAPM), Fama and French three-factor model (FF3), Carhart four-factor model (C4F) and Fama - French five factor model (FF5) to analyze the sin premium offered through investments in sin companies. This paper intends to use the FF5 model to ascertain whether sin stock premium prevails in the Sri Lankan stock market. The main trading strategies to be tested in this paper are long only strategy in sin stocks together with the strategy of taking a long position in sin stocks and a

short position in non-sin stocks. Further, it is intended to form portfolios on equal and value-weighted schemes as well as based on the industries of sin stocks available in Sri Lanka such as alcohol and tobacco. Non-sin stock portfolios are formed based on the firm size of stocks measured on market capitalization. Insights of this research would be significant for the investment industry where this knowledge can be used to form successful trading strategies that are beneficial for both investors and professionals in the investment industry. Further, it is useful for policymakers to design tax policies and other regulatory measures. This study addresses an empirical gap in the area of sin stocks research in Sri Lanka since there is a dearth of related research. The rest of the paper proceeds as follows. Section 2 presents the literature review. In section 3, data and methodology is described. Empirical findings - presented and discussed in section 4 and section 5 - conclude the paper.

1. Literature Review

2.1 Sin Stock Anomaly

Horan (2002) defined financial anomaly as a deviation from the anticipated patterns observed within financial markets. Merton (1987) suggested a theory that stocks with low analyst coverage and low investor interest may present opportunities to offer abnormal returns to investors who invest in unpopular stocks due to mispricing. One frequently referenced rationale for typically higher returns witnessed in sin stocks is the persistent undervaluation resulting from the broad investor avoidance of these stocks. This presents an opportunity for investors who are inclined to diverge from social conventions and allocate their investments towards sin equities as these stocks possess the potential to provide a premium associated with the reputation risk. Heinkel, Kraus and Zechner (2001) developed an equilibrium model that considers the absence of risk sharing among investors who avoid certain stocks using a model where they assume a one-period world with three categories of firms which are acceptable firms, unacceptable firms, and reformed firms. The underlying market mechanism in that model suggests that stocks such as sin stocks experience reduced demand leading to a depressed market value. Consequently, it is expected that sin stocks will yield higher returns. Hong and Kacperczyk (2009) were the pioneers in identifying the impact of social norms on stock markets revealing a phenomenon termed as "shun effect". They provided evidence that investors who prioritize sustainability tend to refrain from investing in firms associated with social controversies in developed markets. Han, Li and Onishchenko (2021) revisited the hypothesis of Hong and Kacperczyk (2009) and noted that the influence

of social norms on sin stocks could potentially interact with legal and religious settings which results in a consistent variation in the cost of sin between nations. Blitz & Swinkels (2021) counter-argues that even if some investors choose to exclude sin stocks, there will always be other investors who have strong financial incentives to take advantage of any potential mispricing that may occur.

2.2Asset Pricing Models

The modern portfolio theory of Markowitz (1952) is based on the principle that investors should diversify their portfolios to reduce risk and achieve an efficient risk-return tradeoff. It leads to the birth of CAPM by parallel work of Sharpe (1964); Lintner (1965); Mossin (1966) and Black (1972). Fama and French (1992, 1993) extended CAPM by adding two more factors size premium and value premium respectively which resulted in the FF3 model. The size premium explains stocks with lower market capitalizations will lead to higher returns than firms with higher market capitalizations. Value premium explains stocks with higher proxies of value such as book-to-market ratios yield higher returns compared to stocks with lower proxies of value. Fama and French (2015) added two more factors to the FF3 model namely profitability and investment. The profitability factor explains that robust profitable stocks will generate higher returns compared to firms with weak profitability. The investment factor explains that firms that follow conservative investment strategies will generate higher returns compared to firms that follow aggressive investment strategies. Salaber (2007); Richey (2017); Blitz and Fabozzi (2017); Yang and Wei (2020); Papadamou, Koulis, Kyriakopoulos and Fassas (2022); Bauckloh, Beyer and Klein (2022); Han, Li and Onishchenko (2021) have applied asset pricing models such as CAPM, FF3, C4F, FF5 and their augmented versions to analyze the sin stock premium. However, it should be noted that the success of an asset pricing model depends on the context in which it has been applied. For example, FF3 and FF5 that are huge successes in US financial markets failed in Japan (Daniel, Titman and Wei (2001);Kubota and Takehara, 2018).

2.3Empirical Evidence for Sin Stock Premium

Early studies such as Fabozzi, Ma and Oliphant (2008); Hong and Kacperczyk (2009); and Statman and Glushkov (2009) showed notable positive abnormal returns for sin stocks even after controlling for popular risk factors in asset pricing models such as market, size, value and momentum. Some critics challenge the concept of positive sin premium and

propose the idea of a sin discount suggesting that investors should anticipate negative premiums instead of positive ones. Their argument is based on the belief that sin stocks represent companies with unsustainable business models that will eventually become stranded assets which result in poor long-run returns as discussed by Andersson, Bolton and Samama (2016); and Caldecott (2018). Recent studies such as Richey (2017); Blitz and Fabozzi (2017); Bauckloh, Beyer and Klein (2022); and Han, Li and Onishchenko (2022) found positive alpha when they employed a range of multifactor asset pricing models to examine the sin stock premium. However, Papadamou et al. (2022) found a negative significant alpha when they analyzed the returns of three cannabis stocks using an augmented FF3 model in GARCH (1,1) and E-GARCH frameworks. Yang and Wei (2020) analyzed eight Asia Pacific markets using the FF5 model. They found positive significant sin stock premiums for India and Hong Kong. However, sin stock discount or negative alpha was the result for Malaysia. Yang and Wei (2020) found insignificant results for other markets namely Australia, China, Japan, Philippines, and South Korea. Since most of the above scholars have found empirical evidence for a positive significant sin premium, the first hypothesis is constructed as below.

H1: Trading strategy of long-only position in sin stocks generate positive significant alpha after controlling for risk factors in the FF5 model.

Salaber (2007) found positive significant alpha for the sin portfolio, as well as the portfolio where sin stocks are in a long position and non-sin stocks, are in a short position in protestant countries, countries with high numbers of lawyers and higher litigation rates. Further, Salaber (2007) reported positive sin stock premiums in countries where there is a high excise tax on beer products. Richey (2017) employed CAPM, FF3, C4F, and FF5 models to search for the existence of sin stock premiums in the USA. He found positive significant alpha for both alcohol and tobacco industries when utilizing CAPM, FF3, and C4F asset pricing models. However, he found insignificant results for alpha in both alcohol and tobacco industries when the FF5 model was used. Blitz and Fabozzi (2017) used CAPM as well as Fama and French (1992, 1993, 2015) models with their augmented versions to test sin stock premium in the globally. Blitz and Fabozzi (2017) analyzed US sin stocks in three different periods. In the period from 1963 to 2016, a positive significant sin premium existed for all asset pricing models except FF5 and the augmented version with seven factors. Positive significant alpha is reported for only CAPM in a global context and only for two

models (CAPM and FF3) in Europe. There is no significant alpha for all models in Japan. Bauckloh, Beyer and Klein (2022) tested value value-weighted difference of portfolios where sin stocks were in a long position and non-sin stocks in a short position against FF3 and C4F models. They found a positive significant alpha at 10 percent only in the FF3 model. However, when long-only portfolios of sin stocks are tested in FF3 and C4F, a positive 5 percent significant alpha was the result. Therefore based on Salaber (2007); and Bauckloh, Beyer and Klein (2022), the second hypothesis is presented below.

H2: The trading strategy of taking a long position in sin stocks and a short position in non-sin stocks yield positive significant alpha after controlling for risk factors in the FF5 model.

3 Data and Methodology

Both population and sample for this study are 45 companies listed in the BFT sector in CSE from January 2018 to December 2022 including four companies in the alcohol and tobacco industries. Four sin companies were used to form five sin portfolios and remaining 41 companies were used to form eight non-sin portfolios based on time series data. All 13 portfolios carry 60 monthly observations. Sampling method is convenience sampling after adjusting for new listings and delistings during the sample period. Monthly stock prices are obtained from CSE and adjusted by authors to dividends and other corporate actions. Data from the All Share Price Index (ASPI) which is the main stock market index in Sri Lanka is also obtained from CSE. Factor data such as size (market capitalization of firms), value (book to market ratio), profitability (return on equity ratio), and investment (total asset growth ratio) were mainly obtained from CSE and individual company annual reports. The adjusted three-month treasury bill rate published by the Central Bank of Sri Lanka (CBSL) is considered the risk-free rate.

3.1 Methodology

This study intends to examine the effectiveness of long-only as well as long and short-trading strategies of sin and non-sin stocks of the BFT sector in CSE. Five portfolios were formed for sin stocks based on the industry type namely alcohol-equally weighted (AEW), alcohol-value weighted (AVW), tobacco (TBC), full sin-equally weighted (FSEW), and full sin-value weighted (FSVW). Full sin stock portfolios include all four sin stocks in the sample. Since there is only one tobacco company, that is one portfolio. Three alcohol

companies were weighted on equal and value weighted basis that lead to two alcohol industry portfolios. Then all four sin companies were weighted on equal and value weighted basis that will lead to two more portfolios. Therefore, there are five sin portfolios altogether. Non-sin stocks are also classified into eight portfolios based on market capitalization. They are non-sin small equally weighted (NSSEW), non-sin small value-weighted (NSSVW), non-sin middle equally weighted (NSMEW), non-sin middle value-weighted (NSMVW), non-sin big equally weighted (NSBEW), non-sin big value-weighted (NSBVW), non-sin full equally weighted (NSFEW) and non-sin full value-weighted (NSFVW). Non-sin stocks below the 30^{th} percentile of market capitalizations of all non-sin stocks are considered as small stocks and stocks above 70^{th} percentile are classified as big non-sin stocks. Non-sin stocks between the 30^{th} and 70^{th} percentile of market capitalization are considered as middle-sized non-sin entities. Similar to full sin portfolios described above, the full version of non-sin stock portfolios includes all non-sin stocks of the BFT sector traded in CSE. All sin portfolios are tested in long-only positions as well as together with short positions in non-sin portfolios. For example, the long and short strategy of AEW (a sin portfolio with a long position) and NSSEW (a non-sin portfolio with a short position) is the return difference between the two portfolios (AEW – NSSEW). Monthly excess stock returns of portfolios are calculated based on both equal and value-weighted schemes.

Eq 1

Eq 2

Eq 3

where,

R_{it} is the return of a single stock i, P_{it} is the price of a single stock i at current month t, P_{it-1} is the price of a single stock i at the month prior to the month t, EWR_{pt} is the equal-weighted portfolio return for the portfolio p at month t, VWR_{pt} is the value-weighted portfolio return for portfolio p at month t, W_i is the weight of stock i based on market capitalization and n is the number of stocks.

As the next step, all portfolios described above were regressed using the generalized method of moments (GMM) regression technique by applying the FF5 asset pricing model. The use of GMM is justified since it is a robust method many econometric issues such as heteroscedasticity, serial correlation, endogeneity and other measurement errors. GMM regressions are mostly free from heteroscedasticity since they handle situations where the error term has inconsistent variances across observations. Further, GMM accommodate time series regression models where the error term is auto correlated. Many seminal papers in asset pricing have used GMM models. Few examples are Fama and French (1993); Hansen and Singleton (1982); Campbell and Shiller (1988); Cochrane (1996); Jagannathan and Wang (1996); Lettau and Ludvigson (2001); Gomes, Yaron and Zhang (2006). FF5 model was used to test the trading strategies of sin and non-sin stocks such as long-only and long-short strategies. Sri Lanka faced the Covid-19 pandemic and subsequent economic crisis during the period of this study. To address this issue, a dummy variable (CRS) which represents the crisis period spans from January 2020 to December 2022 was added to the FF5 model as an additional adjustment. The adjusted FF5 model is stated below.

—— **Eq 4**

where,

R_{pt} is the rate for portfolio p at time t, RF is the risk-free rate, MKT is the market factor which is the difference between the market rate of return and the risk-free rate, SMB is size factor which is the return difference between small stocks and big stocks based on market capitalization, HML is value factor which is the return difference between high book to market ratio stocks and low book to market ratio stocks, RMW is the profitability factor which is the return difference between robust profitability stocks and weak profitability stocks, CMA is the investment factor which is the return difference between stocks with conservative investment strategies and stocks with aggressive investment strategies and CRS is the dummy variable that takes value 1 for months from January 2020 to December 2022 and otherwise 0. The construction of factors in the FF5 is detailed in the table 1 below.

Table 1: Construction of variables in Fama & French Five-factor Model

Factor	**Equation**
MKT	Market rate – risk-free rate (RM-RF)
SMB	SMB(Value) = 1/3(small value + small neutral + small growth) – 1/3(big value + big neutral + big growth) SMB (Profitability) = 1/3(small robust + small neutral + small weak) – 1/3 (big robust + big neutral + big weak) SMB (Investment) = 1/3 (small conservative + small neutral + small aggressive) – 1/3(big conservative + big neutral + big aggressive) **SMB = 1/3[SMB(value) + SMB(Profitability) + SMB (Investment)]**
HML	1/2 (Small value + Big value) – 1/2 (small growth + Big growth)
RMW	1/2 (Small robust + Big robust) – 1/2 (Small weak + Big weak)
CMA	1/2 (Small conservative + Big conservative) – 1/2 (Small aggressive + Big aggressive)

4 Analysis and Discussion

4.1 Descriptive Statistics

As presented in Panel A in Table 2, all sin stock portfolios were providing negative means while all non-sin stock portfolios yielded positive means except NSBVW and NSFVW. The means of all sin stock portfolios was -0.0118 while the average of all non-sin stock portfolios was 0.0086. The average range of sin stock portfolios was 0.2996 while the average range of non-sin stock portfolios is 0.6113. The average range of a non-sin stock portfolio is three times larger than the range of a sin stock portfolio approximately. The above fact is reconfirmed by comparing the average standard deviations of sin and non-sin stock portfolios. The average standard deviation of sin stock portfolios was 0.0514 while the same figure for non-sin stocks was 0.1128 which means there is less variation in sin stocks than in non-sin portfolios.

Table 2: Descriptive Statistics

	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
Panel A: Descriptive Statistics of Stock Portfolios						
AEW	(0.0100)	(0.0120)	0.118	(0.1550)	0.050	60
AVW	(0.0110)	(0.0120)	0.132	(0.1660)	0.055	60
FSEW	(0.0100)	(0.0050)	0.091	(0.1420)	0.042	60
FSVW	(0.0130)	(0.0140)	0.080	(0.2020)	0.048	60
TBC	(0.0150)	(0.0090)	0.132	(0.2800)	0.062	60
NSSEW	0.022	(0.0120)	0.599	(0.2440)	0.160	60
NSSVW	0.017	(0.0110)	0.476	(0.2400)	0.146	60

NSMEW	0.013	(0.0110)	0.287	(0.1980)	0.101	60
NSMVW	0.010	(0.0110)	0.255	(0.2190)	0.096	60
NSBEW	0.003	(0.0060)	0.343	(0.2610)	0.095	60
NSBVW	(0.0050)	(0.0040)	0.310	(0.3170)	0.098	60
NSFEW	0.012	(0.0001)	0.304	(0.2320)	0.110	60
NSFVW	(0.0030)	(0.0050)	0.300	(0.3050)	0.096	60
Panel B: Descriptive Statistics of Risk Factors						
MKT	(0.0006)	(0.0017)	0.2754	(0.2310)	0.0834	60
SMB	(0.3239)	(0.0015)	0.3542	(20.9221)	2.7058	60
HML	0.3206	0.0140	19.8696	(0.3413)	2.5684	60
RMW	(0.5815)	(0.0044)	0.3047	(34.2730)	4.4244	60
CMA	(0.0020)	(0.0037)	0.3044	(0.3323)	0.0866	60

Panel B of Table 2 presents the descriptive statistics of factors used FF5 model. The means of all factors were negative except the HML factor which represents the value premium. The highest standard deviation was reported for the RMW factor which represents the return difference between high and low profitability firms. Factors with the lowest standard deviation were market factor (MKT) and investment factor (CMA).

4.2 Correlation

Table 3 presents the correlation of returns between stock portfolios constructed for this study which includes both sin and non-sin stocks. Most of the correlations were significant except one correlation between TBC and AEW portfolios. Correlations between AEW and all other stock portfolios were negatively significant. Except that all other correlations considered in the study are positively significant.

Table 3: Correlations between Stock Portfolios

	AEW	AVW	FSEW	FSVW	TBC	NSSEW	NSSVW	NSMEW	NSMVW	NSBEW	NSBVW	NSFEW	NSFVW
AEW	1.000												

AVWR	-0.850	1.000											
	(-12.272)	-----											
FSEW	-0.912	0.875	1.000										
	(-16.966)	(13.766)	-----										
FSVW	-0.581	0.703	0.829	1.000									
	(-5.439)	(7.534)	(11.298)	-----									
TBC	-0.238	0.312	0.555	0.892	1.000								
	(-1.867)	(2.502)	(5.081)	(15.060)	-----								
NSSEW	-0.490	0.501	0.480	0.439	0.276	1.000							
	(-4.282)	(4.413)	(4.167)	(3.717)	(2.191)	-----							
NSSVW	-0.479	0.513	0.486	0.455	0.292	0.992	1.000						
	(-4.152)	(4.552)	(4.233)	(3.886)	(2.324)	(59.916)	-----						
NSMEW	-0.424	0.523	0.497	0.500	0.346	0.871	0.893	1.000					
	(-3.563)	(4.678)	(4.367)	(4.395)	(2.804)	(13.481)	(15.122)	-----					
NSMVW	-0.409	0.498	0.499	0.519	0.388	0.848	0.871	0.990	1.000				
	(-3.413)	(4.375)	(4.391)	(4.622)	(3.205)	(12.194)	(13.499)	(54.079)	-----				
NSBEW	-0.505	0.672	0.611	0.616	0.408	0.682	0.710	0.830	0.842	1.000			
	(-4.450)	(6.916)	(5.882)	(5.948)	(3.407)	(7.110)	(7.682)	(11.325)	(11.866)	-----			
NSBVW	-0.601	0.705	0.704	0.672	0.458	0.569	0.588	0.697	0.716	0.923	1.000		
	(-5.733)	(7.576)	(7.546)	(6.918)	(3.919)	(5.270)	(5.540)	(7.393)	(7.812)	(18.288)	-----		
NSFEW	-0.506	0.591	0.554	0.535	0.351	0.942	0.953	0.968	0.955	0.868	0.750	1.000	
	(-4.472)	(5.578)	(5.065)	(4.822)	(2.851)	(21.380)	(24.091)	(29.294)	(24.618)	(13.309)	(8.634)	-----	
NSFVW	-0.600	0.705	0.702	0.675	0.462	0.633	0.653	0.758	0.776	0.944	0.996	0.806	1.000
	(-5.718)	(7.566)	(7.502)	(6.963)	(3.965)	(6.234)	(6.566)	(8.844)	(9.357)	(21.721)	(82.237)	(10.366)	-----

Note: t-statistics are reported in parentheses.

Table 4 presents correlations between risk factors applied in the FF5 model. There were only three significant correlations among all the correlations between risk factors. One of the two negative significant correlations was reported between SMB and HML factors. Another negatively significant correlation was between HML and RMW factors. Only a positive significant correlation was reported between SMB and RMW.

Table 4: Correlation between Risk Factors

	MKT	SMB	HML	RMW	CMA
MKT	1.000				

SMB	-0.145	1.000			
	(-1.116)	-----			
HML	0.135	-0.999	1.000		
	(1.034)	(-213.912)	-----		
RMW	-0.156	0.999	-0.999	1.000	
	(-1.201)	(177.759)	(-152.486)	-----	
CMA	0.077	0.042	-0.026	0.048	1.000
	(0.587)	(0.325)	(-0.201)	(0.368)	-----

Note: T-statistics are reported in parentheses.

4.3 Testing for Unit roots

Augmented Dickey-Fuller (ADF) unit root test has been conducted for all sin and non-sin stock portfolios together with the risk factors. All the test statistics as given in Table 5 were statistically significant at 1 percent level for both conditions that are constant only and both constant and trend.

Table 5: ADF Unit Root Test Results

Variable	Test Statistic – Constant Only	Test Statistic – Constant and Linear Trend
Panel A - Sin Portfolios		
AEW	-8.375***	-8.401***
AVW	-7.803***	-6.802***
FSEW	-7.961***	-7.955***
FSVW	-6.828***	-6.919***
TBC	-7.025***	-5.167***
Panel B - Non-sin Portfolios		
NSSEW	-5.167***	-6.037***
NSSVW	-5.509***	-6.105***
NSMEW	-5.254***	-5.306***
NSMVW	-5.141***	-5.192***
NSBEW	-6.244***	-6.194***
NSBVW	-7.390***	-7.327***

NSFEW	-5.412***	-6.103***
NSFVW	-7.153***	-7.100***
Panel C – Risk Factors		
MKT	-5.873***	-5.831***
SMB	-7.637***	-7.650***
HML	-7.724***	-7.737***
RMW	-7.690***	-7.686***
CMA	-6.621***	-6.563***

Note: *** denotes 1 percent statistical significance.

4.4 Regressions on the Long only Trading Strategy of Sin Stock Portfolios

Regressions for long only strategy of sin stocks are presented in Table 6. A significant sin discount was reported for the AEW portfolio. This is consistent with the findings on Canadian cannabis stocks by Papadamou et al. (2022) and results for Malaysia by Yang and Wei (2020). Alpha is insignificant for all other sin stock portfolios. TBC had reported insignificant positive alpha while all other sin portfolios had resulted in insignificant negative alphas. Since there were no significant positive alphas in long only trading strategy of sin stocks, hypothesis 1 is rejected. Yang and Wei (2020) obtained similar results for Australia, China, Japan, The Philippines, and South Korea. Further, Blitz and Fabozzi (2017) obtained positive sin premiums for all asset pricing models but not for FF5. According to Blitz and Fabozzi (2017), the strongest positive sin premium was reported in the USA while no significant alpha for any asset pricing model they employed in Japan. The market factor is negatively significant for the AEW portfolio which is consistent with the previous findings of Samarakoon (1997). However, market factors were positively significant for the other four regressions where the trading strategy of long-only sin portfolios was tested. SMB and HML had reported a positively significant relation with average returns for FSVW and TBC portfolios but not for other sin portfolios with long-only strategy. It is in line with Anuradha (2008); Dayarathna (2010); Randeniya and Wijerathna (2012) in Sri Lankan context. RMW and CMA factors were reported in significant relations with average stock returns which is consistent with the Thafani and Ediriwickrama (2022) in the Sri Lankan context and Kubota and Takehara (2018) in a non-US international context (Japanese). The dummy variable that represents the crisis that existed in Sri Lanka was negatively significant for all sin stock portfolios except ones that consisted of alcohol stocks. Adjusted R squared for regressions of sin stocks with long-only strategy varied from 25 percent to 54 percent. J statistics for GMM regressions of all sin stocks with long-only strategy were insignificant indicating sound GMM regression results.

Table 6: Regression Results for Long Only in Sin Stock Portfolios

Method: Generalized Method of Moments with Newey-West Weighing Matrix										
Instrument specification: C MKT SMB HML RMW CMA CRS MKT(-1) SMB(-1) HML(-1) RMW(-1) CMA(-1) CRS(-1)										
Portfolio	**Intercept**	**MKT**	**SMB**	**HML**	**RMW**	**CMA**	**CRS**	**Adj. R squared**	**J-stat**	**J-stat (prob)**
	Panel A – Long Position in Sin Portfolios									
AEW	-0.012** (-2.085)	-0.362*** (-3.884)	-0.054 (-0.683)	-0.052 (-0.643)	0.002 (0.058)	-0.009 (-0.137)	0.003 (0.323)	0.247	7.816	0.252
AVW	-0.010 (-1.406)	0.533*** (6.889)	0.058 (1.080)	0.114* (1.980)	0.032 (1.448)	-0.088 (-1.557)	-0.003 (-0.355)	0.456	8.887	0.180
FSEW	-0.001 (-0.069)	0.384*** (6.004)	0.055 (1.167)	0.080 (1.534)	0.014 (0.673)	0.001 (0.014)	-0.014** (-2.265)	0.495	6.426	0.377
FSVW	-0.004 (-0.496)	0.442*** (7.743)	0.123*** (4.632)	0.119*** (3.620)	-0.004 (-0.281)	-0.021 (-0.444)	-0.023*** (-3.009)	0.539	5.389	0.495
TBC	0.008 (0.590)	0.413*** (5.337)	0.131*** (3.378)	0.136** (2.592)	0.002 (0.080)	-0.036 (-0.750)	-0.038** (-2.621)	0.275	6.833	0.337

Note: ***, ** and * denotes 1 percent, 5 percent and 10 percent statistical significance.

4.5 Regressions on the Long and Short Trading Strategy between Sin and Non-sin Stock Portfolios

Table 7 shows the GMM regression results for long and short trading strategies between sin and non-sin stock portfolios. Here, all five sin stock portfolios were in long positions one at a time while all non-sin stocks were in short positions. It is a strategy of taking long in sin stocks and short in non-sin stocks. All alphas in the regressions of long and short strategies were insignificant. The majority of regressions with alcohol stock portfolios generated insignificant negative alpha. However, other sin stock portfolios including all sin stocks and tobacco stocks yielded positive but insignificant alpha. There were no significant positive sin stock premiums for the long-short trading strategies between sin and non-sin stock portfolios which will lead to the rejection of the second hypothesis as well. Bauckloh et al (2022) tested a similar strategy where sin stocks were in a long position and non-sin stocks in a short. However, they also found positive significant alpha at a 10 percent level only for FF3 even though several multi-factor models were employed. However, the present study's findings were against the findings of Salaber (2007) who reported a positive sin premium when employing a long-short trading strategy between sin and non-sin stocks.

Negative coefficients were reported for the market factor in all regressions that tested the long-short strategy between sin and non-sin stock portfolios. Most of the coefficients out of them were negatively significant which confirms the findings of negative beta by Samarakoon (1997) in the Sri Lankan context. However, it is contradictory with the seminal works of Sharpe (1964), Lintner (1965), and Mossin (1966). There were significant as well as insignificant factor loadings for the SMB factor in long-short regressions reported in Table 8. However, most of the significant coefficients of the SMB factor possess negative signs except on a few occasions. This result partially reconfirms the findings of Samarakoon (1997); and Nimal (1997) where they reported size of the firms was not related to average stock returns in the Sri Lankan context. This is contradictory with the original work of Banz (1981); and Fama and French (1993). When the AEW portfolio was regressed under a long-short strategy, only one trading strategy (long AEW and short NSBVW) produced a negatively significant coefficient for the HML factor. The majority of all other regression results showed positively significant coefficients for the HML factor. This result is in line with Anuradha (2008); Dayarathna (2010); Randeniya and Wijerathna (2012) where they found a significant relationship between average stock returns and the value factor. It is further consistent with

the original findings of Rosenberg, Reid and Lanstein (1985); and Fama and French (1993). However, it is against the Sri Lankan findings of Samarakoon (1997); and Nimal (1997).

RMW factor showed positive significant factor loadings for most of the long-short regressions which is in line with the original work of Fama & French (2015). Thafani & Ediriwickrama (2022) have tested FF5 in the Sri Lankan context using three proxies for the profitability factor namely return on equity (ROE), return on assets (ROA), and net profit margin (NPM). However, they found insignificant results for all which is contradictory with the findings of the present study. Most of the coefficients for the CMA factor were statistically insignificant. Thafani and Ediriwickrama (2022) have tested the CMA factor of the five-factor model using three proxies namely total asset growth, non-current asset growth, and working capital growth. They found insignificant results for the CMA factor which is consistent with the findings of the present study. However, it is against the original study of Fama and French (2015) where they reported significant results.

The dummy variable which represents the crisis in Sri Lanka reported negative however insignificant coefficients in long-short regressions between sin and non-sin stock portfolios. However, significant negative coefficients were there for CRS for FSEW, FSVW, and TBC portfolios. This is consistent with Ediriwickrama and Azeez (2016) who they analyzed the impact of war on Sri Lankan initial public offerings using a dummy variable to represent war related events. Adjusted R squared varies within the range of 36 percent to 74 percent for all regressions conducted for long-short trading strategies between sin and non-sin stocks. J statistics were insignificant indicating GMM regressions were acceptable.

Table 07: Method: Generalized Method of Moments with Newey-West Weighing Matrix										
Instrument specification: C MKT SMB HML RMW CMA CRS MKT(-1) SMB(-1) HML(-1) RMW(-1) CMA(-1) CRS(-1)										
Portfolio	**Intercept**	**MKT**	**SMB**	**HML**	**RMW**	**CMA**	**CRS**	**Adj. R squared**	**J-stat**	**J-stat (prob)**
Trading Strategy	**Panel A - AEW is in a Long Position and Non-sin Portfolios are in a Short Position**									
AEW-NSSEW	0.001 (0.101)	-1.220*** (-4.020)	-0.885*** (-3.638)	0.041 (0.187)	0.567*** (4.387)	-0.076 (-0.231)	-0.006 (-0.317)	0.615	8.627	0.196
AEW-NSSVW	0.001 (0.103)	-1.216*** (-4.731)	-0.794*** (-3.932)	0.032 (0.170)	0.505*** (5.001)	0.010 (0.035)	-0.006 (-0.339)	0.633	8.205	0.223
AEW-NSMEW	-0.005 (-0.598)	-1.076*** (6.859)	-0.418*** (-3.553)	0.033 (0.339)	0.275*** (4.360)	-0.081 (-0.550)	-0.002 (-0.139)	0.736	8.189	0.225
AEW-NSMVW	-0.005 (-0.702)	-1.040*** (-6.657)	-0.350*** (-3.319)	0.050 (0.557)	0.242*** (3.707)	-0.075 (-0.596)	0.002 (0.192)	0.737	7.694	0.261
AEW-NSBEW	-0.011 (-1.344)	-1.381*** (-7.877)	-0.064 (-0.498)	-0.035 (-0.305)	0.020 (0.361)	0.198 (1.576)	-0.001 (-0.098)	0.707	7.345	0.290
AEW-NSBVW	-0.009 (-1.107)	-1.546*** (-9.103)	0.008 (0.085)	-0.161* (-1.791)	-0.099** (-2.069)	0.200* (1.819)	-0.001 (-0.117)	0.662	8.184	0.225
AEW-NSFEW	-0.004 (-0.467)	-1.177*** (-6.038)	-0.468*** (-3.180)	0.010 (0.065)	0.292*** (4.103)	0.008 (0.047)	0.001 (0.066)	0.703	8.372	0.212
AEW-NSFVW	-0.008 (-1.081)	-1.498*** (-8.838)	-0.045 (-0.527)	-0.145 (-1.588)	-0.057 (-1.253)	0.185 (1.668)	-0.001 (-0.066)	0.674	7.890	0.246
	Panel B - AVW is in a Long Position and Non-sin Portfolios are in a Short Position									
AVW-NSSEW	-0.001 (-0.064)	-0.450* (-1.746)	-0.677*** (-4.608)	0.232* (1.710)	0.550*** (5.282)	-0.296 (-1.061)	-0.027* (-1.912)	0.517	5.511	0.480

Table 07: Method: Generalized Method of Moments with Newey-West Weighing Matrix										
Instrument specification: C MKT SMB HML RMW CMA CRS MKT(-1) SMB(-1) HML(-1) RMW(-1) CMA(-1) CRS(-1)										
Portfolio	**Intercept**	**MKT**	**SMB**	**HML**	**RMW**	**CMA**	**CRS**	**Adj. R squared**	**J-stat**	**J-stat (prob)**
AVW-NSSVW	0.003 (0.314)	-0.370 (-1.664)	-0.681*** (-6.108)	0.163** (2.044)	0.513*** (6.184)	-0.102 (-0.497)	-0.021 (-1.397)	0.545	5.115	0.529
AVW-NSMEW	-0.004 (-0.408)	-0.126 (-1.098)	-0.270*** (-3.119)	0.200** (2.138)	0.281*** (6.450)	-0.178 (-1.519)	-0.012 (-0.919)	0.467	7.396	0.286
AVW-NSMVW	-0.004 (-0.425)	-0.151 (-1.219)	-0.210** (-2.307)	0.220** (2.058)	0.256*** (6.175)	-0.162 (-1.525)	-0.011 (-0.826)	0.396	7.553	0.273
AVW-NSBEW	-0.008 (-1.571)	-0.408*** (-3.391)	0.153* (1.854)	0.247*** (3.007)	0.051 (1.115)	-0.049 (-0.473)	-0.011 (-1.305)	0.402	5.729	0.454
AVW-NSBVW	-0.003 (-0.436)	-0.572*** (-5.699)	0.105 (1.592)	-0.014 (-0.223)	-0.072* (-1.854)	0.099 (1.185)	-0.009 (-1.118)	0.391	3.879	0.693
AVW-NSFEW	-0.004 (-0.587)	-0.294** (-2.530)	-0.290*** (-3.439)	0.244*** (4.273)	0.320*** (5.424)	-0.231* (-1.742)	-0.016 (-1.449)	0.515	4.697	0.583
AVW-NSFVW	-0.003 (-0.404)	-0.518*** (-4.988)	0.056 (0.848)	0.010 (0.146)	-0.028 (-0.710)	0.081 (0.955)	-0.010 (-1.211)	0.387	4.250	0.643
	Panel C - FSEW is in a Long Position and Non-sin Portfolios are in a Short Position									
FSEW-NSSEW	0.007 (0.695)	-0.524* (-1.997)	-0.653*** (-3.908)	0.235 (1.623)	0.539*** (5.018)	-0.180 (-0.624)	-0.035** (-2.292)	0.547	6.194	0.402
FSEW-NSSVW	0.008 (0.799)	-0.448* (-1.934)	-0.606*** (-4.614)	0.225** (2.277)	0.504*** (5.908)	-0.073 (-0316)	-0.029* (-1.741)	0.571	5.874	0.438
FSEW-NSMEW	0.004 (0.500)	-0.193** (-2.011)	-0.262*** (-2.837)	0.208*** (2.766)	0.282*** (6.388)	-0.082 (-0.698)	-0.018 (-1.266)	0.548	5.146	0.525
FSEW-NSMVW	0.005 (0.570)	-0.207** (-2.120)	-0.214** (-2.281)	0.192** (2.049)	0.244*** (5.788)	-0.077 (-0.770)	-0.018 (-1.357)	0.508	5.074	0.534
FSEW-NSBEW	-0.001 (-0.172)	-0.547*** (-4.813)	0.165* (1.855)	0.225*** (2.991)	0.032 (0.668)	0.058 (0.639)	-0.021** (-2.153)	0.548	3.540	0.739

Table 07: Method: Generalized Method of Moments with Newey-West Weighing Matrix										
Instrument specification: C MKT SMB HML RMW CMA CRS MKT(-1) SMB(-1) HML(-1) RMW(-1) CMA(-1) CRS(-1)										
Portfolio	**Intercept**	**MKT**	**SMB**	**HML**	**RMW**	**CMA**	**CRS**	**Adj. R squared**	**J-stat**	**J-stat (prob)**
FSEW-NSBVW	0.004 (0.692)	-0.676*** (-8.289)	0.158** (2.476)	0.024 (0.589)	-0.082** (-2.060)	0.150** (2.081)	-0.017** (-2.222)	0.576	2.747	0.840
FSEW-NSFEW	0.001 (0.168)	-0.392*** (-3.413)	-0.256** (-2.649)	0.291*** (3.877)	0.327*** (4.959)	-0.159 (-1.226)	-0.022* (-1.975)	0.585	5.268	0.510
FSEW-NSFVW	0.004 (0.729)	-0.627*** (-7.499)	0.101 (1.511)	0.048 (1.150)	-0.033 (-0.805)	0.144* (1.990)	-0.017** (-2.198)	0.578	3.174	0.787
	Panel D - FSVW is in a Long Position and Non-sin Portfolios are in a Short Position									
FSVW-NSSEW	0.013 (0.941)	-0.366 (-1.666)	-0.710*** (-3.595)	0.194 (1.080)	0.550*** (4.614)	-0.129 (-0.447)	-0.038** (-2.051)	0.535	7.260	0.298
FSVW-NSSVW	0.013 (0.917)	-0.335 (-1.610)	-0.634*** (-3.624)	0.219 (1.503)	0.518*** (5.345)	-0.095 (-0.388)	-0.033* (-1.701)	0.551	7.066	0.315
FSVW-NSMEW	0.002 (0.153)	-0.117 (-1.040)	-0.216** (-2.402)	0.274*** (3.402)	0.293*** (5.896)	-0.090 (-0.770)	-0.022 (-1.464)	0.526	8.230	0.222
FSVW-NSMVW	0.001 (0.066)	-0.123 (-1.094)	-0.148* (-1.929)	0.298*** (4.312)	0.265*** (5.724)	-0.103 (-1.036)	-0.021 (-1.545)	0.498	7.446	0.282
FSVW-NSBEW	0.003 (0.285)	-0.462*** (-3.887)	0.074 (0.797)	0.151* (1.784)	0.045 (0.799)	0.118 (1.102)	-0.025** (-2.131)	0.475	5.009	0.543
FSVW-NSBVW	0.002 (0.188)	-0.615*** (-6.272)	0.150** (2.228)	0.044 (0.707)	-0.064 (-1.518)	0.113 (1.477)	-0.023** (-2.088)	0.480	5.706	0.457
FSVW-NSFEW	0.006 (0.557)	-0.264** (-2.320)	-0.312** (-2.612)	0.212** (2.113)	0.317*** (4.343)	-0.092 (-0.702)	-0.025* (-1.787)	0.551	6.874	0.333
FSVW-NSFVW	0.002 (0.226)	-0.566*** (-5.626)	0.099 (1.445)	0.059 (0.917)	-0.025 (-0.546)	0.101 (1.234)	-0.023** (-2.168)	0.484	5.940	0.430

Table 8: Regression Results for the Trading Strategy of Long in Sin Stocks and Short in Non-sin Stocks

Table 07: Method: Generalized Method of Moments with Newey-West Weighing Matrix										
Instrument specification: C MKT SMB HML RMW CMA CRS MKT(-1) SMB(-1) HML(-1) RMW(-1) CMA(-1) CRS(-1)										
Portfolio	**Intercept**	**MKT**	**SMB**	**HML**	**RMW**	**CMA**	**CRS**	**Adj. R squared**	**J-stat**	**J-stat (prob)**
	Panel E - TBC is in a Long Position and Non-sin Portfolios are in a Short Position									
TBC-NSSEW	0.025 (1.331)	-0.295 (-1.412)	-0.711*** (-3.073	0.198 (1.010)	0.555*** (4.138)	-0.040 (-0.137)	-0.050* (-1.989)	0.480	8.080	0.232
TBC-NSSVW	0.027 (1.391)	-0.261 (-1.294)	-0.616*** (-3.049)	0.236 (-1.518)	0.518*** (4.716)	-0.021 (-0.088)	-0.047* (-1.880)	0.492	8.232	0.222
TBC-NSMEW	0.013 (0.775)	-0.169 (-1.330)	-0.221** (-2.099)	0.229** (2.334)	0.271*** (4.840)	-0.075 (-0.603)	-0.042** (-2.075)	0.444	7.663	0.264
TBC-NSMVW	0.011 (0.659)	-0.176 (-1.460)	-0.147 (-1.532)	0.252** (2.559)	0.238*** (4.349)	-0.065 (-0.607)	-0.039** (-2.093)	0.436	7.666	0.264
TBC-NSBEW	0.012 (0.764)	-0.448*** (-4.167)	0.045 (0.387)	0.152* (1.707)	0.065 (1.150)	0.152 (1.366)	-0.039** (-2.172)	0.363	5.423	0.491
TBC-NSBVW	0.010 (0.640)	-0.650*** (-5.989)	0.129 (1.442)	0.043 (0.544)	-0.052 (-1.229)	0.134 (1.644)	-0.037** (-2.113)	0.375	6.485	0.371
TBC-NSFEW	0.016 (0.910)	-0.272** (-2.057)	-0.298** (-2.132)	0.206* (1.845)	0.306*** (3.872)	-0.039 (-0.258)	-0.040* (-1.970)	0.453	7.420	0.284
TBC-NSFVW	0.011 (0.680)	-0.607*** (-5.555)	0.082 (0.912)	0.056 (0.701)	-0.015 (-0.345)	0.119 (1.373)	-0.038** (-2.179)	0.376	6.448	0.375

Note: ***, ** and * denotes 1 percent, 5 percent and 10 percent statistical significance.

5 Conclusion

The main conclusion of the study is that there is no significantly positive sin stock premium for sin stocks traded in the BFT sector in the CSE. Therefore, both trading strategies tested in this study that are long-only strategy and long-short strategy proved to be not viable in portfolio formation in investment decision making. This is a contrasting result when reviewing the literature where they found positively significant sin stock premiums in the international context. There are mixed results for most of the factors in Fama & French's (2015) five-factor model. However, most of the factor loadings for the CMA factor in FF5 were insignificant compared to the other four factors. The main implication for the investment industry is trading strategies based on sin stocks don't provide attractive results for investors. However, there are several limitations in this study. One of the key limitations is the limited number of stocks traded on the CSE. Another important limitation is that the study's period is adversely affected by COVID-19 and the subsequent financial crisis in Sri Lanka. These twin crises adversely affected the entire capital market in Sri Lanka. It is suggested to expand the period of the study and compare it with similar South Asian economies as further research opportunities. Further, other multi-factor models such as FF3, C4F and their augmented versions could be tested to investigate the sin stock premium in Sri Lanka.

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