Sin stocks a closer look: evidence on institutional ownership, analyst coverage and volatility

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Abstract

In this thesis I examine the relationship between sin stocks - publicly traded US companies involved in producing alcohol, tobacco and gaming - and institutional ownership, analyst coverage and return volatility. I present empirical evidence that sin stocks, both combined and by industry, are less held by institutional investors and receive less coverage by analysts than stocks with otherwise comparable characteristics. In line with the social norm hypothesis that there is a societal norm against funding the operations of sin stocks. Investigating institutional ownership over time reveals that the difference between sin stock ownership is consistently lower over time with the difference between sin stocks and non-sin stocks increasing over time. This result does not hold for analyst coverage of sin stocks over time. Evidence on industry differences over time is more mixed. The volatility analysis suggests that sin stocks are more volatile than non-sin stocks. While Dividend paying sin stocks are on average less volatile and have a higher institutional ownership percentage than non-divided paying sin stocks. The results also indicate that the institutional ownership effect on volatility is smaller in sin stocks as compared to non-sin stocks irrespective of the dividend structure. Finding no support for the hypothesis that the sign of institutional ownership on volatility depends on whether the (sin) stock pays a dividend.

Contents

1. Introduction

The bible describes sinning early on as 'the lack, a deficiency, a falling short of the standard of God's perfect goodness' (Deuteronomy 32:4). Individuals not adhering to the social norm[1] laid out by the church could potentially lead to hell for all eternity. The effect of social norms in financial decision making was traditionally tested by reviewing labor markets. Romer (1984) showed that, in a stylized setting, the inclusion of social norms, in labor markets, may be consistent with maximizing behavior (even when earning lower wages) if individuals are sanctioned by loss of reputation. With socially responsible investing (SRI) on the rise over the past decades[2] academical attention[3] has seen an apparent upsurge in interest towards the effects of the inclusion of social norms in financial markets. According to Viviers and Eccles (2012) over 45% of the literature on SRI investments address the financial performance. A similar trend can be observed within the literature on sin stocks. Here the 'neglect' by norm-constrained institutions was long believed to result in abnormal returns for institutions willing to invest in sin stocks (see Salaber, 2008; Fabozzi and Oliphant, 2008; Statman and Glushkov, 2009). Until the work by Blitz and Fabozzi (2017) able to explain the observed returns. Research on institutional ownership in sin stocks is scarce with only two papers published on this topic (see Hong and Kacperczyk, 2009; Durand et al., 2013). Presenting consistent empirical evidence of lower institutional ownership in sin stocks for the US and the Pacific-Basin as compared to non-sin stocks. Even less is known about analyst coverage on sin stocks which has only been addressed by Hong and Kacperczyk (2009). Estimating that analyst coverage on sin stocks is around 30% lower (compared to the mean) as measured over the years 1976 until 2003. This thesis will provide the reader with a comprehensive analysis on institutional ownership and analyst coverage in sin stocks. Doing so by highlighting the differences across industries, across time and by replicating the methodology of Hong and Kacperczyk (2009) over recent years to allow for comparability. Another recently explored topic in the context of sin stocks is volatility. Colonnello et al. (2019) investors do not necessarily boycott sin companies but rather trade-off dividends

[1] Akerlof (1980) defines a social norm as an act whose utility to the agent performing it depends in some way on the beliefs or actions of other members of the community.

[2] According to the US SIF Foundation's 2018 report more than one out of every four dollars under professional management in the United States ($12 trillion or more) was invested according to SRI strategies

[3] See Viviers and Eccles (2012) for summary review of SRI publications

against ethicalness. His model predicts that the dividend share of sin companies exhibits a positive relation with the future return. More generally Rubin and Smith (2009) found that the sign of institutional ownership on volatility depends on the dividend structure. I will replicate the result by Rubin and Smith (2007) to sin stocks and provide an extensive analysis of sin stock volatility. Combining the objectives and formulating the main questions as:

What is the relationship between sin stocks and institutional ownership, analyst coverage and return volatility?

This thesis broadly consists of two parts. The first part focuses on the relationship between institutional ownership in sin stocks and analyst coverage on sin stocks using a semi-annual panel dataset from 1983 to 2017. This part broadly follows the methodology outlined by Hong and Kacperczyk (2009). In the second part I examine the relationship between daily return volatility and sin stocks while accounting for dividend structures. Investigating this relationship with a quarterly dataset from 2000 to 2017. The main research question is answered by formulating testable hypotheses. The hypotheses are consistent throughout the three subjects with the first focusing on difference irrespective of the time and the second focusing on differences over time. This results in six main hypotheses with the first five consisting of two sub hypotheses. The first sub hypothesis focuses on the three sin industries combined while the second focuses on industries separately.

Hong and Kacperczyk (2009) present compelling evidence that investors subject to public scrutiny invest less in sin stocks. Attributing the observed lower institutional holdings in sin stocks to the inclusion of social norms in investment decisions. Reasoning that not adhering to the social norm valued by the investors of norm-constrained institutions could result in reputation costs which in turn negatively affects future cash flows. In their paper pension funds, insurance companies and endowment funds are classified as being norm-constrained institutions due to their public character. On the other hand, mutual funds and hedge funds are believed to be natural arbitrageurs. Indeed, these non-constrained institutions do not hold fewer sin stocks reasoning that only expected return considerations matter for investment decisions. Unfortunately, a classification error by the data distributor (Thomson Reuters) in the institutional type codes prevents me from reviewing the constrained hypothesis over recent years (see 'Database limitations'). At a more aggregated level, the

authors find that total institutional investing is approximately 3 percentage points lower in sin stocks as compared to non-sin stocks over the period 1980 – 2003. This result can be tested over more recent years and leads me to formulate the following testable hypotheses:

H1A Institutional ownership in sin stocks is significantly lower compared to non-sin stocks.

H1B Institutional ownership is significantly lower in all three sin industries.

The first hypothesis effectively tests whether sin stocks differ from other stocks irrespective of time period, e.g. estimated over the full sample. First investigating institutional ownership in all sin stocks combined then separately by industry. Thereafter the relationship between sin stocks and institutional ownership is examined over time. I expect an increasingly negative sign since socially responsible investing (SRI) is on the rise over the past decades with over twenty percent of all assets under professional management being classified as SRI assets in 2016 in the US[4]. The following hypothesis is formulated:

H2A Institutional ownership of sin stocks relative to non-sin stocks is consistently lower over time with the difference increasing over time.

H2B Institutional ownership of the three sin industries relative to non-sin stocks is consistently lower over time with the difference increasing over time.

Similar logic applies to the level of analyst coverage on sin stocks as compared to other stocks. Analysts predominantly supply institutional investors with financial reports and forecasts on the universe of stocks. If institutional investors shun away from sin stocks it would make intuitive sense that analysts are less inclined to provide information on sin stock performance. This rational is confirmed by Hong and Kacperczyk (2009). With sin stocks receiving on average 16 percent less earnings per share (EPS) estimates during the years 1983 to 2003. I hypothesize the following:

H3A Analyst coverage on sin stocks is significantly lower compared to non-sin stocks.

H3B Analyst coverage on the three sin industries is significantly lower compared to analyst coverage on non-sin stocks.

[4] See for review on Global Sustainable Investments: http://www.gsi-alliance.org/wp-content/uploads/2017/03/GSIR_Review2016.F.pdf

The third hypothesis will be assessed by replacing the dependent in the institutional ownership regression with my measure of analyst coverage. Using the last available number of EPS estimates over the two quarters that make up the semi-annual observations under review. Examining the level of sin stock coverage over time by dividing the sample into six smaller time periods and repeatable estimating the relationship. To test hypothesis four:

H4A Sin stocks receive increasingly less analyst coverage relative to non-sin stocks over time.

H4B The three sin industries receive increasingly less analyst coverage relative to non-sin stocks over time.

The last relationship explored in this thesis is sin stock return volatility and the role of dividends. Interestingly, the role of dividends in sin stock investing has only been recently addressed by Colonnello et al. (2019) despite a large body of literature pointing to the importance of dividends on return volatility (Baskin, 1989; Del Guarcia, 1996; Rubin and Smith, 2009). Baskin (1989) provide support for the claim for the choice of dividend policy is in and of itself an important predictor of return volatility even after controlling for many industrial and financial factors. Noting that the channel by which dividends affect volatile is less clear. Research by Rubin and Smith (2009) highlights the importance of institutional investors in this relationship. Hypothesizing that the "Prudent Man" rules constrain institutions from speculating with other people's money leading to an institutional preference for "Prudent stocks". Age, low volatility, and stable dividends have been used in past studies as indicators of prudent stocks (Del Guercia, 1996). The empirical results presented by Rubin and Smith (2009) are consistent with an institutional preference for low-volatility stocks and the tendency of higher levels of institutional ownership to increase volatility through their trading behaviour only in dividend paying stocks. The second result follows, at least partially, from institutional herding behaviour and higher turnover around dividends declaration days, e.g. trading patterns in dividend paying stocks. On the other hand, institutional ownership in non-dividend paying stocks is found to decrease volatility by improving the information contained of stock prices. More specifically, Rubin and Smith (2009) find that a 10% increase in institutional ownership results in a 2% increase in volatility for dividend paying stocks and 3% reduction in non-dividend paying stocks. Hypotheses five and six are formulated as follows:

In the context of sin stocks, Colonnello et al. (2019) find that investors prefer dividend paying stocks but weigh the gain opportunities (dividends) according to their perception of the firms' ethicalness. Here the role of substitutability between dividends and ethicalness is crucial for returns and volatility spreads. Hypothesis five and six are formulated as follows:

H5A Volatility in sin stocks is significantly higher compared to non-sin stocks.

H5B Volatility in the three sin industries is significantly higher compared to non-sin stocks.

H6 Institutional ownership in sin stocks is significantly and positively related to dividend paying sin stocks and negatively to non-dividend paying sin stocks.

Before proceeding with the analysis, I elaborate on the sin stock definition applied in this thesis. The inclusion of the Triumvirate of Sin, namely alcohol, tobacco and gaming, is generally agreed upon and included by all prominent authors (e.g. Hong and Kacperczyk, 2009; Lobe and Walkshäusl, 2016; Blitz et al, 2017). As such, I apply the traditional definition of sin by only considering the Triumvirate of Sin as sinful. Although public opinion on sinful activities evolves over time, the decision to include other industries to the sinning cohort remains arbitrary. Causing the applied definitions of sin to vary across preceding papers making direct comparison of results difficult. For instance, some include nuclear power and biotech (Lobe and Walkshäusl, 2016; Fabozzi and Oliphant, 2008). In Lobe and Walkshäusl (2016) forty-six per cent of the total sin portfolio consists of nuclear power stocks so that the results are dominated by the decision to include the industry. Moreover, it remains unclear that the general public views these activities as sinful. The same can be said about the defence industry. With Hong and Kacperczyk (2009) arguing that Americans do not view the defence industry as a sinning industry. Even though foreign investors in the US indices potentially do not share this point of view. Given these diverging expectations, the defence industry is not included in the main analysis but explored as a robustness check. Lastly, some studies include the adult service industry. Following Blitz and Fabozzi (2017) I refrain from including the few firms that make up the industry since they find that exclusion does not significantly alter the results.

2. Theoretical Framework

2.1 Background profile on the triumvirate of sin

The dictionary defines sinning as "A transgression of a religious or moral law, especially when deliberate". The definition of sinning has not changed much over the past centuries although the same cannot be said for activities regarded as sinful behaviour.

One of the most prominent examples of such a reclassification towards the sinning cohort is the tobacco industry. Nowadays, tobacco products are widely known for their addictive properties though these properties were not immediately recognized. In light of increasingly popular tobacco products, societal anxiety on the potential long-term health risks increased. Evidence addressing the health risks by the medical world was met with counter efforts by the tobacco industry to disregard evidence supporting the health risk claims. With the tobacco industry lobbying extensively to protect their interests and even conducting research themselves highlighting the health benefits.

Producing ad campaigns in the early 1950s featuring physicians assuring consumers that their respective brands were safe (Gardner, 2006). The reclassification of the tobacco goods to the sinning cohort came about only later after documented health risks caught up with the tobacco industry. In 1964 the Advisory Committee to the Surgeon General released damning findings in the first government-sanctioned study unequivocally linking smoking to certain cancers and numerous health afflictions, effectively moving the issue out of the hands of advertisers and back into the public health domain (Alberg, Shopland, and Cummings, 2014). Following the report adult prevalence rates started declining from their peak reached in 1964. Supported by public health efforts to discourage tobacco use during the second half of 20th century. Permanently moving tobacco products into the sin cohort.

In contrast to the tobacco industry the gambling industry has seen a large increase over time. Early on the historical link between gambling and criminal activity resulted in strong regulations by the US government. Deregulations at the national- and state-level only came around in the late 1980 in an effort to increase the proceeds from gambling and cover the gap left by the poor performing US economy. Helped by the reduction in governing laws, the industry saw their customer base expand driving the gaming industry to unprecedented highs in terms of size. A prominent force was the 1988 Indian Gaming Regulatory Act (IGRA)

allowing Native Americans to engage in the gaming industry. Following the approval, more than 260 casinos were opened by 1999 spread over 25 states. With the tribal business growing from 212 million to 6.7 billion by the end of 1997. However, as the economy became strong in the late 1990s tax revenues from the gambling industry became less crucial with societal costs aggregating. Additionally, the up rise of online gambling by offshore party's reduced taxable income while societal costs remained similar. The call for nationwide reform became increasingly loud, as state officials were apparently unable to effectively address the concerns. This resulted in congress passing the "national gambling commission act" in 1996 after an extensive study on potential benefits and drawbacks. The new rules limited states legalization authorities for casino legalization (Chen and Bin, 2001).

Alcohol like gambling has long been classified to the sinning cohort. The addictive properties and subsequent societal costs have led early on to strict regulations on the wholesale of alcoholic beverages. Until recently eighteen US states ran monopolistic wholesale operations on the distribution of alcohol. Several states have privatized their operations since then by transferring to a licensee system (Giesbrecht, 2000). Since the privatizations a policy shift has taken place, moving from minimizing societal costs towards more commercial objectives. Given that companies predominantly focus on efficient distribution, convenience and increasing sales. The government therefore explored alternative solutions to address the alcohol-related issues. Such as an increase the tax on alcoholic beverages to discourage the consumer form buying. Although most bills never see the light of day due to extensive lobbying efforts by the industry. Leading many states to shy away from such measures (Savell, Fooks and Gilmore, 2016).

2.2 The up rise of socially responsible investing (SRI)

The definition of socially responsible investing (SRI) is "integrating personal values and societal concerns with investment decisions" (Statman, 2006; Schueth, 2003; Shank et al., 2005). In practice SRI involves avoiding investments in companies that produce or sell addictive products, such as the Triumvirate of Sin, and pursue investment opportunities in companies engaged in social justice, green investments and environmental sustainability. SRI continues to increase over recent years with total SRI assets at the beginning of 2016 at $8.72

trillion, up 33 per cent from 2014 (US SIF 2016)[5]. With institutional investors, money managers and community investment institutions summing to $8.10 trillion of the total. Indicating that some institutional investors take into account social responsibility criteria besides the traditional trade-off; risk and return. No single standard exists on the applied screening procedure resulting in a lot of heterogeneity. With some SRI funds excluding companies in case the firms' revenues from an 'a-social or un-ethical' sector exceed a certain threshold. While other funds are more restrictive, excluding companies in case its' branches or suppliers are non-compliant (Renneboog et al,2008; Blankenberg and Gottschalk, 2018).

The anecdotal story of higher non-financial utility derived from complying with the SRI standard seemed compelling but remained unexplained until the work by Bollen in 2007. He empirically tests the premises that investors in SRI funds are more loyal. Reasoning that lower cash flow (investments in the fund) sensitivity to recent negative returns and higher cash flow sensitivity to recent positive returns are indicative of higher non-financial utility. His result suggests that SRI investors react stronger to positive returns and weaker to negative returns compared to conventional fund investors. A logical question that arises following the up rise of SRI investing is: does SRI investing result in weaker financial performance?

The first study addressing this question dates back to 1972 in a study by Moskowitz. Evidence from the late 20th century (Goldreyer and Dilz, 1999; Statman, 2000) suggests that the social screening procedures applied by mutual funds do not significantly affect the obtained risk-adjusted return. A result that is reconfirmed by Bauer, Koedijk and Otten (2005) evaluating the performance of 103 German, UK and US SRI mutual funds. Some studies, e.g Derwall et al (2005), even find an out-performance by SRI portfolios. A potential answer to these unexpected results could lie in increased idiosyncratic risk bared by undiversified SRI investors. Renneboog, ter Horst and Zhang (2008) explore this possibility but find no evidence in line with this explanation. As such the findings suggest that social consideration do not influence the obtained result negatively and could be applied by investors without the need to pay a premium.

[5] See for review on Global Sustainable Investments: http://www.gsi-alliance.org/wp-content/uploads/2017/03/GSIR_Review2016.F.pdf

2.3 Sin stock returns: abnormal or simply more risk?

Most of the existing research on sin stocks focuses on the return 'anomaly'. Following the increase in SRI investing, sin stocks were neglected more often. This apparent neglect by investors was all the more surprising given the fact that trading strategies specifically targeting sin stocks were outperforming the SRI funds (Statman and Glushkov, 2009). Raising the question: Are these assets simply more risky or can we really characterize these returns as 'abnormal'?

The traditional models, e.g. CAPM and Fama-French 3-factor model, were unable to explain these returns (Fama and French, 1993; Fabozzi and Oliphant, 2008; Hong and Kacperzyk, 2009; Durand et al, 2013). So that sin stock returns were initially believed to be abnormal reasoning that the mark-up was consistent with a reputation risk premium. Referring to the reputation risk hypothesis formulated by Akerlof (1980):

"Despite the human egoism of maximizing self-interest, social sanctions or loss of reputation may stimulate responsible behaviour of individuals even if additional costs are involved"

Alternatively, these studies propose that sin industries could benefit from monopolistic returns (Fabozzi et al., 2008). Salaber (2008) uncovered that cross-country variation in sin stock performance depends partially on the religious, litigation and tax environment. The religious demographic matters since the evidence shows that Protestants are more sin-avers than Catholics and require a risk premium on sin stocks. Furthermore, sin stocks outperform other stocks in case country-specific litigation risk is heighted suggesting that investors require compensation for the bearing the extra risk inherent in the stock. Hong and Kacperczyk (2009) state that litigation risk is heighted by the social norm. The study by Salaber (2008) also finds evidence that sin stocks have higher risk-adjusted returns when they are located in a country with high excise taxation.

The first compelling evidence explaining the 'abnormal' returns on sin stocks was provided by the work of Blitz and Fabozzi (2017). In an article analysing US, European and global samples the authors first replicate the positive alpha using the traditional CAPM model. Then adding the recently introduced assets pricing factors, in particular *profitability and investment.* Finding that, after controlling for exposures to these factors, no evidence remains of the existence of a premium that pertains specifically to sin stocks, e.g. reputation risk premium.

Implying that higher sin stock returns merely compensate investors for bearing the risk, specifically more risk in profitability and investments. Effectively resolving the sin stock anomaly.

2.4 Sin stocks: Institutional ownership and analyst coverage

Research on institutional ownership structures and analyst coverage in sin stocks is more scarce compared to the literature on sin stock returns. The handful of academics active in this field has uncovered multiple interesting results with considerably room for future research. At the forefront are Hong and Kacperzyk (2009) studying the investment environment of sin stocks. Their sample consists of carefully selected sin stocks and comparable non-sin stocks. Selecting the comparable non-sin stocks by reviewing the Fama and French (1993) industry groupings and one-digit SIC codes of companies included in US indices. The authors find that institutional ownership in sin stocks is approximately 3% lower compared to stocks with otherwise comparable characteristics. A direct comparison between less- and more-constrained institutions reveals that more-constrained institutions, i.e. banks and pension funds, hold less sin stocks compared to their less-constrained, i.e. mutual funds and hedge funds, counterpart. Confirming the reputation risk hypothesis by Akerlof (1980).

Hong and Kacperczyk (2009) then examine the level of analyst coverage on sin stocks. The sin stock coefficient reveals a 16 percent decline in analyst estimates relative to the mean. With sin stocks on average receiving 2.1 analyst estimates compared to 2.5 analyst estimates on comparable stocks. Despite counter efforts by sin firms to minimize the gap in both institutional ownership and analyst coverage. As explained in Kim and Venkatachalam (2011), sin firms are known for their high financial reporting quality aimed at reducing the information asymmetry, adverse selection, and cost of capital, as well as to increase liquidity. Moreover, sin firms undertake alternative methods to detract attention from the adverse business activities by undergoing significant charitable giving and recycling. For example, Anheuser-Busch recycles more than 97% of the waste it generates, making it the world's largest recycler of used aluminium cans (Ahrens, 2004).

Durand, Koh and Tan (2013) examine, amongst other topics, institutional ownership of sin stocks across seven countries in the Pacific-Basic. Using the methodology by Hong and Kacperczyk (2009) to investigate the cross-country variation. They conclude that groupthink

might reduce the cognitive dissonance resulting from holding sin company stock. Presenting evidence that collectivist cultures herd towards sin stocks. Whereas individualistic cultures similar to the US, i.e. Australia and New Zealand, herd away from sin stocks. This conclusion of varying social views towards sin stocks is reinforced by the work of Fauver and Macdonald (2014). They find that sin stocks have an 8% lower equity valuation in countries where society is strongly against sin industries when compared to "sin countries". These findings give a clear indication that social norms vary across countries.

Given the before mentioned results, it is surprising that two dimensions of social norms in relation to institutions ownership in sin stocks remain unexplored: *the time- and industry-dimension.* The up rise in SRI investing goes to show that social norms are not fixed but rather evolve over time (see "The up rise of socially responsible investing"). Meaning that what is regarded as a non-sinful activity today may be regarded as a sinful-activity tomorrow and vice versa. For example, large institutional investors are increasingly setting carbon footprint targets, effectively barring them from investing in stocks with high CO_2 emissions. (Blitz and Fabozzi, 2017). This goes to show that the sin industry classification is not in a steady state. In contrast to the research assumption applied by prominent authors (Fabozzi et al., 2008; Hong and Kacperczyk, 2009; Durand et al., 2013). The other way around is also possible: companies classified as sin stocks today can have a shift in their product mix and revenue sources that results in a reclassification. For instance, Heineken, Anheuser Busch and AB InBev are aggressively marketing their nonalcoholic beer[6].

Besides variation over time, sin stock classifications vary between institutions within a given time period. This view is supported by observed differences between exclusion list published by Robeco, PGGM, APG, NBIM, ABN, and ING. These differences stem from the fact that adoption of SRI is voluntary and therefore institutions can decide on the extent of compliance and relatively importance of the factors. Taken together, these findings suggest that institutional ownership in the sin industries both within time and over time requires additional research.

[6] Described in this article: https://www.marketingweek.com/why-heineken-and-ab-inbev-are-promoting-more-responsible-drinking/

2.5 Institutional ownership-volatility relationship

The existing research on sin stocks and institutional ownership primarily deals with the observed lower levels of institutional ownership in sin stocks. Previous literature describing the role of dividends on institutional buy-decision and the consequence of institutional ownership on return volatility has yet to be linked to sin stocks. Zhang (2010) argues that sources of stock return volatility can be divided into two factors: *trading patterns* and *fundamental factors*. A trade pattern example is institutional herding behaviour around dividend declaration days (Sias, 2004; Rubin and Smith, 2009). Fundamental factors refer to variables that affect uncertainty about future free cash flows. Several proxies for fundamental uncertainty are suggested including, but not limited to, variation in earnings (Wei and Zhang, 2006), growth options (Cao, Simin and Zhao, 2008), and firm focus (Dennis and Strickland, 2009). Uncertainty about fundamentals may be heighted by a weaker information environment. In case the information asymmetries are high, investors have more difficulty in prediction future states, leading to larger and more frequent revisions. The firm's information environment is likely to be affected by factors such as the firm size, disclosure requirement of the exchange (Pastor and Veronesi, 2003), dividends (Baskin, 1989).

Rubin and Smith (2009) describe two hypotheses to capture the observed institutional ownership-volatility relationship. First, the *institutional sophistication hypothesis* stating that institutional investors, by way of their higher financial sophistication, improve the information content of market prices, which in turn lowers the volatility of returns. Second, the *institutional preference hypothesis* according to which institutions are restricted by rules and constraints that would lead them to prefer "prudent stocks". Del Guercia (1996) names age, low-volatility and stable dividends as indicators of prudent stocks. If true, institutional investors would be averse towards high-volatility non-dividend paying stocks. In contrast to this prediction, Blitz and Vliet (2007) present evidence that institutional investors prefer and overpay for risky, high-volatility, stocks resulting a high risk-adjusted return on low-volatility stocks, deemed the volatility effect. Implying a neglect of low-volatility stocks by institutional investors. One potential driver could be the standard equity solvency requirement for institutions. Swinkels et al. (2018) find that differences in risk between stock portfolios do not influence the solvency requirements. Arguing that this encourages risk-seeking behaviour (a

preference for high-volatility stocks) by insurance companies that could sustain or even create mispricing in the cross-section of stocks returns.

Using a sample of US firms, Rubin and Smith (2009) find that return volatility decreases in institutional ownership for firms that do not pay dividends because the information environment is weaker, i.e. higher pricing error. In the literature two alternative sources of volatility are described relating the shareholder base: type and number of shareholders. Brockman and Yan (2009) present evidence that block holders increase the probability of informed trading and idiosyncratic volatility and decrease the firm's stock return synchronicity, i.e. higher pricing error. On the other hand, having a large and diverse shareholder base coincides with a larger fraction of noise traders implying higher return volatility (Jankensgård and Vilhelmsson, 2018). Such traders do not, unlike arbitrageurs, form rational expectations given the available information, although the presence of noise traders increases the value of information to rational investors (Shleifer and Summer, 1990).

Preceding research by Rubin and Smith (2009) indicates that a rise in institutional ownership results in higher return volatility in dividend paying stocks only. This result follows, at least partially, from higher turnover by institutional investors around dividends declaration days, e.g. trading patterns in dividend paying stocks. Additionally, the authors find that an increase in volatility leads to a drop in institutional ownership in both dividend and non-dividend paying stocks. The authors argue that this finding is a result of the "Prudent Man" rules constraining institutions from speculating with other people's money. This should lead to a preference by institutions for "Prudent stocks". Age, low volatility, and stable dividends have been used in past studies as indicators of prudent stocks (Del Guercia, 1996). Hypothesis five and six are formulate as follows

The preceding literature offers practical advice on the determinants of return volatility in sin stocks. Identifying various factors to be included, such as institutional ownership, firm size, earnings, firm focus and dividends. I will combine this information with the research on sin stocks to form my expectations, which are described next. Sin companies are known for their high financial reporting standard with goal to ease the apparent neglect by institutions (Kim and Venkatachalam, 2011). The use of higher reporting standards is expected to decrease volatility, as the information environment is stronger. Despite these efforts Hong and

Kacperzyk (2009) establish that institutional ownership and analyst coverage in sin stocks is lower than in comparable non-sin stocks. These results are expected to have opposing effects on sin stock volatility. First, lower institutional ownership in sin stocks likely results in less informed prices, e.g. higher pricing error, thereby increasing volatility. That is assuming the institutional sophistication hypothesis holds. Second, fewer estimates by analysts' implying less information is available to institutional investors and noise traders. Assuming analysts follow institutions, their main customers, noise traders have less information to trade upon resulting in lower volatility. David Berman (2002) writes, "… sin stocks come with other advantages besides stability. Most of these have lower valuations than the overall market and offer excellent dividends." Evidence on the effect of dividends on the institutional ownership-volatility relationship remains mixed. Since sin stocks that pay dividends offer reduced uncertainty on free future cash flows, while trading patterns such as increased trading volumes around declaration days, presumably increase volatility. In contrast non-dividend paying stock do not offer this reduced uncertainty (lack of dividends) while also not being subject to the same type of trading patterns that increase volatility. Additional research investigating the difference in sin stock volatility by dividend structures could potentially close this gap in existing literature.

The remainder of this thesis is structured as follows. In Section 3, the data is discussed in detail. In Section 4, I discuss the methodology and considerations. In Section 5, the empirical results are presented. In Section 6, the robustness checks are presented. Concluding in Section 7.

3. Data

The data section consists of multiple subsections. The first section describes the data collection process. In the second section the database limitations are discussed. In the third section discussing the sin stock identification technique. The fourth section describes how the control groups are selected. Describing how the variables are constructed in section five.

3.1 Data collection

This section describes the databases used that resulted in the sample(s). The data used in this thesis is collected from in total five databases. Collecting all variables over the same time period, starting from the 1st of January 1982 to the 31st of December 2017. First, the list of sin stocks and control stocks is assembled. Matching the list to the database in question to ensure all firms end up in the final sample. In order to be included in the sample, data needs to be available on both Compustat and CRSP.

Thomson Reuters is the first database. It covers the SEC filings on stock ownership by insiders and institutional investors. Accessing the quarterly data on individual holdings through two subsets of the database. Aggregating the individual shares and dividing by the total shares outstanding results in two ratios: insider and institutional ownership. The construction of the insider (INSIDER) and institutional ownership (IO) is explained below in more detail.

The second database is Compustat, which provides information on historical segments, index constituent and fundamental firm accounting values. Accessing all three through subsets of the database. The historical segment subset identifies three additional SIC- and NAIC-codes needed to supplement the list of sin stocks. The index constituent reports the first- and last-year of all firm listings on US indices. Fundamental accounting values are retrieved from the quarterly fundamentals subset. The variables retrieved are: permno, SIC code, NAIC code, stock price, long-term debt, common-ordinary shares outstanding and net income.

The third database used is CRSP, which offers data on stock characteristics. The monthly stock files are consulted on the total shares outstanding and the cumulative adjustment factor. Using the second to scale the reported shares in the Thomson Reuters database[7]. Next, the

[7] Explained in more detail under “Institutional ownership” and “Insider ownership”.

daily stock files provide the return (incl. dividends), return (excl. dividends), dividend date, ask-quote, bid-quote and trade volume, first price date.

The I/B/E/S database, the fourth source, tracks the number of analysts covering a firm at any point in time. Analyst coverage is defined as the most recent number of earnings per share (EPS) estimates over the last two quarters. The fifth and last database is the Kenneth R. French Library. This library readily provides 48 return portfolios based on the Fama and French (1997) industry classification (see Appendix Figure A). The portfolios are used as inputs in the industry beta calculation.

3.2 Database limitation

WRDS acknowledges that the type code in the 13-F master file is incorrectly assigned after 1997Q4. The code provides information on the institutional type of each shareholder. Table 2 provides an overview of the type-code classification scheme.

Figure 1: Type code classification Thomson Reuters (available through WRDS)

Code	Institutional Type
1	Bank
2	Insurance company
3	Investment Companies and Their managers
4	Investment Advisors
5	All others (Pension Funds, University Endowments, Foundations)

The classification issue results in an unreasonably large increase in the “all others” group at the expense of the remaining four institutional types. Preventing me from investigating the hypothesis that type 1, 2 and 5 are presumably more norm-constrained relative to type 3 and 4. I did experiment with a reference type file to possibly correct for the incorrect classification. Gathering information on all shareholders with their corresponding types before the classification issue took place, e.g. until 1997Q4. Then matching the historical shareholders types to the shareholders for all the remaining years, knowingly 1998 – 2017. Changing the, presumed to be, wrong type code in case the historical type code differs. Table 10 in the Appendix provides an overview of the type code alterations following the procedure.

Although the procedure seems to be quite effective, I elect to not proceed with investigating the norm-constrained hypothesis. Reason being is that this solution is far from perfect since shareholders entering the database after 1998 would remain incorrect. On top of that the institutional investment objective could change over time leading me to wrongfully alter their type. Put it simply, any result that relies heavily on the type code classification after 1998 will be plagued with measurement error. This undoubtedly creates bias in the estimates, with the magnitude remaining unclear, casting doubt on both the internal- and external-validity.

3.3 Sin stock identification

I follow the definition of Hong and Kacperczyk (2009) in identifying stocks as sin stocks. The Fama and French classification scheme (1997)[8] allocates the SIC codes[9] into 48 industries. The classification directly identifies industry group 4 and 5 as respectively, tobacco products (smoke) and alcohol products (beer). This corresponds to SIC codes 2080 – 2085 in the smoke group and SIC codes 2100 – 2199 in the beer group. Unfortunately, the classification does not disentangle gaming stocks from hotel stocks and entertainment stocks. Therefore, I rely on the NAICS classification to identify the gaming stocks. Assigning stocks to the 49th gaming industry if listed under any of the following NAICS codes: 7132, 71312, 713210, 71329, 713290, 72112 and 721120. With the relevant SIC- and NAICS-codes in hand, I build a list of sin firms using two subsets available in Compustat. Firms are added to the list of sin stocks in case any of their segments are classified under the either the beer (4), smoke (5) or the gambling group (49). The fundamental quarterly subset reports one segment per firm; one SIC code and one NAICS code. Fortunately, the historical segments database provides insight into three additional firm segments. In case of non-missing values this results in the identification of 8 segments; 4 SIC codes and 4 NAICS codes. This procedure results in the identification of 327 sin stocks. To establish a comprehensive sin stock list, I review the public exclusion lists by Robeco, PGGM, APG, NBIM, ABN, and ING. Adding tobacco, alcohol, gaming and defence (under robustness) stocks if not already included on the list. On the exclusion lists are well-known tobacco companies such as: Altria Group, Philip Morris, Reynolds

[8] See appendix A for the complete Fama and French (1997) classification based on SIC codes.

[9] SIC and NAICS codes are used to classify firm activities (segments).

American and British American Tobacco. The exclusion lists are comprised of companies worldwide (not only US firms) and seem to only include major players in the field. Cross-referencing the exclusion lists with the already identified sin stocks reveals that sin stocks identification process was successful.

I decide not to include non-Triumvirate of Sin companies named on the exclusion lists since there exists a lot heterogeneity among the excluded industries and firms within each industry. Examples of not-included exclusion list categories are corruption, environment, coal energy, and human rights. Furthermore, I exclude stocks in the services industry, the SIC codes 4900-4999 and 6000-6999, from the analyses and focus on the CRSP share codes 10 and 11[10].

3.4 Industry control groups: ONESICDUM and GDUM

Selecting a good control group ensures that the coefficient on SINDUM, under different specifications, equals the true causal effect of interest. The aim of the two control groups outlined below is to capture higher-order variation unrelated to the sinning nature of the treatment group. Depending on the specification, the interpretation of the control group coefficient changes with the goal remaining the same throughout. That is, the interpretation relates to industry preferences in case the dependent is institutional ownership and analyst coverage. With the coefficient capturing return volatility specific to the control group under the return volatility regressions. In accordance with the methodology of Hong and Kacperzyk (2009), I construct two control group dummies: ONESICDUM and GDUM.

The first approach relies on the SIC-code classification. Assigning a stock to the ONESICDUM group in case the one-digit SIC-code is the same as any of the one-digit SIC-codes of the sin industries. Identification is straightforward for the tobacco (2) and alcohol (2) industries since both are classified directly under the SIC-code classification. In contrast, the gaming stocks are originally identified through the NAIC-classification. As a result, gaming stock are more scattered across SIC-codes. The ONESICDUM group is equal to one in case the stock belongs to the one-digit SIC-codes: 2, 5 and 7.

[10] Share codes 10 and 11 are NYSE American common excluding foreign, ADRs, REIT and Closed End Funds.

Under the second approach each sin industry is assigned a comparable or complementary industry(s). As such, the gambling industry (49) is typically complemented by fun (7) and meals (44). Similarly, the tobacco industry (5) is linked to the food industry (2). With alcohol (4) most likely being intertwined with non-alcohol beverages, e.g. soda (3).

The expectation is that the carefully selected control industries, under the GDUM dummy approach, will result in a more conservative estimate on SINDUM. As it presumably more accurately captures the higher-order variation not specific to the sin stock subsample. The ONESICDUM will therefore only be used ones in all models as the GDUM is more refined[11]. Table 1 provides a complete overview of the sin stocks identification following the Fama and French industry classification scheme with their relevant controls under the two approaches.

[11] The ONESICDUM is more of a quick-and-dirty approach over carefully selected comparables with the GDUM.

Table 1: Sin stock identification, the ONESICDUM and GDUM approach

Sin stock classification			**ONESICDUM**	**GDUM**		
Sin industries	SIC codes	NAIC codes	One-digit SIC codes	Industries	SIC codes	NAIC codes
Alcohol (4)	2080-2085		2	Alcohol (4)	2080-2085	
				Soda (3)	2064-2068, 2086-2087, 2096-2097	
Tobacco (5)	2100-2199		2	Tobacco (5)	2100-2199	
				Food (2)	2000-2046, 2050-2063, 2070-2079	
Gaming (49 - NAIC)		7132, 71312, 713210, 71329 713290, 72112, 721120	5, 7	Gaming (49 - NAIC)		7132, 71312, 713210, 71329, 713290, 72112, 721120
				Fun (7)	7800-7841, 7900-7999,	
				Meals (44)	5800-5813, 5890, 7000-7019	

3.5 Variable description

The observations from the six databases are merged using the triplet: firm identifier-year-quarter combination. This method results in one observation per triplet for every variable. The remainder of this section describes the calculations and transformation that led to the variables. Insider ownership, institutional ownership, analyst coverage and volatility of daily returns deserve special attention as the reliability of the results heavily weighs on their measurement.

Insider ownership

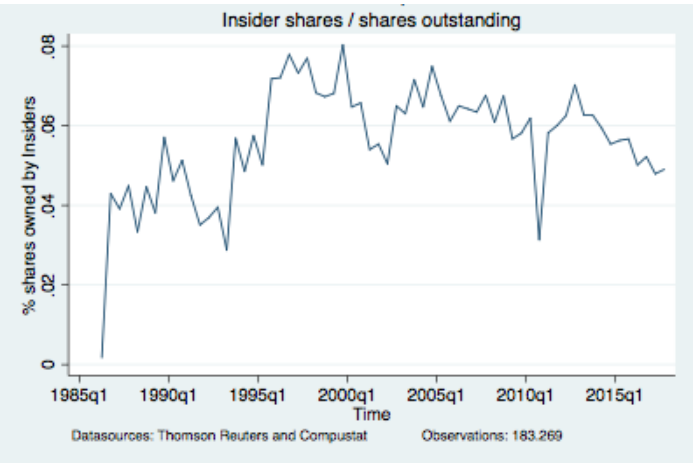
$INSIDER_{it}$ is defined as the fraction of shares held by insiders. The individual insider holdings are taken from Thomson Reuters. Insiders are required by law[12] to report the direct (D) and indirect (I) holdings through Form 3 or Form 4. Indirect holdings are shares held in a trust and/or held by member(s) of the insider's immediate family. Total insider shares for manager i in year-quarter t are calculated by summing over the indirect holdings and adding the direct holdings with the highest sequence number[13]. Merging the Thomson Reuters file date (fdate) with the CRSP monthly files to obtain the shares outstanding and the cumulative adjustment factor. Dividing the individual shares by the cumulative adjustment factor to account for special events, e.g. stock splits. This allows us to compare shares filed on a different date (different fdate) that apply to the same date (same rdate). Removing duplicate observations based on the combination manager (mngr) and report date (rdate). This results in the removal of 34.559 duplicate observations. Summing by firm and dividing by the total shares outstanding results in fraction of shares held by insiders. Importantly, insider is assumed to be zero in case it is not reported. The insider variable in formula:

$$Insider = \frac{\Sigma(\frac{shares_{ijt}}{adjustment\ factor_{jt}})}{total\ shares\ outstanding_{jt}}$$

Where $shares_{ijt}$ is shares held by manager i in firm j at time t, $adjustment\ factor_{jt}$ is the CRSP cumulative adjustment factor and $total\ shares\ outstanding_{jt}$ is the total shares outstanding in firm j at time t.

[12] Since 2002Q3, insiders are required to report the trade within two business days. Before that, the requirement was within ten business days after the month in which the trade took place.
[13] WRDS provides guidelines on calculating total insider shares.

Graph 1: Insiders over time



Institutional ownership

Institutional ownership, IO_{it}, is defined as the fraction of shares held by institutional investors adjusted for insider ownership. Institutions[14] are required to disclose[15] all common-stock positions greater than 10.000 shares or $200.000 through form 13F. Similar to the insider calculation, individual institutional shares are scaled by the cumulative adjustment factor. Removing 1.245.355 duplicates manager (mngr) and report date (rdate) combinations. Summing by firm and dividing by total shares outstanding results in unadjusted institutional ownership. This measure of institutional ownership is adjusted for the percentage held by insiders by dividing the unadjusted measure of institutional ownership percentage by one minus the percentage held by insiders. Doing so to ensure that institutional ownership measure reflects the ratio of shares held by institutions over the shares available in the market (the free float). This results in the adjusted institutional ownership measure, IO in short, which is higher in case insider percentage is unequal to zero in firm i at year-quarter t. In formula:

$$IO = \frac{\left(\frac{\sum\left(\frac{shares_{ijt}}{adjustment\ factor_{jt}}\right)}{total\ shares\ outstanding_{jt}}\right)}{1 - Insider}$$

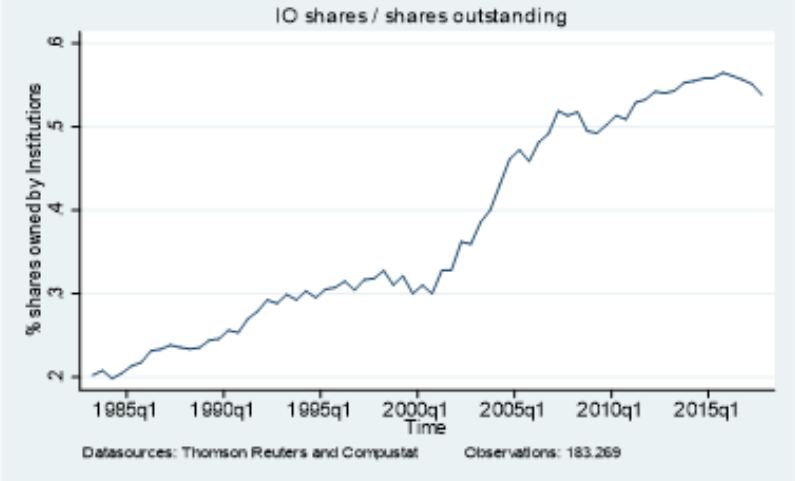
[14] Since the institution of the 1978 amendment on the Securities and Exchange act, all institutions with over 100 million dollars in securities under management are required to report their holdings to the SEC.

[15] The holdings should be disclosed within 45 days after the ending of the last quarter.

Where $shares_{ijt}$ is shares held by institution i in firm j at time t, $adjustment\ factor_{jt}$ is the CRSP cumulative adjustment factor, $total\ shares\ outstanding_{jt}$ is the total shares outstanding in firm j at time t, $Insider$ is total shares held by insiders divided by total shares outstanding.

WRDS acknowledges that the IO measure will exceed the 100% mark in some cases. In my sample this affects 10.354 out of 180.521 observations equivalent to 5.73% of the total. These observations are winsorized to 100% since it is impossible to have a higher share.

Graph 2: Institutional ownership (IO) over time



Analyst coverage

My analyst coverage measure is $LNANALYST_{it}$ defined as the natural logarithm of one plus the number of earnings per share (EPS) estimates on firm i at year-quarter t. The data comes from Detail history subset available in the I/B/E/S database[16]. The provider reports multiple EPS estimates over various horizons at a quarterly frequency, if available.[17]. The measure on analyst estimates is equal to the most recent value available, considering the current- and one-quarter ahead estimates. In other words, the number of estimates on firm i in year-quarter t is equal to the most recent value available over year-quarter t and year-quarter t-1. In case a firm does not appear in I/B/E/S it is assumed to have no analyst following the stock.

[16] The Detail History is used over the Summary History subset, since it accounts for stopped and excluded estimates in the measurement of NUMEST, the amount of estimates.

[17] In I/B/E/S FPI indicates the quarter the estimate applies to. FPI values 4 and 5 are taken into account in constructing the LNANALYST measure, which indicate respectively, the current- and previous-quarter.

Return volatility

Volatility, $LNVOLQ_{it}$, is measured as the natural logarithm of the average quarterly standard deviation of daily stock returns including dividends. Daily returns are retrieved from the daily stock files subset available in CRSP. The volatility of daily returns is calculated for all quarters with a minimum of thirty-three business days in standard deviation values.

Control variables

The remaining control variables are exclusively explanatory variables and described next. $SIZE_{it}$ is defined as the natural logarithm of the firm's market value, e.g. price times the ordinary shares outstanding. AGE_{it} is defined as the natural logarithm of the years since the stock first appears in CRSP. $BETA_{it}$ is the firm's industry market beta (see Appendix Table 12) obtained by dividing the covariance, between the industry return and the market return, with the market return variance. Including it as a proxy for idiosyncratic risk appetite in returns. Return portfolios formed by the Kenneth R. French Library are used to calculate betas on the 48 traditional industries. The 49th Gaming industry is obtained by a two-step procedure. First, forming yearly return portfolios containing the gaming stocks, based on the NAIC codes (see Table 1). Second, calculating the gaming beta using the Library's yearly market returns. $MVBV_{it}$ is defined as the natural logarithm of the market-to-book value. Where market value is the price times shares outstanding and book value is the total shareholder's equity, e.g. total assets minus total liabilities[18]. $LEVERAGE_{it}$ is measured as the ratio of long-term debt over market value. $PRICE_{it}$ is the natural logarithm of the price. $RETURN_{it}$ is the average monthly return over the past year. $VARIANCE_{it}$ is the daily stock return variance during the year preceding the year-quarter t. ROE_{it} is return on equity measured as net income divided by the book value. $DIVSTOCKDUM_{it}$ is a dummy that equals one in case stock i paid a dividend in the previous 12 quarters. $DIVDUM_{it}$ is a dummy that equals one in case the stock has paid during the quarter. The variable $SP500_{it}$ takes on the value of one in case stock i in year t is included in the S&P 500 index and zero otherwise. Similarly, $NASD_{it}$ takes on the value of one in case stock i in year t is included in the NASDAQ-100 index and zero otherwise. Unfortunately the constituents are reported on a year-by-year basis. Consequently, all

[18] From Compustat fundamentals quarterly: total assets (item 44) and total liabilities (item 54).

variation in the dummies comes from cross-year variation hence neglecting variation throughout the year.

3.6 Summary statistics

Table 2 presents the summary statistics of the two samples used in this thesis. Both samples are assembled in a similar manner and can be characterized by a panel data structure with multiple time periods each containing multiple firms. Similarly, the sample mean and sample standard deviation are presented in first two columns after which the samples are split into two parts, namely non-sin stocks and sin stocks.

Table 2 describes the variables included in the semi-annual sample[19] spanning from the 1st of January 1983 until the 31th of December 2017. Covering in total 12,199 firms from 48 industries with 165 sin firms. This dataset is used to investigate the differences in IO_{it} and $LNANALYST_{it}$ between sin stocks and other stocks. Whilst controlling for a host of firm characteristics. The summary statistics presented in Hong and Kacperczyk (2009) over the period 1983 – 2003 based on annual observations[20] are reasonably similar to the statistics presented in Table 2. Naïve comparison between the institutional ownership sample mean and the sin stock mean reveals a difference equal to 2.3 %. Moving down, we observe that insiders own on average 7.3% of the sin stock shares against 5.2% in non-sin stocks. In line with earlier studies on sin stocks the market beta on sin stocks is lower than other stocks. Importantly to note is that the institutional ownership variable is adjusted to account for shares held by insiders (see 'Variable description' on calculations). Moving further down, the index dummies tell a mixed story on sin stock index constituents. With 16.4% of the sin stock observations being included in the S&P 500 index compared to 10.4% of the non-sin stocks. On the other hand, non-sin stock observations are twice as often included in the NASDAQ-100 index. This does not necessarily mean that sin stocks are more likely to be included in the S&P 500 as it could be driven by the fact that sin stocks are on average older, i.e. have more observations, pushing the mean upwards. Supported by the higher mean in AGE reported in Table 2. The remaining control variables are reasonably similar across the two groups.

[19] The summary statistics over 1983 – 2003 based on annual observations are reasonably similar to the statistics presented by Hong and Kacperczyk (2009).

Table 2: Summary statistics semi-annual sample 1983 – 2017

The variable $ANALYST_{it}$ is the natural logarithm of one plus the number of earnings per share (EPS) estimates over the last two quarters. IO_{it} is the fraction of all shares held by institutional investors adjusted for insider ownership. $INSIDER_{it}$ is the fraction of all shares held by insiders.. $SIZE_{it}$ is the natural logarithm of the firm's market value. Market value is calculated as the price multiplied by the total shares outstanding. $BETA_{it}$ is the firm's industry market beta.VOL_{it} is the volatility of daily returns during the past two quarters. $RETURN_{it}$ is the average daily stock return, including dividends, during the past two quarters. $MVBV_{it}$ is the natural logarithm of the market-to-book value. Book value is measured as total assets minus total liabilities. $PRICE_{it}$ is the natural logarithm of the firm's stock price, winsorized at the 1%-level. $GDUM_i$ equals one in case a stock is a sin stock or is part of the industry groups: food (2), soda (3), fun (7) and 43 (meals) and zero otherwise. $ONESICDUM_{it}$ equals one in case a stock is a sin stock or has the same one-digit SIC code as any of the sin stocks and zero otherwise$DIVSTOCK_{it}$ is a dummy that equals one in case stock i paid a dividend in the previous twelve quarters. $SP500_{it}$ equals one in case the stock is included in the S&P 500 and zero otherwise. Similarly, $NASD_{it}$ equals one in case the stock is included in the NASDAQ-100 and zero otherwise. Table 2 reports the summary statistics of the semi-annual sample 1983 – 2017.

	SAMPLE		**NON-SIN STOCKS**				**SIN STOCKS**			
Variables	Mean	St. dev.	Mean	St. dev.	Min	Max	Mean	St. dev.	Min	Max
ANALYST	1.01	0.892	1.008	0.892	0	3.83	0.971	0.920	0	3.22
IO	0.469	0.315	0.469	0.315	0	1	0.446	0.302	0	1
INSIDER	0.052	0.117	0.052	0.116	0	0.50	0.073	0.144	0	0.50
SIZE	19.366	2.241	19.356	2.236	11.08	2.32	20.062	2.515	12.42	26.10
BETA	1.04	0.252	1.044	0.252	0.43	1.43	0.832	0.163	0.61	1.28
VOL	0.034	0.024	0.034	0.024	0	1.72	0.030	0.019	0.002	0.16
RETURN	0.013	0.047	0.013	0.047	-0.29	1.18	0.015	0.041	-0.17	0.32
MVBV	0.750	0.883	0.749	0.88	-9.61	10.68	0.775	0.927	-4.94	6.72
PRICE	2.523	1.166	2.520	1.16	-3.91	7.46	2.71	1.43	-3.47	8.39
GDUM	0.062	0.241	0.048	0.214	0	1	1	0	1	1
ONESICDUM	0.481	0.500	0.473	0.500	0	1	1	0	1	1
DIVSTOCK	0.609	0.488	0.609	0.488	0	1	0.646	0.478	0	1
SP500	0.105	0.306	0.104	0.305	0	1	0.164	0.370	0	1
NASD	0.020	0.139	0.020	0.140	0	1	0.009	0.092	0	1
N	138,619		136,629				1,990			

Table 3: Summary statistics quarterly sample 2000 – 2017

The variable $LNVOLQ_{it}$ is defined as natural logarithm of daily return volatility during the quarter. IO_{it} is the fraction of all shares held by institutional investors adjusted for insider ownership. $INSIDER_{it}$ is the fraction of all shares held by insiders. $SIZE_{it}$ is the natural logarithm of the firm's market value. Market value is calculated as the price multiplied by the total shares outstanding AGE_{it} is the natural logarithm of the amount years since the firm first appeared on CRSP. $LEVERAGE_{it}$ is the ratio of long-term debt over market value. $MVBV_{it}$ is the natural logarithm of the market-to-book value. Book value is measured as total assets minus total liabilities $PRICE_{it}$ is the natural logarithm of the firm's stock price, winsorized at the 1%-level. $RETURNQ_{it}$ is the return in the current quarter. ROE_{it} is return on equity measured as net income divided by the book value. $VOLP_{it}$is the defined as the volatility of profits calculated as the standard deviation of the 12 previous quarterly ROE measures.$GDUM_i$ equals one in case a stock is a sin stock or is part of the industry groups: food (2), soda (3), fun (7) and 43 (meals) and zero otherwise. $ONESICDUM_{it}$ equals one in case a stock is a sin stock or has the same one-digit SIC code as any of the sin stocks and zero otherwise. $DIVDUM_{it}$ equals one in case the stock paid a dividend during the current quarter and zero otherwise. $DIVSTOCK_{it}$ is a dummy that equals one in case stock i paid a dividend in the previous twelve quarters. $SP500_{it}$ equals one in case the stock is included in the S&P 500 and zero otherwise. Similarly, $NASD_{it}$ equals one in case the stock is included in the NASDAQ-100 and zero otherwise. Table 3 reports the summary statistics of quarterly sample 2000 – 2017.

	SAMPLE		**NON-SIN STOCKS**				**SIN STOCKS**			
Variables	Mean	St. Dev.	Mean	St. Dev.	Min	Max	Mean	St. Dev.	Min	Max
LNVOLQ	1.0772	0.622	1.079	0.622	-2.61	5.50	0.980	0.603	-2.54	3.27
IO	0.488	0.367	0.489	0.367	0	1	0.460	0.342	0	1
INSIDER	0.063	0.185	0.062	0.185	0	0.96	0.093	0.223	0	0.96
SIZE	6.044	2.175	6.043	2.171	-7.92	13.50	6.07	2.43	0.66	12.28
AGE	2.842	0.817	2.837	0.819	0	4.53	3.11	0.664	0.693	4.53
LEVERAGE	0.415	1.080	0.409	1.067	0	9.97	0.804	1.597	0	9.972
MVBV	0.818	0.939	0.818	0.935	-11.18	17.17	0.810	1.597	0	9.97
RETURNQ	0.066	0.609	0.066	0.611	-37.49	48.10	0.094	0.457	-2.69	3.65
ROE	-0.016	0.307	-0.016	0.307	-2.03	1.79	0.006	0.315	-2.03	1.79
VOLP	0.136	0.242	0.136	0.242	0	1.99	0.139	0.252	0.002	1.85
GDUM	0.072	0.259	0.056	0.230	0	1	1	0	1	1
ONESICDUM	0.492	0.500	0.483	0.500	0	1	1	0	1	1
DIVDUM	0.168	0.373	0.168	0.374	0	1	0.151	0.3358	0	1
DIVSTOCK	0.351	0.477	0.352	0.477	0	1	0.342	0.474	0	1
SP500	0.082	0.275	0.082	0.274	0	1	0.123	0.329	0	1
NASD	0.015	0.121	0.015	0.122	0	1	0.0003	0.017	0	1
N		197,016		193,631				3,385		

The rational for constructing the quarterly sample, described in Table 3 relates to the volatility measure, reasoning that valuable cross quarter firm-variation[21] in dividends can only be captured in case the observations are measured quarterly. Panel B describes the variables calculated at a quarterly frequency starting in the first quarter of 2000 until the last quarter of 2017. The sample covers 12,009 firms from 48 industries with 132 sin firms.

The mean values on Institutional ownership (IO) and insider (INSIDER) are reasonably similar across the two samples, providing me with confidence on the accurateness of the calculations. Again, insiders have a relatively higher stake and institutional investors a lower stake in sin stocks as compared to non-sin stocks. Interestingly, leverage in sin stocks seems to be twice as high than non-sin stocks. Given that LEVERAGE is calculated as long-term debt divided by the book value, differences could stem from either two. Closer inspection reveals that the book value is 1606.25 and 1654.63 in respectively non-sin stocks and sin stocks. It should therefore be evident this mean difference results from sin firms taking on more long-term debt liabilities. This observation is supported by current literature (Fauver and Macdonald, 2014). My final point relates the industry control groups: GDUM and ONESICDUM. As mentioned before, the GDUM is more conservative in assigning stocks a value of one as compared to the ONESICDUM. This is clearly visible from the sample mean statistics. With only 7.2% of all observations under the GDUM satisfying the conditions (see Table 1) alongside 49.2% under the ONESICDUM approach. Favouring my choice to work predominantly with GDUM variable.

[21] This is especially problematic in case the effect size is small as the standard errors are simply higher in case semi-annual observations are used.

4. Methodology

The methodology section consists of two subsections. First discussing the considerations and choice of the estimation technique used to obtain the results. Thereafter describing the specifications applied under the three topics that are the focus of this thesis: institutional ownership, analyst coverage, and volatility.

4.1 Estimation technique

Choosing the right estimation technique is essential to ensure the validity of the result. I adopt the terminology of Peterson (2009) in defining two commonly encountered forms of dependence in financial research. Discussing both and choosing the estimation technique accordingly. First the *time effect*. Present when the residuals are cross-sectionally correlated within the same time period. It seems plausible that the time effect is present in my dataset since we know that institutional and insider ownership is increasing over time (see figure Graph 1 & 2). The Fama-Macbeth approach (Fama and Macbeth, 1973) is designed to account for this form of dependence. In this approach, T cross sectional regressions are estimated. The average of the T estimates is the coefficient estimate. Second, the *firm effect*. Referring the situation where residuals of a given firm in different years are correlated. Again, it would be reasonable to assume that this form of dependence is present. Implying that firm performance in T dependents to an (unknown) extent on firm performance in T-1. The Newey-west procedure (Newey and West, 1987) is applied to adjust the standard errors, designed to account for serial correlation of an unknown form between lagged residuals of firm i. Choosing the lag length is simplified in a panel dataset, since the maximum lag length is one less the maximum number of years per firm (Peterson, 2009). This implies that if T = 30 (30 years) and firm i has 10 years of observations the procedure taking into account 9 lags (10 – 1). The Newey-West procedure adjusts the standard errors by accounting for firm-level dependence. The problem that remains is that observations of firms within the same industry are not necessarily independent, so that standard errors calculated this way may still be incorrect. This happens in case institutions invest in multiple firms within the same industry for reasons like liquidity or diversification. Clustering the standard errors at the industry-level deals with this form dependence. This results in higher standard errors since identification comes from cross industry variation. Few firms switch industries over time leaving little 'independent variation' to be explained as it makes less assumption about how the errors are

correlated. To that end I validate my choice to cluster at the firm-level under robustness by performing an OLS regression clustered at the industry-level.

4.2 Semi-annual sample: Institutional ownership and analyst coverage

This section describes in detail the specifications used to investigate the variation in institutional ownership and analyst coverage. Testing hypotheses 1, 2, 3 and 4 over the semi-annual dataset starting from the 1st of January 1983 until the 31st of December 2017. Hypotheses 1 and 3 centres around the average difference between sin stocks and non-sin stocks over the full sample period. The estimates are obtained by regressing the $SINDUM_i$ variable, together with a variety of firm/industry characteristics, on respectively the fraction held by institutional investors (IO_{it}) and the amount of analyst estimates ($ANALYST_i$). This setup allows me to access whether institutional ownership in sin stocks (H1A) and analyst coverage of sin stocks (H3A) is on average lower as compared to non-sin stocks.

The statistical hypotheses tested under hypothesis 1a and 3a are:

$$H_0: SINDUM_{it} = 0$$

$$H_a: SINDUM_{it} \neq 0$$

Hypothesis 1 and 3 will be accepted (rejected) in case the T-statistic on $SINDUM_{it}$ is significant.

The model is then altered to include three separate industry dummies and re-estimated to better understand how the $SINDUM_i$ coefficient is build up (H1B and H3B). Testing for statistical differences between the OLS industry-coefficients by performing a T-test (with unequal variances). The three coefficients are obtained by regressing[22] the cross-sectional first stage Fama-Macbeth estimate ($BEERDUM_i, SMOKEDUM_i$, or $GAMEDUM_i$) on a constant only.

The statistical hypotheses on the difference between the coefficients are as follows:

$$H_0: BEERDUM_{it} - SMOKEDUM_{it} = 0$$

$$H_a: BEERDUM_{it} - SMOKEDUM_{it} \neq 0$$

[22] This procedure is necessary because the *asreg* command in Stata, used to estimate the Fama-Macbeth regression, does not accommodate diagnostical tests, such as the F-test and the T-test.

The cross-sectional Fama-Macbeth specification on IO_i and $ANALYST_i$ with $SINDUM_i$ is:

$$Y_i = \beta_0 + \beta_1 SINDUM_i + \beta_2 X_i + \varepsilon_i \; with \; i = 1, \dots, N$$

The cross-sectional Fama-Macbeth specification on IO_{it} and $ANALYST_i$ by industry is:

$$Y_i = \beta_0 + \beta_1 BEERDUM_i + \beta_2 SMOKEDUM_i + \beta_3 GAMEDUM_i + \beta_4 X_i + \varepsilon_i \; with \; i = 1..N$$

where Y_i is IO_i under hypothesis 1 and 2 and $ANALYST_i$ under hypotheses 3 and 4. IO_i is measured as the fraction of all shares held by institutional investors adjusted for insider ownership. $ANALYST_i$, measured as the natural logarithm of one plus the most recent amount earnings per shares (EPS) analyst estimates over the last two quarters. $SINDUM_i$ equals one in case stock i is a sin stock and zero otherwise. $BEERDUM_i$ is equal to one in case stock i belongs to the alcohol industry (4) and zero otherwise. $SMOKEDUM_i$ is equal to one in case stock i belongs to the tobacco industry (5) and zero otherwise. $GAMEDUM_i$ is equal to one in case stock i belongs to the gaming industry (49) and zero otherwise. X_i is a vector of firm/industry characteristics and includes the following variables: $ONESICDUM_i$, $GDUM_i$, $SIZE_i$, $BETA_i$, $INSIDER_i$, $MVBV_i$, $PRICE_i$, $RETURN_i$, VOL_i, $SP500_i$ and $NASD_i$. ε_i is measurement error.

Next I turn to differences between sin and non-sin stocks over time in institutional ownership under hypothesis 2 and analyst coverage under hypothesis 4. To do so the sample is divided into time periods of six years each containing twelve semi-annual observations. Repeatedly estimating the specification that best captured the variability in the dependent over the full sample. This method results in six $SINDUM_i$ estimates, one for each six-year time period. Testing for statistical differences in $SINDUM_i$ across time period by performing an F-test on the coefficients obtained by estimating an OLS regression on the cross-sectional first stage Fama-Macbeth estimates.

The statistical hypotheses on the difference between the coefficients are as follows:

$$H_0: SINDUM_t - SINDUM_{t+1} = 0$$

$$H_a: SINDUM_t - SINDUM_{t+1} \neq 0$$

Hypothesis 2 and 4 will be accepted (rejected) in case the F-test proves significant (insignificant).

4.3 Quarterly sample: return volatility

The third and last dimension explored in this thesis is volatility in daily returns. In contrast to the last model the sample used is quarterly starting the 1st of January 2000 until the 31st of December 2017. The quarterly sample will be used to test hypotheses 7A, 7B, 8A and 8B. Quarterly observations allow me to add variation to the model that would have remained unobserved in case of semi-annual observations. This variation is especially valuable with respect to dividend structures in sin stocks because the sample of sin stocks (listed after 2000) is relatively small and only few do not pay dividends, 53 out of 165 to be exact.

The dependent in the third Fama-Macbeth model is $LNVOLQ_i$ measured as natural logarithm of daily return volatility during the quarter. Analogously to the first two models, the dependent variable is first regressed on $SINDUM_i$ under hypothesis 5A or industry dummies under hypothesis 5B together with a variety of firm/industry characteristics. Del Guercia (1996) and Rubin and Smith (2009) provide me with guidance on the determinants of return volatility. To that end, the vector X_i includes the following variables: $ONESICDUM_i$, $GDUM_i$, IO_i, AGE_i, $LEVERAGE_i$, $DIVDUM_i$, $RETURNQ_i$, ROE_i, $NASD_i$, and $SP500_i$.

Hypothesis 5 is investigated over the full sample period (2000-2017). H5A hypothesizes that sin stocks are more volatility compared to non-sin stocks and will be accepted (rejected) in case the T-statistic is sufficiently high (p-value under 10%). Similarly, H5B hypothesizes that the sin industries are more volatile than non-sin stocks and will be accepted in case all three industries are more significantly more volatile. In addition an F-test is performed to check whether the industry-coefficients are different from one another.

Finally, hypothesis 6 states that institutional ownership in sin stocks is significantly and positively related to dividend paying sin stocks and negatively to non-dividend paying sin stocks. Building on the result by Rubin and Smith (2009) that the sign of institutional ownership on volatility depends on the whether the stock pays dividends. To this end the sample is split by dividend structure into dividend and non-dividend paying stocks estimating the same specification twice. A stock is characterised as a dividend paying stock in case it paid a dividend during the last 12 quarters. Testing the hypothesis by building an interaction term

between $SINDUM_i$ and IO_i to obtain two estimates (dividend and non-dividend paying stocks) on the effect of institutional ownership on volatility specific to sin stocks.

$$\mathrm{LNVOLQ}_i = \beta_0 + \beta_1 SINDUM_i + \beta_2 \mathrm{IO}_i + \beta_3 \mathrm{SINDUM}_i * \mathrm{IO}_i + \beta_4 X_i + \varepsilon_i \; with \; i = 1, \dots, N$$

Hypothesis 6 is accepted in case $\mathrm{SINDUM}_i * \mathrm{IO}_i$ is significant and positively related to volatility in dividend paying sin stocks and negatively to non-dividend paying sin stocks.

5. Results

In the section the results of the multivariate analysis are presented. Firstly, presenting the results from the analysis of the institutional ownership regressions. Secondly, discussing the findings on analyst coverage. Thirdly, the analysis of the return volatility is presented.

5.1 Institutional ownership in sin stocks

Table 4 presents the results of the institutional ownership regression. The results apply to hypotheses 1A, 1B, 2A and 2B and will be discussed in that order. In panel A, the SINDUM variable is significant at the 1%-level across all specifications. Interpreting the dummy variables, including SINDUM, is straightforward as the coefficient represents the percentage distance from the institutional ownership mean. As such, institutional ownership in sin stocks is approximately 7 percentage points lower even in the most restrictive specification (column 6). Moving from column (1) to (2), notice that replacing the ONESICDUM with the GDUM increases the standard error on SINDUM. This is in line with the expectation that the more conservative GDUM control better captures the institutional preference. These results therefore support hypothesis 1A as institutional ownership in sin stocks is significantly lower compared to non-sin stocks. Moving down to the separate sin industries BEERDUM (4), SMOKEDUM (5) and GAMEDUM (49) provide insight in the composition of SINDUM. Judging from column (6) all three dummies has a negative sign although only the alcohol and gaming industry are significant. Suggesting that institutions own on average 9% less shares in BEER stocks and 7% less shares in GAME stock compared to the average stock in sample (the mean). The insignificance on SMOKEDUM will be explored in depth in Table 5. Testing the industry coefficient against one another provides evidence that alcohol stocks (BEERDUM) significantly differ from gaming and tobacco stocks.

Table 4: Institutional ownership in sin stocks

The dependent variable is institutional ownership defined as the fraction held by institutions adjusted for insiders (IO_{it}). $SINDUM_{it}$, $BEERDUM_{it}$, $SMOKEDUM_{it}$ and $GAMEDUM_{it}$ equal one in case stock i is respectively a sin, beer, smoke and gaming stock. $ONESICDUM_{it}$ and $GDUM_{it}$ equals one in case a stock is a sin stock or has respectively the same sin one-digit SIC code or belongs to the industry groups: food (2), soda (3), fun (7) and 43 (meals). $SIZE_{it}$ is the natural logarithm of the firm's market value. $BETA_{it}$ is the firm's industry market beta. $INSIDER_{it}$ is the fraction of all shares held by insiders. VOL_{it} is the volatility of daily returns during the past two quarters. $SP500_{it}$ and $NASD_{it}$equal one in case the stock is included in respectively the S&P 500 index and NASDAQ-100 index. Panel A reports the results of the SINDUM specification. Panel B reports the results of the specification with industry dummies: BEERDUM, SMOKEDUM, and GAMEDUM (controls are repressed for brevity).

	(1)	(2)	(3)	(4)	(5)	(6)
PANEL A - SIN INDUSTRIES COMBINED						
SINDUM	-0.0771***	-0.0749***	-0.0787***	-0.0689***	-0.0672***	-0.0669***
	(0.0166)	(0.0237)	(0.0237)	(0.0213)	(0.0213)	(0.0211)
ONESICDUM	0.0308***					
	(0.00847)					
GDUM		0.0117	0.00844	0.00506	0.00369	0.00345
		(0.0119)	(0.0108)	(0.00860)	(0.00837)	(0.00837)
SIZE	0.0873***	0.0871***	0.0919***	0.0576***	0.0568***	0.0565***
	(0.00386)	(0.00380)	(0.00367)	(0.00149)	(0.00138)	(0.00127)
BETA	0.133***	0.121***	0.122***	0.123***	0.125***	0.125***
	(0.00779)	(0.00632)	(0.00564)	(0.00576)	(0.00613)	(0.00582)
INSIDER			0.278***	0.255***	0.263***	0.262***
			(0.0466)	(0.0470)	(0.0478)	(0.0480)
MVBV			-0.0222***			
			(0.00797)			
PRICE				0.0651***	0.0705***	0.0695***
				(0.00796)	(0.00839)	(0.00882)
RETURN					-0.430***	-0.410***
					(0.0532)	(0.0486)
VOL						-0.184***
						(0.0465)
NASD	-0.0436***	-0.0398***	-0.0386***	-0.0254***	-0.0252***	-0.0246***
	(0.00503)	(0.00588)	(0.00565)	(0.00496)	(0.00501)	(0.00503)
SP500	-0.0712**	-0.0717**	-0.0745**	-0.0396	-0.0433	-0.0431
	(0.0303)	(0.0306)	(0.0284)	(0.0290)	(0.0294)	(0.0293)
PANEL B - BY SIN INDUSTRY						
BEERDUM	-0.0796**	-0.0804*	-0.0795*	-0.0938*	-0.0930*	-0.0926*
	(0.0390)	(0.0457)	(0.0461)	(0.0499)	(0.0497)	(0.0494)
SMOKEDUM	-0.0107	-0.0128	-0.00744	-0.00661	-0.00502	-0.00438
	(0.0132)	(0.0192)	(0.0206)	(0.0182)	(0.0180)	(0.0179)
GAMEDUM	-0.0928***	-0.0887***	-0.0939***	-0.0713***	-0.0691***	-0.0690***
	(0.00694)	(0.0134)	(0.0139)	(0.00801)	(0.00792)	(0.00775)
T-test on mean values first stage (unequal variances), t-statistic in parentheses						
BEERDUM (6) – SMOKEDUM (6) = -0.0882 (-3.01)**			SMOKEDUM (6) – GAMEDUM (6) = 0.0646 (-0.645)			
BEERDUM (6) – GAMEDUM (6) = -0.0236 (-4.48)***						
N	138,619	138,619	138,619	138,619	138,619	138,619
R^2	0.398	0.395	0.420	0.438	0.443	0.445
T	69	69	69	69	69	69

These findings lead me to partially accept hypothesis 1A as only two of the sin industries have a significantly lower portion of shares held by institutions over the full sample. Interesting to note is that INSIDER is highly significant at the 1%-level in specifications (3) to (6), the coefficient suggests that a 1% increase in shares held by insiders results in 2.6% more shares held by institutional investors.

Now turning hypotheses 2A and 2B that address the question of institutional ownership over time. The results testing these hypotheses are presented in Table 5. The specification remains the same throughout columns (1) to (6) with each column addressing a different part of the sample. Interestingly, IO in sin stocks is not significantly lower during the first two periods and even shows a slightly positive sign over 1989 – 1994. This however does not necessarily imply that sin stocks are not less held but could simply stem from a lack of power. Thereafter sin stocks have a significantly lower portion of shares held by institutions compared to non-sin stocks with the difference increasing over time. As IO in sin stocks is on average 6.2% lower during 1995 – 2000 and increasing to 15.2% lower in 2013 – 2017. An F-test on the equality of the coefficients is significant for three out of five consecutive periods. Moreover, a comparison of the sin stock coefficients belonging to the most extreme subsamples (column 1 – column 6) is significant at the 1% level. This leads me to accept hypothesis 2A that institutional ownership of sin stocks relative to non-sin stocks is consistently lower over time with the difference increasing over time.

Closer inspection of the industry coefficients proves interesting and tells a more mixed story than would be evident from the combined sin stock coefficient. Only gaming stocks are consistently and significantly lower across all subsamples, moving from approximately -4% to -9%. Alcohol and tobacco stocks are only significant in halve of the subsamples and, surprisingly, even show a significant positive coefficient of respectively 3.25% and 3.16%. I remain agnostic about the channel causing these positive coefficients. As noted earlier, the subsample coefficients on the tobacco stocks underline the insignificance of the industry coefficient in Table 4 since there is no consistent pattern detectable across the sample. Interestingly, all industry coefficients are highly significant over the last subsample, 2013 – 2017. Taking together, the evidence does not uniformly support hypothesis 2B that institutional ownership of the three sin industries relative to non-sin stocks is consistently lower over time.

Table 5: Institutional ownership in sin stocks over time

The dependent variable is institutional ownership defined as the fraction held by institutions adjusted for insiders (IO_{it}). $SINDUM_{it}$, $BEERDUM_{it}$, $SMOKEDUM_{it}$ and $GAMEDUM_{it}$ equal one in case stock i is respectively a sin, beer, smoke and gaming stock. $ONESICDUM_{it}$ and $GDUM_{it}$ equals one in case a stock is a sin stock or has respectively the same sin one-digit SIC code or belongs to the industry groups: food (2), soda (3), fun (7) and 43 (meals). $SIZE_{it}$ is the natural logarithm of the firm's market value. $BETA_{it}$ is the firm's industry market beta. $INSIDER_{it}$ is the fraction of all shares held by insiders. VOL_{it} is the volatility of daily returns during the past two quarters. $SP500_{it}$ and $NASD_{it}$equal one in case the stock is included in respectively the S&P 500 index and NASDAQ-100 index. Table 5 reports the results of Fama and Macbeth (1973) regressions with Newey and West standard errors over six time periods using semi-annual observations. Panel A reports the results of the SINDUM specification. Panel B reports the results of the specification with industry dummies: BEERDUM, SMOKEDUM, and GAMEDUM (controls are repressed for brevity).

	(1)	(2)	(3)	(4)	(5)	(6)
SAMPLE	1983-1988	1989-1994	1995-2000	2001-2006	2007-2012	2013-2017
PANEL A - SIN INDUSTRIES COMBINED						
SINDUM	-0.0291	0.000769	-0.0615***	-0.0651***	-0.105***	-0.152***
	(0.0213)	(0.0206)	(0.00866)	(0.0123)	(0.00804)	(0.00706)
GDUM	-0.0175***	-0.0224**	0.0107***	0.00295	0.0101***	0.0415***
	(0.00443)	(0.00769)	(0.00165)	(0.00512)	(0.00283)	(0.00528)
INSIDER	0.0645	0.212***	0.228***	0.319***	0.344***	0.417***
	(0.0385)	(0.0209)	(0.0118)	(0.0143)	(0.0143)	(0.0124)
SIZE	0.0507***	0.0520***	0.0616***	0.0655***	0.0552***	0.0532***
	(0.00101)	(0.00149)	(0.00338)	(0.00367)	(0.00123)	(0.000637)
BETA	0.102***	0.133***	0.0921***	0.148***	0.139***	0.136***
	(0.00720)	(0.00610)	(0.00647)	(0.00718)	(0.00541)	(0.00651)
PRICE	0.0331***	0.0522***	0.0702***	0.0928***	0.0805***	0.0885***
	(0.00185)	(0.00591)	(0.00305)	(0.00276)	(0.00230)	(0.000769)
RETURN	-0.369***	-0.229***	-0.270***	-0.685***	-0.384	-0.539***
	(0.0371)	(0.0623)	(0.0481)	(0.135)	(0.224)	(0.0587)
VOL	-0.486***	-0.0868	-0.211*	0.234	-0.325	-0.269
	(0.0834)	(0.144)	(0.113)	(0.308)	(0.186)	(0.150)
NASD	-0.0504	-0.0169	-0.0195	-0.0413***	0.0101	-0.0331*
	(0.0399)	(0.0470)	(0.0133)	(0.00346)	(0.00872)	(0.0148)
SP500	0.0692***	0.0263**	-0.0518***	-0.103***	-0.0907***	-0.110***
	(0.00302)	(0.0109)	(0.00575)	(0.0142)	(0.00538)	(0.00502)
F-test on differences coefficients (OLS on estimates first stage)						
SINDUM (1) – SINDUM (2) = -0.030			SINDUM (3) – SINDUM (4) = 0.0036		SINDUM (5) – SINDUM (6) = 0.047**	
SINDUM (2) – SINDUM (3) = 0.062***			SINDUM (4) – SINDUM (5) = 0.0340**		SINDUM (1) – SINDUM (6) = 0.1229***	
PANEL B - BY SIN INDUSTRY						
BEERDUM	-0.0269	0.0325**	-0.0198	-0.0556***	-0.218***	-0.296***
	(0.0323)	(0.0112)	(0.0237)	(0.00651)	(0.0459)	(0.0128)
SMOKEDUM	-0.0103	0.0408	0.0354	0.0316***	-0.0375*	-0.103***
	(0.00988)	(0.0323)	(0.0211)	(0.00980)	(0.0185)	(0.0304)
GAMEDUM	-0.0393**	-0.0434**	-0.0897***	-0.0797***	-0.0737***	-0.0892***
	(0.0159)	(0.0192)	(0.0174)	(0.0168)	(0.0134)	(0.0105)
N	18,528	21,477	29,091	25,948	23,358	20,217
R^2	0.502	0.493	0.468	0.446	0.367	0.392

5.2 Analyst coverage on sin stocks

Table 4 presents the results on analyst coverage relating to hypotheses 3A, 3B, 4A and 4B. From column (1) and (2) I observe a larger coefficient on ONESICDUM compared to GDUM. The large coefficient draws down the SINDUM coefficient as it leaves less variation to be explained by SINDUM. This is confirmed by the mean estimates on SINDUM with 20.6% fewer estimates under the ONESICDUM and 23.9% fewer estimates under the GDUM approach. Since I believe the GDUM more accurately captures industry preferences, the expectation is that the negative 23.9% under column (2) is closer to the true effect of sin stocks on analyst coverage.

From column (3) onwards the specification account for insiders ownership (INSIDER). The coefficient implies that a 10% increase in INSIDER ownership results in a 1% increase in analyst estimates. Stocks included in the NASDAQ-100 and S&P 500 are also covered more frequently judging from the index coefficients.

In column (6) the average sin stock receives 23.6% fewer analyst estimates compared to the average stock in the sample measured over the period 1983 – 2017. This mean estimate is similar in magnitude to the findings by Hong and Kacperzyk (2009) and in line with hypothesis 3A. Indeed, analyst coverage on sin stocks is significantly lower compared to non-sin stocks. Next the industry-level coefficients are examined. All three-industry coefficients show negative signs and are significant at the 1%-level. Compared to the sample average, alcohol and tobacco stocks receive respectively 33.8% and 36% fewer estimates while gaming stocks receive approximately 11% fewer estimates. Moreover, a T-test on the first stage estimates from the Fama-Macbeth regression suggests that the three industries all have statistically different relationship with the dependent. Hence, Hypothesis 4B is accepted as all three sin industries receive fewer analyst estimates as compared to the non-sin stocks.

Table 6: Analyst coverage of sin stocks

The dependent variable is analyst coverage defined natural logarithm of one plus the amount of analyst estimates ($ANALYST_{it}$). $SINDUM_{it}$, $BEERDUM_{it}$, $SMOKEDUM_{it}$ and $GAMEDUM_{it}$ equal one in case stock i is respectively a sin, beer, smoke and gaming stock. $ONESICDUM_{it}$ and $GDUM_{it}$ equals one in case a stock is a sin stock or has respectively the same sin one-digit SIC code or belongs to the industry groups: food (2), soda (3), fun (7) and 43 (meals). $SIZE_{it}$ is the natural logarithm of the firm's market value. $BETA_{it}$ is the firm's industry market beta. $INSIDER_{it}$ is the fraction of all shares held by insiders. VOL_{it} is the volatility of daily returns during the past two quarters. $SP500_{it}$ and $NASD_{it}$equal one in case the stock is included in respectively the S&P 500 index and NASDAQ-100 index. Table 5 reports the results of Fama and Macbeth (1973) regressions with Newey and West standard errors over six time periods using semi-annual observations. Panel A reports the results of the SINDUM specification. Panel B reports the results of the specification with industry dummies: BEERDUM, SMOKEDUM, and GAMEDUM (controls are repressed for brevity).

	(1)	(2)	(3)	(4)	(5)	(6)
PANEL A - SIN INDUSTRIES COMBINED						
SINDUM	-0.206***	-0.239***	-0.234***	-0.237***	-0.232***	-0.236***
	(0.0218)	(0.0237)	(0.0223)	(0.0228)	(0.0223)	(0.0220)
ONESICDUM	0.124***					
	(0.0155)					
GDUM		0.0933***	0.0860***	0.0902***	0.0871***	0.0934***
		(0.0101)	(0.00657)	(0.00974)	(0.00988)	(0.0109)
SIZE	0.209***	0.209***	0.206***	0.210***	0.207***	0.207***
	(0.00953)	(0.00975)	(0.0125)	(0.0143)	(0.0143)	(0.0137)
BETA	0.310***	0.269***	0.271***	0.268***	0.271***	0.261***
	(0.0403)	(0.0358)	(0.0358)	(0.0367)	(0.0373)	(0.0367)
INSIDER			0.0914***	0.106**	0.127***	0.118***
			(0.0291)	(0.0402)	(0.0402)	(0.0384)
MVBV			0.0220			
			(0.0220)			
PRICE				5.50e-05	0.0180*	0.0384***
				(0.0105)	(0.0103)	(0.0114)
RETURN					-1.315***	-1.436***
					(0.0555)	(0.0684)
VOL						1.816***
						(0.386)
NASD	0.125*	0.132*	0.127*	0.126	0.128*	0.114
	(0.0659)	(0.0743)	(0.0704)	(0.0778)	(0.0767)	(0.0756)
SP500	0.0815***	0.0776***	0.0784***	0.0746***	0.0655***	0.0672***
	(0.0188)	(0.0187)	(0.0217)	(0.0224)	(0.0226)	(0.0233)
PANEL B - BY SIN INDUSTRY						
BEERDUM	-0.296***	-0.332***	-0.327***	-0.332***	-0.331***	-0.338***
	(0.0263)	(0.0274)	(0.0268)	(0.0279)	(0.0272)	(0.0269)
SMOKEDUM	-0.325***	-0.363***	-0.371***	-0.361***	-0.358***	-0.360***
	(0.0846)	(0.0882)	(0.0908)	(0.0881)	(0.0883)	(0.0885)
GAMEDUM	-0.0981***	-0.123***	-0.113***	-0.118***	-0.111***	-0.113***
	(0.0242)	(0.0268)	(0.0262)	(0.0266)	(0.0263)	(0.0263)
T-test on mean values first stage (unequal variances), t-statistic in parentheses						
BEERDUM (6) – SMOKEDUM (6) = 0.022 (9.24)***				SMOKEDUM (6) – GAMEDUM (6) = -0.247 (2.01)**		
BEERDUM (6) – GAMEDUM (6) = -0.225 (8.12)***						
N	138,619	138,619	138,619	138,619	138,619	138,619
R^2	0.308	0.302	0.307	0.305	0.310	0.312

Investigating the variation in analyst coverage over time can prove useful in understanding the insignificance on GAMEDUM. Evaluating the coefficient on the combined sin industries provides clear evidence that the effect varies substantially over time. Sin stocks receive fewer estimates than the average stock in sample irrespective of the time period though the trend is not consistently downward sloping. With the difference in analyst coverage shrinking during 1983 – 2000 and expanding during 2013 – 2018, moving from -36.2% (column 1) to -10.6% (column 3) back down to -34.4% (column 6). Given this trend it is unsurprising that an F-test on the equality of the coefficients (column 1 – column 6) cannot be rejected. Hypothesis 4A can therefore not be accepted as sin stocks do not increasingly receive fewer analyst estimates over time relative to non-sin stocks.

Perhaps that an evaluation of the separate industries helps me understand the driving force behind the observed pattern. The first thing to notice is that all significant industry coefficients are negative, confirming the fact that sin industries receive fewer analyst estimates regardless of the time period. A closer inspection of the alcohol stock coefficients, moving from column (1) to (6), reveals a trend similar to the observed trend in the sin coefficients. Given that alcohol stocks represent the largest share of the sin cohort, I believe that they individually explain the inconsistent pattern in the combined sin stock coefficient. Similarly, gaming stocks do not have a consistent downward trajectory in the amount of analyst estimates over time as compared to the average firm in the sample. In contrast, tobacco stocks show a consistent downward trajectory in the amount of analyst estimates over time. Moving from approximately -13% fewer estimates the average stock in column (1) to approximately -58% in column (6). Hypothesis 4B is partially accepted since only tobacco stocks receive increasingly less analyst estimates relative to non-sin stocks over time. Even though all sin industries receive fewer analyst estimates than the sample average.

Table 7: Analyst coverage of sin stocks over time

The dependent variable is analyst coverage defined natural logarithm of one plus the amount of analyst estimates ($ANALYST_{it}$). $SINDUM_{it}$, $BEERDUM_{it}$, $SMOKEDUM_{it}$ and $GAMEDUM_{it}$ equal one in case stock i is respectively a sin, beer, smoke and gaming stock. $ONESICDUM_{it}$ and $GDUM_{it}$ equals one in case a stock is a sin stock or has respectively the same sin one-digit SIC code or belongs to the industry groups: food (2), soda (3), fun (7) and 43 (meals). $SIZE_{it}$ is the natural logarithm of the firm's market value. $BETA_{it}$ is the firm's industry market beta. $INSIDER_{it}$ is the fraction of all shares held by insiders. VOL_{it} is the volatility of daily returns during the past two quarters. $SP500_{it}$ and $NASD_{it}$equal one in case the stock is included in respectively the S&P 500 index and NASDAQ-100 index. Table 7 reports the results of Fama and Macbeth (1973) regressions with Newey and West standard errors over six time periods using semi-annual observations. Panel A reports the results of the SINDUM specification. Panel B reports the results of the specification with industry dummies: BEERDUM, SMOKEDUM, and GAMEDUM (controls are repressed for brevity).

	(1)	(2)	(3)	(4)	(5)	(6)
SAMPLE	1983-1988	1989-1994	1995-2000	2001-2006	2007-2012	2013-2018
SINDUM	-0.362***	-0.224***	-0.106***	-0.158***	-0.250***	-0.344***
	(0.0598)	(0.00862)	(0.0138)	(0.0286)	(0.0466)	(0.0324)
GDUM	0.0387*	0.0838***	0.105***	0.112***	0.106***	0.114***
	(0.0193)	(0.0193)	(0.00536)	(0.0114)	(0.00530)	(0.0156)
SIZE	0.245***	0.233***	0.209***	0.231***	0.160***	0.162***
	(0.0319)	(0.00675)	(0.0121)	(0.0129)	(0.00684)	(0.00741)
BETA	0.125***	0.194***	0.238***	0.352***	0.280***	0.387***
	(0.0308)	(0.00423)	(0.00982)	(0.0132)	(0.00833)	(0.0124)
INSIDER	-0.00860	0.0567*	0.0370*	0.189***	0.178***	0.268***
	(0.0160)	(0.0275)	(0.0178)	(0.0518)	(0.0112)	(0.0188)
PRICE	-0.00915	0.00516	0.0652***	0.0501**	0.0590***	0.0595***
	(0.00578)	(0.00909)	(0.00828)	(0.0209)	(0.0117)	(0.0134)
RETURN	-1.652***	-0.959***	-1.308***	-1.922***	-1.278**	-1.529***
	(0.131)	(0.218)	(0.0897)	(0.251)	(0.417)	(0.158)
VOL	-0.0244	1.081***	2.058***	3.710***	1.311*	2.765***
	(0.173)	(0.294)	(0.278)	(0.876)	(0.643)	(0.413)
NASD	-0.154**	-0.200**	0.269***	0.268***	0.319***	0.166***
	(0.0651)	(0.0852)	(0.0213)	(0.0296)	(0.0221)	(0.0114)
SP500	-0.00511	0.0976*	-0.0205	0.0168	0.144***	0.184***
	(0.0217)	(0.0498)	(0.0120)	(0.0493)	(0.00835)	(0.0171)
F-test on differences coefficients (OLS on estimates first stage)						
SINDUM (1) – SINDUM (2) = -0.138***		SINDUM (3) – SINDUM (4) = 0.052			SINDUM (5) – SINDUM (6) = 0.094*	
SINDUM (2) – SINDUM (3) = -0.118**		SINDUM (4) – SINDUM (5) = 0.092*			SINDUM (1) – SINDUM (6) = -0.018	
BY SIN INDUSTRY						
BEERDUM	-0.508***	-0.262***	-0.138***	-0.299***	-0.472***	-0.370***
	(0.0598)	(0.0315)	(0.0123)	(0.0124)	(0.0683)	(0.0527)
SMOKEDUM	-0.131***	-0.152**	-0.228***	-0.508***	-0.589***	-0.571***
	(0.0346)	(0.0546)	(0.0337)	(0.0628)	(0.00987)	(0.0442)
GAMEDUM	-0.199**	-0.189***	-0.0404*	0.0422	-0.0521	-0.272**
	(0.0875)	(0.00859)	(0.0217)	(0.0314)	(0.0449)	(0.0901)
N	18,528	21,477	29,091	25,948	23,358	20,217
R^2	0.373	0.371	0.325	0.323	0.236	0.245

5.3 Volatility in sin stocks

The remainder of the results section is dedicated to the institutional ownership relationship and constructed by analysing a quarterly data set covering the 1st of January 2000 until December 31 2017. The total sample consist of 75.497 non-dividend paying stocks and 121.529 dividend paying stocks. Table 8 provides the reader with additional summary statistics on the determinants of volatility split by the dividend structure. Doing so because previous work (Rubin and Smith, 2009) has indicated that dividends matter for the observed volatility through trading patterns not found in non-dividend paying stocks. Panel A provides an overview of the whole sample while panel B focuses on the sin stocks alone. The panels consist of two parts. The first section highlights the differences across the various determinants of volatility between dividend and non-dividend stocks. In the second section the sample is divided into quartiles (of similar size) based on the institutional ownership level to get a better feel of the average volatility associated with different ownership percentages. This is the relationship of interest which is further explored with a regression analysis presented in Table 6. From Panel A.1 and B.1 I observe that, as expected, non-dividend paying and dividend paying stocks differ in number of stock characteristics according to the t-statistic on the difference in sample means. Volatility, measured as the natural logarithm of daily returns in the quarter, is higher in non-dividend paying stocks both over the whole sample and the sin stock subsample. Rubin and Smith (2009) argued that institutions hold a preference for dividend paying stocks through their fiduciary duty towards investors. A direct comparison of mean statistics would provide an indication that this might well be true. Indeed, institutional investors have (on average) a higher proportional stake in dividend paying stocks. This difference in holdings is equal to 4,25% over the whole sample and 10.7% in the sin stock subsample. Other differences include firm size, age (first included in CRSP), and leverage. Breaking the sample down by institutional ownership under Panel A.2 and B.2 provides further insight. I notice that higher ownership by institutions (quartile 4) is associated with lower levels of volatility compared to lower levels of institutional ownership (quartile 1). Institutional ownership and volatility seem to move in opposite directions and the trend seems to be present in both dividend and non-dividend paying stocks.

Table 8: Volatility according to dividend structures

Panel A - WHOLE SAMPLE - Quarterly 2000 - 2017

A.1	Non-dividend paying N = 75,490 Firm clusters = 3865		Dividend paying N = 121,526 Firm clusters = 2881		T test mean diff clustered(firm)
	Mean	St. dev	Mean	St. dev	(Non-dividend - dividend)
Ln (Volatility)	1.292	.594	0.944	.602	27.24***
Institutions (%)	46.19	35.84	50.44	37.05	-4.45***
Insiders (%)	7.67	.203	5.40	.174	7.43***
Ln (Size)	5.233	1.857	6.547	2.206	-21.91**
Age	15.302	12.771	27.709	18.425	-24.41***
Leverage	.426	1.236	.409	.970	0.67

A.2		Non-dividend paying				Dividend paying				
Quartile	Mean (%) institutions	Mean ln(volatility)	St. dev.	N	Firms	Mean ln(volatility)	St. dev.	N	Firms	T test mean diff
Lowest	13.19	1.588	.623	18,144	1837	1.285	.641	31,113	1483	12.93***
2	30.37	1.351	.563	23,980	2635	.954	.596	25,576	1854	22.37***
3	68.93	1.142	.522	16,091	1833	.782	.540	33,166	1912	20.61***
Highest	94.64	1.000	.481	17,282	1661	.771	.471	31,974	1712	15.45***

PANEL B – SIN STOCKS – Quarterly 2000 – 2017

B.1	Non-dividend paying N = 1,299 Firm clusters = 38		Dividend paying N = 2,086 Firm clusters = 43		T test mean diff clustered(firm)
	Mean	St. dev.	Mean	St. dev	(Non-dividend - dividend)
Ln (Volatility)	1.145	.552	.877	.610	2.55**
Institutions (%)	38.36	32.16	50.71	34.53	-1.69*
Insiders (%)	9.20	.220	9.30	.226	-0.06
Ln (Size)	4.731	1.660	6.909	2.457	-4.00***
Age	24.015	18.182	30.052	20.959	-1.14
Leverage	1.088	2.034	.626	1.217	1.41

B.2		Non-dividend paying				Dividend paying				
Quartile	Mean (%) institutions	Mean ln(volatility)	St. dev.	N	Firms	Mean ln(volatility)	St. dev.	N	Firms	T test mean diff
Lowest	1.93	1.354	.607	381	25	1.358	.568	443	21	-0.03
2	32.19	1.227	.506	471	29	.878	.502	548	28	3.00***
3	67.80	.944	.424	281	18	.615	.573	655	31	2.35**
Highest	95.31	.775	.430	166	18	.780	.545	440	29	-0.03

This result is observed in the total sample and sin stocks subsample. Also notice the distribution of the institutional ownership observations across the dividend structures. The largest group of observations in non-dividend stocks in both samples is quartile 2 with respectively 23.980 observations (30.37% IO) in the whole sample and 471 observations (32.19% IO) in the sin stock subsample. In the sin stock subsample quartile 2 (32.19% IO) is three times as large as the quartile 4 (95.31% IO) with volatility measures equal to respectively 1.249 and 0.655. In contrast, the largest dividend paying group is quartile 3 in both subsamples with a mean volatility measure of 0.782 (68.93% IO) for the whole sample and 0.615 (67.80% IO) for sin stocks alone. Similarly, the lower quartiles, lower institutional ownership levels, of the whole sample are associated with higher levels of volatility irrespective of the dividend structure. If we assume that the institutions have little information on the volatility present in a stock when buying, a necessary but unlikely assumption, a mean comparison suggests that higher institutional ownership results in lower levels of volatility.

Obviously, a naïve comparison of means can be misleading since is does not tell me anything about the explanatory power of institutional ownership on volatility. I therefore proceed with a multivariate regression analysis in order to properly test hypotheses 5 and 6. The results are presented in Table 9 and 10. In Table 9 the volatility dependent is regressed on a set of independent variables that have been identified to be individually important (Rubin and Smith, 2009; Wei and Zhang, 2006). The results in Table 9 will guide me in answering hypothesis 5 that volatility in sin stocks (5A), and the three sin industries (5B), is significantly higher compared to non-sin stocks. This makes intuitive sense given that institutional ownership in sin stocks is lower (see Table 4) and the result that sin stocks receive less analyst estimates (see Table 6). Volatility is measured as the natural logarithm of daily return volatility during the quarter. In case the dependent is measured a logarithm, the coefficients can be interpreted as the percentile difference with the sample mean. The negative sign on sin stocks in column (1) is driven by the unprecise one-digit control dummy and will be disregarded. The remaining sin stock coefficients vary between 0.101 (column 2) and 0.0807 (column 5). Implying that sin stocks are on average around 9% more volatility compared to the sample mean. Moreover, the control variables seem do well in capturing the variation in volatility with an R square of 30 percent in column (5).

Table 9: Volatility in sin stocks

The dependent variable is volatility defined natural logarithm of daily return volatility during the quarter ($LNVOLQ_{it}$). $SINDUM_{it}$, $BEERDUM_{it}$, $SMOKEDUM_{it}$ and $GAMEDUM_{it}$ equal one in case stock i is respectively a sin, beer, smoke and gaming stock. $ONESICDUM_{it}$ and $GDUM_{it}$ equals one in case a stock is a sin stock or has respectively the same sin one-digit SIC code or belongs to the industry groups: food (2), soda (3), fun (7) and 43 (meals). IO_{it} is the fraction of all shares held by institutional investors adjusted for insider ownership. AGE_{it} is the natural logarithm of the years since the firm appears in CRSP.$LEVERAGE_{it}$ is the ratio of long-term debt over market value. $DIVDUM_{it}$ equals one in case the stock paid a dividend during the current quarter and zero otherwise. $RETURNQ_{it}$ is the return in the current quarter. ROE_{it} is return on equity measured as net income divided by the book value. $SP500_{it}$ and $NASD_{it}$equal one in case the stock is included in respectively the S&P 500 index and NASDAQ-100 index.

PANEL A	(1)	(2)	(3)	(4)	(5)
SINDUM	-0.0690***	0.101***	0.0871***	0.0804***	0.0807***
	(0.0250)	(0.0138)	(0.0139)	(0.0143)	(0.0142)
ONESICDUM	0.0317***				
	(0.00787)				
GDUM		-0.163***	-0.159***	-0.152***	-0.152***
		(0.0203)	(0.0223)	(0.0198)	(0.0197)
IO	-0.365***	-0.364***	-0.343***	-0.336***	-0.335***
	(0.0130)	(0.0124)	(0.0115)	(0.0127)	(0.0127)
AGE	-0.179***	-0.178***	-0.156***	-0.152***	-0.151***
	(0.0222)	(0.0230)	(0.0212)	(0.0199)	(0.0199)
LEVERAGE	0.0222***	0.0228***	0.0241***	0.0254***	0.0254***
	(0.00365)	(0.00324)	(0.00348)	(0.00321)	(0.00323)
DIVDUM			-0.2539***	-0.152***	-0.152***
			(0.0086)	(0.0198)	(0.0197)
RETURNQ				0.111***	0.111***
				(0.00578)	(0.00579)
ROE					-0.00574***
					(0.000797)
NASD	-0.164**	-0.163**	-0.163***	-0.160***	-0.160***
	(0.0659)	(0.0634)	(0.0557)	(0.0551)	(0.0551)
SP500	-0.335***	-0.335***	-0.311***	-0.305***	-0.304***
	(0.0359)	(0.0363)	(0.0375)	(0.0388)	(0.0388)
PANEL B - BY SIN INDUSTRY					
BEERDUM	0.126***	0.289***	0.393***	0.382***	0.385***
	(0.0265)	(0.0291)	(0.0319)	(0.0277)	(0.0281)
SMOKEDUM	-0.323***	-0.319***	-0.422***	-0.408***	-0.408***
	(0.0378)	(0.0346)	(0.0314)	(0.0325)	(0.0325)
GAMEDUM	0.078	0.167***	0.140***	0.130***	0.130***
	(0.0277)	(0.0173)	(0.0193)	(0.0197)	(0.0196)
T-test on mean values first stage (unequal variances), t-statistic in parentheses					
BEERDUM (6) – SMOKEDUM (6) = 0.793*** (15.35)			SMOKEDUM (6) – GAMEDUM (6) = -0.538*** (-16.60)		
BEERDUM (6) – GAMEDUM (6) = 0.255*** (3.72)					
N	197,016	197,016	197,016	197,016	197,016
R^2	0.241	0.245	0.245	0.274	0.306

For instance, adding quarterly return to the specification reduces the estimate on sin stocks by little over half a percentage point. I take these results as a confirmation of hypothesis 5A that sin stocks are indeed more volatile than other stocks. The industry coefficients tell a more mixed story on volatility. Alcohol stocks and gaming stocks are more volatile compared to non-sin stocks with respectively 38.5% and 13%. Returns of tobacco stocks on the other hand are 40.8% less volatility than the average stock in the sample. Hypothesis 5B can therefore only partially be accepted since only two sin industries are more volatile.

In Table 10 the sample is divided into dividend and non-dividend paying stocks in order to answer hypothesis 6. Hypothesis 6 states institutional ownership in sin stocks is significantly and positively related to dividend paying sin stocks and negatively to non-dividend paying sin stocks. A stock is characterised as a dividend paying stock in case it paid a dividend over the past twelve quarters (three years). The percentage held by institutions, adjusted for insider ownership (see Methodology), is now added to the specification since I believe that the endogeneity concerns relating to the dividend variable are less severe here. Provided that dividends are not independently broad in to explain volatility but used to split the sample into two groups. Additionally, insider ownership is not used as an independent since the results in Table 4 indicate that it explains institutional ownership (see 'Endogeneity'). The interaction term between the sin stock dummy and the institutional ownership separates the effect of institutional ownership on volatility specific to sin stocks. This way the institutional ownership variable is the effect specific non-sin stocks. Allowing me to determine whether sin stocks are unique in terms of the institutional ownership-volatility relationship and directly compare the magnitude of sin and non-sin stock effects within the same dividend structure. In column (2) and (5), the institutional ownership coefficient suggests that a 10% increase in ownership results in a 3.35% and a 4.06% reduction in respectively dividend and non-dividend stocks. If the coefficients are valid, the volatility reduction following from an increase in institutional ownership is in line with the institutional sophistication hypothesis as described by Rubin and Smith (2009). Hereby institutions improve upon the information content of market prices due to their sophistication.

Table 10: Volatility in sin stocks by dividend structure

The dependent variable is volatility defined natural logarithm of daily return volatility during the quarter ($LNVOLQ_{it}$). $SINDUM_{it}$ equals one in case stock i is a sin stock. $GDUM_{it}$ equals one in case a stock is a sin stock or belongs to the industry groups: food (2), soda (3), fun (7) and 43 (meals). IO_{it} is the fraction of all shares held by institutional investors adjusted for insider ownership). AGE_{it} is the natural logarithm of the years since the firm appears in CRSP.$LEVERAGE_{it}$ is the ratio of long-term debt over market value. $RETURNQ_{it}$ is the return in the current quarter. ROE_{it} is return on equity measured as net income divided by the book value. $SP500_{it}$ and $NASD_{it}$equal one in case the stock is included in respectively the S&P 500 index and NASDAQ-100 index.

	Dividend paying stocks			Non dividend paying stocks		
	(1)	(2)	(3)	(4)	(5)	(6)
SIN INDUSTRIES COMBINED						
SINDUM	0.132***	0.114***	0.209***	0.0329	0.0144	0.00960
	(0.00935)	(0.0146)	(0.0217)	(0.0245)	(0.0185)	(0.0330)
GDUM	-0.173***	-0.158***	-0.185***	-0.120***	-0.141***	-0.0872
	(0.0151)	(0.0178)	(0.0141)	(0.0252)	(0.0301)	(0.0529)
IO		-0.335***	-0.335***		-0.406***	-0.399***
		(0.0272)	(0.0282)		(0.00564)	(0.00678)
SINDUM*IO			-0.171***			-0.0365
			(0.0348)			(0.0534)
GDUM*IO			0.0395*			-0.105***
			(0.0226)			(0.0370)
AGE	-0.173***	-0.149***	-0.148***	-0.119***	-0.113***	-0.113***
	(0.0346)	(0.0370)	(0.0372)	(0.00889)	(0.0103)	(0.0103)
LEVERAGE	0.0293***	0.0243**	0.0244**	0.0208***	0.0224***	0.0225***
	(0.0105)	(0.00986)	(0.00985)	(0.00353)	(0.00319)	(0.00321)
RETURNQ	0.114***	0.122***	0.122***	0.108***	0.111***	0.111***
	(0.00858)	(0.00781)	(0.00781)	(0.00506)	(0.00486)	(0.00483)
ROE	-0.0173***	-0.0143***	-0.0143***	-0.0135***	-0.0113***	-0.0112***
	(0.00132)	(0.00135)	(0.00134)	(0.00265)	(0.00202)	(0.00204)
NASD	-0.150**	-0.0982	-0.0985	-0.354***	-0.311***	-0.311***
	(0.0671)	(0.0658)	(0.0659)	(0.0451)	(0.0429)	(0.0430)
SP500	-0.325***	-0.274***	-0.274***	-0.612***	-0.538***	-0.538***
	(0.0461)	(0.0458)	(0.0457)	(0.0101)	(0.0163)	(0.0158)
N	121,526	121,526	121,526	75,490	75,490	75,490
R^2	0.219	0.270	0.271	0.145	0.223	0.224
T	72	72	72	72	72	72

Moreover, dividends reduce the uncertainty around future cashflows resulting in a stronger information environment. This reasoning is supported by the magnitude of the coefficients as institutions have a larger impact non-dividend paying stocks which presumably have a weaker information environment effectively leaving more room for improvement. The sin stock interaction terms both have negative signs providing little support for hypothesis 6 that the sign of institutional ownership on volatility depends on the dividend structure. Also, only the sin stock interaction term in dividend paying stocks is significant with the coefficient suggesting that a 10% increase in ownership leads to a 1.71% reduction in sin stock volatility. That is half the size of the sample coefficient on institutional ownership. One potential explanation for the smaller size of the coefficient could be the higher financial reporting standard as applied by most sin firms (Kim and Venkatachalam, 2011). I would argue that a higher financial reporting standard improves upon the information content of market prices reducing the volatility of returns.

Another interesting property of Table 10 is that the coefficient on sin stocks (SINDUM) is now split between dividend and non-dividend paying stocks. The result in Table 9 suggests that sin stocks are on average 8% more volatility than the sample average. Judging from the separate coefficient in column (3) and (6), dividend paying stocks are 20% more volatile and non-dividend paying stocks behave like other non-sin stocks in terms of volatility. Although the non-dividend paying sin stock coefficient is not significant possibly due to few non-dividend paying stocks in the sample. Determining the driver of this result requires additional research. One potential partial explanation could be found in the work by Colonnello et al. (2019) that the substitutability between dividends and ethicalness is crucial for returns and volatility spreads.

6. Robustness

The aim of this section is to validate that the results are not dependent on the estimation technique chosen, the screening procedures nor suffer from endogeneity.

6.1 Alternative screening procedures and techniques

In this section alternative estimation techniques and variable constructions are explored to confirm the robustness of the main results. The robustness checks are shown in Table 11. The sin stock dummy coefficient, industry coefficients, and GDUM control coefficients are presented omitting the remaining control variables for brevity.

The three estimation procedures estimated and presented in Table 11 are (1) Fama and Macbeth regression with Newey-West standard errors (2) OLS with year fixed effects and clustered at the firm (3) OLS with year fixed effects, clustered at the industry-level.

The main results in this thesis are estimated using the cross-sectional Fama-Macbeth regression with Newey-west standard errors (Newey and West, 1987) modified for the use in a panel data set. As mentioned (see methodology), the Fama-Macbeth regression accounts for the time effect, e.g. dependence across time, by estimating and averaging the cross-sectional coefficients. Adjusting the standard errors with the Newey-west procedure to account for the firm effect, e.g. dependence across time within the same firm.

Another way of dealing with the time and firm effect is to apply OLS with time dummies while clustering at the firm-level (Rogers standard errors). The set of time dummies, which are effectively included in the Fama-Macbeth estimates, deal with the time effect. Rogers standard errors deal with the firm dependence across time (firm effect). Simulations by Peterson (2009) demonstrate that the Newey-West approach, as applied to panel data, does not yield the same estimates as the Rogers (clustered) standard errors. The differences between the two estimates is due to the weighting function used by Newey-West. In contrast to Newey-West approach, Rogers standard errors rely on the number of clusters being large (firm N) opposed to the number of time periods (T) (Peterson, 2009). He finds that even with the maximum lag length, Newey-West estimates still have a small bias. To address this concern, I re-estimate the results by OLS with time dummies and Rogers (clustered) standard errors. Unsurprisingly, the coefficients are similar in size across the three models. My main interest lies in the way the standard errors are calculated. A close inspection of Column (4) to

(6) confirm this prediction since the standard errors are higher overall. While most significance levels remain unchanged, the sin stock coefficients are knocked down one significance level. Overall the conclusions remain the same.

Clustering the standard errors at the firm-level is equal to only using the between-firm variation thereby assuming that firms within the same industry have are uncorrelated errors. I effectively take a stand on how the residuals are correlated. For this reason, Hong and Kacperzyk (2009) cluster the standard errors at the industry-level, e.g. between-industry variation. The aim of clustering at the industry-level is to account for the possibility that institutional investors decide to invest in multiple firms within the same industry for reasons such as diversification or expectations about the industry rather than the firm. Similarly, the number of estimates provided by analysts could depend on the industry the firm is active in rather than the characteristics of specific firm. Given that there are fewer industries than firms in the dataset(s), the standard errors will be higher resulting from less independent variation. Variation across firms within the same industry is now assumed to be less valuable. To this end, I validate the results by estimating an OLS regression with industry-clustered standard errors. Again, the coefficients are similar to the Fama and Macbeth approach. Indeed, this approach is more conservative resulting in higher standard errors. Columns (4) to (6) show that the significance levels are reduced with the sin stock dummy remaining significant. I take these findings as a confirmation that the results are robust to an alternative clustering procedure.

The third robustness check adds the defence stocks to the sin stock group (and GDUM) to determine the consequence of this decision and determine whether my choice was justified. The sin stock definition evolves over time (see 'Background profile triumvirate of sin') and so the classification should evolve with it. Judging from column (1), adding the defence industry to the sin cohort has a substantial effect. The sin stock dummy is only significant at the 10%-level and becomes substantially smaller at -0.0368. The separate defence industry coefficient provides intuition on the mechanism since institutional ownership in defence stocks is positive at 4.88% and highly significant at the 1%-level. This implies that defence stocks have higher institutional ownership than comparable stocks. Interestingly, the opposite is true for analyst coverage. Defence stocks receive approximately 27% less estimates compared to the mean, comparable to the negative signs on alcohol and tobacco stocks with respectively -34%

and -36%. Column (3) shows the results on volatility in returns. The coefficient on sin stocks is slightly larger in size but remains highly significant. The defence stock coefficient reveals that the industry does not significantly differ from other stocks in term of volatility. Taking these findings together makes for mixed evidence and a somewhat puzzling result. Since defence stocks have a higher proportion of shares held by institutional investors while receiving fewer analyst estimates. This could potentially be an interesting direction for future research.

The fourth robustness explores what the effect would have been in case insider is not included and (consequently) institutional ownership is not adjusted. Other research on sin stocks does not include a measure for the ownership by insiders and therefore does not adjust the institutional ownership measure (see for example Hong and Kacperczyk, 2009). The sample consist of 79.827 non-zero insider measures (quarterly sample) and could potentially have a substantial impact on the result. Regressing the explanatory variables, not including the variable INSIDER, on the un-adjusted institutional ownership measure results the coefficient -0.0717 on the sin stocks. This result is quantitatively similar to the -0.0669 in the original specification. Additionally, removing the INSIDER control in the analyst coverage model and volatility model does not lead to quantitatively different results. Overall the insider control and correction does not seem to drive the obtained result.

Table 11: Robustness checks

	Fama & Macbeth with Newey-West St. errors			**OLS year FE, firm clustered (Rogers St. errors)**			**OLS year FE, industry clustered (Rogers St. errors)**		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	IO	ANALYST	VOLATILITY	IO	ANALYST	VOLATILITY	IO	ANALYST	VOLATILITY
SINDUM	**-0.0669*** **	**-0.2348*** **	**0.0807*** **	-0.0755***	-0.2222***	0.0818**	-0.0755**	-0.2222**	0.0818*
(Original)	**(0.0211)**	**(0.0220)**	**(0.0142)**	(0.0273)	(0.0652)	(0.0372)	(0.0351)	(0.1016)	(0.0416)
BEERDUM	**-0.0926***	**-0.3386*** **	**0.385*** **	-0.0956*	-0.3182***	0.3891***	-0.0956***	-0.3182***	0.3891***
(Original)	**(0.0494)**	**(0.0269)**	**(0.0281)**	(0.0546)	(0.1130)	(0.1374)	(0.0327)	(0.0672)	(0.0379)
SMOKEDUM	**-0.0044**	**-0.3609*** **	**-0.408*** **	0.0072	-0.3884***	-0.4139***	0.0072	-0.3884***	-0.4139***
(Original)	**(0.0179)**	**(0.0883)**	**(0.0325)**	(0.0573)	(0.1194)	(0.0171)	(0.0287)	(0.0545)	(0.0480)
GAMEDUM	**-0.0690*** **	**-0.1107*** **	**0.130*** **	-0.0777***	-0.0915	0.1360***	-0.0777**	-0.0915	0.1360***
(Original)	**(0.0078)**	**(0.0266)**	**(0.0196)**	(0.0292)	(0.0756)	(0.0405)	(0.0333)	(0.0582)	(0.0111)
GDUM	**0.0035**	**0.0949*** **	**-0.152*** **	0.0073	0.0973***	-0.1688***	0.0073	0.0973	-0.1688***
(Original)	**(0.0084)**	**(0.0112)**	**(0.0197)**	(0.0136)	(0.0324)	(0.0176)	(0.0359)	(0.0683)	(0.0318)
SINDUM	-0.0368*	-0.2434***	0.0827***	-0.0425*	-0.2329***	0.0937***	-0.0425	-0.2329***	0.0937***
(Incl. DEFDUM)	(0.0203)	(0.0131)	(0.0168)	(0.0236)	(0.0555)	(0.0343)	(0.0447)	(0.0845)	(0.0284)
DEFDUM	0.0488***	-0.2728***	0.0867***	0.0436	-0.2598***	0.1030**	0.0436	-0.2598***	0.1030***
	(0.0035)	(0.0234)	(0.0276)	(0.0300)	(0.0771)	(0.0424)	(0.0317)	(0.0547)	(0.0215)
GDUM	0.0040	0.0918***	-0.1469***	0.0078	0.0947***	-0.1650***	0.0078	0.0947	-0.1650***
(Incl. DEFDUM)	(0.0083)	(0.0119)	(0.0216)	(0.0136)	(0.0324)	(0.0171)	(0.0360)	(0.0692)	(0.0322)
SINDUM	-0.0717***	-0.2348***	0.0505***	-0.0812***	-0.2205***	0.0779**	-0.0812***	-0.2205**	0.0779**
(Excl. INSIDER)	(0.0231)	(0.0220)	(0.0112)	(0.0269)	(0.0654)	(0.0358)	(0.3477)	(0.1030)	(0.0375)
GDUM	0.0029	0.0949***	-0.1474***	0.0069	0.0987***	-0.1607***	0.0069	0.0987	-0.1607***
(Excl. INSIDER)	(0.0084)	(0.0112)	(0.0229)	(0.0132)	(0.0324)	(0.0185)	(0.0351)	(0.0684)	(0.307)

6.2 Endogeneity

In this section I address the endogeneity concerns relating to institutional holdings. In short, endogeneity refers the situation in which the explanatory variable value is determined within the model by other predetermined, exogenous, variables. From Table 4, we know that Institutional ownership can be, at least partially, explained by a variety of stock characteristics, e.g. size and insider holdings. Given weight to the suspicion that institutional ownership is endogenously related to volatility. Endogeneity results in biased estimates through their correlation with the error term. Violating the exogeneity assumption of the Gauss-Markov theorem. In light of potential endogeneity, it is common practice to apply an Instrument Variable (IV) approach. Although finding strong instruments that satisfy the IV assumptions is often a difficult task. Fortunately, Rubin and Smith (2009) provide me with two potential instruments for institutional ownership, i.e. price spread and trade volume. Arguing that lower-order[23] liquidity related measures could potentially work as instruments, since institutional investors are drawn to liquid stocks (Gompers and Metric, 2001).

To this end, I consult the CRSP daily stock files on shares traded, closing prices, bid- and ask-prices. Following Barclay and Hendershott (2004) the spread is defined as the absolute difference between the daily closing price and the quote midpoint, the average of the ask- and bid-price, divided by the midpoint quote. Trading volume is measured as the ratio of daily shares traded over total shares outstanding. Averaging both variables over the quarter to obtain two quarterly instruments for institutional ownership.

IV – estimation

With the two instruments in hand, I proceed by estimating the two-stage least squares regression.[24] In the first stage, the instruments together with all exogenous control variables are regressed on institutional ownership.

$IO_{it} = c_1 + \beta_1 spread_{it} + \beta_2 volume_{it} + \beta_3 X_{it} + \epsilon_{1it}$ (First stage)

Where $spread_{it}$ and $volume_{it}$ are the instruments, X_{it} are the exogenous controls.

The fitted $\widehat{IO}_{it}$ value is obtained by estimating:

$\widehat{IO}_{it} = \hat{c}_1 + \widehat{\beta_1} spread_{it} + \widehat{\beta_2} volume_{it} + \widehat{\beta_3} X_{it}$ (Fitted values first stage)

[23] Unfortunately, I do not have access to CRSP intra-day stock data. Subsequently, I use the next best thing by retrieving daily stock data. Judging from the coefficient, the results remain quantitively similar.

[24] Applying the –xtivreg- Stata command: TSLS IV estimation with panel data.

Where $\widehat{IO}_{it}$, $\widehat{c_1}$, $\widehat{\beta_1}$, $\widehat{\beta_2}$ are the fitted values obtained from the first stage.

Next, the reduced form equation is estimated using the exogenous fitted OLS value. Regressing the fitted values and the original exogenous control variables on the natural logarithm of the quarterly volatility.

$\ln(volq)_{it} = c_0 + \widehat{\beta_{TSLS}}\widehat{IO}_{it} + \beta_5 X_{it} + \epsilon_{0it}$ (Reduced form)

Where $\widehat{\beta_{TSLS}}$ is the two-stage least squares estimator.

Performing the IV approach with spread and volume instrumenting for institutional ownership, results in a coefficient that is positive and unjustifiably large. The coefficient varies between 1.10 and 1.12 depending on the specification.[25]

Table 12 – IV estimation

Instruments = Trading volume and spread

	(1)	(2)	(3)	(4)	(5)
SINDUM	-0.0978***	0.0808**	0.0742**	0.0687**	0.0687**
	(0.0289)	(0.0322)	(0.0303)	(0.0324)	(0.0324)
ONESICDUM	0.102***				
	(0.00661)				
GDUM		-0.139***	-0.138***	-0.139***	-0.139***
		(0.0151)	(0.0142)	(0.0153)	(0.0153)
Predicted IO	**1.098*** **	**1.155*** **	**1.070*** **	**1.119*** **	**1.119*** **
	(0.130)	**(0.134)**	**(0.127)**	**(0.134)**	**(0.134)**
AGE	-0.220***	-0.219***	-0.203***	-0.208***	-0.208***
	(0.00716)	(0.00744)	(0.00673)	(0.00720)	(0.00720)
LEVERAGE	0.130***	0.133***	0.128***	0.136***	0.136***
	(0.00322)	(0.00332)	(0.00311)	(0.00332)	(0.00332)
DIVDUM			-0.197***	-0.186***	-0.186***
			(0.00707)	(0.00710)	(0.00710)
RETURN				0.0812***	0.0812***
				(0.00263)	(0.00263)
NASD	-0.162***	-0.158***	-0.161***	-0.140***	-0.140***
	(0.0197)	(0.0199)	(0.0196)	(0.0195)	(0.0195)
SP500	-0.504***	-0.507***	-0.481***	-0.467***	-0.467***
	(0.0203)	(0.0207)	(0.0195)	(0.0197)	(0.0197)
N	165,225	165,225	165,225	165,225	165,225
Firms	6,666	6,666	6,666	6,666	6,666

[25] Similarly, Rubin and Smith (2009) finds a coefficient that is also ten times as large as the original coefficient, indicative of a mis specified IV approach (bad instruments).

IV – (in)validity of the instruments

In order to obtain a *valid IV* estimate, the *exclusion restriction* and the *independence assumption* need to hold. The exclusion restriction requires that the instruments affect quarterly volatility only through institutions. This seems unlikely because low spread and high volume of trade, indicative of high liquidity, most likely directly affect volatility in returns, not only through an increase institutional ownership. The independence assumption is satisfied if the instruments are exogenous and "as-good-as" randomly assigned. If met, the instruments are uncorrelated with omitted variables in the reduced form regression. It seems implausible that spread and volume are exogenous, because they are driven by time-varying investor behaviour. Assuming that spread and volume are random corresponds to the assumption that investor's behaviour is random. Basic economic theory, as we all know, assumes that investors form rational expectations based on the available stock information available to them. It would therefore be long stretch to argue that this assumption does not hold. The volume and spread instruments are therefore invalid instruments resulting in biased IV coefficients. The bias results from the covariance of the instrument with the error term. The two-stage least square coefficient in formula:

$$\hat{B} = \widehat{\beta_{TSLS}} + \frac{Cov(INSTRUMENTS, \epsilon_{0it})}{Var(\epsilon_{0it})}$$

This reasoning explains the high coefficient in the two-stage least squares estimator suggesting Rubin and Smith (2009) failed to correctly validate the IV assumptions. Lack of a good instrument for institutional ownership on volatility also means that I will not be able to properly address the endogeneity concerns.

7. Conclusion

In this thesis I examined the relationship between sin stocks and institutional ownership, analyst coverage and return volatility. Using a semi-annual panel for the years 1983 – 2017 to investigate institutional ownership and analyst coverage and a quarterly panel for the years 2000 – 2017 to investigate return volatility. The results show that the so-called triumvirate-of-sin stocks (alcohol, beer and gambling) are held less by institutional investors as compared to non-sin stocks. Breaking down the result on institutional ownership by industry reveals that, while tobacco and gaming stocks are not statistically different from another, beer stocks have significantly different relationship to institutional ownership (more negative). Moreover, the results support the conjecture that the difference in institutional ownership in sin stocks as compared to non-sin stocks is increasing over time with institutions holding increasingly less sin stocks. Similarly, the results support hypothesis that analyst coverage on sin stocks is lower as compared to non-sin stocks. Interestingly, the industries all have a statistically different relationship with analyst coverage with the tobacco stocks receiving the lowest number of estimates. Analyses of the difference in analyst coverage between sin stocks and non-sin stocks reveals that sin stocks receive fewer estimates throughout the sample. However, no support is found for a consistently decreasing pattern in the amount of analyst coverage across the subsequent time periods. The last topic addressed in this thesis is return volatility. The research indicates that sin stocks are more volatile than non-sin stocks. While the results do not provide evidence that the sign of institutional ownership on volatility depends on the dividend structure as shown in Rubin and Smith (2009). In both dividend and non-dividend paying stocks, the effect of institutional ownership on volatility is smaller in sin stocks compared to non-sin stocks.

This thesis contributes to the existing literature on sin stocks in two ways: *methodology improvements* and by exploring a new direction (volatility). The first methodology improvement is the accuracy of the estimates by working with semi-annual observations instead of annual observations (like Hong and Kacperczyk, 2009; Durand et al, 2013). Secondly, I add to the literature on institutional ownership and analyst coverage by empirically testing the sin stock effect over time and by estimating separate industry coefficients. Providing the reader with a more detailed insight into the evolvement of the sin stock cohort over time (including more recent years) and the distribution across the three

groups. Thirdly I introduce a measure of insider ownership to the specifications which is found to be individually important in explaining institutional ownership and analyst coverage. Moreover, the adjustment of the institutional ownership variable (by incorporating insider ownership) is believed to improve upon the measurement of institutional ownership. Besides methodology improvement, this thesis addresses a relatively new topic in the context of sin stocks, namely volatility. Preceding research (Rubin and Smith, 2007) already suggested that institutional investing relates to volatility potentially through dividends structures although this result had not been replicated on sin stocks. In this regard I am the first to do so. The importance of dividends in sin investment decisions is highlighted by recently published paper by Colonnello et al. (2019), presenting evidence that dividend paying sin companies exhibit a positive relation with the future return and volatility spreads.

Besides the abovementioned contributions, I find it important to also acknowledge the limitations and shortcomings. This ensures that future researchers are aware of potential fruitful areas left to be explored. As mentioned in the 'database limitation' section, the type code classification problem (in Thomson Reuters) prevents me from empirically testing the 'more-constrained hypothesis'. Stating that some institutional investors, i.e. pension funds, endowment funds and banks, are more restrained in their investment behaviour than are investment companies and investment advisors. Another important limitation is that I am unable control for endogeneity of institutional ownership in the volatility specifications. Suitable instruments that validate the instrumental variable assumptions are lacking. Future research is required to validate the results on volatility presented in this paper.

In addition, future research on sin stocks could expand on the definition of sin by including other ESG factors, for example corruption, environment, coal energy, and human rights. The published exclusion lists by financial institutions (such as ING, APG, and Robeco) already list (few) firms under these factors and will presumably exclude others if investors ethics progress in this direction. Volatility in sin stocks also requires additional attention. While the results support the hypothesis that sin stocks are more volatility, the driving economic channel is less clear. Future research could potentially disentangle the economic drivers behind the observed differences. Taking together, future research could further our understanding of the sin stocks universe by building on the results presented in this thesis.

8. Bibliography

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9. Appendix

Table 13: Type code corrections using a reference file

TYPE INSTITUTIONS	3		4		5	
	before	after	before	after	before	after
1996	85,963	94,998	315,433	285,535	57,712	55,805
1997	96,647	106,895	368,035	334,286	63,455	60,218
1998	80,231	111,714	435,025	398,688	97,637	64,215
1999	11,169	124,592	81,978	423,654	658,681	98,424
2000	20,056	142,826	88,708	433,395	790,328	150,079
2001	16,827	138,029	100,849	421,005	723,418	188,719
2002	13,755	130,216	86,825	399,021	752,01	225,869
2003	13,547	128,726	84,038	387,854	802,129	279,123
2004	16,691	129,702	93,067	408,702	904,259	361,033
2005	16,568	125,794	102,184	414,537	966,814	419,462
2006	17,773	129,814	125,142	418,15	1,037,029	494,232

Table 14: Identified sin stocks by year

Year	Unique companies	Tobacco	Alcohol	Gaming	Defense
1983	188	12	36	19	84
1984	201	13	39	21	89
1985	198	12	39	22	87
1986	189	11	37	23	83
1987	189	13	34	25	84
1988	189	13	33	26	84
1989	187	13	33	28	79
1990	187	11	33	34	77
1991	189	12	33	35	76
1992	190	13	31	39	75
1993	211	12	33	58	74
1994	216	12	31	69	71
1995	227	11	35	71	72
1996	235	12	38	69	71
1997	243	14	39	72	70
1998	230	12	38	67	69
1999	216	12	37	58	64
2000	191	9	34	48	60
2001	172	7	31	44	55
2002	166	8	30	45	51
2003	156	8	27	44	47
2004	123	8	25	44	46
2005	122	8	25	42	47
2006	117	8	24	38	47
2007	116	8	23	38	47
2008	109	10	23	33	43
2009	104	9	21	32	42
2010	100	9	21	31	39
2011	96	9	21	28	38
2012	95	9	21	28	37
2013	94	9	21	28	36
2014	92	11	21	25	35
2015	87	11	20	21	35
2016	84	10	19	22	33
2017	81	9	19	21	32
Total	327	33	80	99	115

Figure A: Fama and French (1997) classification scheme

Agric	Agriculture	0100–0799, 2048–2048
Food	Food Products	2000–2046, 2050–2063, 2070–2079, 2090–2095, 2098–2099
Soda	Candy and Soda	2064–2068, 2086–2087, 2096–2097
Beer	Alcoholic Beverages	2080–2085
Smoke	Tobacco Products	2100–2199
Toys	Recreational Products	0900–0999, 3650–3652, 3732–3732, 3930–3949
Fun	Entertainment	7800–7841, 7900–7999
Books	Printing and Publishing	2700–2749, 2770–2799
Hshld	Consumer Goods	2047–2047, 2391–2392, 2510–2519, 2590–2599, 2840–2844, 3160–3199, 3229–3231, 3260–3260, 3262–3263, 3269–3269, 3630–3639, 3750–3751, 3800–3800, 3860–3879, 3910–3919, 3960–3961, 3991–3991, 3995–3995
Clths	Apparel	2300–2390, 3020–3021, 3100–3111, 3130–3159, 3965–3965
Hlth	Healthcare	8000–8099
MedEq	Medical Equipment	3693–3693, 3840–3851
Drugs	Pharmaceutical Products	2830–2836
Chems	Chemicals	2800–2829, 2850–2899
Rubbr	Rubber and Plastic Products	3000–3000, 3050–3099
Txtls	Textiles	2200–2295, 2297–2299, 2393–2395, 2397–2399
BldMt	Construction Materials	0800–0899, 2400–2439, 2450–2459, 2490–2499, 2950–2952, 3200–3219, 3240–3259, 3261–3261, 3264–3264, 3270–3299, 3420–3442, 3446–3452, 3490–3499, 3996–3996
Cnstr	Construction	1500–1549, 1600–1699, 1700–1799
Steel	Steel Works, Etc.	3300–3369, 3390–3399
FabPr	Fabricated Products	3400–3400, 3443–3444, 3460–3479
Mach	Machinery	3510–3536, 3540–3569, 3580–3599
ElcEq	Electrical Equipment	3600–3621, 3623–3629, 3640–3646, 3648–3649, 3660–3660, 3691–3692, 3699–3699
Misc	Miscellaneous	3900–3900, 3990–3990, 3999–3999, 9900–9999
Autos	Automobiles and Trucks	2296–2296, 2396–2396, 3010–3011, 3537–3537, 3647–3647, 3694–3694, 3700–3716, 3790–3792, 3799–3799
Aero	Aircraft	3720–3729
Ships	Shipbuilding, Railroad Eq	3730–3731, 3740–3743
Guns	Defense	3480–3489, 3760–3769, 3795–3795
Gold	Precious Metals	1040–1049
Mines	Nonmetallic Mining	1000–1039, 1060–1099, 1400–1499
Coal	Coal	1200–1299
Enrgy	Petroleum and Natural Gas	1310–1389, 2900–2911, 2990–2999
Util	Utilities	4900–4999
Telcm	Telecommunications	4800–4899
PerSv	Personal Services	7020–7021, 7030–7039, 7200–7212, 7215–7299, 7395–7395, 7500–7500, 7520–7549, 7600–7699, 8100–8199, 8200–8299, 8300–8399, 8400–8499, 8600–8699, 8800–8899
BusSv	Business Services	2750–2759, 3993–3993, 7300–7372, 7374–7394, 7397–7397, 7399–7399, 7510–7519, 8700–8748, 8900–8999
Comps	Computers	3570–3579, 3680–3689, 3695–3695, 7373–7373
Chips	Electronic Equipment	3622–3622, 3661–3679, 3810–3810, 3812–3812
LabEq	Measuring and Control Equip	3811–3811, 3820–3830
Paper	Business Supplies	2520–2549, 2600–2639, 2670–2699, 2760–2761, 3950–3955
Boxes	Shipping Containers	2440–2449, 2640–2659, 3210–3221, 3410–3412
Trans	Transportation	4000–4099, 4100–4199, 4200–4299, 4400–4499, 4500–4599, 4600–4699,
Whlsl	Wholesale	5000–5099, 5100–5199
Rtail	Retail	5200–5299, 5300–5399, 5400–5499, 5500–5599, 5600–5699, 5700–5736, 5900–5999
Meals	Restaurants, Hotel, Motel	5800–5813, 5890–5890, 7000–7019, 7040–7049, 7213–7213
Banks	Banking	6000–6099, 6100–6199
Insur	Insurance	6300–6399, 6400–6411
RlEst	Real Estate	6500–6553
Fin	Trading	6200–6299, 6700–6799

Table 15: Industry beta's

52 SIC Industries & Gaming industry identified through NAICS

Industry	Beta	Industry	Beta
Agric	0,799486	**Guns**	**0,643117**
Food	0,627828	Gold	0,421121
Soda	0,815007	Mines	1,145842
Beer	**0,665055**	Coal	1,147805
Smoke	**0,649454**	Oil	0,752636
Toys	1,08985	Util	0,436413
Fun	1,351154	Telcm	0,946947
Books	1,079855	PerSv	1,027608
Hshld	0,745109	BusSv	1,304942
Clths	1,118524	Comps	1,371158
Hlth	0,906031	Chips	1,472011
MedEq	0,904505	LabEq	1,304196
Drugs	0,787461	Paper	0,95798
Chems	1,096086	Boxes	1,010939
Rubbr	1,088564	Trans	0,982744
Txtls	1,216392	Whlsl	0,978746
BldMt	1,181059	Rtail	1,017105
Cnstr	1,2465	Meals	0,87957
Steel	1,460567	Banks	1,12777
FabPr	1,078523	Insur	0,978954
Mach	1,295603	RlEst	1,125308
ElcEq	1,283284	Fin	1,338803
Autos	1,2966	Other	1,135857
Aero	1,058151	**Gaming**	**0,994585**
Ships	1,129678		

Note: beta's are calculated as the (industryreturn/cov(industryreturn,marketreturn) over the period 1983-2017

Table 16: correlation matrix on variables in semi-annual sample 1983 – 2017

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	IO	1.000													
2	ANALYST	0.5051	1.000												
3	SINDUM	-0.0243	-0.0157	1.000											
4	ONESICDUM	-0.0352	0.0345	0.0338	1.000										
5	GDUM	-0.0483	-0.0183	0.4409	0.0791	1.000									
6	INSIDER	-0.1713	-0.0038	0.0234	0.0348	0.0304	1.000								
7	SIZE	0.6775	0.5332	0.0147	-0.0057	-0.0082	-0.0462	1.000							
8	INDUSTRYBETA	0.0162	0.0045	-0.1115	-0.0943	-0.2326	0.0029	-0.1305	1.000						
9	MVBV	0.1821	0.2135	0.0043	0.0394	0.0105	0.0503	0.3704	-0.0417	1.000					
10	LNPRICE	0.5655	0.4040	0.0116	-0.0520	-0.0033	-0.0367	0.7731	-0.1191	0.3473	1.000				
11	AVGRETURN	0.0409	0.0162	0.0053	0.0019	-0.0101	0.0418	0.1244	0.0070	0.2895	0.2372	1.000			
12	VOLSA	-0.3361	-0.2170	-0.0146	0.0388	-0.0305	0.0609	-0.4531	0.1303	-0.0908	-0.5770	-0.0338	1.000		
13	NASD	0.1374	0.1713	-0.0108	0.0169	-0.0177	-0.0169	0.2307	0.0339	0.1148	0.1396	0.0090	-0.0416	1.000	
14	SP500	0.2553	0.2933	0.0034	-0.0538	0.0180	-0.0739	0.5016	-0.0910	0.1326	0.3387	-0.0048	-0.2052	0.2421	1.000

Table 17: Sin stocks in sample

A complete list of the sin stocks by industry with the PERMNO identifier in CRSP, together with first year and the last year in the sample and the AGE variable (the difference between the two values).

SIN STOKCS IN SAMPLE

TOBACCO	ALCOHOL	GAMING	DEFENSE
22ND CENTURY GROUP INC	A & W BRANDS INC	AMERICAN WAGERING INC	A C C O BRANDS CORP
ADVANCED TOB PRODS INC	AMERICAN FUEL TECHNOLOGIES INC	AMERICAS CAR MART INC	ADVANCED TECHNICAL PRODUCTS INC
ALLIANCE ONE INTERNATIONAL INC	AMERISCRIBE CORP	AMERISTAR CASINOS INC	AEROJET ROCKETDYNE HOLDINGS INC
ALTRIA GROUP INC	ANHEUSER BUSCH COS INC	ANCHOR GAMING	AEROSONIC CORP DEL
AMERICAN MAIZE PRODS CO	BACARDI CORP	ARGOSY GAMING CO	ALABAMA AIRCRAFT INDUSTRIES INC
AMERICAN MAIZE PRODS CO	BERINGER WINE ESTATES HLDGNS INC	AZTAR CORP	ALLIED DEFENSE GROUP INC
AXION POWER INTERNATIONAL INC	BEV TYME INC NEW	BALLY TECHNOLOGIES INC	ALPINE GROUP INC
BEAM INC	BIG BUCK BREWERY AND STEAKHS INC	BALLYS GRAND INC	AMERICAN OUTDOOR BRANDS CORP
C A BLOCKERS INC	BOSTON BEER INC	BALLYS PARK PL INC	AMERICAN PACIFIC CORP
CARIBBEAN CIGAR CO	BROWN FORMAN CORP	BLACK HAWK GAMING & DEV CO INC	ANALEX CORP
CONSOLIDATED CIGAR HOLDINGS INC	BROWN FORMAN CORP	BOARDWALK CASINO INC	ASTROTECH CORP
CONWOOD CORP	CARDIFF EQUITIES CORP	BOOMTOWN INC	ATLANTIC RESEARCH CORP
CULBRO CORP	CARIBBEAN SELECT INC	BOYD GAMING CORP	AVCO CORP
GENERAL CIGAR HOLDINGS INC	CARLING OKEEFE LTD	CAESARS ENTERTAINMENT CORP	AXON ENTERPRISE INC
KIMBERLY CLARK CORP	CASTLE BRANDS INC	CAESARS ENTERTAINMENT INC	B E I MEDICAL SYS CO INC
LOEWS CORP	CHALONE WINE GROUP LTD	CAESARS NEW JERSEY INC	BAIRNCO CORP
LORILLARD INC	CHINA RECYCLING ENERGY CORP	CAESARS WORLD INC	BALL CORP
MONK AUSTIN INC	COCA COLA BOTTLING CO CONS	CAPITAL GAMING INTL INC	BANGOR PUNTA CORP
NABISCO GROUP HOLDING CORP	COLORADO GASAHOL INC	CASINO MAGIC CORP	BLOUNT INTERNATIONAL INC
OPELIKA MANUFACTURING CORP	CONSTELLATION BRANDS INC	CASINO RESOURCE CORP	BLOUNT INTERNATIONAL INC NEW
PACIFIC GREYSTONE CORP	CONSTELLATION BRANDS INC	CENTURY CASINOS INC	BOEING CO
PARAMOUNT COMMUNICATIONS INC	CRAFT BREW ALLIANCE INC	CHARTWELL LEISURE INC	BREEZE EASTERN CORP
PHILIP MORRIS INTERNATIONAL INC	CRUZAN INTERNATIONAL INC	CHURCHILL DOWNS INC	C B S CORP
PREMIUM CIGARS INTERNATIONAL LTD	DOCTOR PEPPER CO	COLORADO CASINO RESORTS INC	CADE INDUSTRIES INC
R J R NABISCO INC	DOLE FOOD INC	CREATIVE GAMING INC	CENTURI INC
REYNOLDS AMERICAN INC	DR PEPPER SEVEN UP CO INC	DOVER DOWNS GAMING & ENTMT INC	CHALCO INDUSTRIES INC
ROCK CREEK PHARMACEUTICALS INC	E R L Y INDUSTRIES INC	DOVER MOTORSPORTS INC	CHRYSLER CORP
SWISHER INTERNATIONAL GROUP INC	ESKIMO PIE CORP	ELDORADO RESORTS INC	CLABIR CORP
TURNING POINT BRANDS INC	FALSTAFF BREWING CORP	ELMERS RESTAURANTS INC	CLABIR CORP
U S T INC	FREDERICK BREWING CO	ELSINORE CORP	COLEMAN CO
UNIVERSAL CIGAR CORP	GENESEE CORP	EMPIRE RESORTS INC	COLT INDUSTRIES INC DE
UNIVERSAL CORPORATION	GLENMORE DISTILLERIES CO	EPOCH HOLDING CORP	CORDANT TECHNOLOGIES INC
VECTOR GROUP LTD	GOLDEN STATE VINTNERS INC	EUROPA CRUISES CORP	D H B INDUSTRIES INC
	HEILEMAN G BREWING INC	FLORIDA GAMING CORP	DEWEY ELECTRONICS CORP
	ICEE USA CORP	FORTUNE INDUSTRIES INC	DIGITAL OPTRONICS CORP
	INDEPENDENCE BREWING COMPANY	FORTUNET INC	DUCOMMUN INC DE
	IROQUOIS BRANDS LTD	FULL HOUSE RESORTS INC	EMHART CORP VA

JEFFERIES FINANCIAL GROUP INC
JONES SODA CO
LION BREWERY INC
LION COUNTRY SAFARI INC
M B C HOLDING CO
M G P INGREDIENTS INC
MCKESSON CORP
MOLSON COORS BREWING CO
MOLSON COORS BREWING CO
MOUNTAINTOP CORP
NABISCO BRANDS INC
NOR WESTER BREWING INC
NUTRI BEVCO INC
PABST BREWING CO
PAVICHEVICH BREWING CO
PENFORD CORP
PEPSICO INC
PETES BREWING CO
PITTSBURGH BREWING CO
PUBLICKER INDUSTRIES INC
PURE WORLD INC
PYRAMID BREWERIES INC
QUANTUM CHEMICAL CORPORATION
R H PHILLIPS INC
R J R NABISCO INC
RAVENSWOOD WINERY INC
ROBERT MONDAVI CORP THE
ROCKY MOUNTAIN BEVERAGE CO
S K TECHNOLOGIES CORP
SCHWEITZER MAUDUIT INTL INC
SEABOARD CORP
SONOMA VINEYARDS
STEARNS AND LEHMAN INC
TELLUS INDUSTRIES INC
TRUETT HURST INC
UNIVAR CORP
VALERO ENERGY CORP NEW
W I N E INC
WALKER HIRAM RES LTD
WILLAMETTE VALLEY VINYDS INC
G B HOLDINGS INC
GAMETECH INTERNATIONAL INC
GAMING CORP OF AMERICA
GEMINEX INDUSTRIES INC
GLOBAL CASINOS INC
GOLDEN ENTERTAINMENT INC
GRAND CASINOS INC
GRAND GAMING CORP
GREATER BAY CASINO CORP DEL
GRIFFIN GAMING & ENTMT INC
HARRAHS ENTERTAINMENT INC
HARVEYS CASINO RESORTS
HILTON HOTELS CORP
HOLLY HOLDINGS INC
HOLLYWOOD CASINO CORP
I T T CORP NEV
INTERACTIVE SYSTEMS WORLDWIDE IN
INTERNATIONAL GAME TECHNOLOGY
INTERNATIONAL GAMING MANAGMNT IN
INTERNATIONAL THOROUGHBRED BRDRS
ISLE OF CAPRI CASINOS INC
J C C HOLDING CO
LADY LUCK GAMING CORP
LAS VEGAS SANDS CORP
LITTLEFIELD CORP
LONE STAR CASINO CORP
M G M RESORTS INTERNATIONAL
M T R GAMING GROUP
MANDALAY RESORT GROUP
MIRAGE RESORTS INC
MONARCH CASINO & RESORT INC
MULTIMEDIA GAMES HOLDING CO INC
NEVADA GOLD & CASINOS INC
NEVSTAR GAMING & ENTMT CORP
NONA MORELLIS II INC
PENN NATIONAL GAMING INC
PINNACLE ENTERTAINMENT INC
PINNACLE ENTERTAINMENT INC NEW
PLAYERS INTERNATIONAL INC
POKERTEK INC
POWERHOUSE TECHNOLOGIES INC
PRESIDENT CASINOS INC
PRIMADONNA RESORTS INC
RED ROCK RESORTS INC
RESORTS INTERNATIONAL INC
RIO HOTEL & CASINO INC
ENTWISTLE COMPANY
ESTERLINE TECHNOLOGIES CORP
EX CELL O CORP
F M C CORP
FAIRCHILD INDUSTRIES INC
FORCE PROTECTION INC
GENCOR INDUSTRIES INC
GENERAL DEFENSE CORP
GENERAL DYNAMICS CORP
GENERAL MOTORS CORP
GENERAL MOTORS CORP
GEOTEK COMMUNICATIONS INC
GOODRICH CORP
GOULD INC
HAMILTON TECHNOLOGY INC
HARSCO CORP
HERCULES INC
HEXCEL CORP NEW
HI SHEAR INDS INC
HILLENBRAND INC
HONEYWELL INC
I M T INC
K D I CORP
KAMAN CORP
L T V CORP
LOCKHEED MARTIN CORP
LORAL CORP
MARTIN MARIETTA CORP NEW
MASCOTECH INC
MCDONNELL DOUGLAS CORP
MECHANICAL TECHNOLOGY INC
MOOG INC
MOOG INC
N I INDUSTRIES INC
NATIONAL PRESTO INDS INC
NORTHROP GRUMMAN CORP
O E A INC
OLIN CORP
OMARK INDUSTRIES INC
ORBITAL A T K INC
ORBITAL SCIENCES CORP
PACCAR INC
PATLEX CORP
PLANT INDUSTRIES INC
PRECISION AEROTECH INC
PRIMEX TECHNOLOGIES INC

RIVIERA HOLDINGS CORP

SANDS REGENT

SANTA FE GAMING CORP

SCIENTIFIC GAMES CORP

SHOWBOAT INC

SILICON GAMING INC

SODAK GAMING INC

STATION CASINOS INC

STRATOSPHERE CORP

TIX CORP

TRANS WORLD GAMING CORP

TRUMP HOTELS & CASINO RESRTS INC

W H G RESORTS & CASINOS INC

W M S INDUSTRIES INC

WYNDHAM INTL INC

WYNN RESORTS LTD

YOUBET COM

PULLMAN COMPANY DE NEW

R E D M INDUSTRIES INC

RAYMOND ENGINEERING INC NEW

RAYMOND INDUSTRIES INC

RAYTHEON CO

RAYTHEON CO

REINHOLD INDS INC

ROCKCOR INC

ROCKWELL INTERNATIONAL CORP

ROHR INDUSTRIES INC

SEQUA CORP

SEQUA CORP

SOONER DEFENSE FLA INC

SPECIAL DEVICES INC

STANDARD PRODUCTS CO

STANFORD TELECOMMUNICATIONS

STANLEY BLACK & DECKER INC

STARMET CORP

STURM RUGER & CO INC

T R W INC

TALLEY INDUSTRIES INC

TEMTEX INDUSTRIES INC

TERAFORCE TECHNOLOGY CORP

TEXAS INSTRUMENTS INC

TEXTRON INC

U S TRANSPORTATION SYSTEMS INC

UNITED TECHNOLOGIES CORP

VARO INC

VISTA OUTDOOR INC

WEAVER ARMS CORP

WEDTECH CORP

WILDEY INC