

Market quality : joint impact of political lifecycles, high frequency trading and market fragmentation.

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Publication Date:

2019

DOI:

<https://doi.org/10.26190/unsworks/21429>

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THE IMPACT OF POLITICAL LIFECYCLES, MARKET FRAGMENTATION ON MARKET QUALITY

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Submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

School of Banking and Finance

University of New South Wales

30 March 2019

Thesis/Dissertation Sheet

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Abbreviation for degree as give in the University calendar	:	PhD
Faculty	:	Economics
School	:	Banking and Finance
Thesis Title	:	Market Quality: Joint Impact of Political Lifecycles, High Frequency Trading and Market Fragmentation.

Abstract 350 words maximum: (PLEASE TYPE)

The dissertation studies the joint impact of political lifecycles, market fragmentation and HFT on market quality. Market quality is defined as comprising of market efficiency and integrity. Three distinct but inter-related studies are conducted using a unique JSE data set and hand collected political data. Using 2SLS and 3SLS structural equations the research examines effective spreads, market manipulation and HFT in the context of market pluralism, market fragmentation. The research finds a country that has a dominant political party, tends to lead to a deterioration in efficiency and integrity, conversely improved systemic risk. Co-location on the Johannesburg Stock Exchange ushered in a higher participation of HFT. Study of the impact on integrity reveals whilst there was a positive relationship with market integrity, there exists cross equation correlation between effective spreads and EOD used necessitating a 2SLS structural equation analysis to resolve the issue of cross equation correlation. Finally, using 3SLS the dissertation examines the joint impact of market fragmentation and HFT participation on the JSE market. Overall, the study reveals overwhelming positive effect on market quality; effective spreads and EOD decrease ex-post. Crucially, a unit increase in effective spread is associated with a 788 unit increase in the number of EOD incidences, whereas a unit increase in OTT, a proxy for HFT is associated with an approximately 10 unit increase in the number of EOD incidences. Trading in the lit market increases the number of EOD incidences by 1.86 whereas trading in the dark market decreases the number of EOD incidence by 1.87. Curiously, political pluralism exerts a greater effect and impact on both efficiency and integrity accounting for a greater increase in terms of instances of EOD greater than 788 and is evidenced by the negative and significant relationship between stock's province (HQ), pluralism and market quality. The research extents the literature on market quality by providing a unified framework for resolving the cross-equation correlations between effective spreads and measures of market integrity when reviewing HFT market participation.

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KEYWORDS

Acronym	Meaning
2SLS	Two Stage Least Squares
3SLS	Three Stage Least Squares
A2X	A2X Stock Exchange
ANC	African National Congress
ASIC	Australian Securities and Investment Commission
ASX	Australian Securities Exchange
AT	Algorithmic Trading
ATS	Alternative Trading System
BEE	Black Economic Empowerment
CESR	Committee of European Securities Regulators
CM	Conditional Moment
CMCRC	Capital Market Cooperative Centre
CTR	Cancel Trade Ratio
EC	Eastern Cape
EOD	End of Day Price Dislocation
ETF	Exchange Traded Funds
EU	European Union
FMA	Financial Markets Act
FSB	Financial Services Board
FS	Free State
FTSE	Financial Times Stock Exchange
GDP	Gross Domestic Product
GP	Gauteng Province
HFT	High Frequency Trading
HHI	Herfindahl-Hirschman Index
HQ	Head Quarters
IOSCO	International Organization
JSE	Johannesburg Stock Exchange
KZN	KwaZulu Natal

Acronym	Meaning
LCBO	Large and complex banking organisation
LIM	Limpopo Province
LSE	London Stock Exchange
MiFID	Markets in Financial Instruments Directive
MP	Mpumalanga Province
MQD	Market Quality Dashboard
NASDAQ	Nasdaq Stock Market
NC	North Cape Province
NMS	National Market System
NYSE Euronext	New York Stock Exchange / Euronext
NW	North West Province
OLS	Ordinary Least Squares
OTT	Order To Trade Ratio
REE	Rational Expectation Equilibrium
SA	South Africa
SARB	South Africa Reserve Bank
SEC	Securities Exchange Commission
SICRCA	Securities Industry Research Centre of Asia Pacific
SRO	Self-Regulatory Organisation
SSA	Securities Service Act
TRIPI	Technology, Regulation, Information, Participant, Instrument
TRTH	Thompson Reuters Tick History
US	United States
VIX	Volatility Index
VWAP	Volume Weighted Average Price
WC	West Cape Province
HQ	Head Quarters

ABSTRACT

This dissertation comprises studies of the impact of political lifecycles, market fragmentation and HFT on market quality. Market quality is defined as a combination of market efficiency and integrity. Three distinct but inter-related studies are conducted using a unique Johannesburg Stock Exchange (JSE) data set and hand collected political cycles data. Using 2SLS and 3SLS structural equations the research examines effective spreads, market manipulation and HFT in the context of market pluralism and fragmentation. The first study finds that in South Africa, a country that has a dominant political party, there tends to be a deterioration in efficiency and integrity, but also conversely, improved systemic risk. The second study finds that co-location on the JSE ushered in a higher participation of high frequency trading (HFT) and presents evidence of a positive relationship between HFT and market integrity. The study resolves the issue of cross-equation correlation between effective spreads and end of day price dislocation (EOD) by employing a 2SLS structural equation model. The third and final study employs a 3SLS approach to examine the impact of market fragmentation and HFT participation on market quality. The studies present evidence of an overwhelming positive effect on market quality as evidenced by the decrease (improvement) in effective spreads and EOD decrease ex-post. Crucially, a unit increase in effective spread is associated with a 788 unit increase in the number of EOD incidences, whereas a unit increase in OTT, a proxy for HFT is associated with an approximately 10 unit increase in the number of EOD incidences. Trading in the lit market increases the number of EOD incidences by 1.86 whereas trading in the dark market decreases the number of EOD incidence by 1.87. Curiously, political pluralism exerts a greater effect and impact on both efficiency and integrity, accounting for a greater increase in terms of instances of EOD greater than 788 as evidenced by the negative and significant relationship between stock's province or headquarters (HQ), pluralism and market quality in the respective research findings. The motivation for the research is twofold. First, it provides a framework for assessing the channels through which political cycle impact the quality of financial markets, and second, it provides a unified framework for resolving the cross-equation correlations between effective spreads and measures of market integrity when reviewing HFT market participation, thus extending the current literature on market quality which tends to focus on 2SLS models.

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Statement of Original Authorship

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

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Acknowledgement

My PhD has changed my life. The time and commitment required has been challenging but fantastically life changing. My darling wife has been with me throughout the good, the hard and the desperately hard time-poor times when I could not commit to family holidays. Thank you, my darling wife, my friend and my research partner for your love, for your support, for your motivation and above all else for your outstanding help with MS Excel graphing!

To my son and my daughter, thank you for the tarot drinks and cookies that sustained my body which in turn nourished my thinking faculties to push through. It has indeed been a family affair and PhD. I am forever grateful and indebted for your love and support - I owe you the drinks and time aplenty now. I love you both - thank you.

To my supervisor Jerry Parwada, I am fortunate and privileged to have worked with you. You have been more than a supervisor, a friend and confidante all in one. Thank you for your unstinting support, and belief in me. To my advisors Mike Aitken and Shan Ji – thank you for your time, resources and the knowledge share of the Capital Markets Cooperative Research Cooperation. Thank you Robert Emuwe and Jia Shao for your encouragement and assistance in all things Stata even though Matlab rules.

Thank you ASIC, for allowing for enabling me to undertake my PhD whilst driving market design changes. It was a unique experience and as an employer I cannot thank you enough.

Without you all there would be no PhD.

Chapter 1: INTRODUCTION

The aim of this dissertation is to examine the effect of dominant political lifecycles, algorithmic trading and market fragmentation on market quality: market efficiency and market integrity. The thesis examines the channels through which political lifecycles matter for market quality (efficiency, integrity and systemic risk) outcomes as well as the joint effect and impact of electronic trading and market fragmentation on the South African cash equities Johannesburg Stock Exchange (JSE). Three distinct but inter-related studies are conducted, and the ultimate findings of the study indicate that a country that has a dominant political party, leads to a deterioration in market quality that is market efficiency and market integrity, but conversely improvement in market resilience. The key finding is contrary to the general assumption that a dominant political party would in fact reduce uncertainty, but consistent with the view that market fragmentation and electronic trading are good for the market efficiency by providing reduced spreads (quoted, effective and realised), providing markets with less market misconduct (information leakage and end of day price dislocation).

The literature review in chapter two explores existing research on political uncertainty and market quality. The extant literature is examined on the likely channels through which political uncertainty channels into market quality. The motivation for this research is simple – the major of market quality extant research has tended to focus on the two pillars of market quality of market efficiency and

market integrity. Whilst significant and informative evidence has been garnered on market design changes such as market fragmentation as well as electronic algorithmic, the evidence has tended to be highly focused on market efficiency and to a lesser extent integrity, but most notably assuming the two are non-equation cross correlated. As such the extant literature has tended to adopt models where a typical microstructure prism-view of technology, regulation, instruments, participants and information has often been used to model and inform debate on assessing the extent to which market design changes are good or bad for the market.

This thesis researches and examines market quality from a view of a.) the impact of political plurality and b.) the impact of algorithmic trading and market fragmentation. It informs regulatory decision making, a key goal for IOSCO financial markets regulator member and affiliate organisations. The mandate for such regulators is to ensure any market design change is good for the market in terms of preserving fair and efficient markets. Equally significant, the research aims to examine the role of political plurality on financial markets, generalised to emerging markets countries where “powerful ruling parties and their association with leading their nation’s independence and majority rule efforts often characterized by African countries, have presided over economic decline. As such, one open question for financial economists is the need to understand the channels through which such declines set in; on one hand, having a strong ruling party should provide the benefit of calming concerns associated with political risks. On the other, a powerful ruling party may open the economy to corruption and market uncertainty. An assessment of the effect of plurality and impact of political lifecycle events together with a framework corrects the issues of market efficiency and market integrity cross

equation cross correlation forms the basis of this thesis and to extent the extant literature on market quality thus.

The motivation for this research is simple; virtually every major securities regulator in the world including the umbrella International Organization of Securities Commissions (IOSCO), uniformly define their mandates in terms of fairness (“integrity”) and efficiency (“orderliness”). The thesis adopts the IOSCO market efficiency and integrity mandate view of financial markets. Consequently, when market operators, market participants and/or regulators change their respective market designs, that is any of technology, regulatory (“policy”), instruments (“securities”), participants (“market participants”) and information (“transparency”) – TRIPI or at an aggregate level market fragmentation and/or electronic trading including allowing high frequency trading (“HFT”), they are generally obliged to justify these changes on the basis that the changes should enhance both fairness and orderliness and, more recently since the global financial crisis; market resilience. The research aims to inform decision making and specifically in developed and developed nations with dominant political stakeholders.

1.1 PLURALITY, POLITICAL EVENTS AND MARKET QUALITY

Following the literature review in chapter two, chapter three presents a unique data set of the plurality, political lifecycles and daily trading undertaken on the Johannesburg Stock Exchange (JSE) between 2 January 2008 and 15 September 2015. The data is used to illustrate how political events and plurality generalised to developing / emerging countries where in dominant political parties have been in power since independence of their countries can alter trading behaviour. The study

shows that plurality (high dominance by one political party at national and provincial) can act as a channelling or mechanisms through which political lifecycles matter for market efficiency and integrity outcomes in the form of *a.) Information suppression, b.) Inertia (suppression of supervisory oversight), & c.) Corruption & economic cycles.*

The study shows that both market efficiency and market integrity falls ex-ante and ex-post political events within dominant states i.e. provinces with little political plurality. It is postulated political party actors are often incentivized to avoid negative news about their activities (e.g., Peltzman (1976), Watts and Zimmerman (1986)) during periods of political lifecycle events such as elections, party congress, and presidential nomination and selection. To the extent that certain events asymmetrically increase the cost of releasing and disseminating negative news, local politicians are more likely to restrict if transitory, the flow of negative information about firms under their control or influence (province/HQ). Such behaviour would not only affect the fairness and orderliness of the markets, but its resilience to recover from adverse shocks as well. In the event plurality temporary incentives are sufficiently strong, the result will be a reduced flow of negative information in advance of the events, followed by an increase in the flow of negative information after the event as previously suppressed information is subsequently released.

The findings of the study conducted in chapter three contributes to the past literature by (Piotroski, Wong and Zhang 2014). Our study provides empirical evidence of the previous theory on suppression as such temporary suppression of negative information generates a distinct shift in stock price crash behaviour around the political event ex-ante and ex-post where the market was unable to fully unravel

the suppression of bad news. The section presents evidence of a negative relationship between transactions costs (effective and quoted) and the province where a stock / company is headquartered. Pluralism attenuates instances of both EOD and Insider trading. These findings are contrary to the general assumption that a dominant political party would in fact reduce uncertainty and therefore should result in improved overall market quality.

1.2 HIGH FREQUENCY TRADING – IMPACT ON JSE MARKET FAIRNESS

In chapter four, the research examines impact of high frequency on the quality of Johannesburg Stock Exchange (JSE) cash equities market. The section models the determinants of HFT market participation in the form of order to trade ratio (OTT) ex ante and ex post co-location and the OTT (HFT) as an instrument variable and to examine the relationship of high frequency trading on market efficiency and market integrity. It must be noted that in scenario where market efficiency and integrity are cross equation correlated, the result of improved efficiency based on limited information asymmetry needs to be clear and precise i.e. HFT should improve both efficiency and integrity and potentially reduce intraday volatility (market resilience).

The research provides up-to-date analysis and evidence of the impact of HFT on market fairness, however, due to the cross-equation correlation of HFT with market efficiency and measures of market integrity the research also provides evidence of HFT impact on overall market quality - that is both efficiency (effective spreads) and integrity (EOD price dislocation). The study is relevant for informed decision making for both regulatory and for efficient technology market design change debate; from an exchange, buy/sell side and investors perspective HFT is a

technology market design change that could be argued has unequal fairness. The research adopts an empirical event study based on the exogenous shock event of co-location introduced on the Johannesburg Stock Exchange on 12 May 2014. The market design change was introduced in a single non-staggered approach thus enables for a single empirical lens-view study of the impact of HFT on the fairness of the Johannesburg Stock Exchange for cash equities with respect to automated and speed-based trading solutions delivery.

There is no arguing HFT is an important factor in markets that are driven by sophisticated technology impacting all layers of the trading value chain, however discussions on the effect and impact of HFT on the fairness of markets, often tend to lack sufficient and precise information as to the extent of their participation in the marketplace together with evidence of the impact on market quality. As such, this gap between the results of academic research on HFT and its perceived impact on markets in the public, media and regulatory discussions motivates this study. The research in chapter 4 present evidence showing co-location on the Johannesburg Stock Exchange (JSE) ushered in a higher participation rate of HFT with positive impact on market integrity proxied by EOD.

1.3 JOINT IMPACT OF ALGORITHMIC TRADING AND MARKET FRAGMENTATION

Chapter five represents a unified culmination of the dissertation study. It builds on the findings of chapter three and chapter four and the understanding of information asymmetry (uncertain) both from a trading based (information) and from political lifecycles in the context of plurality. A structural equation for is utilised to model the triple impact of political pluralism, high frequency trading, market

fragmentation. A unique data set of the daily statistics on the Johannesburg Stock Exchange is used to illustrate how political lifecycle events are used as channels to transmit uncertainty in the market. The study shows that post the co-location market design shock, fragmentation in the lit market order flow and the increase in competition especially from HFT participation and the dark pools has had an overwhelming positive effect on market quality. Effective spreads and end of day price dislocation (EOD) decrease ex-post. Crucially, an increase in effective spread is associated with a 788 unit increase in the number of EOD incidences, whereas a unit increase in OTT, a proxy for HFT is associated with an approximately 10 unit increase in the number of EOD incidences. Furthermore, trading in the lit market increases the number of EOD incidences by 1.86 whereas trading in the dark market decreases the number of EOD incidence by 1.87. Pluralism has tended to exert a greater effect and impact on both efficiency and integrity accounting for a greater increase in terms of instances of EOD greater than 788.

1.4 SIGNIFICANCE, SCOPE AND DEFINITIONS

Whilst enhancing market quality has always been an important goal, this objective has taken on even greater significance in the wake of direct competition between market venues both nationally and internationally. Whilst market fragmentation is only a recent phenomenon in equities markets, driven by initiatives such as Regulation National Market System (Reg NMS) in North America, the Markets in Financial Instruments Directive (MiFID) in Europe, and Competition in South Africa the international nature of the products traded in commodities markets has meant that competition between markets has always been an issue, although heightened in

recent years as a result of international connectivity and communication protocols which mean that distance and time-zones is no longer the issue it used to be.

The research models and examines the mechanisms through which political lifecycles matter for market quality and the joint effect and impact of electronic trading and market fragmentation. South Africa is well suited to this experiment as it provides events at the national level, with response variables at the firm and provincial level. At the national level, the African National Congress (ANC) has enjoyed unassailed support since the first democratic election on 27 April 1994, dominating the national political scene. On the other hand, there exists significant political plurality at the provincial level. The contribution of this Thesis non-the less important. It not only develops and presents new insights into a.) the dimension of opacity, the suppression negative information not explored in prior research yet, but maps strongly into the prevailing preferences of politicians, and b.) explores the joint effect and impact of fragmentation and algorithmic trading; key contemporaneous market design changes, on market quality. Whilst the research is notable for extending the work of Piotroski, Wong and Zhang (2014) it utilizes an empirical methodology that captures both the suppression and the subsequent release of negative information as a starting point to baseline the extent to which firms and political actors shape information and impact the quality of financial market. It is the first to bring into focus, political lifecycles and the joint effects and impact of market fragmentation and algorithmic trading, on market quality. Within this context, it is important to note that the results also provide a useful framework for future research seeking to identify the exact channels by which politicians and the listed firms temporarily suppress the net flow of negative information around politically sensitive

events ex-ante and ex-post. Finally, the motivation for this research stems from the need to contribute to the nascent literature on political pluralism and the impact on market quality presenting an African context.

1.5 SUMMARY

The combined research explores the triple impact of political pluralism, fragmentation and high frequency trading on market quality, that is fair and orderliness. It is however apparent; the net effect of off-exchange fragmentation has been harmful to overall market quality. This is supported by the fact that fragmentation of trading into the dark (dark fragmentation) has detracted market fairness increasing closing price manipulation and widening the effective spreads. Thus, whilst the lit market fragmentation has the effect positively benefiting both market efficiency (effective spreads) and market manipulation (EOD), fragmentation in the dark has a negative impact on market quality. The recommendation herein is that markets regulators need to consider policy design that improves dark liquidity price discovery in the form of ASIC or Canadian price improvement.

1.6 THESIS OUTLINE

The remainder of this paper is structured as follows: chapter two reviews the relevant existing literature, chapter three conducts an experiment on political lifecycles and the channels through which uncertainty is transmitted into market efficiency, integrity and systemic risk. Chapter 4 examines the exogenous event of co-location implemented on the Johannesburg Stock Exchange (JSE) on 12 May 2014 and the event's impact on the fairness of the JSE cash equities. Chapter five provides a

unified model for examining the triple impact of political uncertainty, market fragmentation, and high frequency participation. Section six presents the presents conclusion.

Chapter 2: LITERATURE REVIEW

The first empirical chapter of this thesis (Chapter 3) is a natural complement to prior research examining how political forces influence financial reporting incentives, practices and the quality of financial markets. In their seminal paper, Watts and Zimmerman (1978) argue that accounting choices are influenced by the expected political costs associated with given financial reporting outcomes. These political costs can range from heightened tax burdens for instance windfall profits tax, to the outright expropriation of the firms' productive assets ("fraud"), and also include a host of indirect taxes such as heightened regulation or the threat of greater government intervention into the firm's business activities. Consistent with these arguments, existing research using international non-United States ("U.S.") data finds that firms tend to remain opaque in the presence of strong political economy forces, as measured by level of state ownership of assets, greater risk of expropriation, and the presence of political connections (Bushman, Piotroski, and Smith (2004), Bushman and Piotroski (2006), Gul (2006), Leuz and Oberholzer-Gee (2006), Wang, Wong, and Xia (2008), Chaney, Faccio, and Parsley (2011), Durnev and Guriev (2011)). Moreover, the financial reporting incentives shift as the firm becomes more or less exposed to these political incentives over time, such as following privatization events (Guedhami and Pittman (2006), Wang, Wong, and Xia (2008), Guedhami, Pittman, and Saffar (2009)).

Most current research in the area of financial reporting incentives in the context of powerful political influences typically tends to focus on earnings

management behaviour via discretionary accruals providing the transmission of influences into the quality of financial markets as measured mostly by market efficiency.

The most recent papers in this area include Jones (1991), Petroni (1992), Han and Wang (1998), and Ramanna and Roychowdhury (2010), who document that firms alter reported net income to either garner expected political gains or minimize expected political costs arising in their setting. However, whether such earnings management behaviour has a net impact on the firm's overall information environment (as proxied by stock prices) is unclear, leaving an area for further research specifically in the area of recent democracies within the African context.

It is clear most of the extant literature on election-motivated fiscal policy, is based on panel models in which it is assumed that the data can be pooled. However, due the heterogeneity of the countries included in most of these studies, this assumption is often questioned. Thus, employing Pooled Mean Group ("PMG") estimator to test whether Political Budget Cycles ("PBC") exist, Jeroen Klomp & Jakob De Haan (2013) find that fiscal policy in general is not affected by elections in the long run. However, in the short run there exists significant heterogeneity in the effect of elections on fiscal policy outcomes. Examining empirical data from 70 countries between 1970 to 2007 Klomp et al find results that suggest the occurrence of PBC is conditional on a country's characteristics that includes primarily, its level of development (GDP), democracy (Party Structure), government transparency (Governance), the country's political system, its membership of a monetary union, and its degree of political polarization.

Other studies examining “budget lifecycles” as a general lever of governments, political actors and political lifecycles across countries, find consistent results suggesting that the strength of cycles depend on a country’s economic or political characteristics which include: the level of economic development, whether elections dates are predetermined or not (Shi and Svensson, 2002b), constitutional rules determining electoral rules and form of government (Persson and Tabellini, 2002, 2003), the “level” of democracy (Shi and Svensson, 2002a, Gonzalez 2002), or other measurable factors such as “transparency” or rent-seeking (Shi and Svensson, 2002a, Alt and Lassen, 2003). Brender and Drazen (2004), present evidence showing that significant finding of a deficit cycle is driven by the experience of new democracies. Shi and Svensson (2002, 2003) find a cycle in both developed and developing countries but argued that the cycle is significantly stronger in developing countries. It is arguable the strength of the political budget cycle may also depend on whether the election date is predetermined or not.

Common amongst these studies of political budget lifecycles is the question of whether such a cycle exists on the macroeconomic level across countries? It turns out that common amongst these studies is not so much “do such lifecycles exists”, but “where and in what countries does these cycles exists? The answer it turns out points to mostly the newly independent countries in Africa and new democracies of Eastern Europe.

This context is therefore not only empirically relevant, but theoretically and practically important, as it provides insight into key factors that account for the existence of the political business lifecycle, which events empirically are highly correlated with economic uncertainty with the potential to transmit into the quality

of financial markets more so from political deficit cycles. Jeroen Klomp & Jakob De Haan (2013) examine the extent to which fiscal policy is affected by upcoming elections, focusing on whether or not “election motivated fiscal policies” enhance the probability of election or re-election of the incumbent.

The authors find the existence of political budget cycle(s), election-motivated fiscal policies tend to have a significant positive, but small effect on the electoral support for the political parties in government. Block (2000) examines African, Sub-Saharan countries and presents evidence of opportunistic political business cycles in the new-democracies; finding consistency with the predictions of rational opportunistic PBC theory, exemplified by Rogoff and Sibert (1988) and Rogoff (1990), in which they point to politicians being motivated primarily in re-election(s), thereby manipulating fiscal and monetary policy instruments to win the support of rational retrospective voters. Block provides evidence showing during election years in Africa countries, fiscal deficits, government consumption, public spending, and net claims on the government increase as a share of GDP whilst post-election, retrenchments are statistically clear only in the cases of fiscal deficits and public expenditures, suggesting, for example, that governments’ election-year raids on their central banks are not compensated ex-post-election year.

2.1 POLITICAL UNCERTAINTY AND MARKET QUALITY

In examining the extent to which political lifecycles impact market quality, the research conducted in Chapter 3 is aided by extant literature that examines suppression and the subsequent release of negative information involving companies located in a powerful ruling party “actor’s” electoral influence. Thus, consistent with

the current literature on information suppression and uncertainty, the research argues this may serve as the transmission mechanism for the effects on market quality, herein defined as consisting of market efficiency, market integrity and systemic risk, within the thesis' experiment.

The basis of this theory documentation is novel to the accounting literature and eliminates many of the alternative interpretations of the pre-event period patterns alone. That said, the Thesis takes the view that "political uncertainty" affects the South African market for cash equities ("JSE") along three planes: 1.) market efficiency, 2.) market misconduct and 3.) market resilience ("systemic risk").

Furthermore, the thesis conjectures political uncertainty impacts these three planes in terms of information asymmetry, ambiguity, and disagreement (Pasquariello and Zafeiridon 2014). It is therefore reasonable to assume that "uncertainty" implies a dispersion of beliefs amongst market participants ("divergence and disagreement") which effect should be identifiable through transaction costs ("efficiency"), volatility ("resilience") and integrity ("instances of misconduct"). Such dispersion of beliefs can arise due to either opinion differences or differences in actual information sets, political actors versus the rest of the market.

It is arguable political party actors are often incentivized to avoid negative news about their activities (e.g., Peltzman (1976), Watts and Zimmerman (1986)) during periods of political lifecycle events such as elections, party congress, and presidential nomination and selection. To the extent that certain events asymmetrically increase the cost of releasing and disseminating negative news, local politicians are more likely to restrict if transitory, the flow of negative information about firms under their

control or influence (province). Such behaviour would not only affect the fairness and orderliness of the markets, but its resilience to recover from adverse.

If these temporary incentives are sufficiently strong, the result will be a reduced flow of negative information in advance of the events, followed by an increase in the flow of negative information after the event as previously suppressed information is subsequently released. Such temporary suppression of negative information would generate a distinct shift in stock price crash behaviour around the political event ex-ante and ex-post where the market was unable to fully unravel the suppression of bad news (Piotroski, Wong and Zhang 2014). This provides the right setting for experiment to study an African “political lifecycles” uncertainty or political pluralism and its impact on market efficiency, integrity and systemic risk.

2.2 MARKET QUALITY (EFFICIENCY, INTEGRITY & RESILIENCE)

Chapter 3 builds on the work of several academics in creating a framework for analysing market design changes and the impact on market quality (efficiency, integrity and systemic risk). It recognizes the effects of information asymmetry on market quality in Rational Expectation Equilibrium (“REE”) are not precisely clear. According to Wang (1994) greater information asymmetry leads to lower trading volume as it decreases the informativeness of asset prices, however, informed trading volumes might also increase with political lifecycles events’ political uncertainty if liquidity is exogenous and inelastic as in Kyle (1985). Greater adverse selection risk may increase market-makers inventory costs and ultimately round-trip costs (“effective-spreads”) leading to lower level of market efficiency as measured by higher or wider liquidity and bid-ask spreads (Ho and Stoll (1981), Amihud and

Mendelson (1986)) or lower depth (Kyle 1985)) with the consequence of higher fraction of zero returns and Roll's price impact. Consistent with Pasquariello and Zafeiridon (2014) the disagreement hypothesis conjectures that greater political uncertainty may increase differences in opinion among market participants. In heterogeneous beliefs models (e.g., Banerjee and Kremer (2010), Hong and Stein (2007)), greater fundamental uncertainty increases disagreement among investors about the fundamental value of the traded asset, leading them to trade more with one another, for instance increasing equilibrium trading volume. It is therefore plausible, trading volume may first increase in the months preceding ANC political events when both political uncertainty and accompanying information heterogeneity among market participants are likely to be high and then decrease afterwards, when political uncertainty is resolved. However, according to Pasquariello and Vega (2007) and Pasquariello and Vega (2009) more heterogeneously informed speculators might instead trade more cautiously (as in less, rather than more) with their private information, leading to deteriorating trading volume and market liquidity.

2.2.1 Market Efficiency & Market Integrity

Whilst various empirical studies on market efficiency exist (Harris and Di Marco, 2012, Foley and Putnins, 2015, O'Hara and Ye, 2011, Tanggaard and Weaver.2009), there exist very limited experiments and studies examining the joint measures of market efficiency and market integrity.

Broadly speaking, market misconduct ("integrity") refers to violations of regulatory and/or market exchange rules such as insider trading, market manipulation, front running-client conflicts, and or best execution. Market efficiency

(“efficiency”) is often proxied by transaction costs, liquidity and price discovery, whilst market misconduct is often proxied by market manipulation proxy of “end of day price dislocation” whilst insider-trading proxied by “information leakage”.

2.2.2 Systemic Risk / Volatility

The on-going consolidation of the financial system has raised concerns with respect to the degree of systemic risk in the financial system. De Nicolo & Kwast (2002) argue that firm inter-dependencies, as measured by correlations of stock returns, provide an indicator of systemic risk potential. They further analyse the dynamics of the stock return correlations of a sample of US large and complex banking organizations (LCBOs) over 1988–1999 and find a significant positive trend in stock return correlations. This finding is consistent with the view that the systemic risk potential in the financial sector appears to have increased over the last decade. The thesis relates firms’ return correlations to their consolidation activity by estimating measures of the consolidation elasticity of correlation. Consolidation at the sample LCBOs appears to have contributed to LCBOs inter-dependencies. However, consolidation elasticities of correlation exhibit substantial time variation, and likely declined in the latter part of the decade. Thus, factors other than consolidation have also been responsible for the upward trend in return correlations.

2.3 FRAGMENTATION & MARKET QUALITY

Lit and dark venues differ in how they operate. Lit venues are required to be fully transparent, ranging from the information they are required to publish into the public domain, whereas dark venues are not subject to similar lit market transparency

rules. A key fact is that dark venues including in Australia, are not required to distribute their best bid/ask prices for public access. Whilst this may seem unfair, in the Canadian and Australian market, this has resulted in implementation of regulatory market design changes such as meaningful price improvement with the aim of improving the quality (efficiency and integrity) of trading outcomes in both lit and dark markets.

According to Degryse, Achter and Wuyts (2008), in 2008 dark pools were almost non-existent, yet to-date in the US alone, more than forty (40) dark pools are in operation with their trading volume annually growing at a rate of forty percent (40%). In Australia twenty-two (22) dark venues were registered with the regulator and in operation accounting for thirty percent (30%). According to Tabb (2004) reporting on institutional equity trading in America, about ninety percent (90%) of all large investment management firms stated using a crossing network (CN) a form of dark pool.

2.3.1 Fragmentation and market efficiency and market integrity

It has been a common assumption that dark venues fragmentation negatively impact efficiency via their drawing liquidity from the lit markets. Degryse, Achter and Wuyts (2008) that that dark venues widen quoted and effective spreads as well as increase price impact.

Proliferation of dark and lit venues in South Africa, Australia, North America (outside of National Markets System (“NMS”) and Market in Financial Instruments Directive (“MiFID”) in Europe provides the motivation for market design changes study and the impact of such market design changes on market quality. This is

important for countries such as South Africa which are emerging market as the results of such study can inform policy decision making. This is critical as in South Africa over the last 3 years, Financial Service Bureau (“FSB”) the national regulator has just approved 3 new stock exchanges. Therefore, a key concern for the regulators as is the case for all IOSCO regulators, is “to what extent is market fragmentation good for the market – put it simply: “What is the impact of market fragmentation on market quality?”. Of note, fragmentation is an aggregation of the TRIPI model as it provides for different combinations of technology (matching engines), instruments, information (transparency), market participants as well as securities trades and when they are trade.

2.4 HIGH FREQUENCY TRADING AND ALGORITHMIC TRADING

Estimations of the effect and impact of high frequency trading a form of algorithmic trading in financial markets tend to vary. Current estimation of the participation of HFT within general financial markets tend to vary significantly. That said, empirical researchers and regulators had tended to coalesce towards agreement that HFT are able to extract value from the market through their superior access to, processing of and response to information. As such, European Union (“EU”) studies in response to the 2010 London Stock Exchange’s (“LSE”) calls for evidence by the Committee of European Securities Regulators (“CESR”) identified that during 2010 the internal estimates of HFT participation varied between thirty-two to thirty-three (32% - 33%) percent of total UK equities trading. A submission for New York Stock Exchange (“NYSE”) Euronext provided evidence suggesting an overall EU marketplace of five percent (5%) market share as a percentage of total traded

value for HFT participants in the first quarter of 2007, increasing to twenty three percent (23%) of market share in the first quarter of 2010.

2.5 SUMMARY IMPLICATIONS

In summary, the implications for market design changes in the form of algorithmic trading and market fragmentation should be evidence of positive correlation between algo-trading with improved market efficiency through reduction in spreads and improved fairness, with average trade value(s) and volume(s) moving price distributions closer to the mean. This should result in the reduction in intraday volatility with the result of improved market resilience.

2.5.1 Political lifecycles and the implications on market quality

It is a given political party-actors are incentivized to avoid negative news about their activities especially during periods of political lifecycle events such as elections, party congress, and presidential nomination and selection. To the extent that political lifecycles (“events”) asymmetrically increase the cost of releasing and disseminating negative news, it is expected local politicians are more likely to restrict if transitory, the flow of negative information about firms under their control or influence (“province”). Such behaviour would not only affect the fairness and orderliness of the markets, but its resilience to recover from adverse shocks. It is therefore logical to argue that firms with headquarters or primary province within ANC dominated electoral states (“low inverse HHI”) are likely to adopt a self-interest approach, making them reliant on the support of the local politicians “Chefs”, and as such firms are likely to also respond to the incentives created by the politicians in this case ANC

political lifecycles. If these temporary incentives are sufficiently strong, the result should be a reduced flow of negative information in ex-ante political lifecycle events, followed by an increase in the flow of negative information ex-post as previously suppressed information is subsequently released. Such temporary suppression of negative information would generate a distinct shift in stock price crash behaviour around the political lifecycle event if the market were unable to fully unravel the suppression of bad news.

2.5.2 Information asymmetry implications

Regarding information asymmetry ex-ante and ex-post ANC political lifecycles, should make private fundamental information much more valuable, thus increasing adverse selection risks. As such we should expect to observe negative and significant skewness in stock price-based measures of negative information such as excess returns – the stock price crash statistic”. As such, the thesis should be able to capture information effects beyond those contained in economic, accounting, or disclosure data alone. By construction, such stock price measure should capture the net flow of all value relevant, adverse information through all available information channels. It is arguable therefore that the measure should thus reflect news from the full set of information production and dissemination mechanisms and the channels that local politician would need to control to effectively suppress negative information, and in doing so, exert an effect and impact on the quality of a given market leveraging market efficiency, market integrity and market resilience, the proxies for market quality used herein.

2.5.3 Fragmentation and market efficiency and market integrity

A key concern therefore of market fragmentation is their impact on market quality as such venues can limit access to their services and do not have to provide pre-trade transparency. The thesis studies the effects and impact of such market design changes to the quality of the JSE marketplace. Market fragmentation and its impact on market quality is a key consideration for policy formulation, attenuation and informed decision making by the authorities. The motivation for assessing the extent to which fragmentation impact market quality is to inform policy

2.5.4 Market quality implications

Consistent with the Harris, Aitken and Ji (2014) who provide the most recent and in-depth analysis of market quality, employing a three-stage-least squares (“3SLS”) model that incorporates both market integrity and market efficiency - the implication of this is that research cannot simply model either of market integrity or market efficiency independent of the other. This Thesis should therefore provide evidence of the joint effect and impact of electronic trading and market fragmentation on quality of JSE market place ex-ante and ex-post.

Both fairness and efficiency impact one another. As such this should validate and provide clear and unambiguous evidence supporting the view that measuring either of fairness or efficiency in isolation is erroneous, and as such the results findings should show that any increase in market manipulation should lead to a worsening in market efficiency and vice versa (i.e. increase in spreads) explained counter intuitively as a worsening or decline in market efficiency in the top seven liquidity deciles.

Chapter 3: PLURALITY, POLITICAL LIFECYCLES AND MARKET QUALITY

3.1 INTRODUCTION

This paper examines the channels through which political lifecycles matter for market quality (efficiency, integrity and systemic risk) outcomes. As noted earlier, powerful ruling parties often associated with leading the nation's independence and majority rule efforts often characterize African countries. To the extent such parties have presided over economic decline, one open question for financial economists is the need to understand the channels through which such declines set in. On the one hand, having a strong ruling party should provide the benefit of calming concerns associated with political risks. On the other, a powerful ruling party may open the economy to corruption and market uncertainty.

For financial markets globally, there is greater pressure from regulators and investors for more efficient financial markets. The International Organization of Securities Commissions (IOSCO) [2013] principle 35 states that regulation should promote trading transparency. The South African Financial Services Board, the country's financial markets regulator like other IOSCO affiliate members is tasked with investigating measures to improve transparency, efficiency and integrity within the South African financial market and specifically cash equities market. One central consideration is the impact of political uncertainty on market quality (market

efficiency), market integrity and systemic risk. Virtually every major securities regulator in the world including the umbrella International Organization of Securities Commissions (IOSCO), uniformly define their mandates in terms of fairness (integrity) and efficiency (orderliness). In this paper I adopt the IOSCO market efficiency and integrity mandate but extend it to include systemic risk as the definition for market quality. Consequently, when market operators and or regulators change their respective market design that is “technology, regulation, information, instruments or participants” they are generally obliged to justify these changes on the basis that the changes enhance both market efficiency and fairness (market integrity).

Whilst enhancing market quality has always been an important goal, this objective has taken on even greater significance in the wake of direct competition between market venues both nationally and internationally. Whilst market fragmentation is only a recent phenomenon in equities markets, driven by initiatives such as Regulation National Market System (Reg NMS) in North America, the Markets in Financial Instruments Directive (MiFID) in Europe, and Competition in South Africa the international nature of the products traded in commodities markets has meant that competition between markets has always been an issue, although heightened in recent years as a results of international connectivity and communication protocols which mean that distance and time-zones is no longer the issue it used to be.

The paper conducts an empirical experiment to explore the relationship between political uncertainty in South Africa and market quality: that is market efficiency and market. Consistent with Lupu and Riedl (2013) the conjecture is political uncertainty tends to often characterize African countries and tends to be a

defining feature of new and developing democracies, shaping their dynamics in powerful ways. South Africa exhibits two of the three types of political uncertainty Lupu and Riedl detail during tumultuous democratic transitions: (a) regime uncertainty, (b) economic uncertainty, and (c) institutional uncertainty that is regime uncertainty and economic uncertainty and specifically at the provincial level. It is observed South African politicians were forced when building new democratic coalitions to confront economic unpredictability, the evolving contours of political rules, and even the fate of South African democracy itself.

The paper creates a novel political pluralism variable as well as political lifecycle(s) variable to examine the mechanisms through which political regimes channels uncertainty into market quality. Of note is the experiment of effect and impact of pluralism on market efficiency and integrity. The study excludes “institutional uncertainty” based on the reputational strength and integrity of South African judicial and financial markets institutions. South African institutions are amongst the world’s best.

Whilst the concept of uncertainty is not new to political science, this paper narrows its definition to pluralism and focuses its application to financial markets and specifically the two pillars of market quality: market efficiency and market integrity. The paper therefore clarifies the concept of political uncertainty and political pluralism both in general terms and with an eye towards its transmission effect and impact into the financial markets of “dominant political parties” that often lead their democratic nations’ independence and majority rule efforts. The research conceives

of pluralism as a matter of degree, that fluctuates over time and space and as such, it is suggested political uncertainty in the context of pluralism can be encountered in old and new, developed as well as developing and emerging democracies. By focusing on political pluralism, a continuous variable, the research seeks and advances theories of political parties more broadly and its impact on financial market models. It is arguable, the high levels of uncertainty and the variation among developing democracies both highlight the importance of uncertainty to political outcomes and provide useful analytical leverage of spillages or transmission into market quality.

Focusing on this context improves our understanding of political and party behaviour, by uncovering general trends and identifying outcomes that arise under conditions of political pluralism within a developing country. Further, by studying the consequences of political pluralism in developing democracies, implications for the effects of the more circumscribed levels of uncertainty on parties in advanced democracies can be better understood; wherein consistent with our generalized “pluralism” framework, regime change is about political competition and competitors’ policy, economic uncertainty is about outcomes and elites’ ability to respond to them, and institutional uncertainty is about the rules of political interaction and their durability (Lupu and Riedl, 2006). It must be noted however, that the three types of uncertainty overlap and interact; with the result that not all countries experience high levels of all three types simultaneously.

Turning to a theoretical discussion of how pluralism might affect the quality of financial markets, the paper presents and discusses proxies for market efficiency,

market integrity and systemic risk and discuss how political pluralism at both the national and provincial level may impact market quality.

The key hypothesis is that political lifecycles might within a country lacking pluralism i.e. a country that has a dominant political party system, leads to deterioration in market efficiency, market integrity and market resilience. The ***Null Hypothesis*** is that the dominant political party reduces uncertainty and if anything, it can be expected to find improvements in market quality at the national level irrespective of political lifecycles and at the provincial level during political lifecycle events conditioning on pluralism.

To assess the channels or mechanisms through which political lifecycles matter for market efficiency and integrity outcomes, as well as the extent to which such channels matter, the paper models the relationship between market efficient, integrity on one hand and political uncertain, pluralism and control variables. The paper reviews and where applicable lends explanation of findings from theories on a.) information suppression, b.) budget lifecycles and pork barrelling, c.) inertia (supervisory oversight suppression, and d.) corruption and economic cycles.

The paper designs an empirical experiment that examines the mechanisms through which political lifecycles matter for market quality. South Africa presents a suitable experiment as it provides events at the national level, with response variables at the firm and provincial level. The provincial events are equivalent to conditioning on variability of political dominance based on the distribution of national vote i.e. results of provincial elections. The paper creates a measure of pluralism ("**iHHI**"), which is defined as the inverse of the Herfindahl-Hirschman Index

(HHI), a statistical measure of market concentration. Motivation for this measure comes from its use by the United States of America (“USA”) Department of Justice, who employ the HHI for evaluating mergers and acquisitions; a worthwhile endeavour with significant impact for market dynamics and outcomes.

The research focuses on South Africa, as it is particularly well suited for this investigation presenting a good national level (**national**) experiment setting wherein the African National Congress (**ANC**) has enjoyed unassailed support since the first democratic election on 27 April 1994, and thus dominates the national political scene. On the other hand, there exists significantly a lot more political plurality at the provincial level. This setting thus allows us to empirically examine the relationship between political uncertainty and market and, and market integrity at two levels a.) the impact of national political cycles, and b.) the channels through which uncertainty is channelled through provincial plurality. The paper examines the reaction of market efficiency, market integrity and systemic risk proxy variables to national political lifecycle events consisting of national and provincial elections. Whilst it is to be expected to observe generalized national political lifecycle impact on market efficiency, market integrity and systemic risk, in order to obtain a nuanced understanding of the extent to which the dominant party channels uncertainty into market quality conditioning on province plurality, the paper drills down to investigate the variability of provincial political lifecycles and the influence and impact on market efficiency, market integrity and systemic risk variables. The argument is if we find evidence of provincial political events having an impact on market quality and at same time, the impact is concentrated within ANC held provinces, then it can

justifiably be confirmed that political lifecycles in a country that has a dominant political party leads to a deterioration in market quality.

This is the first paper to examine the African context of transitory political incentives and its impact on market quality. The paper highlights the important role that transitory political incentives play in shaping the information flow of listed firms in highly politicized environments. Controlling for the South African government's Black Economic Empowerment (BEE) policy objectives to develop the South African economy and domestic stock market, the research finds South African listed firms are sensitive to acute political incentives during periods of political events, with market efficiency, integrity and systemic risk variables all responding negatively to political lifecycle events within a ninety days ex-ante period as well as within ninety days ex-post. The research presents evidence of a positive relationship (effect) which is statistically significant (impact) between political lifecycles (events) and market efficiency and market integrity at the national, whilst local at the local (province), plurality has a significant impact on both market integrity and market efficiency. The study provides empirical evidence of uncertainty channelling into market quality resulting in detracting in market quality in general (national level) level via political lifecycles and at the provincial level plurality is presents a mechanism through which uncertainty affects market efficiency and market integrity. These results findings are consistent with the theory on suppression as temporary suppression of negative information generates a distinct shift in stock price crash behaviour around the political event ex-ante and ex-post. Spreads widens due to information asymmetry and instance of market misconduct proxied by EOD manipulation and insider trading increases. The negative effect explanation is counter-intuitive as a rise in spreads is

in fact deterioration in market efficiency. For integrity, increases in market misconduct is an undesirable state as it equivalent to unfairness or market misconduct (fraud), whilst increase in systemic risk is self-explanatory, a high-risk measure is perceived a negative in the quality of markets though traders who trade risk might differ.

In summary the research shows that at the national level, political lifecycles have a negative effect with market efficiency, integrity and systemic risk - that is a worsening in its effect and impact. Based on our findings, the higher the plurality, the more efficient the market is likely to be.

3.2 INSTITUTIONAL DETAILS

The South Africa possess a mature capital markets serving the domestic economy as well as the African continent. South Africa operates a harmonized tick sizes across the cash equities market to encourage investors to post limit orders whilst narrow enough to minimize transaction costs. The JSE is the 19th largest global exchange by market capitalization and the largest exchange in Africa. The JSE is the frontline regulator for the exchange, setting and enforcing listing and membership requirements as well as market integrity and trading rules. The Financial Services Board “FSB” has oversight of the JSE exchange. As the financial markets conduct regulator the FSB supervises the JSE regulatory performance operating within a twin peaks model of oversight; wherein prudential supervision is undertaken by the South African Reserve Bank “SARB” and market conduct regulation is undertaken by FSB. In 2013-20014 the World Economic Forum’s Global Competitiveness Survey, ranked

South Africa 1st in the world in terms of regulation of securities exchanges a recognition of the strong markets and regulatory framework and capabilities.

3.2.1 Johannesburg Stock Exchange (JSE)

Formed in 1887 during the first South African gold rush, the Johannesburg Stock Exchange (“JSE”) is Africa’s largest stock exchange by market capitalization. The exchange offers primary and secondary capital markets across a range of securities supported by well-developed regulatory and surveillance capability services. On the African continent, the JSE provides access and exposure to the leading capital markets in South Africa and also the broad African continent. Following the 1947 first legislation covering financial markets, the JSE joined the World Federation of Exchanges in 1963 and upgraded to a full electronic trading system in the early 1990s, and demutualized. The bourse demutualized and listed on its own exchange in 2005. Table 3-1: JSE Market Microstructure, breaks down the five elements of market design - technology, regulation, participants, information and instruments (TRIPI) into the possible market characteristics (column 2). Column 3 provides market design details for the case market JSE.

Figure 3-1: JSE Market Microstructure

Table 3-1: JSE Market Microstructure, breaks down the five elements of market design - technology, regulation, participants, information and instruments (TRIPi) into the possible market characteristics (column 2). Column 3 provides market design details for the case market JSE.

Market Element	Design	Market Design Option	JSE Regulated Market
Technology		Trading platform Surveillance Platform Co-location	<ul style="list-style-type: none"> • Full Board and AltX (Trading 400 securities JSE/FTSE All, FTSE/JSE Africa Index Series All) • Millennium Matching Engine • 13 milliseconds (average) system latency • Co-location is offered (12 May 2014) • Mandatory market surveillance (SMARTS). • JSE and FSB conducts real-time and T+1 market surveillance
Regulatory		SRO regulation National regulation Global commitments	<ul style="list-style-type: none"> • JSE acts as SRO • FSB provides JSE oversight • SARB provides prudential oversight • Member of IOSOC • Member of Exchanges Federation • Primary listings • Secondary listings
Information		Disclosure Transparency	<ul style="list-style-type: none"> • Continuous disclosure by listed companies • Immediate post trade disclosure required • Required disclosure • Depth – 10 Level
Participants		Regulators Exchanges Market Participants (market maker, broker, institutional investor, retail investor, politicians) etc.	<ul style="list-style-type: none"> • FSB, JSE is an SRO • JSE is a RM, Exchange operates ATS, Dark Pool and provides reporting facility for OTC conducted trades • Open and fair access to the platform • Mandatory market making for illiquid stocks
Instruments		Types: equities, futures, derivatives, options, commodities, bonds and foreign exchange Pricing	<ul style="list-style-type: none"> • Full-service exchange • Trading 400 securities JSE/FTSE All • FTSE/JSE Africa Index Series All • FTSE/JSE Top 40 Index

The JSE Market Microstructure breaks down the five elements of market design - technology, regulation, participants, information and instruments (TRIPI) into the possible market characteristics (column 2). Column 3 provides market design details for the case market JSE.

3.2.2 Technology

The JSE operates full electronic trading; implementing the Millennium equities matching engine in July 2013, while at the same time moving the trading system from London to Johannesburg. JSE offer trade execution up to 400 times faster than the previous TradElect system. This change not only supports increased liquidity but also algorithmic trading.

3.2.3 Regulation

The South African cash equities market is regulated by the JSE as a self-regulating organization, which in turn is regulated by the Financial Services Board (FSB) under the Financial Markets Act. National Treasury is an issuer and the ultimate maker of financial sector policy but does not directly regulate the market.

The central aim of securities markets policy is therefore to ensure fair and efficient markets and to protect investors. The market should allow stable, low cost access to liquidity, while the secondary market should have low and stable spreads and minimal market misconduct. The difficulty that regulators face is in mandating the right balance between the competing interests of the government, the liquidity providers (primary dealers), the JSE and the brokers and the investors.

3.2.4 Instruments (Securities)

The JSE index series referred to as the “FTSE/JSE Africa Index Series” operates in partnership with the FTSE Group. As such, the two benchmark indices “FTSE/JSE All Share Index” covers ninety-nine (99%) percent of market capitalization, with the FTSE/JSE Top 40 Index tracks the top listings in a representative spread of sectors. Whilst the larger listings such as British American Tobacco “BAT”, SABMiller, GlencoreXstrata and BHP Billiton account for a large share of the market, the JSE has caters for a diverse variety of offerings with almost 400 companies listed on main exchange board and AltX. South Africa’s interest rate market is the largest on the continent. The majority of South African bonds are issued government and state-owned entities, but the number of corporate bonds issued is growing. The JSE also offers a variety of Bond-based Derivatives, including Bond futures, Forward-rate Agreements, Vanilla Swaps and standard bond options. The aims to attract new bond issuers to the bourse, seeking to partner with other African exchanges with a dual-issuance model. Other securities offered through the JSE include Exchange Traded Derivatives (Futures and Options on Equities, Bonds, Indices, Interest Rates, Currencies and Commodities). As such, the JSE was ranked the 6th largest exchange by number of Single Stock Futures traded and 9th by the number of Currency Derivatives traded in 2012 in the World Federation of Exchanges Annual Derivatives Market Survey.

3.2.5 3.1.4 Market Participants

There are sixty-two (62) equities market participants “members”, one hundred and twenty (120) equity derivatives members, ninety-two (92) commodity

derivatives members and one-hundred and two (102) Interest Rate and Currency Derivatives members licensed who are licensed and operational in South Africa with local and international operations. Most if not all stockbrokers are Black Economic Empowerment¹ (BEE) compliant.

3.2.6 Information

The JSE provides real-time pre-trade (orders) and post trade (trade) information to its members, regulatory entities and general public (delayed). Pre and post trade information is used for research as well as surveillance purposes.

3.2.7 Financial Markets Regulator

The Financial Services Bureau (FSB) is South Africa's financial markets regulator. It is an independent institution, established by statute to oversee the South African non-banking financial services industry in the public interest, and fully funded by fees and levies imposed on this industry. The FSB contributes to the stability of the industry while meeting its mandate of protecting consumers of financial products and services. The FSB has developed and maintained a strong, effective presence in the regulatory field, in South Africa and internationally, while working closely with its counterparts elsewhere in Africa to establish solid regulatory frameworks. In 2011 FSB made pre and post trade market integrity rules common to markets trading in

¹ Black is a generic term that refers to Africans, Asians and coloureds (those of mixed race). For previous discussions on BEE, see, in particular, O.C. Iheduru, 'Black Economic Power and Nation-Building in Post-Apartheid South Africa', *Journal of Modern African Studies*, 42, 1(2004), pp. 1–30; W.M. Gumede, 'Down to Business, but Nothing to Show', in S. Jacobs and R. Calland (eds), *Thabo Mbeki's World* (London, Zed Books, 2002), pp. 201–19; R. Southall, 'The ANC and Black Capitalism in South Africa', *Review of African Political Economy*, 31, 100 (2004), pp. 313–28, and 'Ten Propositions about Black Economic Empowerment in South Africa', *Review of African Political Economy*, 34, 111 (2006), pp. 67–84. See also 'BEE 10 Years On', *Enterprise* (Johannesburg), April 2004, pp. 104–8 for a discussion pertinent to the one presented here.

equity market products listed on the JSE market. The rules aim to deal with markets operating within a fragmented market. The FSB's vision is to promote and maintain a sound financial investment environment in South Africa. The FSB's mission amongst others is to promote the:

- Fair treatment of consumers of financial services and products
- Financial soundness of financial institutions
- Systemic stability of financial services industries; and
- Integrity of financial markets and institutions.

3.2.8 Department of National Treasury

The National Treasury is responsible for managing South Africa's national government finances; supporting efficient and sustainable public financial management which is fundamental to the promotion of economic development, good governance, social progress and a rising standard of living for all South Africans. The Constitution of the Republic (Chapter 13) mandates the National Treasury to ensure transparency, accountability and sound financial controls in the management of public finances. The National Treasury set the confines through which the FSB and JSE operates through the "Financial Services Act² 2012 which came into effect 3 June 2013, repealing and replacing the Securities Services Act, 2004 (the "**SSA**") in its entirety. The Act brings South Africa in line with international norms and standards. National Treasury also noted in a media statement on 28 May 2013 that:

² South African Financial Markets Act, 2012:
<http://www.linklaters.com/Insights/Publication1386Newsletter/Insurance-Update-July-2013/Pages/South-African-Financial-Markets-Act-2012-enters-effect.aspx#sthash.eXESv7Z6.dpuf>

"[the Act will also ensure] that the legislative and regulatory framework is brought in line with the recommendations of international standard setting bodies such as the G20, Financial Stability Board, Basel Committee on Banking Supervision and the International Organisation of Securities Commissions".

3.2.9 The African National Congress

The Republic of South Africa is a parliamentary representative democracy. The President of South Africa serves both as the head of state and head of the government; the president is elected by the National Assembly (the lower house of the South African Parliament). South Africans also elect the provincial legislators, which are responsible for governing each of the country's nine provinces.

The African National Congress (ANC) is the governing party; it has been in power since the transition to democracy in 1994. The ANC was initially founded in 1912 in Bloemfontein with the aim of fighting for the rights of black South Africans. The ANC has dominated the South African political landscape since the 1994 first multi-racial election ex-post the 1993 end of Apartheid. The ANC also holds majority in most of the provinces. The ANC's stated key objective is the creation of a united, non-racial, non-sexist and democratic society. The ANC is in an alliance with the South African Communist Party and the Congress of South African Trade Unions. Each Alliance partner is an independent organization, has its own constitution, membership and programmes.

The Tripartite Alliance is founded on a common commitment to the objectives of the National Democratic Revolution, and the need to unite the largest possible cross-section of South Africans behind those objectives. In our experiment, "political

pluralism and directly the uncertainty transmitted into the markets via “political lifecycles policy uncertainty” can therefore be measured within a typical market microstructure model by assessing the effect and degree of impact of our inverse HHI (pluralism variable) on market quality (efficiency), integrity and systemic risk at both the national and provincial levels.

3.3 METHODOLOGY

3.3.1 Methodology

The study innovates by combining a market microstructure and political uncertainty factors to empirically examine the channels through which dominant political parties impact market quality. The variables (and dummies) chosen to model the experiment are the most suited to measure the effect and impact of plurality on market quality and in so doing provides a framework for regulators to potentially assess market design changes with the aim of improving the quality of financial markets.

The project develops a political “plurality”, a generalized framework to express party-political concentration based on the Herfindahl-Hirschman Index (HHI) concentration. Drawing from the “information asymmetry” hypothesis, the project uses the inverse-HHI (**iHHI**) as a measure of political plurality at each province level and adopts the political lifecycles events i.e. national elections, provincial elections, party congress, party president selection as the channels through which political uncertainty can be channelled into the quality of financial markets that is efficiency and integrity. Included in interaction, is the primary province (“province”) in which the company is head quartered. The variables are selected as they are more likely to

lend explanatory power to market quality. Dummy variables are used in order to gain better insight into the timing of potential of dominant political party actors to channel uncertainty into the quality of financial markets; in the form of risk and uncertainty transmission and information flow ex-ante and ex-post the political lifecycle events of national elections, provincial elections as well as ANC party congress, and party president selection. Market efficiency and market integrity variables are selected based on consistency with studies on market efficiency, market integrity and systemic risk. In the OLS model the variables are logged as required to scale.

Data for the experiment consists of JSE financial market cash equities stock daily statistics and hand coded political lifecycle events and dummies created to assess the impact of pre and post event on market efficiency, integrity and systemic risk. Starting with whole of universe JSE daily trading stocks over the sample period of 2 January 2008 to 15 September 2015, the initial population of consisted of 795,848 daily statistics (date, security and daily stats: price, volume, value) transactions (records). Financial markets daily statistics data from Capital Markets Cooperative Research Centre (CMCRC) Market Quality (MQD) database complemented with the Thomson Reuters Tick History (TRTH) intraday data. Proxies for market quality: efficiency, integrity and systemic risk were derived, and values extracted from the “daily statistics” data. Non trade data was hand-collected and or coded including primary province or head-quarter for each stock, election party in power (national and local province).

With stock province data coding, whilst most of the JSE listed stocks were Gauteng Province based, of the 400 stocks on JSE there exists enough variation in

stock-province matching to allow for classifying most stocks, with the exception of a handful of international listed and headquartered stocks which I classified as province 10 (a control group for our information suppression hypothesis).

All reported and officially released market design technology, regulatory, information, participants and instruments (TRIPI) changes across the sample period with respect to JSE cash equities were hand collected using newspapers, JSE website and FSB website. Election data, ANC party congress and president nomination and selection data, was hand collected and extended with dummy variable data at 30, 60 and 90 days ex-ante and ex-post to form political lifecycle events for assessing the degree of political lifecycles and plurality impact on market quality as well as gauge information suppression hypothesis around political event lifecycles. The political lifecycles data was collected from the South African (SA) elections website and the Official ANC website.

Financial markets transaction data was matched to the political lifecycle events based on the date (trade date and event date). In order to determine the dominance or “lack-of” of political parties I obtain individual political party votes as percentages of the total electoral vote and calculate an inverse of the value which I define as the inverse-HHI (**iHHI**) the “key political plurality” variable. This method is used widely by governments including USA government to determine market concentrations a worth endeavour. As such I therefore compute Plurality (**iHHI**) as the ANC (and other parties) Sum of votes by year divided by the Sum of squared votes for the ANC. The higher the **iHHI** the more plural the political landscape i.e. the less the landscape is dominated by one single political party.

The final data sample for experiment consisted of 468,485 daily, securities, trade and quote data across our sample period restricted to the sample period 2 January 2008 – 15 September 2015. The restriction was due to the market quality database data availability starting 2 January 2008. The final data sample consisted of matched financials and political data points of 468,485 over our sample period after removing stocks that did not continue to trade daily throughout as well as delisted stocks due to any of mergers, acquisitions and or failure.

3.3.2 Proxies

The dissertation uses transaction costs in the form of quoted spreads, effective spreads and realized spreads to proxy for market efficiency, end-of-da-price dislocation and information leakage to proxy for market manipulation and insider trading (market integrity), as well as intraday volatility to proxy for systemic risk. The proxies are computed data based on published JSE daily stats for obtained from Capital Markets Cooperative Research Centre and Thomson Reuters Tick History (TRTH) databases. Published daily stats consist of actual date, security, quote and trade data including date, closing price, volume, value, and order imbalance.

The use EOD price dislocation and information is guided by theory which suggest these measures are simple but elegant measures for the extent to which market manipulation and insider trading exists within a given market.

Quoted spreads, effective spreads and realized spreads present good measures for general costs, provision or supply of liquidity and actual round-trip costs realized respective; they are widely accepted as measures of efficiency. Although, the price distortions generally exist only for a short period of time before the close, their

effects are of great consequence because of the wide usage of “closing prices” in financial modelling and calculations.

For systemic risk the dissertation adopts intraday volatility to gauge how soon the market reverts after a shock. The use of intraday volatility is novel with no general agreement in academia for its use, however, it is commonly used in industry and implied volatility gives a good measure of the return to normalcies post a financial markets event shock.

Consistent with Rolls (1984), the I adopt quoted spreads, effective spreads (Roll 1984, Chordia, Roll and Subrahmanyam, 2008, Aitken, Chen and Foley 2013, Flood et al 2013) and realized spreads (Bessembinder and Venkataraman 2009), as the primary measures of market efficiency³, reporting these metrics as weighted average for all equity market products and a weighted average for my JSE securities samples including portfolios sub samples.

Comerton-Forde and Putnins (2011) suggest that returns, spreads, trading frequencies and return reversals can be used to distinguish manipulated closing prices from those occurring in normal trading. Therefore, the research bases market misconduct proxied by market manipulation measure on standardized measures of the abnormality of these variables and use logistic regression to obtain weights and calculate end-of-day price dislocation as our proxy for market manipulation. Manipulation has a significantly detrimental effect on price accuracy. As such, political pluralism in new democracies such as South Africa transmits through

³ Information Sheet 177 - Quarterly cash Equities market data: methodology and definitions (INFO177)
<https://www.asic.gov.au/asic/asic.nsf/byheadline/Quarterly+cash+equity+market+data+release%3A+Methodology+and+definitions?openDocument>

uncertainty “effects and impacts” on market integrity as proxied by market manipulation using the end-of-day price dislocation.

3.3.3 Plurality Measure (iHHI)

Is a dominant party or large number of parties likely to transmit negative or positive effects on the quality of financial markets?

Consistent with measures of market concentration, I adopt the Herfindahl-Hirschman index (HHI) a commonly accepted measure of market concentration. I calculate HHI by squaring the market share of each political party in South Africa at national and provincial level competing at each of the general elections during the sample period and then summing the resulting numbers. It can range from almost zero to 10,000. In economics, the HHI is a measure of the size of firms in relation to the industry and an indicator of the amount of competition among them. It is named after economists Orris C. Herfindahl and Albert O. Hirschman, it is an economic concept widely applied in competition law, antitrust and also technology management. I compute an inverse measure of HHI index (iHHI) and define this as the “plurality” variable which measures the dominance of the various political parties in South Africa. The higher the Plurality (iHHI) the more plural the political landscape.

To gauge the channels through which potential channelling into the quality of financial markets, I hand collect the events ranging from general and local elections, party president nomination and interact these with plurality. In essence iHHI enables the study to model the effect as well as the degree of impact of dominant political party such as the African National Congress (ANC) at both national and provincially level on market quality pre and ex-ante political lifecycle events.

The study develops a generalized framework to express party-political concentration based on the Herfindahl-Hirschman Index (HHI) concentration. Taking the inverse of HHI (**iHHI**) of the national and province election percentage results for each election and drawing from the “information asymmetry hypothesis, the research uses the inverse “political pluralism as a measure of political uncertainty. With the information asymmetry hypothesis, political uncertainty may present information differences and as such should likely affect the information asymmetries between informed and uninformed investors as a source of fundamental uncertainty (Pasquariello and Zafeiridon (2014)). Intuitively, this would translate to greater political uncertainty i.e. ex-ant ANC political lifecycle events, making private fundamental information much more valuable thus increasing adverse selection risk.

In constructing the pluralism variable, the project gathered elections results data was used to calculate a Herfindahl-Hirschman index (HHI); a commonly accepted measure of market concentration. The HHI was computed by squaring the market share of each political party in the elections and then summing the resulting numbers. It can range from close to zero to 10,000. The project develops a political “plurality”, a generalized framework to express party-political concentration based on the Herfindahl-Hirschman Index (HHI) concentration.

In constructing plurality, the research takes the inverse of HHI of the national and province election percentage results for each election. Drawing from the “information asymmetry” hypothesis, the project uses the **inverse-HHI (iHHI)** as a measure of political plurality at each province level and adopts the political lifecycles events i.e. national elections, provincial elections, party congress, party president selection as the channels through which political uncertainty can be channelled into the quality of financial markets that is efficiency and integrity.

Table 3-1: Political Plurality Measure

Sum of votes by year		EC	FS	GP	KZN	L	M	NW	NC	WC	Regional	National
	2004	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	2009	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	2014	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Sum of squared votes												
	2004	69.1%	85.8%	54.8%	37.3%	90.9%	86.7%	78.5%	62.5%	32.9%	55.6%	46.9%
	2009	56.2%	59.7%	48.8%	49.8%	80.6%	87.6%	63.3%	44.0%	40.3%	51.4%	43.2%
	2014	56.5%	57.0%	41.3%	48.8%	72.3%	76.0%	52.7%	68.0%	49.3%	48.3%	40.4%
Inverse HHI		EC	FS	GP	KZN	L	M	NW	NC	WC	Regional	National
	2004	1.4x	1.2x	1.8x	2.7x	1.1x	1.2x	1.3x	1.6x	3.0x	1.8x	2.1x
	2009	1.8x	1.7x	2.0x	2.0x	1.2x	1.1x	1.6x	2.3x	2.5x	1.9x	2.3x
	2014	1.8x	1.8x	2.4x	2.1x	1.4x	1.3x	1.9x	1.5x	2.0x	2.1x	2.5x

Table 3-1 above presents the national and provincial plurality measures defined as the invers of HHI. Gauteng Province (GP) which takes in Pretoria and Johannesburg are historical ANC strong hold both at the national and provincial level and can be seen by the lower plurality values ranging from 2004-2014 elections. More recently however, there has been some changes to the dominance of GP by the ANC as can be seen by the plurality values in recent years.

By construction, this political pluralism and stock price should in effect measures the net flow of all value relevant, adverse information through all available information channels. The measure should therefore reflect news from the full set of information production and dissemination mechanisms and channels that a local politician would need were they to control and for instance effectively suppress negative information, and in doing so, exert an effect and impact on the quality of a given market leveraging efficiency, integrity and resilience proxies for market quality. Interacting **iHHI** within the 3SLS structured market quality (**integrity and efficiency**) equations provides the means through an empirical assessing of the degree that is the effect and impact of plurality on the quality of JSE financial market.

3.3.4 Other Variables, Dummies and Calculations

Dummy variables are used in order to gain better insight into the information suppression; risk and uncertainty transmission and information flow before and after political lifecycle events. Variables are logged as required to scale.

The Variables and dummies used to model the research is motivated by the need to extend the current market microstructure view of market quality. By combining the market microstructure view with political uncertain, the research not only extends the existing literature on market quality but provides a lens and framework for regulators whose mandate is fair and efficient markets but critically in emerging and/or developing markets. The X-vector variables are therefore motivated by the existing literature on market efficiency and market integrity as well as the need to gauge the capture the channels through which political uncertain may feed into the quality of markets.

The market microstructure data for the X-vector variables comes primary from the financial markets databases provided by CMCRC and TRTH databases of published daily by security. X-vector variables for the research study are constructed for the experiment and include return, price, value, volume, trades, Off market volume, off market value, off market trades. The dummies included in the model enable the study to examine at 30, 60- and 90-days intervals, pre and post political lifecycle events the effect of such events on market quality, enabling the research to assess the degree of impact of the channels through which dominant political parties impact market quality. The dummy variables included in the experiment include: General Elections: GE30 GE60 GE90, Provincial Election: ME30 ME60 ME90, ANC Congress: ANCC30 ANCC60 ANCC90, President nomination / selection: PR30 PR60 PR90) and the **plurality** measures at national and province level consisting of inverse-HHI values for eastern cape (EC), free state (FS), Gauteng (GP), KwaZulu natal (KNZ), Limpopo (LIM), Mpumalanga (MP), North Western (NW), Northern Cape (NC), Western Cape (WC) and National (National). Included in interaction, is the primary province (“province”) in which the company is head quartered. The variables are selected as they are more likely to lend explanatory power to market quality. Dummy variables are used in order to gain better insight into the information suppression; risk and uncertainty transmission and information flow before and after political lifecycle events. Variables are logged as required to scale.

For robustness the model includes Mo Ibrahim⁴ and World Bank measures of development and governance variables. Whilst they present little to no variation

⁴ <http://www.moibrahimfoundation.org/iiag>

throughout the individual year, there is sufficient variation between the years. The robustness variables include political rights, judicial independence, digital connectivity, education system quality, and electricity supply, standard of banks, political violence and servicing debt to expenditure ratio.

3.3.5 Measures of Liquidity

The quoted, effective and realised spreads are calculated from the consolidated best bid and offer and are measured in basis points relative to the midpoint / mid quote. Quoted spreads are measured as time weighted average of quoted spreads throughout the day – a daily average round trip transaction costs of immediately reversing trade.

$$\text{Quoted Spread} = [(Ask - Bid)/m] * 10^4 \quad (3-1)$$

Effective and realized spreads take into account the cost of trading of individual trades benchmarked to the mid-point. Effective spreads measure the transaction costs of a marketable order relative to the current mid-point, while realized spreads measure the profit of the liquidity provider relative to the prevailing mid-quote at t+x minutes.

$$\text{Effective Spread} = 2q[(p_t - m_t)/m_t] * 10^4 \quad (3-2)$$

$$\text{Realized Spread} = 2q[(p_t - m_{t+x})/m_{t+x}] * 10^4 \quad (3-3)$$

In these equations, q indicates the direction of the trade obtained by the Lee and Ready (19910) algorithm (+1) for the buyer initiated, and -1 for the seller initiated. The price p_t is measured at trade time for the effective spread, the midpoint

at the time of the trade, m_t and x minutes post trade time, m_{t+x} , for realised spreads. Both measures are weighted by the trade volume across all trades during regular hours. The dollar depth is calculated as at the time weighted dollar depth available at the best bid and offer. Intraday volatility is measured as the standard deviation and autocorrelation of the midpoint returns at various time intervals for each trading day.

$$\text{Midpoint Return}_t = \ln \frac{m_t}{m_{t-x}} \quad (3-4)$$

$$\text{Intraday Volatility} = \text{stdev}(\text{Midpoint Returns}) \quad (3-5)$$

$$\text{Autocorrelation} = |\text{Corr}(r_{k,t}, r_{k,t-1})| \quad (3-6)$$

3.3.6 Hypothesis Development

Powerful ruling parties are often associated with leading the nation's independence and majority rule efforts often characterize African countries. To the extend such parties presided over economic decline, one open question for the financial economist is the need to understand the channels through which such declines set in. On the one hand, having a strong ruling party should provide the benefit of calming concerns associated with political risks. On the other, a powerful running party may open the economy to corruption and market uncertainty.

Prior research into information suppression shows that politicians and their affiliated firms (i.e., firms operating or headquartered in their province) temporarily suppress negative information in response to political incentives (Piotroski, Wong and Zhang (2014)). I examine the pre and post (30, 60 and 90 days) political lifecycles event comprising of general elections, provincial elections as well as political party

president nomination and conferences to determine whether this is the case in South Africa on the JSE or whether there is a significantly different trend. For politicians, the costs create an incentive for local politicians and their affiliated firms to temporarily restrict the flow of negative information about the companies and hence the market quality at an aggregate level. The result should be fewer market integrity violations and improved market efficiency before the event(s) windows, followed by an increase in market integrity violations and worsening market efficiency after the event(s). Thus, by utilizing an empirical methodology that captures both the suppression and the subsequent release of negative information I examine the extent to which firms and political actors (politicians) shape information and impact the quality of the JSE market. Secondly, the results provide a useful framework for future research seeking to identify the exact channels by which politicians and the listed firms temporarily suppress the net flow of negative information around politically sensitive events, such as a reduction in firm-level disclosures, issuing biased financial reports, self-censorship by the media, direct censorship by the politician, and the adoption of disclosure (e.g., bundling) and/or trading strategies to camouflage negative information, and how these channels of suppression actually work across ownership types and political connection levels of the firms, provinces where the firms operate, and the markets where the firms are listed. Third, given the increased opportunity for investors to purchase shares in both the Johannesburg stock exchange listed firms as well as other politically affiliated firms around the world, understanding the impact of short-term political incentives on the underlying financial reporting and information environment of these listed companies is important to understand. Finally, the research contributes to the nascent literature

on political pluralism and the impact on market quality presenting an African context. The findings are consistent with the predictions of the disagreement hypothesis suggesting that political uncertainty induces speculators who shift their trading activity to the most liquid stocks by magnifying the dispersion of their beliefs prior to political events such as elections.

The NULL Hypothesis is that the dominant political parties reduces uncertainty and if anything, it can be expected to find within such as market improvements in market quality including ex-ante and ex-post political lifecycles events.

Hypothesis (H3-1) *Political uncertainty in a country that has a dominant political party leads to a deterioration in market efficiency and integrity*

Hypothesis (3-NUL) *The dominant political party reduces uncertainty and therefore if anything improvement in market efficient and market integrity*

3.3.7 The Data

The study utilises two unique data sets on political lifecycles and Johannesburg Stock Exchange daily starts matched with political lifecycles and plurality data. With stock province data coding, whilst most of the JSE listed stocks were Gauteng Province based, of the 400 stocks on JSE there exists enough variation in stock-province matching to allow for classifying most stocks, with the exception of a handful of international listed and headquartered stocks which is classified as province 10 (a control group for our information suppression hypothesis). Financial markets transaction data was matched to the political lifecycle events based on the

date (trade date and event date). Individual party votes percentages were calculated and used to calculate the plurality value defined as the inverse-HHI (**iHHI**) the “key political plurality” variable.

Starting with the whole universe of JSE trading stocks over the sample period of 2 January 2008 to 31 December 2015, the initial population consists of 795,848 daily statistics (date, security and daily stats: price, volume, value) transactions (records). Financial markets daily statistics data is obtained from Capital Markets Cooperative Research Centre (“CMCRC”) Market Quality (“MQD”) database complemented with the Thomson Reuters Tick History (“TRTH”) intraday data.

The final sample consists of 468,485 matched daily, securities, trade and quote data across our sample period (2 January 2008 – 15 September 2015). The selection of the sample period is limited due to the market quality database data availability starting 2 January 2008. Removing stocks that did not continue to trade daily throughout and factoring for trading holds and suspensions, as well as delisted stocks due to any of mergers, acquisitions and or failure, the final data sample consists of matched financials and political data points of 468,485 over the sample period. The sample includes only cash equities data and excludes derivatives, exchange traded funds (ETF) and funds. Stocks that traded continuously during the sample period are used. The research filters out zero prices and very high prices >250,00 ZAR (South Africa Rand).

3.4 DESCRIPTIVE STATISTICS

The tables below show the summary statistics associated with the aggregated spread measures on the JSE market across the entire sample period. According to

descriptive statistics, demeaned spreads / transaction costs are approximately distributed. The means and medians suggest all variables are normally distributed.

Table 3-2: Panel A: Summary Statistics for Market Quality Metrics

Variable	Mean	Std. Dev.	Min	Max
On Market Volume (MKT Voi)	673,901	2,532,232	1	725 Million
Trade Count (TC)	79	114	1	441
Quoted Spread (QS)	453.26	1090.33	0.00	20000.00
Effective Spread (ES)	506.48	3338.00	0.71	1815576
Realized Spread (RS)	360.92	9053.43	-5688572	1815576
Price Impact (PI)	120.42	8654.96	-46816	5714286
Fill Rate (FILL)	0.857	0.183	0.000	1.000
Message Traffic (MT)	5188	12103	0	350153
OTT	42	159	0	22500
Volatility (VOL)	0.002	0.008	0.000	1.137
Price	\$4,772.54	\$8,913.23	1.00	\$146,000.00
Total Volume (TOT Vol)	855,334	2,708,288	1	824,000,000
Turnover (TURN)	5 Billion	74 Billion	0	39,000 Billion
Market Cap (MKT CAP)	\$258 Million	\$4,040 Million	0	\$156 Billion
No of stocks = 421				
Quoted Spread are in basis points				
Effective Spread, Realized Spread and Price Impact are dollar-volume weighted (in basis points)				
Sample Period 2 January 2008 – 15 September 2015				

I create dummy variables for each of the political events across the sample period. Table 3.3.4 provides dummy variables are created at 30/60/90 days pre and post political lifecycle events (General Elections: GE30 GE60 GE90, Provincial Election: ME30 ME60 ME90, ANC Congress: ANCC30 ANCC60 ANCC90, President nomination / selection: PR30 PR60 PR90) and the plurality measures at national and province level consisting of inverse-HHI values for Eastern Cape (EC), Free State (FS), Gauteng (GP), KwaZulu Natal (KNZ), Limpopo (LIM), Mpumalanga (MP), North Western (NW), Northern Cape (NC), Western Cape (WC) and National (National). Included in the model for interaction purposes, is the primary province ("province") in which the company is head quartered.

The model interacts the dummy variables with plurality at national and province level to determine the extent to which the dummy events channels uncertainty into market-quality. The dummies used in the experiment including robustness variables are presented. In selecting dummy variables, I am motivated by their ability to lend explanatory power in impacting market quality.

Table 3-3: Dummy Variables

The table below presents the dummy variables used in the model.

Variable	Type	Min	Max	Mean	Median	StdDev
ANCC30	Dummy	0.0000	1.0000	0.0203	0.0000	0.1409
ANCC60	Dummy	0.0000	1.0000	0.0457	0.0000	0.2088
ANCC90	Dummy	0.0000	1.0000	0.0691	0.0000	0.2535
Banking	Control	4.5369	4.6052	4.5752	4.5747	0.0208
Debt2Expenditure	Control	3.7639	4.1059	3.8764	3.8330	0.1141
Education	Control	2.2041	3.3105	2.5790	2.3514	0.4024
Electricity	Control	3.8133	4.0431	3.9449	3.9703	0.0694
GE30	Dummy	0.0000	1.0000	0.0398	0.0000	0.1956
GE60	Dummy	0.0000	1.0000	0.0847	0.0000	0.2784
GE90	Dummy	0.0000	1.0000	0.1294	0.0000	0.3356
IHHI EC	Plurality	1.4904	1.9239	1.8585	1.9239	0.1318
IHHI FS	Plurality	1.4510	1.7647	1.7236	1.7647	0.1074
IHHI G	Plurality	1.8897	1.2478	2.1753	2.1273	0.1635
IHHKZN	Plurality	2.1477	2.6644	2.2132	2.1477	0.1157
IHHI L	Plurality	1.1822	1.5322	1.3351	2.1477	0.1775
IHHI M	Plurality	1.2262	1.5254	1.3005	1.2262	0.1293
IHHI NC	Plurality	1.9565	2.2167	1.7154	1.6832	0.1285
IHHU NW	Plurality	1.4657	1.9072	2.1305	2.2167	0.1285
IHHWC	Plurality	2.0183	3.2426	2.4872	2.5418	0.3435
Judicial Indep	Control	4.4018	4.5454	4.4901	4.5065	0.0506
Judicial Process	Control	4.4224	4.6052	4.4908	4.5065	0.0506
ME30	Dummy	0.0000	1.0000	0.0188	0.0000	0.1360
ME60	Dummy	0.0000	1.0000	0.0415	0.0000	0.1993
ME90	Dummy	0.0000	1.0000	0.0628	0.0000	0.2427
IHHI National	Plurality	1.9194	2.1205	2.0389	2.0274	0.0575
Volume	Control	0.0000	21.6169	4.2667	0.0000	9.4835
PR30	Dummy	0.0000	1.0000	0.0355	0.0000	0.1850
PR60	Dummy	0.0000	1.0000	0.0711	0.0000	0.2570
PR90	Dummy	0.0000	1.0000	0.1080	0.0000	0.3104
Political Rights	Control	4.3858	4.4320	4.4123	4.4176	0.0129
Political Violence	Control	3.3499	4.4320	3.9689	4.0360	0.3546
President	Control	2.0000	4.0000	3.7763	4.0000	0.5754
Price	Control	0.0000	13.8971	6.9700	7.2226	2.0756
Province	Control	1.0000	9.0000	4.8437	3.0000	2.8456
Return	Control	-99.0223	987.1000	0.2319	0.0000	24.9909

Crucially, dummy variables used, provide a lens or better insight into the extent to which the information suppression is prevalent in dominant political powers in and around political event lifecycles ex-ante and ex-post. All variables are logged as required to scale.

Table 3-4: Correlation Matrix

	Return	Price	Volume	Off Market	IHHI EC	IHHI FS	IHHI IG	IHHI KZN	IHHI L	IHHI M	IHHI NW	IHHI NC	IHHI WC	IHHI Nation	Province
Return	1	-0.0065954	0.0008242	-0.0010999	0.0044169	0.004234	0.0013661	-0.0043001	0.0004525	-0.0007355	0.0016252	0.0035257	-0.0021429	0.0019126	0.00019
Price	-0.0065954	1	0.1774063	0.4597147	-0.0171885	-0.0057656	0.0460596	0.0089557	0.0534628	0.0594583	0.0434777	-0.0535303	-0.0375925	0.0403377	0.1021075
Volume	0.0008242	0.1774063	1	0.5073472	-0.024176	-0.0163326	0.0253426	0.018568	0.0328011	0.0401806	0.022919	-0.0447295	-0.0176129	0.0200546	-0.0004254
Off Market	-0.0010999	0.4597147	0.5073472	1	0.0105995	-0.0026501	-0.058167	-0.0010163	-0.0649616	-0.0694536	-0.0556634	0.0560733	0.0497916	-0.0525557	0.0180713
IHHI EC	0.0044169	-0.0171885	-0.024176	0.0105995	1	0.9819607	0.4213029	-0.990528	0.2228665	-0.0431263	0.4765508	0.7114373	-0.5853018	0.5371975	0.0130113
IHHI FS	0.004234	-0.0057656	-0.0163326	-0.0026501	0.9819607	1	0.5851879	-0.998623	0.4031755	0.1465608	0.6341877	0.5657241	-0.7280565	0.6869919	0.0205354
IHHI IG	0.0013661	0.0460596	0.0253426	-0.058167	0.4213029	0.5851879	1	-0.5418426	0.9780043	0.887907	0.9980882	-0.337607	-0.9819341	0.9912704	0.0426956
IHHI KZN	-0.0043001	0.0089557	0.018568	-0.0010163	-0.990528	-0.998623	-0.5418426	1	-0.3546132	-0.0944657	-0.5927536	-0.6082032	0.6910919	-0.6479252	-0.0185224
IHHI L	0.0004525	0.0534628	0.0328011	-0.0649616	0.2228665	0.4031755	0.9780043	-0.3546132	1	0.9643306	0.9632427	-0.5265192	-0.9208668	0.941966	0.042901
IHHI M	-0.0007355	0.0594583	0.0401806	-0.0694536	-0.0431263	0.1465608	0.887907	-0.0944657	0.9643306	1	0.8577771	-0.7327774	-0.7848193	0.8195044	0.0404339
IHHI NW	0.0016252	0.0434777	0.022919	-0.0556634	0.4765508	0.6341877	0.9980882	-0.5927536	0.9632427	0.8577771	1	-0.2787841	-0.991752	0.9975241	0.0422748
IHHI NC	0.0035257	-0.0535303	-0.0447295	0.0560733	0.7114373	0.5657241	-0.337607	-0.6082032	-0.5265192	-0.7327774	-0.2787841	1	0.1533947	-0.2105563	-0.0195794
IHHI WC	-0.0021429	-0.0375925	-0.0176129	0.0497916	-0.5853018	-0.7280565	-0.9819341	0.6910919	-0.9208668	-0.7848193	-0.991752	0.1533947	1	-0.9983103	-0.0408859
IHHI Nation	0.0019126	0.0403377	0.0200546	-0.0525557	0.5371975	0.6869919	0.9912704	-0.6479252	0.941966	0.8195044	0.9975241	-0.2105563	-0.9983103	1	0.0415994
Province	0.00019	0.1021075	-0.0004254	0.0180713	0.0130113	0.0205354	0.0426956	-0.0185224	0.042901	0.0404339	0.0422748	-0.0195794	-0.0408859	0.0415994	1

The number of trades and off market trades do not lend much in explanatory power in our model so are dropped. I also drop “value” and “off market value” as they are highly correlated with “volume and off market volume”. The research returns “volume and off market volume” as they are likely to contain signal strength much more than value.

3.5 SPECIFICATION

3.5.1 Specification Test

To ensure the specified models satisfy the assumptions of the ordinary least squared regression (OLS), a model specification test is performed based on the conditional moment (CM test) by Cameron and Pravin (1990a), residual analysis plot, a Heteroskedasticity test (White 1980), testing the restriction on the conditional variance function, and a test of symmetry of the distribution testing the restriction on the third moment of the distribution. Since the error term is unobservable, the project proxies the error term by the residuals of the regression and plot graphs of the residuals, and residuals vs. fitted values. There does not appear to be any discernible patterns between residuals and fitted values for effective spreads and variance ratio - Table 3-5 Panels A, B, C, D, E, F for the residuals vs. fitted values.

3.5.2 Model Specification

I create six linear regression model equations are developed and used to examine the impact of plurality and political lifecycles on market quality. I used as dependent variable(s) price, value, on-market volume and off-market volume as they provide lit market and dark market information content. I surmise off-market trades, (volume and value) contain information readily impounded into prices in the lit market based on the concept informed (uninformed) traders being more (less) likely to take advantage of their information asymmetries in the dark (lit). I include control variables which included economic development, education system quality, telecommunication connectivity, quality of bank system obtained from the World Bank development indicators and quality of governance from Mo Ibrahim Foundation as well as the dummies to ex-ante and ex-post general elections:

- General Elections: GE30 GE60 GE90
- Provincial Election: ME30 ME60 ME90
- ANC Congress: ANCC30 ANCC60 ANCC90
- President nomination (selection): PR30 PR60 PR90

Together with the plurality measures at national and province level consisting of inverse-HHI values for:

- eastern cape (EC)
- Free State (FS)
- Gauteng (GP)
- KwaZulu Natal (KNZ)
- Limpopo (LIM)
- Mpumalanga (MP)
- North Western (NW)
- Northern Cape (NC)
- Western Cape (WC), and
- National.

I include in the model for interaction purposes, the primary province (“province”) in which the company is head quartered as well as provincial elections, party conferences.

Similar to Foley and Putnins (2013) who examine dark trading in Canadian financial markets, I construct a set of linear models; regressing market efficiency (proxied by

transaction costs and short term volatility) on a vector of independent (per security per day / market) control variables, plurality, and the exogenous event dummy for political events taking the value 0 before and 1 after event window plus a disturbance term. I incorporate security fixed effects and use OLS to estimate the impact of plurality (political party dominance) short term volatility, market efficiency and market integrity confident the model(s) has/have credible causality effects on market efficiency, market integrity and short-term volatility. I conjecture political events attenuates the influence of trader venue choice, as well as order transmission, when and when not to trade decisions factoring in private and non-private information. It is therefore reasonable to conclude changes in transaction costs and liquidity are driven by the channels through which plurality prevails in the market devoid of other confounding market design changes during in and around the political events.

Figure 3-1. Model Specification: Plurality, Political Lifecycles Impact on Market Quality

The following model examine the extent to which plurality, primary province and political events dummies impact market efficiency, market integrity and systemic risk. The study uses OLS regression model and examine the B-OLS (*OLS Estimates, Standard Errors, t-statistic and p-value*). The sample consist of 468,485 matched stocks and political events data over the sample period 2 January 2008 –15 September 2015.

$$Y = \alpha + Price * \beta_1 + Volume * \beta_2 + Value * \beta_3 + Plurality * \beta_4 \quad (3-7)$$

$$+ Province * \beta_5 + \sum_{i=1}^n Dummies * \gamma_i + \varepsilon$$

The OLS regressions is run on transaction costs 1.) Quoted spreads, 2.) Effective spreads, 3.) Realized spreads), 4.) Market manipulation (EOD), 5.) insider trading (information leakage) and 6.) Systemic risk (volatility) using the above model with β_1 and γ_i being OLS estimates. The

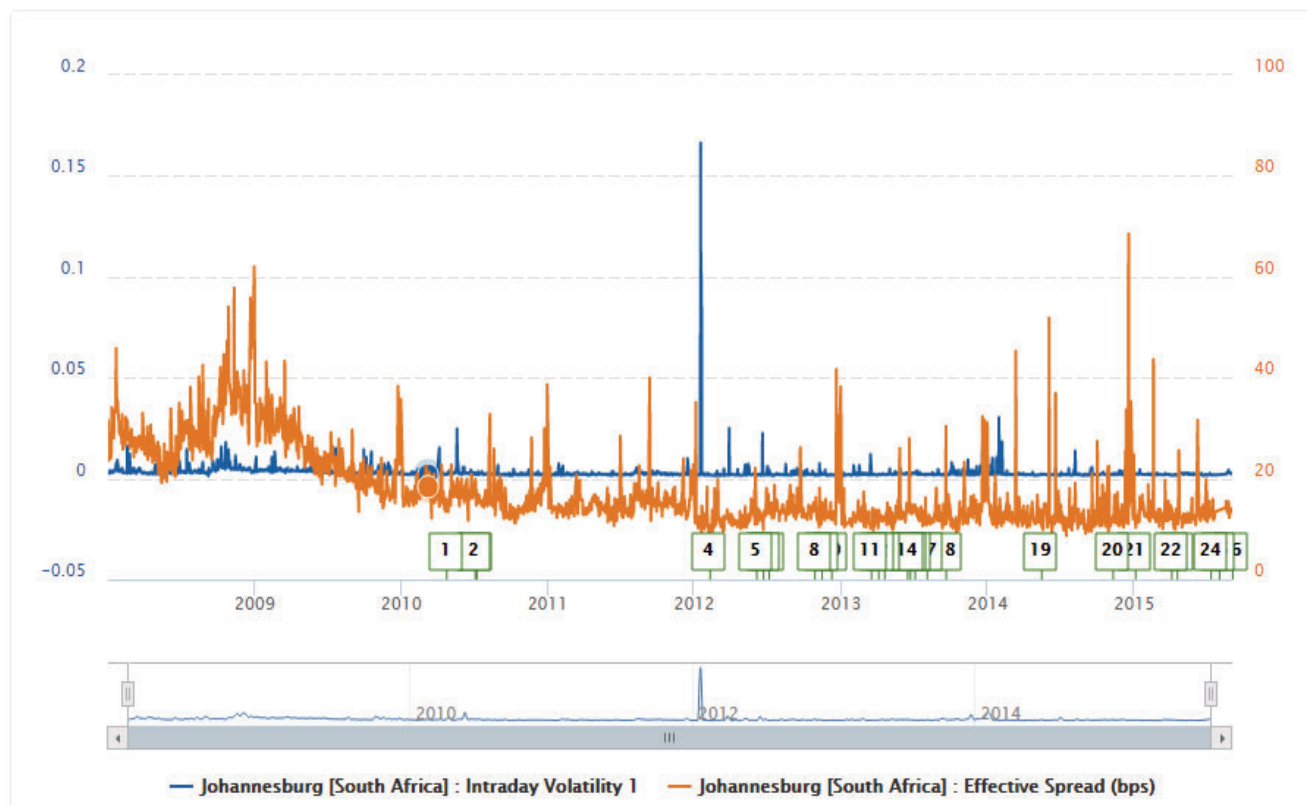
market efficiency proxied by effective spreads provides a good indication of the round-trip transaction for passive and aggressive trades. This is more likely to measure the effect of the plurality on venue selection and transmission decisions as it captures the costs of providing liquidity and demanding liquidity factoring price movements (changes) and market impact (size) during political events. To control for stock and macro variation which drives spreads and volatility I control for stock-based effects and macro effects. This includes the VIX as a measure for macro volatility, an intra-day trading ranges measure for intraday volatility, volume weighted average price (closing price), block trades and dollar volume trades. The model explains the regressands (quoted spreads, effective spreads and realized spreads) as unchanging linear functions of the regressors (price, volume, value, plurality and province) together with the dummies for political events. Market Efficiency is proxied by transaction costs variables of quoted spreads, effective spreads and realized spreads. The proxies are good measures of general market efficiency (quoted spreads), cost of supplying liquidity (effective spreads) and actual realized profits (realized spreads) respectively. The model does not contain any obvious missing or irrelevant variables and the distribution from which the residuals are drawn has mean zero.

3.5.3 Plots

I present the following plots to provide visual context on the general trends for instance the increases in spreads and instances of misconduct and systemic risk which increases are pronounced around the political events across the sample space. This observation provides non-empirical evidence of the causality link of political lifecycle events conditioned on plurality. As such it gives an initial view and impression of the impact plurality on market efficiency, integrity and systemic risk confirming the events captured in the dummies are

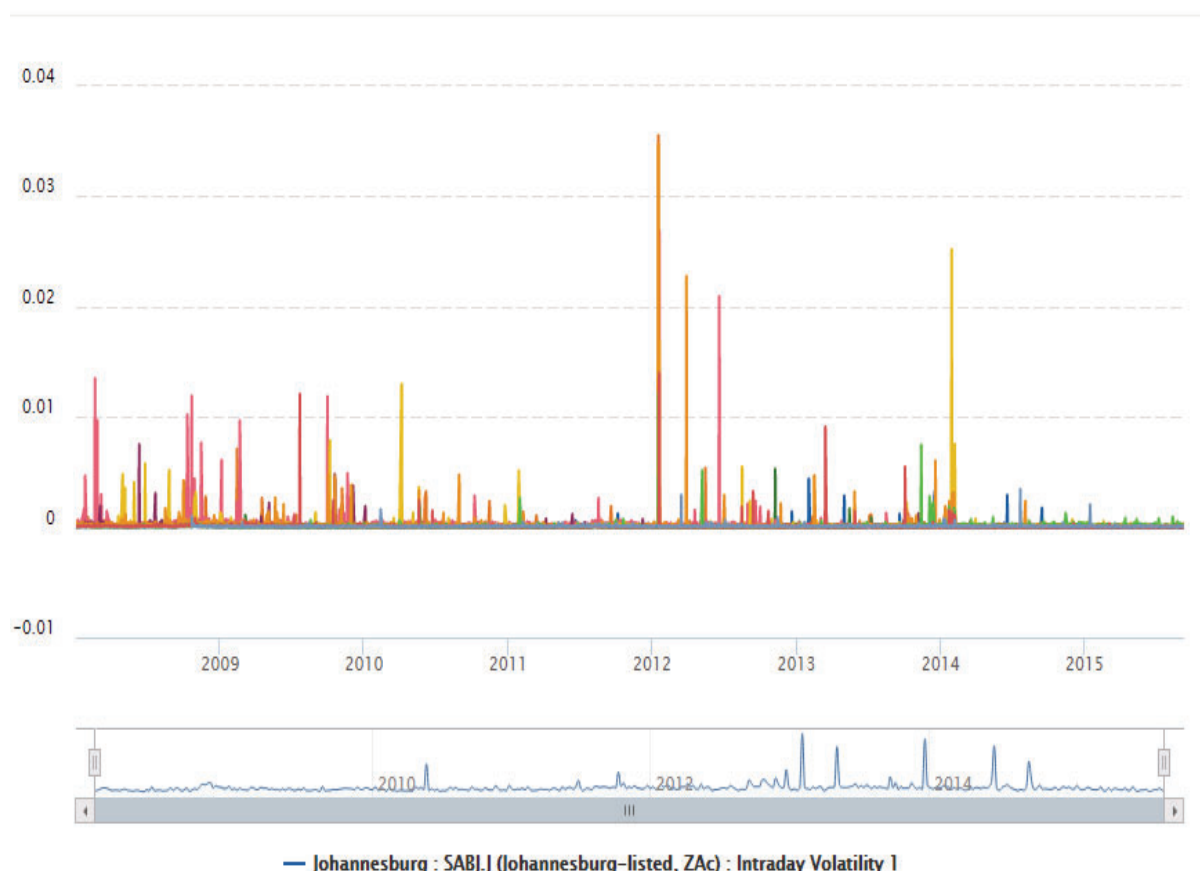
some of the mechanisms / channels through which dominant political parties may channel uncertainty into market quality consistent with the research hypothesis that dominant political parties have a negative effect on market quality and political lifecycle events seem to act as the channels or effect.

Figure 3-2 Transaction Costs (quoted and effective spreads)



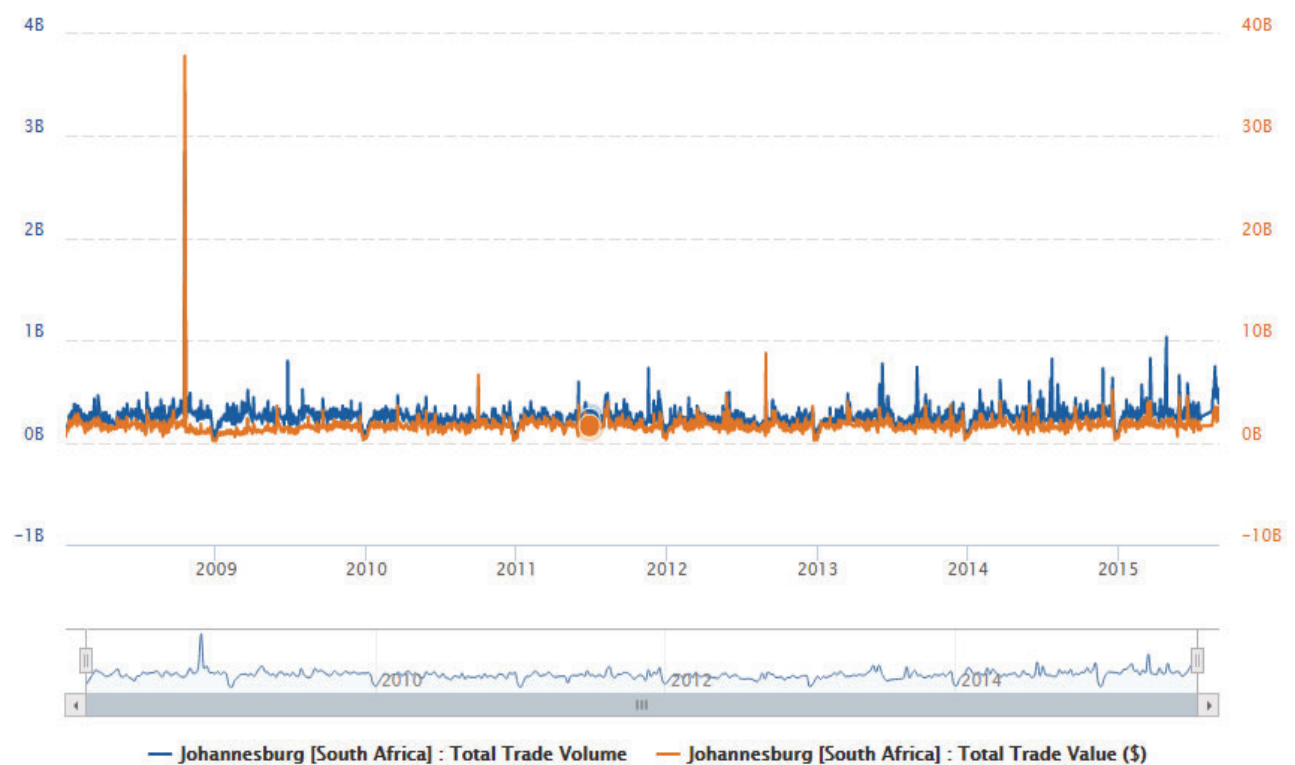
Across our sample period, transaction costs have generally trended downwards, indicating an overall improvement in the efficiency of the JSE marketplace. This trend is occasionally interrupted by political lifecycle events

Figure 3-3: Intraday Volatility



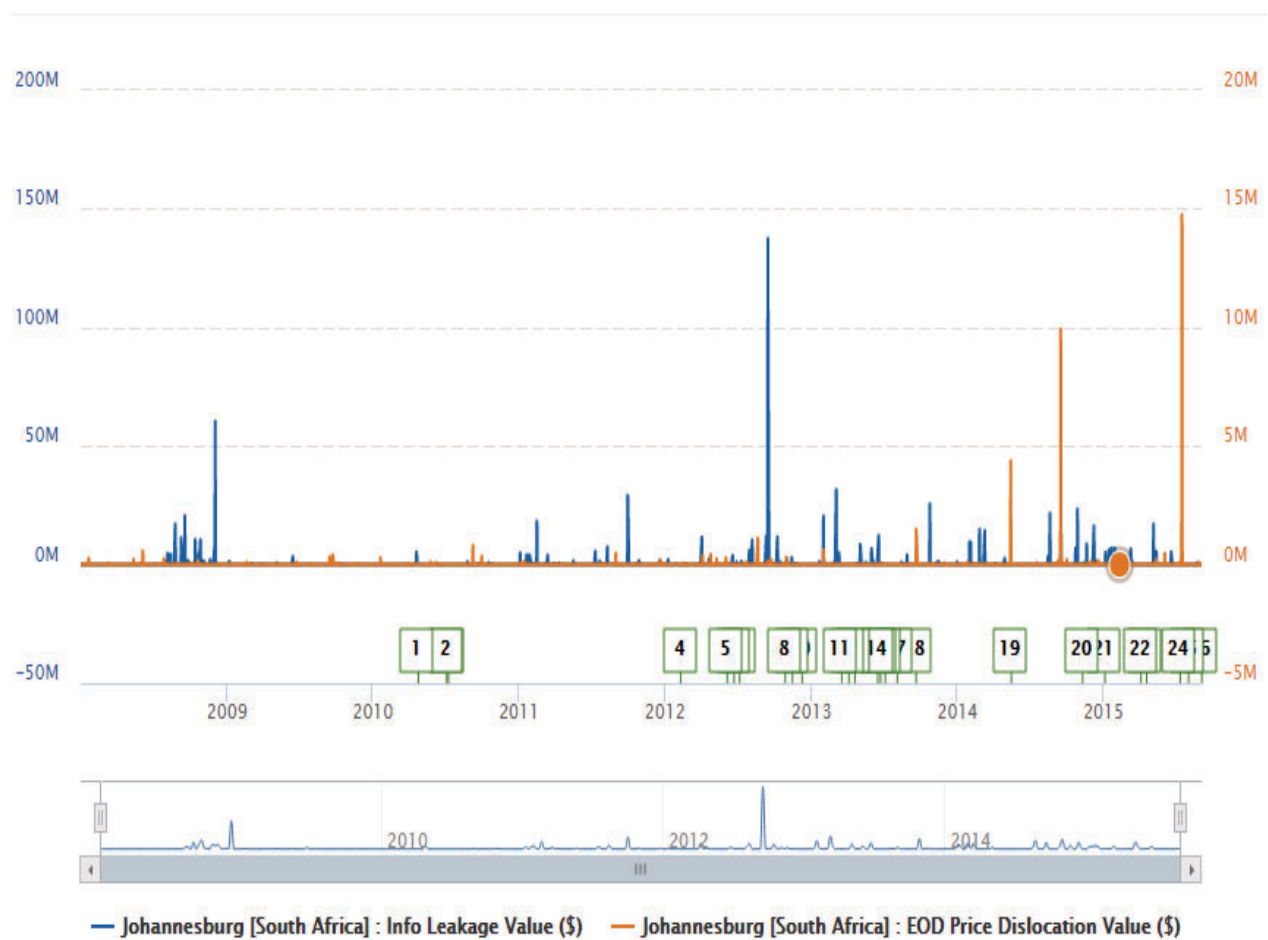
Plotting the time series intraday volatility, there is evidence of spikes across the sample period. When the data (dummies) are overlaid across the plots, it can be seen the spikes across the sample period are found within the 90 days of the political lifecycle events ex-ante and ex-post.

Figure 3-4: Trade Volume



Across the sample period, trade volumes exhibit a gradual improvement, though this trend is not reflected in value turnover (measured in USA dollars). On 19 January 2012, there was large spike on JSE. The paper is able to offer possible explanation based on 10 stocks that listed on that day. The stocks were BILJ, AGLJ, BTIJ, SABJ, SOLJ, MTNJ, IMPJ, NPNJn, SBKJ and CFRJ.

Figure 3-5: Information Leakage vs. EOD

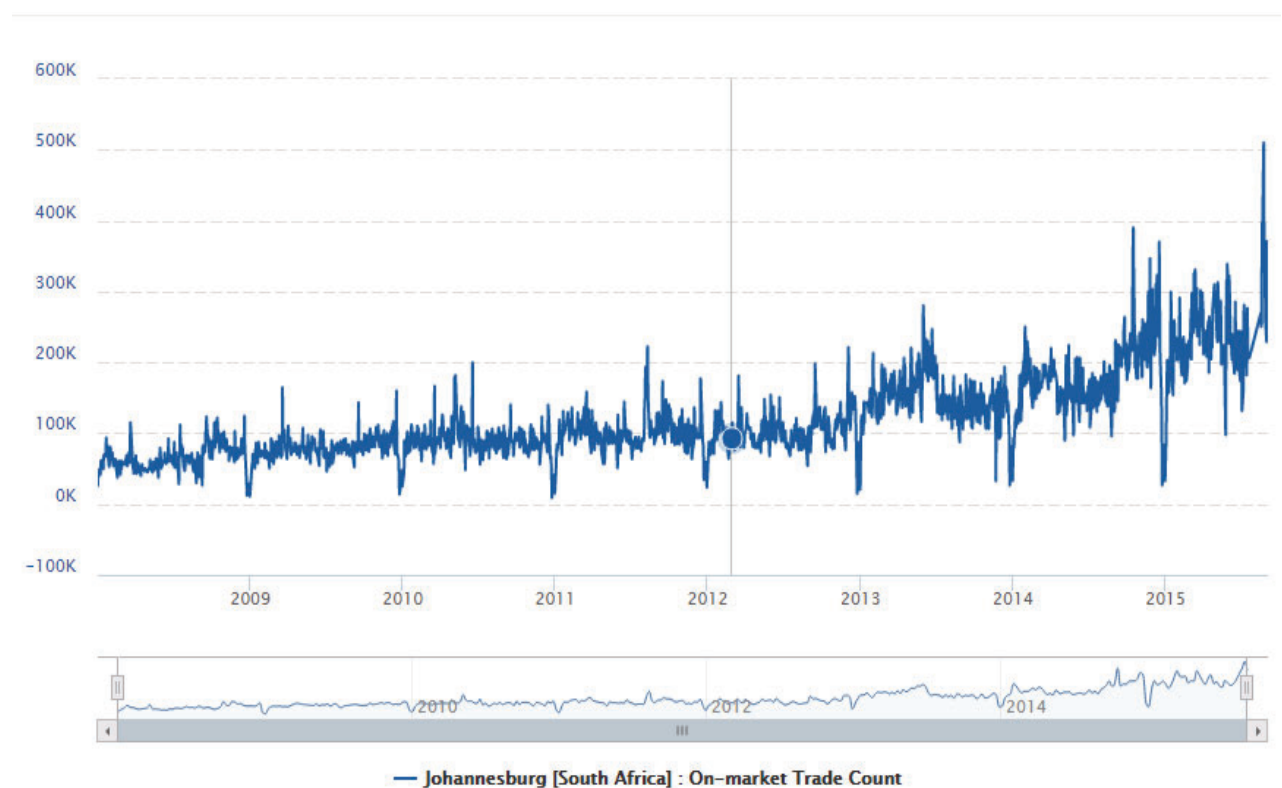


Charting the history of information leakage and end-of-day price dislocation provides a means of quantifying / measuring the **dollar value cost** of market misconduct. There is evidence of spikes for both EOD and Information leakage throughout our sample period. In 2009 pre and post general and provincial elections and again in 2014 there were significant spikes, indicating evidence of market manipulation in and around elections (political lifecycle events).

Modelling market misconduct and market efficiency requires resolving the possible cross equations cross correlation in order to get the true extend of the impact of integrity on market efficiency. That said, it is clear market misconduct causes markets to be inefficient and costs the country and economy in terms of resource allocation inefficiencies.

Figure 3-6: On Market trade count

Generally, on market trade count having been trending upwards, whilst total trade value and volumes have remained consistent.



To ensure the specified models satisfy the assumptions of the ordinary least squared regression (OLS), a model specification test is performed based on the conditional moment (CM test) by Cameron and Pravin (1990a), residual analysis plot, a Heteroskedasticity test (White 1980), testing the restriction on the conditional variance function, and a test of symmetry of the distribution testing the restriction on the third moment of the distribution. Since the error term is unobservable, the project proxies the error term by the residuals of

the regression and plot graphs of the residuals, and residuals vs. fitted values. There does not appear to be any discernible patterns between residuals and fitted values for effective spreads and variance ratio - Table 4 Panels A, B, C, D, E, F for the residuals vs. fitted values.

Table 3-5: Fitted Values and Residuals

The sample period is for 2 January 2008 to 15 September 2015. To be included in the sample, a JSE stock must have traded been actively quoted throughout the sample period. The sample period spans 2 general elections, municipal elections and 2 president nominations and 2 presidents.

Panel A: Quoted Spreads

	Quoted Spreads (Y)	Fitted Value (Yhat)	Residuals (e-temp)
Min	0.0027	6.9059	-16.3446
Max	198.9347	26.6904	194.1861
Mean	4.2146	4.2146	0.0000
Median	1.2010	3.9918	-0.9449
Range	198.9320	33.5963	210.5307
StdDev	10.1424	4.8705	8.8965

Panel B: Effective Spreads

	Effective Spreads (Y)	Fitted Value (Yhat)	Residuals (e-temp)
Min	0.0000	-5.9603	-19.2738
Max	199.9972	20.9466	197.3551
Mean	3.2553	3.2552	0.0000
Median	0.6690	3.0676	-0.7668
Range	199.9972	26.9069	216.6290
StdDev	9.0770	3.8922	8.2001

Panel C: Realised Spreads

	Realized Spreads (Y)	Fitted Value (Yhat)	Residuals (e-temp)
Min	-150.0000	-76.2675	138.8050
Max	683.2840	682.8700	683.0800
Mean	2.0466	2.0647	0.0000
Median	0.2330	2.0083	-0.2169
Range	14572.0000	14572.0000	14570.0000
StdDev	203.7869	4.1461	203.7446

Panel D: Volatility (Systemic Risk)

	Volatility (Y)	Fitted Value (Yhat)	Residuals (e-temp)
Min	0.0000	-0.0007	-0.0009
Max	1.7117	0.0090	1.7098
Mean	0.0036	0.0036	-0.0050
Median	0.0021	0.0035	-0.0010
Range	1.7117	0.0098	1.7188
StdDev	0.0107	0.0014	0.0160

Panel E: End of Day Price Dislocation

	EOD Dislocation (Y)	Fitted Value (Yhat)	Residuals (e-temp)
Min	0.0000	-25813.0000	-34437.0000
Max	298822876.0000	34437.0000	29881000.0000
Mean	5261.0000	5262.6000	-0.0007
Median	0.0000	5133.3000	-5139.9000
Range	298822876.0000	60249.0000	298840000.0000
StdDev	893870.0000	0.0014	893940.0000

Panel F: Information Leakage

	Information Leakage (Y)	Fitted Value (Yhat)	Residuals (e-temp)
Min	0.0000	-12681000.0000	-10937000.0000
Max	8752000000.0000	10937000.0000	87544000000.0000
Mean	1631800.0000	1631800.0000	0.0000
Median	0.0000	1595800.0000	-1592300.0000
Range	9855200000.0000	23618000.0000	87555000000.0000
StdDev	202320000.0000	2877500.0000	202300000.0000

Panels A, B, C, D, E and F reports the summary statistics associated with the aggregated transaction costs (quoted, effective and realized spreads), market manipulation (end of day price dislocation), insider trading (information leakage) measures on JSE sample stock across the entire sample period. According to descriptive statistics, transaction costs, market manipulation, insider trading and systemic risk are approximately distributed.

3.6 RESULTS

The model does not seem to contain any obvious missing or irrelevant variables and the distribution from which the residuals are drawn has mean zero. It satisfies the zero conditional mean assumption of the OLS estimator consequently the OLS estimators are unbiased and consistent. The research therefore uses OLS to estimate the beta estimates and explain the results findings. The study reports OLS Estimates, using standard errors, t-statistic and p-value in our regression tables. The research presents evidence of a decline in overall market quality that is across all the elements of market quality - efficiency, integrity and systemic risk), at the national and provincial level within ninety days pre and post-political events as well as in general during the year of elections (Table 3-4:8).

Table 3-6: Impact of Plurality on Market Efficient (proxied by transaction costs)

Panel A: Quoted Spreads $Y = \alpha + \text{Price} * \beta_1 + \text{Volume} * \beta_2 + \text{Value} * \beta_3 + \text{Plurality} * \beta_4 +$ Primary Province * $\beta_5 + \varepsilon$						
OLS Estimates	α	β_1	β_2	β_3	β_4	β_5
Estimates	24.8881	-2.6413	-1.3001	0.6003	1.1685	-0.1889
S.E.	0.4639	0.0824	0.0843	0.0823	0.2310	0.0051
t-Statistic	53.6465	-32.0442	-15.4270	7.2900	5.0590	-36.7766
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Confidence						
Intervals	α	β_1	β_2	β_3	β_4	β_5
Lower bound	25.6489	-2.5061	-1.1618	0.7354	1.5473	-0.1805
upper bound	24.1272	-2.7764	-1.4383	0.4653	0.7897	-0.1973
R ²	0.2306					
Adjusted R ²	0.2306					

In **Panel A** above present evidences showing plurality has a positive relationship quoted spreads. This can be explained as “ANC political lifecycles nationally exerts a negative transmission effect and impact on quoted spread (JSE general transaction cost measure). The higher the political concentration the higher the plurality; whilst political dominance in percentage terms results in a lower plurality. As an example, plurality measures of over ninety percent (90+%) percent dominance by a single party is equivalent to 1.00 inverse-HHI. The less political-parties concentration the more efficient the market is likely to be. The project findings are boosted by the fact that the province variable has a negative relationship with market efficiency (quoted spreads), suggesting that with dominance of strong political parties in this case the ANC, the effect and impact on market efficiency is negative. The project

examines this finding by incorporating the plurality variable at the provincial level incorporating our inverse-HHI for Eastern Cape (EC), Free State (FS), Gauteng (G) and KwaZulu Natal (KZN).

Panel B: Provincial Level Plurality

					iHHH	Province *	iHHI KZN
	α	Price * β_1	Vol * β_2	Val * β_3	National * β_4	β_5	* β_6
Estimates	9.9057	-2.6269	-1.2839	0.5800	5.7694	-0.1885	2.5710
S.E	0.8341	0.0823	0.0842	0.0823	0.3262	0.0051	0.1056
t-Statistic	11.8759	-31.9003	-15.2508	7.0501	17.6883	-36.7063	24.3573
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Confidence							iHHI KZN
Intervals	α	β_1	β_2	β_3	β_4	β_5	* β_6
Lower bound	11.2736	-2.4919	-1.1458	0.7149	6.3043	-0.1800	2.7441
upper bound	8.5378	-2.7620	-1.4219	0.4451	5.2345	-0.1969	2.3979
R ²	0.2315						
Adjusted R ²	0.2315						

In **Panel B**, presents evidence of positive relationship at national and provincial levels (our plurality measure); in effect a negative effect and impact on market quality (quoted spreads) for at national and provinces within powerful political dominance (ANC held provinces). The summary is the ANC is bad for financial markets.

Panel C: Effects of Political Events ninety days pre and post political events

Panel A: Quote Spreads $Y = \alpha + \text{Price} * \beta_1 + \text{Volume} * \beta_2 + \text{Value} * \beta_3 + \text{Plurality} * \beta_4 + \text{Primary Province} * \beta_5 + \text{GE} * \gamma_1 + \text{ME} * \gamma_2 + \text{PR} * \gamma_3 + \text{ANCC} * \gamma_4 + \varepsilon$

Dummies: OLS										
Estimates	α	β_1	β_2	β_3	β_4	β_5	$\gamma_1(\text{GE})$	$\gamma_2(\text{ME})$	$\gamma_3(\text{PR})$	$\gamma_4(\text{ANCC})$
Estimates	17.3197	-2.6259	-1.2929	0.5891	4.8441	-0.1894	-0.3339	-0.2484	1.4796	-0.0832*
S.E	0.5710	0.0825	0.0843	0.0824	0.2887	0.0051	0.0514	0.0492	0.0569	0.0531
t-Statistic	30.3337	-31.8372	-15.3306	7.1480	16.7814	-36.8905	-6.4988	-5.0516	26.0213	-1.5665
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1172
Confidence										
Intervals	α	β_1	β_2	β_3	β_4	β_5	$\gamma_1(\text{GE})$	$\gamma_2(\text{ME})$	$\gamma_3(\text{PR})$	$\gamma_4(\text{ANCC})$
Lower bound	18.2561	-2.4907	-1.1546	0.7242	5.3175	-0.1810	-0.2496	-0.1677	1.5729	0.0039
upper bound	16.3833	-2.7612	-1.4312	0.4539	4.3707	-0.1979	-0.4181	-0.3290	1.3864	-0.1703
R-squared	0.2306									
Adjusted R-squared	0.2306									

Incorporating dummies for political lifecycle events consisting of general elections (GE90), municipal/provincial elections (ME90), president nomination (PR90) and ANC congress (ANCC90) allow us to capture the effects of such events on the efficiency of the JSE. It can be seen GE90, ME90 and ANCC90 have negative impact on efficiency using quoted spreads. This can be explained in terms of uncertainty. ANCC90 effect is significant at 10 significance level.

Table 3-7: The effect of plurality on effective spreads

Effective Spreads $Y = \alpha + \text{Price} * \beta_1 + \text{Volume} * \beta_2 + \text{Value} * \beta_3 + \text{Plurality} * \beta_4 + \text{Primary Province} * \beta_5 + \text{GE} * \gamma_1 + \text{ME} * \gamma_2 + \text{PR} * \gamma_3 + \text{ANCC} * \gamma_4 + \varepsilon$

Panel A: Effects of Political Events 90 days before and after

Dummies: OLS										
Estimates	α	β_1	β_2	β_3	β_4	β_5	$\gamma_1(\text{GE})$	$\gamma_2(\text{ME})$	$\gamma_3(\text{PR})$	$\gamma_4(\text{ANCC})$
Estimates	14.2244	-2.2967	-1.1826	0.6519	3.4835	-0.1404	-0.0155	-0.3316	0.8975	0.0808
S.E	0.5232	0.0737	0.0759	0.0737	0.2639	0.0046	0.0466	0.0453	0.0526	0.0488
t-Statistic	27.1876	-31.1803	-15.5773	8.8437	13.2019	-30.3609	-0.3321	-7.3256	17.0493	1.6564
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.7398	0.0000	0.0000	0.0976

Confidence Intervals	α	β_1	β_2	β_3	β_4	β_5	$\gamma_1(\text{GE})$	$\gamma_2(\text{ME})$	$\gamma_3(\text{PR})$	$\gamma_4(\text{ANCC})$
Lower bound	15.0825	-2.1759	-1.0581	0.7728	3.9163	-0.1328	0.0610	-0.2573	0.9838	0.1608
upper bound	13.3664	-2.4175	-1.3071	0.5310	3.0508	-0.1480	-0.0919	-0.4058	0.8112	0.0008
R-squared	0.1839									
Adjusted R-squared	0.1839									

For effective spreads, the market seems to have factored in the presidential nominations (PR90) as well as congress (ANCC90) 90 days either side of the political events. ANCC90 is significant at 10 significant levels.

Panel B: National and Provincial Plurality effect on Effective Spreads

$$\text{Effective Spreads} = Y = \alpha + \text{Price} * \beta_1 + \text{Volume} * \beta_2 + \text{Value} * \beta_3 + \text{Plurality} * \beta_4 + \text{Primary Province} * \beta_5$$

Panel B: Effects of Plurality and Stock Primary Province on Effective Spreads

							iHHI KZN
	α	β_1	β_2	β_3	β_4	β_5	* β_6
Estimates	7.0670	-2.2978	-1.1769	0.6457	4.9907	-0.1398	1.9061
S.E	0.7617	0.0735	0.0758	0.0736	0.2971	0.0046	0.0983
t-Statistic	9.2775	-31.2564	-15.5357	8.7783	16.7954	-30.2424	19.3986
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Confidence							iHHI KZN
Intervals	α	β_1	β_2	β_3	β_4	β_5	* β_6
Lower							
bound	8.3162	-2.1772	-1.0526	0.7664	5.4780	-0.1322	2.0673
upper							
bound	5.8177	-2.4183	-1.3011	0.5251	4.5034	-0.1474	1.7450
R-squared	0.1836						
Adjusted							
R-squared	0.1836						

The table for effective spreads presents similar results as found for quoted spreads: Incorporating dummies for political lifecycle events consisting of general elections (GE90), municipal/provincial elections (ME90), president nomination (PR90) and ANC congress (ANCC90) allow us to capture the effects of such events on the efficiency of the JSE. It can be seen GE90, ME90 and ANCC90 have negative impact on efficiency using effective

Table 3-8: Effect and impact of plurality on Realised Spreads

Dummies: OLS										
Estimates	α	β_1	β_2	β_3	β_4	β_5	$\Upsilon_1(\text{GE})$	$\Upsilon_2(\text{ME})$	$\Upsilon_3(\text{PR})$	$\Upsilon_4(\text{ANCC})$
Estimates	16.0224	-9.1493	-8.9948	7.9478	3.5092	-0.1035	-2.7304	0.0871	2.1470	-0.3086
S.E	3.8718	7.2659	7.9421	7.4629	0.4722	0.0186	2.7048	0.1024	1.4129	0.0959
t-Statistic	4.1383	-1.2592	-1.1325	1.0650	7.4315	-5.5722	-1.0095	0.8505	1.5196	-3.2191
p-value	0.0000	0.2080	0.2574	0.2869	0.0000	0.0000	0.3128	0.3951	0.1286	0.0013
Confidence Intervals	α	β_1	β_2	β_3	β_4	β_5	$\Upsilon_1(\text{GE})$	$\Upsilon_2(\text{ME})$	$\Upsilon_3(\text{PR})$	$\Upsilon_4(\text{ANCC})$
Lower bound	22.3720	2.7669	4.0303	20.1870	4.2837	-0.0730	1.7055	0.2551	4.4642	-0.1514
Upper bound	9.6727	-21.0654	-22.0199	-4.2914	2.7348	-0.1339	-7.1663	-0.0809	-0.1702	-0.4659
R-squared	0.0004									
Adjusted R-squared	0.0004									

Our model has the least explanatory power for realised spreads. One possible explanation is the fact that realised spreads measure what investor actually make, which is less likely to be affected by uncertainty from political events as effective spreads and general quoted spreads which are anticipatory.

Table 3-9: Impact of Plurality on systemic risk

Dummies: OLS										
Estimates	α	β_1	β_2	β_3	β_4	β_5	$\gamma_1(\text{GE})$	$\gamma_2(\text{ME})$	$\gamma_3(\text{PR})$	$\gamma_4(\text{ANCC})$
Estimates	0.0116	-0.0008	-0.0002	0.0002	-0.0016	-0.0001	-0.0001	-0.0005	0.0013	-0.0003
S.E	0.0007	0.0001	0.0001	0.0001	0.0004	0.0000	0.0001	0.0000	0.0001	0.0001
t-Statistic	15.7170	-12.4484	-3.6027	3.2442	-4.2014	-14.1051	-1.1465	-9.6125	22.2016	-6.4734
p-value	0.0000	0.0000	0.0003	0.0012	0.0000	0.0000	0.2516	0.0000	0.0000	0.0000
Confidence Intervals	α	β_1	β_2	β_3	β_4	β_5	$\gamma_1(\text{GE})$	$\gamma_2(\text{ME})$	$\gamma_3(\text{PR})$	$\gamma_4(\text{ANCC})$
Lower bound	0.0128	-0.0007	-0.0001	0.0003	-0.0010	-0.0001	0.0000	-0.0004	0.0014	-0.0003
upper bound	0.0104	-0.0009	-0.0003	0.0001	-0.0022	-0.0001	-0.0002	-0.0005	0.0012	-0.0004
R-squared	0.0161									
Adjusted R-squared	0.0161									

Party conference, general elections and provincial elections have a negative effect and impact on systemic risk.

Table 3-10: End of Day Price Dislocation: Market Integrity

Dummies: OLS										Y ₄ (ANC
Estimates	α	β_1	β_2	β_3	β_4	β_5	Y ₁ (GE)	Y ₂ (ME)	Y ₃ (PR)	C)
										-
										7653.81
Estimates	255390.0978	867.5140	1919.1628	-385.5352	-133844.5182	771.4687	5067.9671	-7956.0144	-8081.7763	83
										2233.32
S.E	96152.3481	678.9070	985.4232	884.3315	49963.2060	596.7039	3604.2369	2335.7991	7478.9834	34
t-Statistic	2.6561	1.2778	1.9476	-0.4360	-2.6789	1.2929	1.4061	-3.4061	-1.0806	-3.4271
p-value	0.0079	0.2013	0.0515	0.6629	0.0074	0.1961	0.1597	0.0007	0.2799	0.0006

										$\Upsilon_4(\text{ANC})$
Confidence Intervals	α	β_1	β_2	β_3	β_4	β_5	$\Upsilon_1(\text{GE})$	$\Upsilon_2(\text{ME})$	$\Upsilon_3(\text{PR})$	C)
										-
										3991.16
Lower bound	413079.9486	1980.9215	3535.2569	1064.7685	-51904.8604	1750.0631	10978.9156	-4125.3039	4183.7565	80
										-
										11316.4
upper bound	97700.2469	-245.8935	303.0687	-1835.8389	-215784.1759	-207.1258	-842.9814	-11786.7250	-20347.3092	687
R-squared	0.0001									
Adjusted R-squared	0.0001									

During the sample period, it can be observed, EOD is negatively impacted by political lifecycle events of presidential selection, party president selection, nomination at ninety days ex-ante and ex-post. The results are statistically significant.

Table 3-11: The effect of plurality on insider trading (information leakage)

Dummies:										
OLS Estimates	α	β_1	β_2	β_3	β_4	β_5	$\gamma_1(\text{GE})$	$\gamma_2(\text{ME})$	$\gamma_3(\text{PR})$	$\gamma_4(\text{ANCC})$
										932924.8
Estimates	-29595763.7769	1490270.9805	1597708.9550	-782697.7167	8702162.1028	-253040.9958	-2660502.4447	-924216.0932	3123702.2583	134
										1132851.
S.E	9837520.5111	397378.7218	419246.6487	289288.0553	4832670.0789	171644.3640	868824.3394	408574.6768	1557183.5926	0103
t-Statistic	-3.0085	3.7503	3.8109	-2.7056	1.8007	-1.4742	-3.0622	-2.2620	2.0060	0.8235
p-value	0.0026	0.0002	0.0001	0.0068	0.0718	0.1404	0.0022	0.0237	0.0449	0.4102

Confidence										
Intervals	α	β_1	β_2	β_3	β_4	β_5	$\Upsilon_1(\text{GE})$	$\Upsilon_2(\text{ME})$	$\Upsilon_3(\text{PR})$	$\Upsilon_4(\text{ANCC})$
					16627741.032					2790800.
Lower bound	-13462230.1387	2141972.0843	2285273.4588	-308265.3059	2	28455.7610	-1235630.5281	-254153.6233	5677483.3501	4703
										-
										924950.8
upper bound	-45729297.4151	838569.8767	910144.4512	-1257130.1274	776583.1735	-534537.7527	-4085374.3612	-1594278.5631	569921.1664	435
R-squared	0.0002									
Adjusted R-										
squared	0.0002									

Primary province, general elections and provincial elections exert negative effect and impact (economically significant on insider trading.

3.7 CONCLUSION

Market Integrity as proxied by insider trading (information leakage) and market manipulation (EOD) can increase significantly ninety days ex-ante and ex-post political lifecycles. An increase in information leakage suggests increased fraudulent trading using material but non-public information. An increase in market misconduct results in increased costs of trading as effective and realised spreads increase to cater for the adverse selection. The research provides evidence of both market efficiency and market integrity and thus market quality detraction on the Johannesburg during national and provincial elections. It is important to note the detraction in market quality is closely associated with the dummies representing 90, 60 and 30-day windows ex-ante the political event. Pluralism is the key determinant for transmission of uncertainty in the market with political lifecycles the means through which transmission is affected. In explaining the research findings, it is important to consider but discounts the potential impact of market design changes (*technology, regulatory, information, market participants and instruments/securities*) introduced during the election year and leading up to elections as lending possible higher explanatory power than political plurality. None are able to explain the increase (decreases) in transaction costs (market quality), and increase (decreased) in misconduct (market integrity). Our findings are consistent with the predictions of the disagreement hypothesis suggesting that political uncertainty induces speculators who shift their trading activity to the most liquid stocks by magnifying the dispersion of their beliefs prior to political events such as elections. Additionally, intraday volatility increases during election years supporting the notion of uncertainty being unresolved pre-election with resolution at least six months ex-post

elections (political lifecycles event). The results are consistent and robust to using a wide range of models, controls and specifications.

The research contribution is non the less important in developing new insights into the dimension of opacity, the suppression of information even if only negative information, not explored in prior research yet maps strongly into the prevailing preferences of politicians. The research extends the work of Piotroski, Wong and Zhang (2014) by utilizing an empirical methodology that captures both the suppression and the subsequent release of negative information to baseline the extent to which firms and political actors (politicians) shape information and impact the quality of the JSE market. Secondly, the results provide a useful framework for future research seeking to identify the exact channels by which politicians and the listed firms temporarily suppress the net flow of negative information around politically sensitive events, such as a reduction in firm-level disclosures, issuing biased financial reports, self-censorship by the media, direct censorship by the politician, and the adoption of disclosure (e.g., bundling) and/or trading strategies to camouflage negative information, and how these channels of suppression actually work across ownership types and political connection levels of the firms, provinces where the firms operate, and the markets where the firms are listed. Third, given the increased opportunity for investors to purchase shares in both the Johannesburg stock exchange listed firms as well as other politically affiliated firms around the world, understanding the impact of short-term political incentives on the underlying financial reporting and information environment of these listed companies is important to understand. Finally, the research contributes to the nascent literature on political pluralism and the impact on market quality presenting an African context. The findings are consistent with the predictions of the disagreement hypothesis suggesting that

political uncertainty induces speculators who shift their trading activity to the most liquid stocks by magnifying the dispersion of their beliefs prior to political events such as elections.

3.8 RECOMMENDATION

There is clear evidence of increased in EOD and insider trading as well as widening of spreads (transaction costs) within a period of 90-60- and 30-days ex-ante. Ex-post the reverse is observed with instances of market manipulation and insider trading decreasing as certainty returns to the market and any information previously withheld is released and impounded into stock prices. Political pluralism is important for the quality of financial markets. The research presents evidence showing that political lifecycles within a country that has a dominant political party leads to a deterioration in market efficiency and market integrity. Whilst the null hypothesis was that a dominant political party reduces uncertainty and if anything, it would be expected to find improvements in market efficiency, market integrity and systemic risk during political lifecycle events” conditional on plurality, the research found evidence to the contrary. The paper offers a possible explanation of this finding of information suppression and suppression theory around political lifecycles channelling uncertainty into financial markets. South Africa presented a well-suited experiment for the investigation; at the national level, the African National Congress (ANC) has enjoyed unassailed support since the first democratic election on 27 April 1994, and thus dominates the national political scene, whilst on the provincial level, there exists significantly a lot more political plurality at the provincial level. Such a setting enabled us to examine the relationship between political uncertainty and market quality at the national and provincial level including 30/60/90 ex-ante and ex-post political lifecycle events. The paper presents evidence of a decline in market efficiency, integrity and systemic at the national ex-ante and ex-post ANC

elections and during the year of elections pre and post. Significant increases in instances of end of day price dislocation (EOD) and information leakage (the proxies for market manipulation and insider trading (IT) respectively), consistent with fraudulent trading including for IT using material but non-public information selectively disclosed to “select” traders (investors and brokers) is observed. The results are consistent and robust to using a wide range of models, controls and specifications.

The findings from this study using South Africa JSE market is that dominant political powers tend to leverage political events such as elections and party officials’ conferences thereby impacting market quality. This finding can be generalised to similar markets where entrenched parties dominate politically across Africa (ruling parties are entrenched since nations independence), Asia and Central Europe and Russia. The findings from chapter three leads to the recommendation that due to the increased instances in insider trading and market manipulation on the market, additional regulatory resources for realigning the markets through strong market supervision and enforcement is a must.

Deep, liquid, fair and efficient financial market is a key condition for economic growth based on the role of primary and secondary markets to direct investments into companies needing investments, a second recommendation is for strengthening the regulatory institutions to enable stronger market surveillance, disclosure and reporting.

Additionally, a third recommendation is for strong enforcement for companies involved in information suppression during political lifecycle events. A final recommendation is to implement a public register with ministerial code of conduction to ensure political stakeholders are not involved in stock ownership specifically of companies in the regions or provinces in which they (political stakeholders) are domiciled.

Chapter 4: HIGH FREQUENCY TRADING, IMPACT ON JSE MARKET FAIRNESS

Over the last two centuries, technological advantages have allowed some traders to trade much quicker than others based on superior technology investments. One such technology is high frequency trading often in co-location; on 12 May 2014 the Johannesburg Stock Exchange (JSE) launched co-location, a technology environment which allows the exchange's clients to place their trading equipment in the exchange data centre allowing for the fastest access to all JSE markets.

The chapter examines the effect and impact of HFT market design change on the fairness of the JSE market for cash equities. On one hand, there are studies which have examined and provided evidence of positive HFT impact on the efficiency of financial markets; HFT improves average trade value and volume and moves price distributions closer to the mean. On the other hand, it is conceivable HFT order-flow can be toxic when it adversely selects market makers, who may be unaware they may be providing liquidity at a loss. Within that context, HFT has raised the ire of public attention partly fuelled by the U.S. 6th of May 2010 flash-crash as well as the large increases in trading volumes of HFT strategies. This research models the determinants of HFT participation in the form of order to trade ration (OTT) ex ante and ex post co-location and the OTT (HFT) as an instrument variable and to examine the relationship between high frequency trading and market integrity. It must be noted that in scenario where market efficiency and integrity are cross equation correlated,

the result of improved efficiency based on limited information asymmetry needs to be clear and precise. HFT should improve both efficiency and integrity and potentially reduce intraday volatility (market resilience).

The research provides up-to-date analysis and evidence of the impact of HFT on market fairness. The study is relevant for informed decision making for both regulatory and for efficient technology market design debate; from an exchange, buy/sell side and investors perspective, HFT is a technology market design change that could be argued has unequal fairness. The research adopts an empirical event study based on the exogenous shock event of co-location introduced on the Johannesburg Stock Exchange on 12 May 2014. The market design change was introduced in a single non-staggered approach thus enables for a single empirical lens-view study of the impact of HFT on the fairness of the Johannesburg Stock Exchange for cash equities with respect to automated and speed-based trading solutions delivery. There is no arguing HFT is an important factor in markets that are driven by sophisticated technology impacting all layers of the trading value chain, however discussions on the effect and impact of HFT on the fairness of markets, often tend to lack sufficient and precise information as to the extent of their participation in the marketplace together with evidence of the impact on market quality. As such, this gap between the results of academic research on HFT and its perceived impact on markets in the public, media and regulatory discussions motivates this study.

4.1 INSTITUTIONAL DETAILS

South Africa operates harmonised tick sizes across markets to encourage investors to post limit orders whilst narrow enough to minimise transaction costs. In 2014 South Africa Regulator (FSB) approved Johannesburg Stock Exchange (JSE) co-location market design

change now common to leading western financial markets trading in cash equity market products. The market design change aims to deal markets operating within a competitive and fragmenting marketplace The JSE is a multi-asset class securities exchange, offering investors liquidity across its product range. The JSE provides a.) a primary market – sourcing issuers to list and supporting potential and existing issuers, b.) a secondary market that facilitates trading in cash equities, financial derivatives, commodity derivatives and currency derivatives and interest rate instruments. Other services include c.) post-trade services – Through a division responsible for clearing, settlement and assurance, d.) technology services – that support the JSE’s operations; and e.) information services, including market data. The JSE also acts as a self-regulatory organisation (SRO), it also regulates the primary and secondary markets, whilst the JSE’s risk management structures guards against systemic risk to which the Exchange and investors might otherwise be exposed. The JSE is licensed to operate under the Financial Markets Act, 19 of 2012. The exchange has a market capitalisation of Rand 14 271 billion and has over companies listed with 76 foreign-domiciled companies. According to the World Federation of Exchanges the JSE is one of the top 20 global exchanges by market capitalisation and is ranked 1 in the in the World Economic Forum Global Competitiveness Report based on the strength of auditing and reporting standards, protection of minority shareholders’ rights, and financing through the local equity market. JSE SA market is ranked 2 on the financial services meeting business needs and soundness of banks; and ranked 3 on the efficiency of corporate boards and regulation of securities. The JSE is Africa’s largest exchange by market capitalisation and accounts for eighty percent (80%) market liquidity: (2015: 67%).

A unique OTC / Dark Pools situation existed in South Africa with a number of South African companies able to internalise / issue shares and facilitate trading in the over-the-

counter (OTC) market using often unregulated OTC platforms. As the OTC market expanded, the FSB recognised a need for greater regulation to protect shareholders and ensure a fair, orderly and transparent marketplace for Issuers. The FSB determined that all operators of unregulated OTC platforms must cease operating or apply to become licenced exchanges under the FMA. Board Notice 68 of 2014 reaffirmed the view of the Registrar that operators of exchange infrastructure should be licenced and that a proliferation of exchanges should not be allowed. This has caused significant upheaval in the market, for both Issuers as well as shareholders. As a result of the regulatory amendments a substantial number of OTC companies are now in breach of the FMA. Faced with significant potential penalties under the FMA these companies have either stopped operating their OTC platforms or applied for extensions from the FSB, whilst searching for an alternative to unregulated OTC platforms.

The regulatory framework that governs JSE and ZAR X (as well as the other licensed but not trading exchanges) as Self-Regulatory Organisation (SRO) and the compliance obligations of ZAR X Market Participants comprises the Financial Markets Act, 2012, ZAR X Rules and Procedures and the Financial Intelligence Centre Act, 2001. The regulatory activities undertaken by JSE and ZAR X Market Regulation division include the monitoring of trading on own market to identify possible market abuse and oversight of the market for JSE cash equities stocks as well as the market participant's compliance with their regulatory obligations. Financial Service Board (FSB) FSB is an independent institution, established by statute to oversee the South African non-banking financial services industry in the public interest, and fully funded by fees and levies imposed on this industry. A member of IOSCO and International Exchanges Federation, FSB has contributed to the stability of the financial markets industry while meeting its mandate of fair and orderly market as well as protecting consumers of financial products and services. The FSB has developed and maintained a

strong, effective presence in the regulatory field, in South Africa and internationally, while working closely with its counterparts elsewhere in Africa to establish solid regulatory frameworks. The FSB has oversight of primary and secondary listings in South Africa.

4.2 HYPOTHESIS

Tick sizes are a transmission mechanism for trade decisions, impacting traders' transaction costs and order transmission decisions. Given a competitive fragmented market, where pressures and incentives from market operators abound in attempt to undercut the tick sizes on competing markets to offer execution priority, transaction costs and order transmission decisions should influence the choice of market for trade execution. However, South Africa operates a harmonised tick sizes across markets to encourage investors to post limit orders while narrow enough to minimise transaction costs.

A majority of prior research in market in high frequency trading (HFT) a form of algorithmic trading has tended to examine the impact these new market design changes on market efficiency often citing liquidity, depth and price discovery. More recent, a nascent literature has been developed on market integrity and market quality. To that extent, sparse estimates of the effect and impact of HFT within financial markets varies from increased evidence of the size and impact of HFT liquidity provision but relies on noisy proxies. Jarnećić and Snape (2010) find that forty to sixty (40-60%) of trades include HFT participation on at least one side in their 2009 LSE study. In the LSE's 2010 response to the Committee of European Securities Regulators (CESR call for evidence, the LSE identified that during 2010 their internal estimates of HFT participation ranged between 32-33%. Whilst the estimates of HFT participation in the market varies significant, the move to co-location within major financial markets globally has seen the rise in HFT participation within markets. However,

researchers agree that HFT are able to extract value from the market through the superior access to processing and response to information. This study examines the extent to which HFT participation impacts market integrity, by examining the relationship between proxies for market manipulation (EOD) and insider trading (IT). The research attempts to present evidence of that impact in the form of dollar value cost of market manipulation and insider trading in the South African JSE market.

I conjecture co-location and specifically HFT, has a similar effect to widening tick sizes where by wider tick sizes places greater importance on time priority, making attempts to step ahead more expensive. Within a given marketplace, HFT should have the effect of improving both market efficiency and integrity due to the cross-equation correlation between efficiency and market integrity. HFT should also improve average trade value(s) and volume(s) and move price distributions closer to the mean, thus reducing intraday volatility. There, the JSE co-location implementation (a HFT) enabling market design change should therefore lead to lower information asymmetry, narrow bid / ask spreads and therefore transaction costs for transactions market wide / public (lit) market time priority order, where such order have no information asymmetry advantages to trade more profitability in the dark. Therefore, the research conjecture overall market efficiency should improve (lower transaction costs) supported by migration into the pre-trade transparent JSE Co-location lit market.

Empirically, the thesis conducts an event study examining ex-ante and ex post effect (in basis points) and impact of HFT the integrity of JSE. The experiment uses the introduction of co-location as the event 0 window and proxies market manipulation with EOD.

Hypothesis 4-1: Market fairness proxied by market manipulation (EOD) improve ex-post co-location implementation.

Hypothesis 4-2: Market efficiency proxied by effective spreads improve post co-location implementation.

Hypothesis 4-3: General transaction costs (quoted spreads) do not increase pre and post event period.

Hypothesis 4-4: Total and average daily stock volumes in lit market increase as uninformed trades execute more in the lit market. Additionally, the average daily off market trades decrease post event.

The research uses EOD to proxy for market fairness and effective spreads to proxy for market efficiency. The research conjectures co-location is both a driver and enabler for competition and market quality. The South African Financial Markets Regulator – The Financial Services Board (FSB) approved co-location market design change in the South African market for cash equities for pre- transparency exception order-book submission on 12 May 2014. The market design change was geared to exert downward pressure on transaction costs and market misconduct in the JSE pre- trade transparency public market. The co-location market design change was the first such technology-event in South Africa but followed on post similar market design changes in Australia (ASX), Canada (TSX), London (LSE) markets which implemented similar market design changes between 2010 and 2013. The effect of co-location should thus manifest through narrow transaction costs as well as short horizon (intraday) volatility proxies commonly used for market efficiency and reduced market manipulation proxied by EOD price dislocation.

To the extent co-location aimed to exert downward (upward) pressure on lit (dark) transaction costs, the paper examines the extent to which the market design changes ex-post impacts market manipulation. The research constructs an empirical event-study experiment

to examine ex-post market liquidity, short-term volatility, transaction costs and market manipulation in an attempt to identify venue (lit / dark) order transmission decisions. Consistent with Roll (1984) quoted spreads are used to examine the roles of trader in providing (demanding) liquidity. Consistent with the literature on bid ask spreads components, the research confirms quoted spreads in the context of co-location, are more of a general measure of transaction costs, whereas effective spreads reflect traders' decisions in providing and demanding liquidity. This view conclude, is consistent with generally accepted theory by Glosten and Milgrom (1994) that informed traders are more (less) likely to achieve profit (loss) in dark (lit) venues where superior information asymmetries offers better returns. The research thus argues this should result in uninformed order-flow into (out of) lit (dark) venues post co-location market design rule implementation which should be evidence by volume, value in lit market improvement. Examining the impact of the exogenous shock on short term volatility (variance ratio) examining the extent to which on-market dollar value and off-market dollar value incorporates information into variance ratio. Finally, the research examines the results in the context of supporting the efficacy of FSB approval of JSE co-location on market quality.

4.3 THE DATA

This sections summaries the data and metrics used in the research. The research uses full order book Thomson Reuters Tick History (TRTH) JSE quote and trade data from the Securities Industry Research Centre of the Asia Pacific (SIRCA)'s Reuters Tick History (TRTH) across the sample period 1 November 2013 to 30 November 2014. Research argue transaction costs are a larger component of overall trading and changes positive (negative) are reflected in trading outcomes immediately. To the extent transaction costs temper trading behaviour

(venue selection and transmission decisions), a twelve-month sample period consisting of two sub-sample periods of six months ex-ante and ex-post JSE co-location event, should be sufficient a period to examine the nature and document the long run effect of co-location implementation and HFT participation.

In arriving at the sample stocks, the research filters securities ensuring only securities that traded daily throughout the sample period. The project constructs metrics and extract data for each metric, examining desirable estimation properties of the metrics. Table provides a summary of the data for each of the constructed metric. The JSE did not implement the technology market design change in a security-staggered fashion to enable cause and effect testing of the new technology market design change on market fairness as well as efficiency due to the HFT cross equation correlation with efficiency and integrity. In attempt at establishing causality, the research leverages the Capital Markets Cooperative Research Centre Framework's to document and review market design changes across technology, regulatory instruments, participants and instruments (TRIPI) and prove causality. Whilst it is difficult to isolate the effects of purely co-location technology market design change from other effects of concurrent confounding events such as technology, other regulation, information, market participants, and instruments (TRIPI⁵), with the need to show co-location (HFT) caused decrease (increase) in market efficiency, market integrity and short-term volatility. The research documents and controls for all market design changes that took place across the JSE lit and dark markets during the sample period and control for these changes.

⁵ Capital Markets Cooperative Research Centre Market Quality TRIPI model - www.cmrcrcc.com

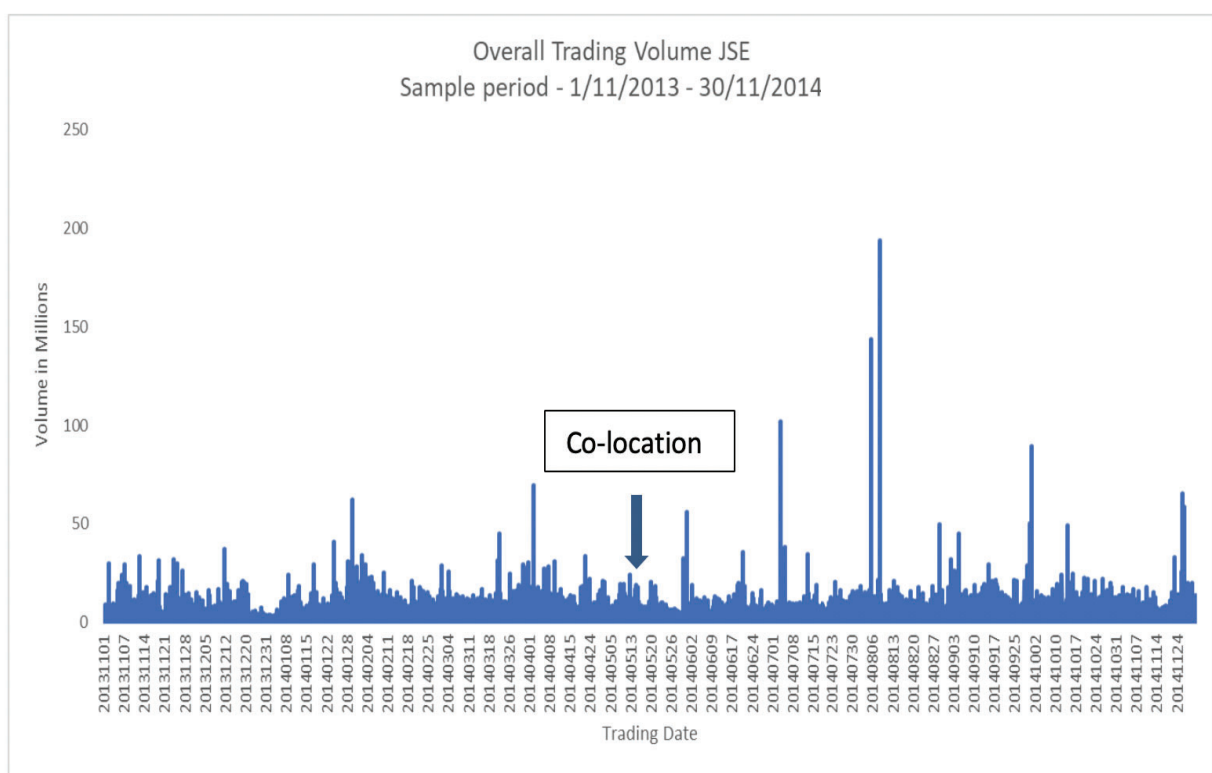
This enables examination of the nature (time-invariant) and consider the effects (firm fixed effects) in the model specification.

Consistent with previous literature, the research adopts Comerton-Forde and Putnins (2011) suggestion that returns, spreads, trading frequencies and return reversals can be used to distinguish manipulated closing prices from those occurring in normal trading. To that effect the experiment uses market manipulation measure on standardized measures of the abnormality of these variables and use logistic regression to obtain weights and calculate EOD which is then used to proxy for market manipulation. The research uses quoted spreads (Roll 1984), effective spreads (Roll 1984, Chordia, Roll and Subrahmanyam, 2008, Aitken, Chen and Foley 2013, Flood et al 2013) as the primary measures of market efficiency⁶, reporting these metrics as weighted average for all equity market products and a weighted average for JSE securities samples including portfolios sub samples. For effective spreads, the research performs metric computations on a per-security per day basis and combine the average observations at an individual security level to provide weighted average market-wide indicators, ensuring weights are determined by the contribution of each security to total market turnover. This captures the relative importance of different securities, thereby placing greater emphasis on those securities that are more actively traded. Variable values for effective spreads, depth and EOD are reported in basis points where 1 basis point (bps) equals 0.01%.

⁶ Information Sheet 177 - Quarterly cash Equities market data: methodology and definitions (INFO177)
<https://www.asic.gov.au/asic/asic.nsf/byheadline/Quarterly+cash+equity+market+data+release%3A+Methodology+and+definitions?openDocument>

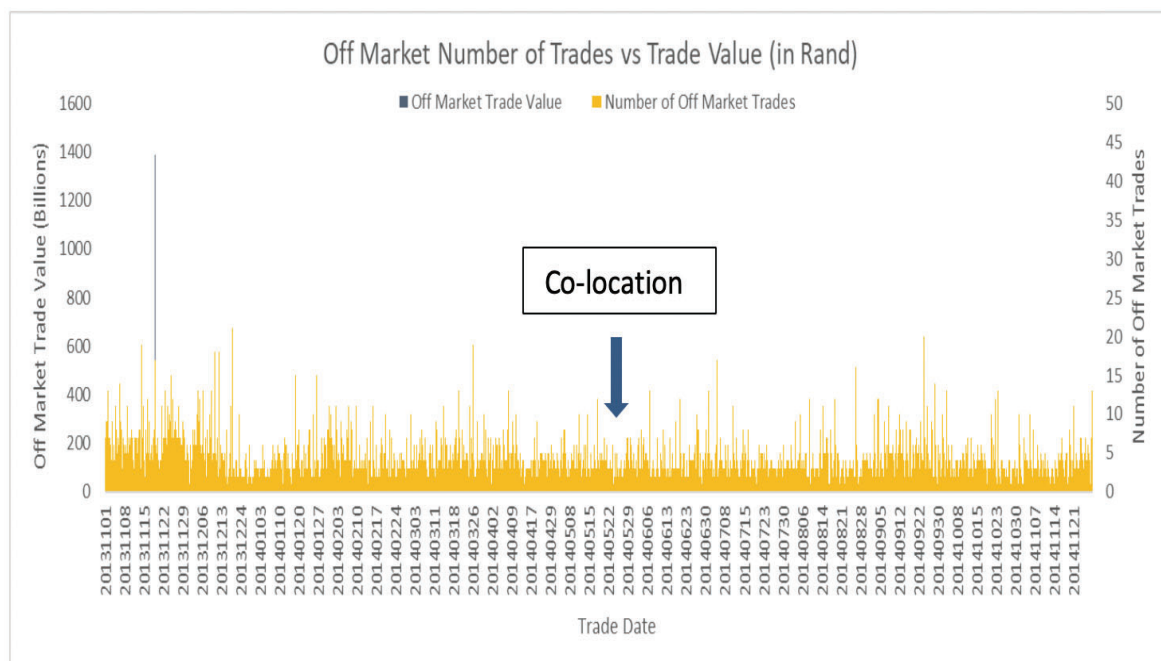
For regression, the variable is scaled by taking their log values to ensure scale consistency for purposes of regression analysis. Metrics spreads are constructed based on raw spreads, changes in daily spreads and standardized (de-mean) spreads, examining log-standardized-spread metrics for their desirable Classical Linear Regression Model (CLRM) estimation properties. To examine the effect of “toxic order flow” flowing from (into) the dark (lit) venues, total off-market and block trading value and volumes are extracted and computed across trading days; averaging out traded securities off-market daily trading value (volume), and extract daily trading block trading value (volume) across the sample period.

Table 4-1: Total Trading Volume (lit and dark)



Across the sample period total lit and dark volume gradually increases. A number of spikes can be observed in and around election periods.

Table 4-2: Off Market Trades (lit and dark)



Off-market trades and trade value fall ex-post. This is consistent with the liquidity flowing back into the lit market as HFT trades against transitory shocks in greater numbers. Across the sample period, the trade volume gradually decreases. This suggests a flight of liquidity in the lit market due to HFT trading on the information asymmetries and moving prices in the lit and dark venues closer to the mean.

4.3.1 Market Efficiency Metric: Effective Spreads

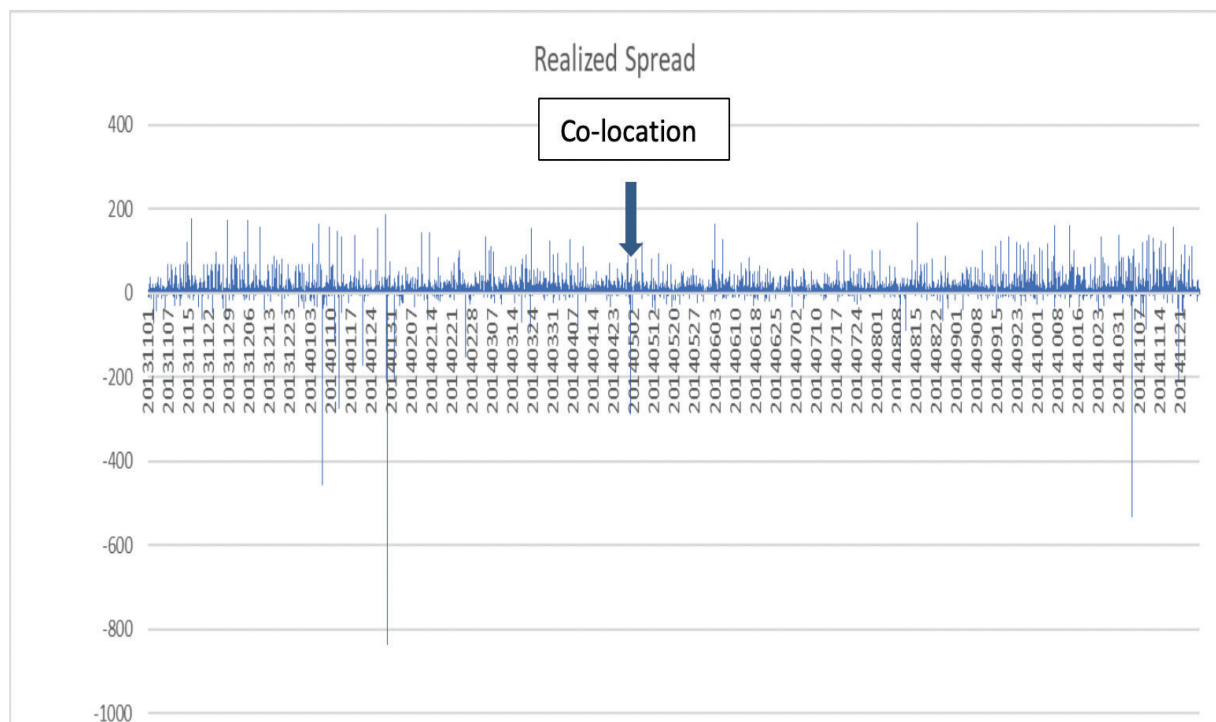
Stock specific effects are controlled by market capitalization as well as liquidity controls. The market efficiency measures assess the effects and impact of HFT (transmitted through the JSE co-location) on small orders (quoted spreads – which is a good **general** measure of transaction costs); For larger orders, effective spreads are good approximation for transaction costs incorporating price movement and market impact. The measures are computed and presented in basis points relative to the midpoint. Effective spreads represent the actual, round-trip cost of trading to the liquidity demander. Effective and realized spreads consider

the actual cost of trading of individual trades, benchmarked to the midpoint. Transaction costs are measured by the volume-weighted effective spread calculated on a per-trade basis and averaged across the month. Estimating round-trip trading costs as relative effective spreads, measured as the trade price minus the midpoint of the bid-ask spread immediately prior to trades, multiplied by two to reflect both entry and exit trade. The thesis transforms this into a percentage of the share price.

$$\text{Effective Spread} = 2q[(p_t - m_t)/m_t]10^4 \quad (4-1)$$

where q is the direction of the trade. A value of 1 is given for a buyer-initiated trade and a value of - 1 for a seller-initiated using the Lee-Ready algorithm. Price p_t : the trade price for stock i at time t . Mid-point m_t : is the midpoint price of the ask and the bid for stock i at time t . The effective spread metric is constructed for each trade on each stock traded on the respective market for each day in the month separately. The average daily spread for each stock is then constructed as the volume-weighted average of the effective spread on each trade, for each stock. This daily-stock effective spread is then converted to a daily-market-wide effective spread by equally weighting the daily-stock spread experienced by each of the stocks traded on that day. In order to reach the monthly-market wide effective spread.

Figure 4-1: Realised Spreads



Examining realized spreads, there is a slight improvement in realized spreads (actual profits traders make). This is consistent with trading in transitory shocks and moving prices to the mean ex-post.

4.3.2 Market Manipulation Metric: End of Day Price Dislocation

Market Manipulation is defined as the extent to which false or misleading representation of the possibility of undisclosed information with the intent to affect the market price. The research proxies market manipulation by end-of-day-price-dislocation (EOD) by counting manipulative value incidences. An EOD incidence is triggered when the price movement of a security in the near market close (i.e. X number of minutes before close) exceeds the rolling benchmark (bootstrapped from the benchmarking period, i.e. 250 days); the price of the security reverses shortly after market re-opens the next morning; By using

publicly available data, the manipulative value of an incidence is calculated by aggregating all trading during the manipulation window. When private data with participant information is provided, the incidence (the manipulative value) can be detected (calculated) with fewer false positives.

$$\Delta EOD_{it} = \frac{Peod, it - P(eod - 15m, it)}{P(eod - 15m, i)} \quad (4-2)$$

$$\overline{\Delta EOD} = \sum_{t=-31}^{t=-1} EOD_{i, t} \quad (4-3)$$

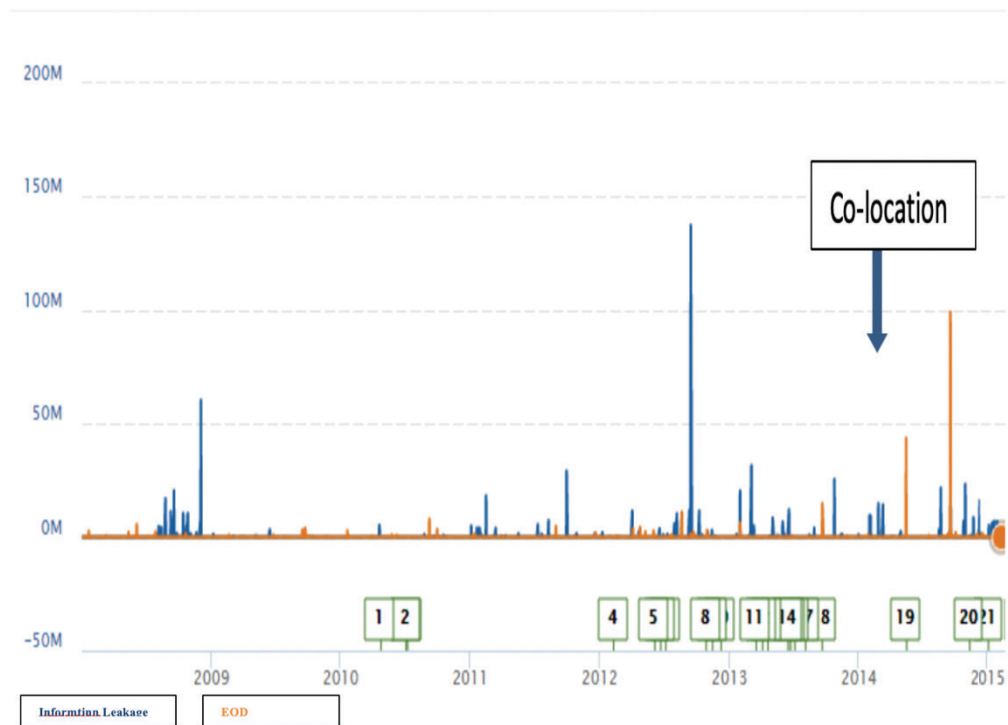
$$\text{Potential positive manipulation if } R_{i,t} > \overline{\Delta EOD}_i + 3 * \sigma_i \quad (4-4)$$

$$\text{Potential negative manipulation if } R_{i,t} < \overline{\Delta EOD}_i - 3 * \sigma_i \quad (4-5)$$

Other types of market manipulation include Order Book Manipulation (e.g., Layering the Order book) measures the frequency of a participant creating false impression of an active market in a security. This metric requires private data with participant information. Quote Stuffing Alert measures the frequency of abnormally large quantity of quote update messages in a short time interval. This metric is often used to detect manipulation by HFT. Closing price manipulation imposes a substantial cost to financial markets. And stock exchanges as well as their participants and investors. This illegal practice commonly involves aggressively buying or selling stock at the end of a trading day in order to push the closing price to an artificial level. Effective market regulation policy provisions in the form of exchange and market rules demands that unfair practices like market manipulation be prohibited and punished. In Australia, whilst the focus on unfair practices has historically tended to be on Insider trading, recent Australian, European, UK and North American courts have affirmed the importance of the market manipulation provisions and willingness to take a wider view of the provisions. The Australian Securities and Investment Commission (ASIC) has been refocusing

once more on market manipulation, strengthening anti market manipulation provision to prohibit a person or persons from engaging in a transaction that has or is likely to have the effect of creating an artificial price for trading in a financial product or maintaining at an artificial level the trading price in a financial product. Although closing price manipulation is perceived by market participants to be common, there is no current universally agreed method for measuring it and little is known about its empirical characteristics. That said, closing prices are important in financial markets as they are used to compute mutual fund net asset values (NAV), as well as determine the expiration value of derivative instruments and director's compensation and options. They impact is far reaching, as they also affect the issue price of many seasoned equity issues, are often used in evaluating broker performance during the day, are used to calculate stock indices and are the most commonly quoted price. Effective provisions for anti-market manipulation underpin the integrity of financial markets and ensure lower capital costs. As such it can be argued one key rationale for the high availability of capital within our markets is the public perception that the market is fair. Continuing on that argument, the economic damage caused by offences such as market manipulation and insider trading can be significant when measured in dollar value. There is no doubt that significant increase in retail investors within Australian cash equities markets and globally together with the perceptions of insider trading and market manipulation have motivated regulators such as ASIC to invest in effective markets supervision.

Figure 4-2: EOD and Information Leakage



The table summarises the value of end of day price dislocation (EOD) and Insider Trading (information Leakage) across the sample period. The sample period consists of 1/11/2013 – 30/11/2014. EOD and Information leakage are presented in RAND value and increase ex-post. The EOD value is the cost of EOD to the market in terms of RAND Dollar value.

4.3.3 High Frequency participation: Message Traffic

HFT has been the subject of intense public debate and controversy. Some commentators argue that it increases trading volume and liquidity, lowers trading costs and helps price discovery, and is therefore a socially beneficial financial innovation. Others claim it may increase volatility and systemic risk and creates a non-level playing field. Some regulators have expressed concern. For example, SEC Chairperson Mary Schapiro in a speech on September 22, 2010 stated "...high frequency trading firms have a tremendous capacity to

affect the stability and integrity of the equity markets. Currently, however, high frequency trading firms are subject to very little in the way of obligations either to protect that stability by promoting reasonable price continuity in tough times, or to refrain from exacerbating price volatility." However, other IOSCO member regulators seem to have shown tacit acceptance or support of HFT. Easley et al. [1996] linked liquidity to informational asymmetry by identifying how market makers adjust their bid-ask spreads to the probability of informed trading. Because informed traders monetize their superior knowledge of a security's future price by adversely selecting uninformed traders, it means that market makers must continuously update their quoted levels and sizes in real time in a manner that reflects their estimate of probability of informed trading. HFT reacts to information leaked by low frequency traders in order to anticipate their actions. Direct Market Access allows and promotes the deployment of this kind of strategic sequential trading logic to market venues. What makes HFT great at strategic sequential trading is the "event-based" interaction with the exchange's matching engine through DMA; co-location provides the means through which HFT can succeed against low frequency traders.

HFT decision making processes are synchronized with the speed at which matching actions take place, thus acting upon the revelation of new information. HFT algorithms therefore are adept at exploit microstructural opportunities in a similar that large speculators exploit a macroeconomic inconsistency. As an analogy, rather than possessing exogenous information yet to be incorporated in the market price, HFT assume that their endogenous actions are likely to trigger a microstructure mechanism, with foreseeable outcome.

In this study, the rate of electronic message traffic is used as a proxy for the amount of automated trading taking place across stocks and days. This proxy is commonly used by

market participants and in academic studies, including Capital Markets CRC Ltd, Hendershott, Jones, and Menkveld (2011), the Tabb Group, as well as exchanges and alternative trading platforms. With respect to the Johannesburg Stock Exchange data, electronic message traffic measures order submissions, cancellations and amendments across the best bid and ask are computed and used in the experiment. The study employs the OTT ratio measure as the raw electronic message traffic (at the best bid and ask) divided by the number of trades. Figure 4-3 plots average daily stock message traffic by market capitalization quartiles over the 1/11/2013 – 31/05/2015 sample period. The message traffic measure is fairly volatile but increases across the quartiles from the start of the sample period to the end of 2013. The Working Paper 19.03.2013 14 sample appears to stabilize across the quartiles following 12 May 2014 coinciding with the introduction of JSE 2014 Co-location.

Figure 4-3: Message Traffic

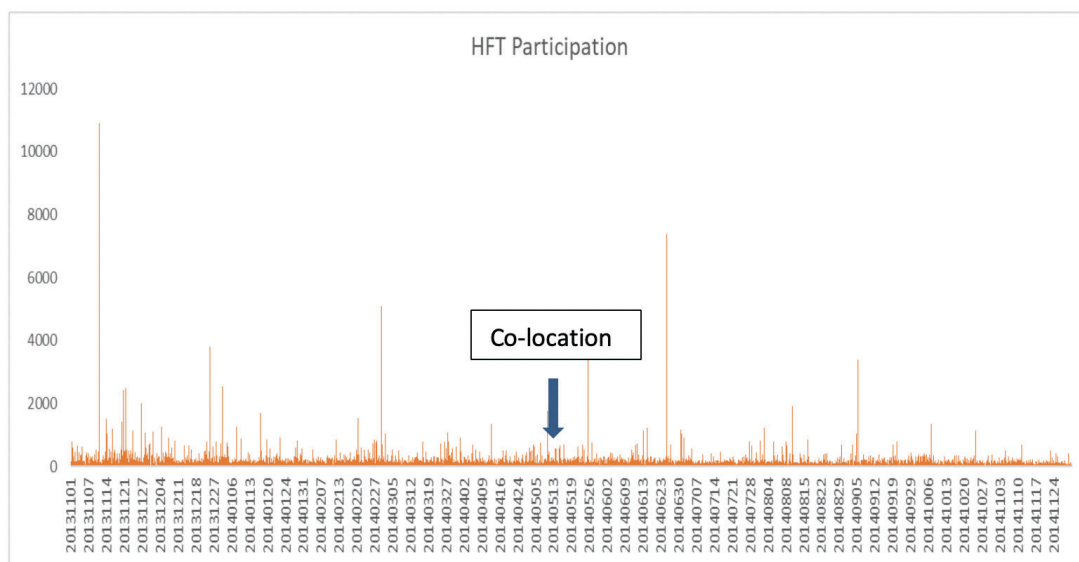


Figure 4-2 summarise the HFT participation. It seems HFT participation was greater ex-ante the market design change. Ex-post, there seems to be less HFT in the market.

4.4 METHODOLOGY

Empirical studies on spreads and measures of market integrity are often simultaneously calculated. To that extent, a structural model for market quality is constructed to deal with this issue; the research uses a two stage-least squares (2SLS) estimation method in the belief that residual errors in spreads and EOD price manipulation together with HFT market participation is likely cross equation correlated. The issue at hand is that market spreads are non-trivial costs of market manipulation, as such higher spreads reduces the incidence or levels of manipulation all things being equal. Alternatively, market manipulation increases information asymmetry with the impact of raising volatility thereby reducing order aggressiveness leading to widening of bid/ask spreads.

4.4.1 Model specification

A 2SLS structural equation model, models, market integrity (EOD) and the High Frequency Trading (HFT) ex-ante and ex-post the exogenous technology market design change of co-location (CLDummyc = 0 ex-ante and 1 ex-post). The term two-stage least squares (2SLS) refers to a method of estimation that combines system equation, sometimes known as seemingly unrelated regression (SUR), with two-stage least squares estimation. It is a form of instrumental variables estimation that permits correlations of the unobserved disturbances across several equations, as well as restrictions among coefficients of different equations, and improves upon the efficiency of equation-by-equation estimation by considering such correlations across equations. It is assumed that each equation of the system is at least just-identified. Equations that are under identified are disregarded in the 3SLS estimation. The Zellner-Theil proposal for efficient estimation of this system is in three stages, wherein the first stage involves obtaining estimates of the residuals of the structural

equations by two-stage least squares of all identified equations; the second stage involves computation of the optimal instrument, or weighting matrix, using the estimated residuals to construct the disturbance variance-covariance matrix; and the third stage is joint estimation of the system of equations using the optimal instrument.

4.4.2 2SLS Structural Equations

$$\begin{aligned} \text{EOD}_{it} &= \alpha + \text{EffSprd}_{i,t} * \beta_1 + \text{HFT}_{i,t} * \beta_2 + \text{VIX}_{i,t} * \beta_3 + \text{Ret}_{i,t} * \beta_4 + \\ &\quad \text{CLDummy}_{i,t} * \beta_5 + \varepsilon \end{aligned} \quad (4-7)$$

$$\begin{aligned} \text{HFT}_{it} &= \alpha + \text{EffSprd}_{i,t} * \beta_1 + \text{EOD}_{i,t} * \beta_2 + \text{Price}_{i,t} * \beta_3 + \\ &\quad \text{IntradayVolatility}_{i,t} * \beta_4 + \text{CLDummy}_{i,t} * \beta_5 + \varepsilon_{i,t} \end{aligned} \quad (4-8)$$

Where $\text{TotalVol}_{i,t}$ = total trading volume in the security. CLDummy_i = Co-location dummy $i=0$ ex-ante & 1 ex-post market design change. $\text{HFT}_{i,t}$ = participation of HFT in the market - messaging calculated as Order To Trade Ratio (OTT) value. $\text{EffSprd}_{i,t}$ = effective spread for security. $\text{EOD}_{i,t}$ = end of day price dislocation incidence for security. The instrumental variables for the endogenous variables are based on reduced form equations of all the exogenous and predetermined variables / regressors. In the model, Market Manipulation (EOD), HFT (OTT HFT) and Market Efficiency (EffSprd) regressors are predicted values.

4.5 SUMMARY STATISTICS

Table 4 - 1: HFT Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
EOD	368.00	6242.75	998131.90	0.00	299000000.00
Effective Spread	368.00	3.40	8.39	0.01	195.20
OTT HFT	368.00	45.15	165.91	0.00	21902.00
Ln(VIX)	368.00	3.00	0.39	2.33	4.39
Total Volume	368.00	894161.40	2710327	423000.00	524000000.02
Price	368.00	5248.22	9363.70	1.00	146000.44
Return	368.00	0.22	27.29	-99.02	9871.43
Volatility	368.00	0.00	0.01	0.00	0.80
CL Dummy	368.00	0.16	0.37	0.00	1.00

The final sample for consist of 368 stocks that traded daily across the sample period of 1 November 2013 – 30 November 2014. A key note from the table above is “Total Volume” ranging from a minimum of 423000 trades to a maximum daily trade of 524 million. EOD has measured in SA RAND has a maximum value of RAND 299 million and a minimum of RAND 0.00. The minimum signifies no market misconduct (EOD) instances on a particular day.

4.6 CORRELATION MATRIX

Table 4 - 1: Correlation Matrix

	EOD	Eff Spread	OTT HFT	Ln(VIX)	Total Volume	Price	Return	Volatility
EOD	1.0000							
Eff Spread	0.0001	1.0000						
OTT HFT	0.0012	-0.0801	1.0000					
Ln(VIX)	0.0001	0.0600	0.0010	1.0000				
Total Vol	0.0001	-0.0811	0.0010	0.0506	1.0000			
Price	0.0001	-0.2010	0.1150	-0.0904	0.0201	1.0000		
Return	0.0100	0.0200	0.0005	0.0045	0.0110	0.0008	1.0000	
Volatility	0.0110	0.2500	-0.0223	0.0736	0.0009	-0.0507	0.0106	1.0000

The correlation matrix presents the correlations between the variables used in the HFT model specification. The variables are used in the model specification examining the impact of HFT on market integrity proxied by end of day price dislocation (EOD). The sample for consist of 368 stocks traded daily across the sample period of 1 November 2013-30 November 2014.

4.7 RESULTS

Table 4-4-3: 2SLS Regression Result.

The table reports the results of the Three Stage Least Squares regression (2SLS) to determine the impact of high frequency trading on market integrity (market manipulation) proxied by end of day price dislocation (EOD). The experiment is conducted across the sample period of 1/11/2013 – 30/11/2014 with 12 May 2014 representing the exogenous event of co-location a technology market design change that is geared towards faster and faster electronic trading – algorithmic trading (AT) / high frequency trading (HFT) trading strategies.

Table 4-1: Summary Results of the 3SLS Structural equations

	EOD (Eq. 1)	Effective Spread (Eq. 2)	OTT /HFT (Eq.2)
EOD		-0.0001 (0.14)	0.0008 (0.65)
Effective Spread	558.0647 (5.34)**		1.8430 (1.00)
OTT HFT	6.7077 (0.13)	-0.0583 (0.35)	
Ln(VIX)	1,049.8694 (0.17)	1.0565 (0.08)	
Price			0.0032 (7.67)**
Return	-11.0901 (2.99)** (0.03)	(0.00)	(0.11)
Volatility			-705.9828 (1.45)
Total Volume		0.00001 (3.08)**	
CL Dummy	9,920.869 (1.25)	-2.1720 (0.15)	-47.1519 (3.89)**
Constant	346,792.128 (3.07)**		-538.3828 (1.18)
Obs	52,294	52,294	52,294
R2	0.0043	0.7843	0.6480
Adj R2	0.0043	0.7843	0.6480

T-Statistics in parenthesis. * $p < 0.05$; ** $p < 0.01$

Table 4-1 presents summary results of the 3SLS Structural equations. EOD specification shows that there is an increase in HFT activity ex-ante colocation. Prior to co-location HFT participation (proxied) by Order To Trade (OTT) can be observed at half the level ex-ante co-location. Post the exogenous event of co-location, both dark and lit fragmentation increase manipulation with the result of widening spreads. This is seen and explained through the positive relationship between HFT, EOD and effective spread.

4.8 CONCLUSION

The research finds that co-location on the Johannesburg Stock Exchange (JSE) ushered in a higher participation rate of HFT. The key finding here is that whilst there was a positive relationship with market integrity, there exists cross equation correlation between market efficiency (effective spreads) and the measure of market manipulation (EOD) used. Thus, estimating the extent to which HFT impacted market integrity ex-post without adjusting for the cross correlation does not give a true picture of the impact leading to the combined unified modelling in chapter five.

Ex-post co-location market fairness proxied by EDO improves (*Hypothesis 4-1*). Though statistically insignificant, the increase in HFT results in lower instances of EOD compared to ex-ante. HFT/AT participation increases two-fold ex-post co-location. Additionally, the number of EOD incidences post the market design change on May 12, 2014, but the increase is statistically insignificant. There is a positive relationship between effective spread, order to trade ratio (OTT) and EOD incidences. A unit increase in OTT, a proxy for HFT is associated with an approximately 7 unit increase in the number of EOD incidences (*Hypothesis 4-2*). Due to the cross-equation correlation between market integrity measures (EOD) and market efficiency (effective spread) when examining HFT, the research shows evidence of

improvement effective spread (Hypothesis 4-3) ex-post co-location. A unit increase in effective spread is associated with a 558 increase in the number of EOD incidences. Finally, total average daily stock volume in lit market increases ex-post due to HFT participation in the lit market (Hypothesis 4-4).

4.9 RECOMMENDATION

The full effect of HFT on market manipulation depends more than just a simple analysis of OTT and efficiency. As such the key recommendation for regulatory authorities and market participants and exchanges is to undertake further research on dark and lit market workings needs to be investigate further for better understanding. In Canada (2012) and Australia (2014) regulatory authorities have taken this approach introducing meaningful price improvement (MPI) to enable improved price discovery, attenuating market manipulation in lit and dark venues. The JSE is the 8th largest market in the world. Dark venues market design changes have been introduced in the SA market for JSE listed cash equities. It is recommended the FSB (the financial market regulator) continue to monitor and empirically examine the dark venue market design changes to enable ongoing effective, efficient and fair markets as more HFT participation occurs in the JSE market.

Chapter 5: THE IMPACT OF POLITICAL LIFECYCLES, MARKET FRAGMENTATION ON MARKET QUALITY

This chapter addresses the joint impact of market fragmentation and HFT participation on market quality, comparing the degree of impact of HFT and Plurality on market quality (market efficiency and integrity). To the extent a market microstructure view is mostly adopted for examining the information asymmetry channels impacting market efficiency and integrity, political pluralism is included to assess jointly the degree to which political pluralism channels uncertainty into market quality. It is a given, algorithmic trading impacts market efficiency by narrowing the spread which in turn affects the incidence of market manipulation as measured by end-of day price dislocation. To that effect this final dissertation chapter study addresses the triple impact of political plurality and joint impact of political lifecycles, algorithmic trading and market fragmentation in the context of political pluralism.

Adopting a typical technology, regulatory, information, participants and instruments (TRIPI) view of market quality research, it is apparent that devoid of a financial markets regulator with ownership, responsibility and mandate to integrate multiple lit exchange and dark venue fragmented marketplaces' information consisting of pre and post trade transparent information, it is difficult if not impossible to for the market to undertake market wide research, surveillance as well as financial markets supervisory activities for fair and orderly markets. That being the case, market design changes such as market fragmentation

would almost inevitably invite market misconduct/market manipulation, market inefficiencies in the form of limited price discovery. That said, market fragmentation has introduced new market design changes such as high frequency trading (HFT). HFT in turn has the effect of attenuating fraudulent market activities such as market manipulation by trading against market shocks and thus bring real time self-discipline to the market.

A question requiring closer analysis and answer is therefore “within politically dominant and emerging democracies, including proliferation of lit venues and dark venues / market fragmentation, what is the effect and impact of such market design changes as co-location (high frequency trading) in the context of political. This question motivates the empirical research in this chapter. This dissertation chapter brings it all together to examine the triple impact on market efficiency (effective spreads) and market manipulation (EOD) resolving for market efficient cross equation correlations with measures of market manipulation when examining HFT.

The research models the determinants of dark trading dark value ratio which is used to proxy for market fragmentation, HFT market participation in the form of order to trade ration (OTT) ex ante and ex post co-location and uses dark value ratio and OTT HFT as an instrument variable and to examine the relationship of high frequency trading on market efficiency and market integrity. Dark value ratio provides a good indication of traders’ venue selection and order flow and therefore market fragmentation, whilst political pluralism provides the prism or channel through which political uncertainty can be channelled into the financial market impacting market efficiency and market integrity. The object of the study is to extent the research in market quality by including other channels through which uncertainty transmitted into the financial markets can be assessed.

5.1 DATA

In order to examine the cross-sectional determinants of algorithmic trading/high frequency trading participation and the dynamics of market quality in relation to political pluralism, electronic trading and market fragmentation as well as analyse in time-series, market manipulation, it was necessary to collect publicly available data full order trade data rather than pre-prepared financial markets regulatory case data and marry it with unique data set consisting of political lifecycles data.

The unique dissertation data set consist of Johannesburg Stock Exchange (“JSE”) financial market cash equities stock daily statistics together with hand coded political lifecycle events and dummies created to assess the effect and impact ex-ante and ex-post of the 1.) political lifecycles, 2. Plurality and 3. Joint impact of algorithmic trading and market fragmentation on market quality – that is efficiency, integrity and systemic risk.

Starting with the whole universe of JSE trading stocks over the sample period of 2 January 2008 to 15 September 2015, the initial population consists of 795,848 daily statistics transactions (records) obtained from Capital Markets Cooperative Research Centre (CMCRC) Thomson Reuters Tick History (TRTH) full order book data. Political lifecycles are individually collected and matched against the trade data by trade date and security (for securities/company) domiciled in dominant political stakeholder’s province (as an elected member of parliament).

5.1.1 Sample Size

The final sample consists of 52,294 matched daily, securities, trade and quote data across the sample period of 1 November 2013 – 30 November 2014. The selection of the

sample period is limited to include a general election political lifecycle event which is used for constructing the plurality variable and a market design change exogenous shock event – co-location implemented by the Johannesburg Stock Exchange (JSE) on 12 May. Retaining only stock that traded continuously throughout and factoring for trading holds and suspensions, as well as delisted stocks due to any of mergers, acquisitions and or failure, the final data sample consists of matched financials and political data points of 52,294 is retained over the sample period for the research. The following are the metrics, and assumptions used in the thesis.

5.1.2 Plurality Metric (inverse of Herfindahl-Hirschman Index - iHHI)

Motivation for creation to of iHHI is based on the use of Herfindahl-Hirschman Index (HHI) by the United States of America (USA Department of Justice), who employ it to evaluate mergers and acquisitions; a worthwhile endeavour with significant impact for market dynamics and outcomes. The HHI is highly responsive to asymmetry of market shares. The research uses the inverse of the HHI of the political parties at the provincial level to calculate the likely influence and hence the channels through which dominance of political party can transmit into financial markets (information asymmetries) in the form of negative information withholding during political events (such as election, president nomination, central committee party meetings for instance), outright fraud (insider trading). A second important property of the HHI is that it reflects the shares of every firm and for this research political party (plurality). The higher the measure for each party across the provinces, the more plural the government and the less likely the channelling of information asymmetries onto the firms' head quartered in the province. For the thesis, the use of HHI (and iHHI) is based on the election data for each electoral party during political events (elections). As such there is no

for an a priori determination of how many parties are significant in measuring market concentration; such a determination, which is inevitably somewhat arbitrary obviously must be made before computing a concentration ratio. This feature of the HHI is regularly cited as one of the HHI's advantages, although it is beneficial only if summing each firm's squared market share accurately indicates the competitiveness of the market. The fact that the HHI includes every firm also is cited as a potential limitation on its use, given the difficulty of learning smaller market shares, however for the research, the election results ex-post is known and thus resolves this issue.

Drawing from the “information asymmetry” hypothesis, the project innovates by creating and using the **iHHI** (inverse HHI of each political party at province level as a measure of political plurality at each province level and adopts the political lifecycles events i.e. national elections, provincial elections, party congress, party president selection as the channels through which political uncertainty can be channelled into the quality of financial markets (fairness and orderliness). Therefore, included in the model is the interaction of the, is the primary province (“province”) in which the company is head quartered. The variables are selected as they are more likely to lend explanatory power to market quality. Dummy variables are used in order to gain better insight into the timing of potential of dominant political party actors to channel uncertainty into the quality of financial markets; in the form of risk and uncertainty transmission and information flow ex-ante and ex-post the political lifecycle events of national elections, provincial elections as well as ANC party congress, and party president selection. In the OLS model the variables are logged as required to scale.

South Africa is well suited for this investigation presenting a good national level (**national**) experiment setting wherein the African National Congress (**ANC**) has enjoyed

unassailed support since the first democratic election on 27 April 1994, and thus dominates the national political scene. On the other hand, there exists significantly a lot more political plurality at the provincial level. This setting thus allows us to empirically examine the relationship between political uncertainty and market and, and market integrity at two levels a.) the impact of national political cycles, and b.) the channels through which uncertainty is channelled through provincial plurality from the national party to its provincial parties in power or otherwise. The research therefore examines the reaction of market efficiency, market integrity proxy variables to national political lifecycle events consisting of national and provincial elections. Whilst it is to be expected to observe generalized national political lifecycle impact on market efficient and market integrity and systemic risk, in order to obtain a nuanced understanding of the extent to which the dominant party channels uncertainty into market quality conditioning on province plurality, the paper drills down to investigate the variability of provincial political lifecycles and the influence and impact on market efficiency, market integrity and systemic risk variables. The argument is if we find evidence of provincial political events having an impact on market quality and at same time, the impact is concentrated within ANC held provinces, then it can justifiably be confirmed that political lifecycles in a country that has a dominant political party leads to a deterioration in market quality.

In construct **pluralism** variable, the project gathered elections results data was used to calculate a Herfindahl-Hirschman index (HHI); a commonly accepted measure of market concentration. The HHI was computed by squaring the market share of each political party in the elections and then summing the resulting numbers. It can range from close to zero to 10,000. The project develops a political plurality”, a generalized framework to express party-political concentration based on the Herfindahl-Hirschman Index (HHI) concentration. By

construction, the political pluralism and stock price should in effect measures the net flow of all value relevant, adverse information through all available information channels. The measure should therefore reflect news from the full set of information production and dissemination mechanisms and channels that a local politician would need were they to control and for instance effectively suppress negative information, and in doing so, exert an effect and impact on the quality of a given market leveraging efficiency, integrity and resilience proxies for market quality. Interacting **iHHI** within the 3SLS structured market quality **(integrity and efficiency)** equations provides the means through an empirical assessing of the degree of impact of plurality on the quality of JSE financial market.

5.1.3 Market Fragmentation Metric (Dark Venue Volume Ratio)

Given the importance and the rapid growth of dark pools as an alternative trading system, there is a growing body of literature that examines the relationship between dark pools and market microstructure. These studies seek to examine whether the growth in dark trading has a positive/effect on market quality and efficiency (Ready 2013). For example, Ye (2010) uses an extension of Kyle's 1985 model to analyse the strategic decisions of a single informed trader who splits trading interest between a dealer market and a dark pool. He shows that as the insider's information advantage increases, the insider optimally submits a smaller order in the dealer market and a larger order in the dark pool. The result leads to the conclusion that dark pool volumes are higher for stocks with higher degrees of adverse selection. Hendershott and Mendelson (2000) include informed traders in a model of competition between a dealer market and a crossing network. Their model shows that increases in the fixed cost and inventory components of the dealer's spreads cause trading to migrate from the dealer market to the crossing network in order to avoid paying these costs.

They therefore predict that crossing network volume will be an increasing function of the percentage spread. Degryse et al (2009) model a crossing network that trades alongside a dealer market and predict that crossing network volumes will be an increasing function of the stock's percentage spread as traders seek to avoid paying the spread in the dealer market. Comerton-Forde and Putniņš (2012) looks at the effect of dark trading on the informational efficiency of prices in the lit market, and also the changes in price discovery in response to a greater share of volume being executed in the dark. Their study finds that informational efficiency is negatively related to the share of volume executed in the dark, suggesting that dark trading harms aggregate price discovery. Laver (2011) tests the impact of dark pools on liquidity in the lit markets by using regression analysis to estimate the relationship between the bid-ask spread quoted for NYSE stocks and the portion of trading executed off-market. The author finds that the greater the portion of trading done off market, the higher the bid-ask spread. The result supports the fragmentation hypothesis for US markets and implies that trading in off-market venues such as dark pools impairs the liquidity of lit markets. Frino (2012) also investigates the impact dark pools on the lit market's liquidity in the Australian Securities Exchange. Frino finds that the impact of dark pools on liquidity is much higher in Australia. He concludes that his research supports the fragmentation hypothesis and raises the question of whether there is any rationale in allowing dark pools to proliferate.

“Does this mean that there is no role at all for dark pools? I do not believe so. There is a role for dark pools in facilitating transactions which simply cannot be executed on-market. Very large or “block” transactions can often destroy liquidity in the lit market for long periods of time, and it may be better for such transactions to be executed off-market in dark pools. However, allowing smaller transactions which could easily be executed on the lit market merely fragments trading and impairs the liquidity of

markets. The regulatory implications of this logic are clear. They imply that the imposition of trade size thresholds above-which transactions can be executed off-market in dark pools and below which transactions must be executed in lit markets can provide an optimum market outcome which promotes overall liquidity and benefits the overall market.” (Frino, 2012).

In addition to these empirical studies, many regulators and stock exchanges have expressed concern that the migration of trading volume to venues with little or no pre-trade transparency may harm price discovery and reduce liquidity. For example, in October 2009, Nasdaq OMX’s Chief Economist Frank Hatheway stated in a congressional testimony that dark pools “undermine public price discovery by shifting liquidity away from the lit markets”. Furthermore, in November 2009 the US SEC proposed rules on the “Regulation of Non-Public Trading Interest”. The International Organization of Securities Commissions of Canada in a 2011 report states that “the development of dark pools and use of dark orders could inhibit price discovery if orders that otherwise might have been publicly displayed become dark. Consequently, on April 13, 2012 Canada approved new price-improvement rules. These rules require that (i) priority be given to displayed orders over non-displayed orders on the same venue; (ii) dark trades for 5,000 shares or less must give the active participant at least one tick price improvement (one-half tick if the spread is one tick); and (iii) give the power to impose a minimum trade size on passive dark orders if they deem it to be necessary. The Canadian meaningful price improvement rule took effect on 15 October 2012. Given the recent implementation of the price improvement rule in Canada, there has begun a body of nascent empirical literature investigating the impact of the new policy implementation on the microstructure of the trading systems in Canada.

To examine the effect of “toxic order flow” flowing from (into) the dark (lit) venues, the research extracts and computes (total off market) trading value and volume across trading days, averaging out all traded securities off-market daily trading value (volume), and extracting daily trading block trading value (volume) across the sample period.

$$\text{Off Market Dollar Value}(\text{DolValOff}) = \sum_{i=1}^n (\text{Price} * \text{Volume}) \quad (5-1)$$

$$\text{On Market Dollar Value} (\text{DolValOn}) = \sum_{i,t}^{N,T} (\text{Price} * \text{Value}) \quad (5-2)$$

Where “On Market Dollar Value” is computed on trade events per security per day using order book flags(+On).

$$\text{Market Capitalisation} (\text{MarketCap}) = \text{SharesOnIssue} * \text{Closing Price} \quad (5-3)$$

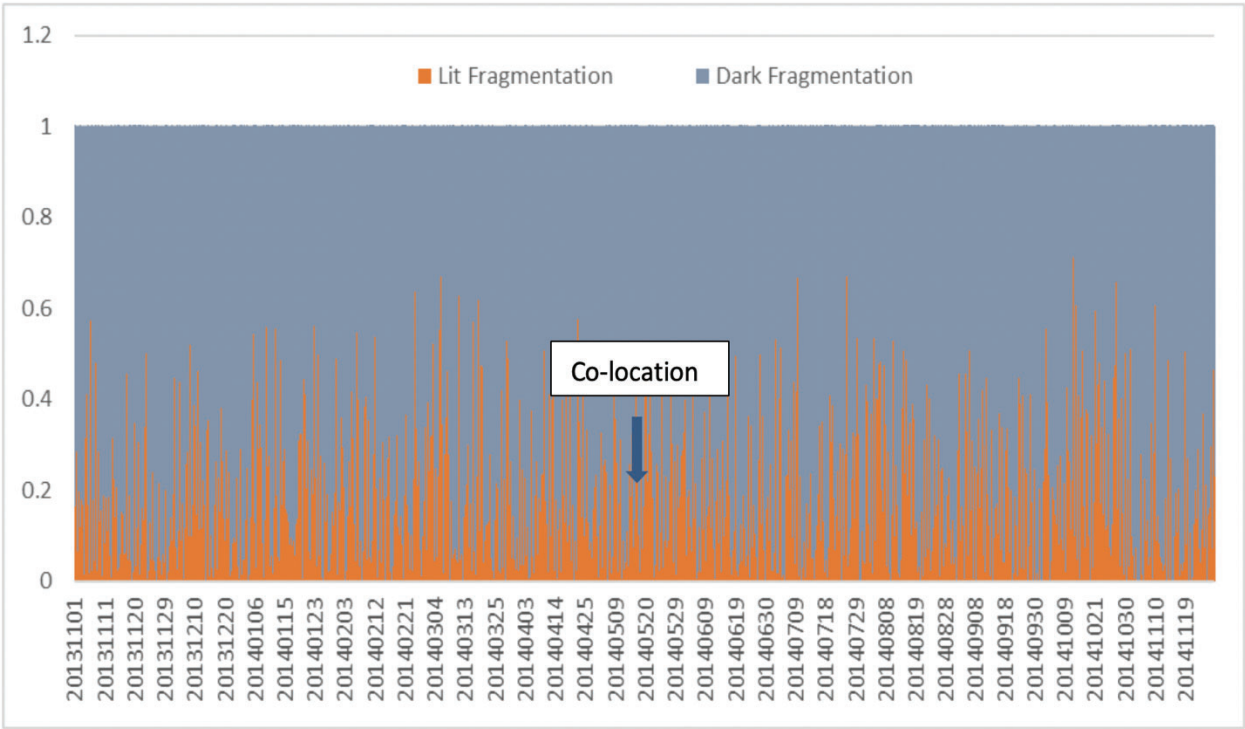
Where stock market capitalisation is computed daily

$$\text{Trade Value} (\text{Value}) = \text{Price} * \text{Volume} \quad (5-4)$$

Where trade value is extracted pre-computed

$$\text{Volatility Index JSE(VIX)} = \text{Bloomberg VIX Index} \quad (5-6)$$

Figure 5 - 1: Dark Fragmentation



The table summarises the dark fragmentation across the sample period. The sample period consists of 1/11/2013 – 30/11/2014. Lit fragmentation increases whilst dark fragmentation decreases. This would seem to suggest, HFT trade against transitory shocks.

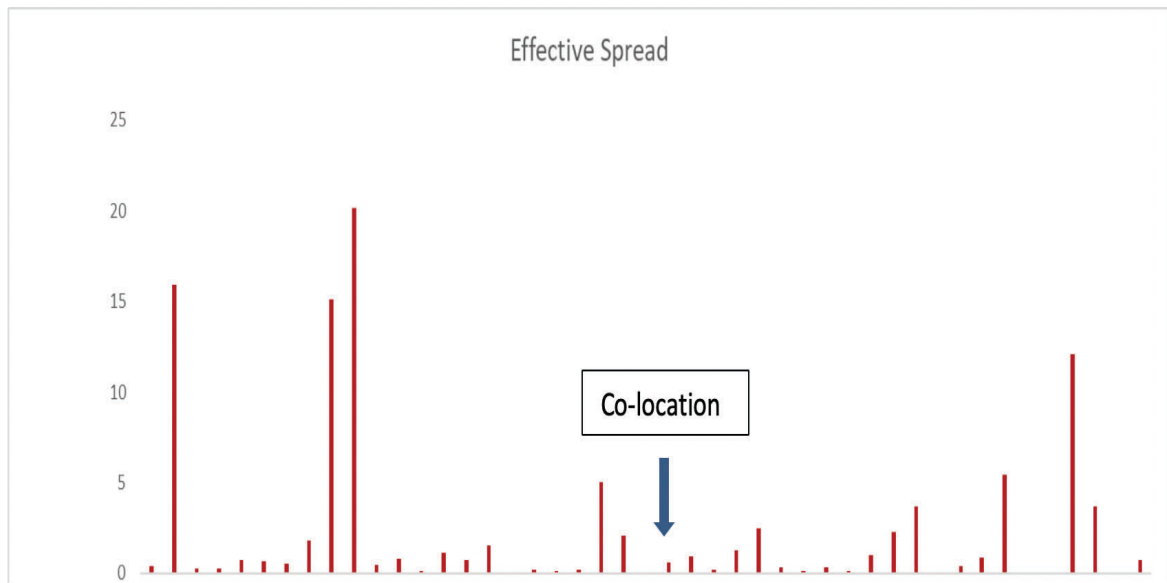
5.1.4 Market Efficiency Metric (Effective Spreads)

Market efficiency is proxied by transaction costs. Transactions costs are measured by volume weighted spread. The research computes effective spread based on daily statistics and averaged across the month. The research estimates round-trip trading costs (effective spreads) as the trade price minus the midpoint of the bid-ask spread immediately prior to trades and multiplied by two for entry and exit trade. The number is then transformed into a percentage of the share price to arrive at the final statistic.

$$\text{Effective spread} = 200 \times D \times ((\text{Price} - \text{Mid})/\text{Mid}) \quad (5-7)$$

Where D is the director of the trade. +1 indicates a buyer-initiated trade and -1 indicated seller-initiated trade based on the Lee-Ready algorithm. Price is the trade price for the stock i at time t and Mid is the midpoint price of the ask and the bid for the stock i at time t. This effective spread metric is constructed for each trade on each stock traded on the respective market for each day in the month separately. The average daily spread for each stock is then constructed as the volume-weighted average of the effective spread on each trade, for each stock. This daily-stock effective spread is then converted to a daily-market-wide effective spread by equally weighting the daily-stock spread experienced by each of the stocks traded on that day. In order to reach the monthly-market wide effective spread.

Figure 5-1: Effective Spreads



$$Realised\ Spread\ (RSPRD) = \frac{1}{T} \sum_t 2 * Trade\ Direction_t * (Price - MidPointPrice_{t+5}) \quad (5-8)$$

For completeness, the research computes and uses realised spreads as the difference between prices at which traders /market makers actually buy and sell. The research uses 5-minute post trade to compute the difference. Realised spreads are usually smaller than quoted spreads as traders occasionally trade at better prices than they quote and because they often adjust their bid and ask prices between trades.

5.1.5 HFT Participation Metric (Order To Trade (OTT) Ratio)

The advent of HFT has radically transformed liquidity provision into a strategic and yet tactical game involving **Liquidity squeezing**: When a distressed large investor is forced to unwind her position, they trade in the same direction, draining as much liquidity as possible. As a result, prices overshoot, and they make a profit (Carlin, Sousa Lobo and Viswanathan [2007]). **Quote stuffing**: Engage in ‘latency arbitrage’.

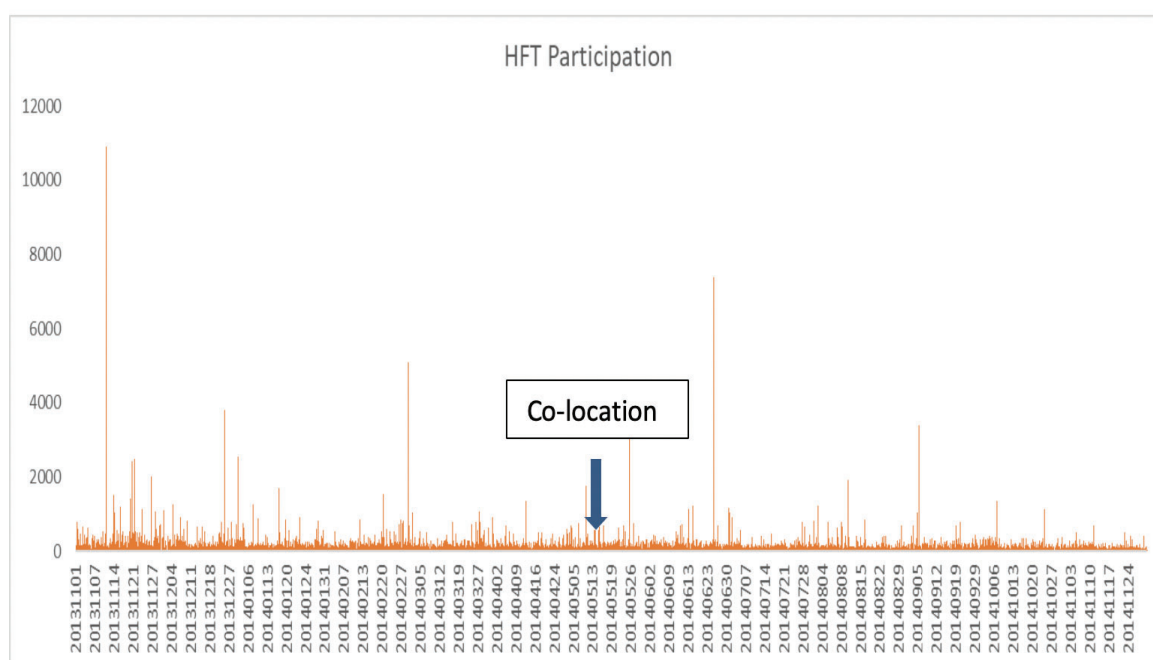
The strategy involves overwhelming an exchange with messages, with the sole intention of slowing down competing algorithms, which are forced to parse messages that only the originators know that can be ignored. **Quote dangling:** Sends quotes that force a squeezed trader to chase a price against her interests. O'Hara [2011] presents evidence of their disruptive activities. **Pack hunting:** Predators hunting independently become aware of each other's activities and form a pack in order to maximize the chances of triggering a cascading effect (Donefer [2010], Fabozzi, Focardi and Jonas [2011], Jarrow and Protter [2011]). NANEX [2011] shows what appears to be pack hunters forcing a stop loss. Although their individual actions are too small to raise the regulator's suspicion, their collective action may be market-manipulative. When that is the case, it is very hard to prove their collusion, since they coordinate in a decentralized, spontaneous manner. Arnuk and Saluzzi [2009] were among the first to highlight the dangerous trend in order cancellation rates. The SEC[2011] reveals that a majority of orders are now cancelled. The TABB Group estimates this at ninety eight percent (98%).

On one hand, there are studies showing HFT positive effects effect on market efficiency and integrity. It is readily acceptable to argue within a given marketplace, HFT has the effect of improving market efficiency by reducing effective spreads. Under this context, HFT has been shown to exhibit improvement in average stock trade value and volume moving price distributions closer to the mean. Brogaard, Brennan, Korajczyk, Macdonald and Vissing-Jorgensen (2010) show evidence of sixty to eight percent (60-80%) of all NASDAQ trades involved a HFT participant as either a liquidity provider or liquidity demander. Ito and Lyden (2012) construct an undisclosed measure of HFT participation for the largest fifteen (15) stocks traded on

NASDAQ, NYSE and BATS in the US and show that HFT participates in one side of trades in between eight seven to ninety two percent (87-92%) of the time. This provides a good experiment for the effects as well as impact of HFT on major markets within the context of market fragmentation. Frino, Lepone and Mistry (2012) find that in the period between 2006 and 2009, algorithmic trading on the Australian Securities Exchange (“ASX”) had grown to account for over fifty five percent (55%) of dollar. The authors’ key finding was that algorithmic traders tend to increase participation when volume, volatility and depth is low, and spreads are wide with the result of narrowing spreads thus improving market efficiency. More recently, research by Hirschey (2013) employing a unique flagged set of HFT trades from the NASDAQ stock exchange; provides evidence showing HFT accounting for approximately forty percent (40 %) of all NASDAQ trades in 2009.

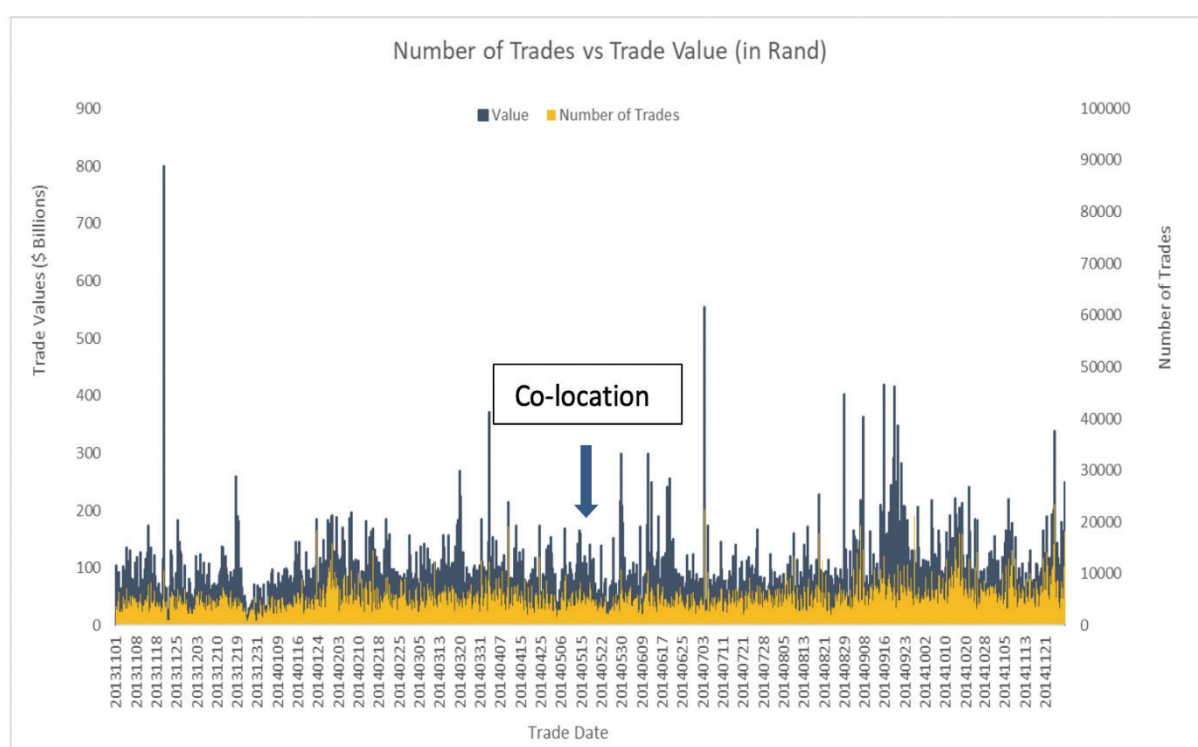
$$HFT_{i,t} = \text{Message_Traffic}_{i,t} / \text{Trades}_{i,t} \quad (5-9)$$

Figure 5-2: HFT Participation



The table summarises the participation of HFT across the sample period. The sample period consists of 1/11/2013 – 30/11/2014. The orange graph

Figure 5-3: Number of Trades vs Trade Value



To account for varying trading volume over the sample period the study employs Hendershott, Jones, and Menkveld’s (2011) HFT/AT proxy that normalizes the raw message traffic measure by dollar trading volume (price * volume) as a robustness test.

5.1.6 Market Integrity Metric (End of Day Price Dislocation)

Market manipulation proxied by End-of-day Price dislocation (EOD) counts manipulative value incidences. An end-of-day-price-dislocation (EOD) incidence is triggered when the price movement of a security in the near market close (e.g., X number of minutes before close) exceeds the rolling benchmark (bootstrapped from

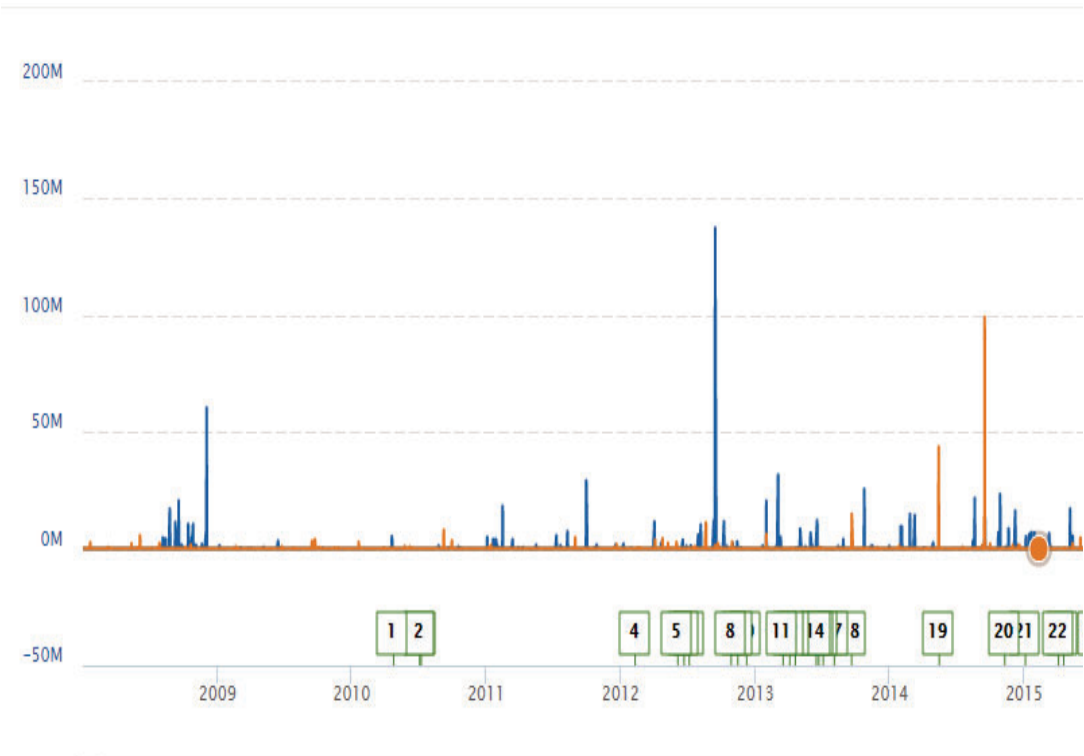
the benchmarking period, e.g., 250 days); the price of the security reverses shortly after market re-opens the next morning; By using publicly available data, the manipulative value of an incidence is calculated by aggregating all trading during the manipulation window. When private data with participant information is provided, the incidence (the manipulative value) can be detected (calculated) with fewer false positives. In recent times, the number of traditional exchanges has declined globally due to consolidation, whilst the number of alternative trading systems (ATS) has increased worldwide. One unique form of ATS is the dark pool or crossing venue, which operates by systematically matching orders in a non-pre-trade transparent manner. Rosenblatt Securities estimated that between July 2008 and July 2012 dark trading in the US has grown from seventeen percent of consolidated. In Australia dark trading is estimated at thirty percent plus of traded volume, whilst in Canada dark trading is estimated at approximately fifteen percent of volume traded. Similar trends have also been observed on European markets. In the USA alone, investors have access to trade on over three hundred exchanges that include thirteen registered lit exchanges, forty-one ATS and the rest being broker-dealer internalisation venues. In Australia, there are four lit markets and approximately twenty-six crossing networks / dark pools. In South Africa, there are currently four lit exchanges and approximately twelve ATS/ dark venues. The growth in pre-trade transparency exception venues stems from the need for trades which may involve significant market impact costs if conducted through lit public markets. Such trades can be conducted off-market to minimise market impact costs. It is therefore evident that dark trading offers a number of potential benefits to investors, particularly large investors; offering additional liquidity in the form of matching large trades at the

midpoint allowing investors to minimize market impact costs and reduce information leakage. Further, in general dark trading, may also offer price improvement (as in Australia and Canada) by trading within the spread offered by lit exchanges and with the result of reducing the explicit costs associated with trading large volumes of trades. The main differences between lit-markets/venues and non-lit venues are:

1. Dark venues offer little to no pre-trade transparency.
2. Dark venues do not have to publish pre-trade information and only have to report aggregate execution post trade, and.
3. Dark venues “trade-execution” occurs at finer granular pricing increments than in lit markets. Dark venues are not obligated to disclose their market structures to the public., as such very few details are known with respect to how their operations differ.

Transaction costs measured in terms of bid and ask spreads, are good indicators of market quality (Bessembinder and Vennkataraman, 2010). I use effective spread to represent actual costs for an aggressive order to immediately access liquidity in the market. Consistent with Roll (1984), I adopt transaction costs measures of quoted spreads (Roll 1984) and effective spreads (Roll 1984, Chordia, Roll and Subrahmanyam, 2008, Aitken, Chen and Foley 2013, Flood et al 2013) as proxies for market efficiency⁷. To examine the triple effect and impact of political pluralism, fragmentation and algorithmic trading on market efficiency and integrity, the thesis combines sections 1 and 2 and adopts a 3-stage ordinary least squares (3SLS) set of equations.

Figure 5-4: EOD and Information Leakage



The table summarises the value of end of day price dislocation (EOD) and Insider Trading (information Leakage) across the sample period. The sample period consists of 1/11/2013 – 30/11/2014. EOD and Information leakage are presented in RAND value. The EOD value is the cost of EOD to the market in terms of RAND Dollar value.

5.1.7 Uncertainty and Market Quality

The effects of information asymmetry on market quality in Rational Expectation Equilibrium (“REE”) are not precisely clear. According to Wang (1994) greater information asymmetry leads to lower trading volume as it decreases the informativeness of asset prices. Greater adverse selection risk may increase market-makers inventory costs and ultimately round-trip costs (“effective-spreads”) leading to lower level of market efficiency as measured by higher or wider liquidity and bid-ask spreads (Ho and Stoll (1981), Amihud and Mendelson (1986)) or lower depth (Kyle

1985)) with the consequence of higher fraction of zero returns and Roll's price impact. Consistent with Pasquariello and Zafeiridon (2014) the disagreement hypothesis conjectures that greater political uncertainty may increase differences in opinion among market participants. In heterogeneous beliefs models (e.g., Banerjee and Kremer (2010), Hong and Stein (2007)), greater fundamental uncertainty increases disagreement among investors about the fundamental value of the traded asset, leading them to trade more with one another, for instance increasing equilibrium trading volume.

5.2 METHEDODOLOGY

Three experiments are conducted for this dissertation. The dissertation employs an empirical 3SLS model to resolve the issue of market manipulation proxied by end of day price dislocation, market efficiency proxied by spreads, and the residual errors. The 3SLS model allows the research project to resolve the issue of algorithmic trading being cross equation correlated with market integrity (manipulation) and market efficiency (spreads). The thesis employs 3SLS to resolve the issue of market efficiency (proxied by spreads) and market integrity (proxied manipulation which in turn is proxied by end of day price dislocation, as well as insider trading proxied by information leakage) cross equation correlation. The term three-stage least squares (3SLS) refers to a method of estimation that combines system equation, sometimes known as seemingly unrelated regression (SUR), with two-stage least squares estimation. It is a form of instrumental variables estimation that permits correlations of the unobserved disturbances across several equations, as well as restrictions among coefficients of different equations, and improves upon the efficiency of

equation-by-equation estimation by considering such correlations across equations. Unlike the two-stage least squares (2SLS) approach for a system of equations, which would estimate the coefficients of each structural equation separately, the three-stage least squares estimate all coefficients simultaneously. It is assumed that each equation of the system is at least just-identified. Equations that are under identified are disregarded in the 3SLS estimation. The Zellner-Theil proposal for efficient estimation of this system is in three stages, wherein the first stage involves obtaining estimates of the residuals of the structural equations by two-stage least squares of all identified equations; the second stage involves computation of the optimal instrument, or weighting matrix, using the estimated residuals to construct the disturbance variance-covariance matrix; and the third stage is joint estimation of the system of equations using the optimal instrument. Although 3SLS is generally asymptotically more efficient than 2SLS, if even a single equation of the system is misspecified.

5.2.1 3SLS Structural Equations Model for Market Quality

The study uses OLS regression model and examine the B-OLS (***OLS Estimates, Standard Errors, t-statistic and p-value***). The sample consist of 368,867 matched stocks and political events data over the sample period 2 January 2008 –15 September 2015:

$$\begin{aligned} EOD_{i,t} &= \alpha + EffSprd_{i,t} * \beta_1 + HFT_{i,t} * \beta_2 + VIX_{i,t} * \beta_3 + Ret_{i,t} * \beta_4 + \%DarkTrd_{i,t} * \\ &\beta_5 + \%LitTrd_{i,t} * \beta_6 + CLDummy_{i,t} * \beta_7 + iHHI_{i,t} * \beta_8 + \varepsilon \end{aligned} \quad (5-1)$$

$$\begin{aligned} EffSprd_{i,t} &= \alpha + EOD_{i,t} * \beta_1 + HFT_{i,t} * \beta_2 + TotalVol_{i,t} * \beta_3 + VIX_{i,t} * \beta_4 + DarkTrd_{i,t} * \\ &\beta_5 + LitTrd_{i,t} * \beta_6 + CLDummy_{i,t} * \beta_7 + iHHI_{i,t} * \beta_8 + \varepsilon \end{aligned} \quad (5-2)$$

$$\begin{aligned} HFT_{i,t} &= \alpha + EffSprd_{i,t} * \beta_1 + EOD_{i,t} * \beta_2 + Price_{i,t} * \beta_3 + IntradayVolatility_{i,t} * \\ &\beta_4 + DarkTrd_{i,t} * \beta_5 + LitTrd_{i,t} * \beta_6 + CLDummy_{i,t} * \beta_7 + iHHI_{i,t} * \beta_8 + \varepsilon_{i,t} \end{aligned} \quad (5-3)$$

Where $\%DarkTrd_{i,t}$ = percentage of dark trading to total trading in security. $\%LitTrd_{i,t}$ = percentage of lit trading to total trading in security. $TotalVol_{i,t}$ = total trading volume in the security. $CLDummy_i$ = Co-location dummy i= 0 ex-ante & 1 ex-post market design change. $HFT_{i,t}$ = participation of HFT in the market (messaging calculated as OTT value). $EffSprd_{i,t}$ = effective spread for security. $EOD_{i,t}$ = end of day price dislocation incidence for security. $iHHI$ = inverses of the Hirschen-Herfindal Index of market plurality in SA. The instrumental variables for the endogenous variables are based on reduced form equations of all the exogenous and predetermined variables / regressors. In the model, Market Manipulation (EOD), HFT (OTT HFT) and Market Efficiency (EffSprd) regressors are predicted values.

5.3 DESCRIPTIVE STATISTICS

5.3.1 Summary Statistics

Table 5 - 2: Summary Statistics

The table below, summaries the descriptive statistics over the sample period is 2 January 2008 – 15 September 2015. The numbers are discussed and explained in later sections.

Variable	Mean	Std. Dev.	Min	Max
On Market Volume (MKT Voi)	673,901	2,532,232	1	725 M
Trade Count (TC)	79	114	1	441
Quoted Spread (QS)	453.26	1090.33	0.00	20000
Effective Spread (ES)	506.48	3338.00	0.71	18155
Realized Spread (RS)	360.92	9053.43	-5688572	18155
Price Impact (PI)	120.42	8654.96	-46816	57142
Fill Rate (FILL)	0.857	0.183	0.000	1.000
Message Traffic (MT)	5188	12103	0	35015
OTT	42	159	0	22500
Volatility (VOL)	0.002	0.008	0.000	1.137
Price	\$4,772.54	\$8,913.23	1.00	\$146,0
Total Volume (TOT Vol)	855,334	2,708,288	1	824,00
Turnover (TURN)	5 Billion	74 Billion	0	39,000
Market Cap (MKT CAP)	\$258 Million	\$4,040 Million	0	\$156 B

The final sample for consist of 368 stocks that traded daily across the sample period of 1 November 2013 – 30 November 2014. Transaction costs measures - quoted spreads, effective spreads and realised spreads are dollar volume weighted (in basis points). Currency for market capitalisation, turnover, and price are in RAND \$ (not US Dollar \$) – the South African currency. The largest turnover is R39 billion with a minimum daily turnover of R5 billion.

Table 5 - 3: Descriptive Statistics

The table below, summaries the descriptive statistics over the sample period is 2 January 2008 – 15 September 2015.

Variable	Obs	Mean	Std. Dev.	Min	Max
EOD	368.00	6242.75	998131.90	0.00	299000000
Effective Spread	368.00	3.40	8.39	0.01	195.20
OTT HFT	368.00	45.15	165.91	0.00	21902.00
Message Traffic	368.00	0.857	0.183	0.00	1.00
Ln(VIX)	368.00	3.00	0.39	2.33	4.39
Total Volume	368.00	894161.40	2710327	1.00	524000000
Price	368.00	5248.22	9363.70	1.00	146000
Return	368.00	0.22	27.29	-99.02	9871.43
Volatility	368.00	0.00	0.01	0.00	0.80
DarkTrade	368.00	3.31	1355.06	0.00	800002
LitTrade	368.00	3.77	1353.65	0.00	800001
CL Dummy	368.00	0.16	0.37	0.00	1.00
IHHI National	368.00	2.03	0.06	1.92	2.12
Variable	368.00	673,901	2,532,232	1.00	725,000,000
On Market Volume	368.00	79	114	1.00	441.00
Trade Count	368.00	5188	12103	0.00	350153
Fill Rate	368.00	120.42	8654.95	-46816	5714286

The final sample for consist of 368 stocks that traded daily across the sample period of 1 November 2013 – 30 November 2014. Transaction costs measures - quoted spreads, effective spreads and realised spreads are dollar volume weighted (in basis points). Currency for market capitalisation, turnover, and price are in RAND \$ (not US Dollar \$) – the South African currency.

5.3.2 Correlation Matrix

Table 5 - 4: Correlation Matrix

	EOD	Eff Spread	OTT HFT	Ln(VIX)	Total Volume	Price	Return	Volatility	DarkTrade	LitTrade	CL Dummy	IHHI
EOD	1.00											
Eff Spread	0.00	1.00										
OTT HFT	0.00	-0.08	1.00									
Ln(VIX)	0.00	0.06	0.00	1.00								
Total Vol	0.00	-0.08	0.00	0.05	1.00							
Price	0.00	-0.20	0.15	-0.09	0.02	1.00						
Return	0.00	0.02	0.00	0.00	0.01	0.00	1.00					
Volatility	0.00	0.25	-0.02	0.07	0.00	-0.05	0.01	1.00				
%Dark	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00			
%Lit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00		
CL Dummy	0.00	-0.03	-0.04	-0.37	-0.01	0.08	0.00	-0.02	0.00	0.00	1.00	
IHHI	-0.01	-0.04	0.00	-0.52	-0.02	0.07	0.00	-0.05	0.00	0.00	0.66	1.00

The final sample for consist of 368 stocks that traded daily across the sample period of 1 November 2013 – 30 November 2014. Dark and trading and lit trading percentage cannot be used at the same time because of the near perfect collinearity issues, so dark trading percentage is used instead in the regressions. The research returns price, return and volatility as they are likely to contain signal strength much more than value.

5.4 3SLS REGRESSION RESULT

Table 5-1: 3SLS Regression Result

	EOD	Effective Spread	OTT HFT
EOD		-0.0001 (0.14)	0.0008 (0.65)
Effective Spread	788.0647 (7.34)**		2.5430 (1.00)
OTT HFT	9.5777 (0.13)	-0.0583 (0.35)	
Ln(VIX)	1,049.8694 (0.17)	1.0565 (0.08)	
Price			0.0032 (7.67)**
Return	-11.0901 (2.99)**		
%Dark	-1.8713 (0.03)	-0.0001 (0.00)	0.0036 (0.11)
%Lit	1.8685 (0.03)	0.0001 (0.00)	-0.0037 (0.11)
Volatility			-705.9828 (1.45)
Total Volume		0.00001 (3.08)**	
CL Dummy	9,920.869 (1.25)	-2.1720 (0.15)	-47.1519 (3.89)**
IHHI National	-170,498.101 (3.27)**	1.2237 (0.06)	278.8952 (1.28)
Constant	346,792.128 (3.07)**		-538.3828 (1.18)

Table 5-2 above present evidence of market efficiency (effective spread) equation correlation with the market manipulation measure of EOD. There is a positive relationship between EOD, Effective Spread and HFT. T-Statistics in parenthesis. * $p < 0.05$; ** $p < 0.01$. An increase in effective spread is associated with a 788 unit increase in the number of EOD incidences, whereas a unit increase in OTT, a proxy for HFT is associated with an approximately 10 unit increase in the number of EOD incidences. Furthermore, trading in the lit market increases the number of EOD incidences by 1.86 whereas trading in the dark market decreases the number of EOD incidence by 1.87.

5.4.1 High Frequency Trading (HFT) Results

Table 5-2: High Frequency Trading Equation

HFT	Effective					Co-location			
	Constant	EOD	Spread	Price	%Dark	%Lit	Volatility	Dummy	iHHI
Estimates	-538.38	0.0008	2.543	0.0032	0.0036	-0.0037	-705.9828	-47.15	278.90
t-Stats	1.18	0.65	1.00	7.67**	0.11	0.11	1.45	3.89**	1.18
Pvalue	0.0001	0.0000	0.0001	0.0010	0.0000	0.0000	0.0000	0.0010	0.0000

The final sample for consist of 368 stocks that traded daily across the sample period of 1 November 2013 – 30 November 2014. A unit increase in effective spreads results in 2.5 units increase in HFT. The explanation of this is clear. increase

5.4.2 Effective Spread (EffSpread) Results

Table 5-3: Effective Spread Equation

Effective Spread	Constant	EOD	OTT HFT	Ln(VIX)	%Dark	%Lit	Co-location		
							Total Volume	Dummy	iHHI
Estimates	46792.13	-0.0001	-0.0583	1.0565	-0.0001	0.0001	0.00001	-2.17	1.22
t-Stats	2.07	-0.0001	0.35	0.08	0.00	0.00	3.08**	0.15	0.06
Pvalue	0.0.001	0.001	0.0001	0.0001	0.000	0.0000	0.0000	0.0000	0.0000

The final sample for consist of 368 stocks that traded daily across the sample period of 1 November 2013 – 30 November 2014. For effective spreads, a unit degrease in HFT results in 0.5 unit decrease in effective spreads.

5.4.3 End of Day Price Dislocation (EOD) Results

Table 5-4: EOD Equation

End of day Price								Co-location	IHHI
Dislocation	Constant	Effective Spread	OTT HFT	Ln(VIX)	Return	%Dark	%Lit	Dummy	National
Estimates	346792.13	788.06	9.58	1049.87	-11.09	-1.87	1.87	9920.87	-170498.10
t-Stats	3.07	7.33**	0.13	0.17	2.99**	0.03	0.03	1.25	3.27*
Pvalue	0.0.001	0.0.002	0.0.003	0.0.004	0.0.006	0.0.007	0.0.008	0.0.009	0.0.010

The final sample for consist of 368 stocks that traded daily across the sample period of 1 November 2013 – 30 November 2014. The result in Table 5-7 above for the EOD specification shows that there is an increase in the number of EOD incidences post the market design change on May 12, 2014, but the increase is statistically insignificant.

There is a positive relationship between effective spread, order to trade ratio (OTT) and EOD incidences. An increase in effective spread is associated with a 788 unit increase in the number of EOD incidences, whereas a unit increase in OTT, a proxy for HFT is associated with an approximately 10 unit increase in the number of EOD incidences. Furthermore, trading in the lit market increases the number of EOD incidences

by 1.86 whereas trading in the dark market decreases the number of EOD incidence by 1.87. It would seem dark trading (market fragmentation) is overall good for the Johannesburg cash equities market. There is a negative relationship between pluralism and EOD price dislocation though the relationship is positive for effective spreads and HFT.

Chapter 6: CONCLUSION

The dissertation studies the triple impact of political lifecycles, market fragmentation and high frequency / algorithmic trading on market quality. Market quality is defined as comprising of market efficiency and integrity. This thesis examines the channels through which political lifecycles matter for market quality. Three distinct but inter-related studies are conducted, and the findings of the study indicate that a country that has a dominant political party, tends to lead to a deterioration in market quality, but conversely improvement in systemic risk. These findings are contrary to the general assumption that a dominant political party would in fact reduce uncertainty and therefore should result in improved overall market quality. The literature review on chapter two illustrates that research in market quality and political lifecycles is sparse but there exist channels through which political lifecycles matter for market quality. Further, the literature review reveals that market quality studies have tended to focus mostly on market efficiency with limited studies in the combined effect and impact of fragmentation and algorithmic trading. Further, some limited HFT studies reveal a positive relationship between HFT and market efficiency and integrity. This research extends the extant research by examining the fragmentation of markets and the role of HFT within political pluralism. Whilst significant and informative evidence has been garnered on market design changes such as market fragmentation as well as electronic algorithmic, the evidence has tended to be highly focused on market efficiency and to a lesser extent integrity, but

most notably assuming the two are independent of each other, adopting models where-in a typical microstructure view of market design changes (technology, regulation, instruments, participants and information) is often used to model the extent to which market design changes are fair and or efficient for the market. The thesis however recognises that market efficiency and measures of market manipulation equation are cross correlated in the study of the effects of HFT on market quality. The problem is resolved by constructing and using three stage least squares structural equations for market efficiency, market manipulation and HFT, which is then used to examine market quality from a view of a.) the impact of political plurality and b.) the joint impact of algorithmic trading and market fragmentation. As such, the dissertation develops and undertakes three studies to work towards a single approach for market quality research.

A unique data set of the daily statistics on the Johannesburg Stock Exchange is used to illustrate how political lifecycle events are used as channels to transmit uncertainty in the market. South Africa is well suited to the experiment as it provides a setting through which events at the national level, and response variables at the firm and provincial level can be examined with respect to the extent to which political events affect and impact market quality. Further experimentation examines the impact of market fragmentation and algorithmic trading on market quality. At the national level, the African National Congress (ANC) has enjoyed unassailed support since the first democratic election on 27 April 1994, dominating the national political scene. On the other hand, there exists significant political plurality at the provincial level. The thesis finds evidence of negative impact on overall market quality, and specifically on efficiency, integrity at the national pre-and post ANC elections and

during the year of elections pre-and post. The thesis presents evidence of significant information leakage associated with the political events on the JSE market. These findings are consistent with fraudulent trading using material, but non-public information selectively disclosed to “select” investors and brokers. For systemic risk, the thesis finds improvement resilience that is reversion to normalcy consistent with theory of certainty. The thesis finds evidence of consistently higher volatility during major political lifecycle events such as election years leading to the conclusion that “uncertainty is unresolved pre-election with resolution at least 6 months’ post elections”. The thesis investigates all market design changes introduced within the South African JSE marketplace. All technology, regulatory, information, market participants (“participants”) and instruments (“TRIPI”) as well as market fragmentation and electronic trading in the South African financial markets during political lifecycle events such as election year pre and post elections are examined with a view to assessing the extent to which such market design changes lend explanatory power than political uncertainty are considered and discounted. None of these events can explain the increase (decreases) in transaction costs (market efficiency), and increase (decreased) in misconduct (market integrity). Second, on examining the impact of algorithmic trading and third, the joint impact of algorithmic trading and market fragmentation, the research finds fragmentation reduces market competition and reduces transaction costs with the additional impact on growth in dark trading or fragmentation. Dark trading has the effect of reducing market misconduct by providing an additional venue that has lesser price impact, whilst algorithmic trading has a positive effect on both market integrity, market efficiency as well as systemic risk.

Chapter 7: RECOMENDATIONS

The first study in chapter three reviews the channels outside the TRIPI model information asymmetries can be channelled into the market, whilst the second study examines the impact of HFT participation within the market and the last study puts it all together to provide a view of triple impact of political lifecycles and the joint impact of market fragmentation and electronic trading. The motivation for the research is to inform regulatory decision making, a key goal for IOSCO financial markets regulator member and affiliate organisations and provide a unified model for research market design changes with a view of understanding their impact on market quality. The mandate for regulators is to ensure any market design change is good for the market in terms of preserving fair and efficient markets, this dissertation provides the means through which examination of fair and orderliness can be undertaken. Equally significant, the research provides for the first time a lens view enabling examination of the role of political plurality on financial markets. Whilst generalised to emerging markets / countries where “powerful ruling parties and their association with leading their nation’s independence and majority rule efforts often characterized by African countries, have presided over economic decline, the rule applies to other countries where powerful ruling parties have been in power for decades, one open question for financial economists becomes the need to understand the channels through which such declines set in; on one hand, having a strong ruling party should provide the benefit of calming concerns associated with political risks. On the other, a powerful ruling party may open the economy to

corruption and market uncertainty. An assessment of the effect of plurality and impact of political lifecycle events together with a framework corrects the issues of market efficiency and market integrity cross equation cross correlation forms the basis of this thesis and to extent the extant literature on market quality. The research findings lead to the recommendation to strengthen regulatory institutions in countries with dominant political parties to enable stronger market surveillance, disclosure and reporting especially during political lifecycle events. The difficult of dominant party stakeholders to enact legislation that limits personal benefit is an obvious constraint, however governments need to enact strong government policy for sustainable economic benefit well beyond their political terms. A second recommendation would be to enforce stringent company disclosure and reporting during political parties. Last but a register of stock / asset ownership of politician should be considered to limit the channels which evidence shows are means through which dominant political partners benefit through channelling of uncertainty.

In chapter four, the research finds that co-location on the Johannesburg Stock Exchange (JSE) ushered in a higher participation of HFT in the lit JSE market. Whilst the research finds a strong positive relationship between HFT and market integrity, the cross-equation correlation nature of efficiency (effective spreads) and the measure of market manipulation (EOD) means further research that extends the research of HFT impact to include efficiency. Thus, estimating the extent to which HFT impacted market integrity ex-ante and ex-post without adjusting for the cross correlation does not give a true picture of the impact leading to the combined unified modelling in chapter five. That said the findings in chapter 4 leads to the recommendation that financial markets regulators consider policy design that

improves dark liquidity price discovery in a similar context to the Australian (ASIC 2014) and/or Canadian (2012) meaningful price improvement market design changes as per there regulatory mandate for fair and efficient markets.

Chapter five represents the culmination of the study, by building on the understanding of information asymmetry (uncertain) both from a trading based (information) and from political lifecycles in the context of plurality. The study employs a 3SLS to examine the joint impact of market fragmentation and HFT participation on market quality. A unique data set of the daily statistics on the Johannesburg Stock Exchange is used to illustrate how political lifecycle events are used as channels to transmit uncertainty in the market and gauge which factors out of plurality, market fragmentation and HFT has greater impact on market quality. Post the co-location market design shock, fragmentation in the lit market order flow and the increase in competition especially from HFT participation and the dark pools has had an overwhelming positive effect on market quality. Effective spreads and end of day price dislocation (EOD) decrease ex-post. Crucially, an increase in effective spread is associated with a 788 unit increase in the number of EOD incidences, whereas a unit increase in OTT, a proxy for HFT is associated with an approximately 10 unit increase in the number of EOD incidences. Furthermore, trading in the lit market increases the number of EOD incidences by 1.86 whereas trading in the dark market decreases the number of EOD incidence by 1.87. Pluralism has tended to exert a greater effect and impact on both efficiency and integrity accounting for a greater increase in terms of instances of EOD greater than 788. The research finds evidence of the net effect of off-exchange fragmentation having been harmful to overall market quality. Fragmentation of trading into the dark (dark fragmentation) has

detracted market fairness increasing closing price manipulation and widening the effective spreads. Thus, whilst the lit market fragmentation has the effect of improving both market efficiency (effective spreads) and market manipulation (EOD), fragmentation in the dark has had a negative effect and impact on market quality. The full effect of HFT on market manipulation depends on more than just a simple analysis of OTT and efficiency. As such the key recommendation for regulatory authorities and market participants and exchanges is to undertake further research on dark and lit market workings needs to be investigate further for better understanding. In Canada (2012) and Australia (2014) regulatory authorities introducing meaningful price improvement (MPI) to enable improved price discovery, attenuating market manipulation in lit and dark venues. The JSE is the 8th largest market in the world and Africa's largest market. Dark venue market design changes are being introduced across the South African market for JSE listed cash equities. It is there recommended that key regulatory institutions such as the financial service bureau (FSB) the South African financial market regulator continue to monitor and supervise the markets based on clearly defined "market integrity and exchange rules" which rules must support fair and orderly (efficient) markets as more HFT participates in both lit and dark markets.

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