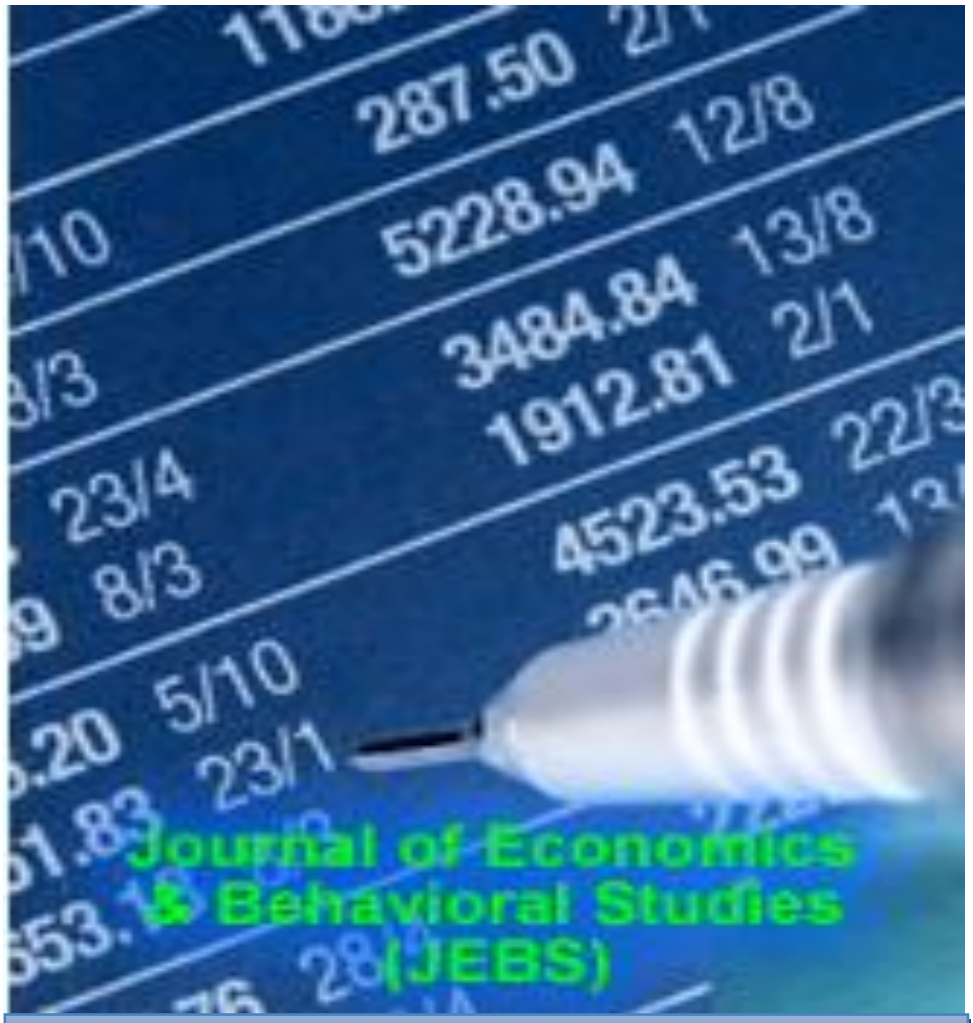

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Editorial

Journal of Economics and Behavioral Studies (JEBS) provides distinct avenue for quality research in the ever-changing fields of economics & behavioral studies and related disciplines. Research work submitted for publication consideration should not merely limited to conceptualization of economics and behavioral developments but comprise interdisciplinary and multi-facet approaches to economics and behavioral theories and practices as well as general transformations in the fields. Scope of the JEBS includes: subjects of managerial economics, financial economics, development economics, finance, economics, financial psychology, strategic management, organizational behavior, human behavior, marketing, human resource management and behavioral finance. Author(s) should declare that work submitted to the journal is original, not under consideration for publication by another journal, and that all listed authors approve its submission to JEBS. Author (s) can submit: Research Paper, Conceptual Paper, Case Studies and Book Review. Journal received research submission related to all aspects of major themes and tracks. All submitted papers were first assessed by the editorial team for relevance and originality of the work and blindly peer-reviewed by the external reviewers depending on the subject matter of the paper. After the rigorous peer-review process, the submitted papers were selected based on originality, significance, and clarity of the purpose. The current issue of JEBS comprises of papers of scholars from China, USA, Turkey and South Africa. A review of mouse-tracking applications in economic studies, application of financial ratio analysis on concordat firms, address of the 2008 global financial crises with unconventional monetary policies, influence of culture on investment decisions & shadow banking, bank liquidity and monetary policy shocks in emerging economies were some of the major practices and concepts examined in these studies. Current issue will therefore be a unique offer where scholars will be able to appreciate the latest results in their field of expertise, and to acquire additional knowledge in other relevant fields.

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TABLE OF CONTENTS

Description	Pages
Title	I
Editorial	II
Editorial Board	III
Table of Contents	IV
Papers	V
A Review of Mouse-Tracking Applications in Economic Studies Geran Tian, Weixing Wu	1
An Application of Financial Ratio Analysis on Concordat Firms: A Model Suggestion on Construction Firms Listed in Borsa Istanbul Mustafa ÖZYEŞİL	10
An Address of the 2008 Global Financial Crises with Unconventional Monetary Policies Baneng Lucas Naape, Mamokgaetji Marius Masoga	23
Influence of Culture on Investment Decisions: A Cross-Sectional Study of Ghanaian Population Adu K. Bonna, Robert Awobgo-Moah Amoah	32
Shadow Banking, Bank Liquidity and Monetary Policy Shocks in Emerging Economies: A Panel VAR Analysis Sheunesu Zhou	46

PAPERS

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A Review of Mouse-Tracking Applications in Economic Studies

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Abstract: Since mouse-tracking paradigm came under the spotlight two decades ago, by providing mouse cursor trajectories, it has been applied by behavioral scientists to a variety of topics to help understand real-time psychological state when people are faced with multiple choices. In this article, we provide a comprehensive, documentation of experimental economics studies with mouse-tracking paradigm. Among these studies, some focus on measuring choice uncertainty including subject uncertainty, temporal uncertainty, and probabilistic uncertainty; the rest are concerned with economic games including bargaining games and social dilemma games. Why and how these works employ mouse-tracking technique in their experiments is elaborated in detail. Finally, limitations of mouse-tracking paradigm are discussed, and research opportunities are proposed. Basic know-hows are appended as a general guide for interested readers.

Keywords: *Mouse-tracking, Behavioral decision-making, Experimental economics, Cursor trajectory, Game theory.*

1. Introduction

Computerized experiments are favored by experimental economists because of the high efficiency and accuracy. To facilitate researchers, toolkits were developed such that little or minor programming is needed for specific experiments. To augment the functions of ready-made platforms, auxiliary tools such as eye-tracking and mouse-tracking were developed. As one of the earliest supplementary tools for economic experiments, eye-tracking first appeared in the late 19th century. Over decades, its accuracy, ease of operation, cost, and unobtrusiveness have been ameliorated, and its application in marketing and psychology research has been expanded. However, an eye-tracking system costs $3,000 to $30,000 depending on configuration. As technology advances, mouse-tracking has emerged in the beginning of the 21th century as an economical alternative to eye-tracking.

Mouse-tracking is a computer-based program that records cursor position information of computer users and offers abundant real-time data of decision-making process, and thus it is also referred to as response dynamic. In contrast to eye-tracking with result error of 31 to 59 pixels (Johansen, San Agustin, Skovsgaard, Hansen, & Tall, 2011), mouse-tracking records cursor trajectories down to exact pixels. While eye-tracking protocol records discrete data points during trails, averages over trials, and yields time-course estimates of processing, mouse-tracking paradigm provides continuous time-course coordinates, making it possible for dynamical systems theory analysis (Magnuson, 2005). In a typical mouse-tracking experiment, participants are asked to complete tasks on computers, including moving mouse cursor and choosing one or more options among multiple alternatives that are represented by clickable buttons.

As the participants proceed, the motion of cursor is recorded. According to the theories that motor functions are driven by cognitive process (Goodale, Pelisson, & Prablanc, 1986; Spivey & Dale, 2006), cursor trajectories are considered as a sign of commitment to or contradiction among available choices (Freeman, Dale, & Farmer, 2011). Thus, mouse-tracking technique has been utilized as a tool for cognitive science, economics, and computer science studies, where researchers can drill deep into computer users' real-time decision-making process. In this review, we aim to summarize an array of studies with cursor dynamics in economics and how it can be further exploited. The interpretation on those articles focuses on (1) what problem they address and (2) how mouse-tracking technique was utilized, regardless of theoretical frameworks. The literature search for this review was concluded in July 2019.

2. Techniques that Capture Cursor Information

Currently, there are a few software packages available on the internet to acquire mouse cursor information – Mouseflow ("Mouseflow," n.d.), Mousetrap (Kieslich & Henninger, 2017), Heat Map Tracker (Callen & Thompson, 2019), Clicktale ("Clicktale," n.d.), Lucky Orange ("Lucky Orange," n.d.), MouselabWEB (a web version of Mouselab) (Lohse & Johnson, 1996; Willemsen & Johnson, n.d.), MouseTracker (Freeman & Ambady, 2010), etc. Each has its own expertise for example MouselabWEB is dedicated to monitor webpage searching behaviors, while MouseTracker is developed to trace decision-making process on a specially-designed computer program. These toolkits also generate outputs in distinct forms. Heat Map Tracker exhibits tracking results by creating heat maps, while Mousetrap produces average cursor trajectories and tracking parameters. Notably, although "tracing" and "tracking" are almost semantically indifferent, in this paper.

We follow the tradition from previous literature that "tracing" refers specifically to Mouselab, and "tracking" represents the technologies that record the entire mouse cursor trajectories. Mouselab and Mouse-tracking differ significantly in theoretical focus, interface design, and data structure. For MouseTracker, the options are often binary and are placed at the top left and right corners. In most cases, the task either asks the participants to indicate their preferences, or requires the participants to respond to certain stimuli. The cursor trajectory is recorded in three dimensions – x, y, and time. Namely, for each point of time, a pair of (x, y) coordinate is recorded. Mouse-tracking software's that record cursor trajectories such as MouseTracker are considered sensitive detector of response conflict in a situation facing two options. As for Mouselab, information on the computer is initially masked by boxes, and is often arranged in form of m×n matrix. Experiment participants can reveal information by either one of the three ways depending on Mouselab settings: 1) moving the mouse cursor inside the box, 2) moving the cursor inside the rectangle and left-clicking the box, 3) moving the cursor into the box and holding the left mouse button down.

Instead of the trajectories, the time that cursor enters and exits the rectangle is reported by Mouselab. In other words, Mouselab focuses on decision process with respect to information acquirement; by contrast, MouseTracker monitors how attention flows. Based on definition of what is recorded, Mouselab does not belong to mouse-tracking, but due to its early and extensive use in game theory studies and the fact that it deals with mouse cursor information, Mouselab is also considered in Section 3 of this review. Apart from Mouselab, decision moving-window (DMW) is another alternative (Franco-Watkins & Johnson, 2011). DMW can be viewed as a combination of eye-tracking and mouse-tracing. DMW is an eye-tracking protocol with occlusion, meaning the information is masked until the subject fixates on the area. This paradigm is tested with risky choice experiments and the results were compared with those of mouse-tracing and basic eye-tracking. It is found that DMW led to fewer fixations than the other two methods (Franco-Watkins & Johnson, 2011). Notably, Bonn experimental System (BoXS) (Seithe, Morina, & Glockner, 2016) incorporates mouse-tracking and eye-tracking options for both interactive and non-interactive experiments. Some of the most important technical know-hows are introduced in the appendix.

3. Research Articles with Mouse Cursor Information

Behavioral Economics: In behavioral economics, mouse-tracking is usually employed to detect choice uncertainty. Tzafilkou, Protogeros, and Yakinthos (2014) suggest that risk perception leads to hesitation, whose pattern is one of the most common and salient patterns of all mouse behaviors. Variables were identified as indicators of risk perception: pause time (Dijkstra, 2013), movements between choices (Ferreira, Arroyo, Tarrago, & Blat, 2010), and response time ("Clicktale User Manual," 2010). To decipher how mouse cursor movement is related to uncertainty, R. Bodily et al. (2015) designed a set of experiments based on Metamemory Framework, which suggests that when people are given a question, they have a feeling of knowing. Feeling of knowing is the extent to which the decision maker thinks he/she knows the answer of the question or he/she can find the answer after comprehending the question but before trying to answer it. However, one may encounter the situation that he/she has a strong feeling of knowing, but cannot find a fine answer.

The mouse cursor appears at the bottom center of the screen at the beginning of the task. According to this model, there are at least three possible outcomes: 1) the subject knows the answer and responds fast; 2) the subject is not aware of the answer but searches for one; 3) the subject does not know the answer and randomly selects one. Three situations represent different levels of choice uncertainty, ranking from low to high. In the experiments, low, moderate, and high uncertainty questions were deployed and the results showed that AUC was higher when people had moderate level of uncertainty than if low or high uncertainty were present. Uncertainty is tightly embedded in intertemporal choice. In a study of (O'Hora, Carey, Kervick, Crowley, & Dabrowski, 2016), participants were requested to indicate which they prefer, a money reward now or a larger one later. Decision dynamics revealed by cursor trajectories indicated that as reward delayed more, subjective value of reward decreased.

Those who chose "now" responded faster, made less x-flips, and were less likely to create a large MD. On the other hand, those who chose "delay" when rewards were further postponed exhibited higher MD and more x-flips, which is in consistent with the findings from (Dshemuchadse, Scherbaum, & Goschke, 2013). When money reward is replaced by a "vice" preferred by participant, which might be alcohol, food, cigarette, or nothing, the area under the discounting curve (AUDC) (Note that "area under the discounting curve" is abbreviated to "AUC" in some literature, which differs from "area under the curve") demonstrated interesting results. The participants who chose smoking as their vice exhibited the largest discounting factor k (k = 1-AUDC), and those who did not choose a vice discounted their rewards least strongly. Cheng and González-Vallejo (2017) deployed mouse-tracking paradigm on intertemporal choice experiment, conducted principle component analyses on data collected, and suggested that decision-making difficulties are composed of two facets – uncertainty and conflict.

An uncertain situation means the options are similar to the subject, and a conflict situation provides tempting and competing alternative. For example smaller and sooner versus larger and later rewards, Cheng and González-Vallejo (2017) also reported that idle time reflects thinking, instead of distraction, and that x-flip indicates choice uncertainty, instead of jittering. Other than the studies mentioned above, Dshemuchadse et al. (2013) confirmed date-delay effect with their mouse-tracking experiment evidence, i.e. stronger temporal discounting when representing delays (e.g. "in 9 days") comparing to calendar dates (e.g. "on the 11th of November") as measured by beta weights. Apart from temporal uncertainty, Koop and Johnson (2011) and Bruhn (2013) on the other hand examined how mouse cursor reflects probabilistic risks. In their works, cursor trajectory captured the nuance when subjects were faced with different probability and probabilistic cues.

Game Theory: Early game theory studies with mouse cursor information are dominated by Mouselab protocol. With Mouselab, payoffs are concealed by black rectangles, and subjects can reveal the payoffs with the mouse. One of the earliest Mouselab applications in game theory appears in the book written by Camerer, Johnson, Rymon, and Sen (1993) in order to keep an account of information search process in a three-round alternating-offer bargaining game (e.g. a $5 pie with a discount factor of 0.5 means in the perfect equilibrium the first mover should offer $1.25 and keep the rest). The incentive behind was to inspect how information was assembled in brain, aiming at addressing two questions: (1) what information was retrieved; (2) in what order information was processed. If the participants harnessed backward induction to calculate perfect equilibrium, they should have first inspected third-round information, and then looked at second-round, finally first-round.

Camerer et al. (1993) also predicted longest inspection time in the second-round. As is common in most bargaining games, the offers mostly lied between equal split and perfect game equilibrium. Participants need to move the mouse to reveal his/her role and the pie size for each round. Since the information was revealed as long as mouse cursor stayed upon the box, subjects opened and reopened boxes frequently, rather than memorized the information covered by the boxes. Mouselab suggested that subjects did not follow the expected route from the third-round to the first-round and did not look at information long enough for backward induction. Instead, they focused primarily on current round to make offers. Some subjects looked at future round information and were more likely to accept low offers, but they were not more likely to make offers closer to equilibrium. In this study, researchers deduced that subjects did not adopt backward induction from Mouselab evidence.

Costa-Gomes, Crawford, and Broseta (2001) altered Mouselab settings in a normal-form game experiment such that the subjects could only reveal information by left-clicking and leave the box by right clicking. This approach reduces the noise caused by random look-ups and guarantees each inspection was a conscious action. Theoretically, mouse-tracking can record more information than Mouselab in aforementioned games with the same setting. But the conundrum is how to interpret noisy trajectories lingering around the boxes, and that is probably why economists chose Mouselab for their games. One intriguing phenomena in social dilemma games is that under some circumstances people deviate from their best response to cooperate, especially when time pressure is present. With the help of mouse-tracking, Kieslich and Hilbig (2014) investigated whether defection, as compared to cooperation, entails more cognitive conflict.

MD was shown to be higher for people who decide to defect than to cooperate in three games - prisoner's dilemma game, chicken game, and stag hunt game, all of which embody the features of social dilemma. This study did not recruit time as an indicator for intuition/reflection, and thus avoid the controversy whether a fast response was intuition-driven in decision making. They further conclude that since cooperation is associated with lower degrees of cognitive conflict and thus it is the "default" choice. Opposing this argument, Myrseth and Wollbrant (2015) reasoned that since cognitive conflict can come from resisting impulse both successfully and unsuccessfully, and defection might be the result of unsuccessful self-control. In recent years, there are more studies exploring the cognitive process underlying economic games. Myrseth and Wollbrant (2015) documented a table describing the full scenario (2015, Table 1), and the following Table 1 is an augmentation of it.

We conjecture that, one cannot tell which choice is the "default" without knowing whether self-control wins or impulse wins, but if economists were able to construct two groups of participants that differ in and only in who wins the battle and redo this mouse-tracking experiment, this problem might have a solution. For those with strong self-control (type A subjects), self-control wins over intuition in most, if not all, decision-making trials, and whichever choice type A subjects made with less conflict should be the "default" choice. And vice versa, type B subject choice with more conflict should be "default". That said, how to select type A and B subjects remains questionable. There might be two ways: (1) by personality tests emphasizing self-control; (2) by different stimulus prior to mouse-tracking experiment. However, personality test can be difficult and dangerous – with personality test, it is difficult to make sure that type A and B are not *fundamentally different* (A & B may differ in many other aspects as well.

Finally, there are 4 possible outcomes: (1) for group A, MD(defect)>MD(cooperate), and for group B, MD(defect)<MD(cooperate); (2) for group A, MD(defect)<MD(cooperate), and for group B, MD(defect)>MD(cooperate); (3) for both A and B, MD(defect)>MD(cooperate); for both A and B, MD(defect)<MD(cooperate). For the outcome 3 and 4, one can easily conclude which is the "default" choice; but if outcome 1 or 2 happens with statistical significance, the pre-treatment is playing a role affecting subjects' "default" choice. The table other than the first column is the full scenario Myrseth and Wollbrant (2015) proposed, and Kieslich and Hilbig's Study (2014) is consistent with highlighted cells. The first column is added to show, how to construct subject samples such that we know which row we are referring to in each trial.

Table 1: Experiment Design for Kieslich and Hilbig's (2014) Social Dilemma Game

Designed Self-Control Through Grouped Subjects	**Assumed Self-Control and its Relation to Conflict**	**Assumed "Default" Choice**	
		Cooperation	**Defection**
Null (subjects without self-control do not provide differentiated conflict results)	No-self control	No difference between Cooperators and Defectors	No difference between Cooperators and Defectors
Subject type A: Self-control wins	More conflict with successful self-control	More conflict for Defectors than for Cooperators	More conflict for Cooperators than for Defectors

Subject type B: Impulse wins	More conflict with unsuccessful self-control	More conflict for Cooperators than for Defectors	More conflict for Defectors than for Cooperators

Table 2: A Summary of Experimental Studies with Cursor Information in Economics and Cognitive Science

Domain	Topic	Studies
Behavioral economics	Subject uncertainty	R. Bodily, Harris, S., Jenkins, J., Larsen, R., Sandberg, D., & Stokes, S., et al. (2015)
	Temporal uncertainty	Calluso, Tosoni, Pezzulo, Spadone, and Committeri (2015); Cheng and González-Vallejo (2017); Dshemuchadse et al. (2013); Gabaix, Laibson, Moloche, and Weinberg (2003); O'Hora et al. (2016)
	Probabilistic uncertainty	Bruhn (2013);Koop and Johnson (2011)
Game theory	Bargaining game	Camerer et al. (1993); M. A. Costa-Gomes and Crawford (2006); M. Costa-Gomes et al. (2001)
	Social dilemma game	Kieslich and Hilbig (2014); Myrseth and Wollbrant (2015)

4. Limitations and Future Research

Mouse-tracking as a newly emerging technique has been playing a non-negligible role in social science research, especially in experimental studies attempting to evaluate people's attention in preferential or perceptual decision-making process. However, in addition to the variability of mouse devices, one of the major limitations of mouse-tracking paradigm is that, mouse behaviors differ significantly among users, and this introduces much noise in data analysis. For example, most people are right-handed, and the mouse are most likely be placed at the right-hand-side of the users by default; some users have a habit of highlighting text with their cursor, and some tend to leave their mouse idle while scanning information. With a being a Wallstreet elite and B being an alcoholic with no self-control, taken to an extreme), and it is dangerous that type B subjects may not undergo the impulse-conscious battle at all. Third, size congruity effect might be triggered by different font size (Henik & Tzelgov, 1982).

As for the second approach, randomly selected subjects are given distinct stimulus as pre-treatment to provoke group A's deliberation and group B's intuition before mouse-tracking experiments, and one possible pre-treatment would be asking subjects to solve some arithmetic questions, without and with time pressure for group A and B respectively. Therefore, it is necessary to apply aggregate statistics on a pool of users to infer attention (Navalpakkam et al., 2013). Fischer and Hartmann (2014) also proposed several concerns about interpreting mouse-tracking results in number studies. They pointed out specific mental relationships between space and number. First, the SNARC effect (Spatial-Numerical Association of Response Codes) suggests that small and large numbers are associated with left/lower and right/upper areas, respectively (Dehaene, Bossini, & Giraux, 1993). Second, odd and even numbers are linked with left and right areas, respectively (Nuerk, Iversen, & Willmes, 2004).

Fourth, the relative location of each digit in a multi-digit numerical influences its meaning through the place-value system (Nuerk et al., 2004). All these factors make number-related mouse-tracking experiment a tricky case. A possible solution is to randomize the layout of display among trials so that averaged results absorb these effects. Similar to numbers, abstract direction vocabularies (e.g. north, south, west, east) generate a framing effect on the following spatial orders (e.g. up, down, left, right). (Tower-Richardi, Brunyé, Gagnon, Mahoney, & Taylor, 2012), and this may have an impact on the un-biasedness of some text-oriented mouse-

tracking studies. At this point, number and text-related effects have not been quantified systematically. Considering a great portion of economic experiments involve numbers and texts, there stands a research opportunity to fully examine to what degree these effects influence the curvature of mouse trajectories, and whether spatial manipulation can mitigate these problems. For economists, there is still plenty of room to expand mouse-tracking in their research.

For example, We discussed in Section 4 how to improve Kieslich and Hilbig's experiment (2014) with a pre-treatment to answer the "default" question in social dilemmas. Mouse-tracking is useful in evaluating bounded rationality as well, such as the case in alternating-offer bargaining game (Camerer et al., 1993) where cursor position showed that people in fact did not use backward induction. Other than bounded rationality, there are much more theories and phenomena to be tested with mouse-tracking technology. Nudge theory, for instance, has not been fully examined with mouse-tracking. Other research opportunities lie in examining the neurophysiologic responses associated with mouse moves and clicks, and clarifying whether mouse-tracking data are supplementary to other neuroscience tools, for example skin conductance, functional magnetic resonance imaging (fMRI), electroencephalography (EEG), etc. Hindy et al. (2009) proposed a new combination of mouse-tracking and transcranial magnetic stimulation (TMS), and such a combination has not been fully explored.

Appendix: Measurements and Analyses

A1: Response Time (RT), Velocity, and Acceleration Component (AC): The definition of RT is self-revealing. RT measures the time it takes from showing of a certain task page till a decision is made. Rubinstein's work on web-based experiments (2013) suggests that RT can be an indicator of accuracy for objective questions. The strong correlation between relatively short RT and errors is supported by several well-established experiments, including those of Tversky and Kahneman (1983; 1986). Furthermore, novel visualization methods of mouse-tracking data such as decision landscapes (Zgonnikov, Aleni, Piiroinen, O'Hora, & di Bernardo, 2017) await discovery. Despite the fact that some participants are intellectually unable to give the right answer, some are intentionally choosing random responses to minimize time and effort they devote in the experiments, especially in experiments without performance incentives. One possible solution is to lock each experiment interface for a reasonable period before one can move on to the next question. How long the locking time should be and whether this practice improves devotion deserves further exploration. Note that if task page contains complicated information to read, RT need to be taken good care of and mouse-tracking result will be inevitably harder to deal with (Stillman, Shen, & Ferguson, 2018). Velocity of cursor trajectory is measured in "pixels per second" or "degree per second".

Researchers are more interested in peak velocity other than average velocity. Conversely, if two choices are situated up and down, there will be a y-flip if a sudden change of choice occurs. To do that, cursor velocities under different treatments are often plotted over the time course, and higher peak velocity is considered a symbol for greater response activation. Derived from velocity and acceleration, AC is an indicator of how many times cursor acceleration changes direction (Dale & Duran, 2011):

$$\mathrm{AC} = \left(\sum H[-(a_t - a_{t-1})(a_{t-1} - a_{t-2})]\right) - 1$$

Where a_t is the acceleration of cursor at time t. When acceleration changes direction, the Heaviside function gives 1. However, even in the simplest trajectory, the cursor accelerates and decelerates for at least once, and thus the summation returns 1. To correct it, 1 is subtracted from AC calculation to standardize this measurement. Usually, when the competition between responses is greater, subjects are more hesitant during the decision-making process and thus lead to greater MD and AUC. However, it is argued that AUC is a better index of overall attraction towards unselected choice incorporating all time intervals, while MD is a better indicator for maximum attraction, limited to shorter time duration.

A2: Measurements for Spatial Attraction - Area under the Curve (AUC) and Maximum Deviation (MD): AUC and MD are calculated based on the ideal response trajectory, which is defined as the line segment connecting the start point and the selected destination. Therefore, ideal response trajectory is the shortest route to give a certain response. AUC is the geometric area enclosed by recorded trajectory and ideal trajectory (Note that the area on the opposite side of the ideal trajectory is considered negative), and MD is

calculated as the largest perpendicular deviation between the recorded and the ideal trajectory (Freeman & Ambady, 2010). AUC is also referred to as "curvature" in some literature. An equivalent measure is absolute average deviation (AAD), which is defined as the average deviation between the ideal response trajectory and the actual trajectory.

A3: Measurements for Complexity – X-Flips and Y-Flips: X-flips and/or y-flips are count-based parameters that measure mouse trajectory complexity. "Flip" refers to a sudden change of cursor trajectory from one choice to another, and sometimes it is referred to as "midflight" in literature. As in most cases two choices are allocated with left-right layout, and there is a sudden change of choice along the x-axis, then it is an x-flip. Both AUC and MD are crucial measurements for spatial attraction. In most experimental studies, the correlation between AUC and MD is 0.8 to 0.9 (Stillman et al., 2018), and replacement of AUC by MD for the same data does not critically change the results (Freeman, Ambady, Rule, & Johnson, 2008). Regarded as a result of competition between potential targets, flip is one of the most important measures for identifying distraction. x-flips are calculated as below (Dale, Roche, Snyder, & McCall, 2008):

$$\mathrm{x-flips} = \sum H[-(\triangle x_t - \triangle x_{t-1})(\triangle x_{t-1} - \triangle x_{t-2})]$$

Where x_t represents x-axis coordinate at time t. The Heaviside step function will return 1 when there is a change of directionality along the x-axis. Figure 1 is a schematic presentation of how AUC, MD and x-flip are calculated.

Figure 1

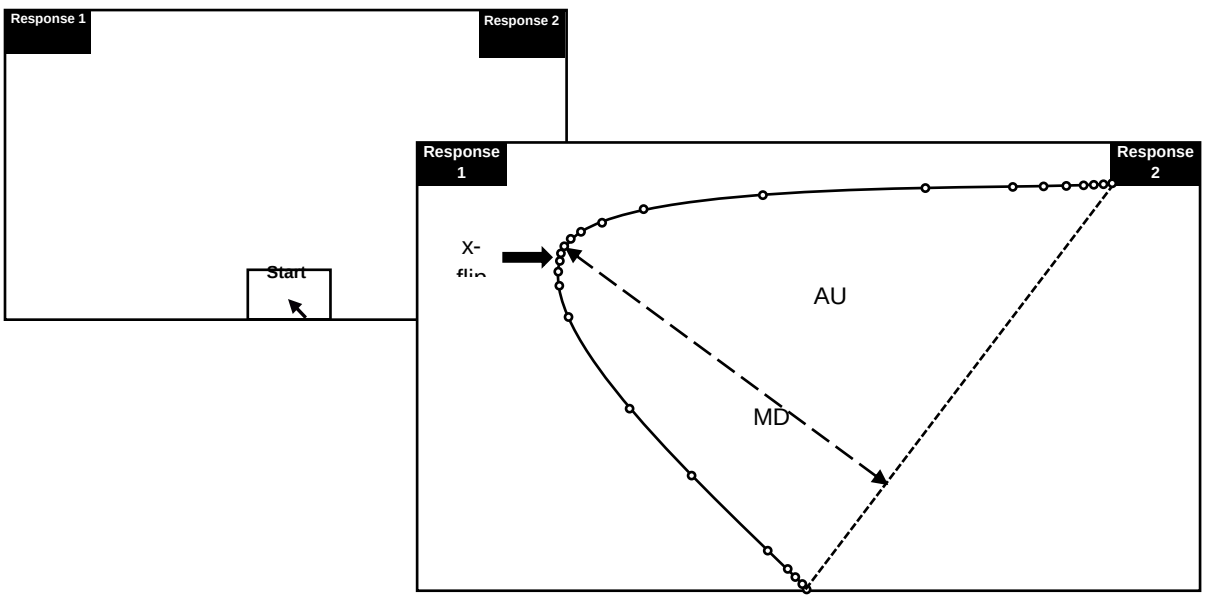

Figure 1 A schematic presentation on how AUC and MD are defined in a two-way layout. The top-left diagram is initial interface. After clicking "start" button, the task is initiated. The solid curve in the bottom-right diagram represents a possible trajectory, in which case the subject was first attracted to Response 1 and finally chose Response 2, resulting in 1 x-flip and corresponding AUC (shaded area) and MD (dotted line).

A4: Distributional Analyses – Bimodality: Bimodality is to detect whether trajectory responses are a result of single- or dual-process cognition. If dual-process is present, some trajectories are likely to exhibit a sudden change, and the distribution of AUC has more than one peak. Freeman and Dale's work (2013) carried out simulations to test several bimodality metrics – Bimodality coefficient (BC), Hartigan's dip (HDS) and the difference in Akaike's information criterion between one-component and two-component Gaussian mixture distribution models, and concluded that the HDS may be the most suitable measure for detecting bimodality for two reasons –HDS is sensitive in distinguishing unimodality and bimodality and it is immune to some disturbing effects.

Since generally BC and HDS converges, BC's formula is shown below (Cary, 1989):

$$\mathrm{b} = \frac{g_1^2 + 1}{g_2 + \frac{3(n-1)^2}{(n-2)(n-3)}}$$

Where, n is the number of observations, g_1 stands for skewness, and g_2 represents kurtosis. When b is greater than 5/9, bimodal or multimodal distribution is present. Readers interested in how to analyze dual process cognition with mouse-tracking should read the article of Wel, Sebanz, and Knoblich (2014) for reference.

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An Application of Financial Ratio Analysis on Concordat Firms: A Model Suggestion on Construction Firms Listed in Borsa Istanbul

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Abstract: The main purpose of this study is to apply a detailed financial ratio analysis on the firms that have declared concordat, to determine which kind of financial ratios predict the more successful preliminary estimations and to form a model according to the findings obtained and to apply this model to the firms operating in Borsa Istanbul construction sector. For this purpose, the last 5 years' financial statements of the two companies whose shares are traded on Borsa Istanbul and declared concordat are analyzed by the ratio analysis method. As a result of the analysis, it was found out that the ratios that gave the strongest concordat signal are the liquidity and financial structure ratios. According to the results of the analysis, a model that can be used for the general of the companies is proposed by giving weight to each rate type. In order to test these findings, the model is applied to the financial statements of three companies operating in Borsa Istanbul construction sector and financial ratio scores of firms are calculated over the years. According to the results of the analysis, it is found that the financial situation of the construction firms is much better than the ones of the firms that has declared concordat. However, when the construction firms are compared with each other, it can be stated that YYAPI is lagging behind others in terms of financial performance.

Keywords: *Financial Analysis, Ratio Analysis, Concordat, Model Construction.*

1. Introduction

The financial statements issued by the firms have vital importance for the information users during the decision-making process. It is available to classify information users as internal ones that include shareholders, managers, and employees and as external ones that include suppliers, customers, investors, financial institutions, government and so on. As stated in article 3 of the international auditing standards (IAS), the financial statements of the firms represent financial claims for the mentioned users, particularly for external ones. Therefore, these claims must be confirmed and analyzed analytically. Verification of financial assets is carried out by an independent audit process and includes checking whether each financial statement item exists and shows the correct amount. Analytical analysis, on the other hand, is defined as a part of the independent audit process, but actually refers to the concept of financial analysis. Financial analysis is the process of analyzing the audited financial statements of the firm in an analytical manner and generating the necessary signals to the management about the financial and operational performance of the firm. Financial analysis is the process of analytically examining the financial and operational results of firms.

Financial analysis is the process of examining and interpreting financial statements using generally accepted analysis techniques (Gümüş et al., 2017). Financial analysis is performed to measure financial performance. Financial performance analysis includes the calculation of activity and financial performance indicators, determination of financial position of firms and measurement of the efficiency and risks of investments made based on historical financial statement information of a company and form the basis for the financial projection to be made for the next years (Gümüş et al., 2017).

Proper financial analysis sheds light on decision-makers on the following issues (Çelik, 2017):

- Operational performance
- Realization rate of targets
- Equity adequacy / Leverage level
- Important information and feedback on costing and pricing is provided.

The benefits of financial analysis and the information users they serve are summarized in the table 1 below:

Table 1: Benefits of Financial Analysis and the Information Users they serve

Indicator	Explanation	Information User / Related Party
Operational performance	It provides crucial information about the company's business model. Receivables turnover rate and inventory turnover rate are the main indicators of how effective and risky a business model that firms have.	Covers both Internal (Managing Partners) and External (Investors, Financial Institutions, Government) Information Users. Managers need this information in internal performance evaluation and decision processes. As external information users, financial institutions and investors need this information to evaluate the risk and return of the firm's business model.
Realization rate of targets	It is examined whether the managers of the company have achieved the financial and operational success indicators determined in the budget of each year.	Mostly used by managers who Internal Information User. In addition, investors may have information based on the declarations made by the company through the material disclosure statements within the scope of PR & IR practices.
Equity adequacy / Leverage level	It provides critical information about the financial risk level of the firms. Financial fragility will increase as the leverage level of firm increases. Adequate and sustainable cash flows are required to meet the financing expenses arising from the increasing debt level of the firm. Otherwise, the company will have to cover its debt by relying on other debts and after a certain period of time, the financial collapse will be inevitable.	This indicator also concerns both internal and external information users. Investors determine the level of investment by measuring the risk of the firms. In addition, banks determine the credit allocation for the firm by doing the credibility analysis of the firm according to the indebtedness level.
Costing and pricing behaviors	Both pieces of information are among the strategic financial management issues of the firms. Today, many companies are unable to calculate their unit costs precisely because they fail to constitute an effective cost accounting system. In addition, many companies do not show the necessary sensitivity to the pricing process and generally prefer traditional pricing methods such as cost + expected profit margin.	Both external and internal sides need this kind of information.

Source: Author's Own Explanations

The objectives of the financial analysis are summarized below (İskenderoğlu et al., 2015):

- A comparative analysis of the annual or quarterly financial statements of the firms, to obtain indicators of the entity's asset and debt structure.
- Examining the financial statements of the companies in the previous periods to determine the progress of the firm during the analysis period.
- To measure the relative performance of the analyzed firm's financial and operational results in comparison with the results of firms of similar size and operating in the same sector in other words, comparing with the industry average.
- Calculation of historical payment performance of a company that requests a loan, deciding the repayment capacity and making a final decision on the allocation of loans.
- Preparation of the investment budget needed for the investment decisions of the firms.

The most commonly used techniques in financial analysis can be listed as follows (Karadeniz, 2016):

- Horizontal Analysis (Comparative Financial Statements Analysis)
- Vertical Analysis (Vertical Percentage Analysis)
- Trend Analysis (Trend Percentage Analysis)
- Ratio Analysis (Financial Ratio Analysis)

The ratio establishes a relationship between two different financial items. In this respect, ratio analysis calculates the financial metrics which are the pioneer for firms by dividing 2 different financial items to each other. While all other analyzes are applied separately to balance sheet and income statement, income statement and balance sheet items are used together in ratio analysis and the relationship between them is revealed. Ratio analysis is classified under 4 headings; Liquidity Ratios, Financial Structure Ratios, Activity Ratios and Profitability Ratios (İç et al., 2015). A description of each ratio and its related formula is shown in Table 2 as follows:

Table 2: Financial Ratios Breakdown

Liquidity Ratios	**Formula**	**Explanation**
Current Ratio	Current Assets / Short Term Liabilities	It shows how many times the business entity is able to pay its short-term debts during one fiscal year.
Acid - Test Ratio	(Current Assets - Inventories) / Short Term Liabilities	It indicates how many times a firm can afford to pay back its short-term debts during a fiscal year after excluding inventories which is one of the slowest items to be converted to cash.
Cash Ratio	(Current Assets – Inventorie – Trade Receivables) / Short Term Liabilities	It shows how many times the business entity can repay its short-term debts only relying on the cash and cash equivalents item during a fiscal year.
Fiscal Structure Ratio	**Formula**	**Explanation**
Leverage Ratio	Total Debt / Total assets	It shows how much of the business entity's assets are financed by debt.
Short-Term Liabilities %	Short-Term Liabilities / Total Assets	It shows the share of short-term debts in total assets which are more risky than long-term debts due to maturity.

Profitability Ratios	**Formula**	**Explanation**
Gross Profit Margin %	Gross Profit / Net Sales	Shows the difference % between net sales and cogs.
Operating Profit Margin %	Net Operating Profit / Net Sales	It shows the net added value remaining to the business entity after the deduction of operating expenses together and cogs from net sales item.
Ebidta %	(Profit Item Before Interest, Tax, Amortization, and Depreciation) / Net Sales	EBIDTA, which is the real cash generating indicator of the firm, is calculated by adding the expenses that do not require cash outflow to the operating profit. EBIDTA% represents the EBIDTA amount remaining to the firms for each 1 TL sale.
Return on Assets	Net Profit / Total Assets	It shows how much of the firm's 1 TL asset investment remains to the firm as profit.
Return on Equity	Net Income / Total Equity	It shows how much of the firm's 1 TL equity investment remains to the firm as profit. This rate is used especially for calculating the payback period of the money provided by the shareholders.
Activity Ratios	**Formula**	**Explanation**
Trade Receivables Turnover Ratio	Net Sales / Average Trade Receivables	It shows how many times the firm can collect its trade receivables from its customers during a fiscal year.
Inventory Turnover Ratio	Net Sales / Average Inventories	It shows how many times the firm can sell its all products to the customers during a fiscal year.
Asset Turnover Ratios	Net Sales / Average Assets	It indicates how many times the firms convert their assets to sales during a fiscal year.

Source: (Kanapickienė and Grundienė, 2015)

The financial analysis is based on the firm's historical financial statements. In this way, the historical performance of the companies is measured. It also forms the basis for the preparation of financial projections based on forecasts that management will determine in the light of historical averages. In this respect, financial analysis not only performs detailed performance appraisal of previous periods but also generates important signals for future periods. The aim of this study is to create clues by calculation financial metrics through the financial analysis of firms. The main purpose of this study is to conduct financial analysis for the firms that announced concordat and by modeling the results of these firms a new model will be established that may illuminate other firms listed in Borsa Istanbul - Construction sector. In the second part of the study, the previous study about financial analysis is discussed in detail. Section 3 will provide information about sample construction and methodology. In sections 4 and 5, the test results will be shared and the results of the analysis will be interpreted. The data used in the analysis are based on the financial statements for the 2014-2015 and 2015-2016 harvest periods of 150 plants. In the study, they divided the sample into groups and applied discriminant and clustering analysis.

2. Literature Review

Rodrigues and Rodrigues (2018), tried to determine the financial situation of the sugarcane sector in Brazil and to provide the necessary information about the investors, company managers and the decisions to be made to the government. According to the results of the analysis, it shows that the sector presents a heterogeneous structure due to different company groups in the sector. The results of the analysis show that it is difficult to increase the production capacity in the short term, but recovery is possible in the medium and long term provided that the general market conditions are positive and the institutional framework of the country's fuel sector is permanent. Arkan (2016), showed the use of financial ratios derived from financial statements in the stock markets of developing countries in estimating stock price movements. In the Kuwait financial market during the 2005-2014 analysis periods the predictive power of 12 financial ratios was analyzed on fifteen firms from three sectors. After the ineffective variables were eliminated from the analysis by STEPWISE method, multiple regression analysis was applied to estimate the stock price for each sector. According to the results of the test, it was determined that some ratios, especially ROA, ROA and Net Profit Ratio could provide strong signals of the relationship with stock price behavior and trend for industrial firms. The most effective ratios for investment and service sectors are ROA, ROE, P / E and EPS ratios, respectively. Zorn et al. (2018) used financial ratios as sustainability measures in the agricultural sector.

In their studies, they included the most frequently used financial ratios in the analysis by taking into account the different practices between Europe and North America in farm management. While 5 of the ratios used in the analysis are related to profitability indicators, 4 of them are related to liquidity indicators. The other eight financial indicators are related to financial efficiency, financial stability and repayment capacities of firms. More than 14,000 financial data of dairy farms from the Swiss Farm Accounting Data Network (FADN) were analyzed. Spearman correlation analysis was performed for normalized and harmonized financial ratios. According to the results of the correlation analysis, a positive relationship was found between financial ratios and economic sustainability. They calculated the compound average of the 17 financial ratios used in the analysis for Europe and North America separately and obtained similar results with the general results. Banerjee et al. (2016), analyzed efficiency of the ratings of the initial public offerings in the primary market. They observed that although the rating methodology of rating agencies seemed different, they were essentially the same in terms of basic characteristics. In the sample, ratios related to profitability, liquidity and credit quality data of 5 major commercial banks of South Africa were used.

They observed that all rating agencies used financial ratios, which is one of the analytical tools to rate initial public offerings, and as a result, they measured the impact of financial ratios on the rating of initial public offerings. In the analysis, they used the liquidity and profitability ratios as an estimator in the prediction studies and tested whether the issuers' liquidity and profitability ratio performances before the initial public offering continued after the issuance. In this way, they measured whether the investors who purchased stocks from the first issue would obtain positive returns. For this purpose, a sample based on 35 graded initial public offerings between 2011 and 2013 was analyzed. In the analysis, they used 15 profitability and liquidity ratios of the firms performed initial public offerings as independent variables. In order to determine the factors affecting IPO rating, they applied factor analysis to these independent variables. They also performed a regression analysis in order to analyze the estimation power of financial ratios in IPO rating. According to the results of the analysis, they found that the interest coverage ratio could explain the IPO rating statistically significantly. Kumbirai and Webb (2010) investigated the financial performance of commercial banking industry in South Africa during the 2005-2009 periods. They found that the use of Fin-tech data provided more benefits to investors.

According to the results of the study, all bank performance indicators increased significantly during the first 2 years of the analysis period. According to analyze it was stated that a significant change was observed in the trend in 2007 when the global financial crisis erupted and this change peaked in 2008-2009. It was stated that this situation resulted in insufficient liquidity, low profitability and deteriorating credit quality in South Africa's banking system. Sueyoshi (2005) used financial ratio analysis to measure the financial performance of energy sector in USA. In the analysis, the firms in the sample were divided into two groups as default and non-default firms. In the final version of the sample, financial data of 147 non-default firms and 24 default firms were used. Nonparametric discriminant analysis was used in the analysis. It is underlined that such

weight estimates provide an assessment score of the discriminatory function as well as a total measure of financial evaluation in which the financial performance of power / energy firms can be determined. The results of the analysis showed that both leverage ratio and return on equity ratio are he important financial factors that protect firms from bankruptcy or financial turbulence. The findings from the US energy sector were compared with European and Japanese firms.

He observed that Japanese energy firms are sufficient in terms of managerial and financial skills, even if the US financial analysis standards are applied. He also stated that the results of the analysis showed that Japanese energy companies outperform than US firms. Rakićević et al. (2016), propose a logic-based methodology for the use of Dupont to analyze the financial performance of firms. The audited financial statements of the company prior to concordat will be analyzed in Excel 2016. In their study, the Dupont method is described as a basic performance indicator to decompose the return on equity (ROE) into profit, turnover and leverage components and to determine the basic source of ROE. Model that they developed was applied on a sample of 18 companies operating in the automotive sector Grennan and Michaely (2019), Described market intelligence Fintech as process that gathers many data sources including nontraditional ones and uses artificial intelligence to make investment suggestions. By using data from Fintech, they evaluate the relationship between data coverage at Fintech and market efficiency. According to the results of the analysis, they found out that price information was higher for stocks with wider field coverage of Fintech and traditional sources of information had less effect on stock prices. In line with the changing behavior of investors, they found a substitution relationship between Fintech data and traditional data.

3. Sample Construction and Methodology

In this study, for the last 5 years prior to the application date, the financial statements of the listed firms that apply for the arrangement of bankruptcy (concordat) will be analyzed by the ratio method. Main objective of this study is to evaluate the power of financial ratios in estimating the concordat and financial deterioration. In this respect, financial statements of two firms whose shares are traded on BIST and applied for concordat during the last 2 years will be analyzed. The audited financial statements of the company prior to concordat will be analyzed in Excel 2016. According to the results of the analysis, the weighting will be made among the financial ratios according to the degree to show the most obvious distortion in the financial structure. By using these weights and financial ratios a scorecard will be created for these companies that have applied for concordat. The model, which is based on the results of this scorecard, will be applied to the listed firms operating in Borsa Istanbul Construction sector and their financial situation will be interpreted in the light of the results obtained. Descriptive information about two listed firms that form the basis for the model is provided in Table 3 as follows:

Table 3: Descriptive Information of Firms that Apply for Concordat

Ticker	Stock Name	Industry	Closing Price (trl)*	Market Value (mn trl)**	Market Value (mn $)**	Free Float Ratio (%)	Capital (mn trl)
EMNIS	Eminiş Packaging	Paint	1,55	9,6	1,6	20,8	6,2
FRIGO	Frigo Pak Food	Food	13	78	13,1	48,2	6

Source: www.isyatirim.com
* Indicates the Closing Price Information on 26.12.2019.
** Calculated according to the Stock Closing Price Information on 26.12.2019.

4. Financial Analysis and Model Construction

In this part of the study, the financial statements for the 5-year period before the concordat application date will be analyzed over selected ratios for both firms. Since the concordat application of companies is made on different dates, the concordat date will be called t and the financial statements for 5 years prior to t, will be called t-1, t-2 and so on respectively. The financial statements to be analyzed shall be financial statements prepared annually (as of the end of the year). Table 4 below indicates the related dates on which both firms declared concordat.

Table 4: Date of Concordat Declared by the Firms

Firms	Date
EMNIS	25.09.2018
FRIGO	15.07.2016

Source: www.kap.org.tr

The ratios to be used for the analysis are obtained from Kanapickienė and Grundienė (2015) study. The ratios used in the study are shown in Table 5 as follows.

Table 5: Selected Ratios

Liquidity Ratios	Formula
Current Ratio	Current Assets / Short Term Liabilities
Acid - Test Ratio	(Current Assets - Inventories) / Short Term Liabilities
Cash Ratio	(Current Assets – Inventorie – Trade Receivables) / Short Term Liabilities
Fiscal Structure Ratio	**Formula**
Leverage Ratio	Total Debt / Total Assets
Short-Term Liabilities %	Short-Term Liabilities / Total Assets
Profitability Ratios	**Formula**
Gross Profit Margin %	Gross Profit / Net Sales
Operating Profit Margin %	Net Operating Profit / Net Sales
EBIDTA %	(Profit Item before Interest, Tax, Amortization, and Depreciation) / Net Sales
Return on Assets	Net Profit / Total Assets
Return on Equity	Net Income / Total Equity
Activity Ratios	**Formula**
Trade Receivables Turnover Ratio	Net Sales / Average Trade Receivables
Inventory Turnover Ratio	Net Sales / Average Inventories
Asset Turnover Ratios	Net Sales / Average Assets

Source: (Kanapickienė and Grundienė, 2015)

Financial ratio analyses are applied for both firms in Table 6 in Table 7 as follows:

Table 6: Financial Ratio Analysis of the FRIGO

Liquidity Ratios	**t-5**	**t-4**	**t-3**	**t-2**	**t-1**
Current Ratio	0,93	0,73	1,50	1,14	0,92
Acid-Test Ratio	0,33	0,26	0,57	0,36	0,29
Cash Ratio	0,05	0,01	0,30	0,07	0,02
Activity Ratios	**t-5**	**t-4**	**t-3**	**t-2**	**t-1**
Trade Receivables Turnover	7,96	15,32	12,83	11,49	8,06
Inventory Turnover	2,03	3,13	1,99	2,17	2,02
Trade Payables Turnover	2,57	4,23	3,66	3,06	2,01
Asset Turnover	0,65	0,81	0,65	0,78	0,77
Fiscal Structure Ratios	**t-5**	**t-4**	**t-3**	**t-2**	**t-1**
Leverage Ratio	0,70	0,63	0,73	0,75	0,80
Short-term Liabilities %	0,47	0,50	0,33	0,41	0,53

Profitability Ratios	t-5	t-4	t-3	t-2	t-1
Operating Profit Margin %	-3%	-3%	-12%	-1%	-2%
Return on Assets	-8%	-4%	-11%	-4%	-9%
Return on Equity	-26%	-11%	-39%	-14%	-47%
EBITDA %	1%	3%	-4%	3%	2%

When the liquidity ratios are analyzed, it is seen that the liquidity ratios of the firm are below the expected average for all years during the analysis period. The fact that the current ratio is less than 1 during all years indicates that the firm does not have sufficient current assets to meet its short-term debt. In other words, there is a negative working capital experience for the company for 5 years before the concordat. In this case, it can be said that the entity has either paid its debt with debt or sold fixed assets for its debts during the last 5 years before the concordat. Considering that the leverage ratio has increased gradually over the years, it can be considered that the firm has resorted to borrowing again to pay short-term debts. Acid-test ratio is calculated as less than one third of the current ratio. This can be explained by the high share of inventories in current assets. The average share of stocks in current assets during the analysis period is 65%, which explains the reason for the low acid-test ratio.

When the trend of liquidity ratios is analyzed, it is seen that the liquidity situation of the firm improved relatively in the 2nd and 3rd years before the concordat date. Some of this improvement in liquidity can be explained by increasing indebtedness and some by increasing efficiency in business activities. When the activity rates are analyzed, it can be considered that the turnover rate of the company is high and this situation can be seen as a positive signal for the company. This reveals that the collection period of the receivables of the firm is less than 52 days. In all years of the analysis period, the turnover rate of the receivables is higher than seven. The years in which the turnover rate of the company is relatively high are the 4th, 3rd and 2nd years before the concordat date, respectively. Despite the high turnover rate of the company, it is clear that the inventory turnover rate is not too high. Although the inventory turnover rate is greater than 1, it is well below the sector average.
During the analysis period, the average inventory turnover rate is 2.3 for all years. This ratio shows that the company is able to sell all inventories 2.3 times in one year. Based on this information, it shows that the company converts its inventories for sale approximately every 159 days. The trade payables turnover rate is 3.10 on average during the analysis period. Accordingly, it can be inferred that the company has paid 3, 10 times commercial debt in 1 fiscal year. Therefore, it is seen that the company pays commercial debt approximately every 117 days. The collection period of the receivables, inventory turnover period and commercial debt payment period can be gathered and the cash conversion cycle of the company can be calculated as follows:

$$CCC = ACPOR + ATPOI - ATPPP \qquad (1)$$

The explanations of the notations in the formula are as follows:
CCC = Cash Conversion Cycle
ACPOR = Average Collection Period of Receivables
ATPOI = Average Turnover Period of Inventories
ATPPP = Average Trade Payables Payment Period

The cash conversion cycle of the firm during the analysis period by years is shown in Table 7:

Table 7: CCC Calculations of the FRIGO by Years

Items	t-5	t-4	t-3	t-2	t-1
ACPOR	45,87	23,83	28,46	31,77	45,30
ATPOI	179,44	116,60	183,02	167,94	180,56
ATPPP	142,12	86,33	99,86	119,28	181,78
CCC	**83,19**	**54,09**	**111,62**	**80,42**	**44,08**

As known, the cash conversion cycle is the period in which the company's cash outflows will be returned to them as cash inflows. The higher the cash conversion period, the longer the company's access to cash will be. The cash conversion cycle of the firm is calculated as positive throughout the years of the analysis period. However, the period with the highest cash conversion cycle is the third year before the concordat application. During these periods, the periods of financial payments are not taken into account. Here, the cash conversion time is calculated entirely by considering the commercial cycle. For an overall cycle, periods of financial payments must also be taken into account. In this case, the cash conversion period will also increase by including the duration of the financial payments. When the ratio analysis results of Frigo are examined, two main findings are obtained. The first finding is that financial ratios have generally been able to produce a precursor signal in the last five years prior to the concordat. Looking at all ratios in the last 5-year analysis period, they all indicate a negative process leading to concordat. When the estimation power of the ratios is examined for the last 5 years it can be concluded that financial ratios indicate the bad situation of the company and can produce the necessary early signals.

The second finding is related to the analysis of the analysis period year by year. Although it can generate accurate signals regarding the financial position of the firm in the last 5 years before the concordat, the strength of these signals is not the same for each year. In particular, it can be easily seen from the table that the company's financial turbulence has started to improve relatively as it approaches the concordat date. In other words, although negative signals continue in financial ratios, a relative improvement towards the date of concordat also is observed. Then this question should arise: Either this improvement is not sufficient to ensure that the firm may not need to declare concordat or there is financial manipulation occurred in the financial items that form the basis of the firm's financial ratios. According to the results of the analysis, it can be assumed that the financial ratios that gave the strongest concordat signal in the last 5-year period before the concordat are Liquidity and Financial Structure Ratios. Based on this finding, it can be accepted that activity rates have improved relatively over the 5-year period. Therefore, possible financial manipulation can be found in financial items subject to activity ratios.

Table 8: Financial Ratio Analysis of the EMNIS

Liquidity Ratios	**t-5**	**t-4**	**t-3**	**t-2**	**t-1**
Current Ratio	0,38	0,50	0,39	0,39	0,54
Acid-Test Ratio	0,27	0,40	0,28	0,30	0,43
Cash Ratio	0,00	0,00	0,00	0,00	0,01
Activity Ratios	**t-5**	**t-4**	**t-3**	**t-2**	**t-1**
Trade Receivables Turnover	4,38	6,54	4,63	4,29	2,84
Inventory Turnover	7,89	8,86	8,04	8,94	7,10
Trade Payables Turnover	3,92	124,21	-	-	-
Asset Turnover	0,86	0,94	0,85	0,75	0,91
Fiscal Structure Ratios	**t-5**	**t-4**	**t-3**	**t-2**	**t-1**
Leverage Ratio	0,91	0,90	0,95	0,97	0,92
Short-term Liabilities %	0,50	0,53	0,62	0,75	0,81
Profitability Ratios	**t-5**	**t-4**	**t-3**	**t-2**	**t-1**
Operating Profit Margin %	-18%	-6%	-11%	-20%	1%
Return on Assets	-26%	-15%	-19%	-31%	-7%
Return on Equity	-282%	-151%	-393%	-1096%	-84%
Ebitda %	-6%	5%	-5%	-13%	5%

Similar to Frigo, liquidity ratios are well below the expected value which is 1.5. Particularly, the current ratio is around 0.5, indicating that the company can only cover half of its short-term debt even if it sells all of its current assets. When we look at the activity ratios, similar to the Frigo Company the activity rates are more favorable than the other rate types. The average trade receivable turnover rate for the last 5 years is 4.5. This result reveals that the company made approximately 4.5 collections from customers during 1 fiscal year. According to the receivables turnover rate, the collection period of the company is calculated as 81 days. The inventory turnover ratio is calculated as approximately 8.17 for the last 5 years. Based on this information, the turnover period of inventories of the firm for sale is calculated as 44, 68 days. Since the company did not have any trade payable debts in the last 3 years before the concordat, the turnover period of commercial debt could not be calculated for these years. Based on this information, the cash conversion cycle of the firm is calculated in Table 9 as follows:

Table 9: CCC Calculations of the EMNIS by Years

Items	t-5	t-4	t-3	t-2	t-1
AOTS	83,30	55,81	78,87	85,17	128,43
SODS	46,28	41,19	45,40	40,82	51,38
Tİ.BO.DS	93,17	2,94	-	-	-
CCC	**36,41**	**94,06**	**124,27**	**126,00**	**179,81**

It is observed that the cash conversion cycle of Eminiş is higher than Frigo. It is observed that the cash conversion period increases especially as it approaches the concordat date. In the financial ratio analysis of Eminiş, similar results to those of Frigo are observed. For the whole of the last 5 years before the concordat, all ratios confirm the financial trouble existence. However, there is a relative improvement in ratios as the concordat date approaches. According to the receivables turnover rate, the collection period of the company is calculated as 81 days. The ratio, which has the most evident improvement, is the activity ratios. Therefore, the most probable part of the firm's financial manipulation is the financial items used in the activity ratios. As a result of the detailed financial analysis of both companies that have declared concordat, it is seen that the financial ratios which make the strongest estimation in the process of declaring concordat are the liquidity and fiscal structure ratios. It is found that both ratio types accurately predict the concordat signal by approximately 70%. However, since there is no statistically significant result from the sample data built on two firms, the findings cannot be generalized. In the light of the current findings, we can list the financial ratio types in order of importance for accurate signaling of financial turbulence in Table 10 as follows:

Table 10: Weights of the Ratio Types in Determining Financial Turbulence

Ratio Type	Weight (%)
Liquidity Ratios	%40
Fiscal Structure Ratios	%40
Activity Ratios	%10
Profitability Ratios	%10

The pre-concordat financial score for both firms is calculated by multiplying the importance of each type of financial ratio and the financial ratios of the firms during the 5-year period before the concordat in Table 11 and Table 12 respectively, as follows:

Table 11: Financial Ratio Scores of FRIGO before Concordat

Type of Financial Ratios	t-5	t-4	t-3	t-2	t-1
Liquidity Ratios	0,52	0,40	0,95	0,63	0,49
Activity Ratios	1,32	2,35	1,91	1,75	1,29
Fiscal Structure Ratios	0,47	0,45	0,42	0,46	0,53
Profitability Ratios	- 0,04	- 0,01	- 0,07	- 0,02	- 0,06

Table 12: Financial Ratio Scores of EMNIS before Concordat

Type of Financial Ratios	t-5	t-4	t-3	t-2	t-1
Liquidity Ratios	0,26	0,36	0,27	0,28	0,39
Activity Ratios	1,70	14,06	#SAYI/0!	#SAYI/0!	#SAYI/0!
Fiscal Structure Ratios	0,56	0,57	0,63	0,69	0,69
Profitability Ratios	- 0,33	- 0,17	- 0,43	- 1,16	- 0,08

Model Application to the Listed Firms Operating in Construction Industry: In the previous section, we conducted a detailed financial ratio analysis of the last 5 years before the concordat of the two companies that have declared concordat at Borsa Istanbul. In ratio analysis, we examined and graded each category comparatively according to predictive power. Finally, we multiplied each calculated ratio by weight and calculated the financial ratio score of the firms for each year. In this part of the study, financial ratio analysis of the construction companies whose shares are traded on Borsa Istanbul will be performed for 2013-2018 period and financial score calculation will be made for each year. Then, the calculated financial ratio scores will be compared with the scores of the companies that have declared concordat. Descriptive information of the companies operating in Borsa Istanbul construction sector is shown in Table 13 as follows.

Table 13: Descriptive Information of Listed Firms Operating in Construction Industry

Ticker	Stock name	Closing Price (trl)*	Market Value (mn trl)**	Market Value (mn $)**	Free Float Ratio (%)	Capital (mn trl)
ENKAI	Enka İnşaat	6,44	32.200	5410,9	11,8	5.000
TKFEN	Tekfen Holding	19,65	7.271	1221,7	50,8	370
YYAPI	Yesil Yapi	0,63	147	24,6	99,3	233

Source: www.isyatirim.com
* Indicates the Closing Price Information on 30.12.2019.
** Calculated according to the Stock Closing Price Information on 30.12.2019.

The reasons for the adaptation of the model to construction companies are listed below:

- The construction sector will be among the trigger sectors of economic growth in Turkey as expressed in the Medium-Term Plan published by the government.
- The sector provides a lot of job opportunities for the unqualified workforce, thus making a vital contribution to employment.
- Since the construction sector has commercial transactions with many types of sectors, the improvement in this sector will directly affect other sub-sectors positively.
- Since most of the raw materials used in the sector are produced /obtained domestically, the net contribution of the sector to the current balance (current deficit) will be positive.

Based on the facts described above, it can be stated that the construction sector is prominent for the overall economy growth. Based on this determination, the financial ratio scores of the firms operating in the construction sector in Borsa Istanbul are calculated and compared with the ratios of the firms that announced concordat. The financial ratio scores of the construction firms for the last 5 years are calculated in Table 14 as follows.

Table 14: Financial Ratio Scores of Construction Sector by Years

Type of Financial Ratios/ Firms	2018/12			2017/12			2016/12			2015/12			2014/12		
	ENKAI	TKFEN	YYAPI	ENKAI	TKFEN	YYAPI	ENKAI	TKFEN	YYAPI	ENKAI	TKFEN	YYAPI	ENKAI	TKFEN	YYAPI
Liquidity Ratios	2,35	1,25	1,01	1,99	1,15	0,90	2,66	0,98	1,14	2,56	1,05	0,42	2,26	1,20	0,56
Activity	1,9	2,1	0,9	8,7	1,5	0,7	12,	1,2	1,7	51,	1,1	1,0	54,	1,6	1,2

Ratios	7	2	0	6	2	9	57	4	5	08	9	6	75	9	6
Fiscal Structure Ratios	0,13	0,48	0,29	0,13	0,51	0,33	0,14	0,49	0,17	0,16	0,46	0,50	0,20	0,42	0,56
Profitability Ratios	0,06	0,07	0,04	0,07	0,06	0,01	0,06	0,04	0,12	0,05	0,03	0,08	0,05	0,02	-0,03

According to Table 14, it can be inferred that the financial ratio scores of the firms operating in the Borsa Istanbul construction sector are in a better financial position than the firms that have declared concordat. Therefore, it can be stated that the firms included in the analysis do not / will not have to declare concordat.

5. Conclusion and Recommendations

In this study, detailed financial ratio analysis is made based on the financial data of two firms that have declared concordat. The main purpose of the ratio analysis is to test the concordato estimation power of financial ratios. According to the findings, the financial ratios that give the most reliable signal that the firm has deteriorated financially are liquidity and financial structure ratios respectively. Since the sample consisted of only two firms, the results cannot be statistically generalized. We built a model based on our findings related to two firms to estimate concordat probability of the firms by using financial metrics. We applied it to construction firms listed in Borsa Istanbul. Based on financial ratio scores calculated based on our established model, it seems that firms operating in construction industry are more stable in terms of financial position. Therefore, they can be considered far from making concordat announcement. When comparison analysis is made among them, it can be said that YYAPI is underperforming compared to other firms.

Research Implications: The limitations of the study can be summarized as follows:

- Due to the small sample size, the results need statistical confirmation. Only two firms are included in the sample and the model is established based on findings of these firms. Therefore, our findings do not provide statistically reliable results.
- The construction companies to which the model is applied consist of only three major construction companies whose shares are traded on the stock exchange. Therefore, the results of the model applied to these firms do not produce statistically significant results.
- The sample which the model is based on includes different industries such as paint and food while the firms are used for the application of the model is operating in the construction industry. They significantly differ from each other and lead financial analysts to interpret each ratio differently according to the selected industry.

Proposed Furthers Research: It is strongly recommended to carry out studies that will allow comparison between countries and sectors related to financial analysis. In this way, more realistic findings can be obtained by interpreting each financial ratio according to the sector in which the company operates.

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An Address of the 2008 Global Financial Crises with Unconventional Monetary Policies

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Abstract: This study aims to assess the impact and spill over effects of the United States (US) Quantitative Easing (QE) to South Africa. Using an event-study analysis on daily data spanning from 25/11/2008 – 12/12/2012 for selected QE dates, the study finds that US Treasury bills fall by 106 basis points on average during QE1, rise by 9 basis points and 8 basis points during QE2 and QE3, respectively. For South Africa, government bonds fall by 61 basis points on average during QE1, 9 basis points during QE2 and 2 basis points during QE3. This leads to the conclusion that UMPs boost the economy in the short run but hurt the economy in the long run, especially when targeting inflation, and used extensively. Therefore, policymakers should concentrate on the overall financial system to measure the financial risk, and thus consistently strengthen macro prudential orientation.

Keywords: *Global financial crisis, quantitative easing, event study analysis, unconventional monetary policy, interest rates.*

1. Introduction

The central banks normally influence aggregate demand and ensure price stability using short term interest rates – the so called conventional monetary policy (Horvath, 2017). However, since the dawn of post-financial crisis era of 2007-2008, countries around the world adopted Unconventional Monetary Policies (UMPs) to protect their economies against disastrous effects of the financial crisis (Yasin et al., 2013). The UMPs as described by Korniyenko and Loukoianova (2015), range from purchases of large scale private and public debt securities up to direct lending to banks. They have been adopted with an intention to inter alia, ensure that monetary policy is accommodative at the zero-lower bound of interest rates, and ensure that financial markets have liquidity. As Bowdler & Radia, (2012) elaborated, the emergence of financial crisis jeopardised the liquidity and solvency of systematically important financial institutions, such as Lehman brothers in the US and Northern Rock, amongst others. As a result, the functioning of the financial markets became severely impaired (Bowdler & Radia, 2012).

The Federal Reserve Bank, European Central Bank, Bank of Japan and Bank of England responded to the financial crisis using UMPs and managed to unleash roughly $9.5 trillion (Subacchi, 2013). This has appeared as a collective reaction since central banks in advanced economies applied similar expansionary paths when faced with ballooning budget deficit, public debt, credit crunch and recession. The debris of the financial crisis as argued by Yasin et al. (2013) cannot be cleaned by monetary policy as this is not cost effective and interest rate policy is insufficient. Since interest rate policy appeared not enough for averting massive detriment induced by financial crisis, Borio (2011) highlighted that UMPs have been adopted so that countries scramble and reorganize their balance sheets. This was done in order to broadly influence financial conditions and long-term interest rates and give guidance to credit terms and credit spreads. When interest rates approach zero, UMPs are considered. As a result, low interest rates fuel spending, which raises the profits of non-financial firms. Furthermore, borrowing becomes less costly, resulting in business expansions, declines in unemployment rates, which further leads to lower loan delinquencies and charge-off rates.

All of these are necessary to mitigate risk and have a healthy economy and sound financial system (Chodorow-Reich, 2014). Two sets of UMPs have been enacted since 2009, both intending to achieve varied goals. The first and second rounds of the United States (US) UMPs began in December 2008 and November 2010 respectively, with the former aimed at increasing the avaliability of credit in private markets and the latter at strengthening the economic recovery and combating a possible Japanese-style deflationary outcome (Liber8 Newsletter, 2011). The European Central Bank (ECB) latter announced its own programme of UMPs in January 2015 (Oosthuizen, 2016). Meanwhile advanced economies implemented safety measures thereof, it is worth noting that expansionary policies like UMPs has some spill over effects for other countries. This study aim to assess how South Africa felt the strains owing to UMP measures applied by advanced economies.

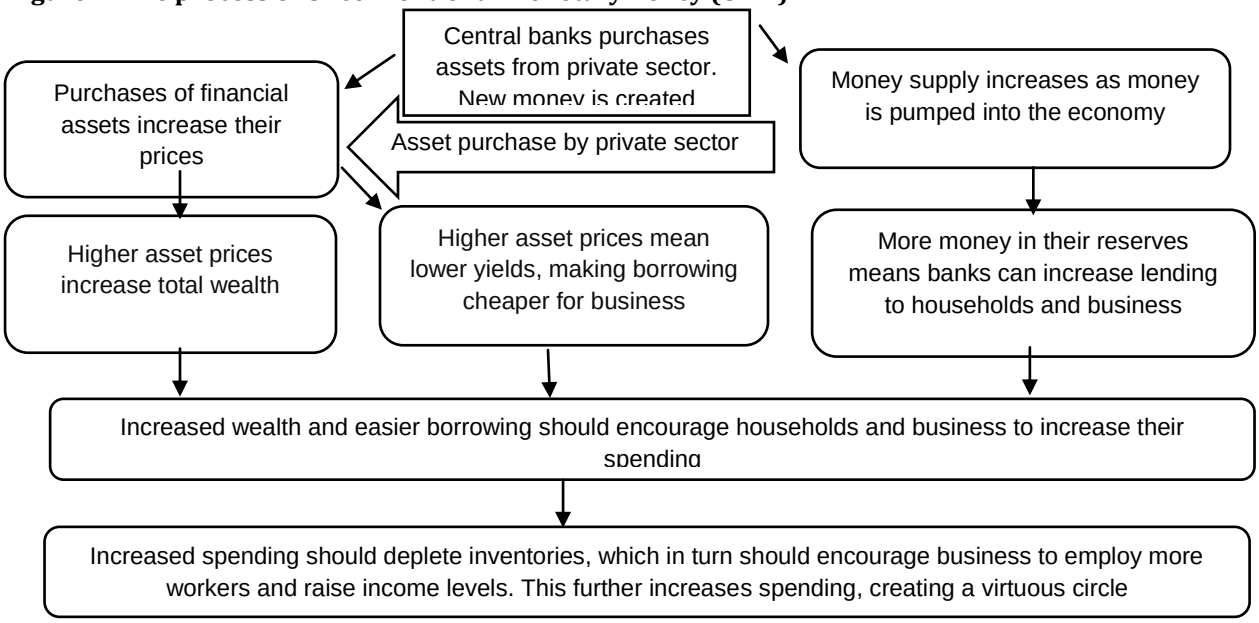
Bhattarai, Chatterjee and Woong (2015) revealed that QE resulted in an exchange rate appreciation, increased capital inflows, a stock market boom and reductions in long-term bond yields in emerging economies.

Nevertheless, there are limited studies that explicitly examined how South Africa was influenced by unconventional monetary policies. Instead, existing studies generally aimed to assess the consequences of such policies on developing countries Asia and the Pacific region (Punzi and Chantapacdepong, 2017). An event-study analysis is a rarely applied methology, especially on studies similar to this particular study. For instance, Stephanos Nikolaos, & Panayiotis, (2019) explored the spillover effects on the stock markets of six African countries and Middle Eastern emerging market economies during and after the implementation of unconventional monetary policies by US, using classical, dynamic, and time-varying Granger causality tests. Whilst it is important to acknowledge that UMPs affected most countries in the global economy, the discussion in this paper features unique aspects in terms of methodolgy and presentation of thoughts and/or arguments to broaden literature and therefore contribute additional knowledge and understanding on the topic under scrutiny. The paper is structured as follows; section 2 outlines literature review. Section 3 discusses methodology of the study. The findings of the study and interpretation are presented in section 4. The conclusion and policy recommendations are presented in sections 5.

2. Literature Review

Theoretical Literature: The signalling and portfolio-balance channels are the transmission channels suggested in UMP theory (Cecioni et al., 2011). The activation of signalling channel is when central banks communicate with the public, notifying them about intentions regarding future evolution of short-term interest rates. The activation of portfolio-balance channel is via operations of the central bank like outright purchase of securities, liquidity injections and asset swaps also called Quantitative Easing (QE). As a result, the size and composition of balance sheet become modified for both the central banks and private sector (Cecioni et al., 2011). Figure 1 shows the process of Unconventional Monetary Policy (UMP) using a diagram, indicating how UMP works from large scale asset purchases to increases in wealth, lower borrowing costs, capital expansion and depletions in inventory.

Figure 1: The process of Unconventional Monetary Policy (UMP)



Source: Bank of England Pamphlet (2011)

Central banks are often concerned with the risks of low inflation rates. As such, they usually reduce their lending rates so that borrowing becomes less costly to financial institutions and the public at large. Since

interest rates cannot fall below zero, central banks inject new electronic money into the economy through the purchase of assets such as government bonds and high-quality debt from private companies (Liber8 Newsletter, 2011). The idea is not to print more banknotes but to credit the sellers' bank accounts which results in new electronic money in the wider economy. The sellers will have more money in their bank accounts, while their banks will have a comparable claim against the central bank. Additionally, this study provides a leeway for future research in terms of engaging more on country focused discussions, unlike broad-based assessements on particular group of countries, which may to some extent limit the scope of debates. The sellers, having more money, are then able to increase their spending, thereby boosting growth (Bank of England (Reich, 2014), 2011). UMPs are considered when interest rates are near zero.

Empirical Literature: The aftermaths of global economic and financial crises in 2007/08 have triggered the use and application of unconventional monetary policy measures. As a result, this sparked greater amount of research by academics, scholars and researchers alike. Most interestingly, the key theme that benefited wide scrutiny was appraisal of the effectiveness of unconventional monetary policies (Rossi, 2018). The significant impact of UMPs in developed economies has been through ensuring liquidity within financial markets (Tatiana, 2013). Nonetheless, Borio and Zabai (2016) argued that, there is still an on-going debate about the effectiveness of these UMPs since it is tough to disentangle their impact. In contradiction, the impact has been confirmed to exist since Tatiana (2013) found that UMPs relatively had significant impact within real economy and financial markets in developed countries. According to Francois and Mathieu (2016), the positive effects of large-scale asset purchases remained uncertain on both inflation and the economy. This is despite their effectiveness in supporting financial markets in the period of crisis. Korniyenko and Loukoianova (2015) observed that, from 2008 to 2014, there has been significant expansion in balance sheets of central banks which adopted UMPs. This means that there have been more purchases of large-scale assets.

Bernanke (2009) observes that, economic recovery cannot be sustainable if there is crisis within the financial systems. The idea of central banks to adopt UMPs was not bad because dealing with certain economic shocks require possible effective policies that are available. Reich (2014) found that UMPs boosts growth and causes inequality to reduce. As evidence evolved, empirical results found by Kapetanios et al. (2012) suggest that in the absence of UMPs, real GDP in England would have exacerbated in 2009, and inflation also would have become negative. In the presence of conventional monetary policy, low and stable inflation have been achieved, but the occurrence of asset market bubbles was not averted (Joyce, Miles, Scott, & Vayanos, 2012). According to Kapetanios et al. (2012), UMPs were effective to assist UK economy to avert the likelihood of deflation and deep recession. The counterfactual analysis has been done by Lenza et al. (2010) who used large BVAR model to provide evidence that UMPs have been successful in restoring the functioning of the financial markets given the noticeable contraction in money spreads. Similarly, it has been stated by Vinals et al. (2013) that the functioning and intermediation of the markets have been restored by UMPs. The consistent under-performance of the economy coupled with inflation in early 2000s led the bank of Japan to resort in massive purchase of assets (Francois 2016).

In the United States, UMPs averted contraction, and the reason why US has experienced rapid recovery from great recession than some of its counterparts is because of UMPs (Bhattarai, Eggertsson and Gafarov, 2015). The research by Cecioni, et al. (2011) found that, macroeconomic effects of UMP in Fed and ECB were significant in averting deflation thread and collapse of output. Unconventional Monetary Policies such as purchasing of public and private assets and currency swaps have been adopted to avert the collapse of the financial system and a devastating depression (Tatiana, 2013). However, from the observation of public opinion, this created and still creates the risk of undesirable side-effects. In comparison with standard monetary instruments, the substantial fiscal and re-distributional effects may incur as a result of unconventional operations (Tatiana, 2013). Bhattarai, et al. (2015) indicated that, QE creates mismatch duration on the balance sheet of the central banks as it issues short-term debt in exchange for long term assets. As a result, "This opens up the possibility of possible future balance sheet losses/gains by the central bank, because the price of its liabilities may fall/rise relative to its assets" (Bhattarai, et al., 2015: 2). Furthermore, it has been highlighted by Bhattarai, et al. (2015) that, quantitative easing or UMPs are problematic since they do not work in theory, but only work in practice.

The Potential Risks Associated with Unconventional Monetary Policies: As coined out by Meier (2009), UMPs impose financial and political risks. As far as the former is concerned, private sector has been at risk previously. Therefore, when central banks purchase assets in the private sector, the credit access might ameliorate, and valuations of assets may be boosted. But, this will cause significant loss of capital if the assets acquired lose value over time. As a result of capital losses, the discretionary of central banks would be undermined, and their capacity to maintain inflation would be adversely affected (Weale and Wieladek, 2014). As far as the latter is concerned, the balance sheet of the central banks can survive some financial loss as a result of strong existing capital cushions (Meier, 2009). However, the reputational risk relating to the possible criticism of squandering taxpayer money may occur. In general, as Meier (2009) advocated, unconventional operations have tendency of heightening the proximity between monetary and fiscal policies, potentially threatening the focus of central banks on price stability. In addition, the chief among the risks of UMPs is the risk of inflation and profitability of financial institutions.

UMPs were critically important in breaking the downward trend caused by the 2008 global financial turmoil as apparent from earlier discussions. However, UMPs became a problem rather than a solution when it was used for an extended period (Kenc et al., 2011). The longer the highly accommodative stance remains in place, the more probable its reactions are to develop. Most significantly, UMPs failed to restore economic growth, more especially in Europe and Japan. The prolonged UMPs have resulted in rising commodity and financial market prices, while promoting risk-taking behaviour in investing and punishing savers by subduing bond yields. This explains the slow growth in many countries. Instead of reflating the global economy, UMPs in Europe and Japan is shrinking it. Therefore, the following set of questions remains: is UMPs still required after such an extended period, or should central banks rather look at changing monetary policy approach? What about the role of fiscal policy side-by-side with monetary policy? Can the government also not look at structural challenges to the economy, thereby supporting monetary policy to deal with the problems that necessitated UMPs in the first place? UMPs boost the economy in the short run but hurt the economy in the long run.

3. Methodology

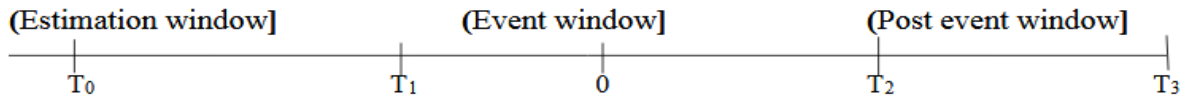
Data: We make use of daily data for selected QE dates, spanning from 25/11/2008 – 12/12/2012. The period is restricted to 2008 – 2012 given the limitations of the econometric technique used (i.e. event study). To put this in context, the event study analysis is more robust over short horizons than long horizons. Also, previous studies (e.g. Kapetanios et al., 2012; Tatiana, 2013; Reich, 2014) have shown that the effects of QE are usually felt in the short run than in the long run. Further to this, advanced market economies have been reluctant to initiate QE programs in the later years amid global economic recovery and the dire economic effects brought about by extended QE programs. The data was collected from secondary servers including St. Louis Federal Reserve Database and Investing.com.

Model Specification: The study utilised the event study methodology which is used to investigate the effects of an event on a specific variable(s). Furthermore, a short horizon approach of the event study was exploited instead of a long horizon approach given the limitations of long horizons (Holler, 2014) Khothari and Warner (2007) state that event studies focusing on announcement effects for short horizons provide relevant and reliable evidence for understanding corporate decisions. To conduct an event study, one needs to identify the event of interest, which is UMP in our case and derive a measure of abnormal returns (Benninga, 2008; Chacha, 2017). The UMP adopted in this study is QE, which refers to actions by central banks aimed at purchasing securities from the market in order to lower interest rates and increase the money supply. Below, we present a measure of abnormal return:

$$ABR_t = AR_t - ER_t \qquad (1)$$

Where ABR_t is the abnormal return, AR_t is the actual return and ER_t is the expected return. Let $t = 0$ represent the event window. Notably, we consider 10-days changes given by $(5 - t)$ which is the estimation window and $(t + 5)$ which is the post event window.

Figure 2: Event Time Frames



Source: Benninga (2008)

For simplicity sake, the expected return is calculated as the average of the actual return. The abnormal return is thus calculated as the difference between the normal return and the expected return. To evaluate and conclude on the impact of the events on the selected variable(s), the abnormal returns are aggregated as Cumulative Abnormal Returns (CARs). Following Khothari and Warner (2007), the CARs during the event window are calculated as:

$$CAR_t = \sum_{t=0} ABR_t \qquad (2)$$

CAR is defined as the measure of the total abnormal returns during the event window and it is computed as the sum of abnormal returns during the event window.

4. Results and Discussion

This section details findings and their interpretation. The analysis includes tests for two countries: The United States (US), which is the country where the event took place and South Africa (SA), which is the African-country that acquired the most spill-over effects given its strong interlink age with the global financial market.

United States: Tables 1 presents data for 10-days changes in treasury bills for the first five QE1 dates. The selected dates for QE1 range from 25 November 2008 (10-day change from 20 November to 30 November) to 18 March 2009 (10-day change from 13 March to 23 March).

Table 1: 10-Day Changes in Treasury Bills (Basis Points) During QE1 Dates

		Treasury Constant Maturity Yields				
Date	**Event**	**1-year**	**3-year**	**5-year**	**10-year**	**30-year**
25 Nov 2008	Initial announcement	-12	-24	-38	-42	-38
01 Dec 2008	Bernanke speech	-46	-150	-32	-26	-38
16 Dec 2008	FOMC statement	-10	-60	1	-40	-42
28 Jan 2009	FOMC statement	6	24	27	26	25
18 Mar 2009	FOMC statement	-18	-3	-6	-13	-2
Total		**-80**	**-213**	**-48**	**-95**	**-95**

Source: Authors' computations

It is worth noting that QE operates in different channels, hence its effects on different variables differ. From table 1, we can see that 5-year treasury yields fall by 48 basis points (bps) while 3-year treasury yields fall by 243 bps, the largest in table 1. Additionally, 10-year yields and 30-year yields are equally significant, both falling by 95 bps. In overall, treasury yields fall by 106 bps. However, the results in Table 1 provide little evidence as to whether long term yields were more sensitive to QE announcements than short term yields or not. Krishnamurthy and Vissing-Jorgensen (2011), through the duration risk hypothesis, found that the yields of many long-term bonds fell more than those of short-terms bonds. Moreover, QE1 dates are significantly negative than any other dates. These findings are almost in line with existing literature although they used 2days changes (Krishnamurthy and Vissing-Jorgensen, 2011; Gagnon et al., 2011). The sum for 10-year treasury yields is -95 bps while that for Gagnon et al. (2011) was -100 bps. Table 2 presents data for the first three QE2 dates. QE2 dates range from 27 August 2010 (10-day change from 22 August to 1 September) to 3 November 2010 (10-day change from 29th October to 8th November).

Table 2: 10-Day Changes in Treasury Bills (Basis Points) During QE2 Dates

		Treasury Constant Maturity Yields				
Date	**Event**	**1-year**	**3-year**	**5-year**	**10-year**	**30-year**
27 Aug 2010	Bernanke speech	-1	7	14	24	26
21 Sep 2010	FOMC statement	0	-11	-22	-30	-29
03 Nov 2010	FOMC statement	2	18	15	6	29
Total		**1**	**14**	**7**	**0**	**26**

Source: Authors' Computations

Unlike QE1, treasury yields rose during QE2. For example, 1-year yields rose by 1 bps, 3-year yields by 14 bps, 5-year yields by 7 bps and 30-year yields by 26 bps. QE2 seems to have had no impact on 10-year yields. In overall, treasury yields rose by 14 bps in QE2 while they fell by -243 bps during QE1, a 229 -bps difference. This finding is consistent with a similar study conducted by Financial Times (2013) which revealed QE to be having dilutive effects on asset prices overtime. For QE3, the dates range from 22 August 2012 (10-day change from 17 August to 27 August) to 12 December 2012 (10-day change from 7 December to 17 December). The results are presented in table 3.

Table 3: 10day Changes in Treasury Bills (Basis Points) During QE3 Dates

		Treasury Constant Maturity Yields				
Date	**Event**	**1-year**	**3-year**	**5-year**	**10-year**	**30-year**
22 Aug 2012	FOMC statement	-2	-6	-13	-16	-18
13 Sep 2012	FOMC statement	0	4	4	8	8
12 Dec 2012	FOMC statement	-2	6	30	17	18
Total		**-4**	**4**	**21**	**9**	**8**

Source: Authors' Computations

As can be seen in table 3, the results for QE3 dates are quite like QE2 dates, except for the 1-year treasury yield. In total, the 3-year treasury yields rose by 4 bps, 5-year yields by 21 bps, 10-year yields by 9 bps, 30-year yields by 8 bps while 1-year treasury yields fell by 4 bps. On average, treasury yields rose by 8 bps, 6 units less than in QE2. A study by Chodorow-Reich (2014) revealed that the stock price index for life insurers in the US changed by 1.96 percentage points in QE1; 1.29 percentage points in QE2 and 1.19 percentage points in QE3, reflecting diminishing returns. These findings are in line with our study as we find QE3 to have dilutive effects relative to QE2 and QE1. The quantity of long-term securities purchased plays a crucial role on the effects of QE, which could be one of the reasons for the differences in QE effects on treasury yields.

South Africa: The findings for SA are presented in tables 4 to 6. The QE dates and events are the same as those for US. Thus, this sub-section provides findings of the spill-over effects of the US QE on the South African economy through government bonds. The bonds are chosen based on the availability of data. The bonds' durations are: 3-month, 2-year, 5-year, 10-year and 30-year. Table 4 below provides 10-days changes in government bonds during QE1 dates. It is worth noting that the data for 17th December 2008 was used instead of 16th December 2008 since 16th December is a public holiday in SA, hence markets close.

Table 4: 10-Day Changes in Bond - Yields (Basis Points) During QE1 Dates

		Government Bond - Yields				
Date	**Event**	**3-Month**	**2-year**	**5-year**	**10-year**	**30-year**
25 Nov 2008	Initial announcement	-36	-19	-4	2	10
01 Dec 2008	Bernanke speech	10	-29	-11	-11	-16
16 Dec 2008	FOMC statement	5	-32	-28	-27	-20
28 Jan 2009	FOMC statement	-25	-1	-7	-4	-15
18 Mar 2009	FOMC statement	-148	5	26	28	41
Total		**-194**	**-76**	**-24**	**-12**	**0**

Source: Authors' Computations

It is evident in table 4 that the last announcement of QE1 had the greatest impact on the 3-month government bond, falling by 148 bps. In total, the 3-month government bond fell by 194 bps, 2-year government bond by 76 bps, 5-year government bond by 24 bps, 10-year government bond by 12 bps while the 30-year government bond had nil. Table 4 further illustrates that for most dates, government bonds fell by over 10 bps. Nonetheless, Table 5 illustrates government bond yields during QE2 dates.

Table 5: 10-Day Changes in Bond - Yields (Basis Points) During QE2 Dates

		Government Bond – Yields				
Date	**Event**	**3-Month**	**2-year**	**5-year**	**10-year**	**30-year**
27 Aug 2010	Bernanke speech	-30	-	11	9	10
21 Sep 2010	FOMC statement	-7	-	-18	-19	-20
03 Nov 2010	FOMC statement	-7	-	11	10	16
Total		**-44**	**-**	**4**	**0**	**6**

Source: Authors' Computations

It is undoubtedly clear from table 5 that QE2 had a much less impact on the South African bond market. In total, the 3-month government bond fell by 7 bps which is less compared to 194 bps during QE1. Contrast to QE1, the 5-year, 10-year and 30-year government bonds rose by 11 bps, 10 bps and 16 bps, respectively, during QE2. This brings in the notion that QE has a negative impact on the financial market when used for a prolonged period. Nonetheless, table 6 provides findings from QE3 which began in 2012.

Table 6: 10day Changes in Bond - Yields (Basis Points) During QE3 Dates

		Government Bond – Yields				
Date	**Event**	**3-Month**	**2-year**	**5-year**	**10-year**	**30-year**
22 Aug 2012	FOMC statement	0	-	-8	-8	-1
13 Sep 2012	FOMC statement	0	-	2	10	30
12 Dec 2012	FOMC statement	1	-	-14	-11	-9
Total		**1**	**-**	**-20**	**-9**	**20**

Source: Authors' Computations

Table 6 indicates that QE3 had a mixture of diluted and muted effects on government bond yields. The first and second announcements had muted effects on the 3-month government bond. The third announcement had a positive impact on 5-year, 10-year and 30-year government bonds as bond yields fell by 14 bps, 11 bps and 9 bps, respectively. However, the overall impact on the 30-year government bond was negative as yields fell by 20 bps. Given the values in tables 4 to 6, it can be concluded that QE1 had the greatest impact on the bond market than QE2 and QE3. These findings are consistent with the Financial Times (2013) study which revealed that QE2 and QE3 had diluted and muted effects whereas QE1 had a significant impact on most asset prices.

5. Conclusion and Recommendations

The study aimed to assess the impact and spill over effects of Unconventional Monetary Policies (UMPs); identify the potential risks associated with UMPs. Having identified that UMPs are associated with the risk of increasing inflation and low profitability of financial institutions, the event analysis methodology was used to achieve the stated objectives. The sample included the United States (US) as the country where the event occurred and South Africa (SA) as a country that acquired the most spill-over effects after the global financial crises of 2007-2008. It was therefore found that US Treasury bills fall by 106 basis points on average during QE1, rise by 9 basis points and 8 basis points during QE2 and QE3, respectively. As for South Africa, government bonds fall by 61 basis points on average during QE1, 9 basis points during QE2 and 2 basis points during QE3. Therefore, it is noted that when considering US treasury bills and SA government bonds, UMPs bodes well for significant stabilisation of the economy in the short run. As the purchase of the afore-

mentioned securities (treasury bills and government bonds) are associated with high risk, its use to correct disastrous global events like the global financial crises can be achieved in the short horizon but could hurt the economy in the long run. Nonetheless, this study also displayed to some extent, diverse perspectives by different academics and researchers, whereby some ideas complement each other. As stated by Botezatu and Diaconescu (2014), the use of unconventional measures (QE in this case) appears to be appropriate in certain circumstances.

However, the timing of using these measures is equally important as they bring about consequences. It has not yet proven that the marginal costs of using UMPs exceed the marginal benefits of using those policies (Botezatu and Diaconescu, 2014). However, UMPs became a problem rather than a solution when they were used for an extended period. The financial crisis necessitated the need to consider financial stability as prerequisite for the proper functioning of transmission mechanisms. Similarly, macroeconomic stability requires financial stability (Ortiz, 2010). It is recommended that the decision to halt the use of UMPs requires careful judgment on the appropriate sequencing and speed of monetary action. Therefore, policymakers must allow for possibility that interaction of unconventional and conventional policy elements may alter normal transmission mechanism. The cooperation of international monetary policy together with policy rules that are sound should be enforced to revert within stable international monetary system. It is also required that, given previous financial crisis, better understanding of appropriate policy response is important. It is necessary to understand the source of financial stability and understand how cross-border cooperation can assist to provide public good of international financial rules and systems. The policymakers should concentrate much on the overall financial system to measure the risk, and thus consistently strengthen macro prudential orientation.

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Influence of Culture on Investment Decisions: A Cross-Sectional Study of Ghanaian Population

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Abstract: This study seeks to explore the influence of culture on the investment decisions of Ghanaians. It is motivated by the perception that Ghanaians show no enthusiasm for long-term investments or life insurance products. To explore this problem, we used a random sampling, quantitative cross-sectional technique to administer a set of questionnaires to a cross-section of 120 Ghanaians residing in the City of Columbus, Ohio, U.S.A. Hofstede's five cultural dimensions were used as the theoretical framework to guide the study. The results showed that Ghanaians prefer short-duration risk-free investments to long-duration risky investments. Ghanaian investors are not aggressive in gathering and analyzing financial information before making investment decisions. Their investment decisions are influenced by others, intuition, comfort and security, and their belief systems, rather than rational analysis of information, and risk-reward relationships derived from financial models. The use of intuition and information passed on from relatives, family members and others in making investment decisions paves the way for cultural factors to influence investment decisions. We conclude that cultural values have significant influence on the investment decisions of Ghanaians. The study seeks to motivate investors to examine and broaden their cultural awareness to enable them develop financial plans to achieve their investment goals. We recommend that to overcome negative cultural influence on investment decision making, financial education should be vigorously pursued to broaden financial literacy.

Keywords: *Cultural dimensions, cultural factors, investment decisions, investment theories, Ghanaian cultural values.*

1. Introduction

One of the goals of financial markets is to mobilize savings and long-term investments to accelerate economic development although there are different types of financial markets, in Ghana the most common ones are capital markets and money markets. The money markets deal with raising short-duration investments ranging a year or less, whereas capital markets deal with long-duration investments of over two years. The Ghana Stock Exchange (GSE) was established to promote long-term investments from individual and institutional investors to accelerate economic development. However, the average individual investment on the GSE is very small and declining. As much as 75% of individual portfolio investment is less than $5,000, (Osei, 1998). This seems to confirm a long-standing perception that Ghanaians show no enthusiasm for long-term investments and life insurance products. This lackadaisical attitude towards financial investments may be attributed to cultural factors. Although cultural factors have not been intensively studied in the finance literature, they are extremely important in investment decision-making process. Modern investment theories ignore cultural factors and focus only on economic factors, which deal with rational analysis of information, and risk-return relationships.

For example, capital asset pricing model (CAPM) suggests that individuals select investments using cognitive processes and the efficiency of the markets to maximize returns at a given level of risk (Sharpe, 1964). Despite the weakness of CAPM, it has become one of the best-known models for determining risk and return relationships in the finance literature (Fama and French, 2004). Behavioral finance emerged recently to deal with some of the psychological factors that affect individual investment decisions. Currently a new body of knowledge is emerging in the literature, which shows that people approach financial decisions differently due to their cultural values and belief systems (East, 1993; Grinblatt and Keloharju, 2001; Lee, 2012). Even in modern corporations, organizational culture affects investment and financing decisions as well as corporate governance practices (Lee, 2012; see also Zhao, 2014). There are several studies that show that cultural values have some influence on individual investment behaviors. Some of the studies used the theory of planned behavior in the context of individual investment decision making to indicate how social norms, cultural beliefs, subjective norms, and behavioral intentions affect investment behavior (East 1993; Rafiee and Sarabdeen, 2012; Sondari and Sudarsono, 2015).

Problem Statement: Recently, there has been the emergence of various financial schemes, such as '*Susu*' and microfinance activities, in Ghana, which have received great patronage without any apparent reason (Boye, 2005). Conversely, the capital market has not been able to attract such a patronage from individuals (Osei, 1998). Despite the patronage of the financial schemes, they collapse within few months of operations, causing major financial losses to these investors (Boye, 2005). Subsequent interviews with affected investors indicated that their investments in those schemes were mainly due to advice and influence of relatives and friends, who encouraged them to do so (Kesse, 2018). The schemes promised guaranteed high rate of returns, and emphasized liquidity, easy access to funds, and no investment risk, to lure investors (Amoah, 2018; Boye, 2005). Investment selection of such schemes has had many adverse effects on the victims, and the economy of Ghana. The most obvious effects are financial loss of lifetime savings, and economic impairment of affected investors. The question that arises is why people should risk their hard-earned money to invest in financial schemes they are not familiar with, without collecting and analyzing any information on them. Do cultural factors have any influence on investment behavior of Ghanaians?

Objective of the Study: Many Ghanaian investors seem to believe that investment recommendations from relatives, friends and others are favorable investments with less risk and high expected returns. Although the capital asset pricing model assumes that risk and expected returns are positively correlated, many investors behave as if the correlation is negative, expecting higher returns with minimum level of risk. The primary objective of the study is to explore and document how the investment decisions of Ghanaians are made, and to consider the factors affecting their selection of investment products. The interest is not on the impact of cultural factors on their investment performance. We sought to study why investment decision is made without collecting and analyzing information from reliable sources, and Ghanaians' attitude towards investment risk. The secondary objective is to encourage further research on cultural influences affecting Ghanaian investment decisions to close the wide gap that exists in the literature.

2. Review of Literature

Investment decisions involve the setting of investment objectives including risk tolerance levels, gathering and analyzing information from varied sources, and selecting assets to achieve the stated objectives (Reily and Brown, 2003). Hofstede's cultural dimensions have also been used in the literature to provide the theoretical framework of analyzing culture and investment behavior in different national cultures (Khairullah and Khairullah, 2013; Leonard, Slaubaugh, and Wang, 2010). In this paper, we use Hofstede's (1980) cultural model to explore how culture influences investment decisions of sampled Ghanaians living in the United States. The decision-making process requires information that is timely, complete and relevant. Based on the gathered information and its analysis, an investor should be able to determine the expected return, at a given level of risk. Although there is no one accepted approach to analyze investments, fundamental and technical analyses are considered the most popular in the finance literature (Suresh, 2013). Fundamental analysis considers economic, industry and company specific information, whereas technical analysis focuses on the use of statistics such as past prices and trading volumes obtained from market activity to make decisions (Reilly and Brown, 2003, Suresh, 2013).

Several investment theories, including the theory of risk tolerance (Govind, Chapman, and Domian, 2000; Grable and Lytton, 1999), random walk and efficient market theory (Fama and French, 1993; Malkiel, 1973), modern portfolio theory (Markowitz, 1991), and Behavioral Finance (Tversky and Kahneman, 1974), help explain the factors affecting investment decision making process. This literature review would consider some of these theories and how they influence investment choices. The Theory of Risk Tolerance: The theory of risk tolerance holds that individuals invest in financial assets based on their ability and willingness to bear risk (Govind et al., 2000; Grable and Lytton, 1999). Accordingly, individual investors are classified as aggressive, conservative, or moderate. Aggressive investors have high risk tolerance level as they are willing to bear higher risks to grow their assets. Aggressive investors are expected to have a large proportion of their assets in risky assets including stocks, long-term corporate bonds, real estates and financial derivatives. Conversely, conservative investors have low risk tolerance levels as they are willing to bear less risk to preserve their assets. Such investors would have large proportion of their capital in short duration money market securities. Moderate investors fall between aggressive and conservative investors and are willing to take some level of risk to sustain their asset growth.

The Theory of Planned Behavior: Ajzen (1985, 1991), proposed the theory of planned behavior from the original theory of reasoned action (Fishbein and Ajzen, 1975) to predict an individual's intention to engage in a specified behavior. Bierman (1997) explained that investment horizon, short-duration or long-duration, is positively related to investment risk short-duration financial assets are thus considered less risky than long-duration financial assets. Ibarra (2013) showed that long-duration assets tend to over perform short-duration assets across different periods in international markets. This is consistent with the investment principle that the higher the risk, the greater the expected return. This theory suggests that investors with low risk tolerance levels would select a large proportion of short-duration investments in their portfolios and vice versa. The theory of planned behavior seeks to link an individual's behavior to his beliefs, rather than to risk tolerance levels. It holds that a person's behavior is influenced by attitudes, behavioral intention, social norms, perceived power, and behavioral control.

Ajzen (1985) explained that attitude is the tendency to pursue a behavior because of the expected outcomes resulting from such a behavior, whereas behavioral intention considers the motivational factors that influence a given behavior. According to Ajzen (1985), social norms refer to how a behavior is affected by actions and attitudes of a group of people in a cultural context. Subjective norms relate to how the social environment accepts or rejects such behavior. Perceived power involves factors such as knowledge, and availability of resources that would help facilitate the performance of the behavior. Perceived control behavior deals with the ability and the autonomy to carry out the behavior. Although the theory was meant for psychology and life applications, it has been used in studying financial investment decisions. East (1993) and Sondari & Sudarsono (2015) used the theory of planned behavior independently to study individual investment choices, and concluded that investment decision is influenced by availability of funds, perceived outcome of profitability, security of the investment, and group behavior including that of friends and relatives, past behavior, attitude towards the investment, and subjective norms.

Random Walk Theory: The random walk theory implies that knowledge and perceived outcomes of profitability are less relevant in investment analysis. The theory holds that security performance cannot be predicted because prices reflect all available information, which is consistent with the efficient market hypothesis (Malkiel, 1973). The theory stipulates that it is impossible to consistently outperform the market because it is efficient. Thus, investors cannot accurately determine the perceived outcomes of their investment based on their perceived power or knowledge. The theory suggests that investors would do better by investing in passive and low-cost portfolios. Thus, the craze of selecting securities using technical and fundamental analyses is costly, time consuming, and less productive because the market is efficient. Behavioral finance, however, questions the efficiency of the financial markets and holds that individuals are not that rational and are biased when it comes to processing of investment information.

Theory of Behavioral Finance: The theory of behavioral finance combines economic models and cognitive psychological theories to explain why individuals make irrational financial decisions (Tversky and Kahneman, 1974). The theory holds that individuals are prone to heuristics-driven biases such as overconfidence in their abilities, and conservatism. Baker and Nofsinger (2002) explained the cognitive and emotional biases of investors, such as feeling of overconfidence in their abilities, conservatism, decision-regret, anchoring to initial decisions, representativeness, and confirmation bias. Conservatism is the tendency for individuals to hold on to their old beliefs even if new information is available. Individuals also tend to make decisions to avoid emotional pains and regrets in the event of an unfavorable outcome. Decision regret influences individual investors to invest in known and familiar assets. Representativeness means that under uncertainty, investors tend to believe that the past performance of a given investment is a true representation of its future performance. Confirmation bias holds that people generally think that they are good decision-makers and will seek information to confirm their beliefs.

Modern Portfolio Theory: Modern portfolio theory seeks to overcome the psychological and emotional biases that result in investor mistakes. The theory contends that risk-averse investors can construct efficient and optimal portfolios that maximize their return at a given level of risk (Markowitz, 1991). The theory quantifies the benefits of diversification, in which investors construct their portfolios from multiple uncorrelated asset classes. The investment behavior of optimizing investments would result in economic equilibrium of a capital asset pricing model. The model assumes that investors are risk averse and would

rationally prefer less risky portfolios to risky portfolios and would assume higher risk only if they are compensated by a higher return. Although all the theories of investment considered in this paper explain very well the economic, psychological, social and cultural factors that affect investment decision-making, we focus greatly on the theory of planned behavior because of its emphasis on social and cultural factors (Ajzen, 1991). Consistent with theory of demand, Aregbeyen and Mbadiugba (2011), and Rahimi, Mousai, Azad, and Syedaliakbar (2014) showed that economic, social, psychological, and cultural factors affect the demand for investment products and services. Cultural factors cited by Aregbeyen and Mbadiugba (2011) include the following:

- Persuasion of friends and family members
- Investing culture of the family
- Awareness of prospects of investing
- Exposure to investing
- Environmental influence
- Social class and status

Other cultural factors cited by Rahimi et al. (2014) include:

- Values and beliefs
- Cultural training, as well as habit and opportunity.

Despite these cultural factors affecting behavior, the influence of culture on investment decisions has not been fully explored in the literature. This could be attributed to the complex nature of culture as each culture is unique. We use cultural models found in the literature to guide our study.

Cultural Models: There is no single acceptable cultural model that precisely defines culture. There are various definitions of culture in the literature. However, only two definitions are considered here. According to Lederach (1995), "Culture is the shared knowledge and schemes created by a set of people for perceiving, interpreting, expressing, and responding to the social realities around them" (p. 9). Hofstede (1984) defined culture as "the collective programming of the mind which distinguishes the members of one category of people from another" (p. 51). Culture is a set of ideas that coordinate actions and construct the meanings of a group of people. Rafiee and Sarabdeen (2012) explained that cultural values are passed on from one generation to another such as from parents to their children, teachers to their students, peers to friends, leaders to followers, and institutions to members. People from different cultures differ in behaviors, social interactions, and communications. Grinblatt and Keloharju (2001) documented that language and other cultural attributes affect how investors own, sell or buy stocks. Nazemi, Rahimnia, Lagzian, and Ghayour (2012), also shared same view when they reported that cultural values, facilities, and behavior have an impact on investment decisions. Schwartz (2012) explained that cultural values are beliefs, desirable goals, which help to set standards and guide individual actions. Various cultural models have been used to study different cultures and their impact on international business. Notable among them are models by Hofstede (1980, 1984), Schwartz (1992), and Trompenaars and Hampden-Turner (1997).

Hofstede's (1980) cultural model has been widely used in the literature to analyze cross-cultural differences and their impact on financial decision making (Khairullah, and Khairullah, 2013; Leonard, Slaubaugh, and Wang, 2010; Zhao, 2014). Hofstede's (1980) described five cultural dimensions of power distance, uncertainty avoidance, individualism versus collectivism, masculinity versus femininity, and long-term versus short-term orientation. We will discuss briefly the assertion of each dimension. Power distance refers to how people view or accept power distribution among cultural groups. In power distance cultures, power is centralized in the hands of a few people, usually based on age, education, social class, income, position, or family roles. In high power-distance cultures, decision making is in the hands of those in authority, without the participation of less powerful in society. Schwartz (2012, p. 5) included social status, prestige, and cultural dominance over people and resources in power distance cultures. Uncertainty avoidance describes how people deal with future uncertainties and stressful situations. According to Hofstede (1980), strong uncertainty avoidance cultures have tendency to avoid risk and stress. In such cultures, members like to

maintain the status quo, ensure safety, and ensure the stability of society, relations and self (Schwartz, 2012). Members prefer to deal with people they know and trust and show less tolerance for different ideas and opinions. This culture is also characterized by lack of individual decision-making and initiatives, as members prefer to act in same way as majority of members of the group.

Individualism/collectivism indicates the degree at which individuals are related to other members and group goal. In individualistic cultures, the focus is on personal success and achievement, whereas in collectivist cultures, the focus is on group goals, benevolence, and preservation and enhancement of the welfare of others to promote supportive social relations (Schwartz, 2012). Masculinity/ femininity explain how the society views sex roles, aggressiveness, achievement, materialism, and performance. In masculine cultures, people are aggressive and there is much focus on money, materialism, status and achievements. Conversely, in feminine cultures the focus is on modesty, cooperation, care for others, and strong inter-personal relationships. Long-term/short-term orientation considers how different cultures view time management, present, past, and future. In long-term oriented cultures, the focus is on the future rather than present or the past. Long-term oriented cultures value time and spend much efforts and resources to achieve future-oriented goals. Such cultures encourage thrift, savings and long-term investments to enhance and improve future lifestyles.

On the contrary, short-term oriented cultures focus much efforts and resources on activities to achieve short-term benefits. Such cultures do not value time management and there is lack of commitment to long-term goals. In short-term oriented cultures people have tendency to prefer small payoffs now compared to larger payoffs in the future. Hofstede (1984) computed national average indexes to measure the degree of the cultural dimensions. According to Hofstede, developing countries (including Ghana) scored high on a power distance index (PDI), low on an individualism index (IDV), low on a masculinity index (MAS), high on an uncertainty avoidance index (UAI), and low on a long-term orientation index (LTI). Thus, Ghanaian society falls under a high power-distance, collectivist, feminine, high uncertainty avoidance, and short-term oriented culture. Using the theoretical cultural framework created by Hofstede, we integrate and synthesize cultural beliefs of Ghanaians regarding the five cultural dimensions to examine the relationships between them and investment decisions.

Figure 1: Framework of Cultural Values on Investment Decision-Making

Based on the theoretical framework in Figure 1, we propose the following hypotheses:

H_0: Ghanaian financial investment decisions are not influenced by others.
H_1: Ghanaian financial investment decisions are influenced by others.
H_0: Ghanaian individual investors do not have any investment preference.
H_2: Ghanaian individual investors have investment preference.
H_0: Ghanaian individual investors do not use investment information in making decisions.
H_3: Ghanaian individual investors use investment information in making investment decisions.
H_0: Cultural factors do not affect investment decisions.
H_4: Cultural factors do affect investment decisions.

3. Methodology

We employed a quantitative cross-sectional design approach for this study. We used the survey technique to collect data. Data were collected by means of a 20-item questionnaire. The items included both open-ended and closed-ended questions like 'how would you spend a gift of $200,000', 'are you aware of activities of the stock market', 'which of these assets do you consider most or less risky', and so forth. The closed-ended questions asked the participants to choose from pre-defined responses such as "aware" or "not aware". Other questions asked for demographic information such as income levels, level of education, and employment

status. Similar studies in the past have used cross-sectional study and inferential statistics to explore cultural factors and decision making in various countries (Aregbeyen & Mbadiugha, 2011; Boye, 2005; and Khairullah & Khairullah, 2013). The sample was drawn from an estimated adult working Ghanaian population of about 3,000, residing in Columbus, Ohio (www.africafocus.org)[1]. We determined a sample size of 109 using a priori G*power statistical test analysis (see Table 1). A two-tailed *t*-test was used to estimate the sample size. The input parameters were set at 0.05 alpha level, 0.90 power, and 0.3 effect size. Table 1 shows a detailed analysis of the test.

Table 1: Calculation of Sample Size Using G*Power Analysis

Alpha (α)	Power (1 -β)	Effect size (d)	Critical *t*	Sample size
0.05	0.90	0.3	1.9824	109

The survey items were randomly administered to 120 participants to provide each potential participant equal opportunity in the study. However, 96 individuals, constituting 80.0% of the participants returned valid responses to the research questions. All participants were Ghanaians by birth and had resided in the United States for at least 5 years. The Statistical Package for the Social Sciences (SPSS) 24.0 was used to analyze the data. We used frequency distribution tables and Analysis of Variance (ANOVA) to summarize the results of the study. Table 2 presents the category of participants used in the study. The participants were adult workers, self-employed, and working students.

Table 2: Participant Demographic Characteristics

Variables	Categories	Frequency	Percentage
Sex	Male	69	71.9%
	Female	27	28.1%
Employment Status	Adult Workers	78	81.2%
	Self-Employed	2	2.1%
	Working Students	16	16.7%
Education	Graduate	40	41.7%
	College	39	40.6%
	High School	17	17.7%
Income	less than 50,000	57	59.4%
	50,000 - 100,000	26	27.1%
	100,001-150,000	8	8.3%
	150,001- 200,000	4	4.2%
	200,001- 250,000	1	1.0%

Table 2 illustrates the characteristics of participants including their age, sex, employment status, education, and income. Age wise, participants were between 22 and 55 years old. Male participants constituted 71.9% while female participants constituted 28.1%. On employment status, 81.2% were full-time adult workers working for various employers, 2.1% were self-employed individuals while 16.7% were students who

[1]**Source:** U.S. Census Bureau, 2008-2012 American Community Survey. Five-year estimates, retrieved from http://www.africafocus.org/docs14/migr1410.php, show the Ghanaian population in the United States between 2008-2012 was 120,785 with 8.0% (approx. 9,663) living in Ohio. The average population growth rate of Ohio is estimated at 1.4% per year. About 30.0% of Ghanaian immigrants in Ohio live in Columbus (google search). We estimated the population as of 2017 to be 9,663 $(1.014)^5$ =10,359 and 0.3 *10,359 =3,108.

worked full-time. The majority (41.7%) of the participants had graduate degrees (undergraduate plus some other course, e.g. nursing; not necessarily masters or doctorate), 40.6% had graduated from college or had college diploma, while 17.7% were high school graduates or had at least secondary education. Participants' income distribution is also illustrated in table 2. Most participants (59.4%) earned less than $50,000 per year. Individuals with income between $50,000 and $100,000 per year represented 27.1% of the participants. Only 8 individuals, representing 8.3% of the participants, earned between $100,001 and $150,000 per year. Four participants (4.2%) earned between $150,001 and $200,000 per year, while 1 person (1.0%) earned between $200,001 and 250,000 per year.

Questionnaire Items: We developed the questionnaire items to collect data from the following areas:

- Cultural attributes; belief and value systems and how they impact investment choices,
- Awareness of the stock market and investment opportunities,
- Financial literacy,
- Influence of family members/inheritance and successful business mentors,
- Kinds of investments and their risk levels,
- Beliefs about sources of wealth,
- Vii) How to spend $200,000 gift.

Other questionnaire items were aimed at obtaining responses from participants' investing experience, sources of investment information, and pension plans. To explore our research topic, we chose descriptive statistics and used analysis of mean variance (ANOVA) to help us better understand the cultural value systems that influence investment behaviors.

Limitation (s) of the Study: We admit that there are some limitations to our research. First, the survey data were collected from Ghanaians residing in the United States and may not be a true representation of Ghanaians in the home country. Therefore, we cannot be very sure of the generalization of our findings. Second, although our survey design may be reliable in providing attitudes of the general population, it is generally weak in validity and respondents may act differently in real life than what they stated on the questionnaire (Babbie, 2014). In addition, our sample size was less than the sample size determined using the G*power analysis. This did not create room for high expected non-response rate. Nevertheless, these limitations were less likely to invalidate the results of the study since the cultural characteristics of non-respondents did not materially differ from the respondents. The following responses were achieved. While 57.3% indicated they were being influenced by other factors when it comes to long-term decisions such as pension plans, 25% indicated that their short-term investment decisions were influenced by other factors. Also, understanding culture and its influence on financial decision making is researchable despite the above limitations.

4. Statistical Results

This section of the study comprises statistical display including descriptive statistics, and analysis of variance (ANOVA) of survey variables. See tables 3, 4, 5 and 6 below:

Table 3: Descriptive Statistics

Descriptive Statistics							
	Stock Market Awareness	**Investment Preference**	**Level of Risk**	**Sources of Information**	**Sources of Wealth**	**Influence of Others**	**Effect of Cultural Factors**
N	96	96	96	96	96	96	96
Mean	1.38	1.22	1.22	3.53	1.64	1.6	1.53
Std. Deviation	0.67	0.42	0.46	1.00	0.71	0.77	0.88
Kurtosis	0.88	-0.29	2.94	1.82	-0.78	-0.83	1.31

Std. Error of Kurtosis	0.48	0.48	0.48	0.48	0.48	0.48	0.48

The descriptive statistics show that the mean statistic of participants' awareness of the stock market is 1.38 (standard deviation = 0.67) whereas their average (mean) investment preference is 1.22 (SD = 0.42). The mean of participants' investment risk tolerance level is 1.22 with a SD of 0.46. Furthermore, while the mean static of participants' sources of investment information is 3.53 (SD= 1.00), the mean static of their sources of wealth is 1.64 (SD = 0.71). The influence of others on investment decisions has a mean of 1.60 with a SD of 0.77. In addition, the effect of cultural factors on investment decisions recorded a mean statistic of 1.53 and a SD of 0.88. Thus, less than 2.00 Kurtosis statistics indicate a normal univariate of data distribution.

Test of Mean Differences: Analysis of Variance (ANOVA) was used to test the mean differences of the participants. The results of the F-tests used to test the differences of means are presented in Tables 4 through 6. Tables 4, 5, and 6 display results of significant tests of participants' stock-market awareness, investment preference, sources of investment information, risk-tolerance level, source of wealth, influence of other factors, and effect of cultural factors.

Table 4: Test of Significance Using Analysis of Variance

Stock Market Awareness					
	Sum of Squares	**DF**	**Mean Square**	***F***	**Sig.**
Between Groups	0.7	2	0.35	0.78	.463
Within Groups	42.03	93	0.45		
Investment Preference					
	Sum of Squares	DF	Mean Square	*F*	Sig.
Between Groups	1.72	2	0.86	5.25	.007
Within Groups	15.23	93	0.16		

Stock Market Awareness: There was no significant difference in stock market awareness, F (2, 93) = 0.78, p = .463. The null hypothesis is retained.

Investment Preference: There was a significant difference between the groups of Ghanaian investors, F (2, 93) = 5.25, p = .007. The null hypothesis is rejected.

Table 5: ANOVA Results

Sources of Information					
	Sum of Squares	**DF**	**Mean Square**	***F***	**Sig.**
Between Groups	0.93	2	.47	.46	.636
Within Groups	94.97	93	1.02		
Level of Risk					
	Sum of Squares	DF	Mean Square	*F*	Sig.
Between Groups	0.33	2	0.16	.76	.471
Within Groups	20.62	93	0.22		

Sources of Information: There was no significant difference in stock market awareness among Ghanaian investors, F (2, 93) = .46, p = .636. The null hypothesis is retained.

Level of Risk: There was a significant difference among Ghanaian investors about their attitude towards level of risk, F (2, 93) = .76, p = .471. The null hypothesis is rejected.

Table 6: ANOVA Results

Sources of Wealth					
	Sum of Squares	**DF**	**Mean Square**	***F***	**Sig.**
Between Groups	16.16	2	8.08	23.63	.001
Within Groups	31.79	93	0.34		
Influence of Others					
	Sum of Squares	DF	Mean Square	*F*	Sig.
Between Groups	4.034	2	2.02	3.54	.033
Within Groups	52.92	93	0.56		
Effect of Cultural Factors					
	Sum of Squares	DF	Mean Square	*F*	Sig.
Between Groups	1.86	2	0.93	1.21	.304
Within Groups	72.03	93	0.77		

Sources of Wealth: There was a significant difference between the groups of Ghanaian investors on sources of wealth F (2, 93) = 23.63, p = .001. The null hypothesis is rejected.

Influence of Others: There was a significant difference between the groups of Ghanaian investors, F (2, 93) = 3.54, p = .033. The null hypothesis is rejected.

Effect of Cultural Factors: There was a significant difference between the groups of Ghanaian investors, F (2, 93) = 1.21, p = .034. The null hypothesis is rejected.

Survey Analysis: We present here the analysis of the results of our survey questions. On the question of participants' stock-market awareness and its role in economic development, 71.9% indicated they had knowledge of the stock market, while 17.7% indicated they had little or no knowledge of the stock market and its activities but had heard about its existence, and 10.4% indicated they were unsure of the stock-market existence and its activities. On participants' preference for investment products, 77.1% indicated they preferred short-term to long-term investments while 22.9% indicated they preferred long-term investments to short-term investments. Our results also indicated that participants were more prone to investment risk than an average investor. While 79.1% of participants indicated that there is more risk involved when it comes to investment especially long-term investments, 18.8% believed real estates and small businesses are risky, and 2.1% admitted short-term investments were risky. Additional question was asked whether other factors other than cultural factors influenced participants' investment decisions.

Because information is considered very important in making investment decisions, we sought our participants' source of information for making their investment decisions. Surprisingly, 10.4% indicated that they relied on their financial advisors for investment information, 6.3% of the few educated participants indicated they used accounting information including ratio analyses and annual reports, while 3.1% indicated they used companies' websites and other sources to gather financial information. Also, 80.2% indicated they relied on self-knowledge and intuition, friends, and other unknown sources to make investment decisions. We also investigated how likely cultural factors impacted participants' investment decisions. Approximately 68% believed that cultural factors such as the environment, investment culture of family members, beliefs about wealth creation, value systems, and social status influence their investment decisions while 16.67% did not indicate such factors as basic investment influence. Also, 10.4% were unsure if culture had any effect on their actions, while 5.2% did not know if cultural factors affected their decisions.

Discussion

The first hypothesis postulated that Ghanaian investor's decision-making is influenced by others. The null hypothesis suggests that investors would engage in thorough mean-variance investment analysis that weighs

risk factors against investment returns to make investment decisions. Also, 17.7% of the participants believed that they made their own decisions without any known influence from others. Asked about what brings about wealth, participants indicated different qualitative variables such as hard work, effective planning, and risk taking. Statistically, while 49% attributed wealth to hard work, 37.5% indicated wealth comes as a result of good planning, and 13.5% believed risk taking was the key to financial success. However, our findings show that investment decisions are influenced by friends, relatives and others. Boye (2005) reported that investment decisions of Ghanaian investors are mostly influenced or approved by others, such as superiors, friends, groups, or cultural logic. Similar studies in Asia had also reported results that support our findings. For example, Lee (2012), and Khairullah & Khairullah (2013) conducted similar studies in Korea and China respectively. Both studies found that subordinates acknowledge those in authority to make decisions, and it would be disrespectful to ignore opinions and views of those in authority.

Although, Lee (2012) and Khairullah & Khairullah (2013) did not specifically address financial decisions at investor level as they considered managers' decisions regarding projects of multinational corporations, their findings nevertheless fit well into and supported our study. Hypothesis Two postulated that Ghanaian investors have preference for short-duration, less-risky investments compared to long-duration investments. We found that a great number of investors seemed to prefer short-duration investments to long-duration investments. Arshad and Ibrahim (2019) studied the investment behavior of Pakistani investors and found that risk avoidance and uncertainty avoidance significantly influence investment choices. They explained that Pakistani investors tend to estimate the financial loss they may incur as a result of their decisions and develop strategies to reduce or avoid the risk. The strategies they cited included gathering more information and investing in interest bearing account rather than stocks. This finding is consistent with our findings and that of earlier studies of Boye (2005), and Khairullah and Khairullah (2013). We defined short-duration investments to include interest bearing or savings account, money market funds, government-issued treasury bills, and negotiable certificate of deposits issued by commercial banks.

These securities are considered risk-free or less risky than long-term securities such as stocks. Several reasons including safety, flexibility, and the ability to see tangible results quickly, could influence the preference of short-duration investments (Arshad and Ibrahim, 2019; Boye, 2005). When viewed against the background of the responses on investment type preference, we could deduce that lack of awareness of capital markets, need for liquidity and easy accessibility of funds when needed, were the major factors affecting short-duration investment selection. Khairullah and Khairullah (2013) stated that the Chinese cultural values of harmony and uncertainty avoidance make them choose safer and less risky investments. According to them, the philosophy in China is "*Live with it don't try to change*". They found that Chinese workers are passive and do not like to take initiative to avoid risk. The current finding is, however, inconsistent with that of Yeboah's (2014) study though. Yeboah (2014) found that uncertainty avoidance does not affect the risk-taking behavior of Ghanaian small-business entrepreneurs. The differences in the findings suggest some difficulty in classifying entrepreneurship.

In our study, we found that Ghanaians considered wealth from entrepreneurship as hard working rather than risk-taking. The third hypothesis sought to determine the sources of information used in making investment decisions. We wanted to know if participants had access to and/or relied on common sources of investment information such as financial newspapers, company websites, financial advisors, leading economic indicators, and released financial reports, to make investment decisions. The results overwhelmingly indicated that majority of Ghanaians did not rely on these investment information sources when making financial decisions. The reasons could possibly range from time and cost of collecting and analyzing the information to lack of financial knowledge to lack of trust in the information sources. We admit that analyzing and evaluating the reliability and usefulness of such information could be very difficult, especially for nonprofessional investors. This is not surprising because Hofstede (1980) asserted that in feminine cultural societies such as Ghana, people are less aggressive and more modest when making decisions. Our finding is consistent with the results of Boye (2005) and that of Dawuda and Azeko (2015).

Dawuda and Azeko (2015) explained that lack of accounting knowledge, inability to quantify the value of financial information, lack of financial education, and limited access to information may account for this reason. However, our finding disagrees with the findings of Arshad and Ibrahim (2019) who reported that

Pakistani investors gather and analyze more information as a strategy to reduce risk. Li, Masuda, and Russel (2014) also echoed similar findings with Arshad and Ibrahim in their study of online financial decision-making process of East Asian and North American countries that Hong Kong Chinese, compared to European Canadians, spend time to parse through information before making financial decisions. Hypothesis four sought to determine whether cultural factors affect investment decisions. The results indicated that cultural factors do affect the investment decisions of Ghanaians. Cultural factors were defined to include beliefs about wealth creation and risk, value systems and social norms, environment, and the investment culture of family members and friends.

Our findings tend to corroborate the results of similar studies by Aregbeyen and Mbadiugba (2011), Nazemi et al. (2012), and Rahimi et al. (2014) who studied cultural factors and its impact on economic decision-making in power distance cultures. They found that cultural factors, including environmental factors, habits and upbringing play significant roles in financial decision-making process especially concerning what to buy and how to spend money. They all agreed that cultural factors do affect the proper understanding of financial decision-making process, and selection of investment products. We did not as yet come across any study in the literature either at micro or macro level that plays down on the importance of culture in decision-making process. Intuition and personal preferences are shaped by cultural values and belief systems. We also conclude that Ghanaians are less aggressive in collecting and analyzing information from varied reliable sources before making investment decisions.

5. Conclusion and Recommendations

From this research, it seems very clear the importance of culture in financial decision-making. We conclude that there is a significant reliance on intuition and the influence of others in the investment decisions of Ghanaians. There is adequate evidence from the survey results and analysis that Ghanaian investors rely on friends, family members, and others they trust to make such decisions. And their investment preference is geared towards short-duration investments. These conclusions are consistent with Hofstede's (1980) cultural dimensions of power distance, uncertainty avoidance, feminism, and short-term orientation, as well as findings of earlier studies. This range of cultural factors, not accounted for in the traditional economic models of "rational investor" behavior, plays a major role in investment decisions. We believe that undertaking investment projects without analyzing relevant information and preferring short-duration investments to long-duration and other alternative investments can lead to suboptimal portfolios and excessive risk-taking that reduce portfolio performance. Erosion of capital is possible because of too much emphasis on short-duration investments. Such investments pay lower rate of return than that of long-duration investments. Furthermore, short-duration investments can lose value after adjusting for inflation.

Because of lack of diversification of the investment portfolio, total risk of the investment increases and rate of return decreases. We, therefore, recommend that investors seek advice from investment professionals who can provide them with financial information and analysis before investing. Consistent with the theory of risk tolerance and modern portfolio theory, we also recommend that investors invest in a mix of short and long-duration assets to diversify their portfolio and stick with it to meet their financial goal. Financial investments should not be considered as a get-rich-quick tactic that could be held for a short period of time with the expectation of earning a significant rate of return. It is a long-term process that needs patience, commitment, self-control, and discipline. By understanding cultural values and investment decision making process, investors may be able to improve their investment outcomes. To overcome any negative cultural influence on investment decision-making, financial education should be vigorously pursued to broaden financial literacy. Admittedly, the findings of our study do not speak for all cultures, environments or financial systems and therefore, renders us incapable of making an exhaustive generalization. To fill the gap that our study might have left, we recommend further study of the topic. Future studies may increase the sample size and look at the impact of these cultural factors on investment performance of Ghanaians or people from other cultural settings.

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Shadow Banking, Bank Liquidity and Monetary Policy Shocks in Emerging Economies: A Panel VAR Analysis

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Abstract: The study provides an analysis of the relationships between shadow banking, bank liquidity and monetary policy rate in emerging economies. It is aimed at broadening knowledge on the effects of shadow banking on monetary policy transmission. Furthermore, the study seeks to analyse the impact of changes in bank liquidity on the growth of the shadow banking sector. We employ panel VAR technique to analyse the dynamics of monetary policy, shadow banking and bank liquidity using data for 15 emerging economy countries. We find that a contractionary monetary policy shock results in a decrease in shadow banking and a decrease in bank liquidity. We also find that a positive shock in bank liquidity increases shadow bank growth and a positive shock in shadow banking also increases bank liquidity. The results point to complementarity between shadow banking and bank liquidity; close interconnectedness between the two sectors; and the dominance of risk-taking in emerging economies. We suggest coordination between monetary policy and prudential regulation to improve the potency of monetary policy.

Keywords: *Monetary policy, bank liquidity, shadow banking, panel VAR.*

1. Introduction

The shadow banking[2] sector accelerated growth in advanced economies in the period prior to the financial crisis and its negative role in propagating systemic risk is well documented (Adrian and Ashcraft, 2016, FSB, 2017). Research on the economic benefits and costs of this sector have however been limited by its opaque nature and hence lack of data that accompanies such opacity. Whilst there is no debate on the existence of this sector and the role played by shadow banks, it is not clear as yet how its growth impacts monetary policy transmission. However, with the continued growth of shadow banking assets in both advanced and emerging economies, it is ideal to analyse the possible impact this has on monetary policy transmission to proffer new ideas on how to improve monetary policy frameworks in different countries. The purpose of our paper therefore, is to empirically analyse the linkages between shadow banking and monetary policy within the context of emerging economies. Contributions made in this direction range from studies that analyse the association between price stability and financial stability (Smets, 2014, Hellwig, 2015), papers on effectiveness of monetary policy that accounts for shadow bank activities (Ge, 2011, Verona et al., 2013) and also studies that directly investigate linkages between shadow banking and monetary policy (Chen et al., 2017, Nelson et al., 2018, Verona et al., 2013, Xiang and Qianglong, 2014).

In addition, the role of shadow banks in risk taking has also been investigated (Zhou and Tewari, 2019b). The risk taking channel of monetary policy describes the response of economic agents to changes in the policy rate by increasing or decreasing their uptake of risky assets (Borio and Zhu, 2012). A monetary policy shock is deemed to impact financial agents' risk taking in at least two ways (Gambacorta, 2009). Firstly, a negative shock in the interest rate induces agents to substitute low interest government bonds with high risk, high return assets. Secondly, variations in monetary policy rate impact asset valuation and risk metrics. For instance, lowering the nominal interest rate reduces volatility estimate, hence impacts risk metrics favourably, consequently leading to increase in risk appetite of economic agents. Others have also argued that increased risk uptake by financial agents in the shadow banking sector lead to financial sector fragility and slows down business cycle recovery (Moreira and Savov, 2017, Adrian and Ashcraft, 2016). The linkages between monetary policy and the non-bank financial sector complicate the assumed dichotomy between

[2] Shadow banking is defined by the Financial Stability Board (FSB, 2017) as, "credit intermediation involving entities and activities (fully or partly) outside of the regular banking system"

price stability and financial stability. Smets (2014) show that the decision on how to relate monetary policy and financial stability depends on three things: the efficacy of macro-prudential regulations, significance of risk taking channel of monetary policy and extent of financial dominance[3].

Monetary policy is linked to non-bank financial sector through two channels, the interest rate and liquidity. Firstly, changes in the interest rate influence financial market participants' risk taking (Gambacorta, 2009). The second link is provided by the substitutability between bank liquidity and wholesale market liquidity, so that in times of monetary contraction, non-bank financial firms provides liquid liabilities to the banking sector (Aftab and Varotto, 2017). Whilst this is contrary to Adrian and Shin (2009)'s observation that liquidity is only of a global nature, it is intuitive that banks source for liquid assets from wholesale markets during periods of monetary contraction, thereby maintaining their operations and weakening monetary policy. This study aims to analyse the response of shadow banking and bank liquidity to an innovation to the monetary policy rate in a panel VAR framework. Two closely related works to ours are Nelson et al. (2018) and Chen et al. (2017) who relate shadow banking to monetary policy in the US and China respectively. We extend this literature by considering a panel of emerging economies in a panel VAR framework. If the direct impact of the policy rate is dominant than via bank liquidity, the implication could be that the risk-taking channel's impact on shadow banking offsets the effect of variations in bank deposits.

Our theoretical contribution stems from investigating the channels that link monetary policy to shadow banking. Therefore, the two propositions being tested are: firstly, a positive shock in the interest rate will increase bank risk, attenuate risk taking and reduce shadow banking activities, and eventually decrease shadow bank growth. Secondly, a positive shock in the policy rate should result in a decrease in bank deposits/bank liquidity, however banks maintain their credit creation activities using shadow bank liabilities, which in turn increases shadow banking. Our results show that shadow banking responds negatively to an innovation in the policy rate and responds positively to a positive shock in bank liquidity. We therefore do not find evidence of substitutability between bank liabilities and shadow bank liabilities. Instead the study findings suggest the presence of risk taking in the non-bank financial sector, which result in expansion of shadow banking during when interest rates are low and contraction of shadow banking in times of high interest rates in emerging economies. Our paper is organised as follows: in Section 2, literature on shadow banking and monetary policy transmission is reviewed. Section 3 outlines the methodology used in the study, and the results of the analysis are presented in section 4. Section 5 provides conclusions and recommendations.

2. Literature Review

Theoretically, the study is positioned within the body of literature that links monetary policy to financial sector disturbances (Smets, 2014, Knoop, 2008). Standard models of monetary policy such as the New Keynesian Dynamic Stochastic General Equilibrium (DSGE) Models have evolved to account for macro-prudential policy in addition to monetary policy (Galí, 2015, Chen and Columba, 2016). In addition, theories of financial frictions have been used to explain the relationship between monetary policy and the financial sector within the DSGE framework (Bernanke et al., 1999). However, whilst these succinctly show the balance sheet channels of monetary policy transmission, they do little in explaining instability originating from the financial sector. To complement this deficiency, several studies have attempted to augment these models with a banking sector (Gertler and Karadi, 2011, Mazelis, 2014, Simpasa et al., 2014). More so, others have further included a shadow banking sector in their analyses (Verona et al., 2013, Xiang and Qianglong, 2014). We add to this body of literature by empirically estimating the relationship between monetary policy, bank liquidity and shadow banking within a panel VAR framework.

[3] It refers to, "the risk that financial stability considerations undermine the credibility of the central bank's price stability mandate" Smets (2014)

Empirical studies surveyed include those focusing on the linkages between monetary policy and the financial sector through both the risk taking channel and the non-bank financial sector (Nelson et al., 2018, Chen et al., 2017, Borio and Zhu, 2012, Zhou and Tewari, 2019b, Xiao, 2018). Xiao (2018)'s work documents a shadow banking channel of monetary policy for the US. Their study is based on two assumptions, the first being that shadow banks offer inferior services and the other being depositors with different yield sensitivity. They demonstrate that about 35% of drop in bank deposits during monetary contraction is off-set by an increase in shadow bank deposits. Shadow banks offer high interest rates and therefore depositors switch from formal banks to shadow banks seeking high yields. Haisen and Yazdifar (2015) undertake a similar study for China using SVAR model and OLS regression. They conclude that an increase in shadow banking has the effect of increasing money supply and the price level. They support Xiao (2018)'s findings that monetary policy becomes less potent in the presence of shadow banking.

Nelson et al. (2018) also employ the Bayesian VAR approach and simulate the effect of monetary policy changes on both assets of formal banks and shadow banks. They argue for a pro-cyclical response of commercial bank assets to a shock in monetary policy and a contra cyclical response of shadow bank asset growth to the same shock. In addition, their study builds a DSGE model with shadow banks, which is able to explain theoretically their findings from the Bayesian VAR. Their results are further buttressed by Chen et al. (2017) who investigate the association between shadow banking and monetary policy in China. The study employs both descriptive analysis and panel VAR model. They find monetary policy contraction to lower bank loans but increases high risk non-loan assets. Evidence from both analyses demonstrates that contractionary monetary policy positively impacts shadow banking. Mazelis (2014) employs a DSGE model and find contractionary monetary policy to decrease bank loans whilst at the same time it increases shadow bank loans. In their model, the presence of shadow banks dampens the power of monetary policy as represented by a Taylor rule. Mazelis (2014) also find that the presence of shadow banks increase the elasticity of other variables in their model to a shock in monetary policy. Using corporate loan pricing policies, Paligorova and Santos (2017) investigates the risk taking channel for the US. Their study shows that monetary policy stance has an effect on loan spreads. They find high risk banks to respond to monetary tightening by increasing their yield spreads. On the contrary, in periods of monetary easing, high risk banks reduce spreads, limiting the full impact of monetary policy changes.

In another study, Aftab and Varotto (2017) use money market funds (MMFs) in analysing liquidity regulations' impact on shadow banking. They find that new regulations have increased the resilience of MMFs. In a related study, Loutskina (2011) investigates the impact of bank securitisations on sustainability of lending. Their studies construct a new index of bank loan liquidity and employ regression analysis to analyse liquidity of US banks. Their findings show that securitisation increases the lending ability of banks, in fact liquid assets provided through securitisation act as substitutes to bank deposits. Further, securitisations are found to increase bank liquidity and reduce effectiveness of monetary policy. In related studies, the relationship between monetary policy and bank regulation has been investigated by De Moraes et al. (2016). Their study analyses the response of banks to monetary policy changes by focusing on capital requirements and the risk taking channel. They conclude that banks respond to monetary policy changes through altering loan loss provisions and their capital adequacy ratio. Their study challenges the separate use of prudential regulation and monetary policy. They point to an integrated approach, which can ensure that the conduct on macroeconomic policy does not, influence prudential oversight negatively. De Moraes et al. (2016) show that monetary policy impacts micro-prudential supervision, which calls for close coordination between the different policies.

Bruno and Shin (2014) argue for a cross border risk taking channel for the US. The study employs a recursive VAR in which implied volatility, the real interest rate, leverage and real effective exchange rate are endogenous variables. According to Bruno and Shin (2014), banks are a vital element in the transmission mechanism and their cross border operations are elastic to movements in the policy stance. The finding is important as it confirms evidence on the susceptibility of shadow bank liabilities to sudden withdrawals (Moreira and Savov, 2017). They are therefore, more vulnerable to sudden withdrawals in the face of economic or financial instability, increasing the instability in the process. In another study, De Nicolò et al. (2010) employ ordinary least squares (OLS) procedure and scatter diagrams to demonstrate a negative association between the ratio of risk weighted assets of banks to capital and the US policy rate. They establish

a negative association between the two variables signifying the presence of a risk taking channel of monetary policy in the US.

3. Empirical Model and Variable Description

In this study, the researcher focuses on investigating the relationships among monetary policy, bank liquidity and shadow banking using a panel of 15 emerging economy countries. Cross border liabilities of banks are an alternative liquidity source to bank deposits and are vulnerable to both changes in economic conditions in the source country and also in destination country. Panel data framework is preferred due its robustness over both time series and cross sectional analyses. The study follows previous studies on monetary policy, which employ the vector autoregressive model (VAR) (Sims, 1980, Nelson et al., 2018). However, since we are using panel data, the study estimates a panel vector autoregressive model (PVAR). A PVAR accounts for country fixed effects and uses GMM instruments to deal with Endogeneity. We report on granger causality tests, impulse response functions and forecast error variance decompositions. As argued in literature (Kilian, 2011, Stock and Watson, 2001) these analyses are more informative than estimated coefficients in a VAR.

Panel VAR Model: In basic panel VARs, all variables are endogenous to the system like in the time series VARs. Thus all variables are interdependent and shock transmissions can be identified. The technique uses GMM-like instruments to deal with Endogeneity of the regressors and thus overcome the Nickell (1981) bias. The following is a panel VAR representation:

$$y_{it} = A_{oi}(t) + A_i(l)Y_{t-1} + \mu_{it}, \#(2)$$

Where, $i = 1, \dots \dots, N$ and $t = 1 \dots \dots, T$

y_{it} is the vector of endogenous variables in each unit (e.g. in a country) and Y_t is therefore a stacked version of y_{it} and μ_{it} is a vector of random disturbances, assumed to be white noise. According to Canova and Ciccarelli (2013), there are three distinguishing features of equation (2); firstly it portrays dynamic interdependency, which is the fact that information of past periods is captured in the model through lags of all endogenous variables. The second characteristic is that of static interdependence, which is explained by correlation amongst the different units'μ_{it}. The third characteristic is cross sectional heterogeneity – the slope, the intercept and variance of shocks μ_{it} are different for each unit.

Model Variables and Data: The data used in the study covers the period 1998Q2 to 2015Q1. The sample period is constrained by the unavailability of shadow banking data in some jurisdictions beyond 1998. The following model shall be estimated for the four countries following Love and Zicchino (2006).

$$y_{it} = A_{oi}(t) + A_i(l)Y_{t-1} + \mu_{it}, \#(3)$$

where $y_{it}$is a vector of the following 6 variables, A_i is a matrix of parameters and ε_t are white noise innovations. The model variables are described in Table 1 below.

Table 1: Variable Description

Variable	Description	Data Source
Infl	Inflation	Central banks/IMF
Sbcorr	shadow banking/non-core liabilities	BIS/FSB
GDPn	Nominal GDP	World bank
Reer	Real Effective Exchange rate	IMF/Smith and Galesi (2014)
Liquid	Liquidity measure – M1	IMF/World bank
Pr	Central Bank policy rate	BIS

Shadow Banking Measure: Shadow banking is mainly constructed using data from the FSB[4] on assets of other financial intermediaries and data on foreign liabilities from the BIS for four countries that do not participate in the FSB Shadow Bank Monitoring programme. The data is transformation logarithms and measured as growth in shadow bank assets. Reported results show a positive association between the interest rate and shadow banking implying that shadow banking increases as bank liquidity decreases (Barbu et al., 2016, Altunbas et al., 2009). Their studies do not however take into account the bi-directional effect that can exist between the two variables.

Data for Countries: The country sample for the study is provided in Table 2**.** We include Singapore amongst 14 emerging economies due to its proximity to emerging countries in Asia. Our sample size consists mainly of emerging economies; however, the sample is constrained by lack of data on our shadow banking measures for other countries.

Table 2: Country Sample

Argentina	Malaysia	Thailand
Brazil	Mexico	India
Chile	Philippines	South Africa
China	Peru	Saudi Arabia
Indonesia	Singapore	Turkey

4. Empirical Results

We provide in this section a concise description of the results from the panel VAR model. We take into account the presence of cross sectional dependency in the sample, by employing Pesaran's PESCADF (2007) unit root test to test for stationarity of each variable. Two advantages of this unit root test are that it accounts for cross sectional dependence and is applicable in unbalanced panels. Thus the following procedure is followed to obtain the results: Preliminary univariate analysis of data, cross sectional dependence test, unit root tests and then estimation of panel VAR.

Descriptive Statistics: We provide summary statistics for all the 15 countries in the sample in Table 3. It is noteworthy to mention that variables used in the estimation are logarithms in the cases of inflation (logarithm of the consumer price index), gdpn (logarithm of nominal GDP in US$ terms), reer (logarithm of the country specific reer), shadow banking (logarithm of OFI assets of bank foreign liabilities) and liquidity (liquid) is the logarithm of M1 or M2 depending on available country data. This transformation is important for basically two reasons, firstly to avoid outliers in the data and secondly to minimise the possibility of heteroskedastic errors from the estimation. From Table 3, all data presented show consistence in terms of low standard deviations and shorter ranges. The number of observations for both sbscorr and liquid show that the panel is unbalanced as it is less than the maximum number expected per variable from all the countries.

Table 3: Summary Statistics

Variable	Observations	Mean	Std. Dev	Min	Max
Sbscorr	1.097	10.68576	0.6669625	8.7717	12.98063
Liquid	1.104	551.5009	318.8401	1	1103
Infl	1.125	1.811522	0.495537	-0.0105076	2.209343
Gdpn	1.125	4.940878	0.3239192	4.415491	6.264406

[4] We mainly use data from BIS on foreign liabilities of banks. Where the data is not available, we use data on shadow bank assets from FSB. The FSB is extrapolated from annual frequency to quarterly frequency following Smith and Galesi (2014) in Eviews. The results presented here are robust to the use of annual data for all variables and annual shadow bank data from FSB. The results of the robustness model are available on request.

Pr	1.125	0.069643	0.0860626	0	2.000267
Reer	1.125	1.793163	0.3476365	05895266	2.82597

Correlation Matrix: Table 4 below shows individual correlations for all variables used in the model. As expected, we see a very high correlation coefficient for liquidity and inflation. All other correlations are below 0.5 reducing the possibility of multi-collinearity.

Table 4: Correlation Table

Sample: 1998Q2 2015Q1

Correlation	REER	SBSCORR	PR	LIQUID	GDPN	INFL
REER	1.000000					
SBSCORR	-0.044901	1.000000				
PR	-0.152604	0.036007	1.000000			
LIQUID	-0.236705	0.238839	0.237018	1.000000		
GDPN	-0.022537	0.471653	-0.164176	0.177695	1.000000	
INFL	0.179980	0.045384	-0.323402	-0.846239	0.222644	1.000000

Cross Sectional Dependence Test: According to Sarafidis and Wansbeek (2012) cross sectional dependence refers to the presence of correlation across panels. Most panel data estimation methods assume cross sectional independence and the presence of cross sectional dependence can influence the estimated results (Comunale, 2017). Sarafidis and Wansbeek (2012) argue that cross sectional dependence can result in biased and inconsistent results. In addition, traditional panel unit root tests do not account for cross sectional dependence. However, in many macro panels cross sectional dependence exists (Pesaran, 2007, Sarafidis and Wansbeek, 2012). The study applies Pesaran (2004)'s cross sectional dependence test and the results are presented in Table 5.

Table 5: Cross Sectional Dependence Test

Variable	CD-test stat	P-value
Dpr	9.50	0.000
Dsbscorr	22.16	0.000
Dgdpn	24.20	0.000
Dliquid	17.36	0.000
Dreer	42.58	0.000
Dinfl	7.68	0.000

Table 5 shows that for all variables, the null hypothesis of cross sectional independence can be rejected. Thus all variables exhibit cross sectional dependence. In the next section, the study tests for stationarity of variables taking into consideration cross sectional dependence in the spirit of Pesaran (2007).

Panel Unit Root Tests: Our work utilises Pesaran (2007) panel unit root test. The tests account for cross sectional dependence by augmenting the Augmented Dickey Fuller (ADF) regressions with panel averages of lagged values and first differences of the series. It is noteworthy that using data at levels does not show any non-negligible difference in the simulated IRFs. The estimation method follows Love and Zicchino (2006) and Abrigo and Love (2016). The method accounts for country specific individual unobservable characteristics using fixed effects. The null hypothesis in the test is that the series are non-stationary. As shown in Table 6, we conclude that all series in the model are non-stationary ant level. However, all differenced series show evidence of stationarity, specifically all series are integrated of order one I (1).

Table 6: Unit Root Tests

Variable	Levels	1st Diff	Conclusion
REER	-1.117	-6.275***	I(1)
SBSCORR	0.819	-7.161***	I(1)
PR^T	-0.173	-8.825***	I(1)

LIQUID[T]	-0.796	-3.201***	I(1)
GDPN	3.542	-6.412***	I(1)
INFL	-1.056	-6.544***	I(1)

[T] refers to inclusion of a time trend. *, **, *** refers to 10%, 5% and 1% significance level respectively.

PVAR Estimation Results: This section reports results from the panel VAR estimates. Full estimation results are attached in Appendix A. The presence of unit roots in our main data set requires that we estimate the VAR in differences. However, in order to overcome the Nickell (1981) bias where correlation between the error term and lagged values of the dependent variable exist, Helmert transformation is used. Helmert procedure removes fixed effects using forward mean differencing, preserving orthogonality between the transformed variables and lagged variables and helps to reduce serial correlation (Hove et al., 2015). The model is estimated using the method of generalised methods of moment (GMM). Cholesky decomposition is used for identification in both IRFs and FEVD. We follow Dajcman (2016) and Dajcman and Tica (2017) who suggest the following order of variables: MACROECONOMIC variables, MONETARY variables and then BANK SPECIFIC variables. The ordering assumes that macroeconomic variables are the most exogenous and in turn influence monetary variables, which also influence financial or bank specific variables. According to Dajcman and Tica (2017) it is important to identify all monetary policy channels in order to develop optimal monetary policy. They argue that unidentified channels can dampen the monetary policy impulses, reducing the intended impact of a policy shift. Thus our variables are ordered as follows: **reer – GDPn – pr - infl – sbscorr – liquidity.**

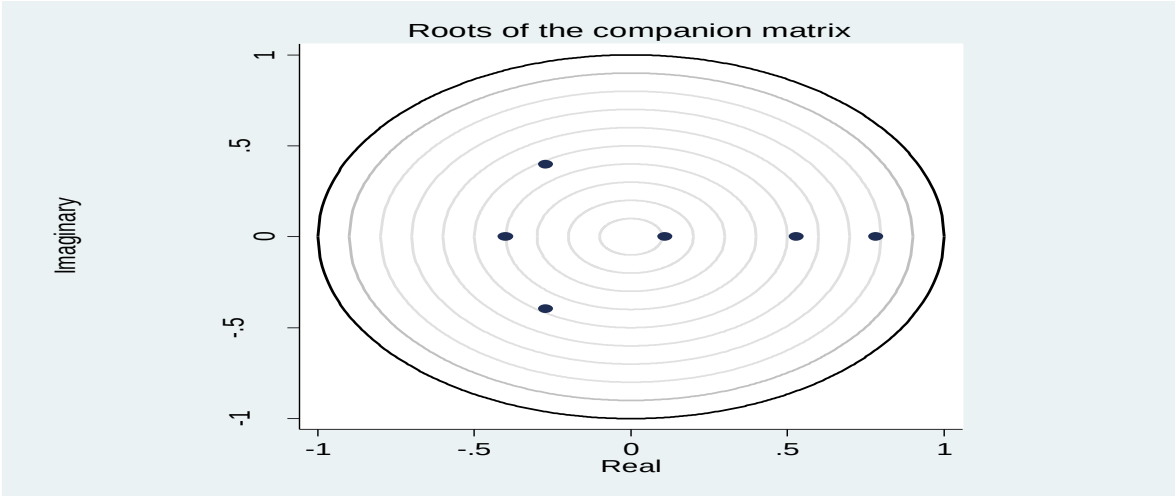
PVAR Lag Order Selection: Lag selection is done following Abrigo and Love (2016) and a PVAR of lag order 2 is selected. Table 7 presents results of the lag selection criterion. We follow the lag order as selected by the MAIC selection criterion suggested by Andrews and Lu (2001).

Table 7: PVAR Lag Order Selection

Lag	CD	J-STA	J-P Value	MBIC	MAIC	MQIC
1	0.95	91.73	0.092	-422.88	-58.26	-197.15
2	0.85	37.89	0.895	-305.19	-62.10	-154.70
3	-24.42	16.29	0.905	-155.24	-33.70	-79.99

PVAR Model Stability: Model stability is checked using the AR roots graph. Figure 1 shows the AR roots graph for the estimated model. It indicates that the model is stable as all roots are inside the circle. Furthermore, the study tests the model for over identifying restrictions using Hansen's J-statistic. The coefficient of the J-statistic is found to be 88.88 (p = 0.086), which is not significant at the 5% level. Therefore, we can conclude that the GMM instruments are valid.

Figure 1: AR Roots Graph



Granger Causality Tests: Panel granger causality tests were undertaken after estimating the panel VAR model and the results are presented in Table 8. The null hypothesis is that the excluded variable (*left hand variable*) does not granger cause the equation variable (*right hand variable*). Thus the alternative hypothesis is that the excluded variable granger causes the equation variable.

Table 8: Panel VAR Granger Causality Test

	Hypothesis	Chi2 stat	P-value
1	dpr does not granger cause dsbscorr	5.18	0.023
2	dliquid does not granger cause dsbscorr	230.44	0.000
3	dsbscorr does not granger cause dpr	0.14	0.712
4	dliquid does not granger cause dpr	1.53	0.216
5	dsbscorr does not granger cause dliquid	8.13	0.004
6	dpr does not granger cause dliquid	0.024	0.878

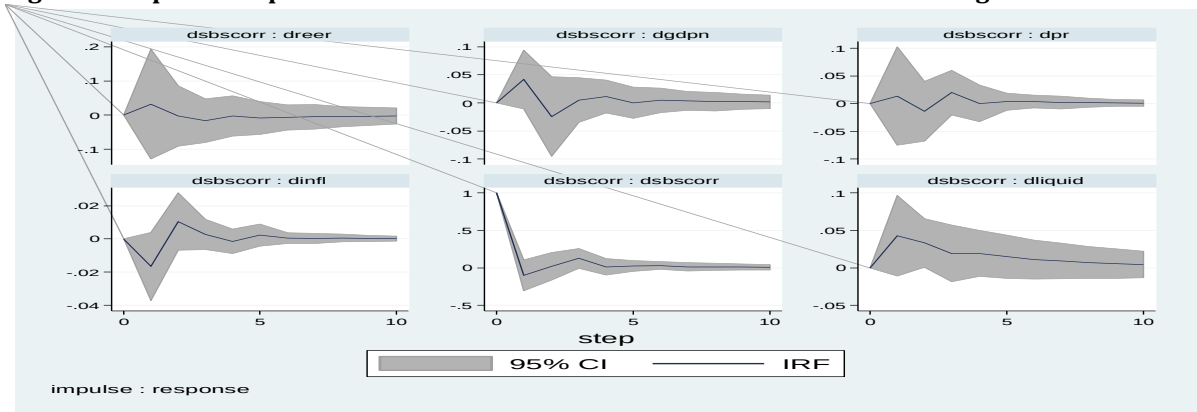
The granger causality tests in table 8 show that lagged values of policy rate and bank liquidity granger cause shadow banking. Furthermore, shadow banking and the policy rate depicts a uni-directional relationship. The implication would be that monetary policy stance impact shadow bank activity but the reverse is not true. This proposition has been suggested in Borio and Zhu (2012) on the who argues that changes in the monetary policy stance have a bearing on financial market agents' risk taking. In addition, the study establishes a bi-directional relationship between shadow banking and bank liquidity as measured by $m1$.

Impulse Response Functions: This section reports on cumulative impulse response functions from the estimated PVAR model. Three shocks are simulated, a monetary policy shock, a shock to shadow banking and a shock to bank liquidity. These are discussed separately below.

(A) Impulse Responses to a 1 Standard Deviation Shock to Shadow Banking: Figure 2 shows the response of other variables to a shock in shadow banking. A positive shock in shadow banking results in an increase in bank liquidity as measured by the money supply. This could imply shadow banking has a complementary effect on the liquidity of banks, with increased participation of shadow banks in financial activities increasing bank deposits. On the other hand, banks could also be taking advantage of wholesale markets to raise finance from the shadow banking system, which substitutes bank deposits in credit creation hence they are able to extend credit whilst at the same time increasing their stock of liquid liabilities. Viewed from either side, shadow banking complementary effect on bank liquidity implies banks do not entirely depend on central bank money and deposit creation for funding. The finding supports evidence in Loutskina (2011), who demonstrate that securitisation increases bank liquidity and decrease the elasticity of bank credit creation to changes in bank deposits.

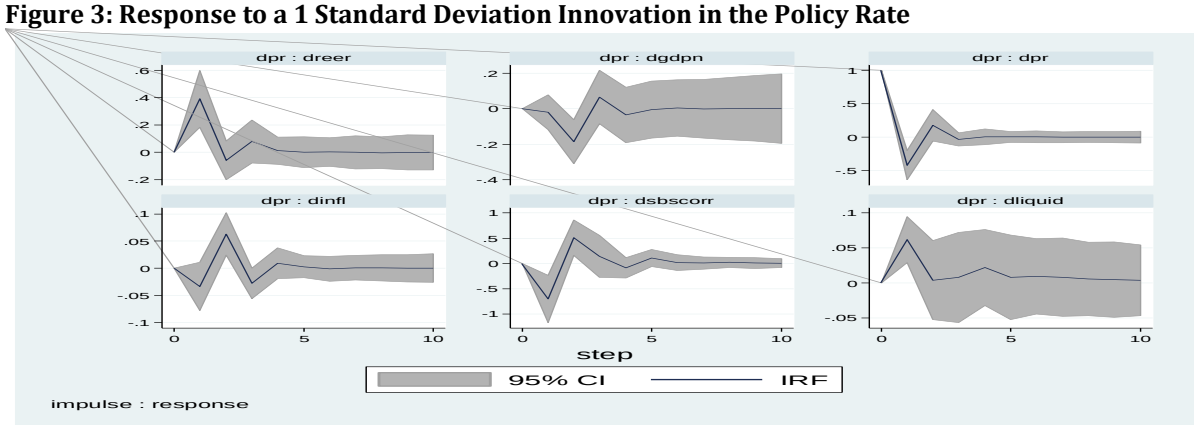
The response of the policy rate to an innovation in shadow banking portrays mean reversion around the zero x-axis. Thus initially there is a rise in the policy rate in response to a shock in shadow banking. The mean reverting shape indicates there is over-correction of the changes in the policy rate. A shock to shadow banking also results in depreciation of the domestic currency. The depreciation of the domestic currency as a result of a shock in shadow banking could be indicative of the cross border nature of shadow banking activities. The results supports findings of Zhou and Tewari (2019a) who conclude that there is a close association between changes in shadow banking activities and international capital flow changes, leading to currency depreciation/appreciation.

Figure 2: Impulse Responses to a 1 Standard Deviation Shock in Shadow Banking



Impact of shadow bank shocks on both inflation and GDP is very small as shown in the graph, which may be interpreted as not significant. The direction of the shocks however may give an important insight into the relationships amongst these variables. For instance, a shock in shadow banking induces a decrease in inflation rate in emerging economies. This finding may indicate the reduction in consumption as funds are transferred from consumers into financial markets for investment purposes as shadow banks grow. A shock in shadow banking also induce an increase in GDP, a finding in tandem with the Granger causality tests above, which established a uni-directional relationship between GDP and shadow banking flowing from shadow banking. The results supports literature on financial innovation and economic growth, which suggests that financial innovation increases economic growth (Bara et al., 2016, Beck et al., 2014, Laeven et al., 2015).

Figure 3: Response to a 1 Standard Deviation Innovation in the Policy Rate



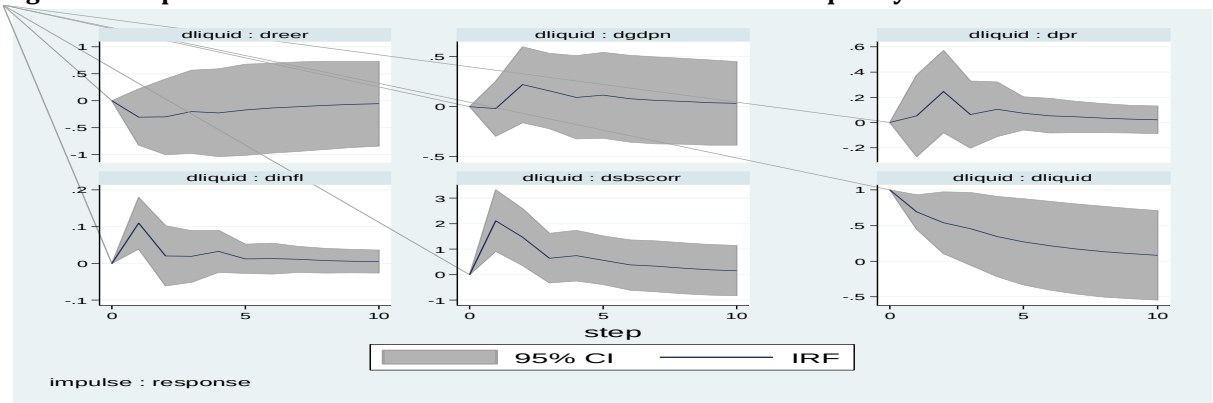
(B) Impulse Responses to a 1 Standard Deviation Shock to the Monetary Policy Rate*:* Figure 3 shows results of the response to a shock in the policy rate. Contractionary monetary policy shock induces a decrease in shadow banking. However, the decline is short lived. The finding is first of all contrary to other studies such as Nelson et al. (2018) and Funke et al. (2015) whose findings suggest an increase in shadow banking in the event of a positive shock in the policy rate. However, our results are in support of the risk-taking proposition, which suggest that increasing the policy rate increases risk and in turn make market participants to reduce their appetite for risky assets. The dominance of the risk-taking proposition could suggest that shadow banking is not substitutes for bank liquid liabilities in emerging economies. This second explanation is supported by the finding that bank liquidity increases with a shock to shadow banking and the work of Loutskina (2011) who reports that securitisation increases bank liquidity. We argue that the impact of monetary policy on shadow banking is different in developed vs emerging or developing economies.

A positive shock to the policy rate leads to in an immediate increase in bank liabilities contrary to theoretical expectations. The increase is however short-lived and followed by a deep decrease. Thus in the presence of shadow banking money supply does not respond to the policy rate immediately but with a lag. Instead, it can

be shown that the policy rate impact shadow banks negatively first before bank liquidity begins to dwindle. Our explanation for this finding points to banks participation in shadow banking and sudden withdrawal of shadow banking liabilities in the event of a monetary policy shock. Formal banking institutions respond to a monetary policy shock by reducing shadow banking asset holdings converting them to accessible liabilities on their balance sheets. A contractionary monetary policy shock however, decreases both inflation and GDP growth as expected. In theory, tight monetary policy is used against an overheated economy, reducing both the price level and output (Klaeffling, 2003). We therefore confirm the overall potency of monetary policy in emerging economies. this finding is supported by previous empirical works on monetary policy (Gambacorta et al., 2014).

(C) Impulse Responses to a 1 Standard Deviation Shock to Bank Liquidity (m1): In this section, the study analyses response to a shock in bank liquidity a positive shock in bank liquidity increases shadow bank assets growth. Again this confirms the complementarity between bank liquidity and shadow banking in emerging economies. This can be explained by the role formal banks in shadow banking sectors of emerging market economies. We proffer two explanations; firstly, commercial banks have a parent/subsidiary relationship with shadow banks. A decrease in funding in the parent company would also negatively affect the subsidiary. The second explanation could be the importance of formal banking institutions as financiers of shadow banking activity in emerging markets. We agree with the findings of Acharya et al. (2013), who argue that shadow banking in emerging market economies derives its funding from commercial banks. Intuitively, a reduction of commercial bank funding will therefore have a negative effect on shadow bank growth and *vice-versa*.

Figure 4: Response to a 1 Standard Deviation Innovation in Bank Liquidity



A shock in bank liquidity also induces the monetary authorities to raise the policy rate as indicates in the second panel of Figure 4. However, the effect is small and almost insignificant. A positive shock in liquidity is however shown to be important in driving economic growth during the first and second quarters, only to dissipate sharply after the second quarter. The finding confirms the short-run potency of monetary policy in driving real activity. Inflation rate explains about 9.4% of the variability in the policy rate. The other variables do not explain a significant portion of the variability in the policy rate. Variability in shadow baking is also to a greater extent explained by it. Again a positive shock to money supply, driven by lower interest rates could be accompanied by an outward capital flow. Lastly variability in the exchange rate is explained by changes in GDP, inflation and the policy rate. The capital outflow results in currency depreciation as shown by an upward movement in the REER. There is however, a small appreciation before the exchange rate starts depreciating. The effect of a shock in bank liquidity on inflation is positive in line with theoretical expectations.

Forecast Error Variance Decompositions (FEVD): This section report results on FEVD. The results are displayed in Table 9 below. Response variables as selected are the policy rate, shadow banking and bank liquidity. The main result from the study is that in both the short-run and the long-term, variability in these variables is driven by the variables themselves. The rate of inflation and GDP have significant influence on the policy rate however, with approximately 1.5% variation being explained by GDP in the short-run. Notable

contributions to variations in shadow banking however, are drawn from GDP, inflation and the policy rate. For instance, after 10 periods (10 quarters), GDP contributes about 3.3% of the variation in SBSCORR, INFL contributes about 2% and the policy rate contributes about 1.9% to variation in shadow banking. The last variable of interest is bank liquidity. Variation in bank liquidity is also mostly explained by itself. Variability in both inflation and GDP is explained by the variation in the policy rate and the exchange rate (REER). For instance, about 4.2% of the variation in REER in the 10th period is explained by the policy rate. GDP and Inflation explain approximately 11.8% and 3.1% of the variation in the REER respectively.

Table 9: Forecast Error Variance Decompositions[5]

Response Variable	**Impulse Variable**					
	dpr	dgdpn	dliquid	dinfl	dreer	dsbscorr
Δdpr	0.88	0.015	0.0005	0.094	0.0007	0.0001
$\Delta sbscorr$	0.019	0.033	0.001	0.021	0.012	0.92
$\Delta liquid$	0.0004	0.004	0.99	0.0003	0.0013	0.0002
$\Delta gdpn$	0.15	0.94	0.008	0.005	0.02	0.000008
$\Delta infl$	0.042	0.008	0.0002	0.93	0.01	0.0002
$\Delta reer$	0.042	0.12	0.007	0.031	0.79	0.003

*The results presented are for period 10 or 10 quarters, which can be used to indicate short run responses. The variances do not change significantly with longer time periods.

5. Conclusion

The study provides insight into the linkages between shadow banking, bank liquidity and monetary policy in emerging countries. The results indicate a weak response of monetary policy to developments in the shadow banking sector. Using Granger causality tests, impulse response functions and FEVD, the study shows that monetary policy does not respond to a shock in shadow banking. To the contrary, we find compelling evidence that shadow banking responds to changes in the monetary policy rate. This results points to the existence of a shadow banking channel of monetary policy as proffered by Xiao (2018). However, contrary to previous studies, increases in the policy rate result in an immediate decrease in shadow banking activity. We also find that bank liquidity responds to shocks in the policy rate as expected from literature, with a hike in the policy rate dampening bank liquidity. Our findings indicate the potency of monetary policy in emerging economies. In addition, a shock to bank liquidity lead to increased shadow banking. The economic significance of this finding is that strong linkages should exist between shadow banks and commercial banks for these results to be valid. Our findings also indicate the dominance of the risk taking proposition in emerging economies. We also find a shock in shadow banking to increase bank liquidity. The result shows that banks are able to raise more liquid liabilities from the shadow banking sector and vice-versa.

The study's findings show that monetary policy has an influence on the financial sector and by extension on financial stability through its effect on shadow banking. Analysis and conduct of monetary policy that does not account for its influence on financial variables may lead to a less optimum policy stance being taken. We recommend policy coordination between monetary and prudential authorities to minimise effect of negative shocks emanating from the shadow banking sector. In addition, international cooperation aimed at achieving financial stability could assist monetary authorities in emerging economies in taking into consideration movements in international financial markets when implementing monetary policy.

[5] Full results are provided in the Appendix.

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APPENDIX: PVAR Estimation Results

```
. pvar dlgdp dliquid dinfl dpr dsbs dreer,instl(1/3)gmmstyle overid

Panel vector autoregresssion


GMM Estimation

Final GMM Criterion Q(b) =       .448
Initial weight matrix: Identity
GMM weight matrix:     Robust
                                                  No. of obs      =       174
                                                  No. of panels   =        15
                                                  Ave. no. of T   =    11.600
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
dlgdp						
dlgdp L1.	.359843	.0569882	6.31	0.000	.2481483	.4715378
dliquid1 L1.	.0001355	.000093	1.46	0.145	-.0000469	.0003178
dinfl L1.	-.28586	.0976801	-2.93	0.003	-.4773095	-.0944105
dpr L1.	-.0197455	.0110314	-1.79	0.073	-.0413667	.0018758
dsbs L1.	.022306	.0039484	5.65	0.000	.0145673	.0300448
dreer L1.	-.0901364	.0218658	-4.12	0.000	-.1329925	-.0472803
dliquid1						
dlgdp L1.	214.3923	160.245	1.34	0.181	-99.68204	528.4666
dliquid1 L1.	.506925	.1414012	3.59	0.000	.2297839	.7840662
dinfl L1.	2079.143	322.0018	6.46	0.000	1448.031	2710.255
dpr L1.	-72.83388	37.68332	-1.93	0.053	-146.6918	1.02407
dsbs L1.	19.97763	5.988867	3.34	0.001	8.239662	31.71559
dreer L1.	204.1839	56.08308	3.64	0.000	94.26308	314.1047
dinfl						
dlgdp L1.	.3873381	.0805319	4.81	0.000	.2294985	.5451777
dliquid1 L1.	.0001248	.0000764	1.63	0.102	-.000025	.0002746
dinfl L1.	-.102988	.1013495	-1.02	0.310	-.3016293	.0956534
dpr L1.	.0721434	.0339095	2.13	0.033	.0056819	.1386048
dsbs L1.	.0003702	.0038194	0.10	0.923	-.0071157	.0078562
dreer L1.	-.2182248	.0307453	-7.10	0.000	-.2784844	-.1579652
dpr						
dlgdp L1.	-.0029995	.126565	-0.02	0.981	-.2510625	.2450634
dliquid1 L1.	-.0000155	.0000919	-0.17	0.866	-.0001957	.0001647
dinfl L1.	-1.641409	.1603011	-10.24	0.000	-1.955593	-1.327225
dpr L1.	.1967237	.0248887	7.90	0.000	.1479427	.2455047
dsbs L1.	-.0197052	.0050657	-3.89	0.000	-.0296337	-.0097767
dreer L1.	.143991	.0484597	2.97	0.003	.0490119	.2389702
dsbs						
dlgdp L1.	2.727264	1.13797	2.40	0.017	.4968827	4.957645
dliquid1 L1.	.0004306	.0007891	0.55	0.585	-.001116	.0019772
dinfl L1.	2.68057	1.87753	1.43	0.153	-.999322	6.360462
dpr L1.	-.6563347	.2831044	-2.32	0.020	-1.211209	-.1014602
dsbs L1.	.1084573	.0618004	1.75	0.079	-.0126693	.229584
dreer L1.	2.90687	.5488993	5.30	0.000	1.831047	3.982693
dreer						
dlgdp L1.	.2679613	.1363155	1.97	0.049	.0007878	.5351347
dliquid1 L1.	.000181	.0001594	1.14	0.256	-.0001314	.0004933
dinfl L1.	1.745452	.3200026	5.45	0.000	1.118259	2.372646
dpr L1.	-.0510903	.0448685	-1.14	0.255	-.139031	.0368504
dsbs L1.	.0435114	.0082278	5.29	0.000	.0273852	.0596376
dreer L1.	.020051	.0698875	0.29	0.774	-.1169259	.157028

```
Instruments : l(1/3).(dlgdp dliquid1 dinfl dpr dsbs dreer)


Test of overidentifying restriction:
  Hansen's J chi2(72) = 77.930565 (p = 0.296)
```