GOVERNANCE REPUTATION AND THE MARKET REACTION TO THE AUDITOR SWITCH AND RETENTION DECISION

by

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DEDICATION

This work is dedicated to the greatest economist the world almost knew, David Christopher Rodgers (1977 – 2004).

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ABSTRACT

The purpose of this dissertation is to examine the informational role of audit client (i.e. firm) reputation in the auditor switching and retention decision. I perform an experimental examination of an analytical model, prescribing the optimal choices made by firms in the decision to retain or switch auditors without considering firm reputation. Using an experimental markets approach, I provide evidence of the market reaction to a firm's switch/retention decision under two alternative treatments. In the first (baseline) treatment, an explicit test of the analytical model, firms do not incur reputation effects when making the decision to switch or retain auditors. In the second treatment, firms consider market perceptions of opportunistic auditor switching and retention and the potential effects on the firm's reputation.

The choice of auditor switching and retention is a significant component of the firm's corporate governance structure. I precisely measures reputation formation and its impact on this specific governance decision by the inclusion of prior period auditor switch/retention decisions made by firms in reputation treatment conditions. Prior archival research has demonstrated a link between auditor quality and earnings quality. These studies suggest that the retention of a high-quality auditor, or dismissal of a poor-quality auditor, can signal high quality earnings to the market. The converse is also suggested; retention of a poor-quality auditor, or dismissal of a high-quality auditor, can signal poor earnings quality. The decision to retain or switch auditors is made annually by firms who have superior information over their auditors and investors. In the short run,

the decision to retain or switch auditors offers a temporary signal which the market may not clearly price. However, including the firm’s track record of auditor switching and retention decisions among auditors of differing quality allows for the development of a positive or negative reputation on this portion of corporate governance.

The results presented provide evidence of the model’s descriptive validity for the firm’s optimal choices and related market reaction to the auditor switching decision for a finite time horizon. Additionally, the study examines the market reaction to a firm’s reputation on the auditor switching and retention decision.

I. INTRODUCTION

In February of 2002, five months prior to the passage of The Sarbanes Oxley Act proscribing non-audit services, The Walt Disney Company announced at its annual shareholders' meeting that the Company would no longer purchase non-audit services from its independent auditor, PriceWaterhouseCoopers. This decision, one of the first made by a member of the Fortune 500 in the wake of the Enron scandal, could have been made to manage the firm's reputation for quality reported earnings and corporate governance.[1] Examining reputation within the context of the Enron audit failure committed by Arthur Andersen, Chaney and Philipich (2002) and Barton (2005) document a market-wide negative reaction for other audit clients of Andersen on key dates, such as the document shredding announcement, during the time period outlining the audit firm's demise.[2] Illustrating the impact of corporate governance reputation in the market, Disney chose to manage a portion of its reputation by separating non-audit services from the monitoring function of its auditor. On the other hand, Andersen's clients failed to realize the negative market impact of their corporate governance reputation by retaining an auditor of questionable quality. Both Disney and Andersen's

[1] Disney's shareholders were clamoring for the Company to cease the purchase of non-audit services from PWC prior to the announcement, which may lead readers to infer the choice was not a pure signal of quality governance.

[2] Chaney and Philipich and Barton both observe very few firms switching prior to Andersen's debarment from SEC practice. Rival explanations for Andersen retentions include the key event dates coinciding with fiscal year ends for a number of firms, and increased costs of switching auditors close to fiscal year end.

clients demonstrate that firm reputation is integral to the market. How do these examples differ, and what was the optimal decision process that the firms could have taken?

This study employs an experimental markets examination of an analytical model developed by Teoh (1992, hereafter Teoh) predicting the market reaction to a firm's auditor switch/retention decision. The model's key predictions document that the market reaction is conditional on the context of the switch and characteristics of the switching firm.[3] The context and characteristics of the switch in Teoh's model focus on both prior period audit opinions and the costs associated with auditor switches. After providing empirical results from experimental markets designed to test Teoh's general model, I develop a second set of experimental markets to examine a firm's governance reputation formation. This study precisely measures reputation formation and its impact on this specific governance decision by the inclusion of prior period auditor switch/retention decisions made by firms in reputation treatment conditions. I support the proposition that reputation formation is a key component of the market's reaction to the auditor switch/retention decision which has been omitted in Teoh's model.[4] The use of

[3] Smith, Schatzberg and Waller (1987) and Friedman and Sunder (1994) describes the interrelationship between theory and empirics. Theory can formulate normative and prescriptive predictions, which create the need to test the theory with empirics. Formally, investigators can use the empirical results to provide feedback and, possibly, modify the underlying theory.

[4] It should be noted that, with the passage of The Sarbanes Oxley Act (SOX), the responsibility for hiring and replacing external auditors now lies in the hands of the firm's independent audit committee. Prior to SOX, management could directly engage with the auditor for attestation services and was able to make auditor switching and retention decisions. Regardless of whether the hiring decision is in the hands of management or the audit committee, the anticipated findings of the experimental treatments should not decrease the tractability of the analytical model to current governance requirements introduced by SOX. Audit committees and managers will face similar cost structures in auditor replacement. When reputation is included as an experimental treatment, reputation formation for an audit committee may become positively valued as well. However, a market perception of audit committee reputation accruing separately from

experimental markets is a particularly powerful tool to measure the effect of firm reputation formation on the switching and retention decision and the related market reaction, as the design allows for comparisons of markets where reputation formation can, and cannot, occur.

The choice of auditor switching and retention is a significant decision within the firm's corporate governance structure. Prior archival research has demonstrated a link between auditor quality and earnings quality, and from these studies one can generalize that retention of a high-quality auditor, or dismissal of a poor-quality auditor, can signal high quality earnings to the market. The converse is also true; retention of a poor-quality auditor, or dismissal of a high-quality auditor, can signal poor earnings quality. The decision to retain or switch auditors is made annually by firms who have superior information over their auditors and investors. In the short run, the firm's decision to retain or switch their auditor offers a temporary signal to the market which is not clearly priced. However, examining the firm's track record of auditor switching and retention decisions among auditors of differing quality allows for the development of a positive or negative reputation on this corporate governance decision. Unlike archival capital market research, reputation formation can be both controlled for and captured in the experimental markets setting employed in this paper.

A brief description of the experimental markets employed follows. Initially, firms are endowed with an asset of randomly determined terminal value which they will offer

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management's reputation is not the focus of this study. This avenue of research may become fruitful for further examination, using both archival and experimental data.

for sale to investors in the market. Consistent with the current reporting environment, firms must rely on an auditor in order to report the value of the asset for sale to investors. Firms are randomly matched with an incumbent, non-strategic, automated auditor who will report the asset value to investors. However, the nature of the auditor report is such that error may be present in the auditor's observation and resulting report. Because firms have superior information to both auditors and investors, firms can observe the asset's true value and the presence and direction of the auditor error. Firms then use this information to decide whether to retain or switch their auditor. If the randomly assigned incumbent auditor is retained, the retention decision and auditor reported value is sent to investors in the market. However, if the firm makes the decision to switch their incumbent auditor, then a replacement, non-strategic automated auditor is randomly assigned to the firm. This replacement auditor will report both the switch decision and the asset value, again potentially with error, to investors in the market. Investors then bid for the asset by way of an auction using only the switch/retention decision made by the firm and the auditor's report of firm value. After the winning bid is determined, the true value of the asset for sale is revealed and profits are calculated for market participants. Firms earn a profit by retaining the highest bid less any transaction costs. Investors who submit the highest bid can accrue earnings (either positive or negative) by the difference between the highest bid and the actual asset value.

Using this simple game, I first measure the predictive validity of Teoh's model. Second, I identify conditions where the model does not formulate predictions regarding optimal firm choices and the related market reaction. Next, by repeating the game with fixed market participants across multiple trials, I demonstrate that several of the key predictions of the model will change in experimental markets when a firm develops a high quality reputation from their switching and retention decisions.

From a game-theoretic perspective, reputation is defined as the probability that a player will be of a certain type or take a defined set of actions. This study uses this game-theoretic definition of reputation in measuring the market reaction to auditor switches and retentions. Existing accounting literature frequently cites firm reputation as an important component of the market reaction to a firm's financial disclosures (as in Lang and Lundholm, 1996, and Botosan, 1997, among others). This line of research suggests that firm reputation should be included in the analysis of market reaction to accounting information, albeit subject to measurement difficulties in archival research as documented in Barton (2005). Using an experimental markets methodology, this study precisely measures reputation formation and its impact on this specific governance decision by the inclusion of prior period auditor switch/retention decisions made by firms.

In this study, I will describe the analytical model under examination and then present predictions for the model. The description of the experimental markets follows Teoh's model in all significant aspects, with one important deviation: Teoh does not offer predictions for the market reaction to firms' decision to opportunistically retain their incumbent auditor. Opportunistic retentions are defined as the event where the firm decides to retain an auditor who would allow a report containing artificially inflated firm value. Teoh's model defines auditor observations as containing multi-directional error (or bias), therefore opportunistic retentions are mathematically defined under the parameters defined in her model. I will also provide empirical results documenting the experimental markets results, dependent on treatment condition.

The first prediction, consistent with Teoh, is that for markets where firm reputation cannot accrue and where opportunistic retentions are not defined, an auditor switch after an unqualified opinion will be bad news to investors. However, this prediction changes in a market that allows for both reputation formation and opportunistic auditor retentions. In a market with reputation formation and opportunistic auditor retentions, investor reaction to an auditor switch after an unqualified opinion can signal strong corporate governance and an increased probability that the reported value will approach the actual firm value.

The second prediction, also consistent with Teoh, is that in a 'no reputation' treatment, the market reaction to an auditor switch after a qualified opinion may be good news or at least better news than a switch after an unqualified opinion.[5] However, the market reaction to auditor switches under this context also changes in a market where a firm's reputation can accrue. In a 'reputation' treatment, the market reaction to an auditor switch after a qualified opinion can signal strong corporate governance and an increased probability that the reported value will approach the actual firm value.

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[5] Given the relative infrequency of qualified reports in financial statement audits of publicly traded firms, Teoh's model also extends to settings where auditors are considering issuing a modified report. Examples of such reports can include additional language such as a going-concern paragraph as an addendum to a standard, unqualified opinion. There are no significant changes to the predictions of Teoh's model given this alternative interpretation. To ease expository comparison between this study and Teoh's original model, this study will refer to the auditor's decision of whether to issue "unqualified" vs. "qualified" reports.

The final prediction, which is defined but not examined in Teoh's model, is that in a 'no reputation' market, the market reaction to an auditor retention decision may become problematic for investors.[6] Depending on the true underlying value of the firm, a retention decision made after the issuance of an unqualified report may be interpreted as no news, or even bad news in the event of opportunistic auditor retentions. These retentions will introduce noise into investors' interpretation of the retention decision after an unqualified report. However, the inclusion of reputation should mitigate the occurrence of firms' opportunistic retentions and, as such, will signal earnings quality when auditor retentions occur.

This study makes two contributions to the literature on auditor switching and retention. First, it offers an experimental test of a descriptive model of the market reaction to both auditor change and retention decisions. Testing Teoh's general model adds to its external validity, as well as identifying settings where her model's explanatory power lessens. Teoh's model seemingly concludes that the market reaction to auditor retentions may not be as significant of an event as auditor switches. Recent changes to the auditor landscape, namely the departure of Arthur Andersen from SEC practice, motivate the need to understand an auditor retention decision to the same extent that the auditor switch decision has been examined in prior literature.

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[6] Such problematic auditor retentions are explicitly examined in both Chaney and Philipich (2002) and Barton (2005). Both studies document a negative market reaction to an auditor retention decision within the context of an announced audit failure. However, an announcement of an audit failure is not a necessary condition for an ineffective audit at the client level. Given the firm's superior information over investors, an ex-post investor analysis of auditor over-reporting may impact the market reaction to a retention decision.

The second contribution of the study provides further evidence on reputation formation for firms in publicly traded markets. Reputation formation as an economic concept can be both added, and subsequently controlled for, as a key determinant of the market reaction to accounting information in an experimental markets setting. This contribution will assist future researchers in developing a more precise tool of measuring reputation formation in a market setting.

The study proceeds as follows. In Section II, I review prior research on auditor quality and auditor changes. In Section III, I discuss the prior economics literature concerning how reputation is established, and review the results of prior accounting experiments dealing with reputation. In Section IV, I define and modify Teoh's analytical model, assert the model's predictions, and design a baseline experiment to test these predictions. In Sections V and VI, I introduce the market predictions for both the 'no reputation' and 'reputation' treatments. In Sections VII, I present the results of the experimental markets conducted to test Teoh's model and predicted outcomes for reputation markets. Finally, Section VIII presents conclusions and future research designs are discussed.

II. PRIOR RESEARCH ON AUDITOR QUALITY, EARNINGS AND AUDITOR CHANGES

This study relies on the relationship between auditor quality and reported accounting information as one of its basic assumptions. The link between auditor quality and the quality of reported earnings has been extensively examined using several different research methodologies. Prior literature links the use of auditors for reporting firm performance to a reduction in information asymmetry and agency costs (Antle, 1982, and Baiman et. al 1987). Following from this, the firm's choice in auditor quality has been linked to the quality of accounting disclosures within the context of stratified auditor selection (i.e. Big N / Non-Big N auditor choice, as in Palmrose, 1986), the IPO market (as in Simunic and Stein, 1987, and Menon and Williams, 1991), and the market reaction to earnings surprises (as in Teoh and Wong 1993). While there is abundant research on the initial selection of quality auditors on reported earnings, changes in the environment of both the firm and auditor markets facilitate the need for auditor realignments. Endogenous changes in operating characteristics of the client, as well as exogenous changes to the audit supply, such as auditor litigation, auditor mergers, and industry specialization make analysis of the auditor realignment process somewhat problematic.

Archival research on the market reaction to changes in auditors has provided mixed results. Fried and Schiff (1981) offer early analysis, examining 8-K announcements of auditor changes and the required documentation of auditor-client disagreements prior to the switch. Fried and Schiff summarily conclude that there appears to be negative market reaction around the time of the switch, but encounter difficulty in interpreting the motivation for this reaction. In response to Fried and Schiff's difficulties, Smith and Nichols (1982) motivate a follow-up study, documenting that the market reaction can be couched in the explanation that 8-K disclosures of auditor changes and auditor disagreements provide value relevant information to investors. Nichols and Smith (1983) later extend their initial findings, evaluating auditor changes and auditor quality in events where firms change auditors, documenting positive, but not statistically significant, abnormal returns to firms which move from "non Big 8" to "Big 8" auditors. Chow and Rice (1982) focus on the contextual features of auditor changes by examining the pre-switch audit report and find, from a random sample of SEC registrants, a greater probability of auditor realignment after a qualified opinion, but do no find a systematic realignment with auditors of lower quality. Finally, focusing on firm-specific characteristics, Johnson and Lys (1990) explain auditor realignments as "efficient responses to changes in client operations and activities over time" (p. 281) and that lower share prices are associated with firms prior to the audit switch when compared with non-switching firms. However, they document no abnormal price reaction to 8-K announcements of auditor changes.

The mixed results due to differences in archival metrics used in studies of the market reaction to auditor switches motivate researchers to refine the analysis using analytical models. Such models describe and predict the switch/retention decision made by firms. Magee and Tseng (1990), for example, examine the circumstances under which auditors have incentives to compromise their independence prior to an auditor switch, finding that a necessary condition for a reduction of independence is that the client must benefit from the 'preferred reporting strategy' even after an auditor switch (p. 330). Dye (1991) posits that "an auditor is more likely to be replaced the more favorable is the client's perceptions of the company's [client's] financial condition relative to the auditor and the lower the report [earnings] the auditor is willing to attest to, and will *not* be replaced when the client knows no more about its financial condition than its auditor and the financial reports reveal all this information" (pp. 362-363). Finally, an analytical model of the market reaction to auditor switches was proposed by Teoh (1992). Teoh models an economic setting for which auditor switches can be both good news and bad news, depending on the opinion expressed prior to the switch and the financial condition of the firm engaging in auditor retention or realignment. Given recent changes to the regulatory auditing environment and the recent increases in auditor switching, Teoh's model has implications for modern corporate governance issues. As such, her model is the basis for this study. It is the intent of this study to provide further evidence on the existing auditor switching literature.

Recent anecdotal evidence on the increase in auditor switching post-Sarbanes Oxley provides further motivation for examining these specific changes in the governance structure (Gullapalli, 2005). While prior research focused primarily on switches across auditors of varying quality, further evidence on exogenous changes to auditor quality merits examination. Chaney and Philipich (2002) and Barton (2005) both examine the market reaction to exogenous audit quality changes for both the auditor switching and retention decisions made by Andersen’s clients surrounding key event dates of the Enron audit failures. Both studies document that a large portion of Andersen’s clients retained their auditor up until the date that the SEC debarred them from audits of public companies. Conversely, both studies find it difficult to provide descriptive statistics about Andersen clients who chose either to retain or switch prior to the audit firm’s collapse. This study contributes to the emerging literature on auditor retentions and related market reactions by examining the impact of exogenous changes to auditor quality on the firm’s switching and retention decision.

III. ECONOMIC IMPACT OF REPUTATION

Echoing the examinations of Chaney and Philipich (2002), auditor reputation may be a significant component of the market's reaction to the firm's switch/retention decision. Further, Barton (2005) provides a fruitful avenue to examine whether the reputation of the firm, accruing separately from the reputation of the auditor, may contribute to the overall market reaction. While firm reputation is often cited in studies examining analyst following (Lang and Lundholm 1996), and disclosure quality and cost of capital (Botosan 1997), for example, the specific impact of a firm's reputation formation can only be proxied, rather than quantitatively measured. Reputation as an economic concept has been extensively measured and examined in other streams of literature. Camerer (2003) defines reputation as an economic concept in game-theoretical analysis, stating that "a player's reputation is crisply defined as 'the probability that she has a privately observed type or will take a certain action'" (p.445). The probability that a player will take a certain action can explain differences in equilibrium predictions between one-shot and repeated non-cooperative games. The Prisoner's Dilemma game is a widely cited example of such a game. In it, players will move away from the Pareto inferior prediction of a one round interaction, and towards a cooperative outcome in multiple iterations of the game between matched players. Naturally, the cooperative, Pareto superior, outcome is achieved only when both players accrue reputations as cooperators. A single reputation violation, or deviation from Camerer's definition of reputation formation, can result in a Pareto inferior outcome for multiple trials.

Much of the game theoretical literature on reputation formation originates with Kreps and Wilson (1982), who define reputation formation in finitely repeated games by adding a “small” amount of imperfect or incomplete information about player’s payoffs. Their analysis demonstrates that reputation formation for being “tough” or “benevolent”, for example, is sufficient given incomplete information about payoffs. Given the asymmetric nature of a firm’s private information about earnings in a capital markets setting, reputation formation can be a significant component of the firm’s corporate governance decisions and the related market reaction to such decisions. Accounting information is by nature subject to management estimates and is often times directly correlated with the ‘payoffs’ of firm members by way of contract incentives. This contracting scenario fits the Kreps and Wilson definition of reputation formation.

The Kreps and Wilson definition of reputation formation may more appropriately fit the accounting information market over alternative economic models, such as Spence’s signaling hypothesis (1973). Spence’s hypothesis examines the employment market by utilizing agents who have one of two ability levels, high or low. Because the ability of the agent can only be determined ex-post, the signaling hypothesis develops a separating equilibrium between agents. Those of high ability are able to engage in costly education with a positive expected value, whereas low ability agents are unable to afford the cost of education. As such, the decision to pursue education is an affordable signal of high quality for some agents, but not others.

Unlike Spence’s signaling hypothesis, earnings signals made by firms are dynamic from year to year. In periods of financial success, a signal of high value is much more affordable than during periods of financial distress. In order to achieve a separating equilibrium consistent with Spence's signaling hypothesis, any market-perceived signal must be affordable to some types, and not to other types. Using an alternative economic model such as Spence's signaling hypothesis does not allow for dynamic changes in quality of performance, and as such suffers from this fatal flaw.

Many prior experimental markets examine reputation formation, both within the context of traditional game theory (e.g., Camerer and Weigelt 1988, and Neral and Ochs 1992), and within the context of an accounting setting (King 1996 and Mayhew 2001). Camerer and Weigelt (1988) use a borrower-lender, two player game, in which a single borrower is assigned a random type, either normal (X) or nice (Y). The lender then chooses whether to lend, which yields them a higher payoff concurrent with the positive probability of loss, or to not lend, yielding a lower fixed payoff in return. A normal (X) borrower prefers to default, whereas a nice (Y) borrower gets nothing for defaulting and prefers to repay. The equilibrium strategy in this game is for borrowers to mimic being nice (Y) by repaying in early rounds, and then defecting in later rounds. Neral and Ochs (1992) expand the Camerer and Weigelt game by varying payoffs, with both studies documenting that sequential equilibrium adherence is high and provides a more suitable explanation than reputation formation.[7]

[7] Repeated and sequential equilibrium games may be unavoidably impacted by subject learning. This type of game should acknowledge (at a minimum), control for, or examine and analyze subject learning in its predictions and related data analysis. A growing body of judgment and decision making studies on subject learning within an experimental setting is constantly emerging and shifting in their findings. While this study does acknowledge that subject learning may be present in its design, further analysis is not part of its current focus.

King (1996) turns to a stylized accounting experiment to examine “the extent to which reputations for honest reporting can be established and maintained in market settings” (p. 376), diverging from a two-player game and testing the assumption that markets will price reputation formation in accounting disclosures. King follows the traditional Kreps and Wilson (1982) definition of reputation and provides an interesting design innovation that will potentially allow reputation to form outside of a sequential equilibrium by introducing a game with an uncertain endpoint. Consistent with reputation formation, King finds that misreporting by sellers in experimental markets without auditors decreased overall, suggesting that reputation formation does indeed take place in market experiments. However, his results did not document sellers’ consistent reputation formation. The current study departs from King’s experimental markets, as his study did not include auditors as an integral component of the sellers’ information disclosure. Given that auditors are a significant component of a firm’s public disclosures, it follows that an examination of auditor reputation formation may contribute to the quality of accounting information.

Mayhew (2001) extends King’s work on reputation formation in an accounting experiment, changing the basic structure of his market to include auditors, and focuses solely on the information verifiers’ ability to develop a reputation for quality attestation. Mayhew finds that, in most experimental treatments, the market attaches a premium to reports issued by auditors who develop a reputation for high quality reporting. However, Mayhew intentionally occludes firm (seller) identification numbers thus allowing subjects to focus solely on auditor reputation formation. The results of the markets in

Mayhew's study suggest that investors reward the reports of reputable auditors, supporting reputation formation in an accounting experiment.

This study is designed to bridge the findings of King and Mayhew, by focusing specifically on firm reputation formation in a market with information verifiers. This study complements King and Mayhew, but focuses on specifically on reputation formation from the firm's decision to switch or retain auditors. Whereas King did not document a market premium attached to reputation formation, this study diverges by introducing a non-strategic, automated auditor in the reporting process. Further, Mayhew documented the market premium attached to reputable auditors. Since this study uses an automated auditor follows a mechanical decision rule, the role of reputation formation can be isolated solely to the firm's switching and retention decision process.

IV. OPERATIONALIZING A MODEL OF THE MARKET REACTION TO AUDITOR SWITCHES AND RETENTIONS

As I present the model under examination in this study, I will simultaneously describe how Teoh's model is operationalized. It is important to outline the key assumptions and parameters of Teoh's general model as the market is defined and described, as the first goal of the experimental markets in this study is to test the model and its predictions. Operationalizing Teoh's model in an experimental setting allows for a preliminary assessment of her model's explanatory power. As mentioned in the introduction, tests of an analytical model can assess the validity and provide empirical feedback on the underlying theory. Also, the use of an experimental markets methodology is a rich tool to test a theory and to identify boundary conditions for its predictions in a controlled environment.[8] For the remainder of the text, all model terms presented here are consistent with Teoh's general model, with deviations from the model explicitly noted. Interested readers can refer to Teoh's general model, described in summary format as Appendix A in this study.

This study adopts Teoh's general model which includes mechanical auditors who follow an exogenous decision rule to determine the type of report they will issue, either qualified or unqualified. Teoh establishes predictions for this general model and some resulting comparative statics, and then extends her model's findings to a market with

[8] Tests of predictive analytical models as illustrated in tests of DeAngelo's low balling model (1981) from experiments conducted by Schatzberg (1990) and Dopuch and King (1996), as well as Magee and Tseng's audit pricing and independence model (1991) tested by Calegari et al, 1998, among others.

strategic human auditors. This study is designed to first test Teoh's model in its most general setting and then extend it to a market with reputation formation, rather than examining the extensive comparative statics and strategic auditor predictions. If the reputation predictions of this study hold, there could be an opportunity for further research by including human players as strategic auditors who may accrue reputation separately from the firm's reputation in experimental markets.

In order to minimize context effects, subjects assume value-neutral roles. The use of value-neutral roles is consistent with prior research in experimental audit markets, as in King (1996), Calegari, Schatzberg and Sevcik (1998), and Mayhew (2001), among others. This design choice is made in order to prevent role playing and, more importantly, to increase mundane realism (Swieringa and Weick 1982) in order to test the key assumptions and features of Teoh's model (Smith, et al 1987). Firms are referred to as "sellers", investors as "buyers", and auditors as "verifiers". Consistent with Teoh's general model, the auditor role is an automated process that follows a mechanical decision rule for reporting, and is not presented as a human subject to participants. The mechanical auditors' investigation and report will be referred to as an "announcement." For expository convenience, the remainder of the text will use the terms "seller", "incumbent verifier", "replacement verifier", "announcement" and "buyers". Consistent with the model under experimental examination, all parameters and experimental values are common knowledge to all participants in the market.

Sequence of Actions in the Market

1. Sellers and buyers interact in a market where all sellers are of one type, either high value (H) or low value (L) sellers, in period X_1

2. The seller learns the value of a newly endowed asset with a randomly determined value, either (H) with probability p or (L) with probability (1-p) at the beginning of period X_2

3. The seller is assigned to an incumbent verifier $A_o^{(i)}$, who will announce the asset value either free of error with probability q, or with error with probability (1-q). Since sellers know the value of the endowed asset, they are able privately to observe the presence and direction of the incumbent verifier's announcement error, i_o, with certainty

   - Buyers do not initially observe the incumbent verifier's announcement error, but can make the following assumptions based on the seller type in period X_1

     i. If the seller is of type high value (H) in period X_1, the incumbent verifier's announcement error i_o is set to zero with probability (q) and positive with a complementary probability (1-q)

        a. If the incumbent verifier's announcement error i_o is set to zero, the verifier will announce the asset value perfectly

        b. If the incumbent verifier's announcement error i_o is set to positive, the verifier will announce the asset value as H, regardless of the true value of the asset

ii. If the seller is of type low value (L) in period X_1, the incumbent verifier's announcement error i_o is set to zero with probability (q) and negative with a complementary probability (1-q)

a. If the incumbent verifier's announcement error i_o is set to zero, the verifier will announce the asset value perfectly

b. If the incumbent verifier's announcement error i_o is set to negative, the verifier will announce the asset value as L, regardless of the true value of the asset

4. Given the observed endowment and incumbent verifier, the seller makes a decision to either retain the incumbent verifier $A_o^{(i)}$ or pay a switch fee C and switch to a replacement verifier $A_n^{(i)}$. The seller's decision is revealed to all buyers

   a. If the seller retains his incumbent verifier $A_o^{(i)}$, the direction of the incumbent verifier's announcement error i_o, if any, will persist and an announcement of the assets value is issued along with the seller's decision to retain the verifier

   b. If the seller switches to a replacement verifier $A_n^{(i)}$, a new verifier will be randomly assigned who has an unknown announcement error i_n. The replacement verifier will make an announcement of asset value along with the seller's decision to switch.

i. The announcement error i_n of the replacement verifier is set as either negative with probability (j), zero with probability (k), or positive with probability $(1 - j - k)$[9]

5. The incumbent verifier (if retained) or replacement verifier (if switched) issues a announcement on the endowed asset, containing either an announcement error i_o or i_n based on the verifier's type

6. Buyers bid for the asset value in a first priced, sealed bid auction

The following table describes the experimental values used in operationalizing this general model.

Table 1
Parameter Definitions and Values

Description	Symbol	Experiment Value
Market where all sellers were announced to be either high value (H) or low value (L) in Period X_1	X_1 = H X_1 = L	Constant and random assignment of subjects for an experimental session. In Condition A, X_1 = L; In Condition B, X_1 = H;
High value asset	H	\$12
Low value asset	L	\$6
Probability of receiving a high or low value asset in period X_2	p	.5

[9] Here, $\Pr(j) + \Pr(k) < 1$

Table 1 (cont)
Parameter Definitions and Values

Error in the incumbent verifier's announcement Verifier's announcement bounded by values of H (at the maximum) and L (at the minimum)	$A_o^{(i)}$ Where $i \subset \{+,0,-\}$	When X_1 = H $A_o^{(+)} = +\$6$ $A_o^{(0)} = \$0$ When X_1 = L $A_o^{(0)} = \$0$ $A_o^{(-)} = -\$6$
Probability the incumbent verifier has zero error in the announcement of asset value	q	½
Probability the incumbent verifier has non-zero error in the announcement of asset value	$1-q$	½
Switch fee, determined based on experimental session type	C	C = \$0 or C = \$3
Error in the replacement verifier's announcement	$A_n^{(i)}$ Where $i \subset \{+,0,-\}$	$A_n^{(+)} = +\$6$ $A_n^{(0)} = \$0$ $A_n^{(-)} = -\$6$
Probability the replacement verifier has negative error in the announcement of asset value	j	1/3
Probability the replacement verifier has zero error in the announcement of asset value	k	1/3
Probability the replacement verifier has positive error in the announcement of asset value	$(1-j-k)$	1/3
Over-reporting penalty	P	\$2.67

Description of the Model and Experimental Setting

In each experimental session there are either one or four human subjects who participate in the role of seller.[10] The seller is required to use a verifier to announce a terminal asset value to buyers in a market, comprised of four human buyers.[11] Subject assignments to the roles of sellers and buyers are maintained throughout the experiment.

To describe the model within the context of the parameters defined in Table 1, sellers will first discover the randomly assigned value of their asset (X_2) and the announcement error of the verifier ($A_o^{(i)}$) with whom they were randomly matched. It is a key assumption of the model that the seller is fully informed of the asset value and the announcement error of the incumbent verifier prior to making a verifier switch or retention decision.

The presence of verifier announcement error affects the seller's switch/retention decision, thus meriting extensive discussion. Verifier error impacts the seller's decision as follows: Rather than offering a traditional unqualified or modified opinion on the seller's presentation of the asset value, verifiers will instead follow an automated decision rule and will issue the sole announcement of the asset value to buyers. The verifier's

[10] The variation in the number of sellers is necessary to establish and analyze markets where reputation can or cannot accrue. The predictions of these two markets will be discussed in greater depth in the equilibrium analysis section.

[11] The number of human sellers and buyers was selected based on the results of beta testing to achieve a competitive bidding outcome of a first priced, sealed bid auction. The incremental costs and benefits for the inclusion of additional subjects in any role is always a concern in experimental studies; for example, Mayhew's (2001) findings did not materialize until he extended the number of investors/buyers in the market from three to six, consistent with the predictions of Cox, Smith and Walker (1998).

announcement takes on one of two forms: an announced asset value of $12 or $6, and is a direct function of the verifier's error.[12] This is operationally equivalent to an unqualified audit opinion, and takes on the value $12, which is reserved for high value assets. A modified/qualified/adverse audit opinion takes on the value $6, indicating that the asset is of low value. This verifier announcement mechanism mitigates the seller's ability to present opportunistic asset value without a verifier and is consistent with the operationalization of auditor reporting as described in Calegari, et al. (1998).

Asset values of $12 and $6 were selected such that the presence and direction of verifier error could result in $12 assets possibly being announced as a value of $6, and vice versa. However, the reported values were limited to the set {$12, $6} by design; a positive error verifier would always report a value of $12 and a negative error verifier would always report a value of $6. This also allows buyers in the experimental session to focus on only two possible announced asset values, $12 and $6. It should be noted that the magnitude of the error must occur within the support of asset value, thus satisfying the requirements of Teoh's general model. Providing upper and lower bounds to the amounts announced by verifiers will prevent verifier error from artificially inflating value beyond the support of asset value, while maintaining buyer and seller information asymmetry in the market. Maintaining upper and lower bounds for announcements of asset values is also consistent with auditor conservatism and professional skepticism, a

[12] The verifier's error impacts the announcement of the asset value, but the announced value is limited to the set {$12, $6}; this will be discussed in greater detail in the following pages

natural tendency in auditing standards to attest to a minimum threshold amount of asset value.

To illustrate the impact of the verifier's error using experimental parameters, the maximum and minimum amounts that a verifier will announce for asset value are \$12 or \$6. For example, a seller with an announced value of \$12 must be paired with verifier who has either zero error ($A_o^{(0)}=$ \$0) or a positive error ($A_o^{(+)}=$ +\$6) in their announcement. Conversely, a seller with an announced value of \$6 must be paired with a verifier who has either zero error or negative error ($A_o^{(-)}=$ –\$6) in their announcement. Consistent with the model, only the seller is fully informed of the presence and direction of verifier error. However, buyers can infer that, for any seller receiving a \$12 value announcement, there is a zero probability the seller is paired with a negative error verifier. Whether a seller with a \$12 announcement is paired with a verifier who has a positive or zero error is known by the seller, but remains unknown by the buyers. The same logic holds for sellers receiving a \$6 value announcement from the verifier. Buyers can infer that a seller receiving a \$6 announcement must not be paired with a positive error verifier.

In the model, the incumbent mechanical verifier's error will persist in magnitude and direction if retained. This represents the incumbent verifier placing reliance on their own work from a prior period (X_1), and carrying this error into the announcement of the seller's asset value for any subsequent period (X_2). For example, if an incumbent verifier is discovered to have a positive error, the seller could retain the incumbent verifier for the announcement of the asset value. Thus, the seller is assured to receive an unqualified ($12) announcement, regardless of the actual value of the endowed asset (either $12 or $6).

If the seller chooses to switch verifiers using the information set described above, they must pay the switching fee, *C,* and are randomly assigned to a replacement verifier with an unknown error type. The switching fee is implemented in certain markets and captures real-world costs of searching for replacement auditors, new auditor's setup costs, and the related constraints on the seller's time. All replacement verifiers in the market are independently and identically distributed, with 1/3 chance of having a positive error ($A_n^{(+)}$ = +$6, i.e., will always announce the asset value as $12), a 1/3 chance of having a zero error ($A_n^{(0)}$ = $0, i.e., will always announce the actual asset value), and a 1/3 chance of having a negative error ($A_n^{(-)}$ = –$6, i.e., will always announce the asset value as $6).

There is one unique deviation from Teoh's original model captured in the operationalization of the positive error for automated verifiers. Following the opportunistic retention definition presented in this study, Teoh's model does not examine situations where sellers are low valued but paired with an incumbent verifier who has a positive error. This random pairing allows for over-inflated announcement of asset value.[13] While this is a potentially troubling, yet realistic outcome for market participants,

[13] I have contacted Teoh directly regarding this troubling potential outcome. She noted in correspondence that if positive error verifier were allowed to announce $6 value firms as $12, some of the equilibrium conditions in her general model may not hold. She also noted that this outcome can only occur with

it has been addressed by the implementation of an over-reporting penalty *P* of $2.67 in each experimental market. The over-reporting penalty *P* is triggered whenever the true value of the endowed asset is $6, but the incumbent or replacement verifier will announce a value of $12 due to the positive error in the verifier's announcement. This over-reporting penalty acts similar to switch costs in that it reduces seller profits whenever it occurs. The penalty serves two purposes in the model. First, it is implemented into the experimental design as a potential effort costs of the seller either in response to SEC investigations or potential earnings restatement costs. The over-reporting penalty was calculated in order to address a principle concern in the reputation market, to be discussed in more detail in the equilibrium analysis section on the following pages.

Teoh's model assumes that any error contained in an incumbent verifier's announcement of X_1 earnings cannot be revised in light of a change in verifier. When a verifier change occurs, the new verifier will simply announce the asset value he observes at that time, in period X_2. This operationalization also has real world similarities in that a new auditor can choose to disclaim an opinion on prior financial statements audited by the predecessor "because of the inability to perform procedures the successor auditor considers necessary in the circumstances" (AU Section 315.18). In summary, buyers can only learn from the switch/retention decision and its impact on current (period X_2) asset

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investors' ex-ante expectation of verifier error, which is included in her original model. The potential for $6 firms to be paired with a positive error verifier is an interesting condition that should not be omitted from the current design. Opportunistic retentions, in which sellers retain verifiers that would allow over-reporting of firm value, have significant real-world implications, as illustrated in the findings of Chaney and Philipich (2002) and Barton (2005). The reputation condition has distinctly different predictions of management behavior, to be discussed in the following section.

value, rather than prior (period X_1) earnings that may have been erroneously announced and are potentially subject to restatement.[14]

As previously stated, the seller will have full knowledge of the incumbent verifier's error, and, if retained, is certain of the type of announcement he will receive in the future. The seller's switch/retention decision is then based on the following information set:

a) The direction of the incumbent verifier's error discovered in period X_1, and
b) The endowment of the asset value in period X_2, operationalized as either \$12 or \$6

The seller is given the opportunity to engage in opinion shopping and/or opportunistic retention under this market mechanism. Consistent with Teoh, selecting a new verifier is equivalent to a random draw from verifiers with an unknown error.

The net value of the endowed asset, less any switch cost C and over-reporting penalty P, will be calculated and updated by the experimental software and presented on the seller's screen. After the verifier switch or retention decision is made, the verifier's announcement of the asset value is transmitted electronically to buyers in the experimental markets. Consistent with Teoh, buyers will only observe the switch decision and the verifier's announcement of the asset value prior to bidding for the asset. The market reaction to the disclosure of the switch/retention decision will be measured by buyer bidding for the expected value of the asset in a first-priced, sealed bid auction.

[14] Examination of the market reaction to restatements of prior period earnings has flourished in recent archival analysis, most notably Palmrose and Scholz (2004). Including corporate reputation in the analysis of restatements may also prove to be a fertile ground for research, and is compatible with an experimental markets methodology.

Buyer profit is calculated as the difference between true asset value and the maximum bid submitted for the asset available for sale.

In defining the general model and comparing it to Teoh's model, there is one prominent deviation from the structure of Teoh's model which merits attention. In addition the switch costs, *C,* Teoh introduces a separate qualification cost *K.* This qualification cost captures the real world cost to firms who receive any audit report other than the standard, unqualified report. These qualification costs could range from the simple, such as violations of debt covenants, to quite complex calculations of changes to the implied cost of capital as a result of receiving a modified opinion. In order to reduce the cognitive demands of subjects in the experiment, I have elected to omit the qualification costs. However, in keeping with the spirit of Teoh's qualification costs, there is a positive probability that a seller with a high-valued asset could be erroneously announced as low value, and vice versa. By setting the error in the verifiers' announcements within the support of X_t, this captures the spirit of qualification costs in Teoh's model. In a footnote to her model (1992, p. 6), Teoh acknowledges that qualification costs could be omitted while achieving the same switch/retain equilibria. As such, the decision to omit qualification costs *K* should not be considered a limitation in testing Teoh's general model.

Description of the Experimental Tests

This basic model allows for an explicit test of Teoh's model under certain settings and is further illustrated in Figure 1. The experiment is conducted based on a 2 X 2 X 2 factorial design, analyzing the market reaction in a setting that manipulates the following experimental treatments:

- X_1 asset value, operationalized between-subjects as Condition A (previously qualified/low valued sellers) and Condition B (previously unqualified/high valued sellers): This is an explicit test of Teoh's general model
- Presence and absence of switch costs: This is also an explicit test of Teoh's model with comparative statics, and
- Presence and absence of reputation formation.

A further discussion of these design manipulations follows. Presenting the different market manipulations prior to equilibrium analysis will allow for a more clear presentation in the following sections.

Condition A and Condition B

All treatments in this experiment are split into two experimental conditions, defined as Condition A and Condition B. These two conditions capture Teoh's X_1 seller values in summary format. Between-subjects experimental sessions will trade in sessions where all sellers were either previously low valued (Condition A) or high valued

(Condition B). The basic predictions of this model, as well as Teoh's, is that the prior period verifier's announcement should impact buyers' reaction to the verifier switch/retention decision, as documented archivally by Chow and Rice (1982).

Two examples help illustrate how the prior period verifier's announcement will affect buyers' reaction to a switch/retention decision. First, consider Condition A, in which all sellers receive an X_1 low value announcement. Because all sellers in Condition A have received an X_1 low value announcement, buyers can infer that the incumbent verifier's error must necessarily be either negative or zero. Given an incumbent verifier with a negative error, the seller would be faced with an impending low value announcement in X_2. This would be a potentially troubling outcome for the seller if they are endowed with a high valued asset in X_2. In this case, the seller's switch decision indicates that the seller is seeking a verifier announcement that reflects the actual asset value in X_2.

In the second example, suppose that a seller in Condition B switches their verifier after an announcement of high value in X_1. Because all sellers in Condition B have received an X_1 high value announcement, buyers can infer that the incumbent verifier's error must necessarily be either positive or zero. Here, the market reaction to the seller's switch decision would indicate opinion shopping; the seller must have been paired with a verifier who has zero error, and would have announced the true value of the asset, which necessarily must be low (otherwise the verifier would have been retained). Both of these examples illustrate the switch decision made by a seller; however the market reaction to a switch is dependent on the X_1 announcement of value.

The decision to separate all firms into Condition A and B departs from Teoh's model in the following sense. Her model does not pre-establish a prior period (X_1) announcement in analyzing the market reaction to the switch/retention decision. I test the general model in a between-subject design in which market participants are assigned to either Conditions A or B in order to reduce the computational complexity of the environment. Subjects who participated in a market where the prior period (X_1) report varied between high and low values within rounds could possibly make the experimental task more difficult. Bayesian revisions for two periods (X_1 and X_2) of cumulative asset values could further complicate the subjects' experimental tasks. Experimental studies in the economics literature, most recently Charness and Levin (2005) have revealed limitations in subjects' ability to correctly revise their expectations using Bayes' Theorem.[15] The goal of testing the model is to determine how the prior period report affects current period market reaction, rather than accumulations of firm value across years through Bayesian revisions.

This operationalization is also reasonable because it is consistent with information set available for publicly traded companies. In the event of an auditor switch or retention, buyers are able to refer to the prior period audit opinion in assessing the context of the switch/retention decision. Using Conditions A and B in the experimental markets mirror

[15] This operationalization of periods X_1 and X_2 asset values should not be confused with Teoh's "Static Case" (Teoh, 1992, p. 8), where the underlying value of the asset does not change. In Teoh's static case, which is not examined in this study, a seller is essentially faced with the opportunity to have their asset value 'reaudited' by a new verifier if they choose to switch. In this study, all sellers were previously given an X_1 report of either high or low values and then are endowed with a new asset of randomly determined value.

traders' investment decisions in companies who received either unqualified or modified prior period audit reports. It is important to note that unqualified or modified reports are mutually exclusive, again supporting the separation of prior period announcements into Conditions A and B as presented in the design.

Presence and Absence of Switch Costs

Switch costs, *C*, set at \$3 or \$0, are operationalized in the general model, and will reduce the seller's total profit in the experimental markets. In equilibrium, high valued sellers may switch verifiers to avoid an undervaluation by their incumbent verifier. Teoh's model demonstrates that with a switch cost, there is a threshold where sellers will weigh these costs in the switch/retention decision. Switch costs have clear real-world analogies, as described above and in Teoh's model.

In examining comparative statics of her general model, Teoh examines the case where switch costs are omitted from the general model. I follow Teoh's comparative statics by varying the existence of switch costs as a treatment variable. As will be discussed in the following sections, Teoh demonstrates that the absence of switch costs will increase opinion shopping in markets, yielding inefficient market outcomes. I extend these predictions and anticipate that reputation will have a similar effect as switch costs in several treatments.

Presence and Absence of Reputation Formation

The variation in the number of sellers participating in any given market session (one or four) serves as a proxy for reputation formation in the following way. For markets where reputation formation is allowed, the structure of the market consists of one seller and four buyers. The seller and buyers will trade for the entire session, and the experimental software displays the results of prior period trades. This allows for buyers to make an ex-post evaluation of the verifier switch/retention decision and simultaneously allows sellers to engage in reputation formation.

In markets where reputation formation is expressly controlled for, also a direct test of Teoh's general model, there are four sellers and four buyers in the experimental markets. The basic structure of the general model is the same, however each individual seller is randomly selected, without replacement, to participate in any given round. As outlined in the subject instructions, sellers will be randomly selected and then endowed with an asset exactly once every four rounds. This process of random selection without replacement creates an experimental markets setting where reputation formation is not possible. Buyers in the no reputation sessions are never notified which seller was selected to trade in any given year and, as such, are not able to infer what the seller's retention/switching decision was in prior periods.[16]

[16] Original beta markets tested an experiment which was designed with a different structure for reputation formation. The beta markets all consisted of eight subjects, each containing four buyers and four sellers. In the reputation condition, sellers maintained a static identification number and buyers were provided with a history of prior period retention and switching decisions. Alternatively in the no reputation condition, similar to Mayhew's markets, seller identification was obscured in every period, and buyers relied solely on

This completes the general model description and experimental manipulations conducted. Between-subjects data collection dictates that buyers who were assigned to 'no reputation' treatments continued to trade in 'no reputation' treatments, and vice versa. There is concern that, if reputation is introduced and then taken away, participants would engage in hypothesis guessing. Since the second goal for this study focuses on the inclusion of reputation formation in the market reaction to verifier switching, serious internal validity concerns may arise if reputation was operationalized as a 'within-subjects' design.

Experimental markets were conducted in the Economic Science Laboratory at the University of Arizona. The experiment was programmed and conducted with the software z-Tree (Fischbacher, 1999). Subject instructions are presented as a reference in Appendix B.

Subjects participated in multiple iterations of the market in each experimental session in order to allow for subject learning, data collection, and, in the treatment condition, reputation formation. In all treatments, the market was repeated for twenty eight trials with certainty. After the twenty-eighth trial, the twenty-ninth and all

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reports and switching/retention decisions of four different assets. While the parameters chosen are satisfied in this market structure, and the hypotheses were generated assuming four distinct investment decisions would be made by investors, the empirical results revealed an unintended consequence. Investors made bidding decisions that appeared to parallel hedging activities; for assets associated with verifier announcements and switch decision that had low ambiguity, investors tended to overbid for these assets in an attempt to recover potential losses on riskier prospects. Both the general model and Teoh's model make no predictions regarding risk diversification. Post-beta markets limit the investment opportunity set of buyers to only one asset per market round. Research on hedging activities adopted by investors in experimental markets may prove to be a fruitful avenue for future research.

subsequent trials were the last trial with a probability = .2.[17] This design choice prevents end-game effects in which subjects may backward-induce from a fixed number of trials. Theory and experimental evidence suggests that, in order for reputation to develop, the game should have an uncertain end point. If the game ended in a fixed number of trials, sellers will choose opportunistic verifier retentions and opinion shopping in the final period as reputation has no bearing beyond the final trial. Assuming that buyers know what sellers will do in the final period, they will price-protect and bid low in the last period. Then, knowing that buyers will price protect, sellers will opportunistically retain and opinion shop in the next-to-the-last period. Buyers will respond by price protecting in the next-to-the-last period, and so on. This backwards induction continues, unraveling to a single period game in which sellers never choose to form reputations and the market will clear close to a Lemons Equilibrium (Akerloff, 1970) for all buyers where there is significant uncertainty about the accuracy of announced asset value. A complementary explanation to backwards induction lies in the solution set of a sequential equilibrium, which does not lend to the development of reputation formation as documented in Camerer and Weigelt (1988) and Neral and Ochs (1992). Alternatively, the described operationalization of an indefinite end period is consistent with the reputation formation studies conducted by King (1996) and Mayhew (2001).

[17] In the unlikely event that the experiment continues into new periods (with .2 probability) for greater than two hours, the subsequent trial probability is revised to .9, with a maximum time horizon of three hours. This maximum time horizon is not likely to be reached given the probability revision after two hours of experimental play. Prior to conducting each experimental session, the number of new periods was randomly pre-sequenced and the market software was manually stopped after reaching the terminal period.

Subjects participating in an experimental session were given a $10US show up fee to participate in the experiment. Profits and losses accumulated by subjects in the experimental sessions were subject to an exchange rate, and paid in cash at the end of the session, privately, to each market participant. The exchange rate was pre-determined assuming equilibrium decision making and set to equate cash payments across subjects.[18] The time duration for each experimental session ranged between one and a half to two hours, including the instructional period. Descriptions of the markets conducted are summarized in Table 4 and will be discussed in greater detail in the results section of the paper.

[18] Seller exchange rates were 3.5 cents per experimental dollar in reputation formation treatments and increased to 14 cents per experimental dollar in no reputation treatments. The difference in seller exchange rates is a multiplied factor of four, as no reputation treatment sellers will participate with ¼ the frequency of subjects in reputation formation treatments. Buyer exchange rates were set at 5 cents per experimental dollar, including the exchange of the buyer's initial endowment of $200. Subject payments are presented in Table 1.

V. EQUILIBRIUM ANALYSIS OF THE SELLER'S RETENTION / SWITCHING DECISIONS: 'NO REPUTATION'

Based on the model parameters and assumptions set forth in the preceding section, the predictions and the hypotheses are presented for both buyers and sellers in a market where reputation formation is not possible. As summarized in Figure 1, half of the treatments presented below are direct tests of Teoh's model and predictions.[19]

Seller Predictions

In a market where reputation formation cannot occur, sellers are assumed to profit-maximize in the market. This assumption is based on the nature of the 'no reputation' treatment, where sellers' prior period actions cannot be observed by buyers in the market. Since prior period actions cannot be impounded into current bid prices, sellers will not attend to potential buyer losses and will pursue the maximum reported value for their endowed asset. In game-theoretic terms, the no-reputation treatment is a series of one-shot games between strangers.

The switch/retain decision equilibrium for the 'no reputation' treatment with positive switch costs is presented graphically in Figure 2. The basic predictions of Teoh's model are valid for assets which have a continuous distribution of value. Operationally,

[19] Specifically, sessions conducted in Condition A, without reputation formation, are tests of Teoh's predictions. As outlined earlier, Teoh's model does not address opportunistic retentions; as such, the majority of predictions for Condition B are not covered by her model.

asset values maintain a random probability of outcomes but are confined to the set {$12, $6}. Translating Teoh's model into a market with binary asset outcomes loses no generalizability to the model's basic predictions, as outlined below.

The following illustration, using the parameters defined for the experiment, serves to define the predictions of Teoh's model as described by Figure 2.[20] A seller who was previously qualified in period X_1 (Condition A) and is assigned an X_2 asset value of $6 belongs to Region I. This seller cannot improve their position by switching verifiers in a market with switch costs.[21] A seller who previously qualified in period X_1 (Condition A) and is assigned an X_2 value of $12 belongs to Region II if they were paired with a negative error verifier. This seller will benefit from switching verifiers as the probability of receiving a correct report is 2/3. Finally, a seller with an X_2 value of $12 who is not paired with a negative error verifier (in Condition A) will fall into Region III. This seller is certain of an unqualified opinion from their incumbent verifier and will never switch. These examples outline several of the possible outcomes in a market with switch costs for Condition A. The predictions in a 'no reputation' treatment will follow Teoh's general model for sellers.

It is important to note an important deviation from Teoh's predictions for sellers in Region III that has been operationalized in the experimental design. Teoh's retention predictions are such that buyers should perceive sellers in Region III as being endowed

[20] A complete summary of all predictions in the no-reputation market are outlined on Table 2 at the end of this section.

[21] This prediction changes for sellers in a market without switch costs, as the expected value of a report for firms in Region I becomes positive when there is no explicit cost to switching. This will be further developed in the hypothesis section of the following pages.

with an asset value of $12. However, her predictions do not take into consideration the positive probability that, in Condition B, the true value of some assets in Region III may actually be $6, and the incumbent verifier has a positive error. Using the parameters chosen in the experiment, this means that some sellers with an actual value of $6 could be erroneously announced by their incumbent verifier as $12. This potential outcome merits further investigation.

In her analysis, Teoh also examines the static case where verifier switches are costless. Her predictions are such that Region I disappears from the diagram, and the resultant market reaction to verifier changes is unilaterally negative. Consistent with testing her model, this comparative case is also used in the experimental markets. In the following sections, an exhaustive analysis of sellers' equilibrium switching and retention decisions will be further discussed.

Buyer Predictions

In a market where reputation formation cannot occur, buyers are assumed to price-protect in the market. Buyers are at a distinct disadvantage in the 'no reputation' treatment given the levels of asset value and verifier error. There are multiple opportunities for sellers to engage in opportunistic verifier retentions and switching as described above. However, the results these opportunistic behaviors will not be revealed until after the buyers have submitted bids in a first-priced sealed bid auction. Buyers could develop an ex-ante probability estimate of opinion shopping and opportunistic retentions if they could observe sellers' decisions in prior rounds, but this information is intentionally occluded in the 'no reputation' prediction. Without reputation, the majority of markets will collapse into the Lemons Equilibrium (Akerloff, 1970), in which buyers will not rely on verifier reports and bid up to expected asset value given opinion shopping and opportunistic retentions, and no higher.

The equilibrium seller switching/retention decisions are dependent on the market reaction of buyers in the market. As such, it is necessary to define the bids for buyers in the market assuming that the seller is assumed to profit maximize. Presented below are Bayesian revision bids made by buyers assuming that sellers in the market will opportunistically retain and/or opinion shop.[22] These bids are grouped by report type, with description of the experimental condition. Importantly, these bids are all defined in a market where reputation formation cannot occur. The design of no-reputation markets is such that sellers will profit maximize without fear of repercussion in later rounds (i.e. by reduced bids). Knowing this is optimal, buyers will bid up to the expected value of the reported asset under the different report types.

There are four possible report types that buyers in the market will receive: Retain – 12, Switch – 12, Retain – 6, and Switch – 6. These reports are the result of the seller's switch decision (i.e., "Retain" or "Switch"), and the reported value of the asset by the original verifier (if retained) or replacement verifier (if switched).

[22] As described in the section above, opportunistic retentions can only occur in Condition B, where incumbent verifiers can have a positive error in their reporting. As demonstrated in the buyer predictions in the following pages, opinion shopping can occur in both Condition A and Condition B.

Bidder Equation 1:

For reports of Switch – 12 in Conditions A and B, assuming opinion shopping can occur:[23]

$$\Pr(12 \mid S12) = \frac{\Pr(S12 \mid 12) * \Pr(12)}{[\Pr(S12 \mid 12) * \Pr(12)] + [\Pr(S12 \mid 6) * \Pr(6)]} = \frac{\frac{2}{3} * \frac{1}{2}}{\left[\frac{2}{3} * \frac{1}{2}\right] + \left[\frac{1}{3} * \frac{1}{2}\right]} = \frac{2}{3} \qquad (1)$$

Buyers who view an announcement of Switch – 12, assuming opinion shopping, will bid up to $\$6 + \frac{2}{3}(\$6) = \$10$. Switch costs can affect the seller's ability to opinion shop, thus affecting buyers' bids in different treatment conditions. As such, this will be discussed in greater detail in the buyer prediction section.

Bidder Equation 2:

For reports of Switch – 6 in Conditions A and B, assuming opinion shopping can occur:

$$\Pr(12 \mid S6) = \frac{\Pr(S6 \mid 12) * \Pr(12)}{[\Pr(S6 \mid 12) * \Pr(12)] + [\Pr(S6 \mid 6) * \Pr(6)]} = \frac{\frac{1}{3} * \frac{1}{2}}{\left[\frac{1}{3} * \frac{1}{2}\right] + \left[\frac{2}{3} * \frac{1}{2}\right]} = \frac{1}{3} \qquad (2)$$

[23] Buyers' assumption of opinion shopping is dependent on the inclusion of switch costs, a common knowledge component of the experimental design. This will be examined in greater detail in the following pages.

Buyers who view an announcement of Switch – 6, assuming opinion shopping, will bid up to $\$6 + \frac{1}{3}(\$6) = \$8$. Here again, switch costs can affect the seller's ability to opinion shop, thus affecting buyers' bids in different treatment conditions.

Bidder Equation 3:

For reports of Retain – 6, in both Condition A and B, buyers will assume that opinion shopping has not occurred:

$$\Pr(12 \mid R6) = \frac{\Pr(R6 \mid 12) * \Pr(12)}{[\Pr(R6 \mid 12) * \Pr(12)] + [\Pr(R6 \mid 6) * \Pr(6)]} = \frac{0 * \frac{1}{2}}{\left[0 * \frac{1}{2}\right] + \left[\frac{2}{3} * \frac{1}{2}\right]} = 0 \qquad (3)$$

Buyers who view an announcement of Retain – 6 will bid up to \$6. Because the seller has chosen to retain their verifier, no assumption of opinion shopping will be made in the given trading year (i.e. $\Pr(R6 \mid 12) = 0$, given a retention would be a strictly dominated strategy).

Bidder Equation 4:

For reports of Retain – 12 in Condition A, there is no assumption of opportunistic retentions given incumbent verifiers with zero or negative error.

$$\Pr(12 \mid R12) = \frac{\Pr(R12 \mid 12) * \Pr(12)}{[\Pr(R12 \mid 12) * \Pr(12)] + [\Pr(R12 \mid 6) * \Pr(6)]} = \frac{1 * \frac{1}{2}}{\left[1 * \frac{1}{2}\right] + \left[0 * \frac{1}{2}\right]} = 1 \qquad (4)$$

Buyers who observe bids of Retain – 12 in Condition A will submit bids approaching $12, as there is no opportunity for the seller to opportunistically retain their verifier in Condition A (i.e. $\Pr(R12 \mid 6) = 0$). This equation changes in Condition B, as stated below.

Bidder Equation 5:

For reports of Retain – 12 in Condition B, assuming opportunistic retentions can occur:

$$\Pr(12 \mid R12) = \frac{\Pr(R12 \mid 12) * \Pr(12)}{[\Pr(R12 \mid 12) * \Pr(12)] + [\Pr(R12 \mid 6) * \Pr(6)]}$$

$$= \frac{1 * \frac{1}{2}}{[1 * \frac{1}{2}] + [\frac{1}{2} * \frac{1}{2}]} = \frac{\frac{1}{2}}{\frac{1}{2} + \frac{1}{4}} = \frac{\frac{1}{2}}{\frac{3}{4}} = \frac{2}{3} \tag{5}$$

Buyers who view an announcement of Retain – 12, assuming opportunistic retentions, will bid up to $12 * \Pr(12|R12) = (12 * \frac{2}{3}) + (6 * \frac{1}{3}) = 10$. Since the probability of receiving a $R12$ report given a true asset value of 6 is non-zero, Condition B bids for these types of reports are less than those for Condition A.

After outlining bids that buyers would submit for every report combination, as defined in equations 1-5, I can now outline the equilibrium decisions made by sellers and related buyer behavior in the market. Note that the bidder equations defined above are contingent on an expectation of profit maximization by the seller. Switch costs and X_1 reporting will affect the equilibrium decisions, as outlined below. All seller strategies and bidder responses are outlined in summary format on table 2.

Seller predictions – Condition A (X_1=L), no reputation and no switch costs (C = 0):

For sellers in Condition A, the only types of incumbent verifiers are negative or zero error. Given an X_2 = \$12, a seller will switch an incumbent negative error verifier, as the switch decision has a positive expected value, summarized as follows:

Seller Strategy 1*:* For X_2 = 12 and A_o^-,

E (bid from switching) = Pr (receiving S-12, by equation 1)

+ Pr (receiving S-6, by equation 2)

$$= \left(\frac{2}{3} * \$10\right) + \left(\frac{1}{3} * \$8\right) \approx \$9.33 \tag{6}$$

E (bid for retention) = \$6

E (bid from switching) \$9.33 > E (bid from retaining) \$6

Also for sellers in Condition A, given an X_2 = \$12, a seller will retain an incumbent zero error verifier, as a report of Retain-12 will receive a bid approaching \$12 for Condition A, as shown in bidder equation 4.

Next, given an X_2 = \$6, a seller is indifferent to the decision to switch *any* verifier (either zero or negative), as the retention decision has the same value in expectation. This indifference is due to the over-reporting penalty *P*, set at \$2.67. The seller strategy is then summarized as follows:

Seller Strategy 2: For X_2 = \$6 and A_o^i,

E (bid from switching) = Pr (receiving S-12, by equation 1)

+ Pr (receiving S-6, by equation 2)

$$= \left(\frac{1}{3}*10\right) + \left(\frac{2}{3}*\$8\right) - \$2.67 \approx \$6.00 \tag{7}$$

E (bid for retention) = \$6

E (bid from switching) \$6.00 ≈ E (bid from retaining) \$6

Seller strategy 2 yields an indifference to opinion shopping with the inclusion of the over-reporting penalty. This indifference point will be further investigated in the reputation predictions of this paper.

Seller predictions – Condition A (X_1=L), no reputation and switch costs (C=3):

As before, the only types of incumbent verifiers in the market are either negative or zero error. However, this condition differs in that switch costs have a positive value, \$3, and are set such that there is a natural barrier to opinion shopping.

Given an X_2 = \$12, a seller will switch incumbent negative error verifiers, as the switch decision has a positive expected value, summarized as follows:

Seller Strategy 3: For X_2 = 12 and A_o^-,

E (bid from switching) = Pr (receiving S-12, by equation 1)

+ Pr (receiving S-6, by equation 2)

$$= \left(\frac{2}{3}*\$10\right) + \left(\frac{1}{3}*\$8\right) - \$3 \approx \$6.33 \tag{8}$$

E (bid for retention) = \$6

E (bid from switching) \$6.33 > E (bid from retaining) \$6

Analyzing the decision process behind Seller Strategy 3, this supports Teoh's 'good news' verifier-switching decision for firms in Region II of Figure 2.

Next, given an X_2 = \$6, a seller will not switch any verifier (either zero or negative), as the switch decision has a negative expected value, summarized as follows:

Seller Strategy 4: For X_2 = \$6 and A_o^i,

E (bid from switching) = Pr (receiving S-12, by equation 1)

+ Pr (receiving S-6, by equation 2)

$$= \left(\frac{1}{3}*10\right)+\left(\frac{2}{3}*\$8\right)-\$2.67-\$3 \approx \$3.00 \tag{9}$$

E (bid for retention) = \$6

E (bid from switching) \$3.00 < E (bid from retaining) \$6

Seller strategy 4 yields a negative expected value to opinion shopping. As such, a switch will never occur in any market other than X_1 = 12 paired with an incumbent verifier with negative error.

The predictions for this treatment condition are captured graphically in Figure 2, and are an explicit test of Teoh's general model. Sellers in Region I of the Figure 2 will retain their verifier, those in Region II will switch, and those in Region III will retain.

Seller predictions – Condition B (X_1=H), no reputation and no switch costs (C=0):

For sellers in Condition B, the only types of incumbent verifiers are zero or positive error. This is in direct contrast to Condition A, where all incumbent verifiers are negative or zero error.

Given an X_2 = \$12, a seller will retain the incumbent verifier, regardless of error in their announcement, as the switch decision has a negative expected value, summarized as follows:

Seller Strategy 5: For X_2 = \$12 and A_o^i,

E (bid from switching) = Pr (receiving S-12, by equation 1)

+ Pr (receiving S-6, by equation 2)

$$= \left(\frac{2}{3}*10\right)+\left(\frac{1}{3}*\$8\right)\approx \$9.33 \tag{10}$$

E (bid for retention) = \$10

E (bid from switching) \$9.33 < E (bid from retaining) \$10

Analyzing the decision process behind Seller Strategy 5, this supports Teoh's 'good news' retentions for all cases except where the value of X_2 = \$6.

Given an X_2 = \$6 and an incumbent verifier with a positive error, a retention decision will be made, summarized as follows:

Seller Strategy 6: For X_2 = \$6 and A_o^+,

E (bid from switching) = Pr (receiving S-12, by equation 1)

+ Pr (receiving S-6, by equation 2)

$$= \left(\frac{1}{3}*10\right)+\left(\frac{2}{3}*\$8\right)-\$2.67\approx \$6.00 \tag{11}$$

E (bid for retention) = \$10 – \$2.67 ≈ \$7.33

E (bid from switching) \$6.00 < E (bid from retaining) \$7.33

Seller Strategy 6 yields a positive expected value to an opportunistic retention. As such, a switch will never occur in any market other than X_1 = 6 paired with an incumbent verifier with a zero error. Given switch costs set at C=0, a switch will indicate opinion shopping. This prediction is anticipated to change given reputation formation, to be discussed in the next section.

Seller predictions – Condition B (X_1=H), no reputation and switch costs (C=3):

For sellers in Condition B, the only types of incumbent verifiers are zero or positive error. Further, in this condition, switch costs are a positive value and are set such that there is a natural barrier to opinion shopping.

For any value of X_2, a seller will retain the incumbent verifier, regardless of error in their announcement, as the switch decision has a negative expected value, summarized as follows:

Seller Strategy 7: For any X_2 and A_o^i,

E (bid from switching) = Pr (receiving S-12, by equation 1)

+ Pr (receiving S-6, by equation 2)

$$= \left(\frac{1}{3}*10\right)+\left(\frac{2}{3}*\$8\right)-\$2.67-\$3.00 \approx \$3.00 \tag{11}$$

E (bid for retention) = \$10 – \$2.67 ≈ \$7.33

E (bid from switching) \$6.00 < E (bid from retaining) \$7.33

Analyzing the decision process behind Seller Strategy 7, there is a positive expected value to an opportunistic retention. As such, a switch will never occur in any market. Opinion shopping will be eliminated in the market as outlined in Seller Strategy 4.

Summary of predictions: 'No reputation'

This section outlines seller and buyer decision making in a market where there are four sellers and four buyers. The treatment is conducted where one of four sellers are selected participate in the market randomly, and without replacement. As a result of this design feature, sellers are unable to form reputations for either honest reporting or opportunistic actions. Further, buyers are unable to identify which seller is making the switch/retention decision.

The experimental conditions described above outline the predictions for both buyers and sellers, manipulating the presence and absence of switch costs and prior period earnings (Condition A and B). The predictions presented in this section can be summarized in general hypothesis form as follows:

> H1: In a market where reputation formation is not possible, sellers will make switching/retention decisions based on the highest expected announcement of value, as represented below in Table 2.

> H2: In a market where reputation formation is not possible, buyers will make pricing decisions assuming that sellers seek the highest expected announcement of value, as represented below in Table 2.

Table 2 – Predictions under 'no reputation' conditions

Condition A - All incumbent verifiers have negative or zero reporting error

Panel A – Seller predictions

Value, Switch costs	A_0^i = Negative	A_0^i = Zero
X_2 = \$12, C = \$0	Switch	Retain
X_2 = \$6, C = \$0	Indifferent	Indifferent
X_2 = \$12, C = \$3	Switch	Retain
X_2 = \$6, C = \$3	Retain	Retain

Panel B – Buyer predictions

Report	C = \$0	C = \$3
Retain – 12	\$12	\$12
Retain – 6	\$6	\$6
Switch – 12	\$10	\$12
Switch – 6	\$8	\$12

Condition B - All incumbent verifiers have zero or positive reporting error

Panel A – Seller predictions

Value, Switch costs	A_0^i = Zero	A_0^i = Positive
X_2 = \$12, C = \$0	Retain	Retain
X_2 = \$6, C = \$0	Switch	Retain
X_2 = \$12, C = \$3	Retain	Retain
X_2 = \$6, C = \$3	Retain	Retain

Panel B – Buyer predictions

Report	C = \$0	C = \$3
Retain – 12	\$10	\$10
Retain – 6	\$6	\$6
Switch – 12	\$6	\$6
Switch – 6	\$6	\$6

VI. EQUILIBRIUM ANALYSIS OF A SELLER'S RETENTION / SWITCHING DECISIONS: REPUTATION

Experimental markets that allow reputation formation depart from 'no reputation' markets along only one, very important, dimension. Reputation formation is introduced into the experimental markets by simply fixing one seller in the market with four buyers. Buyers are provided with a running history of actual asset value, announced asset value, and the switch/retention choice made by the fixed seller in the market.[24] This experimental treatment is in stark contrast to the 'no reputation' treatment, in which the identities of sellers in the market were intentionally occluded by random sampling without replacement. All other values and parameters were held constant. The predictions presented below assert that the implementation of reputation departs from Teoh's general model, in that buyers can observe and evaluate the context of past switches and retentions from one period to the next. Seller reputation then becomes a key determinant in the market reaction to the switch and retention decisions made by sellers.

Reputation formation is not immediate in market experiments. Sellers may opinion shop or opportunistically retain their incumbent verifier for a number of periods before their past actions will be impounded into the bid price of buyers in the market. Similarly, it is reasonable for subjects participating as buyers to underbid or overbid for

[24] The running history of prior period outcomes could have been omitted from buyers' computer screens, but the decision was made to track this information for subjects so that they did not need to track this information manually. This decision was made in order to reduce the experimental tasks, allowing buyers to devote more cognitive processing towards the current period bids. History displays were not provided to investors in 'no reputation' markets. Cumulative data such as total profit was calculated and displayed across all conditions.

assets in early periods but revise their expectations over time, consistent with reputation formation. Over time, sellers in the market who follow reputation equilibria can develop a positive reputation for reliable announcements, resulting in higher bids from buyers in the market. Similar to existing capital markets, reputation formation can only occur across multiple market iterations.

Most importantly, the adoption of reputation across a series of market iterations offers no guarantee that future period deviations will not occur. When sellers deviate from a 'high quality' reputation, the market outcomes for this section are identical to those of the 'no reputation' condition in Table 2, where buyer bids approach the expected value without considering verifier switch/retention decisions.[25] Similar to experiments focusing on the repeated Prisoner's Dilemma game, seller deviations from reputation equilibrium can be met with some type of tit-for-tat strategy, where buyers reduce their bids (yielding lower seller profits) for a number of periods until reputation is re-established.

Buyer Predictions

In a reputation where reputation formation can occur, buyers can evaluate prior period switch/retention decisions from one seller. As such, they can develop an expectation for the context of the switch/retention in a market where prior period

[25] Here, 'high quality' reputation is defined as periods when seller switch/retention decisions are made to accurately report asset values. Equilibrium reputation predictions are defined on the following pages.

earnings (Condition A or B) and switch costs (C=\$0 or \$3) are held constant across the experimental treatment.[26]

As with the 'no reputation' treatment, the seller's equilibrium switching/retention decision is dependent on the market reaction of buyers in the market. As such, it is necessary to define the bids for buyers in the market assuming that the seller has chosen to either profit maximize (i.e. a poor reputation for switching/retention) or adhere to the reputation predictions of verifier switching and retention. The bid functions for buyers in a market where the seller develops a low-quality reputation for switching/retention will be similar to the bids defined in the no-reputation section, summarized in Table 2. However, given a high-quality reputation for switching and retention, the following reputation bids will result, grouped by report.

Reputation bids for switch reports

For reports of Switch – 12 and Switch – 6 in Condition A, if buyers observe opinion shopping has not occurred in prior rounds, the switch signal indicates a seller who has a high value but was paired with a verifier with a negative error. Opinion shopping, as outlined in the prior section, occurs when the seller has a low asset value (X_2 = \$6) and is paired with a negative or zero biased verifier (A_o^- or A_o^0), but switches their verifier in hopes of receiving a positive biased verifier (A_n^+), occurring with Pr = (1/3). In

[26] Buyers' assumptions of opinion shopping and opportunistic retention are not dependent solely on the inclusion of switch costs, a common knowledge component of the experimental design. This will be examined in greater detail in the following pages.

the event opinion shopping has not been observed, the report of any switch in Condition A will yield a bid of 12, as the seller's switch decision is indicating that the firm was undervalued (X_2 = \$12 and A_o^-).[27]

For reports of Switch 12 and Switch 6 in Condition B, if buyers observe opinion shopping has not occurred in prior rounds, the switch signal must indicate a seller who has a low value but was paired with a positive error verifier. Opinion shopping occurs when the seller has a low asset value (X_2 = \$6) and is paired with a zero biased verifier (A_o^0), but switches their verifier in hopes of receiving a positive biased verifier (A_n^+), occurring with Pr = (1/3). Based on the incumbent verifier bias in Condition B (either A_o^0 or A_o^+), an announcement of a switch, coupled with an assumption of no opinion shopping, indicates that the seller is trying to avoid an opportunistic retention. As with the no-reputation markets, an opportunistic retention is defined as the event where a seller has a low value asset (X_2 = \$6) and is paired with a positive biased verifier (A_o^+). As such, the report of any switch in Condition B will indicate low asset value, and will yield a bid of 6.[28]

[27] In other words, under reputation equilibrium, the switch announcement in Condition A indicates that the asset would be announced as undervalued by the incumbent verifier, thus the true value must necessarily be \$12.

[28] In other words, under reputation equilibrium, the switch announcement in Condition B indicates that the asset would be over-reported by the incumbent verifier, or verifier retention would have occurred.

Reputation bids for retention reports

For reports of Retain 12 in Condition A, buyers will not need to consider prior period opinion shopping, as incumbent verifier error is either negative or zero (A_o^- or A_o^0). As such, the report of verifier retention in Condition A will yield a bid of 12. This prediction is identical to the 'no reputation' treatment.

For reports of Retain 12 in Condition B, if buyers have observed opportunistic retentions have not occurred in prior rounds, this switch signal is indicating a seller with true high value. As such, this report will yield a bid of 12. This prediction is in direct contrast to the 'no reputation' treatment.[29]

For reports of Retain 6 in both Condition A and B, buyers will infer that opinion shopping has not taken place, as the seller's opportunity to receive a higher report of asset value was not taken. As such, this report in either Condition A or B will yield a bid of 6. This prediction is consistent with the 'no reputation' treatment.

Seller Predictions

Seller predictions – Condition A (X_1=L), reputation and no switch costs (C = 0):

[29] The equilibrium analysis of the seller's choice to retain or switch in Condition B is analyzed in depth on the following pages.

The only types of incumbent verifiers in Condition A are negative or zero error. Consistent with the no-reputation predictions, given an X_2 = \$12, a seller will switch a negative error verifier and retain a zero error verifier as documented in Seller Strategy 3. However, if a seller in the reputation condition chooses to adopt a reputation for quality reporting, an X_2 value of \$6 will yield a retention decision in order to maximize the bid from subsequent period switch reports by engaging in the switch/retention decision to promote truthful reporting of asset values.

Seller Strategy 8:

E (bid | reputation) = Pr (Retention | \$12 & zero) + Pr (Switch | \$12 & negative)

+ Pr (Retention | \$6 & zero) + Pr (Retention | \$6 & negative error)

$$\text{E (bid | reputation)} = \left(\frac{1}{4} * \$12\right) + \left(\frac{1}{4} * \$12\right) + \left(\frac{1}{4} * \$6\right) + \left(\frac{1}{4} * \$6\right) = \$9 \qquad (12)$$

E (bid | opinion shopping) = Pr (Retention | \$12 & zero) + Pr (Switch | \$12 & negative)

+ Pr (Switch | \$6 & zero) + Pr (Switch | \$6 & negative error)

E (bid | opinion shopping) =

$$\begin{aligned} &\left(\frac{1}{4} * \$12\right) + \left(\frac{1}{4} * \left\{\left[\frac{2}{3} * \$10\right] + \left[\frac{1}{3} * \$8\right]\right\}\right) + \left(\frac{1}{4} * \left\{\left[\frac{1}{3} * \$10\right] + \left[\frac{2}{3} * \$8\right] - \$2.67\right\}\right) \\ &+ \left(\frac{1}{4} * \left\{\left[\frac{1}{3} * \$10\right] + \left[\frac{2}{3} * \$8\right] - \$2.67\right\}\right) \approx \$3 + \$2.33 + \$1.5 + \$1.5 \approx \$8.33 \end{aligned} \qquad (13)$$

E (bid | reputation) \$9 > E (bid | opinion shopping) \$8.33

Therefore, by Seller Strategy 8, the seller may engage in reputation behavior.

Seller predictions – Condition A (X_1=L), reputation and switch costs (C=3):

Consistent with a market where all incumbent verifiers are negative or zero error and positive switch costs, reputation will have no impact in a market with switch costs. As documented in seller strategy 3, the only switch announcement will originate from a seller with an X_2 = \$12 paired with an incumbent verifier with negative error (A_o^-). Therefore, the implementation of switch costs in this treatment suggests that reputation may serve the place of explicit switch costs, as the predictions for the switch-cost treatment are identical to those presented for those with no switch costs.[30]

Seller predictions – Condition B (X_1=H), reputation and no switch costs (C=0):

The only types of incumbent verifiers in Condition B are zero or positive error. Consistent with the no-reputation predictions, given an X_2 = \$12, a seller will retain a zero or positive error verifier as documented in Seller Strategy 5. However, with an X_2 value of \$6, if the seller chooses to adopt a reputation for quality reporting, an incumbent positive error verifier (A_o^+) will yield a switch decision. Under the reputation equilibrium, the seller will forgo short-term over-reporting in order to maximize bids from future period retention reports, as documented below.

[30] This prediction is illustrated in Table 3.

Seller Strategy 9:

E (bid | reputation) = Pr (Retention | \$12 & zero) + Pr (Retention | \$12 & positive)

+ Pr (Retention | \$6 & zero) + Pr (Switch | \$6 & positive)

$$\text{E (bid | reputation)} = \left(\frac{1}{4}*\$12\right)+\left(\frac{1}{4}*\$12\right)+\left(\frac{1}{4}*\$6\right)+\left(\frac{1}{4}*\$6\right)=\$9 \qquad (14)$$

E (bid | opportunistic retentions and opinion shopping) = Pr (Retention | \$12 & zero)

+ Pr (Retention | \$12 & positive) + Pr (Switch | \$6 & zero)

+ Pr (Retention | \$6 & positive)

E (bid | opportunistic retention and opinion shopping) =

$$\left(\frac{1}{4}*\$12\right)+\left(\frac{1}{4}*\left\{\left[\frac{2}{3}*\$10\right]+\left[\frac{1}{3}*\$8\right]\right\}\right)+\left(\frac{1}{4}*\left\{\left[\frac{1}{3}*\$10\right]+\left[\frac{2}{3}*\$8\right]-\$2.67\right\}\right)$$
$$+\left(\frac{1}{4}*\left\{\left[\frac{1}{3}*\$10\right]+\left[\frac{2}{3}*\$8\right]-\$2.67\right\}\right)\approx\$3+\$2.33+\$1.5+\$1.5\approx\$8.33 \qquad (15)$$

E (bid | reputation) \$9 > E (bid | opportunistic retention and opinion shopping) \$8.33

Therefore, by Seller Strategy 9, the seller may engage in reputation behavior.

Seller predictions – Condition B (X_I=H), no reputation and switch costs (C=3):

The inclusion of switch costs serves to eliminate opinion shopping in this condition. However, their presence in the market makes opportunistic retentions slightly greater than reputation predictions, demonstrated as follows:

Seller Strategy 10:

E (bid | reputation) = Pr (Retention | \$12 & zero) + Pr (Retention | \$12 & positive)

+ Pr (Retention | \$6 & zero) + Pr (Switch | \$6 & positive)

$$\text{E (bid | reputation)} = \left(\frac{1}{4}*\$12\right)+\left(\frac{1}{4}*\$12\right)+\left(\frac{1}{4}*\$6\right)+\left(\frac{1}{4}*\$6-3\right)=\$8.25 \qquad (16)$$

E (bid | opportunistic retentions) = Pr (Retention | \$12 & zero)

+ Pr (Retention | \$12 & positive) + Pr (Retain | \$6 & zero)

+ Pr (Retention | \$6 & positive)

$$\begin{aligned}\text{E (bid | opportunistic retention)} = {} & \left(\frac{1}{4}*\$12\right)+\left(\frac{1}{4}*\left\{\left[\frac{2}{3}*\$10\right]+\left[\frac{1}{3}*\$8\right]\right\}\right)\\ & +\left(\frac{1}{4}*6\right)+\left(\frac{1}{4}*\left\{\left[\frac{1}{3}*\$10\right]+\left[\frac{2}{3}*\$8\right]-\$2.67\right\}\right) \qquad (17)\\ & \approx \$3+\$2.33+\$1.5+\$1.5\approx \$8.33\end{aligned}$$

E (bid | reputation) \$8.25 < E (bid | opportunistic retentions and opinion shopping) \$8.33

Thus, this particular treatment combination does not support reputation formation.

Summary of predictions: 'Reputation'

The experimental conditions described above outline the predictions for both buyers and sellers, manipulating the presence and absence of switch costs and prior period earnings, all in a market structure with reputation formation.

This section outlines seller and buyer decision making in a market where there is one seller and four buyers. Because of this design feature, sellers will consider their reputations for either honest reporting or opportunistic actions, as future reports may be discounted to reflect deviations from reputation equilibrium. As noted previously, buyer reaction to the switch/retention decision is contingent on reliable reputation formation. It is anticipated that the reputation equilibrium predicted above will take several market iterations and are sensitive to deviations from the reputation equilibrium by sellers.

The predictions presented in this section can be summarized in general hypothesis form as follows:

> H3: In a market where reputation formation is included, sellers will make switching/retention decisions that will result in accurate reporting of asset values in all markets except for Condition B with switch costs, as presented below in Table 3

> H4: In a market where reputation formation is included, buyers will make pricing decisions that reflect accurate reporting of asset values in all markets except for Condition B with switch costs, as presented below in Table 3.

Table 3 – Predictions under 'reputation' conditions

Panel A – Seller predictions

Condition A - All incumbent verifiers have negative or zero reporting error

Value, Switch costs	Negative	Zero
X_2 = \$12, C = \$0	Switch	Retain
X_2 = \$6, C = \$0	Retain	Retain
X_2 = \$12, C = \$3	Switch	Retain
X_2 = \$6, C = \$3	Retain	Retain

Condition B - All incumbent verifiers have zero or positive reporting error

Value, Switch costs	Zero	Positive
X_2 = \$12, C = \$0	Retain	Retain
X_2 = \$6, C = \$0	Retain	Retain
X_2 = \$12, C = \$3	Retain	Retain
X_2 = \$6, C = \$3	Retain	Retain[31]

Panel B – Buyer predictions

Condition A - All incumbent verifiers have negative or zero reporting error

Report	C = \$0	C = \$3
Retain – 12	\$12	\$12
Retain – 6	\$6	\$6
Switch – 12	\$12	\$12
Switch – 6	\$12	\$12

Condition B - All incumbent verifiers have zero or positive reporting error

Report	C = \$0	C = \$3
Retain – 12	\$12	\$10[32]
Retain – 6	\$6	\$6
Switch – 12	\$6	\$6
Switch – 6	\$6	\$6

[31] These retention decisions are documented in Seller Strategy 10, and do not support reputation formation.

[32] Because opportunistic retentions yield a higher payoff in the presence of switch costs, this treatment does not support reputation formation. As such, the predictions are identical to Table 2.

VII. RESULTS

One hundred and four student subjects participated in the experiment across 16 different sessions.[33] A total of eight different treatments were run, based on the 2 X 2 X 2 factorial design of the experiment (Condition A / Condition B, Switch costs / No switch costs, Reputation / No reputation). Each treatment was run for two independent sessions. Average subject payment across all treatments was $20.19, with minimum and maximum payments of $18.00 and $24.00, respectively.

Descriptive statistics on the seller retention and switching decision are provided in Table 5 for the experimental treatments conducted. Panel A presents Condition A treatments, followed by Condition B treatments in Panel B. Buyer's decisions across all treatments are provided as Table 6, followed by further analysis of seller strategies in Table 7. Table 8 presents statistical analysis of differences between mean bids across comparable treatments.[34] The results of each treatment are discussed in depth below, grouped in order by Condition A/B, then switch costs and reputation, to allow comparisons across experimental treatments.

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[33] There were two occasions where independent sessions were conducted in the same facility at the same time. Subjects who participated in a 'multiple session' lab were informed that there were two sessions being conducted simultaneously, and that subjects assigned to one session would remain in the same session throughout the experiment. This design decision was made in order to recruit the maximum number of subjects during hours when students were available to participate in markets.

[34] The Student's T test was chosen as the statistical test to evaluate the differences between means. This statistical test was selected primarily because of its' flexibility of testing small samples of different sizes. Test results are two-tailed, testing the null hypothesis of no difference between independent samples. As will be discussed in the following pages, caution should be used when interpreting the results primarily due to sample size.

Condition A Results

The market results for Condition A, without reputation, offer an explicit test of Teoh's model and provide preliminary evidence on its descriptive validity, given the parameters and market structures used in the market. The treatments where switch costs were not included are presented first, followed by a discussion of treatments where switch costs were set at $3. Within each discussion, a comparison is made for sessions where reputation formation is controlled for, then included, in each treatment.

For Condition A markets where switch costs and reputation were not implemented, Teoh's basic prediction (that Region I will disappear from Figure 2) is supported. Table 5 documents that, for the two sessions run with no switch costs or reputation (Sessions 1a and 1b), opinion shopping occurred in 17 out of 33 switches (51.52%), supporting the prediction that the elimination of switch costs would make the switch signal difficult to interpret by buyers. Table 6 presents buyer bids across these sessions, documenting that the mean (predicted) price bid for switches in these markets was $7.23 ($10) for reports of Switch – 12 and $5.34 ($6) for reports of Switch – 6. [35] The difference between the mean and predicted prices for reports of Switch - 12 can be reasonably attributed to loss aversion for subjects participating in the role of buyers.

[35] The distributions of High and Low valued assets in Sessions 1a and 1b do not appear to be even at first glance (42 high values and 34 low values out of 76 trials), but are roughly equally distributed (chi-square 0.842, p = .359). An even distribution of these random variables would approximate close to the same number of high and low valued assets endowed to sellers, given a larger number of trials in each experimental session. This is an unfortunate side-effect of having the computer generate random values for each market. My further research in experimental markets will incorporate pre-sequencing of random variables in the market in order to pre-evaluate distributions to ensure even binomial distributions, mitigating alternative behavioral explanations to uneven distributions.

Surprisingly, sellers seemed to respond similarly in the same treatment where the absence of switch costs was held constant but reputation formation was included. Table 7 documents that, for the two sessions run with no switch costs and reputation formation (Sessions 2a and 2b), opinion shopping occurred in 31 out of 44 switches (70.45%), providing evidence that the absence of switch costs supersedes reputation formation for the experimental markets conducted. This is in contrast to the predictions stated for the reputation conditions. It is important to note that, on the aggregate, the number of high and low valued assets endowed to sellers appears to be approximately evenly distributed, but the individual sessions do not reflect this distribution (11 high values to 24 low values in Session 2a, and 23 high to 15 low values in Session 2b). This uneven distribution of high and low values may impact sellers' behaviors due to the gambler's fallacy. Subjects may make a short-run decision in one round assuming that, for example, the high value was 'due' in the next period, ignoring the constant underlying probability of receiving a high value.[36] The results from this session indicate that sellers did not fully take reputation formation into account and buyers correctly responded by reducing their mean and median bids approaching the Bayesian revised bids assuming occasional opinion shopping.

Most importantly, the mean bids submitted for reports are statistically different in markets where reputation is included as a treatment variable while holding constant both

[36] The 'Gambler's Fallacy' has been widely documented as a bias in judgment and decision making literature, notably in Tversky and Kahneman (1974). An explicit test of the gamblers fallacy is not the intention of this study, and is an unfortunate byproduct of lab sessions with a finite time horizon. Two other sessions suffer from apparent uneven distributions of firm values, as discussed in the prior footnote. These deviations from an even distribution will be subsequently noted in the analysis for these treatments.

Condition A and switch costs = 0. Using Student's T-test, the mean bids submitted for Sessions 1a and 1b are statistically different (lower) than for bids submitted in Sessions 2a and 2b, suggesting that reputation does impact buyer reaction to the seller's occasional adherence to reputation equilibrium.[37] For example, the Switch 12 mean bid under no reputation sessions is \$7.23, while under reputation conditions is \$9.12 (*t value = -3.91, p =.0005*). Similarly, the Switch 6 mean bid under no reputation is \$5.34, while under reputation conditions is \$6.60 (*t value = -5.75, p = .0001*). The differences between both Switch reports suggest that buyers were more comfortable submitting higher bids under reputation conditions. The deviations from predicted bid amounts under reputation conditions are the result of occasional departures from reputation equilibrium.[38]

For Condition A markets where switch costs were set at \$3, Teoh's basic equilibrium (retain in Region I, switch in Region II, and retain in Region III) is supported. For the sessions (3a and 3b) conducted with switch costs and no reputation, only three documented cases of opinion shopping occurred in 20 total switches (15%). Additionally, the two sessions (4a and 4b) conducted with switch costs and reputation yielded 2 cases of opinion shopping in 17 total switches (10.53%). Buyers responded to

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[37] The t-test results in Table 7 present negative signs on the t statistic. Based on the results reported, the null hypothesis of no difference compares no reputation conditions against reputation conditions, in that order, for all tests run. A negative t-statistic suggests that the reputation conditions are indeed higher than those for the comparable no-reputation treatment, grouped by report.

[38] Reputation equilibrium is defined for markets with an uncertain end-point, thus discounting deviations from equilibrium are not incorporated. Based on the limitations of limited experimental times and human subject cognitive processing, it is not unreasonable to expect the occasional defection from reputation equilibrium. The observed deviations did impact the market ex-post, thus reducing bids submitted in reputation markets from their expected values (\$12 for Switch 12 and Switch 6) to their observed values (\$9.12 for Switch 12 and \$6.60 for Switch 6). The important finding documented in Table 7 is that the bids were significantly different between reputation and no-reputation markets, whereas all else was held constant across treatments.

the switch costs implemented in markets by submitting mean (predicted) bids of \$9.37 (\$10) for reports of Switch – 12 and \$7.75 (\$8) for reports of Switch – 6 in Sessions 3a and 3b. For the two sessions conducted with switch costs and reputation (4a and 4b), buyers submitted mean (predicted) bids of \$8.75 (\$10) for reports of Switch – 12 and \$8.36 (\$8) for reports of Switch – 6. These results support the hypotheses that, for a market with switch costs in Condition A, the switch signal will be interpreted as good news rather than opinion shopping. The inclusion of reputation in a market with switch costs provides no noticeable differences from a market without possible reputation formation.

Statistical tests conducted on the mean bids submitted for reports are not statistically different in markets where reputation is included as a treatment variable while holding constant both Condition A and switch costs = 3. Using Student's T-test, the mean bids submitted for all switch reports are not statistically different (lower), regardless of the reputation treatment, suggesting that switch costs impact buyer reaction to the seller's switching and retention decision. Further, the lack of statistical difference between bids submitted in Sessions 3 and 4 support comparability of other markets where reputation plays a more significant role in the market reaction to switches and retentions.

Condition B results

The market results for Condition B do not offer an explicit test of Teoh's model given the parameters and market structures used in the market. As discussed previously, her model does not define the market reaction to an opportunistic retention. However, opportunistic retentions impact the market reaction to the switch/retention decision as suggested by the archival results of Barton (2005) and Chaney and Philipich (2002). Results for the treatments where switch costs were not included are presented first, followed by a discussion of treatments where switch costs were set at \$3. Within each discussion, a comparison is made for sessions where reputation formation is controlled for, then included, in each treatment.

For Condition B markets where switch costs and reputation were not implemented, opportunistic retentions were pervasive, as predicted, occurring in 20 out of 53 retentions (37.74%).[39] Additionally, opinion shopping occurred in 11 out of 23 switches (30.43%). This is in line with the predictions for Condition B markets with zero switch costs and no reputation formation. Buyers in the market responded by reducing their bids for Retain – 12, submitting mean (median) bids of \$8.98 (\$9.50). Additional pricing decisions for Switch – 12 and Switch – 6 reflect an awareness of opinion shopping by mean (median) bids of \$6.78 (\$5.75) and \$6.40 (\$6.50), respectively. Finally, there were five switch decisions made by sellers in the market which were coded as “irrational switches” that may have impacted sellers’ reaction to the switch report. In these cases, the seller’s asset value was high, yet a switch decision was made. It is unclear how, or to what extent, these cases may have impacted the market.

[39] The distribution of high and low values for Sessions 5a and 5b do not appear approximate an even distribution individually, however they appear evenly distributed in the aggregate (for Session 5a, chi-square of 1.00, p = .317; for Session 5b, chi-square of 0.90, p = .343). There are possible alternative behavioral explanations for seller decision making based on this unfortunate outcome. Since the number of opportunistic retentions was reduced beyond the expected value for these outcomes, investor reactions may have been slightly different given an even distribution of asset values. Again, pre-sequencing these random asset values may have alleviated this concern.

For Condition B markets where switch costs were held at zero, but reputation formation was implemented, the number of opportunistic retentions decreased slightly, occurring in 13 out of 56 retentions (23.31%). In turn, buyers responded by submitting higher mean (predicted) bids for Retain – 12 of \$9.47 (\$12), suggesting that reputation formation did impact both buyer and seller decisions. However, opinion shopping did not decrease in the market sessions with reputation formation, occurring in 9 out of 18 switches (50%). Sellers responded accordingly, submitting mean (predicted) bids of \$6.93 (\$6.00) and \$6.11 (\$6.00) for reports of Switch – 12 and Switch – 6, respectively.

T-test results for Retain – 12 and Retain – 6 reports under reputation conditions demonstrate a statistically different market reaction from those identical reports under no-reputation conditions. Similar to the findings in the Condition A treatments, in markets without switch costs, reputation impacts the market reaction to the retention decision made by sellers in the market. Retain – 12 reports in Sessions 5a and 5b are statistically different (lower) than for bids submitted in Sessions 6a and 6b. For example, the Retain – 12 mean bid under no reputation sessions is \$8.98, while under reputation conditions is \$9.47 (*t value = -2.49, p = .015*).

Both Condition B markets without switch costs do demonstrate that ‘good news’ switches did occur, but were not observed consistently. Good news switches in Condition B occur when the seller has chosen to switch verifiers in order to avoid over-reporting of their asset. However, inclusion of reputation formation did not make a significant difference in seller’s decision making between these two alternative treatments. In the no reputation market, there were 7 good news switches out of 23 total switches (47.83%), but only 8 good news switches out of 18 total switches in a market with reputation formation (44.44%).

Condition B markets which include switch costs as a component of the market were predicted to result in extensive opportunistic retentions in treatments with and without reputation formation. The market results support these predictions. In no reputation markets, opportunistic retentions occurred in 5 out of 30 retentions (19.44%), whereas they occurred in 16 out of 63 retentions (25.40%) in reputation markets. Buyers responded to the opportunistic retentions by submitting mean (median) bids of \$8.94 (\$9.50) in the no reputation market, and \$8.55 (\$9.00) in the reputation markets, for reports of Retain – 12. Opinion shopping was anticipated to reduce due to the implementation of switch costs. However, the no reputation market (1g) revealed 3 opinion shopping attempts in 6 switches (50%), and the reputation markets (1h and 2h) demonstrated 6 opinion shopping attempts in 16 switches (37.50%). [40] The number of opinion shopping attempts was captured in buyer bids submitted across both conditions. In the no reputation market, buyers submitted mean (median) bids of \$7.56 (\$8.50) for reports of Switch – 12 and \$6.75 (\$6.75) for reports of Switch – 6.

T-test results comparing Sessions 7a and 7b to Sessions 8a and 8b find no statistically significant differences between buyer bids for any reports, with the exception

[40] In experimental session 8b (Condition B, switch costs, reputation), the results of one market may be difficult to interpret due to the number of 'irrational' switches made during the session. The irrational switches occurred when the seller was endowed with a high valued asset, but chose to pay the switch costs in order to receive a new verifier. These switch decisions resulted in reduced profit for the seller in every case, and were not optimal decisions. It is unclear why this seller chose to decrease their profits in this manner, but the data must be accepted as presented.

of Switch – 6.[41] This is consistent with the hypotheses of no difference in these market sessions, due largely to the over-reporting penalty implemented across all experimental sessions.

Summary of results

The results of the experimental markets conducted in Condition A, both with and without switch costs, offer strong support for the predictions of Teoh's general model. In markets where switch costs were included, opinion shopping was greatly reduced, supporting the notion that sellers in Region I of Figure 2 will weigh the costs and benefits of a verifier switch. Further supporting Teoh's basic predictions, reports of switching firms received higher bids when switch costs were included, indicating that good news switches can occur in markets with explicit switch costs.

The results of the experimental markets also demonstrate situations where the explanatory power of Teoh's general model is reduced. Opportunistic retentions were not previously defined in her model, but the market reaction to such retentions is captured in the results of the current study.

Finally, the results of the experimental markets suggest that reputation plays a role in the market reaction to the auditor switch and retention decision. Buyers submitted higher bids across several reputation treatments when compared to the identical, no-reputation market, suggesting that investors are able to reward good behavior when it can

[41] The statistical differences documented for reports of Switch - 6 across conditions were not anticipated, and absolute differences were detected in the wrong direction. In other words, the no-reputation markets had higher bids than those for reputation markets, with marginal significance (*t value = 2.70, p = .016*). This difference may also be the result of the pervasive irrational switches documented in Session 8b.

be identified. This identification process is only possible in the reputation treatments due to the fixed participants across trials. However, the interpretation of this data is not without significant caveats, as discussed in the footnotes of this section.

VIII. CONCLUSION

Auditor switching and retention decisions are an important facet of corporate governance. As such, recent changes in the litigation environment (SOX) have renewed interest in the study of corporate governance. I believe that this study will add to the existing literature, bridging prior experimental studies of King (1996) and Mayhew (2001). Additionally, archival researchers should attempt to classify prior auditor switches and retentions across time, from the perspective of reputation formation. Auditor realignments are not necessarily indicative of opinion shopping and retentions are not necessarily signs of strong governance. Exogenous changes to auditors, such as increases to their litigation environment, can change the market's perception of auditor changes and retentions. Such changes to the audit market can be well captured using Teoh's model as a framework for the market reaction to auditor switching and retention.

The results of the study support the general model under examination and offer support for reputation formation. The incremental contribution of the study supports Teoh's general model, in that investors do attend to the information provided in the switch/retention decision regarding prior period audit opinion and the presence/absence of switch costs. The replication of the general model without reputation provides such evidence. Future research on reputation formation in experimental markets should continue using several of the basic tools developed in this study. First, control over reputation formation should be implemented as a baseline for data analysis of markets testing reputation formation explicitly. Secondly, in order to mitigate the occurrence of a sequential equilibrium solution set, an uncertain end point should be used. Third, pre-sequencing of random variables should be implemented in order to mitigate decision biases, such as the gamblers' fallacy.

APPENDIX A – TEOH'S MODEL IN SUMMARY FORM

Note – All of ***bold text*** *that follows indicates that the text is taken directly from Teoh (1992). Page numbers are provided at the end of each section of the copied text.*

There are two periods in the model, $t = 1, 2$, and all individuals are assumed to be risk neutral. The gross firm value X_t, $t = 1, 2$, is random with density $f(X_t)$, and support $[\overline{X}, \underline{X}_t]$, $\underline{X}_t > 0$. The change in X_t between the two periods is $\delta \equiv X_2 - X_1$. δ is independent of X_1, has density $h(\delta)$, and has zero mean and support $[\overline{\delta}, \underline{\delta}]$. The terminal net value of the firm, V, equals the gross value in period 2 less any switching cost, C, and qualification cost, K, incurred:

$$V = X_2 - I(S)C - I(Q_1)K - I(Q_2)K, \qquad \textbf{(a1)}$$

where:

C	**= the cost of a switch**
K	**= the cost to the firm if it is qualified**
I(S)	**= 1 if a switch occurred and 0 otherwise**
$I(Q_t)$	**= 1 if the firm was qualified in period *t* and 0 otherwise**

The cost of switching auditors *C* arises from the need to search and solicit presentations from potential auditors, from the new auditor's setup costs, and from procedures that require the time of employees. The qualification cost *K* consists of renegotiation costs associated with a qualified opinion, such as technical defaults on existing loans or a decline in credit rating. A qualified opinion may also invite regulator involvement, such as a temporary suspension of trading. The costs *C* and *K* are common knowledge. I assume for the present that audit fees

are the same across auditors, and hence can be ignored in the switch/retain decision… (Teoh, 1992, p 3)

At the start of each period, the firm privately observes X_t. It is required to hire an auditor for each period. The firm selects the initial auditor at random in period 1, and either retains (*R*) the old auditor (*o*) or switches (*S*) to a new auditor (*n*) for period 2. For each period, based on a noisy estimate of the firm's value, the auditor issues either a clean (*U*) or a qualified (*Q*) opinion. All uncertainty is resolved and the firm is liquidated at the end of the second period. Neither investors nor the auditor observe X_t until the end of period 2, and they have common priors about the densities $f_t(X_t)$ and $h(\delta)$… (Teoh, 1992, pp. 3-4)

The auditor forms his report based on observing firm value at the start of the period, A_t, t= 1, 2, with error ε_t. At the start of period 1, his observation is $A_1=X_1+\varepsilon_1$. Define y as the net value of the firm prior to the switch/retain decision, $y=X_2-I(Q)K$. Let A_2^n and A_2^o represent the second period observations of the firm's net value for the new and old auditor, respectively. At the start of period 2, these observations are:

$$\begin{aligned} A_2^n &= y - C + \varepsilon_2^n \\ A_2^o &= y + \varepsilon_2^o \end{aligned} \qquad \textbf{(a2)}$$

The audit errors $\varepsilon_1, \varepsilon_2^o$, and ε_2^n are random with zero mean and independent of X and δ.[42] The auditor's observation A_t is not revealed to investors; however, I assume that the firm learns the

[42] To rule out assessments outside the support of X_t, Teoh defines $A_1 = \underline{X}_1$ if $X_1 + \varepsilon < \underline{X}_1$, and $A_1 = \overline{X}_1$ if $X_1 + \varepsilon > \overline{X}_1$. Similarly, $A_2 = \underline{X}_2 - I(Q_1)K - I(S)C$ if $X_2 + \varepsilon < \underline{X}_2$ and $A_2 = \overline{X}_2 - I(Q_1)K - I(S)C$ if $X_2 + \varepsilon > \overline{X}_2$ (Teoh, 1992, p. 4)

errors in the auditor's observations. In practice, public corporations are required to file Form 8-K with the SEC concerning any major disagreements with their auditors regarding accounting principles. Thus, it is likely that the auditor will discuss disagreements with the client.

The probability densities of the errors for an old or a new auditor are $g^o(\varepsilon_t)$ and $g^n(\varepsilon_t)$ with support $\left[\underline{\varepsilon}, \overline{\varepsilon}\right]$. $g^i(\varepsilon^t), i = o, n$, is known to all parties. It is assumed that the error of the old auditor's observation persists over the two periods $\left(\varepsilon_2{}^o = \varepsilon_1{}^o\right)$, but the error in the new auditor's observation is independent of the old auditor's error. These assumptions reflect an audit technology in which the incumbent auditor places more confidence in his own previous assessment than would a new auditor. Hence, the firm is more certain about a future assessment of the firm by an incumbent auditor than by a new auditor.

Under the following exogenous qualification rule:

$$\begin{aligned} &\text{if } A_t \le \hat{A} \text{ issue qualified report} \\ &\text{if } A_t > \hat{A} \text{ issue clean report,} \end{aligned} \qquad \textbf{(a3)}$$

the auditor is a pure technology, independent of management influence. At date 2, the minimum and maximum possible values of *y* given that a firm received a clean or a qualified opinion at date 1 for given ε_1 are denoted $\overline{y}_U(\varepsilon_1)$, $\overline{y}_Q(\varepsilon_1)$, $\underline{y}_U(\varepsilon_1)$, and $\underline{y}_Q(\varepsilon_1)$.[43]

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[43]These values are: $\overline{y}_U(\varepsilon_1) = \overline{X}_1 + \overline{\delta}$ (independent of ε_1), $\underline{y}_U(\varepsilon_1) = \hat{A} - \varepsilon_1 + \underline{\delta}$, $\overline{y}_Q(\varepsilon_1) = \hat{A} - \varepsilon_1 + \overline{\delta} - K$, and $\underline{y}_Q(\varepsilon_1) = \underline{X}_1 + \underline{\delta} - K$ (independent of ε_1). They are obtained by noting that the maximum value of X_1 for a previously clean firm is $\overline{X}_1$, and for a previously qualified firm is $\hat{A} - \varepsilon_1$. The minimum value of X_1 for a previously clean firm is $\hat{A} - \varepsilon_1$ and for a previously qualified firm is $\underline{X}_1$ (Teoh, 1992, p. 4)

I assume that the critical value $\hat{A}$ is common knowledge. $\hat{A}$ may be interpreted as the face value of the firm's debt, so a firm with $A_t \leq \hat{A}$ is issued a going-concern qualification. Alternatively, $\hat{A}$ may be viewed as the minimum value of a firm with a clean opinion; if so, qualification implies substantial uncertainty about whether the firm is worth at least $\hat{A}$. The second interpretation corresponds to a qualification issued because of material uncertainties… (Teoh, 1992, pp. 4-5)

The firm makes its switching decision to maximize its expected terminal net value V¸ as given in (4) and (5) below for cases of switch and retain:

$$E^m\left(V \mid R, \theta_1, y, \varepsilon_1\right) = y - \Pr\left(\mathrm{Q}_2{}^o \mid \theta_1, y, \varepsilon_1\right) K \qquad \textbf{(a4)}$$

$$E^m\left(V \mid S, \theta_1, y, \varepsilon_1\right) = y - \Pr\left(\mathrm{Q}_2{}^n \mid \theta_1, y, \varepsilon_1\right) K - C \qquad \textbf{(a5)}$$

Subtracting (4) from (5) and noting that qualification and clean opinion are mutually exclusive events, the expected gain from switching (Π) is:

$$\Pi\left(\theta_1, y, \varepsilon_1\right) = \left[\Pr\left(U_2^n \mid \theta_1, y, \varepsilon_1\right) - \Pr\left(U_2^o \mid \theta_1, y, \varepsilon_1\right)\right] K - C \qquad \textbf{(a6)}$$

The gain from switching, which arises if there is an increased likelihood of a clean opinion from a new auditor, is measured by difference in probabilities of a clean opinion between the new and old auditor multiplied by the cost of qualification *K*. A firm will switch auditors if the benefits outweigh the cost *C*, i.e., if Π > 0… (Teoh, 1992, pp. 4-5)

APPENDIX B – SUBJECT INSTRUCTIONS

This is an experiment in market decision-making. If you follow the instructions carefully and make good decisions, you can earn a considerable amount of money, which will be paid to you in cash at the end of the experiment.

This experiment will have FIVE / EIGHT[44] human participants. Participants will buy and sell 'assets' in a market in which there are ONE/FOUR[45] sellers, and FOUR buyers. The sellers and buyers in the market are human subjects. This experiment will consist of a number of trading years, each lasting a few minutes each.

After you are seated at your computer terminal, the computer will assign which role you will take in today's experiment. You will be assigned to the role of either a BUYER or SELLER, and you will remain a buyer or seller throughout the entire experiment. The instructions provided below are identical for both buyers and sellers, although each role will have different tasks for each trading year.

In addition to the human sellers and buyers, there are SEVERAL automated verifiers also participating in the experiment. The automated verifiers act by a fixed set of rules, and

[44] Instructions vary dependent on treatment. In 'no reputation' markets, there are four sellers; in 'reputation' markets, there is one fixed seller.

[45] Instructions vary dependent on treatment. In 'no reputation' markets, there are four sellers; in 'reputation' markets, there is one fixed seller.

the verifiers' actions are determined by EITHER the flip of a virtual coin OR the roll of a virtual six sided DIE.

The sellers will make an asset available for sale. There will be one asset available for sale to buyers in each trading year. The buyers will submit ONE bid for the asset available for sale by way of an AUCTION. The highest bid for the asset will become the winning bid. After the winning bid is determined, the true value of the asset for sale is revealed. The SELLER in the market keeps the winning bid, and BUYERS submitting the highest bid in the market keep the difference between their bid and the asset's true value. This process is described in depth below.

The auction process will proceed as follows. Each buyer simultaneously submits a bid for the asset available for sale. In this auction, buyers can submit only ONE bid for the asset available for sale. Once the bids are submitted, the computer will determine the highest bid for the asset and will award the asset to the highest bidder.

The Sellers in the market make a profit by selling their asset, which has a randomly determined value; the true value of the asset is revealed AFTER buyers purchase the asset. For example, if the highest bid is $8, the SELLER will receive the highest bid of $8, regardless of the true value of the asset for sale. If there are two or more ties for the highest bid, the seller will receive only the value of the highest bid. The seller will pay any transaction fees (to be discussed in a moment) from the amount of the highest bid.

The difference between the asset's TRUE value and the amount of the bid submitted by the highest bidder becomes BUYER profit or loss. For example, if the asset's true value is \$6, and the highest bid was \$4, the highest bidder would earn \$2 PROFIT (\$6 – \$4). However, if the highest bid for the \$6 asset was \$9, the highest bidder would incur a LOSS of \$3 (\$6 – \$9).

It is possible that the highest bid can be a tie between two or more buyers. If two or more bidders tie for the highest bid, the tying bidders will evenly split the profit or loss as described above.

Buyers are given an initial endowment of \$200. The endowment is adjusted by the difference between the actual value of the purchased asset and the winning bid for the asset purchased. A winning bid is subtracted from the endowment, and the actual value of the asset won is added back to the endowment. Bids that are not the highest (winning) amount are NOT subtracted from the endowment; in the event a bidder does not submit the highest bid, the bidder makes no purchase.

In the instructions that follow, the impact of any decisions you might make is described, along with specific rules for trading. Buying and selling will take place over a sequence of independent trading years. All rules described below apply equally to each trading year.

NO REPUTATION CONDITION[46] – In today's experiment, there are FOUR subjects in the role of seller. The computer will randomly determine which one of the SELLERS will 'participate' by selling an asset in each trading year. Each seller will be randomly selected one time every four rounds. BUYERS will not know which seller has been selected in any given trading year.

An illustration of how the computer will select a seller to participate follows. Suppose the computer had a bag of four poker chips, each with a different seller's name on it. The computer will pick out a chip to select the seller for trading year 1; <u>the computer will not put the selected chip back in the bag</u>. Then, the computer will pick out a different chip to select the seller for trading year 2, and <u>will not replace the chip in the bag</u>. Once the bag is empty (after trading year 4), the computer will put all of the poker chips back into the bag and randomly pick a new seller for trading year 5, 6, 7 and 8. After every four trading years, the bag will be empty and the computer will put all of the chips back in the bag.

REPUTATION CONDITION[47] – In today's experiment, there is one subject in the role of seller. The seller will offer an asset for sale in each trading year throughout the experiment.

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[46] The following two paragraphs are displayed for subjects in a 'no reputation' condition. Sellers are selected randomly, and without replacement

[47] The following paragraph is displayed for subjects in a 'reputation condition', where there is one fixed seller

In each trading year in this experiment, the randomly selected[48] seller is required to have an automated verifier who will ANNOUNCE a value of the asset for sale. Depending on the verifier's type, the announcement is EITHER the TRUE value of the seller's asset, or the announcement may contain ERROR. The ERROR in verifier announcements will be discussed in a moment.

The seller will then be randomly assigned to an ORIGINAL verifier who follows a fixed set of rules, to be discussed in a moment. The seller can choose to either keep the ORIGINAL verifier, or switch to a REPLACEMENT verifier. If the seller chooses to keep the ORIGINAL verifier, the verifier will ANNOUNCE a value of the asset for sale. If the seller switches to a REPLACEMENT automated verifier, the REPLACEMENT automated verifier will ANNOUNCE the value of the asset for sale following a fixed set of rules.

After the ANNOUNCEMENT of asset value by the ORIGINAL or REPLACEMENT verifier, the auction will commence. Buyers will submit their bids for the asset available for sale after observing the verifier's ANNOUNCEMENT and whether the SELLER switched verifiers.

The outline for each trading year is as follows:

[48] The phrase 'randomly selected' is omitted in 'reputation condition' treatments

1. Asset values are one of two amounts, either \$6 or \$12. The seller will flip the first virtual coin (GREEN COIN) and find out the value of their asset for sale; ONLY THE SELLER observes the GREEN COIN flip. The seller observes the true value of their asset after the flip of the GREEN COIN.
    - The seller receives an asset whose value is either \$6 or \$12, depending upon the flip of a virtual coin (GREEN COIN). "Heads" indicates that the asset is worth \$12. "Tails" indicates that the asset is worth \$6. In other words, the probability of the seller having a HIGH value is 50%, and the probability of a LOW value is 50%.
    - The GREEN COIN flip is determined by a random number, generated by the computer. If the computer generates a random number between 0.0000000 and .500000000, the value of the seller's asset is \$6. If the random number is greater than .500000000, the value of the seller's asset is \$12. Each trading year, the seller's asset value will be determined with a different random number.

2. The seller will flip a second virtual coin (BLUE COIN) and discovers the type of the ORIGINAL automated verifier they are randomly paired with; ONLY THE SELLER observes the BLUE COIN flip (original verifiers are one of two types).

- IN MARKET CONDITION A [49]: The second virtual coin (BLUE COIN) determines whether the ORIGINAL automated verifier has a NEGATIVE or ZERO type. A "tails" indicates that the ORIGINAL verifier has a NEGATIVE type; this type of verifier ALWAYS announces the value of the seller's asset as $6. A "heads" indicates that the ORIGINAL automated verifier has a ZERO type; this type of verifier ALWAYS announces the TRUE value of the seller's asset. Only the seller will see the outcome of the BLUE COIN, and the seller OBSERVES the outcome of the blue coin BEFORE he decides whether to switch verifiers.
- IN MARKET CONDITION B [50]: The second virtual coin (BLUE COIN) determines whether the ORIGINAL automated verifier has a POSITIVE or ZERO type. A "tails" indicates that the ORIGINAL verifier has a POSITIVE type; this type of verifier ALWAYS announces the value of the seller's asset as $12. A "heads" indicates that the ORIGINAL automated verifier has a ZERO type; this type of verifier ALWAYS announces the TRUE value of the seller's asset. Only the seller will see the outcome of the BLUE COIN, and the seller

[49] The following paragraph is displayed for subjects trading in markets where firms are previously qualified, outlined as Condition A in the market description

[50] The following paragraph is displayed for subjects trading in markets where firms are previously unqualified, outlined as Condition B in the market description

OBSERVES the outcome of the blue coin BEFORE he decides whether to switch verifiers.

- The BLUE COIN flip is determined by a random number, generated by the computer. If the computer generates a random number between 0.0000000 and .500000000, the ORIGINAL verifier's type is NEGATIVE/POSITIVE[51]. If the random number is greater than .500000000, the ORIGINAL verifier's type is ZERO. Each trading year, the ORIGINAL verifier's type will be determined with a different random number.

3. The seller will DECIDE whether they would like to keep the ORIGINAL automated verifier.
   - If the seller decides to keep the ORIGINAL verifier, the verifier will ANNOUNCE the value of the seller's asset to all buyers in the market. <u>The seller does NOT get any information about the potential REPLACEMENT verifiers if they decide to keep the ORIGINAL verifier</u>

[51] The term 'NEGATIVE' or 'POSITIVE' is used based on treatment condition

4. If they decide to switch to a REPLACEMENT verifier, the seller pays a switching fee and then[52] rolls a virtual DIE; ONLY THE SELLER observes the DIE roll.

   - If the seller decides to switch to the REPLACEMENT verifier, the REPLACEMENT verifier will ANNOUNCE the value of the asset to all buyers in the market.

   - If the outcome of the virtual DIE is 1 or 2, the REPLACEMENT verifier has a NEGATIVE type; this type of verifier ALWAYS announces the value of the seller's asset as $6.
   - If the outcome of the virtual DIE is 3 or 4, the REPLACEMENT verifier has a ZERO type; this type of verifier ALWAYS announces the TRUE value of the seller's asset.
   - If the outcome of the virtual DIE roll is 5 or 6, the REPLACEMENT verifier has a POSITIVE type; this type of verifier ALWAYS announces the value of the seller's asset as $12.

   - The replacement verifier DIE roll is determined by a random number, generated by the computer. If the computer generates a random number between 0.0000000 and .333333333, the REPLACEMENT

[52] The phrase "the seller pays a switching fee and then" is omitted for subjects trading in markets where there are no explicit switch costs, outlined as 'No switch costs' in the market description

verifier's type is NEGATIVE. If the random number is between .333333333 and .666666667, the REPLACEMENT verifier's type is ZERO. If the random number is between .666666667 and .999999999, the REPLACEMENT verifier's type is POSITIVE. Each trading year, the REPLACEMENT verifier's type will be determined with a different random number

5. Buyers will bid for the seller's asset after observing the verifier's ANNOUNEMENT of the asset value and being informed whether the seller SWITCHED verifiers.
    - If the seller decided to keep the ORIGINAL verifier, buyers will be informed that NO switch was made, and they will receive the ORIGINAL verifier's ANNOUNCEMENT of the seller's asset value.
    - If the seller decided to switch to the REPLACEMENT verifier, buyers will be informed that a switch WAS made, and they will receive the REPLACEMENT verifier's ANNOUNCEMENT of the seller's asset value.

Keeping in mind that the ANNOUNCEMENT of the ORIGINAL automated verifier is randomly determined by the BLUE COIN, and automated verifiers follow an automated process, the ORIGINAL verifier COULD announce the value of the seller's asset with error.

The ORIGINAL verifier will never announce above $12 and never below $6. This is illustrated in the following diagram:

ORIGINAL type / value	HIGH value ($12)	LOW value ($6)
NEGATIVE type verifier	$6	$6
ZERO type verifier	$12	$6

ORIGINAL type / value	HIGH value ($12)	LOW value ($6)
POSITIVE type verifier	$12	$12
ZERO type verifier	$12	$6

[53]

After the seller observes the flip of the GREEN COIN, which determines the value of the seller's asset, and the flip of the BLUE COIN, which determines the type of ORIGINAL verifier, the seller decides whether to retain the ORIGINAL verifier or switch to a REPLACEMENT verifier for the ANNOUNCEMENT of the seller's asset.

If the seller chooses to switch to a REPLACEMENT verifier, they will pay a switch fee of $3, and[54] a virtual DIE will be rolled. The roll of the DIE will determine the type of the REPLACEMENT verifier. The seller does NOT know the REPLACEMENT verifier's type before he decides whether to keep his ORIGINAL verifier or to switch to a REPLACEMENT verifier. If the seller decides to switch to the REPLACEMENT

[53] The displayed diagram is dependent on experimental condition. In Condition A, the first diagram is displayed. In Condition B, the second diagram is displayed.

[54] The phrase "they will pay a switch fee of $3 and" is displayed dependent on treatment condition.

verifier, his decision is made before the DIE is rolled, and the decision is FINAL. The switch fee of $3 is subtracted from the SELLER'S profit in that round.[55]

The REPLACEMENT verifier will never announce above $12 and will never announce below $6. This is illustrated in the following diagram:

REPLACEMENT type / value	HIGH value ($12)	LOW value ($6)
NEGATIVE type verifier	$6	$6
ZERO type verifier	$12	$6
POSITIVE type verifier	$12	$12

After the REPLACEMENT verifier's type is determined, or the ORIGINAL verifier is kept, the automated verifier will ANNOUNCE a value of the seller's asset to all buyers. Remember, verifier type will be known by the seller if the ORIGINAL verifier is retained. The seller also knows the value of his asset, and thus he knows the value the FIRST verifier will ANNOUNCE to buyers. However, the seller will NOT know the type of the REPLACEMENT VERIFIER before the REPLACEMENT verifier is selected; as described above the REPLACEMENT verifier has a type that has a chance of being NEGATIVE (1/3), ZERO (1/3), and POSITIVE (1/3).

In addition to the switch fee of $3[56], if the verifier's ANNOUNCEMENT of the seller's asset value is GREATER THAN the true value, then the SELLER will pay a PENALTY

[55] The sentence "The switch fee of $3 is subtracted from the SELLER'S profit in that round" is displayed dependent on treatment condition.

of $2.67. If the ANNOUNCED value is less than the true value of the seller's asset, no penalty is paid. This PENALTY is subtracted from the SELLER'S profit in that round.

After the ORIGINAL (if kept) or REPLACEMENT (if switched) verifier's announcement, the buyers in the market will bid for the asset in an auction. Buyers enter the amount they would be willing to pay for each seller's asset on their computer screens, after observing whether the seller retains or switches verifiers and the verifier's ANNOUNCEMENT. The buyer with the highest bid purchases the asset and receives the TRUE asset value, less their bid.

The current trading year will then end, and profit will be calculated for buyers and the seller. Once profits are displayed to the seller and winning bidders, another trading year will begin following the same format.

There will be at least 20 trading years in this experiment with certainty. At the end of trading year 20, there is a 20% chance that trading year 21 will be the last year. If trading year 21 is NOT the last year, the experiment will continue on an additional trading year. There is a 20% chance that trading year 22 will be the last trading year. Thus, after 20 trading years, each additional trading year has a 20% chance of being the last. If the experiment lasts more than three hours, the probability of the next trading year being the last becomes 90%.

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[56] The phrase "In addition to the switch fee of $3" is displayed dependent on treatment condition.

EXPERIMENTAL PROCEDURES

In a moment, you will be logged into the computer and given your assignment for the duration of the experiment: that of a ‘buyer’ or a ‘seller’. This assignment will not change through the course of the experiment.

The computer will then demonstrate how it calculates random numbers to determine the seller’s asset value and verifier type. This step is outlined in further detail on the last page of the instructions.

After ALL participants have finished the random number sample program, you will receive an announcement on your computer screen that the eight trial trading years will be conducted. Participants in the trial trading years will not accrue profits or losses. These trial trading years are designed to make you familiar with the computer program and the choices to be made.

After the eight trial periods are completed, an announcement will appear notifying you that the actual experiment is ready to begin. Once you have been notified that the experiment has begun, you will be able to earn more money, based on the decisions made in the experiment.

Participants are GUARANTEED to earn at least $10 US in the form of a participation fee mentioned above. Your decisions in the experiment can give you the opportunity to earn more money, depending on the decisions you make. There is a possibility of not earning any more money in the experiment, or even 'losing' money in the experiment in some trading years. However, the $10 participation fee will be yours to keep, no matter what happens in the experiment.

If, during the course of the experiment, you accrue excessively large losses, you may be asked to leave the experiment. The experiment will continue without you, but you will be paid the $10 US show-up fee if you are excused from the experiment.

Experimental dollars are different from U.S. dollars. Experimental dollars will be subject to an exchange rate which will be positive. So, at the end of the experiment, if you have positive experimental dollars, it will be exchanged to U.S. dollars. If you have negative experimental dollars, no money will be subtracted from the participation fee of $10 US. The exchange rate will be as follows:

SELLERS : One experimental dollar will be transformed into 3.5 cents / 14 cents in U.S. dollars ($0.035) / ($0.14) [57]

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[57] The exchange rate is varied dependent on treatment condition. In a 'reputation' condition, the exchange rate is set at 3.5 cents; the expected exchange rate is multiplied by four in the 'no reputation' condition, to equate subject payments across condition (3.5 cents multiplied by four equals 14 cents).

BUYERS : One experimental dollar will be transformed into 5 cents in U.S. dollars ($0.05). The buyers' $200 experimental dollar endowment will be transformed in the same manner.

By participating in this experiment, you will be required to submit your legal name and social security number, per The University of Arizona policy on Subject payments. Also, by participating in this experiment, you are receiving NO OTHER COMPENSATION other than what will be paid in U.S. dollars at the end of the experiment.

– Random number test –

At the beginning of today's experiment, you will have the opportunity to observe how the computer creates random numbers to determine the value of Sellers' assets and Verifiers' type. The random number generated will be between 0 and 1, and is expressed in decimal form, such as .356430285 or .953023000

It is important to note that EACH random number is created <u>independently</u>; one random number does NOT depend on the value of another. For example, the computer could come up with a random number of .332322111 for one seller, and the random number of .332355111 for another seller. Similarly, it is mathematically possible that the random number generator could give three or four random numbers in a row that are all below .500000000; the computer does not have a 'memory' of which number was last generated. The computer is not 'due' to give out a random number within any given range.

The random number generation for the value of EACH seller's asset occurs as follows:

- If the computer generates a random number between 0.0000000 and .500000000, the value of the seller's asset is \$6. If the random number is greater than .500000000, the value of the seller's asset is \$12. Each trading year, the seller's asset value will be determined with a different random number.

The random number generation for the type of the ORIGINAL verifier occurs as follows:

- If the computer generates a random number between 0.0000000 and .500000000, the ORIGINAL verifier's type is NEGATIVE/POSITIVE[58]. If the random number is greater than .500000000, the ORIGINAL verifier's type is ZERO. Each trading year, the ORIGINAL verifier's type will be determined with a different random number.

The random number generation for the type of the REPLACEMENT verifier occurs as follows:

- If the computer generates a random number between 0.0000000 and .333333333, the REPLACEMENT verifier's type is NEGATIVE. If the random number is between .333333333 and .666666667, the REPLACEMENT verifier's type is

[58] The phrase "NEGATIVE/POSITIVE" is displayed dependent on treatment condition

ZERO. If the random number is between .666666667 and .999999999, the REPLACEMENT verifier's type is POSITIVE. Each trading year, the REPLACEMENT verifier's type will be determined with a different random number.

You may want to keep this handy while you practice with the random number generator program.

Figure 1 – Matrices of treatments and predictions

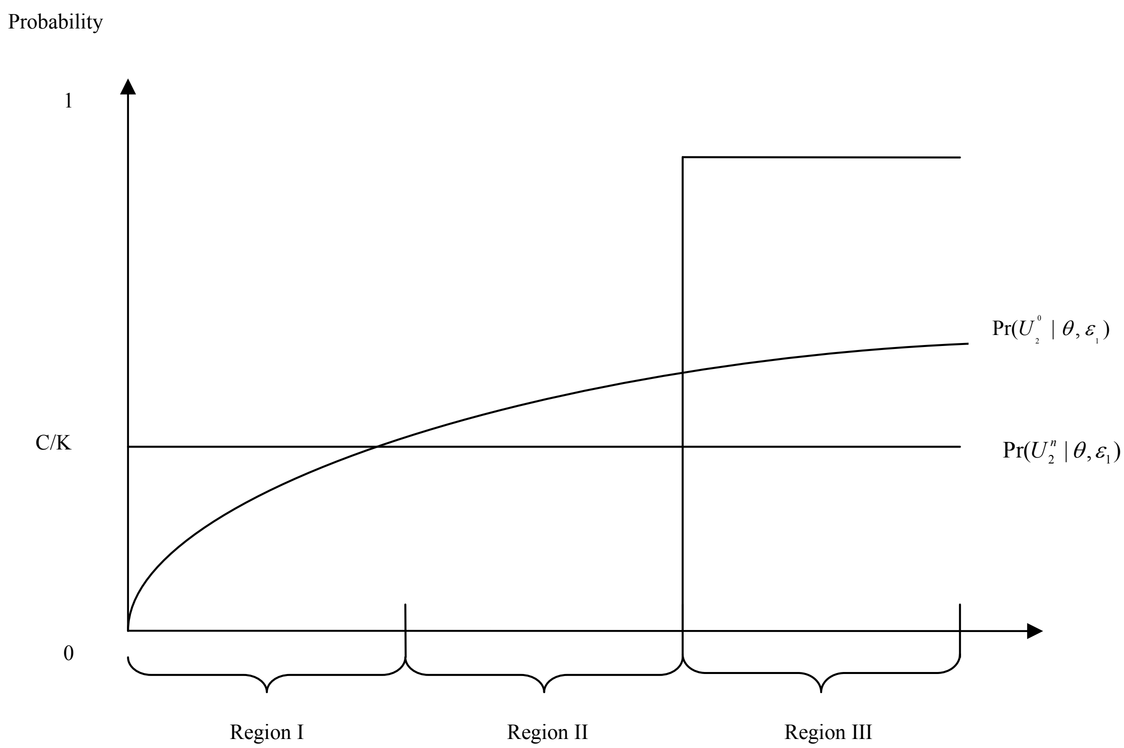
Condition A

	Reputation	No reputation
Switch cost	No change to Teoh's predictions	Testing Teoh
No switch costs	Improving Teoh's predictions	Testing Teoh

Condition B

	Reputation	No reputation
Switch cost	Opportunisitc retentions not covered in Teoh	Opportunisitc retentions not covered in Teoh
No switch costs	Improving Teoh's predictions	Opportunisitc retentions not covered in Teoh

Figure 2 – Equilibrium seller switching and retention, adapted from Teoh (1992)



Where:

C	cost of switching
K	qualification cost
U_t^i	unqualified (or clean) opinion from auditor *i* at time *t*
Θ_1	auditor opinion (either *U* or *Q*) at the end of period 1
ε	auditor's assessment error of the firm

Table 4 - Summary of treatments

Panel A - Sessions and markets by experimental condition and treatment

Condition A

	Reputation	
Switch costs	Yes	No
Yes	2 sessions; 76 markets	2 sessions; 72 markets
No	2 sessions; 73 markets	2 sessions; 76 markets

Condition B

	Reputation	
Switch costs	Yes	No
Yes	2 sessions; 79 markets	2 sessions; 68 markets
No	2 sessions; 74 markets	2 sessions; 76 markets

Panel B - Independent subjects by experimental condition and treatment

Condition A

	Reputation	
Switch costs	Yes	No
Yes	2 sessions; 2 sellers, 8 buyers	2 sessions; 8 sellers, 8 buyers
No	2 sessions; 2 sellers, 8 buyers	2 sessions; 8 sellers, 8 buyers

Condition B

	Reputation	
Switch costs	Yes	No
Yes	2 sessions; 2 sellers, 8 buyers	2 sessions; 8 sellers, 8 buyers
No	2 sessions; 2 sellers, 8 buyers	2 sessions; 8 sellers, 8 buyers

Panel C - Average subject payment by experimental condition and treatment

Condition A

	Reputation	
Switch costs	Yes	No
Yes	$ 20.20	$ 20.13
No	$ 20.13	$ 20.56

Condition B

	Reputation	
Switch costs	Yes	No
Yes	$ 20.20	$ 19.50
No	$ 20.20	$ 20.63

Minimum subject payment	$ 18.00
Maximum subject payment	$ 24.00
Average subject payment	$ 20.19
Total cash paid	$ 2,331.00

Table 5 - Summary statistics - Sellers' decision making for all sessions

Panel A - Condition A

Session description	Session #	Rounds	High value	Low value	Retention	Good news retention	Bad news retention	Switch	Good news switch	Opinion shopping switch	Irrational switch
No switch costs, no reputation	1a	36	21	15	25	25	0	11	7	4	0
	1b	40	21	19	18	18	0	22	8	13	1
Total		**76**	**42**	**34**	**43**	**43**	**0**	**33**	**15**	**17**	**1**
No switch costs, reputation	2a	35	11	24	11	11	0	24	6	18	0
	2b	38	23	15	18	18	0	20	6	13	1
Total		**73**	**34**	**39**	**29**	**29**	**0**	**44**	**12**	**31**	**1**
Switch costs, no reputation	3a	40	21	19	25	25	0	15	12	3	0
	3b	32	18	14	27	27	0	5	5	0	0
Total		**72**	**39**	**33**	**52**	**52**	**0**	**20**	**17**	**3**	**0**
Switch costs, reputation	4a	36	18	18	25	25	0	11	9	2	0
	4b	43	23	20	35	35	0	8	8	0	0
Total		**79**	**41**	**38**	**60**	**60**	**0**	**19**	**17**	**2**	**0**

Table 5 - Summary statistics - Sellers' decision making for all sessions

Panel B - Condition B

Session description	Session #	Rounds	High value	Low value	Retention	Good news retention	Bad news retention	Switch	Good news switch	Opinion shopping switch	Irrational switch
No switch costs, no reputation	5a	36	21	15	27	20	7	9	2	6	1
	5b	40	17	23	26	13	13	14	5	5	4
Total		**76**	**38**	**38**	**53**	**33**	**20**	**23**	**7**	**11**	**5**
No switch costs, reputation	6a	36	17	19	27	20	7	9	2	7	0
	6b	38	19	19	29	23	6	9	6	2	1
Total		**74**	**36**	**38**	**56**	**43**	**13**	**18**	**8**	**9**	**1**
Switch costs, no reputation	7a	**36**	**17**	**19**	**30**	**25**	**5**	**6**	**3**	**3**	**0**
	7b	38	19	19	29	23	6	9	6	2	1
Total		**74**	**36**	**38**	**59**	**48**	**11**	**15**	**9**	**5**	**1**
Switch costs, reputation	8a	40	22	18	36	29	7	4	0	3	1
	8b	39	22	17	27	18	9	12	2	3	7
Total		**79**	**44**	**35**	**63**	**47**	**16**	**16**	**2**	**6**	**8**

Table 6 - Summary statistics - Buyers' decision making for all sessions

Panel A - Condition A

Session description	Session #	Rounds	Retain 12 n	Mean (Median)	Retain 6 n	Mean (Median)	Switch 12 n	Mean (Median)	Switch 6 n	Mean (Median)
No switch costs, no reputation	1a	36	13	8.44 (8.5)	12	6 (6)	6	7.13 (7.25)	5	6.65 (6)
	1b	40	12	9.29 (11)	6	4.38 (5)	8	7.31 (7.5)	14	4.88 (5)
Total		**76**	**25**	**8.85 (9)**	**18**	**5.46 (5.75)**	**14**	**7.23 (7.38)**	**19**	**5.34 (5.25)**
No switch costs, reputation	2a	35	4	10.13 (11)	7	6.29 (6.5)	9	10.22 (10.5)	15	6.5 (6)
	2b	38	11	10.18 (11)	7	5.64 (5.5)	8	7.88 (7.5)	12	6.73 (6.5)
Total		**73**	**15**	**10.2 (10)**	**14**	**5.96 (6)**	**17**	**9.12 (9.25)**	**27**	**6.6 (6.75)**
Switch costs, no reputation	3a	40	9	10.33 (11)	16	4.97 (5)	10	8.98 (9.5)	5	7.8 (7)
	3b	32	11	10.36 (11)	16	6.16 (6)	3	10.67 (11)	2	7.63 (7.5)
Total		**72**	**20**	**10.3 (10.5)**	**32**	**5.56 (5.13)**	**13**	**9.37 (9.25)**	**7**	**7.75 (7.25)**
Switch costs, reputation	4a	36	9	10.47 (11)	16	5.33 (5.25)	6	8.08 (9)	5	7.75 (8.5)
	4b	43	14	10.91 (11)	21	6.08 (6)	4	9.75 (10.5)	4	9.13 (9.5)
Total		**79**	**23**	**10.7 (11)**	**37**	**5.76 (5.75)**	**10**	**8.75 (9.25)**	**9**	**8.36 (8.25)**

Table 6 - Summary statistics - Buyers' decision making for all sessions

Panel B - Condition B

Session description	Session #	Rounds	Retain 12 n	Mean (Median)	Retain 6 n	Mean (Median)	Switch 12 n	Mean (Median)	Switch 6 n	Mean (Median)
No switch costs, no reputation	5a	36	25	8.46 (8.5)	2	5.5 (5.25)	2	7.65 (7.25)	7	6.21 (6.5)
	5b	40	22	9.57 (11)	4	5.38 (5.5)	6	6.5 (5.25)	8	6.56 (6.25)
Total		**76**	**47**	**8.98 (9.25)**	**6**	**5.42 (5.5)**	**8**	**6.78 (6.75)**	**15**	**6.4 (6.5)**
No switch costs, reputation	6a	36	24	9.32 (10.5)	3	5.58 (5.5)	3	7.5 (7)	6	6.13 (6)
	6b	38	24	9.63 (11)	5	6.15 (6.5)	4	6.5 (6.5)	5	6.1 (6.5)
Total		**74**	**48**	**9.47 (9.63)**	**8**	**5.94 (5.88)**	**7**	**6.93 (6.75)**	**11**	**6.11 (6.25)**
Switch costs, no reputation	7a	36	22	8.94 (9.5)	8	5.44 (5)	4	7.56 (8.5)	2	6.75 (6.75)
	7b	32	19	8.22 (8)	5	5.9 (6)	3	6 (5)	5	7.1 (6.7)
Total		**68**	**41**	**8.61 (8.75)**	**13**	**5.62 (5.5)**	**7**	**6.89 (7)**	**7**	**7 (6.75)**
Switch costs, reputation	8a	40	28	9 (9.5)	8	5.97 (5.5)	3	7.83 (8.17)	1	6 (5)
	8b	39	24	8.02 (8.55)	3	5.08 (5)	3	7.08 (7)	9	6.19 (6)
Total		**79**	**52**	**8.55 (8.5)**	**11**	**5.73 (5.75)**	**6**	**7.46 (7.38)**	**10**	**6.17 (6.13)**

Table 7 - Seller strategies

Panel A - Condition A

Session description	Session #	Retentions	Good news retentions	Bad news retentions	Switches	Good news switches	Opinion shopping	Irrational switches
No switch costs, no reputation	1a	25	100.00%	0.00%	11	63.64%	36.36%	0.00%
	1b	18	100.00%	0.00%	22	36.36%	59.09%	4.55%
Total		**43**	**100.00%**	**0.00%**	**33**	**45.45%**	**51.52%**	**3.03%**
No switch costs, reputation	2a	11	100.00%	0.00%	24	25.00%	75.00%	0.00%
	2b	18	100.00%	0.00%	20	30.00%	65.00%	5.00%
Total		**29**	**100.00%**	**0.00%**	**44**	**37.29%**	**61.02%**	**1.69%**
Switch costs, no reputation	3a	25	100.00%	0.00%	15	80.00%	20.00%	0.00%
	3b	27	100.00%	0.00%	5	100.00%	0.00%	0.00%
Total		**52**	**100.00%**	**0.00%**	**20**	**85.00%**	**15.00%**	**0.00%**
Switch costs, reputation	4a	25	100.00%	0.00%	11	81.82%	18.18%	0.00%
	4b	35	100.00%	0.00%	8	100.00%	0.00%	0.00%
Total		**60**	**100.00%**	**0.00%**	**19**	**89.47%**	**10.53%**	**0.00%**

Table 7 - Seller strategies

Panel B - Condition B

Session description	Session #	Retentions	Good news retentions	Bad news retentions	Switches	Good news switches	Opinion shopping	Irrational switches
No switch costs, no reputation	5a	27	74.04%	25.93%	9	22.22%	66.67%	11.11%
	5b	26	50.00%	50.00%	14	35.71%	35.71%	28.57%
Total		**53**	**62.26%**	**37.74%**	**23**	**47.83%**	**30.43%**	**21.74%**
No switch costs, reputation	6a	27	74.07%	25.93%	9	22.22%	77.78%	0.00%
	6b	29	79.31%	20.69%	9	66.67%	22.22%	11.11%
Total		**56**	**79.76%**	**23.31%**	**18**	**44.44%**	**50.00%**	**5.56%**
Switch costs, no reputation	7a	30	83.33%	16.67%	6	50.00%	50.00%	0.00%
	7b	24	79.17%	20.83%	8	62.50%	37.50%	0.00%
Total		**54**	**81.48%**	**18.52%**	**14**	**57.14%**	**42.86%**	**0.00%**
Switch costs, reputation	8a	36	80.56%	19.44%	4	0.00%	75.00%	25.00%
	8b	27	66.67%	33.33%	12	16.67%	25.00%	58.33%
Total		**63**	**74.60%**	**25.40%**	**16**	**12.50%**	**37.50%**	**50.00%**

Table 8 - Buyer Strategies

Student's T test for differences in reports. *P value represents two-tailed test results of the hypothesis of no difference between comparable treatments*

Report	Market description Condition A No switch costs No reputation = reputation (Sessions 1 = Sessions 2)	Condition A Switch costs No reputation = reputation (Sessions 3 = Sessions 4)	Condition B No switch costs No reputation = reputation (Sessions 5 = Sessions 6)	Condition B Switch costs No reputation = reputation (Sessions 7 = Sessions 8)
Retain - 12	t= -3.63 0.0008	t= -2.42 0.02	t= -2.49 0.015	t= 0.309 0.76
Retain - 6	t= -1.75 0.09	t=-0.955 0.34	t= -2.33 0.038	t=-0.488 0.63
Switch - 12	t= -3.91 0.0005	t= 1.02 0.32	t=-0.264 0.8	t= -1.05 0.32
Switch - 6	t= -5.75 0.0001	t= -1.09 0.29	t= 1.13 0.27	t= 2.70 0.016

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