Consequences of auditor reputation loss: Market reaction, audit fees, auditor change and audit quality in the case of Satyam Ltd. and PriceWaterhouseCoopers India

By Sati P Bandyopadhyay, Ranjini Jha and Kaustav Sen

In this paper we examine the share price effects, auditor switch frequencies, and audit fee and audit quality changes consequent to the loss of PricewaterhouseCoopers' (PwC) reputation as an auditor, when Indian authorities arrested two of its audit partners in charge of the audit of Satyam Ltd., a large Indian Information Technology (IT) company. We find that PwC's non-Satyam clients suffered significant negative returns in the aftermath of the arrest. Moreover, the adverse share price effects were sharper for other (non-Satyam) IT clients of PwC and also clients with high levels of promoters' control, reflecting enhanced expected agency costs for these firms. There was also an exodus of PwC clients to other Big 4 and non-Big 4 auditors in the following two years, with PwC's non-Satyam IT clients exhibiting a greater frequency of auditor switches as compared to their clients in other industries. However, those firms that continued to engage PwC as their auditor over the next two years (i.e., 2009 and 2010) received significant audit fee discounts. PwC clients that received fee discounts suffered a decline in audit quality in 2009 and 2010, relative to other Big 4 clients, consistent with PwC "low balling" its clients to arrest a rapidly shrinking market share, and probably unable to garner enough resources to deliver them their 2008 level of audit quality.

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1. Introduction

The resignation and arrest of Mr. B. Ramalinga Raju, the majority shareholder and CEO of Satyam Ltd., a large Indian Information Technology (IT) outsourcing firm, in January 2009 on fraud charges and the subsequent arrest of the two audit partners of the Indian subsidiary of PricewaterhouseCoopers (henceforth PwC) in charge of its audit, sent shockwaves through the corporate sector in India.[1] [2] In this paper, we document a decline of non-Satyam PwC clients' share prices of 1.12 percent surrounding the arrest date, and a drop in PwC's share of the Indian audit market for listed firms over the next two years, as well. For example, the total market value of PwC clients' reflected 18% of Bombay Stock Exchange (BSE) market capitalization in 2008. This share fell to 15% in 2008 and then to 11% in 2010. In fact, the share of all Big 4 clients' in BSE market capitalization fell from 51% to 48% over this period. However, PwC appears to have provided its continuing clients with audit fee discounts in 2009 and 2010, which was not available to other Big 4 clients. We also find that audit quality of these PwC continuing clients suffered significantly.

In this paper, we examine the details of the foregoing adverse outcomes (price effects, market share effects and audit fee and audit quality effects) that are attributable to the loss of PwC's reputation in the Indian audit market arising from the arrest of its two audit partners. We also attempt to identify factors that appear to explain their cross sectional variation.

Our predictions about the cross sectional variations in the adverse consequences faced by PwC and its clients are based on the notion that auditors play a monitoring role in mitigating conflicts of interests between manager and shareholders and other stakeholders such as lenders (Watts and Zimmerman 1986, Jensen and Meckling 1976). Auditing enhances credibility of financial statements prepared by managers and tends to reduce agency costs arising from potential moral hazard problems. However, the quality of audits is not readily observable to outside observers and is inferred from the reputation of the auditor for impartiality and its independence from its clients. The assurance value of the audit is thus directly related to the reputation of the auditor" (Nelson, Price and Rountree, 2008). The better the reputation of the auditor, the greater the magnitude of its quasi rents associated with its existing clients and the higher the incentives of the auditors to maintain high level of audit quality (DeAngelo 1981). Conversely, any event that might be perceived as having jeopardized auditors' impartiality and independence is likely to be viewed negatively by market participants. We view the arrest of the two PwC partners on fraud charges as an example of such loss of reputation.

However, auditing is only one of several monitoring mechanisms that are available for the mitigation of agency conflicts. For example, a strong board could provide an alternative monitoring mechanism over the firm if the auditor reputation is jeopardized. If other modes of monitoring are available, the demand for auditing is likely to be less critical and the adverse

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[1] The sequence of events surrounding this scandal is provided in Appendix 1

[2] The Satyam affair was widely discussed both in the Indian and the international press at that time. Several business schools in North America prepared case studies on Satyam for MBA class discussions.

consequences from a perceived audit failure as described above, are likely less severe. Conversely, when agency conflicts facing firms are powerful, the foregoing negative effects are likely accentuated (Jensen and Meckling 1976). In this paper, we examine the mitigating role, if any, of promoter-entrepreneurs, board expertise, foreign equity holdings and affiliation of client firms with large Indian Business Groups. Consistent with Weber, Willenborg and Zhang (2008) and others, our predictions are based on the monitoring hypothesis. An alternative to the monitoring hypothesis is the insurance hypothesis. For example, Menon and Williams (1994) suggested that their findings that LH clients suffered decline in share prices when it went bankrupt is consistent with the *insurance hypothesis*, which states that auditors provide insurance to client firms' shareholders against the adverse effects of potentially misstated financial statements because large international audit companies have "deep pockets". However, ground realties in India likely do not provide a strong foundation for the insurance hypothesis. Litigation activities by shareholders against auditors to recover investment losses are extremely rare. Consequently, it is more meaningful to test the implications of the monitoring hypothesis in the Indian audit market. [3]

The findings from our paper suggest that PwC's IT service clients suffer significantly higher negative returns during the event period and they changed their auditor more often than clients in other industries. Some of the auditor change frequencies by PwC clients are quite astounding. For example, in 2010, about a quarter of PwC clients switched to other Big 4 and non-Big 4 auditors, which is approximately 10 times more frequent than auditor switches by Other Big 4 clients (about 2.7%) that year. Interestingly, those PwC clients who continued to be audited by PwC in 2009 and 2010 appear to enjoy audit fee discounts relative to their 2008 amounts, as compared to audit fees charged by Other Big 4 firms for their continuing clients. Moreover, PwC clients who received audit fee discounts in 2009 and 2010 also appear to have recognized more income increasing accounts receivable accruals over the next two years consistent with lower audit quality.

This study makes a number of contributions. While the Satyam episode had received wide publicity in the financial press, there has not been any systematic study of its negative effects on the economy at large. This study fills this void. Secondly, our study provides indirect evidence of the effectiveness of conventional devices for monitoring management decisions in India. Khanna and Palepu (2004) point out that "corporate governance has not been, historically, a first order concern (in India)."[4] This contrasts with the extensive research evidence from developed economies that quality of corporate governance acts as an effective deterrent to managers intending to undertake negative net present value projects, such as "empire building" or enjoying 'excessive perquisites". In the absence of credible corporate governance, audits by Big N audit firms provide an important monitoring role in emerging economies. For example, Fan and Wong (2005) show that Big N audits play an important monitoring role in emerging economies as an effective mechanism in assuring the credibility of accounting information. Consequently, these audit firms mitigate potential agency conflicts that might exist between entrepreneurs/managers and external shareholders. But what happens when the reputation of a Big N audit firm is severely

[3] The insurance hypothesis cannot be altogether ruled out since a number of Big 4 clients have significant foreign holdings especially US holdings. US shareholders of Indian firms can and do file suits against their auditors in US courts especially if the audit firm is one of the Big 4. A number of Big 4 Indian clients are also listed on US stock exchanges as ADRs and GDRs. The insurance hypothesis might well be applicable for the holders of these securities. In order to provide a cleaner test of the monitoring hypothesis, we replicate our Indian stock returns tests on a sample of Big 4 clients that exclude those that have ADRs and GDRs. The results remain substantially the same.

[4] Khanna and Palepu (2004) point out that information technology firms are probably an exception because they had to compete globally to acquire market share.

tarnished, so that the credibility of financial reports is in jeopardy? Our study shows that when a Big 4 audit has lost some credibility because of lost audit reputation, other alternative monitoring mechanisms do not appear to be effective in reducing agency problems in emerging economies.

We also contribute by providing some evidence that is consistent with PwC "low balling" (DeAngelo 1981) its clients in 2009 and 2010, in order to maintain its market share in the face of rapidly dwindling number of clients after the arrest event, particularly because PwC clients' audit fee declines were associated with lower audit quality. If PwC set its audit fees too low to stem the flight of clients, they were probably unable to garner enough resources in 2009 and 2010 to deliver to its clients their 2008 level of audit quality. On the contrary, average audit fees of other Big 4 clients were slightly higher than their 2008 levels and they were not associated with audit quality anyway.

Finally, our paper adds to small corpus of research that examine the consequences of similar examples of loss of auditor reputation that have taken place in Germany (KMPG), Japan (ChuoAoyama, which is PwC's Japanese affiliate) and USA (Arthur Andersen). Our paper contributes by providing additional evidence of the high value that the market places on perceptions of Big 4 auditor reputation of independence from its clients and the far-reaching implication of events that adversely affect such perceptions.

There are a few important caveats. The sample size is 395 firms and this could raise concerns about the power of the empirical tests. Second, many of our significant results are in respect of PwC's IT industry clients. This has implications for the generalizability of our conclusions.

The rest of the paper is organized as follows. Section 2 discusses hypotheses development; section 3 provides research design; section 4 provides a discussion of the results; section 5 concludes the paper.

2. Literature Review

A number of authors have examined the effects of catastrophic events that have afflicted large audit firms on loss of audit market share, negative share price impact on their audit clients around event dates, and determinants of cross-sectional differences in these adverse outcomes. Predictions of negative returns of audit clients and loss of audit firms' market shares surrounding audit firms' "bad news" events based on two competing theories of audit quality, namely, the insurance hypothesis and the monitoring hypothesis. The insurance hypothesis holds that auditors provide insurance to client firms' shareholders against the adverse effects of potentially misstated financial statements because large international audit companies have "deep pockets". This insurance protection is a part of the client firms' share price (Menon and Williams 1994). Thus, reputed auditors provide high quality audits in order to save on expected litigation costs arising from potential shareholder court action to recover investment losses. Menon and Williams (1994) and Baber, Kumar and Verghese (1995), claim that their results, namely that event day returns are more negative for loss-making and financially distressed clients, support the insurance rather than the monitoring hypothesis. Menon and Williams (1994) argue that when Laventhol and Horwath (LH) filed for bankruptcy, the ability of shareholders of client firms to recover their investment losses from the auditor was significantly restricted. [5] LH's client firms thus lost value. Auditors have incentives to provide high quality audits in order to save on expected litigation costs arising from shareholders suing them in court for potential audit failures. While Baber et al. (1995)

[5] At the time of bankruptcy, LH was the ninth largest audit firm in the world in terms of fee revenues.

report similar evidence of LH's client firms experiencing negative returns, they were unable to find evidence that discriminated between the insurance hypotheses and the monitoring hypothesis

A number of papers have examined Arthur Andersen's (AA) non-Enron clients' share price effects at the time of the Enron episode. For example, Chaney and Philipich (2002) and Krishnamurthy, Zhou and Zhou (2006) found that share prices of non-Enron AA clients declined at the time of Enron-related document shredding episode and when AA was indicted on fraud charges by the US government, respectively. Both studies attributed the share price effects as reflecting loss of auditor quality arising from these disclosures that increased the probability that financial statements audited by AA might have overstated the true value of (non-Enron) clients' assets and revenues. Variations in share price declines reported in these papers were related to industry memberships of the audit clients and audit independence measures such as the proportion of total fees that were consulting fees. However it is unlikely that Indian audit markets provide an appropriate setting for testing the insurance hypothesis. Litigation activities by shareholders against auditors to recover investment losses are extremely rare. Consequently, it is more meaningful to test the implications of the monitoring hypothesis in the Indian audit market.

Consistent with the monitoring hypothesis, Skinner and Srinivasan (2012) find that audit clients of ChuoAoyama (PwC's Japanese affiliate and one of Japan's largest audit firms) suffered negative returns in 2006 when they were suspended by the Japanese Financial Services Agency for their involvement in the failed audit of Kanebo, a large Japanese company. These authors attribute the negative impact to the loss of auditor reputation and auditor quality, which reduced the credibility of financial statements audited by them. ChuoAoyama also lost considerable market share in the Japanese audit market, which was most conspicuous among larger sized Japanese clients and clients with high growth options. Similarly, Weber et al. (2008) find evidence of the audit clients of KMPG's German affiliate suffering share price decline when it became known that their auditor was implicated in an accounting scandal involving ComROAD AG, a German public company.[6] KPMG also lost a number of clients in Germany as a result. The negative stock price effects and loss of audit market share effects appeared to be restricted to smaller KPMG (non-ComROAD) clients and clients that faced greater monitoring demand. Most of these papers invoked the monitoring hypothesis rather than the insurance hypothesis to derive predictions.

Chaney and Philipich (2002) argue that their findings, namely that AA's Houston non-Enron clients suffered more than other clients, are consistent with the monitoring hypothesis. Krishnamurthy et al. (2008) claim that their evidence of negative event period returns of clients, in respect of whom AA's independence is suspect, is also consistent with the monitoring hypothesis. So are Weber et al.'s (2008) results of greater negative returns of KPMG Germany's smaller and financially distressed and more complex clients. Weber et al (2008) view their paper as a test of the monitoring hypothesis because German audit regulations provide auditors protection against legal liability, implying that the insurance hypothesis is not very meaningful.

3. Hypotheses Development.

[6] The case of Germany's KPMG affiliate is in many ways similar to that of the Indian PwC affiliate examined in this paper because of certain similarities between these two countries. For example, litigations against auditors are few in Germany, as in India, and both countries provide auditors some protection against shareholder lawsuits.

Agency relationships cause managers to voluntarily subject their firms to high quality monitoring to persuade potential shareholders not to take price protection against managers potentially undertaking negative net present value projects such as using excessive perquisites (Jensen and Meckling 1976). One form of monitoring is the provision of high quality audits that provide assurance that a firm's financial statements are not materially misstated and its assets and revenues are not overstated. However, the quality of audits is not observable and is inferred to a large extent from the reputation of the auditor. The greater the reputation of the auditor, the greater the magnitude of its quasi rents associated with its existing clients.

In this paper we examine a number of outcomes arising from the PwC arrest event, namely, share price declines of non-Satyam PwC clients around the arrest event, change of auditors away from PwC in the aftermath of the arrest, audit fee discounts provided to PwC's continuing clients and decline in audit quality among PwC clients who received fee discounts during the 2009 and 2010 period.

3.1 Predictions about share prices of client firms

Fan and Wong (2005) show that Big N audit firms play an important monitoring role in emerging economies in assuring the credibility of accounting information and thereby mediating potential agency conflicts that might exist between entrepreneurs and external shareholders. However, the quality of their audits is not observable and is inferred from auditors' reputation of their independence from their clients. PwC India likely lost some of that reputation with the arrest of two of their partners in connection with the Satyam episode. Outside shareholders of other (i.e., non-Satyam) PwC clients likely revised upward the probability of misstatement of financial statements that might have overstated firm assets and revenues, as compared to the shareholders of other Big 4 audit client. This would result in market participants revising downwards the future expected incomes of other PwC clients, leading to the hypothesis that their stocks earned negative abnormal returns after the arrest date. This leads to the hypothesis that non-Satyam clients of PwC India exhibit larger negative abnormal returns after the arrest event period, as compared to other Big 4 client firms.

3.1.1 Factors moderating share price effects surrounding the arrest event.

Corporate Governance

High quality corporate governance is one factor that could mitigate the adverse effect of PwC's reputation loss on a client firm's share prices (Beasley, Carcello, Hermanson, and Lapides, 2000). We measure corporate governance quality by the expertise of board members derived from serving on other corporate boards. The existence of a high quality board of director likely mitigates some of the adverse effects of the loss of reputation by an incumbent auditor. Thus, we hypothesize that PwC client firms with an expert board will suffer smaller share price decline compared to other firms.

Business Group affiliation of client firms

One factor that could influence the quality of managerial decision-making in India is whether the client firm is a member of a business group that exercises decision control over affiliated firms. There is ongoing debate whether affiliation to a business group has beneficial effects on the value of outside shareholdings, especially in emerging economies such as India. The conventional view about concentrated ownership is that agency problems between inside managers and outside

shareholders diminish as managerial shareholdings increase, leading to incentive alignment (Jensen and Meckling 1976).

In the Indian context, Khanna and Palepu (2000) and Khanna and Yafeh (2005) argue that in fact, affiliation to a business group facilitates risk sharing in an environment that has weakly developed economic institutions, and provide easier access to scarce resources. Other authors point to the adverse effects of potential conflicts between entrenched ownership and minority shareholders (e.g.,Young et al. 2008, Morck et al. 2005). Entrenched owners of business groups have incentives to act for the controlling group and not for shareholders, engage in non-arms-length transactions such as tunneling and undertake other dysfunctional behavior (Morck and Yeung 2003). Empirically, there is evidence (Jian and Wong, 2004, and Liu and Lu, 2004) that business groups in some emerging economies smooth income and shift cash flows across affiliates (tunneling) that could have an adverse effect on outside shareholders' welfare. Sarkar, Sarkar and Sen (2008) show that higher level of insider control in business group affiliates is associated with larger discretionary accruals indicative of opportunistic earnings management.

However, this paper deals with the effects of PwC's loss of reputation on client firms. Khanna and Yafeh (2007) suggest that business groups with affiliates can make up for under-developed institutions, thereby reducing transaction costs. In particular, business groups create 'internal capital markets' so that affiliated firms can bail each other out during financial distress (see Gopalan, Nanda and Seru 2007). We believe that in this framework, business groups would exercise tight control over the affairs of their affiliates. Thus, the capital market might view the effects of potential audit failure in one of its affiliates less adversely. We hypothesize that PwC clients that are part of a business group are likely to experience smaller share price declines as compared to other firms.

PwC's Information Technology (IT) clients.

In October 2007, with the expiration of the non-compete agreements relating to the sale of its consulting practice to IBM, technology firms including Satyam were promoted by PwC as a strategic partner for systems integration engagements and a recommended choice for IT outsourcing due to the lucrative nature of the contracts. This suggests potential conflicts of interests arising from the services provided in consulting by PwC and its connections to the IT service firms that serve as its technical resources and its audit clients. This suggests that agency costs are likely higher in the IT industry and enhances the demand for audit services in this sector of the economy, especially PwC's audit clients. Consequently, we focus on the IT sector for our tests.[7] We hypothesize that non-Satyam PwC clients that are members of the IT industry are subject to high levels of moral hazard problems and will exhibit larger negative abnormal returns during the event period, as compared to other non-Satyam PwC clients.

3.2 Predictions about auditor switches

Consistent with DeAngelo (1981), "unhappy" PwC clients are hypothesized to "punish" their auditors if they believe that latter might renege on their promise to deliver the high level of assurance they have agreed to provide in their audit contract. This belief could potentially arise

[7] Please see the following links for additional information http://retheauditors.com/2009/05/26/how-satyam-supported-pwcs-schizophrenic-strategy-to-reenter-the-systems-integration-business/; http://retheauditors.com/2009/07/24/pwc-and-satyam-its-bigger-than-a-blown-audit-mira-el-dedazo/ ; http://www.gartner.com/resources/160000/160032/pwc_to_world_we_implement_160032.pdf

from PwC's reputation loss arising from the arrest of its partners involved in Satyam's audit. However, a client's incentive to "fire" the incumbent auditor suspected of providing a lower quality audit product is traded off against her expected cost of switching auditors. For example, there is the cost of identifying and engaging a new audit firm when a number of client firms are looking to hire new auditors (Kohlbeck et al. 2008; Ramnath and Weber 2008, Skinner and Srinivasan 2012). There is also the cost of lost firm-specific audit expertise when the incumbent auditor is fired and a new one is engaged (DeAngelo 1981).

We hypothesize that PwC clients switch their auditor in greater numbers following the arrest event in early 2009 relative to earlier years and as compared to other Big 4 clients. We also hypothesize that PwC client firms that face high demand for credible accounting information will have greater incentives to do so than other firms. This could lead to greater incentives to switch auditors as compared to other firms.

3.3 Predictions about Audit Fee reductions

As discussed above, clients have incentives to switch auditors following a serious loss of reputation of their existing auditors. On the other hand, for the "tainted" auditors, there is incentive to maintain market share by providing audit fee discounts as an incentive to its current clients to continue with them. This could be viewed as similar to instances of "low balling" audit fees at the time of initial engagement by an auditor to its clients. DeAngelo (1981) first suggested that auditors have incentives to low ball their initial audit engagement fees in order to secure the contract. Francis (1984) provided evidence of low-balling in the context of Australian audit fees at initial engagement. Consistent with the notion of low-balling, we hypothesize that PwC's Indian affiliate will reduce their audit fees to minimize loss of share of the audit market.

3.4 Audit Quality predictions

One consequence of the predicted audit fee discounts in an effort to keep its client base is that the auditor might not be able to maintain the high quality audit it would have otherwise delivered. The auditing profession has commented on this possibility. For example, the Australian auditors' mouthpiece *Charter*, in its August 2010 edition, urges auditors not to try to achieve cost savings by cutting down on audit procedures when they are forced to provide audit fee discounts to its clients. However, whether audit firms are able to achieve cost savings when they have taken recourse to *low-balling,* and still deliver high quality audits is an empirical question. We test the relation between audit fee decline and audit quality in empirical tests.

4. Data Sources and Sample

We obtain our data from Prowess, which is distributed by the Center for Monitoring Indian Economy (CMIE). Founded in 1976, CMIE currently is the leading vendor of financial statement data in India and has a large dedicated team of analysts and researchers. Prowess is a subscription-based database product, covering the financial performance of over 27,000 companies, including all companies traded on the National Stock Exchange and the Bombay Stock Exchange as well as thousands of unlisted companies. It is built from Annual Reports, quarterly financial statements, stock exchange feeds and other reliable sources. There are over 3,500 data items per company in the Prowess database.

To allow for cross sectional and time series comparisons, the data is adjusted by CMIE for any variation in how firms combine or segment financial information. Prowess has been used in several academic studies in economics and finance, including Bertrand, Mehta and Mullainathan (2002), Gopalan, Nanda and Seru (2007), Khanna and Palepu (2000) and Siegel and Chowdhury (2012).

4.1 Sample period

This paper tests hypotheses of the consequences of reputation loss of the PwC's Indian affiliate arising from the arrest of two its partners in charge of Saytam's audit. Accordingly, we identify three returns generating periods, viz., the pre-event, the event and the post-event periods based on the arrest of two of PwC India's partners, Mr. G Gopalkrishnan and Mr. Srinivas Talluri on January 24, 2009.

Here is a brief timeline of the events leading to the arrest of the PwC partners on January 24, 2009:

- December 16, 2008: Raju, the CEO of Satyam, announces plans to acquire Maytas Infra and Maytas Properties, two companies owned by his sons. At this time, Satyam is the fourth largest IT Company in India with clients worldwide.
- December 17, 2008: Satyam's stock fall by a third in reaction to this announcement.
- December 23, 2008: World Bank bars Satyam from doing business with it.
- December 26, 2008: One independent director quits the Satyam board.
- December 29, 2008: Three more directors quit the Satyam board.
- January 9, 2009: Raju, the CEO of Satyam resigns, admitting inflating company profits.
- January 14, 2009: Deloitte, KPMG appointed new joint auditors for Satyam.
- January 21, 2009: Raju confesses diverting funds from Satyam.
- January 24, 2009: Two audit partners of PwC who were in charge of Satyam's audit are arrested.

Since January 24, the date of the arrest was a Saturday, and January 26, Monday was also a national holiday being the Indian Republic day, the event date is chosen as Tuesday, January 27, 2009.

The post event period covers fifteen trading days (0 to +15) beginning from the date of arrest of two PwC partners on January 24th, 2009and commences from the first trading date after the arrest, namely, January 27, 2009 and ends on February 15th, 2009.

The set of events that started with Mr. Ramalinga Raju's announcement on December 16th to acquire the two firms owned by his family culminated in the arrest of the auditors. Thus, the December 16th, 2008 to January 24th, 2009 period reflects events related to the Satyam scandal. We exclude this period from our analyses because we are concerned about the effects of PwC's reputation loss, rather than the effects of disclosures about Satyam. The pre–event period is a matching fifteen day window prior to these events at Satyam. Further, we do not want this window to be affected by any information leakage about the scandal; thus our pre event window covers September 9th to September 29th, 2008, which is a fifteen-day period that commences 90 days prior to the exclusionary period. [8]

4.2 Sample firms

Our sample comprises all firms listed on the Bombay Stock Exchange (BSE) A and B groups that have been audited by one of the Big 4 firms or its affiliates during the fiscal year 2008-09 and have all the necessary data for testing hypotheses. For example, as on 1st September 2011 there are 2,567 firms in the Prowess database that met the BSE group A, B listing criteria. Group A firms are highly liquid large cap stocks, whereas group B are the highly liquid mid and small cap stocks. Of these, 395 firms were audited by the Big 4 for the fiscal year 2008-09, 124 of which were PwC's clients and the remaining 271 were audited by the other three Big 4 auditors.

The Big 4 auditors operate in India as a network of audit firms. The firms associated with PwC are Price Waterhouse & Co., Lovelock & Lewes and Dalal & Shah. The firms associated with Deloitte Touch and Tohmatsu are Deloitte & Touche, Deloitte Haskins & Sells, A F Ferguson & Co., A F Ferguson Associates, S B Billimoria & Co., S B Billimoria & Company, Fraser & Ross,Fraser & Ross Associates. The firms associated with KPMG are B S R & Associates, B S R & Co., B S R & Company. The firms associated with Ernst &Young are S R Batliboi & Associates, S R Batliboi & Co. and S V Ghatalia & Associates.

5. Empirical models

5.1 Returns Models

We estimate the following model to test the share price hypotheses stated above. The first model uses the sample of 395 clients of the Big 4 auditors. We consider the three moderating variables discussed in section in 3.1.1, as well as three measures related to stock ownership patterns and use three alternative measures of Cumulative Abnormal Returns (CAR) in estimating the model parameters of equation (1) below:

$$
\begin{aligned}
CAR_{it} &= \beta_0 + \beta_1 \text{ PwC}_{i2008} + \beta_2 \text{ Board Expertise}_{i2008} + \beta_3 \text{ Business Group}_{i2008} + \beta_4 \text{ IT Services}_{i2008} \\
&+ \beta_5 \text{ Foreign Holdings}_{i2008} + \beta_6 \text{ Institutional Holdings}_{i2008} + \beta_7 \text{ Promoters' Holdings}_{i2008} \\
&+ \gamma_1 \text{ PwC}_{i2008} * \text{Board Expertise}_{i2008} + \gamma_2 \text{ PwC}_{i2008} * \text{Business Group}_{i2008} \\
&+ \gamma_3 \text{ PwC}_{i2008} * \text{IT Services}_{i2008} + \gamma_4 \text{ PwC}_{i2008} * \text{Foreign Holdings}_{i2008} \\
&+ \gamma_5 \text{ PwC}_{i2008} * \text{Institutional Holdings}_{i2008} + \gamma_6 \text{ PwC}_{i2008} * \text{Promoters' Holdings}_{i2008} + \varepsilon_{it}
\end{aligned}
\tag{1}
$$

[8] We also tried other 15- days pre-event windows including 60 and 30 days prior to the exclusionary period. The results were directionally similar.

The coefficients β_1 to β_7 indicate the main effect of the seven corresponding variables on CAR, γ_1 to γ_6 indicate how the main effects are moderated for PwC clients. We hypothesize that coefficients γ_1 and γ_2 are positive and γ_3 is negative.

CAR_{it} is measured over three different returns generating periods (i) A two-day Event window that includes January 23 (t =-1) and January 27, 2009 (t=0)) surrounding the PwC arrest event date of January 24, 2009, (ii) a period deemed Post that includes a 15 trading day window after the event that span a period from January 27, 2009 to February 15, 2009 (iii) the Post period ***minus*** the Pre–event period which is a matching fifteen day window covering a period from September 9th to September 29th, 2008 that commences 90 days prior to the exclusionary period, discussed earlier. Thus, the third measure of returns is the net change in cumulative abnormal returns in the POST period *over* the PRE period. This measure allows each firm to be its own control.[9]

To understand whether stock ownership patterns influence CAR, we include holdings by institutions, foreign bodies and insiders in regressions. Specifically, we add PwC * Institutional Holdings in the model to allow for the beneficial monitoring effects, if any, of institutional investors. We include Foreign Holdings in equation (1) because this variable could proxy either for better monitoring (Ferreira and Matos, 2008), in which case coefficient γ_4 is positive, or it might reflect transitory effects that, at the first sign of any trouble, foreign investors divests their investments in affected firms (see, for example, Gozzi, Levine, and Schmukler, 2008 and Schill and Sarkissian, 2009). In this case γ_4 is negative. Similarly, Promoters' Holdings can reduce agency costs since promoters are shareholders and managers as well, or increase agency costs if promoters undertake value-reducing decisions, such as empire building at the cost of other minority shareholders.

Variable definitions

Dependent Variable:

CAR is defined as the adjusted excess return, which is calculated (i) as the cumulative abnormal returns (CAR) surrounding the PwC arrest event date over the appropriate window and (ii) by subtracting the mean return of the characteristic matched portfolio from the sample firm's stock return (see Daniel and Titman, 1997). Twenty-seven portfolios are formed within each two-digit NIC code by ranking all 2,567 stocks based on size (market cap), book-to-market and one-year return momentum.

Independent variables:

PwC	= 1 if auditor is PwC affiliate, 0 if other Big 4 affiliate.
IT Services	= 1 if firm's 2-digit NIC code is 62 (Computer Programming, Consultancy and Related Activities) or 63 (Information Service Activities), and 0 otherwise.

[9] This design is also consistent with "untreated control group design with pre-test and post-test" described in Cook and Campbell (1979, p103). In our setting, OB4 client firms is designated as the control group and PwC client firms as the experimental group. The difference-in-difference measure is the value of POST-PRE for the experimental group less the corresponding value for the control group.

Board Expertise	= 1 if at least one board member serves on another firm's board and 0 otherwise.
Business Group	= 1 if the firm is affiliated with a business group, and 0 otherwise.

5.2 Auditor switch Models

The following auditor change probit model, based on Weber et al. (2008) is estimated:

$$AudChng_{it}$$

$$= \beta_0 + \beta_1 Ln(Asset)_{it} + \beta_2 \%(ChngAsset)_{it} + \beta_3 Lev_{it} + \beta_4 \%(ChngLev)_{it} + \beta_5 ROA_{it} + \beta_6 Loss_{it} + \beta_7 PWC_{it-1} + \beta_8 PwC_{it-1}*Year_i\ 2009_10 + \varepsilon_{it} \quad (2)$$

Where:

$AudChng_{it}$	= 1 if a client firm changes auditor and 0 otherwise, for firm i, from year t-1 to t
$Ln(Asset)_{it}$	= natural logarithm of total assets.
$\%(ChngAsset)_{it}$	= percentage change in total assets
Lev_{it}	= total liabilities divided by total assets
$\%(ChngLev)_{it}$	= change in leverage
ROA_{it}	= net income divided by total assets
$Loss_{it}$	= 1 if loss and 0 otherwise
PWC_{it-1}	= 1 if PwC is the prior year audit firm and 0 otherwise
$PwC_{it-1}*Year_i\ 2009_10$	= 1 if PwC is the audit firm for 2008 and the current year is 2009-10

A significant and positive β_8 variable is consistent with more PwC client companies changing their auditors in 2009 or 2010 as compared to other Big 4 clients.

In order to test the effect of the monitoring variables, the following model, also based on Weber et. al. (2008), is estimated for the cross sectional and time series observation separately for 2009 and 2010 period *for clients audited by PwC ONLY*

$$PwCAudChng_{it}$$

$$= \beta_0 + \beta_1 Ln(Asset)_{it} + \beta_2 \%(ChngAsset)_{it} + \beta_3 Lev_{i,t} + \beta_4 \%(ChngLev)_{it} + \beta_5 ROA_{it} + \beta_6 Loss_{it} + \beta_7 IT\ Services_{it} + \beta_9 (CARPwCEvent)_i + \varepsilon_{it} \quad (3)$$

Where:
PwCAudChng = 1 if a firm changed its auditor from PwC in year t (2009, 2010) and 0 otherwise.

Client firms might 'fire' PwC as their auditor if it suffered share price losses around the PwC arrest event. The $CARPwCEvent_i$ variable is included in the model to capture this notion and is measured as (i) Cumulative abnormal returns for firm i for 2 days around January 24, 2009 and (ii) the Post period minus the Pre–event period (which is a matching fifteen day window covering a period from September 9th to September 29th, 2008 that commences 90 days prior to the exclusionary period), discussed earlier.

Other variables have been defined earlier.

5.3 Audit Fee models

The hypothesis that PwC's continuing clients received larger audit fee discounts as compared to other Big 4 continuing clients is tested through a two-stage process. Continuing clients are those clients that engaged PwC and other Big 4 firms for three successive years, namely, 2008, 2009 and 2010. In the first stage the parameter estimates of the following model (Chaney, Jeter and Shivakumar 2004) are estimated using data for all Big 4 clients over the 2001 to 2008 period.

$$\text{Log (Audit Fee)}_{it}$$

$$= \beta_0 + \beta_1 \text{ Ln(Asset)}_{it} + \beta_2 \text{ \%(Asset Turnover)}_{it} + \beta_3 \text{ Export}_{it} + \beta_4 \text{ \%(Current Assets)}_{it}$$
$$+ \beta_5 \text{ Debt-Equity Ratio}_{it} + \beta_6 \text{ Quick Ratio}_{it} + \beta_7 \text{ ROA}_{it} + \beta_8 \text{ ROA}_{it} \text{ x Loss}_{it}$$
$$+ \beta_{11} \text{ New Debt dummy}_{it} + \text{Absolute value of extraordinary items}_{it} + \varepsilon_{it} \quad (4)$$

where :

Asset Turnover = sales divided by total assets
Export = sales outside India divided by total sales
Current assets = current assets/divided by total assets
Debt-Equity ratio = long-term debt/total equity
Quick ratio = current assets minus inventory divided by current liabilities
New Debt dummy = 1 if new debt is issued that year and 0 otherwise
Absolute value of extraordinary items = Absolute value of extraordinary items divided by total assets

Other variables have been defined earlier.

The decline in 2009 (2010) client audit fees is measured as the difference between *actual* audit fees paid in 2009 (2010) ***minus*** its 2009 (2010) *fitted* value using parameters estimated from equation (4) above. A negative value of this difference is consistent with a decline in audit fees.

The hypothesized decline of audit fees for PwC clients relative to OB4 is tested by estimating the following cross sectional time series model over the 2009 to 2010 period.

$$\text{UnexAF}_{it} = \beta_0 + \beta_1 \text{ YearDum} + \beta_2 \text{ PwC}_{it} + \beta_3 \text{ LossDum}_{it} + \beta_4 \text{ PwC}_{it}\text{*BG}_{it} + \varepsilon_{it} \quad (5)$$

Where:

UnexAF_{it} = Actual audit fees for the client firm in 2009 (2010) *minus* its fitted value **less** Actual audit fees for the client firm in 2008 (2008) minus its fitted value. As noted earlier, this measure also allows each firm to be its own control (see footnote 9).

PwC_{it} = 1 if auditor is PwC affiliate for client i in year t, 0 if other Big 4 affiliate

A negative β_4 coefficient is consistent with Business Group affiliated clients of PwC exhibiting greater audit fee discount as compared to other PwC clients.

5.4 Audit Quality Predictions

While commenting on the role of PwC India in the Satyam episode, PCAOB and SEC criticized its quality of accounts receivable audit (PCAOB 2011,SEC 2011) Thus, our tests of audit quality

are based on the quality of accounts receivable (AR) accruals, using the methodology suggested by Marquardt and Wiedman (2004), as follows:

$$UAR_{it} = [AR_{it} - (AR_{it-1} * Sales_{it} / Sales_{it-1,})]/TotatAssets_{it-1} + \varepsilon_{it} \quad (6)$$

Where UAR is the unexpected AR accrual and is used as a measure of audit quality. Note that positive values of UAR are associated with lower audit quality.

We measure discretionary accounting receivable accruals, DiscUAR, as dUAR0908 (dUAR1008) which is the difference in UAR for 2009 ***minus*** UAR for 2008 (UAR for 2010 ***minus*** UAR for 2008).

The following model tests the hypothesis that PwC provided lower quality audit to its continuing client firms that received audit fee discounts over the 2009-2010 period.

$$DiscUAR_{it} = \beta_0 + \beta_1 YearDum + \beta_2 PwC_{it} + \% \beta_3 \Delta Sales + \beta_4 LossDum_{it} + \beta_5 UnexAF_{it} + \beta_6 PwC_{it} * UnexAF_{it} + \varepsilon_{it} \quad (7)$$

Note that both the dependent variable (DiscUAR) and the independent variable (UnexAF) use 2008 values as the benchmark for measuring deviation from their normal value. A negative and significant β_6 is consistent with smaller (or negative) unexpected audit fees (or audit fee discounts) being associated with larger accounts receivable accruals (or lower audit quality) for PwC clients relative to OB4 clients.

6. Results

6.1 Stock returns tests

Univariate results

Table 1 shows the industry distribution of the sample firms. Manufacturing firms form the bulk of the sample for both PwC's non-Satyam clients (35%) and other Big 4 clients (42%) reflecting the preponderance of manufacturing firms in the Indian capital markets. Table 2 provides descriptive statistics for the non-Satyam PwC clients and other Big 4 clients and shows that the two sub-samples are similar in many respects. For example, the median size (log of total assets) of PwC clients is 8.97 which are not significantly different from that of other Big 4 clients of 9.15 ('*t*'= 0.21, *Z* = 0.17). The corresponding figures for debt equity ratios are 0.47 and 0.38 respectively, which are also not significantly different from one another. The monitoring variables, namely, Foreign Ownership, Promoters Control, Institutional Ownership, and Board Expertise are also not significantly different between PwC clients and other Big 4 clients. The foregoing similarities between these two sets of firms tend to reduce concerns related to validity of conclusions being confounded by firm specific characteristics.

Figure 1 shows that the shares prices of non Satyam PwC clients went into a sharp decline surrounding arrest of the two PwC partners in charge of Satyam audit at their Hyderabad, India office, in the POST period. It is interesting to note that prior to the events surrounding the Satyam scandal, the share returns of non Satyam PwC clients were not worse than other Big 4 clients. The difference between the share returns from the *before* ***versus*** *after* the event for the two sub-samples, supports our use of the net change in the cumulative abnormal returns over two windows

(POST - PRE) as a dependent variable in our empirical tests of our hypotheses. The other dependent variables used in multivariate returns tests are the cumulative abnormal returns for the 2-day window around the arrest and the POST period. Figure 1 provides evidence supporting the Hypothesis 1 that PwCs non-Satyam clients suffer greater negative returns as compared to other Big 4 clients during the sample period.

Figure 2 shows the pattern of share prices of the IT services clients versus other clients of PwC. As indicated earlier, PwC's canvassing activities for its IT clients has the potential to reduce perception of its audit independence. This could exacerbate the share price consequences arising from the PwC arrest event. As hypothesized, share prices of PwC's IT clients fell below its other clients soon after the arrest event.

Figure 3 shows that while the share returns of PwC IT clients were similar to or slightly more positive than those of the Other Big 4 firms' IT clients prior to the arrest event, the situation reversed itself in the POST period.

Table 3 provides univariate statistics for the outcomes of the PwC arrest event. The two-day event period mean abnormal returns for PwC clients is -1.12% which is significantly lower than -0.07% exhibited by other Big 4 clients. The 't' value is 1.92 ($p<.10$) and the Wilcoxon Z statistics is 2.37 ($p<.05$) This result is consistent with the hypothesized larger negative abnormal returns earned by PwC clients, as compared to clients of other Big 4 audit firms. Moreover, the mean POST period (days 0 to day +15) 15 day CAR return is -1.86% for PwC clients which is significantly more negative than the CAR of 0.89% for other Big 4 clients ($p<.05$).

The third returns difference between PwC clients and Other Big 4 clients is POST period CAR <u>minus</u> PRE period CAR. This particular difference is -2.49% for PwC clients which is significantly more negative than the corresponding figure of 3.58% for other Big 4 clients. The corresponding *difference in difference* in stock returns in 6.07, which is significant at $p <.01$. This shows that Other Big 4 clients' share prices actually rose from the PRE to the POST period whereas the prices of PwC clients fell.

These univariate results for all the three event windows are consistent with the hypothesized negative share price effects for PwC clients around the arrest event.

Regression results*:*

The regression results for returns analyses are provided in Table 4. The first column provides results of tests using the 2 day event window as the dependent variable. The analysis indicates that the PwC*Promoter interaction is negative (-2.24) and significant ($p<.10$) which is consistent with the notion that PwC clients that have high levels of "promoters' control" are more subject to moral hazard issues, rather than less, and exhibit larger negative abnormal returns during the event period, as compared to PwC clients with low promoter control. The adjusted R^2 is 0.039.

Table 4 also reports the results of estimating equation (1) using (i) a longer (0 to +15 days) event window, denoted by POST period CAR and (ii) a longer window *difference* measure, namely, CARs for POST minus CARs of PRE event period (0 to +15 days each) for sample firms as two more dependent variables. The PRE–event period covers a fifteen-day window from September 9th to September 29th, 2008 that commences 90 days prior to the exclusionary period of December 16 to January 24 relating to various events that culminated in the arrest of the auditors,

The POST period CAR analysis has a higher R^2 value of 0.078 than that of the two-day window

estimates. The IT services indicator variable is positive (coefficient estimate of 10.15) and significant (p<. 01); indicating that the IT services clients experienced a positive price reaction during the longer event window period in the post arrest period. But, the PwC * IT services interaction is negative (-13.45) and significant (p<. 01) indicating that, as hypothesized, PwC's IT services clients suffered an overall (10.15-13.45) negative return of -3.3% during this longer event window. Also for the same dependent variable, the PwC * Foreign interaction is negative (-7.83) and significant (p<. 10) suggesting foreign equity investors may not be effective in their indirect monitoring role in mitigating agency issues and are temporary investors who probably disinvest as soon as a client firms is involved in the PwC arrest event.

Results of the POST *minus* PRE CAR estimation are similar; with IT services main effect being positive (19.93) and significant (p<. 01) and its interaction with PwC negative (-16.34) and significant (p<. 05). These findings are consistent with hypothesis that PwC's IT services clients were affected by the PwC arrest event because it accentuated the agency conflicts associated with these firms.

Table 4 also reports the results of returns-related regression for the 39 Big 4, IT clients. For the (i) post CAR and the (ii) POST *minus* PRE CAR regressions, the PwC dummy variables is significant (p<.05 and p<.05 respectively) and negative coefficient (-14.98 and -19.76 respectively) indicating that PwC's IT clients exhibited more negative event period returns, as defined, as compared to the IT clients of Other Big 4 firms. None of other independent variables are significant and none of the variables for the two-day (days -1,0) return regression, are significant either.

The foregoing results show that the stock price effects of the arrest event are reflected in longer windows rather than the over the short 2 day returns window.

6.2 Auditor Switch Analyses

Univariate analyses

The auditor switch analyses are based on 387 Big 4 client firms for which auditor identity is known for all 2008 and 2009 and 319 Big 4 client firms for which auditor identity is known for all 2009 and 2010. Panel A of Table 5 shows that of the 123 PwC clients in 2008 (for which 2009 auditor identities are known), 12 clients changed away from PwC in 2009, a 10% change. Seven out of a total of 264 other Big 4 clients in 2008 switched to other audit firms, reflecting a 2.7% change. However, the chi-square statistic is 6.94 (d.f.=4) does not reject the null of no relation between auditor identities in 2008 and 2009. The differences in auditor switches between PwC versus Other Big 4 clients in 2010 are sharper: 23% of 97 PwC clients (or 22 clients) in 2009 switched to other audit firms in 2010. The percentage for other Big 4 firms is much less at 2.7% (6/222). This indicates that the foregoing events of 2008/2009 are associated with a virtual exodus of clients away from PwC. However, the chi-square statistic is 9.41 (d.f.=4) rejects the null of no relation between auditor identities in 2009 and 2010.

Multivariate analyses

Results of estimating equation (2) are reported in Table 6, panel A, for all Big 4 client firms for the 2001 to 2010 period. Panel A shows that the $PwC_{2009\text{-}10}$ is positive (0.762) and significant (p<.01) indicating that PwC clients are more likely to switch auditors in 2009 to 2010 period as compared to clients of Other Big 4 firms. These are the consequences of the hypothesized loss of PwC reputation in the aftermath of the arrest event.

Panel B reports results of estimating a probit model of auditor changes for the PwC clients only for the 2009 and 2010 period. As hypothesized, PwC's IT clients firms are more likely to switch as compared to their other clients in 2009. The coefficient of the IT dummy is positive (0.777, 0.719) and significant ($p<.05$, $p<.05$) for both measures of event date returns, namely the PRE **minus** POST window and the 2-day event window respectively.

6.3 Audit Fee Analyses

The results of estimating the audit fee model is shown in Table 7, panel A. The model provides the normal level or the average level of audit fees predicated on the audit fee determinants provided by Chaney and Philipich (2002). Any deviation from this model is hypothesized to be abnormal or unexpected. The model R^2 is 0.72 which is consistent with the findings of other studies. Many of the right hand side variables are significant.

Panel B of Table 7 reports results of tests of hypothesized audit fee discount provided by PwC to its continuing clients as an incentive for not terminating their engagement. A negative value of the residual, namely, actual audit fees ***minus*** predicted or fitted values (or the normal) audit fees is consistent with an audit fee discount. Note that the predicted value of audit fees is calculated using the parameter estimates of the audit fee model reported in panel A of Table 7.

The difference in unexpected audit fees in 2009 (2010) ***minus*** the unexpected audit fees for 2008 (2008) for PwC's continuing clients, is -0.007 (-0.045) whereas for the other Big 4 clients the difference is actually positive, being 0.069 (0.059). Note that by subtracting the unexpected audit fees for 2008 from that of 2009 (2010) for both PwC and OB4 continuing clients, we are attempting to use each client firm as its own control.

Results of panel B shows that the unexpected audit fees have increased from their levels in 2008 for Other Big 4 clients but have declined for PwC clients reflecting discounted audit fees. The difference between PwC versus other Big 4 clients' foregoing unexpected audit fee changes from 2008 to 2009 is negative and marginally significant ($t=-1.49$, $p<.10$). The results are similar for 2010. These results are consistent with PwC providing its continuing clients with an audit fee discounts, relative to OB4 clients.

Panel C reports results from estimating equation (4) for the 2009-10 period, to examine if PwC provided audit fee discounts to its clients who stayed with them for the 2008 to 2010 period. The sample consists of all firms who had PwC or Other Big 4 firms as their auditor for all the 3 consecutive years, namely, 2008, 2009 and 2010 and did not switch to other firms during the period. The dependent variable is measured in this Table as unexpected fees in 2009 (2010) **minus** the unexpected audit fees in 2008 (2008), where unexpected audit fees equal logarithm of actual audit fees **minus** their fitted values. The PwC variables is negative (-0.090) and marginally significant ($t = -1.40$) at $p<.10$. The Business Group variable is insignificant. The YearDummy is not significant indicating that there is no difference between the audit fee discounts in 2009 and 2010.

Audit Quality tests

The results of the audit quality-audit fee discount relationship tests are reported in Table 8. Panel A of Table 8 shows that discretionary accruals of continuing clients of both PwC and OB4 increased in 2009 and 2010 and the differences between their mean increases are not significant. Note that discretionary AR accruals for 2009 (2010) are measured as unexpected AR accruals in 2009 ***minus*** unexpected AR accruals for 2008 (2008), which is an attempt to use each client as its

own control. However, untabulated results show that PwC clients had fewer negative accruals as compared to OB4 clients during this period. For example, while only 35% (38%) of PwC's 2009 (2010) were negative, the corresponding proportion for B4 clients were significantly higher at 52% (50%) at $p<.05$ ($p<.10$). This indicated PwC clients realized income increasing AR discretionary accruals more frequently than OB4 clients during the 2009-2010 period.

The relation between discretionary AR accruals and audit fee discount is examined in panel B of Table 8. These results show PwC * Unexpected Audit Fee interaction variable is negative (-0.115) which is also significant ($p<.01$). This is consistent with the hypothesis that audit fee discounts given to PwC are also associated with lower quality accounts receivable accruals. The Unexpected Audit Fee variable is not significantly different from zero, indicating that for Other Big 4 clients, audit fee declines are not associated with audit quality. Probably for other Big 4 clients, audit fee declines do not reflect "low balling" but more efficient and less expensive audit technology. The situation appears different for PwC. The negative and significant PwC * Unexpected Audit Fee interaction variable in the model is not consistent with less expensive and more efficient audit technology but with PwC "low balling" its continuing clients over the 2009-2010 period. As a result PwC was probably unable to garner enough resources through cost savings in 2009 and 2010 and failed to deliver to them their 2008 level of audit quality.

5. Conclusions

In the month of December 2008 and January 2009, the Indian affiliate of PwC, a Big 4 audit firm suffered a significant loss of its reputation when its involvement in an alleged misappropriation of funds by Satyam Ltd., one of its audit clients, came to light. On January 24, 2009, Indian authorities arrested two PwC partners in charge of Satyam's audit. We find that PwC's non-Satyam clients suffered significant decline in their share prices, especially its IT clients, in the following weeks, likely as a result of perceived loss of audit quality.

We argue that audit is only one form of monitoring to which a client firm's financial statements are subject and other forms of monitoring could mitigate the effects of auditor reputation, but do not find support for that in our returns tests. However, the negative returns effects are strongest for PwC's IT industry clients.

We find PwC's clients left their auditor in large numbers in the next two years, particularly its IT clients. But those PwC clients that decided to continue to engage PwC in 2009 and 2010 received larger audit fee discounts as compared to OB4 clients, and PwC clients also recognized positive discretionary AR accruals more frequently as compared to OB4 clients during this period. The negative correlation between unexpected AR accruals and unexpected audit fees paid by its continuing clients during 2009 and 2010 is consistent with the notion that PwC "low balled" its continuing clients in those years and was consequently unable to deliver their 2008 level of audit quality due to lack of adequate resources.

Appendix 1: Detailed timeline of events surrounding the Satyam scandal and the impact on PwC

December 16, 2008	Satyam's Chairman, B. Ramalinga Raju announces plan to buy Maytas Infra and Maytas Properties owned by his sons for $1.6 billion after markets closed in India. Satyam's top executives hold stakes in Maytas Infra and in Maytas Properties. Satyam cancels plans to buy the two builders just 12 hours after announcing the deal.
December 23, 2008	The World Bank bars Satyam from doing business with it for eight years.
December 26, 2008	An independent director resigns from Satyam's board.
December 29, 2008	Three more directors resign from Satyam's board.
January 5, 2009	PwC is looking at reviewing its continuance with Satyam it has been Satyam's statutory auditor since 2000.
January 7, 2009	Raju's resigns and confesses to inflating company profits.
January 9, 2009	Raju is arrested on charges of cheating and forgery. Satyam's board is disbanded. Inquiry begins into PwC's auditing of Satyam accounts.
January 10, 2009	The Federal government reconstitutes Satyam board.
January 12, 2009	PwC's fees are under scanner - it received a consolidated audit fee of Rs 43 million for the financial year 2007-08 - around twice as much as what Satyam's peers in the IT industry, on an average, pay their auditors.
January 14, 2009	PwC offices raided; Deloitte, KPMG named new joint auditors for Satyam; (PwC), says its opinion on the IT firm's financials may be rendered "inaccurate and unreliable"
January 21, 2009	Raju confesses diverting Satyam funds to the Maytas firms
January 23, 2009	Raju sent to judicial custody till Jan 31
January 24, 2009	Former Satyam auditor PwC's S. Gopalakrishnan and Srinivas Talluri arrested
February 6, 2009	Class action lawsuit filed in the U.S. against Satyam, Raju and PwC.
March 5, 2009	PwC India to set up advisory board
March 18, 2009	PwC global team to review PwC's India audit
April 24, 2009	Satyam investigators allege PwC auditors knew of fraud

Appendix 2: Variable List

Variable	Description
Abnormal Ret	characteristic adjusted excess return, which is calculated by subtracting the mean return of the characteristic matched portfolio from the stock return. Twenty seven portfolios are formed within each two-digit NIC code by ranking all 2,567 stocks based on size (market cap), book-to-market and one-year return momentum.
Post Event Cum Abnormal Ret	accumulated abnormal return over the sixteen day window following the arrest i.e. post-even window (Jan 27-Feb 17, 2009)
Difference in Cum Abnormal Ret	difference of the cumulative abnormal return during the post event window (Jan 27-Feb 17, 2009) and the abnormal cumulative return during the pre event window (Nov 20-Dec 15, 2008).
PwC	indicator variable identifying the firm's auditor. It equals 1 if the firm is audited by a PwC affiliate and equals 0 if it is audited by any of the other Big 4 affiliates
Foreign Ownership	indicator variable that equals 1 if the ownership by foreign entities is > 20%, 0 otherwise. The ownership by foreign entities is the total ownership by foreign promoter institutions, foreign institutional investors and foreign venture capitalists.
IT Services	indicator variable that equals 1 if the 2-digit NIC code of that the firm belongs to is 62 (Computer Programming, Consultancy and Related Activities) or 63 (Information Service Activities), 0 otherwise.
Promoter Control	indicator variable that equals 1if the ownership by promoters is > 50%, 0 otherwise.
Institutional Ownership	indicator variable that equals 1 if the ownership by institutional investors is > 5%, 0 otherwise.
Board Expertise	indicator variable that equals 1 if there is at least one board member who serves on the board of another firm, 0 otherwise.
Business Group	indicator variable that equals 1 if the firms is affiliated with a business group, 0 otherwise.
Debt-to-Equity ratio	long-term debt to equity ratio
Size	log of total assets

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Figure 1

CAR plots of the 124 PwC non Satyam clients versus 271 all other Big 4 clients for three intervals: immediately before unraveling of the Satyam fraud (Nov 20, 2008 – Dec 15, 2008), during unraveling of the Satyam fraud (Dec 16, 2008 – Jan 23, 2009) and immediately after unraveling of the Satyam fraud (Jan 27, 2009- Feb 17, 2009). The arrest of the two PwC auditors that happened on Jan 24, 2009 is the event for this study.

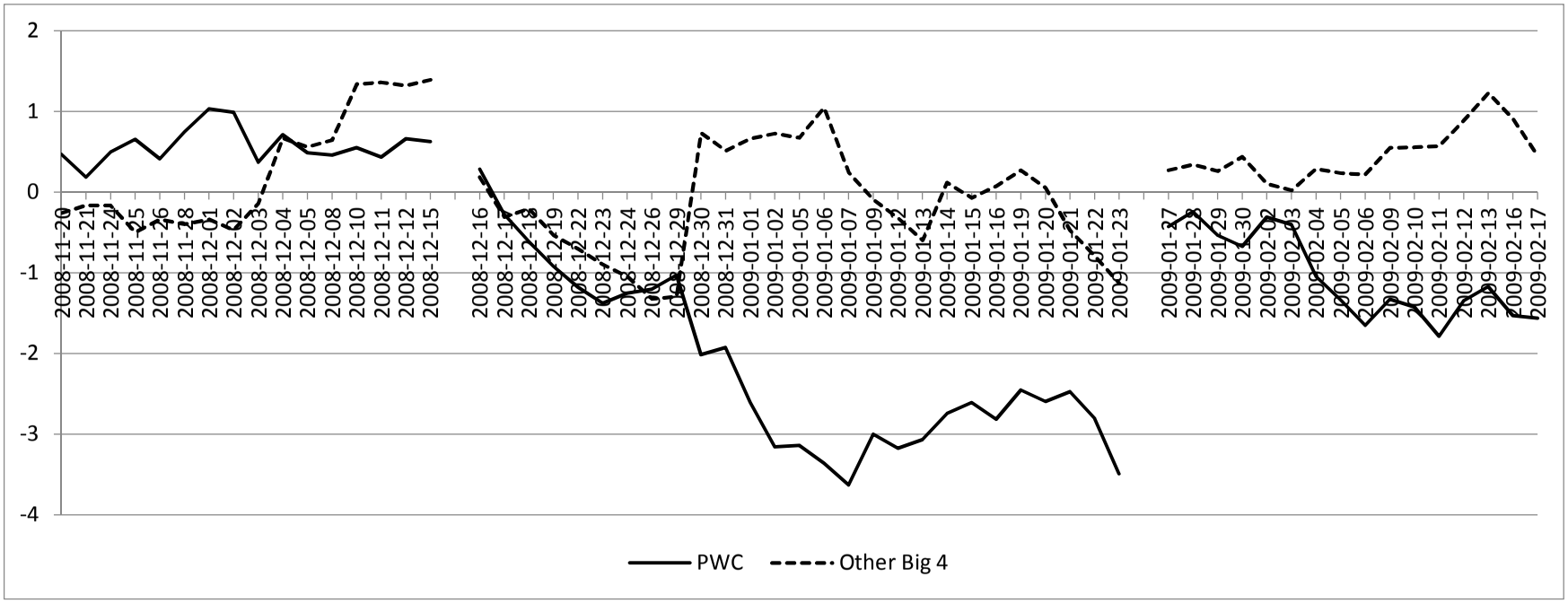

Figure 2

CAR plots of the 124 PwC non Satyam clients in the computer services industry (12 firms) versus other industries (112 firms) for three intervals: before unraveling of the Satyam fraud (Nov 20, 2008 – Dec 15, 2008), during unraveling of the Satyam fraud (Dec 16, 2008 – Jan 23, 2009) and after unraveling of the Satyam fraud (Jan 27, 2009- Feb 17, 2009). The arrest of the two PwC auditors that happened on Jan 24, 2009 is the event for this study.

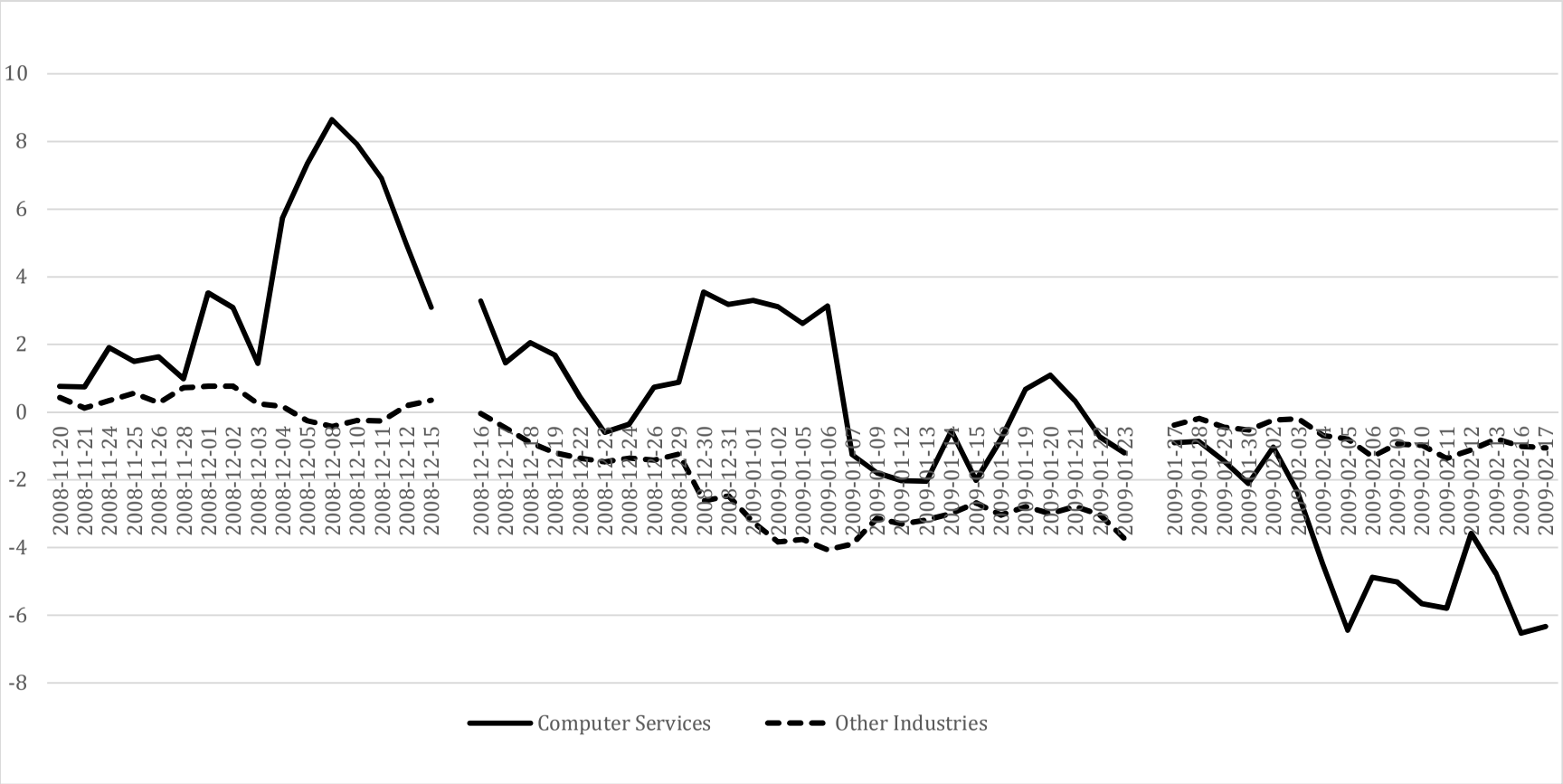

Figure 3

CAR plots of the 12 PwC non Satyam clients in the computer services industry versus the 27 other Big 4 clients in the computer services industry for three intervals: before unraveling of the Satyam fraud (Nov 20, 2008 – Dec 15, 2008), during unraveling of the Satyam fraud (Dec 16, 2008 – Jan 23, 2009) and after unraveling of the Satyam fraud (Jan 27, 2009- Feb 17, 2009). The arrest of the two PwC auditors that happened on Jan 24, 2009 is the event for this study.

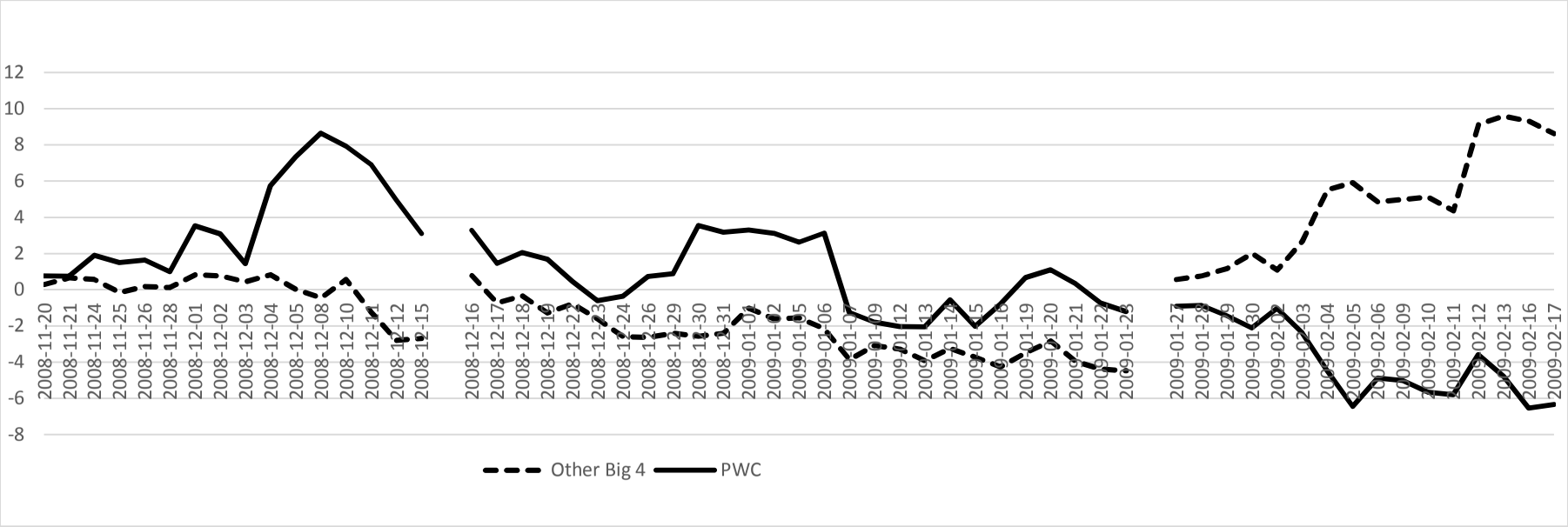

Table 1: Industry composition of PwC clients and other Big 4 clients

NIC	Description of Industry	Number of PwC clients	% of PwC clients in sector	Number of other Big 4 clients	% of other BIG 4 clients in sector
0	Agriculture, Mining	3	2.4	6	2.2
1	Manufacturing (Food, Wood, Paper, Apparel)	19	15.3	30	11.1
2	Manufacturing (Chemical, Pharmaceuticals, Computer, Electrical)	44	35.5	115	42.4
3	Utilities (Electricity, Gas, Waste Mgt.)	13	10.5	13	4.8
4	Construction, Wholesale, Repair	11	8.9	15	5.5
5	Transportation, Hotel, Information	5	4.0	16	5.9
6	Telecom, Software, Financial, Real Estate	22	17.7	62	22.9
7	Professional, technical, administrative services	2	1.7	2	0.7
8	Administration, education, health services	0	0.0	1	0.4
9	Entertainment, other services	5	4.0	11	4.1
Total		124	100.0	271	100.0

This table presents industry classifications using the National Industry Classification Standard (NIC) definitions for the sample that comprises all firms listed on the Bombay Stock Exchange (BSE) A and B groups that have been audited by one of the Big 4 firms or its affiliates during the fiscal year 2008-09 and have all the necessary data for testing the hypotheses.

Table 2: Descriptive Statistics of Independent Variables

Client firms		Size	Debt-to-Equity Ratio	Business Group Member	Foreign ownership (%)	Promoter control (%)	Institutional ownership %	Board Expertise	IT services clients
PwC n=124	Mean	9.08	0.81	0.645	9.67	55.77	18.37	0.75	0.1
	Med	8.97	0.47	1.00	5.49	54.11	17.48	1.00	0.0
Non-PwC Big 4 n=271	Mean	9.30	2.04	0.575	9.02	52.01	17.50	0.76	0.1
	Med	9.15	0.38	1.00	5.49	52.92	14.31	1.00	0.0
Mean Difference		-0.21	-1.24	0.07	0.64	3.75**	0.87	0.01	0.0
Median difference		-0.17	0.09	0.0	0.0	2.19	4.06	0.0	0.0

***, **, * denote significance at the 1%, 5%, and 10% levels (two tailed), respectively

Table 3: Comparison of market reactions, auditor switches and independent director resignations between PwC clients and other Big 4 clients to the arrest of PwC auditors on January 24, 2009

Market Reaction – Cumulative Abnormal Returns in Percentages

	Mean CAR % - Arrest Event, Saturday, January 24, 2009; Monday, January 26, 2009, Holiday – Indian Republic Day			
	Arrest Event CAR (-1, 0) Window: January 23 and January 27, 2009 **(1)**	**Post CAR (0 +15) Window: January 27 – February 15, 2009** **(2)**	**Pre CAR (-90 to -75) September 9 – September 29, 2008** **(3)**	**Post – Pre CAR Difference (2) – (3)**
All Big 4 clients (N = 395)	-0.4	0.02	-1.65***	1.67*
Non Satyam PwC clients (N=124)	-1.12**	-1.86*	0.63	-2.49
Other Big 4 clients (N=271)	-0.07	0.89	-2.69***	3.58***
Difference PwC- Other Big 4	-1.05	-2.74	3.24	-6.07
't' statistics for difference	-1.92**	-2.05**	2.55***	-2.9***
Wilcoxon Z for difference	-2.37**	-2.04**	2.77***	-2.74***

***, **, * denote significance at the 1%, 5%, and 10% levels (one tailed), respectively

Table 4: Market Reaction to the arrest of PwC auditors on January 24, 2009: Multivariate Analysis

	All Firms			IT Firms only		
Dependent Variable	**CAR (-1, 0)**	**Post CAR (0 +15)**	**Post CAR (0, +15) - Pre CAR (-90, -75)**	**CAR (-1, 0)**	**Post CAR (0 +15)**	**Post CAR (0, +15) - Pre CAR (-90, -75)**
Intercept	0.15	2.25	7.79	1.53	10.66	23.46
PwC (yes, no)	-3.22	-3.17	-16.50	-1.74	-14.98**[a]	-19.76**[a]
IT Services	1.10	10.15***	19.93***			
Board Expertise	-0.77	-2.40	-3.35			
Foreign Holdings	1.20	3.69	8.21**	-0.84	2.21	6.63
Institutional Holdings	0.02	-1.78	-6.28**	-0.88	-2.93	-6.00
Business Group	0.05	2.55	2.76	-1.90	8.21	9.48
Promoter Holdings	0.42	-1.53	-2.26	1.79	-6.45	-9.16
PwC (yes, no) * IT Services	-1.66	-13.45***[a]	-16.34**[a]			
PwC (yes, no) * Board Expertise	2.62	2.52	8.99			
PwC (yes, no) * Foreign Holdings	-2.51	-7.83*	-7.20			
PwC (yes, no) *Institutional Holdings	1.87	2.49	7.59			
PwC (yes, no) * Business Group	-0.01	-0.76	0.01			
PwC (yes, no) * Promoter Holdings	-2.24*	-1.52	-1.45			
N	369	369	369	39	39	39
R-Square	0.0392	0.0781	0.1112	-.04	.04	.05

***, **, * denote significance at the 1%, 5%, and 10% levels, respectively

a: one tailed tests

Table 5: Transition matrix of change in auditors by Bombay Stock Exchange listed Big 4 clients

Panel A: Number of clients who changed auditors from 2008 to 2009

From 2008		To 2009			
		Auditor Identity in 2009			
Auditor identity in 2008		PwC	Other Big 4	Non Big4	Number of Big 4 clients in 2008 for which their 2009 auditor identity is known
PWC		111	6	6	123
Other Big 4		2	257	5	264
Total					387

Panel B: Number of clients who changed auditors from 2009 to 2010

From 2009		To 2010			
		Auditor Identity in 2010			
Auditor identity in 2009		PwC	Other Big 4	Non Big4	Number of Big 4 clients in 2009 for which their 20010 auditor identity is known
PWC		75	7	15	97
Other Big 4		0	216	6	222
Total					319

Table 6: Probability of auditor switch: Probit model

Panel A:
Sample period: 2001 to 2010
Dependent variable: Probability of Auditor Switch
Sample: **All Big 4 clients.**

Independent Variable	Parameter estimate	Wald φ^2
Intercept	-0.523	26.902***
Ln(Asset)	-0.050	21.495***
% ChngAsset	0.000	2.833*
Lev	0.120	2.628
% ChngLev	-0.195	1.655
ROA	-0.839	19.780***
Loss	0.102	3.170*
PwC (yes, no) $_{t-1}$	-0.835	245.504***
PwC (yes,no) $_{2009-2010}$	0.762	55.820***
Number switching	819	
Number not switching	4817	
Likelihood Ratio	377.759*	
% concordant	66.10%	

***, **, * denote significance at the 1%, 5%, and 10% levels, respectively

The dependent variable is probability of auditor change over the 2001-10 sample period.

$$AudChng_{it}$$

$$= \beta_0 + \beta_1 \, Ln(Asset)_{it} + \beta_2 \, \%(ChngAsset)_{it} + \beta_3 \, Lev_{it} + \beta_4 \, \%(ChngLev)_{it} + \beta_5 \, ROA_{it} + \beta_6 \, Loss_{it} + \beta_7 \, PWC_{it-1} + \beta_8 \, PwC_{it-1} * Year_i \; 2009_10 + \varepsilon_{it}$$

Panel B: Sample period: 2009-2010
Dependent variable: Probability of Auditor Switch
PwC clients only

	2009		2010	
	Event period returns		Event period returns	
	Post – Pre window	2 day arrest event window	Post – Pre window	2 day arrest event window
Intercept	-0.707	-0.415	0.551	0.688
Log (Asset)	-0.106	-0.115	-0.072	-0.085
% Δ Asset	-0.001	-0.001	0.006	0.007
Leverage	0.510	0.168	-0.801	-0.651
% Δ Leverage	0.424	0.464	-3.654	-3.243
Return on Assets	-0.222	-0.443	-3.961	-4.914*
Loss dummy	0.531	0.663**	0.235	0.027
IT company	0.777**	0.719 **	-2.830	-2.539
Event Period Returns	-0.005	0.018	0.020*	0.313
N (No. switched)	123 (12)	123 (12)	97 (22)	97 (22)
Fisher Scored Likelihood Ratio	77.11	81.05	73.27	71.95
% Concordant	74.0	75.4	76.8	69.6

***, **, * denote significance at the 1%, 5%, and 10% levels, respectively

The dependent variable is probability of PwC client changed its auditor in 2009 or 2010.

$$PwCAudChng_{it}$$

$$= \beta_0 + \beta_1 \, Ln(Asset)_{it} + \beta_2 \, \%(ChngAsset)_{it} + \beta_3 \, Lev_{it} + \beta_4 \, \%(ChngLev)_{it} + \beta_5 \, ROA_{it} + \beta_6 \, Loss_{it} + \beta_7 \, IT\ Services_{it} + \beta_8 \, CARPwCEvent_{i} + \varepsilon_{it}$$

Table 7: Audit fee analysis

Panel A: Audit fee model of determinants

Dependent Variable : Log(Fee)		
Independent variables	Parameter Estimates	't' values
Intercept	-5.238	-35.10***
Size	0.638	46.82***
Asset Turnover	0.255	7.26***
Export	0.000	0.99
CA/TA	0.281	2.20**
Debt/Equity	0.000	0.37
Quick Ratio	-0.194	-2.11**
ROA	0.342	1.66*
ROA*Loss	-1.544	-3.57***
New Debt	-0.099	-2.42**
Absolute Vale of Extra-ordinary items	1.676	4.68***
N	970	
Adjusted R^2	.72	

***, **, * denote significance at the 1%, 5%, and 10% levels (one tailed), respectively

Panel B: Mean difference in unexpected audit fees of Big 4 clients over time

	Unexpected audit fees in 2009 *minus* Unexpected audit fees in 2008	Unexpected audit fees in 2010 *minus* Unexpected audit fees in 2008
PwC	-0.007	-0.045
Other Big4	0.069	0.059
Difference	-0.076	-0.104
't' for Diff	-1.49*	-1.48*

***, **, * denote significance at the 1%, 5%, and 10% levels, respectively

Panel C: Determinants of Unexpected Log (Fee)

Dependent Variable : Unexpected Log(Fee): Sample Period: 2009-2010		
Independent variables	Parameter Estimates	't' values
Intercept	0.081	2.88***
YearDum	-0.004	-0.12
PwC (yes, no)	-0.090	-1.40*
Loss Dummy	-0.036	-0.73
PwC * Business Group	-0.011	-0.15
N	597	
Adjusted R^2	.02	

***, **, * denote significance at the 1%, 5%, and 10% levels, respectively

Unexpected Log audit fees is defined as:

Actual Log fees for 2009 (2010) **minus** fitted value of Log fees for 2009 (2010) ***less*** Actual Log fees for 2008 (2008) **minus** fitted value of Log fees for 2008 (2008).

Fitted values of Log audit fees for 2008, 2009 and 2010 are based on parameter estimates from the following model using data from 2001 to 2008 (see table 7, panel A for parameter estimates):

Log (Audit Fee)

$= \beta_0 + \beta_1 \text{Ln(Asset)}_{it} + \beta_2 \text{\%(Asset Turnover)}_{it} + \beta_3 \text{Export}_{it} + \beta_4 \text{\%(Current Assets)}_{it} + \beta_5 \text{Debt-Equity Ratio}_{it} + \beta_6 \text{Quick Ratio}_{it} + \beta_7 \text{ROA}_{it} + \beta_8 \text{ROA}_{it} \times \text{Loss}_{it} + \beta_{11} \text{New Debt dummy}_{it} + \text{Absolute value of extraordinary items}_{it} + \varepsilon_{it}$

Table 8: Determinants of Accounting Quality

Panel A: Mean difference in discretionary accounts receivable accruals

	Unexpected AR accruals in 2009 ***minus*** Unexpected AR accruals in 2008	Unexpected AR accruals in 2010 ***minus*** Unexpected AR accruals in 2008in 2008
PwC	0.019	0.059
Other Big4	0.037	0.035
Difference	-0.018	0.024
‘t’ for Diff	-0.60	0.52

Panel B:
Dependent Variable: Discretionary accounts receivable accruals

	Parameter estimates	't'
Intercept	0.027	1.43
YearDum	0.014	0.61
PwC (yes, no)	-0.016	-0.64
% ΔSales	-0.000	-1.77*
Loss Dummy	0.021	0.64
Unexpected Audit Fee	0.001	0.07
PwC (yes, no)* Unexpected Audit Fee	-0.115	-3.13***
N	525	
R^2	0.02	

***, **, * denote significance at the 1%, 5%, and 10% levels, respectively

Discretionary AR accruals: Unexpected Accounts Receivable accrual for 2009 (2010) ***minus*** Unexpected Accounts Receivable accrual for 2008 (2008), where:

Unexpected Accounts Receivable accrual (UAR_{it}) is estimated from the following equation (Marquardt and Wiedman (2004):

$$UAR_{it} = [AR_{it} - (AR_{it-1} * Sales_{it} / Sales_{it-1,})]/TotatAsssts_{it-1}$$