

**The Effect of the Big 4 and Non-Big 4 Audit Market Concentration on Audit Quality:  
Evidence from China Metro Audit Market**

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## **The Effect of the Big 4 and Non-Big 4 Audit Market Concentration on Audit Quality: Evidence from China Metro Audit Market**

### **Abstract**

Existent literature regarding the effect of audit market concentration on audit quality, based upon U.S. or cross-country data is inconclusive. This study explores the effect in a fresh setting - China metropolitan audit market where the Big 4 audit firms' market shares are significantly lower than those in U.S. and many other developed markets and the non-Big 4 (mostly domestic Chinese) firms are growing rapidly in size under the help of a series of recent Chinese regulations. We use audit adjustment based upon a proprietary database to proxy for audit quality. We find that the Big 4 market concentration in China is harmful to audit quality - clients are less likely to experience the incidence of audit adjustment if they are located in metro markets with more shares held by Big 4 auditors and more disproportionate distribution of shares within the Big 4 group. However, the non-Big 4 firms' concentration is beneficial to audit quality - clients are more likely to have audit adjustment in metro areas where shares are more disproportionately distributed in the non-Big 4 market.

Overall, these results are consistent with the notion held by regulators around the world that promoting market participation of non-Big 4 audit firms and providing much needed competition to the Big 4 improve audit quality. Further, the effect of the Big 4 concentration on audit quality could be sensitive to the type of institutional and regulatory environment under which the effect is examined. For instance, the Big 4 concentration could still be harmful even in a legal jurisdiction, such as China, with relatively low Big 4 dominance.

**Key words:** audit market concentration; the Big 4; the Non-Big 4 auditors; audit adjustment; audit quality.

## 1. Introduction

In this paper, we examine whether concentration in China metropolitan (metro) audit markets affects audit quality measured by audit adjustment.<sup>1</sup> In recent years, regulators in U.S. and Europe have expressed serious concerns over audit market concentration and urged research understanding the implication of concentration on audit quality (as well as other audit outcomes including audit pricing, clients' auditor choice, etc.) (European Commission 2010; House of Lord 2010; Government Accountability Office 2003, 2008; Oxera 2006, 2007; United States Treasury 2008).<sup>2</sup> In principle, the relation between concentration and audit quality is ambiguous i.e., high concentration could improve or harm audit quality (GAO 2008). Empirical evidence, based upon either U.S. audit market or pooled multi-country data, is inconclusive on the effect of audit market concentration on audit quality (Boone et al. 2012; Francis et al. 2013; Kallapur et al. 2010). We respond to this important, yet unresolved issue by using a proprietary dataset of audit adjustments from China metro audit market to investigate how audit market concentration affects audit quality.

China audit market provides a unique setting for gathering new evidence on the relation between audit market concentration and audit quality because concentration by the Big 4 supply in China is much lower than that in U.S. and Europe (Bradbury et al. 2014; Francis et al. 2013). Among the 42 countries examined by Francis et al. (2013), China has the lowest Big 4 market share (only 17%). Similarly, in our sample, the average Big 4 market share at metro (province) level is only 20%. After the release of "The Instruction of

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<sup>1</sup> In this study, we treat each of the following as a metropolitan statistical area: 23 provinces, 5 autonomous districts and 4 municipalities located in mainland China.

<sup>2</sup> The impact of concentration on other audit outcomes such as audit pricing and clients' auditor choice is also part of regulators' concern.

Development in Audit Service Industry” (the Instruction) as part of the strategy policy of the 11th Five-Year Plan published by the national government in 2008 (The Chinese Institute of Certified Public Accountants (CICPA) 2008), regulators in China have adopted a series of policies facilitating domestic firms to expand firm size and access multiple services. Thereby, the market share and revenue of domestic audit firms have increased tremendously in recent years. As of year 2012, Big 4 audit firms no longer represent the four largest audit firms in China audit market as Ruihua, a domestic Chinese audit firm exceeded KPMG in revenue to become the fourth largest firm. In 2013, Ruihua advanced to the third in terms of revenue ranking. Further, the quality of Big 4 audits for Chinese clients tends to be different from that for clients in other institutional environments. For instance, Ke et al. (2014) find that the quality of Big 4 audits tend to be lower for clients listed only in China than those cross-listed in Hong Kong due to the weaker institutional environment in China. As such, findings based upon U.S. data or cross-country data on the effect of audit market concentration - primarily attributable to the Big 4 supply - on audit quality may not be generalizable to Chinese audit market.

We use audit adjustment obtained from a proprietary database as a proxy for audit quality. Audit quality is assumed to be higher when audit adjustment occurs. As argued by Lennox et al. (2014), audit adjustment could be viewed as a better proxy for audit quality than some other commonly-used measures such as accruals which are often subject to measurement errors or restatements which fail to capture within-GAAP (General Accepted Accounting Principal) earnings management and which are rare events and can often go undetected (DeFond and Zhang 2014). When audit adjustment occurs, it directly indicates

that a misstatement in clients' financial statements is detected and corrected by auditors, consistent with DeAngelo's (1981) definition of audit quality.<sup>3</sup>

Following Francis et al. (2013), we examine two dimensions of audit market concentration at metro (province) level: (1) the degree to which market shares of Big 4 auditors as a whole dominate market shares of non-Big 4 (domestic Chinese) audit firms (variable name: B4SHARE) in a metro market and (2) the degree to which market shares are unequally distributed among auditors of both types (Big 4 and non-Big 4) in a metro market overall (HERF), among Big 4 auditors within the Big 4 market (HERF\_BIG4), and among non-Big 4 auditors within the non-Big 4 market (HERF\_NONBIG4). We use Herfindahl index (calculated alternatively based upon audit fees, clients' audited sales, or clients' audited assets) to measure market share equality among auditors.

Using a large sample of observations of public clients traded in Chinese A stock market in the period of 2007 – 2012, we observe the following. Audit adjustment is less likely to occur in metro markets where the Big 4 market share (relative to the non-Big 4 share) is higher and the Big 4 market share is more disproportionately distributed within the Big 4 group. In economic terms, in a metro market comprising both Big 4 and non-Big 4 auditors, as the percentage of total shares held by Big 4 auditors as a group (B4SHARE) increases by one unit, the likelihood of a client receiving audit adjustment decreases by 5%. Within the Big 4 market, as the share inequality (HERF\_BIG4) increases by one unit, the likelihood of audit adjustment decreases by 4%. In contrast, the non-Big 4 firms' concentration is beneficial, i.e. the incidence of audit adjustment is more likely to occur among clients belonging to metro

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<sup>3</sup> DeAngelo (1981) defines audit quality as the probability that the auditor (1) detects the misstatement in a client's financial report and (2) corrects the misstatement.

areas where the non-Big 4 market is dominated by one or few large non-Big 4 auditors rather than shared equally. In economic terms, within the non-Big 4 market, as the share inequality (HERF\_NONBIG4) increases by one unit, the likelihood of audit adjustment increases by 6%.

In additional analysis, we distinguish between upward (adjusted profits higher than pre-adjustment values) and downward adjustments, and large (adjustment amount exceeding 5% of pre-audit profits) and small audit adjustments. We use adjusted Herfindahl index and Gini Coefficients as alternative measures for market share equality. We use abnormal accruals calculated based upon Modified Jones model (Kothari et al. 2005; Dechow et al. 1995; Jones 1991) and the accrual quality measure developed by Dechow and Dechow (2002) as alternative proxies for audit quality. Results from these additional analyses are by and large consistent with main results. Finally, we examine the effect of audit market concentration on audit fees. Evidence regarding the effect of Big 4 auditors supply concentration on audit fees is mixed. However, we find that higher concentration among non-Big 4 auditors is associated with higher audit fees, consistent with large Chinese audit firms in more concentrated metro markets spend more audit efforts leading to better audit quality.

Our study contributes to the limited and inconclusive literature that addresses an important public policy issue, that is, whether and how audit market concentration affects audit quality. Several unique features of our study allow us to probe into the issue from a fresh angle. Prior literature examines the concentration effect either within the U.S. or across country. Differently, as far as we know, our paper is the first one that examines the effect at the metro level in China, where the institutional and regulatory environment, the audit market structure in terms of the Big 4 supply dominance, and the evolvement of the market are quite

different from those in U.S. and other developed economics. Our finding that the Big 4 concentration could still be harmful even in a legal jurisdiction, such as China, with relatively low Big 4 concentration could imply that there may not be a single uniform answer to the issue whether auditor concentration is beneficial or harmful to audit quality. Rather, the effect could be contingent upon the specific institutional environment and type of audit market within which the effect is examined. Further, our finding that concentrated non-Big 4 audit markets (primarily constituted by domestic Chinese firms) are associated with higher audit quality is consistent with the notion held by Chinese regulators (as reflected in some recently adopted regulations) and researchers (Chan and Wu 2011) that growth and expansion of domestic Chinese audit firms enables them to access more resources, build more industry and technical expertise, provide much needed competition to the Big 4, all of which lead to better audit quality. Finally, this study measures audit quality using audit adjustment, which arguably is a better and more direct measure for audit quality than most of the proxies used in prior literature studying the concentration effect.<sup>4</sup>

The rest of the paper is organized as follows. We describe the research background, review the relevant literature and develop hypotheses in the next section. Section 3 discusses our data and research design. Empirical results for main analyses and additional analyses are reported in section 4 and section 5 respectively, and section 6 concludes.

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<sup>4</sup> Proxies used in prior studies include abnormal accruals based upon the modified Jones model, accrual quality measure calculated based upon the Dechow and Dichev (2002) model, the likelihood of reporting a loss, the likelihood of meeting or beating consensus analyst forecast, timely loss recognition, etc. (Boone et al. 2012; Francis et al. 2013; Kallapur et al. 2010).

## **2. Research Background, Literature Review and Hypothesis Development**

### ***2.1 Research Background***

U.S. and European audit market are highly dominated by large audit firms. According to the investigation of GAO (2003), the largest firms, known as the “Big 4”, audit over 78 percent of all U.S. public companies and 99 percent of all company sales in 2002. In September 2005, the UK Department of Trade and Industry (DTI) and the Financial Reporting Council (FRC) jointly commissioned a study on competition and choice in the UK audit market. Oxera (2006) published its findings from this study in April 2006, which showed the Big 4 firms audit all but one listed companies in the FTSE 100 and represent 99 percent of audit fee in the FTSE 350.

While the dominance of Big 4 firms is becoming stronger in U.S. and European audit markets, the Chinese audit market is less concentrated by the Big 4 (Bradbury et al. 2014; Francis et al. 2013). Among the 42 countries examined by Francis et al. (2013), China has the lowest Big 4 market share (only 17%). Similarly, in our sample, the average Big 4 market share at metro (province) level is only 20%. Next we briefly discuss the development of the Chinese audit market structure over time.

Compared to U.S. and European audit markets, the Chinese audit market is much younger and has been established only in recent decades. Early in 1994, with the release of Law of Certified Public Accountant of China, audit service and responsibilities of auditor and audit firms are legally recognized. The Law provides the legal framework for further development of Chinese audit market. At that time, audit was a new-born service in China. The audit quality of domestic Chinese audit firms inevitably was far below that of



international audit firms (the Big 4), due to lack of experiences and expertise, sophisticated audit methodologies, and necessary resources.<sup>5</sup> The conversion of local GAAP to International Accounting Standards (IAS) further constrains domestic auditors' ability from providing audit service of desirable quality. Consequently, China Securities Regulatory Commission (CSRC) (2001), in the 16<sup>th</sup> Rule of Information Disclosure for Listed Company (the 16<sup>th</sup> Rule), requires all listed companies should be audited by international audit firms as a supplementary audit when they make their initial public offering or second public offering of securities. Two months later, CSRC (2002) modified the scope of the 16<sup>th</sup> Rule to be applicable to only listed companies with initial public offering exceeding 300 million Yuan (300 million Yuan included) and expand supplemental auditors to include those audit firms authorized by CSRC.<sup>6</sup> Lack of competition from domestic Chinese audit firms, plus the requirement of supplemental audit along with other beneficial policies (such as lower income tax rate brackets to which international accounting firms belong<sup>7</sup>) allow the Big 4 to rapidly expand their business in China during the period of 2000 to 2006. According to the Top 100

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<sup>5</sup> A series of financial reporting scandals occurred in the Chinese stock market during the period of 1996 to 2002. In 1997, Qiongminyuan scandal, one of the most serious fraud cases in Chinese history broke out. The management of the Qiongminyuan Company faked 54 million net profits in the annual report. In 1999, Hongguang Company became the first listed company that was involved in serious criminal investigation because of its fraudulent financial reports. In the same year, Yinguangxia scandal, which is viewed as the Chinese version of Enron Corporation, broke out. In 2001, a professor in Central University of Finance and Economics accused Lantian Company manipulated its publicly disclosed financial information, and the accusation was proved to be true. In all of these cases, incumbent auditors failed to detect the fraud.

<sup>6</sup> This is not the first time that regulators in China adopt policies that require international public firms to involve in supplemental audit of listed companies. In 2000, CSRC (2000) released the 8th Rule of Information Disclosure for Listed Company---Special Request of Format and Information in Annual Report for Stock Broker which require all stock brokers listed in A share market to be audited by international public firms as a supplemental audit. Hereafter, CSRC (2003) released the 18th Rule to request all listed commercial banks to purchase supplemental audit as stock brokers do. By the end of 2006, almost all listed companies in financial industry were required to perform supplemental audit by international public firms in their annual reports and IPO.

<sup>7</sup> Under Income Tax Law in China, international public firms registered in China as Chinese-foreign cooperative enterprises are subject to lower income tax bracket than domestic firms.

Audit Firms Rank (Table 1) issued by the CICPA, the Big 4 occupy the top four positions in year 2002; in descending order by profit, they are PWC (with revenue of 766 million Yuan), KPMG (revenue of 334 million Yuan), DTT (revenue of 291 million Yuan) and EY (revenue of 246 million Yuan). The fifth ranked firm BDO (revenue of 101 million Yuan) is another international audit firm. The highest ranked Chinese firm is Yuehua (with revenue of 83 million Yuan) ranked as the sixth. Among the top 10 firms, the combined revenue of the Big 4 (1638 million Yuan) is nearly five times as large as that of the Chinese firms (347 million Yuan). The dominant trend of the Big 4 supply continues in the next few years. As of 2006, the top four positions are still occupied by the Big 4, with an even larger revenue gap between the Big 4 and other Top 10 Chinese firms (6,259 million Yuan combined revenue for the Big 4 which is nearly seven times as large as the combined 920 million Yuan revenue for the Chinese firms).

[Insert Table 1 here]

Subsequently, a series of policies promulgated by the Chinese regulators slow down international firms' growth in China. In 2007, Ministry of Finance (MOF) and CSRC (2007) request all listed companies to adopt modified accounting standards which are very similar to International Accounting Standards (IAS), and released an announcement (the Abolishment of Supplemental Audit for Applied Listed Companies) to abolish supplemental audit. CICPA (2008) released "the Instruction of Development in Audit Service Industry" (the Instruction) as part of the strategy policy in the 11<sup>th</sup> Five-Year Plan published by the national government. The Instruction planned to foster 100 domestic Chinese audit firms to have the capability to provide high audit services for middle or large size clients, and at least 10 domestic audit

firms to become international firms within 5 to 10 years. Related policies were published after the Instruction.

In 2009, with the approval of MOF and the CSRC, “the Authorization of Local Firms for Providing Audit Service to Listed Companies in Hong Kong” (the Authorization) was released (MOF 2009). This Authorization allows local firm that meet the requirements (e.g. CPA number, revenue, qualification) stipulated in the Authorization provide audit service to listed companies in Hong Kong market. One year later, the MOF (2010) published another policy, “the Temporary Policy of Converting to Limited Liability Partnership for Middle and Large Size Audit Firm”, to encourage local firms to convert their partnership structure to limited liability partnership. According to this new policy, the number of partners in Chinese audit firms with limited liability partnership will no longer be limited to 50. Removing the constraint on the number of partners facilitates the growth in size of local firms.

Benefiting from the above policies, local Chinese audit firms have grown rapidly in size and revenue since 2008. In 2012, Ruihua, a local audit firm became the 4<sup>th</sup> largest audit firm in Chinese audit market, replacing KPMG. The top 4 firms in 2012 (Table 1) are PwC, DTT, Ruihua and EY, and their revenues are 3226 million Yuan, 3045 million Yuan, 2437 million Yuan and 2236 million Yuan, respectively. In 2013, Ruihua was ranked as the 3<sup>th</sup> largest audit firm, and EY and KPMG became the 5<sup>th</sup> and 6<sup>th</sup> in the rank. As of 2013, the combined revenue of the Big 4 is only about one and half times as large as that of the local Chinese firms in the Top 10 rank.

While concentration of the Big 4 supply in Europe and U.S. has been increasing in recent years, it is showing a decreasing trend in China. As Big 4 firms remain their crucial

roles in the Chinese audit market, the significance of domestic audit firms is not negligible as they grow bigger and become more competitive. Above all, we believe the Chinese audit market provides an interesting and meaningful setting to examine the effect of audit market concentration, not only from the Big 4 supply but also from the non-Big 4 supply on audit quality.

## ***2.2 Literature review and hypothesis development***

### **2.2.1 Prior literature**

Research on audit market concentration can be traced back to the work of Mautz and Sharaf (1961) who note that the concentration was taking place within the America audit market. They further predict that if the trend towards concentration continued then the market would ultimately consist of a small number of very large firms and a large number of very small firms with little in between. This prediction was later evidenced not only in U.S. but also internationally as a few large international public accounting firms become dominant in the global audit market (Gilling and Stanton 1978). As such, audit market concentration has become a global topic for researchers around the world.

Some research attempts to explain the formation of concentration by exploring determinants of concentration.<sup>8</sup> Other research investigates the impact of audit market concentration on audit outcomes, such as audit pricing (Pearson and Trompeter (1994); (Chen

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<sup>8</sup> DeAngelo (1981) and Dopuch and Simunic (1982) argue that firms' ability to produce quality- differentiated products and reputation for superior quality explain their market dominance. Dopuch and Simunic (1982) and Danos and Eichenseher (1986) suggest that economies of scale in audit production favor market dominance by a few firm. Doogar and Easley (1998) demonstrate practices, client size distributions and differences in auditor productivity jointly determine audit firms' market shares.

et al. 2007; Ciconte et al. 2014), and client auditor choice GAO (2003) and Dunn et al. (2011)

More closely related to our work is a stream of research that examines the effect of audit market concentration on audit quality. Two studies conducted by U. S. Government Accountability Office (GAO 2003 2008) found no evidence that high concentration of the Big 4 is harmful to audit quality. Using data from 2000 to 2006 in the U.S. market, Kallapur et al. (2010) document a positive association between audit market concentration (as measured by Herfindahl index) at the metropolitan level and audit quality (as measured by discretionary accruals and the Dechow- Dichev (2002) measure of accrual quality). Similarly, Newton et al. (2013) find that greater audit market concentration (as measured by Herfindahl index) in U.S. metro areas are associated with lower instances of misstatements (i.e., higher audit quality). Using data from 42 countries in the period of 1999-2007, Francis et al. (2013) document a positive association between Big 4 market shares and clients' earnings quality (as measured by total accruals, abnormal accruals, the likelihood of avoiding a loss, and timely loss recognition). However, there is evidence suggesting otherwise – that is, the adverse effect of audit market concentration on audit quality. For instance, Boone et al. (2012) find that greater city level concentration is associated with lower audit quality (as measured by the likelihood of a client using discretionary accruals to meet or beat analyst consensus forecast). Francis et al. (2013) find that clients' earnings quality is lower in countries where the Big 4 market is concentrated by one or two Big 4 firms rather than shared equally among the four. Dunn et al. (2013) find that lower (national-industry) Big4 market equality, i.e. higher concentration, is associated with lower audit quality measured by client restatements.

To summarize, most of prior studies are based on U.S. or European markets and

findings of these studies are mixed for the effect of audit market concentration on audit quality as measured by a variety of proxies. To extend this stream of literature, we study the association between audit quality and market concentration in China, where market structure and institutional environment are quite different from U.S. and European markets, using audit adjustment as a novel proxy for audit quality.<sup>9</sup>

### **2.2.2 Hypotheses development**

Theoretically speaking, in a highly concentrated audit market where a few large audit firms own a significant portion of the market shares, audit quality could be affected in different ways. First, limited auditor supply constrains client choice and lowers the likelihood of client-initiated auditor turnover. Lower client retention pressures reduce the likelihood that auditors compromise independence to tolerate clients' aggressive reporting. This will lead to better audit quality. However, low client retention pressures can be harmful to the extent that oligopolists have less incentive to invest efforts and resources in innovation to improve audit efficiency and effectiveness. Second, to the extent that high concentration allows oligopolists to negotiate more auditor-favorable contracts (i.e. charge higher audit fees) as documented in several studies (GAO 2008; Oxera 2006) and these fee premium or at least part of it represents extra audit efforts, audit quality is expected to be higher. Alternatively, concentration of market share can cause price competition among market leaders (Pearson and Trompeter 1994; Dunn et al. 2013). A possible outcome of this competition is that

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<sup>9</sup> DeFond et al. (1999) investigate change in market share after the adoption of new accounting standard in China and find that large firms' shares declined after the adoption. Bandyopadhyay et al. (2013) find mandatory partner rotation policy is most pronounced in those Chinese provinces with low levels of audit market concentration. Bradbury et al. (2014) find the fee premiums effects among big auditors exist in the Chinese audit market. These studies examine audit market concentration by exploring its causes and economic consequence, such as audit pricing, in China, but research is in general lacking on the effect of concentration on audit quality in the context of Chinese audit market.

auditors choose to maintain profit margins in the expense of audit quality by reducing audit hours and substantive test.<sup>10</sup>

Because of these conflicting arguments and the mixed evidence documented in existent literature (as reviewed in Section 2.2.1), we do not predict the direction of the relation between audit market concentration and the incidence of audit adjustment. Following Francis et al. (2013), we examine two dimensions of audit market concentration at metro (province) level: (1) the degree to which market shares of Big 4 auditors as a whole dominate market shares of non-Big 4 (domestic Chinese) audit firms in a metro market and (2) the degree to which market shares are unequally distributed among auditors of both types (Big 4 and non-Big 4) in a metro market overall, among Big 4 auditors within the Big 4 market, and among non-Big 4 auditors within the non-Big 4 market. Below, we state our first set of hypotheses, which examines the relation between Big 4 market shares and the incidence of audit adjustments, in the null form (Hypothesis 1) as well as the two competing alternative forms (Hypotheses 1a and 1b):

*H1: Ceteris paribus, there is no relation between Big 4 market shares and the incidence of audit adjustments.*

*H1a: Ceteris paribus, the higher Big 4 market shares, the lower the incidence of audit adjustments.*

*H1b: Ceteris paribus, the higher Big 4 market shares, the higher the incidence of audit adjustments.*

Our second set of hypotheses examines the relation between market share inequality

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<sup>10</sup> Another possibility is that audit quality of large audit firms will not be affected by price competition, because these large firms are able to develop more efficient audit methods to maintain audit quality despite of reduction in audit fees (audit hours).

and audit adjustments. Again, we do not offer a prediction on the relation. Below, we state our hypotheses in the null form (Hypothesis 2) as well as the two competing alternative forms (Hypotheses 2a and 2b):

*H2: Ceteris paribus, there is no relation between market share inequality (overall, among Big 4 auditors, and among non-Big 4 auditors) and the incidence of audit adjustments.*

*H2a: Ceteris paribus, the higher market share inequality (overall, among Big 4 auditors, and among non-Big 4 auditors) the lower the incidence of audit adjustments.*

*H2b: Ceteris paribus, the higher market share inequality (overall, among Big 4 auditors, and among non-Big 4 auditors) the higher the incidence of audit adjustments.*

### **3. Data and research design**

#### *3.1 Models and variables*

##### *The dependent variable measuring audit quality*

The expected role of an auditor is to reduce management's bias and increase earning quality in financial reports (Grein and Tate 2011; Kinney et al. 1994; Lennox et al. 2013). Lennox et al. (2014) use audit adjustment to test the mandatory partner rotation and audit quality in China and argue that audit adjustment could be a better proxy of audit quality. We follow their method by setting audit adjustment as a dummy variable, which equals 1 if company *i* has a profit audit adjustment in year *t*, and 0 otherwise.

##### *Test variables measuring audit market concentration*

Following Francis et al. (2013) , we investigate the concentration at the metro market



(province) level from two dimensions: (1) the degree to which market shares of Big 4 auditors as a whole dominate market shares of non-Big 4 (domestic Chinese) audit firms (variable name: B4SHARE) in a metro market and (2) the degree to which market shares are unequally distributed among auditors of both types (Big 4 and non-Big 4) in a metro market overall (*HERF*), among Big 4 auditors within the Big 4 market (*HERF\_BIG 4*), and among non-Big 4 auditors within the non-Big 4 market (*HERF\_NONBIG4*).

For the first dimensions, B4SHARE is calculated as the percentage of total clients audited by the Big 4 within the metro market-year grouping. We measure B4SHARE alternatively based upon audit fees, clients' audited sales and clients' audited assets. For the second dimension, we use the Herfindahl index (calculated alternatively based upon audit fees, client's audited sales, or clients' audited assets) to measure market share inequality among auditors, computed as the sum of the squares of the ratios of each audit firm's size to the total size of the audit market (GAO 2003, 2008; Dunn et al. 2011; Boone et al. 2012; Francis et al. 2013; Ciconte et al. 2014):

$$HERF_{k,t} = \sum_{i=1}^{n_{k,t}} [X_{k,t,i}^2]$$

Where,  $n$  is the total number of audit firms in the province  $k$ ;  $X$  is the market share of audit firm  $i$  in the province  $k$ . Following prior research we define size of each audit firm  $X$  based on audit revenues (audit fees from audit service), audited client sales and assets. For a given  $n$ , *HERF* is larger when market share is unevenly distributed among auditors. If all audit firms are of equal size then *HERF* equals  $1/n$  and higher as  $N$  gets smaller. For example, if market share is equally distributed within the Big 4 grouping, then *HERF* will equal to 0.25.

Francis et al. (1999) argue that audit markets are local. In the context of this study, audit market concentration at the national level and metro level could be different. There is also significant variation in the degree of concentration across metro areas. In our sample, the percentage of Big 4 market shares falls into the wide of range of 0% - 69% across Chinese metro markets. Decisions about client retention, audit pricing, and more importantly, audit adjustments are primarily made at the local office level. Further, a client might prefer a local audit office to a remote one because of convenience in communication with audit firm personnel, reduction in audit fees due to lower audit personnel travel costs, and better audit quality (Choi et al. 2010). As such, we measure the audit market concentration at metro (provinces) level.

### *Control variables*

Following Lennox et al. (2014), we include a set of control variables capturing various client characteristics and other factors that may affect the likelihood that a financial statement misstatement occurs and the probability that the auditor detects and corrects the misstatement by requiring an audit adjustment. We control for leverage (total liabilities divided by total assets) because the higher leverage the more likely a firm's manager engages in earnings manipulation, for instance, selects accounting procedures that shift reported earnings from future periods to the current periods (DeFond and Jiambalvo 1994). We control for size (the natural log of sales) and profitability (net income divided by sales) which explain managers' misreporting behavior (Kinney Jr and McDaniel 1989). A dummy variable indicating whether company  $i$  is involved in a merger and acquisition in year  $t$  ( $M\&A_{it}$ ) is included because Kinney et al. (2004) find mergers and acquisitions can increase the

incidence of misstatements.  $M\&A_{it}$  takes the value of 1 if company  $i$  acquires more than 20% of the equity of another company in year  $t$ , and zero otherwise. A dummy variable for loss-reporting firms ( $Loss$ ) is included because loss firms have a greater incentive to take a big bath. We control for subsidiaries (the natural log of the number of consolidated subsidiaries) because large companies with complex operations often encounter complicated accounting issues in the process of consolidating financial reports which could raise the probability of misstatement.

In addition to clients' characteristics, corporate governance can also have an impact on audit adjustment. Klein (2002) suggest that the independence of audit committee has a negative association with abnormal accruals, indicating poor corporate governance may lead to lower earning quality and increase the probability of audit adjustment. Moreover, corporate governance also affects auditor's ability to detect misstatements and affect the outcome of auditor-client negotiations over audit adjustments (Keune and Johnstone 2012). Therefore, we employ the following variables to control for corporate governance: board size (the natural log of the number of directors), the number of board meetings (the natural log of the number of meetings held by company), dummy variable ( $Duality$ ) indicating whether the CEO chairs the board of directors, and a dummy variable ( $Audit\ committee$ ) indicating if there is an audit committee in the company.

We also include various controls for auditor characteristics. We control for the size of the audit firm ( $Big4=1$  if company  $i$  is audited by a Big 4 firm in year  $t$ , and 0 otherwise). We include a dummy variable ( $Auditor\ M\&A= 1$  if company  $i$ 's audit firm merges with another audit firm in year  $t$ , and 0 otherwise) to control the merge of audit firms because HUNG

CHAN and Wu (2011) find that audit firm mergers in China let to higher audit quality. We include a dummy variable (Unclean Opinion=1 if company i receives a qualified or modified audit opinion in year t, and 0 otherwise) because auditor will issue a modified or qualified audit opinion if management refuse to accept a proposed audit adjustment. Audit fees (Fee = the natural log of the audit fee paid by company i in year t) and analyst following (Analyst= 1 if there is at least one analyst following company i in year t, and 0 otherwise) are also include because Keune and Johnstone (2012) find audit adjustments are less likely to be waived when audit fees are higher and analyst following is lower. We include audit firm tenure (Tenure= the natural log of audit firm tenure at company i in year t) which can affect audit quality.

### ***Models for hypotheses testing***

To examine the effect of audit market concentration in Chinese metro markets on audit quality, we estimate the following binary logistic regression models of audit adjustments:

$$\begin{aligned}
 ADJ_{it} = & \alpha + \beta_1 B4SHARE_{kt} + \beta_2 HERF_{kt} + \beta_3 Size_{it} + \beta_4 ROS_{it} + \beta_5 Leverage_{it} \\
 & + \beta_6 M\&A_{it} + \beta_7 Subsidiaries_{it} + \beta_8 Loss_{it} + \beta_9 Board\ Size_{it} \\
 & + \beta_{10} Board\ Meetings_{it} + \beta_{11} Duality_{it} + \beta_{12} Audit\ Com_{it} + \beta_{13} Big4_{it} \\
 & + \beta_{14} Auditor\ M\&A_{it} + \beta_{15} Unclean\ Opinion_{it} + \beta_{16} Fee_{it} + \beta_{17} Analyst_{it} \\
 & + \beta_{18} Tenure_{it} + \beta_{19} SOE_{it} + \varepsilon \quad (1)
 \end{aligned}$$

$$\begin{aligned}
ADJ_{it} = & \alpha + \beta_1 B4SHARE_{kt} + \beta_2 HERF\_BIG4_{kt} + \beta_3 HERF\_NONBIG4_{kt} + \beta_4 Size_{it} \\
& + \beta_5 ROS_{it} + \beta_6 Leverage_{it} + \beta_7 M\&A_{it} + \beta_8 Subsidiaries_{it} + \beta_9 Loss_{it} \\
& + \beta_{10} Board\ Size_{it} + \beta_{11} Board\ Meetings_{it} + \beta_{12} Duality_{it} \\
& + \beta_{13} Audit\ Com_{it} + \beta_{14} Big4_{it} + \beta_{15} Auditor\ M\&A_{it} \\
& + \beta_{16} Unclean\ Opinion_{it} + \beta_{17} Fee_{it} + \beta_{18} Analyst_{it} + \beta_{19} Tenure_{it} \\
& + \beta_{20} SOE_{it} + \varepsilon \quad (2)
\end{aligned}$$

In Equation (1), we test market share inequality measured for the overall metro audit market of Big 4 and non-Big 4 auditors combined (HERF), while in Equation (2) we test market share inequality separately within the Big 4 grouping (HERF\_BIG4 ) and the non-Big 4 grouping (HERF\_NONBIG4). In both equations, B4SHARE is tested.

### **3.2 Data and sample**

Starting 2006, all audit firms are required to submit the pre-audited, which is not public disclosed, and audited financial reports of publicly traded clients to the MOF in China. However, one of the authors has cooperation in research program with the CICPA under the MOF and has been allowed to use the data for academic research. We use the data from the period of 2007 to 2012, as data before this period is incomplete. We start with 14,786 observations in Chinese A stock market available from WIND database, during the period of 2007 to 2012. Next we exclude 261 observations in the financial industry, 3125 observations missing audit adjustments data, and 2270 observations not covered by the database of China Security Market & Accounting Research (CSMAR). These steps yield a final full sample of 9108 observations which we use to estimate Equation 1 as introduced next. We further remove 1283 observations for clients located in metro markets without the presence of at

least one Big 4 firm, to form a reduced sample of 7825 observations for estimating Equation

2. Table 2 summarizes the sample selection process.

[Insert Table 2 here]

## **4. Empirical results**

### ***4.1 Descriptive statistics for market concentration and audit adjustments***

Table 3 presents descriptive statistics of audit adjustments by year (panel A) and the number of Big 4 in a metro market (panel B). In panel A, we find audit adjustments occur on 66.35% (third column) of engagements. The proportion of upward adjustments (fourth column), downward adjustments (fifth column) and no adjustments are 23.29%, 43.06% and 33.65%, respectively. This is consistent with Kinney et al. (1994) who find that adjustments are required in 60-90% of U.S. audit and similar with Lennox et al. (2014) who find audit adjustment occur on 67.09% of engagements and report the proportion of upward adjustments, downward adjustments and no adjustments are 22.02%, 45.07% and 32.91% , respectively. The sixth and seventh column in panel A report the proportion of adjustments cataloged by magnitude, we conclude the absolute value of adjustments above 5% of pre-audit profit to be the large adjustment. Large adjustments and small adjustments are 29.24% and 37.11%. In the period of 2007 to 2012, the proportion of adjustments is decreasing (third column), from 72.82% to 59.88%. However, the proportion of downward adjustments (fifth column) does not charged too much. This is consistent with managers are more likely to make attempts that increase current-year income, but auditors are more likely to require that those attempts be adjusted (Nelson et al. 2002).

[Insert Table 3 Panel A here]

Panel B provides descriptive statistics for audit adjustment by number of big 4 in a province. There are 9108 observations distributed in 186 provinces from 2007 to 2012, and most of observations (3724 observations) are located with the province with 4 Big 4 firms. However, provinces with 2 Big 4 firms have the largest proportion of adjustments (77.13%), and provinces with 3 Big 4 firms have the lowest proportion of adjustments (58.78%). However, the proportion of adjustments decreased when more Big 4 firms enter the same province. The proportion of adjustments in the provinces with no Big 4 firms is 59.63%---just higher than the proportion in the provinces with 3 Big 4 firms but much lower than the provinces with more Big 4 firms.

[Insert Table 3 Panel B here]

In table 3, Panel C and Panel D report the descriptive statistics of independent variables by years and by the number of Big 4 in a metro market. We calculated B4SHARE and HERF based on the audit fee in table 3 because the person correlations between independent variables in table 4 shows the variables based on audit fee, audited clients' sales and audited clients' assets are similar. In panel C, the mean of B4SHARE is decreasing from 2007 to 2012, from 0.2286 to 0.1782. Obviously, Big 4 firms are losing their market share in Chinese audit market. This is opposite to the audit market U.S. where the market shares of Big 4 are increasing (GAO 2003, 2008). The aggregated mean of B4SHARE is 0.2009 which is close to Francis et al. (2013) who report the B4SHARE in China is 0.17. The aggregated mean of HERF is 0.1820, lower than HERF\_NONBIG4 which is 0.2167 and HERF\_BIG4 which is 0.5710. This indicates the inequality in Big 4 grouping is much higher than overall market, which means there is more competition in the overall audit market.

[Insert Table 3 Panel C here]

In panel D, the descriptive statistics for the sample are cataloged by number of Big 4 in a metro market. HERF of metro markets with 2 Big 4 firms (0.2807) are the highest, and decreased when more Big 4 firms entered the same market, and this is also happened to the HERF\_NONBIG4—— which reached peak value at the 2 Big 4 firms in a metro market (0.3304) and decreased to 0.1674 when 4 Big 4 firms are in the same market. This indicates Big 4 firms could actually cause the change of market structure at local audit market as the HERF and HERF\_NONBIG4 changes every time when different numbers of Big 4 firms enter the market.

[Insert Table 3 Panel D here]

[Insert Table 4 here]

#### ***4.2 Descriptive statistics for Control variables***

Table 5 provides descriptive statistic for the control variables. The mean value of log of sales (Size) is 20.969 and ranges from 16.437 to 25.077. The mean return on sales (ROS) is 8.192% and the mean value of leverage (Leverage) is 47.517%. We find 36.11% of clients are involved in a merger or acquisition transaction during the year (M&A). The natural log of (one plus) the total number of subsidiaries (Subsidiaries) ranges from 0.000 to 4.419. We find 8.63% of clients are reported a loss during the year (Loss). The natural log of the number of board member (Board size) ranges from 1.609 to 2.708 and the natural log of the number of board meeting times during the year (Board meeting) ranges from 1.386 to 3.045. We find 20.83% clients' CEO is also Chairman of the Board of Director (Duality) and 56.63% of clients have an audit committee (Audit committee). We find 5.03% clients are audited by Big



4 companies (Big 4) which is consistent with low proportion in other China studies such as Lennox et al. (2014). We find 14.02% of clients are audited by a firm that merges with another audit firm (Audit M&A) and 1.11% receive qualified or modified audit opinion (Unclean opinion). We find 49.96% clients are national owned enterprise (SOE). Descriptive statistics for the other control variables are also consistent with expectations and prior results.

[Insert Table 5 here]

[Insert Table 6 here]

### ***4.3 Regression results***

Table 7 presents regression results for testing the effect of two dimensions of audit market concentration on audit quality: the dominance of Big 4 market shares as a group relative to the non-Big 4 shares (B4SHARE, tested by H1), and market share inequality among auditors as measured by the Herfindahl index (HERF, HERF\_BIG4, HERF\_NONBIG4, tested under H2). Since the market share inequality among auditors of all types, HERF is highly correlated with that among non-Big 4 auditors HERF\_NONBIG4 (Table 4), we separately analyze the effect of HERF and inequality for auditors of each type, HERF\_BIG4 and HERF\_NONBIG4. We present results for share inequality measured by the Herfindahl index alternatively based on audit fee, client audited sales, and client audited assets. As such, the three regressions on the left side of Table 7 test BSHARE and HERF; while the three regressions on the right side test BSHARE, HERF\_BIG4 and HERF\_NONBIG4.

[Insert Table 7 here]

Consistent with H1a, B4SHARE is significantly negative in the three regressions on

the right side ( $p < 0.01$ ), suggesting that greater market shares held by the Big 4 in a Chinese metro market are associated with fewer audit adjustment, i.e. impaired audit quality. In economic terms, one unit increases in B4SHARE is associated with 5% decrease in the likelihood of audit adjustment.<sup>11</sup> Consistent with H2b, we find that HERF is positively associated with audit adjustment occurrence, i.e. better audit quality (in the three regressions on the left side). Similar to HERF, market share inequality among non-Big 4 auditors HERF\_NONBIG4 is positively associated with audit adjustment ( $p < 0.01$ ), suggesting that uneven share distribution among non-Big 4 auditors at metro level improves audit quality. The economic significance is 6% increase in the likelihood of audit adjustment. Differently, market share inequality among Big 4 auditors HERF\_BIG4 is significantly negative ( $p < 0.01$ ; 4% decrease in the likelihood of audit adjustment in economic terms), suggesting that disproportionate share allocation among Big 4 auditors rather than equal share distribution is harmful to audit quality.

To summarize the results in Table 7, we find that even in a legal jurisdiction, such as China, with relatively low Big 4 dominance, the Big 4 market concentration (captured by BIG4SHARE and HERF\_BIG4) can still be harmful to audit quality. As such, there may not be a single uniform answer to the issue of Big 4 audit market concentration on audit quality. Instead, the response to the issue could vary across different institutional and regulatory environments. On the other hand, the positive relation between HERF\_NONBIG4 and audit adjustment suggests that as advocated by regulators around the world, promoting market participation of

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<sup>11</sup> Economic magnitude = coefficient  $\times p \times (1 - p) \times$  one standard deviation of the variable, where  $p$  = the probability that the dependent variable equals 1 (i.e., the probability that audit adjustment occurs).

non-Big 4 audit firms and providing much needed competition to the Big 4 improve audit quality.

In terms of the control variables, we find significant negative coefficient on Size and Leverage, indicating that audit adjustments are less common among larger companies and companies with higher leverage. We also find negative significant coefficient on Big 4, indicating that adjustments are less common among Big 4 clients. This is consistent with these companies having higher quality pre-audit financial statements. However, we failed to find any connection between Auditor M&A and audit adjustment, we believe this inconsistent with Lennox et al. (2014) is caused by the selection of samples. We find positive significant coefficient on Fee when the independent variables are not calculated by audit fee, indicating higher audit fee could lead to more incidence of audit adjustment. This is consistent with Ward et al. (1994) who find a positive association between the number of audit adjustment and audit fee. We find audit adjustment occur more frequently when audit firm tenure is longer (Tenure). At last, we find negative significant coefficient on SOE, indicating that adjustment among stat owned enterprise are less common. This is consistent with these companies have larger size and better pre-audit financial restatements. The rest of control variables are not statistically significant.

## **5. Robust and Additional Analysis**

### ***5.1 Upward and downward adjustments***

Nelson et al. (2002) find managers are more likely to increase current-year income rather than decrease, and auditors are more likely to require those attempts be adjusted. In table 3, downward adjustments are almost twice of upward adjustments. Therefore, in this

section, we examine whether our prior results are equally effective in correcting managers' understatement and overstatements. We construct a trichotomous variable ( $ADJUST\_SIGN_{it}$ ) which equals zero when there is no adjustment, one when there is an upward adjustment, and two when there is a downward adjustment. As  $ADJUST\_SIGN_{it}$  takes three possible values, the models are estimated using multinomial logit, with benchmark comparison being the no adjustment observations ( $ADJUST\_SIGN_{it} = 0$ ).

Table 8 provides the results of our test. We find significant negative coefficients for HERF in both models, indicating that the increase of inequality in overall audit market could cause more upward adjustments and downward adjustments. This is consistent with our prior results that the increase of inequality in overall market will benefit audit quality. We also find significant negative coefficient on HERF\_BIG4 and significant positive coefficient on HERF\_NONBIG4 in both models, indicating that the decrease of inequality in Big 4 grouping and the increase of inequality in non-Big4 grouping are contributing more occurrences of both upward adjustments and downward adjustments. This is consistent with our results in main model.

[Insert Table 8 here]

### ***5.2 Large and small audit adjustments***

In this section, we examine whether audit market concentration affects both large and small audit adjustments. In table 3, we observed that the proportion of large adjustments is lower than small adjustments. Large adjustments could bring more impact to clients' financial reports, because audit adjustments could reduce the bias in financial reporting (Kinney et al. 1994). Therefore, it is necessary to examine the association between audit market

concentration and the incidence of audit adjustment. We construct a trichotomous variable ( $ADJUST\_SIZE_{it}$ ) which equals zero when there is no audit adjustments, one when there is a large adjustment and two when there is a small adjustment. We follow Keune and Johnstone (2012) and Lennox et al. (2014) who define the large adjustment with amount exceed 5% of pre-audit profits. As  $ADJUST\_SIZE_{it}$  takes three possible values, the models are estimated using multinomial logit with the benchmark group being the case of no adjustment ( $ADJUST\_SIZE_{it} = 0$ ).

Table 9 shows the results of association between audit market concentration and the occurrences of large and small audit adjustments. We find significant positive coefficients on  $EQUALITY$  and  $EQUALITY\_NONBIG4$  and significant negative coefficients on  $EQUALITY\_BIG4$ . These results are consistent with our prior findings. This indicates the inequality of overall audit market and non-big4 market are helping auditors to make both large adjustments and small adjustments. However, the increase of inequality in Big 4 grouping is making the auditor give less audit adjustment. This indicates the increase of inequality within Big 4 grouping is impairing audit quality.

[Insert Table 9 here]

### ***5.3 Alternative proxies of audit quality***

We employ abnormal accruals to measure the audit quality. Total accruals ( $TOTACC$ ) is defined as the firm's income before extraordinary items, less cash flows from operations, scaled by lagged total assets. The calculation of abnormal accruals ( $ABACC$ ) is based on a modified Jones model of expected accruals which controls for concurrent firm performance (Kothari et al. 2005; Dechow et al. 1995; Jones 1991). Abnormal accruals are measured as the

firm-specific residual in the following model of expected (normal) accruals:

$$TOTACC_{it} = \alpha + \beta_1 \left( \frac{1}{ASSET_{it-1}} \right) + \frac{\beta_2(\Delta SALES_{it} - \Delta AR_{it})}{ASSET_{it-1}} + \frac{\beta_3(PPE_{it})}{ASSET_{it-1}} + \beta_4(ROA_{it}) \\ + Year\ Fixed\ Effects + Industry\ fixed\ Effects + \varepsilon$$

Where ASSET is a firm's total assets, SALES is a net sales, AR is account receivable, PPE is gross property, plant and equipment, and ROA is return on assets. Higher quality audits are expected to reduce managerial discretion and result in smaller accruals in audited earnings.

Table 10 shows the results of association between the absolute value of residue of modified Jones Model and the occurrence of audit adjustments. We find significant negative coefficient on HERF and HERF\_NONBIG4, indicating the increase of inequality in overall market and non-Big 4 grouping improve the earning quality of financial report. This result is consistent with the result of our main model.

We employ second proxy of audit quality measure developed by Dechow and Dichev (2002) model and modified by McNichols (2002). Dechow and Dichev (2002) model earnings quality as accruals quality—accruals are of high quality if the map into past, current, and future cash flows effectively. McNichols (2002) suggests that including the original Jones-model variables in the model improves performance of the model. Thus, we obtain the second alternative measure by calculating the time series standard deviation of residuals from a cross sectional regression estimated from the following equation:

$$\Delta WCA_{it} = \alpha_1 + \alpha_2 CFO_{it-1} + \alpha_3 CFO_{it} + \alpha_4 CFO_{it+1} + \alpha_5 \Delta REV_{it} + \alpha_6 PPE_{it} \\ + Year\ Fixed\ Effects + Industry\ Fixed\ Effects + \varepsilon$$

Where  $\Delta WCA_{it}$  is change in working capital from year t-1 to t of firm i, CFO is cash

flow from operations,  $\Delta REV_{it}$  is change in net sales from year t-1 to t of firm i,  $PPE_{it}$  is gross property, plant and equipment of firm i in year t. All variables above are deflated by average total assets. The larger the standard deviation of residuals the greater is the noise in earnings and lower is the quality of earnings, hence the lower is the audit quality.

Table 10 shows the association between the absolute value of residue of Dechow and Dichev (2002) Model and the incidence of audit adjustment. We find significant positive coefficient on B4SHARE. This result is consistent with our previous result that reduce the market share of Big 4 firms could increase audit quality.

[Insert Table 10 here]

#### ***5.4 Alternative proxies of market concentration***

We measure concentration at the metro market (province) level. For each province and each year, we follow prior studies to measure concentration using the Adjusted Herfindahl index (AHI) (Dunn et al. 2011; Minyard and Tabor 1991). Herfindahl index (HI) measures the level of competition within an industry or market and had been used in academic research (GAO 2008, 2003; Francis et al. 2013; Dunn et al. 2013). However, it is sensitive to the number of audit firms and it will almost always increase if the number of firms decreases. Unlike HI, AHI is less sensitive to the number, and it could provide more objective results when we compared the concentration between Big 4 grouping and non-Big4 grouping.

$$AHI_{k,t} = \sum_{i=1}^{n_{k,t}} [X_{k,t,i}^2] - 1/n_{k,t}$$

Where,  $n$  is the total number of audit firms in the province k;  $X$  is the market share of audit firm  $i$  in the province k. Following prior research we define size of each audit firm  $X$

based on audit revenues (audit fee from audit service), audited client sales and assets. More (less) inequality of market shares among the firms in a metro market (province) is consistent with higher (lower) AHI.

We also consider the Gini measure of audit market share at the province level. The Gini measure provides a measure of market share equality based on the Lorenz curve. A Lorenz curve graphs the cumulative market share from the smallest market share to the largest market share in a province. The Gini measure effectively compares the curve to the 45-degree angle representing equal market shares. We follow the method in prior study (Dunn et al. 2011).

$$\text{Gini}_{k,t} = (2/n_{k,t}^2 \bar{X}_{k,t}) \sum_{i=1}^{n_{k,t}} \left[ \left( i - \frac{n_t}{2} \right) X_{k,t,i} \right]$$

Where  $n$  equals the number of auditors in province  $k$  in year  $t$ ;  $\bar{X}_{k,t}$  equals the mean market shares based on the audit fees for the auditors within province  $k$  in year  $t$ ; and  $X_{k,t,i}$  equals the market share of auditor  $i$  in province  $k$  at year  $t$ . The Gini measure is calculated for each province, with the auditors ordered from smallest to largest in terms of market share rank within each province. More (less) inequality of market shares among the firms in a province is consistent with higher (lower) Gini coefficient.

Table 11 reports the results of the two alternative variables in our model. The results are consistent with our main model.

[Insert Table 11 here]

### ***5.5 Additional analysis on audit fee***

Prior studies investigate the association between audit fee and market concentration (Dunn et al. 2013; Pearson and Trompeter 1994). We employ the natural log of audit fee (Fee)



as the dependent variable to test the association between audit fee and market concentration in Chinese market.

Table 12 reports the results. We find significant positive coefficients on both B4SHARE and HERF, indicating the increase of market share of Big 4 firm and the inequality in overall market increases, the audit fee increases. We also find significant negative coefficient on HERF\_BIG4, indicating the increase of inequality in Big 4 grouping may cause price competition within the grouping. For the HERF\_NONBIG4, we find a significant negative coefficient, indicating the increase of inequality in non-Big 4 grouping leads to higher audit fee, consistent with large Chinese audit firms in more concentrated metro markets spend more audit efforts leading to better audit quality.

[Insert Table 12 here]

### ***5.6 Reduced period of samples***

Since the 11<sup>th</sup> Five-Year Plan has been published in the year of 2008, Chinese government released a series of policies to benefit the local audit firms from 2009. Therefore we test our model by using the data from 2009 to 2012 to examine whether the results change.

Table 13 reports the results and all results are consistent with our prior results.

[Insert Table 13 here]

## **6. Conclusion**

Existent literature regarding the effect of audit market concentration on audit quality, based upon U.S. or cross-country data is inconclusive. This study explores this important, yet unresolved issue in a fresh setting - China metropolitan audit market. In China, the Big 4 audit

firms' market shares are significantly lower than those in U.S. and many other developed markets. On the other hand, the non-Big 4 (mostly domestic Chinese) firms are growing rapidly in size under the help of a series of recent Chinese regulations. The unique structure of China audit market allows us to study the effect of concentration of supply not only by the Big 4 but also by the non-Big 4 auditors.

As an improvement from prior literature that uses noisy measures such as accrual quality or earnings quality to infer about audit quality, we use a more direct, better measure - audit adjustment based upon a proprietary database to proxy for audit quality (Lennox et al. 2014). We find that the Big 4 market concentration in China is harmful to audit quality, i.e., the incidence of audit adjustment is less likely to occur among clients located in metro markets where the Big 4 market share (as a group) is greater relative to the non-Big 4 shares, and where one or two Big 4 audit firms dominate the Big 4 market rather than four firms share the market equally. Economically speaking, in a metro market comprising both Big 4 and non-Big 4 auditors, as the percentage of aggregated shares held by Big 4 auditors increases by one unit, the likelihood of a client receiving audit adjustment decreases by 5%. Within the Big 4 market, as the share equality increases by one unit, the likelihood of audit adjustment decreases by 4%. In contrast, the domestic Chinese firms' concentration is beneficial, i.e. the incidence of audit adjustment is more likely to occur among clients belonging to metro areas where the non-Big 4 market is dominated by one or few large non-Big 4 auditors rather than shared equally. In economic terms, within the non-Big 4 market, as the share equality increases by one unit, the likelihood of audit adjustment increases by 6%.

Taken together, findings in this study further our knowledge about the effect of audit

market concentration on audit quality, and could potentially yield several useful implications for regulators around the world continuously aiming at promoting a healthy audit market. First, our results provide support to regulators' view that broadening non-Big 4 firms' market participation and providing much needed competition to the Big 4 improves audit quality. Second, the Big 4 concentration could still be harmful even in a legal jurisdiction like China with relatively low Big 4 dominance. As such, the effect of the Big 4 concentration on audit quality could be sensitive to the characteristics of the institutional and regulatory environment with which the effect is examined.

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**Table 1 Top 10 audit firm ranked by total income (million Yuan) from CICPA**

<i>Rank</i>	<i>Firm Name</i>	<i>2002</i>	<i>Firm Name</i>	<i>2003</i>	<i>Firm Name</i>	<i>2006</i>	<i>Firm Name</i>	<i>2007</i>	<i>Firm Name</i>	<i>2012</i>	<i>Firm Name</i>	<i>2013</i>
1	PwC	766	PwC	902	PwC	2,038	PwC	2,626	PwC	3,226	PwC	3,351
2	KPMG	334	KPMG	432	EY	1,598	EY	2,316	DTT	3,045	DTT	2,881
3	DTT	292	DTT	376	DTT	1,386	DTT	2,124	Ruihua	2,437	Ruihua	2,776
4	EY	246	EY	329	KPMG	1,237	KPMG	1,945	EY	2,236	BDO	2,509
5	BDO	101	BDO	114	BDO	220	RSM	505	BDO	1,774	EY	2,364
6	Yuehua	83	Yuehua	86	Yuehua	210	BDO	371	KPMG	2,136	KPMG	2,347
7	Rightson	71	ShineWing	85	ShineWing	203	ShineWing	254	WUYIGE	1,366	Pan-China	1,341
8	Jingdu	65	Zhongshen	75	Zhongshen	186	WUYIGE	229	Pan-China	1,105	DAHua	1,238
9	ShineWing	65	Rightson	74	Rightson	169	Wanlong	194	ShineWing	1,041	ShineWing	1,175
10	Zhongshen	63	Gongzheng	68	Wanlong	152	Reanda	188	DAHua	1,008	WUYIGE	1,101

**Table 2 Sample selection**

Firm-year observations from WIND	14786
Less:	
financial industry	261
data not available in audit adjustment	3147
data not available in WIND and CSMAR	2270
Full samples	9108
Less:	
Metro (province) without Big 4 firms	1283
Reduced samples	7825

**Table 3 Descriptive statistics for the sample (N=9108)**

*Panel A: Breakdown by sample year*

Year	N	firm number	Audit adjustment %	Upward adjustment %	Downward adjustment %	Large adjustment %	Small adjustment %
2007	1,203	62	72.82%	30.84%	41.98%	38.49%	34.33%
2008	1,254	56	68.58%	23.60%	44.98%	37.80%	30.78%
2009	1,458	52	65.71%	23.66%	42.04%	29.77%	35.94%
2010	1,776	51	69.71%	23.65%	46.06%	28.32%	41.39%
2011	1,757	49	63.57%	21.34%	42.23%	22.99%	40.58%
2012	1,660	42	59.88%	18.92%	40.96%	23.19%	36.69%
Total	9,108		66.35%	23.29%	43.06%	29.24%	37.11%

*Panel B: Breakdown by number of Big 4 in a province*

Number of Big 4 in a province	Number of Province-year	Observations	Audit adjustment %	Upward adjustment %	Downward adjustment %	Large adjustment %	Small adjustment %
0	61	1,283	59.63%	20.81%	38.82%	30.01%	29.62%
1	60	1,918	64.60%	23.88%	40.72%	28.68%	35.92%
2	26	1,443	77.13%	25.57%	51.56%	35.27%	41.79%
3	11	740	58.78%	20.95%	37.84%	27.03%	31.76%
4	28	3,724	66.89%	23.42%	43.47%	27.36%	39.55%
Total	186	9,108	66.35%	23.29%	43.06%	29.24%	37.11%

*Panel C: Breakdown by sample year*

	Min	Mean	SD	P25	P50	P75	Max
<b>B4SHARE</b>							
2007	0.0000	0.2286	0.2267	0.1828	0.0000	0.3759	0.5624
2008	0.0000	0.2330	0.2136	0.1929	0.0287	0.3916	0.6889
2009	0.0000	0.2079	0.2023	0.1798	0.0289	0.2934	0.6643
2010	0.0000	0.1874	0.1364	0.1648	0.0449	0.2488	0.5955
2011	0.0000	0.1882	0.1302	0.1583	0.0373	0.2849	0.5814
2012	0.0000	0.1782	0.1072	0.1534	0.0379	0.2952	0.5244
Total	0.0000	0.2009	0.1700	0.1718	0.0449	0.2950	0.6889
<b>HERF</b>							
2007	0.0937	0.1879	0.0852	0.1284	0.1584	0.2301	0.4533
2008	0.0781	0.1890	0.0989	0.1095	0.1723	0.2287	0.4321
2009	0.0795	0.1834	0.1032	0.1067	0.1704	0.2035	0.4424
2010	0.0813	0.1743	0.0986	0.0909	0.1543	0.1998	0.4127
2011	0.0795	0.1814	0.1073	0.1210	0.1519	0.1922	0.5135
2012	0.0812	0.1862	0.1087	0.1088	0.1543	0.2047	0.4460
Total	0.0781	0.1831	0.1015	0.1078	0.1543	0.2080	0.5135
<b>HERF_BIG4</b>							
2007	0.3312	0.6049	0.2473	0.4593	0.4900	1.0000	1.0000

2008	0.3155	0.5887	0.2689	0.3701	0.4465	1.0000	1.0000
2009	0.3200	0.6131	0.2835	0.3697	0.5328	1.0000	1.0000
2010	0.3245	0.5446	0.2467	0.3351	0.5125	0.5691	1.0000
2011	0.2925	0.5485	0.2614	0.2991	0.5476	0.6336	1.0000
2012	0.2973	0.5545	0.2617	0.3172	0.4850	0.7945	1.0000
Total	0.2925	0.5710	0.2631	0.3609	0.5000	0.7945	1.0000

HERF\_NONBIG4

2007	0.0937	0.2157	0.1078	0.1293	0.1714	0.2637	0.4632
2008	0.0982	0.2228	0.1152	0.1095	0.1744	0.3162	0.4447
2009	0.0843	0.2158	0.1158	0.1128	0.1726	0.3174	0.4637
2010	0.0840	0.2088	0.1119	0.1241	0.1528	0.3151	0.4513
2011	0.0795	0.2172	0.1199	0.1244	0.1660	0.3306	0.5135
2012	0.0812	0.2216	0.1166	0.1402	0.1624	0.2889	0.4796
Total	0.0795	0.2167	0.1150	0.1241	0.1714	0.3151	0.5135

*Panel D: Breakdown by number of Big 4 in a province*

	Min	Mean	SD	P25	P50	P75	Max
<b>B4SHARE</b>							
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1	0.0000	0.1368	0.1160	0.1139	0.0492	0.2572	0.5624
2	0.0000	0.1012	0.0449	0.1066	0.0289	0.1647	0.4685
3	0.1302	0.1972	0.2040	0.0535	0.1364	0.2268	0.3040
4	0.0820	0.3232	0.2939	0.1569	0.2248	0.4048	0.6889
Total	0.0000	0.2009	0.1700	0.1718	0.0449	0.2950	0.6889
<b>HERF</b>							
0	0.0795	0.1915	0.1024	0.1003	0.1697	0.2462	0.5135
1	0.1005	0.2188	0.1062	0.1362	0.1743	0.3098	0.4424
2	0.1303	0.2807	0.1238	0.1810	0.2119	0.4265	0.4460
3	0.1271	0.1900	0.0394	0.1543	0.1933	0.2247	0.2506
4	0.0781	0.1227	0.0388	0.0908	0.1078	0.1584	0.2353
Total	0.0781	0.1831	0.1015	0.1078	0.1543	0.2080	0.5135
<b>HERF_BIG4</b>							
1	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000
2	0.5000	0.5631	0.0835	0.5074	0.5236	0.5653	0.7945
3	0.3620	0.4352	0.0882	0.3722	0.3786	0.4593	0.6412
4	0.2925	0.3801	0.0792	0.3172	0.3562	0.4629	0.5476
Total	0.2925	0.5710	0.2631	0.3609	0.5000	0.7945	1.0000
<b>HERF_NONBIG4</b>							
0	0.0795	0.1917	0.1024	0.1003	0.1697	0.2462	0.5135
1	0.0977	0.2352	0.1113	0.1519	0.1811	0.3296	0.4637
2	0.1650	0.3304	0.1179	0.2311	0.2939	0.4561	0.4796
3	0.1310	0.2383	0.0997	0.1509	0.1966	0.3502	0.4066
4	0.0940	0.1674	0.0840	0.1128	0.1242	0.1707	0.4632
Total	0.0795	0.2167	0.1150	0.1241	0.1714	0.3151	0.5135

**Table 4 Pearson correlations between independent variables**

<i>Variable</i>	1	2	3	4	5	6	7	8	9	10	11	12
<b>B4SHARE</b>												
1 Audit Fee	1											
2 Sales	0.90	1.00										
3 Assets	0.93	0.97	1.00									
<b>HERF</b>												
4 Audit Fee	-0.32	-0.27	-0.28	1.00								
5 Sales	-0.27	-0.22	-0.25	0.82	1.00							
6 Assets	-0.30	-0.28	-0.29	0.83	0.92	1.00						
<b>HERF_BIG4</b>												
7 Audit Fee	-0.48	-0.53	-0.55	0.32	0.48	0.46	1.00					
8 Sales	-0.51	-0.53	-0.59	0.11	0.33	0.30	0.80	1.00				
9 Assets	-0.46	-0.50	-0.54	0.17	0.39	0.36	0.83	0.96	1.00			
<b>HERF_NONBIG4</b>												
10 Audit Fee	-0.23	-0.13	-0.14	0.90	0.70	0.71	0.14	0.03	0.07	1.00		
11 Sales	-0.35	-0.31	-0.31	0.77	0.81	0.90	0.38	0.29	0.32	0.80	1.00	
12 Assets	-0.35	-0.30	-0.32	0.80	0.88	0.86	0.43	0.33	0.36	0.81	0.94	1.00

**Table 5 Descriptive statistics for the sample (N=9108)**

<i>variable</i>	<i>Mean</i>	<i>SD</i>	<i>Min.</i>	<i>P25</i>	<i>P50</i>	<i>P75</i>	<i>Max.</i>
Size	20.969	1.480	16.437	20.042	20.913	21.832	25.077
ROS	8.192	20.086	-106.530	2.390	6.850	14.090	99.690
Leverage	47.517	26.266	4.010	29.440	47.060	63.050	181.260
M&A	0.361	0.480	0.000	0.000	0.000	1.000	1.000
Subsidiaries	1.644	1.153	0.000	0.693	1.792	2.485	4.419
Loss	0.086	0.281	0.000	0.000	0.000	0.000	1.000
Board size	2.180	0.199	1.609	2.079	2.197	2.197	2.708
Board meeting	2.143	0.354	1.386	1.946	2.197	2.398	3.045
Duality	0.208	0.406	0.000	0.000	0.000	0.000	1.000
Audit committee	0.566	0.496	0.000	0.000	1.000	1.000	1.000
Big4	0.050	0.219	0.000	0.000	0.000	0.000	1.000
Auditor M&A	0.140	0.347	0.000	0.000	0.000	0.000	1.000
Unclean opinion	0.011	0.105	0.000	0.000	0.000	0.000	1.000
Fee	13.248	0.597	12.101	12.899	13.122	13.528	15.394
Analyst	0.756	0.429	0.000	1.000	1.000	1.000	1.000
Tenure	1.574	0.803	0.000	1.099	1.609	2.197	2.890
SOE	0.470	0.499	0.000	0.000	0.000	1.000	1.000

The continuous variables are winsorized at the top and bottom 1% in order to address outliers.

**Table 6 Pearson correlations between control variables**

<i>Variable</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 Size	1.00																
2 ROS	-0.02	1.00															
3 Leverage	0.17	-0.30	1.00														
4 M&A	0.12	0.00	0.14	1.00													
5 Subsidiaries	0.28	-0.01	0.16	0.18	1.00												
6 Loss	-0.14	-0.56	0.26	-0.01	-0.05	1.00											
7 Board size	0.27	-0.01	0.08	0.03	0.08	-0.01	1.00										
8 Board Meeting	0.14	0.01	0.11	0.27	0.15	-0.01	0.00	1.00									
9 Duality	-0.17	0.04	-0.15	-0.05	-0.10	-0.02	-0.14	-0.06	1.00								
10 Audit committee	0.04	-0.06	0.12	0.07	0.06	0.04	-0.02	0.08	-0.03	1.00							
11 Big4	0.31	0.04	0.05	0.03	0.12	-0.02	0.14	0.06	-0.06	-0.03	1.00						
12 Auditor M&A	0.01	-0.03	0.01	0.00	-0.10	0.04	0.02	-0.01	-0.02	0.01	-0.08	1.00					
13 Unclean opinion	-0.10	-0.23	0.19	0.01	-0.00	0.21	-0.03	0.01	0.00	0.01	-0.02	0.01	1.00				
14 Fee	0.65	0.01	0.18	0.15	0.28	-0.05	0.19	0.18	-0.10	0.04	0.49	0.02	-0.02	1.00			
15 Analyst	0.32	0.17	-0.23	0.01	0.07	-0.22	0.11	0.04	0.02	-0.06	0.12	0.02	-0.13	0.19	1.00		
16 Tenure	0.13	-0.03	0.08	0.05	0.07	-0.01	0.04	0.03	-0.08	0.07	-0.03	-0.01	0.01	0.08	-0.02	1.00	
17 SOE	0.34	-0.07	0.21	0.04	0.11	0.03	0.23	0.00	-0.27	0.04	0.11	0.04	-0.02	0.18	0.01	0.10	1.00

**Table 7 Regression results**

<i>Dep. Var. = ADJ</i>	<i>Based on audit fee</i>	<i>Based on audited sales</i>	<i>Based on audited assets</i>	<i>Based on audit fee</i>	<i>Based on audited sales</i>	<i>Based on audited assets</i>
B4SHARE	-0.037 (-0.238)	-0.164 (-1.562)	-0.159 (-1.419)	-1.435*** (-7.210)	-0.764*** (-5.962)	-1.136*** (-8.116)
HERF	2.528*** (9.704)	0.490** (2.473)	1.103*** (4.255)			
HERF_BIG4				-0.695*** (-6.000)	-0.806*** (-6.238)	-1.365*** (-9.781)
HERF_NONBIG4				2.227*** (8.485)	1.483*** (6.799)	2.421*** (8.639)
Size	-0.074*** (-2.916)	-0.085*** (-3.332)	-0.081*** (-3.212)	-0.057** (-2.024)	-0.064** (-2.260)	-0.066** (-2.334)
ROS	0.001 (0.417)	0.001 (0.421)	0.001 (0.404)	0.001 (0.781)	0.001 (0.491)	0.001 (0.631)
Leverage	-0.003*** (-2.967)	-0.003*** (-3.061)	-0.003*** (-3.049)	-0.003** (-2.525)	-0.004*** (-2.895)	-0.003*** (-2.859)
M&A	0.074 (1.430)	0.089* (1.711)	0.086* (1.653)	0.050 (0.879)	0.064 (1.113)	0.060 (1.046)
Subsidiaries	0.046 (1.580)	0.052* (1.757)	0.050* (1.704)	0.035 (1.100)	0.045 (1.405)	0.044 (1.361)
Loss	-0.186* (-1.837)	-0.201** (-1.993)	-0.203** (-2.018)	-0.165 (-1.459)	-0.208* (-1.871)	-0.182 (-1.613)
Board size	-0.241* (-1.907)	-0.218* (-1.724)	-0.219* (-1.732)	-0.177 (-1.287)	(0.188) (-1.381)	-0.165 (-1.205)
Board Meeting	0.029 (0.403)	0.023 (0.328)	0.023 (0.326)	0.099 (1.250)	0.072 (0.916)	0.084 (1.050)
Duality	-0.072 (-1.166)	-0.072 (-1.173)	-0.068 (-1.103)	-0.036 (-0.525)	-0.029 (-0.429)	-0.041 (-0.604)
Audit committee	-0.033 (-0.672)	-0.042 (-0.864)	-0.044 (-0.909)	-0.015 (-0.274)	-0.025 (-0.470)	-0.019 (-0.351)
Big4	-1.932*** (-13.382)	-1.976*** (-13.567)	-1.965*** (-13.517)	-2.018*** (-13.682)	-2.013*** (-13.478)	-1.999*** (-13.300)
Auditor M&A	0.005 (0.066)	0.046 (0.613)	0.031 (0.409)	0.135 (1.606)	0.106 (1.260)	0.119 (1.396)
Unclean opinion	0.345 (1.428)	0.299 (1.240)	0.306 (1.269)	0.399 (1.383)	0.381 (1.348)	0.402 (1.399)
Fee	0.101 (1.632)	0.144** (2.319)	0.136** (2.194)	0.050 (0.730)	0.075 (1.084)	0.066 (0.952)
Analyst	0.025 (0.398)	0.036 (0.578)	0.038 (0.599)	0.057 (0.803)	0.034 (0.488)	0.025 (0.353)
Tenure	0.323*** (10.779)	0.335*** (11.225)	0.337*** (11.266)	0.301*** (9.042)	0.327*** (9.906)	0.321*** (9.642)



SOE	-0.365***	-0.393***	-0.398***	-0.295***	-0.311***	-0.289***
	(-6.650)	(-7.187)	(-7.281)	(-4.788)	(-5.073)	(-4.678)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Chi-squared	740.225	649.964	662.873	759.548	695.284	746.066
Prob>chi2	0.000	0.000	0.000	0.000	0.000	0.000
pseudo $R^2$	0.081	0.073	0.074	0.100	0.093	0.100
$N$	9108	9108	9108	7825	7825	7825

\*\*\*, \*\* and \* denote statistically significant at the 1%, 5% and 10% levels, respectively.

Z-statistics are reported in parentheses.

**Table 8 Audit market concentration and the incidence of upward and downward audit adjustments**

<i>Dep. Var =</i> <i>ADJUST_SIGN</i>	<i>Upward adjustment</i> <i>(ADJUST_SIGN =1)</i>						<i>Downward adjustment</i> <i>(ADJUST_SIGN=2)</i>					
B4SHARE	0.173 (0.921)	-0.093 (-0.731)	-0.031 (-0.229)	-1.201*** (-4.781)	-0.764*** (-4.782)	-1.044*** (-5.916)	-0.161 (-0.950)	-0.204* (-1.800)	-0.234* (-1.929)	-1.564*** (-7.127)	-0.760*** (-5.462)	-1.183*** (-7.765)
HERF	2.597*** (8.021)	0.535** (2.141)	1.223*** (3.706)				2.480*** (8.932)	0.460** (2.134)	1.026*** (3.644)			
HERF_BIG4				-0.663*** (-4.537)	-0.878*** (-5.472)	-1.359*** (-7.745)				-0.711*** (-5.627)	-0.761*** (-5.434)	-1.361*** (-8.955)
HERF_NONBIG4				2.324*** (7.364)	1.635*** (6.249)	2.579*** (7.592)				2.167*** (7.793)	1.393*** (5.978)	2.321*** (7.777)
Control variables	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Chi-squared	1022.778	928.928	941.955	984.799	919.761	969.606	1022.778	928.928	941.955	984.799	919.761	969.606
Prob>chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
pseudo R <sup>2</sup>	0.066	0.061	0.062	0.075	0.071	0.075	0.066	0.061	0.062	0.075	0.071	0.075
N	9108	9108	9108	7825	7825	7825	9108	9108	9108	7825	7825	7825

\*\*\*, \*\* and \* denote statistically significant at the 1%, 5% and 10% levels, respectively.

Z-statistics are reported in parentheses.

**Table 9 Audit market concentration and the incidence of large and small audit adjustments**

<i>Dep. Var =</i> <i>ADJUST_SIZE</i>	<i>Large adjustment</i> <i>(ADJUST_SIZE =1)</i>						<i>Small adjustment</i> <i>(ADJUST_SIZE=2)</i>					
B4SHARE	-0.069 (-0.375)	-0.255** (-2.035)	-0.277** (-2.079)	-1.556*** (-6.236)	-0.921*** (-5.819)	-1.345*** (-7.736)	-0.069 (-0.395)	-0.133 (-1.154)	-0.116 (-0.936)	-1.419*** (-6.405)	-0.693*** (-4.937)	-1.045*** (-6.777)
HERF	2.888*** (9.443)	0.645*** (2.675)	1.335*** (4.210)				2.306*** (8.075)	0.399* (1.796)	0.965*** (3.340)			
HERF_BIG4				-0.741*** (-5.201)	-0.837*** (-5.348)	-1.413*** (-8.329)				-0.640*** (-4.965)	-0.771*** (-5.398)	-1.324*** (-8.467)
HERF_NONBIG4				2.393*** (7.870)	1.410*** (5.526)	2.361*** (7.220)				2.146*** (7.559)	1.558*** (6.559)	2.481*** (8.095)
Control variables	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Chi-squared	1214.229	1123.123	1137.731	1157.641	1093.489	1144.973	1214.229	1123.123	1137.731	1157.641	1093.489	1144.973
Prob>chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
pseudo R <sup>2</sup>	0.085	0.080	0.081	0.097	0.093	0.097	0.085	0.080	0.081	0.097	0.093	0.097
N	9108	9108	9108	7825	7825	7825	9108	9108	9108	7825	7825	7825

\*\*\*, \*\* and \* denote statistically significant at the 1%, 5% and 10% levels, respectively.

Z-statistics are reported in parentheses.

**Table 10 Alternative proxy of audit quality**

	<i>Dep.= Absolute value of residue of modified Jones Model (N=8957)</i>						<i>Dep.= Absolute value of residue of Dechow and D Model (N=9013)</i>					
	<i>Based on audit fee</i>	<i>Based on audited sales</i>	<i>Based on audited assets</i>	<i>Based on audit fee</i>	<i>Based on audited sales</i>	<i>Based on audited assets</i>	<i>Based on audit fee</i>	<i>Based on audited sales</i>	<i>Based on audited assets</i>	<i>Based on audit fee</i>	<i>Based on audited sales</i>	<i>Based on audited assets</i>
B4SHARE	-0.002 (-0.756)	-0.001 (-0.978)	0.000 (-0.291)	0.000 (0.117)	-0.001 (-0.289)	0.002 (1.107)	0.357*** (5.641)	0.260*** (6.147)	0.330*** (6.976)	0.348*** (4.428)	0.270*** (5.477)	0.350*** (6.064)
HERF	-0.021*** (-6.036)	-0.010*** (-3.569)	-0.015*** (-3.764)				-0.076 (-0.959)	-0.122* (-1.700)	0.056 (0.544)			
HERF_BIG4				0.002 (1.234)	0.005** (2.343)	0.009*** (4.023)				-0.059 (-1.198)	-0.009 (-0.158)	0.020 (0.313)
HERF_NONBIG4				-0.017*** (-4.954)	-0.011*** (-3.965)	-0.017*** (-4.686)				0.046 (0.603)	(0.047) (-0.670)	0.001 (0.012)
Control variables	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F value	49.737	48.645	48.782	41.176	40.385	40.673	62.651	62.654	62.814	55.405	55.337	56.058
Prob>F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
adj. R <sup>2</sup>	0.201	0.199	0.199	0.195	0.195	0.196	0.467	0.468	0.468	0.473	0.474	0.475
N	8957	8957	8957	7683	7683	7683	9013	9013	9013	7737	7737	7737

\*\*\*, \*\* and \* denote statistically significant at the 1%, 5% and 10% levels, respectively.

T-statistics are reported in parentheses.

**Table 11 Alternative proxy of market concentration**

<i>Dep. Var. = ADJ</i>	<i>Gini Coefficient</i>						<i>Adjusted Herfindahl Index</i>					
	<i>Based on audit fee</i>	<i>Based on audited sales</i>	<i>Based on audited assets</i>	<i>Based on audit fee</i>	<i>Based on audited sales</i>	<i>Based on audited assets</i>	<i>Based on audit fee</i>	<i>Based on audited sales</i>	<i>Based on audited assets</i>	<i>Based on audit fee</i>	<i>Based on audited sales</i>	<i>Based on audited assets</i>
B4SHARE	-0.294*	-0.231**	-0.860***	-1.549***	-0.928***	-1.203***	-0.037	-0.164	-0.159	-1.435***	-0.764***	-1.136***
	(-1.939)	(-2.326)	(-6.858)	(-7.954)	(-7.019)	(-8.641)	(-0.238)	(-1.562)	(-1.419)	(-7.210)	(-5.962)	(-8.116)
HERF	2.627***	-0.17	1.168***				2.528***	0.490**	1.103***			
	(5.266)	(-0.383)	(8.463)				(9.704)	(2.473)	(4.255)			
HERF_BIG4				-1.219***	-1.196***	-1.690***				-0.695***	-0.806***	-1.365***
				(-6.644)	(-5.784)	(-7.616)				(-6.000)	(-6.238)	(-9.781)
HERF_NONBIG4				5.301***	4.925***	5.756***				2.227***	1.483***	2.421***
				(7.901)	(7.085)	(7.588)				(8.485)	(6.799)	(8.639)
Control variables	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Chi-squared	677.18	641.307	700.985	745.447	686.738	708.521	740.225	649.964	662.873	759.548	695.284	746.066
Prob>chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
pseudo R <sup>2</sup>	0.076	0.073	0.079	0.097	0.091	0.093	0.081	0.073	0.074	0.100	0.093	0.100
N	9108	9108	9108	7825	7825	7825	9108	9108	9108	7825	7825	7825

\*\*\*, \*\* and \* denote statistically significant at the 1%, 5% and 10% levels, respectively.

Z-statistics are reported in parentheses.

**Table 12 Additional analysis on audit fee**

<i>Dep. Var = LnFee</i>	<i>Based on audit fee</i>	<i>Based on audited sales</i>	<i>Based on audited assets</i>	<i>Based on audit fee</i>	<i>Based on audited sales</i>	<i>Based on audited assets</i>
B4SHARE	0.195*** (7.018)	0.160*** (8.429)	0.164*** (8.219)	0.146*** (3.873)	0.112*** (4.858)	0.121*** (4.775)
HERF	0.416*** (9.564)	0.279*** (7.717)	0.362*** (7.656)			
HERF_BIG4				0.032 (1.587)	-0.068*** (-3.140)	-0.065*** (-2.779)
HERF_NONBIG4				0.394*** -9.754	0.325*** -9.568	0.417*** -9.589
Control variables	Included	Included	Included	Included	Included	Included
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
F value	243.196	242.917	242.333	217.207	217.468	216.088
Prob>F	0.000	0.000	0.000	0.000	0.000	0.000
adj. $R^2$	0.584	0.584	0.583	0.596	0.597	0.596
<i>N</i>	9108	9108	9108	7825	7825	7825

\*\*\*, \*\* and \* denote statistically significant at the 1%, 5% and 10% levels, respectively.

T-statistics are reported in parentheses.

**Table 13 Regression results of reduced samples**

<i>Dep. Var. = ADJ</i>	<i>Based on audit fee</i>	<i>Based on audited sales</i>	<i>Based on audited assets</i>	<i>Based on audit fee</i>	<i>Based on audited sales</i>	<i>Based on audited assets</i>
B4SHARE	-0.149 (-0.796)	-0.123 (-1.031)	-0.156 (-1.207)	-1.729*** (-7.563)	-0.583*** (-4.059)	-1.093*** (-6.915)
HERF	2.775*** (9.173)	0.855*** (3.737)	1.547*** (5.282)			
HERF_BIG4				-0.813*** (-6.182)	-0.529*** (-3.593)	-1.239*** (-7.524)
HERF_NONBIG4				2.318*** (7.686)	1.546*** (6.418)	2.285*** (7.412)
Control variables	Included	Included	Included	Included	Included	Included
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Chi-squared	581.559	516.479	530.827	618.261	547.036	582.406
Prob>chi2	0.000	0.000	0.000	0.000	0.000	0.000
pseudo $R^2$	0.084	0.075	0.077	0.104	0.091	0.097
<i>N</i>	6651	6651	6651	5888	5888	5888

\*\*\*, \*\* and \* denote statistically significant at the 1%, 5% and 10% levels, respectively.

Z-statistics are reported in parentheses.

**Appendix : Variable Specifications**

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<i>Variable</i>	<i>Variable definition</i>
$B4SHARE_{kt}$	is measured by the percentage of total audit fee(client audited sales and assets) audited by Big 4 firms with metro market (province) k groupings in year t;
$HERF_{kt}$	is a measured using a Herfindahl index based on total audit fee (client audited sales and assets) audited by each firm in a metro market (province) k in year t;
$HERF\_BIG4_{kt}$	is a measured using a Herfindahl index based on total audit fee (client audited sales and assets) audited by each Big 4 firm in a metro market (province) k in year t;
$HERF\_NONBIG4_{kt}$	is a measured using a Herfindahl index based on total audit fee( client audited sales and assets)audited by each none Big 4 firm in a metro market (province) k in year t;
$Size_{it}$	the natural log of sales for company i in year t;
$ROS_{it}$	company i's return on sales in year t, defined as net income divided by sales;
$Leverage_{it}$	total liabilities divided by total assets for company i in year t;
$M\&A_{it}$	one if company i has a merger or acquisition transaction that involves the purchase of more than 20% of the target company in year t, and zero otherwise;
$Subsidiaries_{it}$	the natural log of (one plus) the total number of consolidated subsidiaries;
$Loss_{it}$	one if company i report a loss in year t, and zero otherwise;
$Board\ Size_{it}$	the natural log of the number of board directors at company i in year t;
$Board\ Meetings_{it}$	the natural log of the number of board meetings held by company i in year t;
$Duality_{it}$	one if company i's CEO in year t concurrently serves as chair of the board, and zero otherwise;
$Audit\ Com_{it}$	one if company i has an audit committee in year t, and zero otherwise;
$Big4_{it}$	one if company i is audited by a Big Four firm in year t, and zero otherwise;
$Auditor\ M\&A_{it}$	one if company i's audit firm merges with another audit firm in year t, and zero otherwise;
$Unclean\ Opinion_{it}$	one if company i receives a qualified or modified audit opinion in year t, and zero otherwise;
$Fee_{it}$	the natural log of the audit fee paid by company i in year t;
$Analyst_{it}$	one if there is as least one analyst following company i in year t, and zero otherwise;
$Tenure_{it}$	the natural log of audit firm tenure at company i in year t;
$SOE_{it}$	one if company i owned by States in year t, and zero otherwise.

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