

Does Audit Market Concentration Harm the Quality of Audited Earnings? Evidence from Audit Markets in 42 Countries*

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1. Background

Recent high-profile reports in the United States, the United Kingdom, and the European Union have raised concerns over the concentration of supply by the Big 4 accounting firms, and the potentially adverse effect this concentration may have on audit markets and the quality of audits in these legal jurisdictions (General Accounting Office 2003; Government Accountability Office 2008; Oxera 2006, 2007; United States Treasury 2006, 2008).¹ We emphasize the importance of “legal jurisdictions” because audit markets are country-specific in nature due to country-level controls over the licensing and regulation of auditors. As a consequence, accounting firms are organized as legally autonomous and country-specific partnerships.² In other words, even though the Big 4 accounting firms operate a global network, each country constitutes a separate legal practice and audit market.³

We exploit the country-specific nature of audit markets to investigate if cross-country variation in audit market structure (concentration of supply) affects engagement-level audit outcomes in countries. The quality of engagement-level audit outcomes in our study is based on statistical properties of clients’ *audited earnings* with respect to accruals, the likelihood of reporting a loss, and timely loss recognition. Audited earnings are the outcome of the negotiation between the firm and the auditor (Antle and Nalebuff 1991; Gibbins, McCracken, and Salterio 2010), and statistical properties of earnings can be used to draw inferences about the underlying quality of audit outcomes under different scenarios (Francis 2011). In our setting, the test scenario relates to the effect of audit market

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1. The Big 4 accounting firms are Deloitte, Ernst & Young, KPMG, and PricewaterhouseCoopers. Our study also includes Arthur Andersen for the years 1999–2001 before it collapsed in 2002, but the results are robust to excluding clients of Arthur Andersen.
2. The following statement on the global website of PricewaterhouseCoopers is illustrative: “In most parts of the world, the right to practice accountancy is granted only to national firms in which locally qualified professionals have majority or full ownership. Consequently, PwC member firms are locally owned and managed” (PwCIL 2011a).
3. The autonomy of these country-specific partnerships and markets is underscored by the following disclaimers for each country within the PricewaterhouseCoopers network: “PricewaterhouseCoopers and PwC refer to the network of member firms of PricewaterhouseCoopers International Limited” (PwCIL 2011a). “Each member firm is a separate legal entity and does not act as agent of PwCIL or any other member firm. Neither PwCIL nor any member firm is responsible or liable for the acts or omissions of any other member firm nor control the exercise of another member firm’s professional judgment or bind another member firm or PwCIL in any way” (PwCIL 2011b).

concentration in a country on clients' earnings quality. Following prior research, earnings are assumed to be of higher quality when accruals are smaller, when there is a greater likelihood of reporting a loss (rather than a profit), and when a firm exhibits more timely loss recognition (Ball and Shivakumar 2005; Frankel, Johnson, and Nelson 2002; Jones 1991).

Our evidence on audit market concentration is timely and especially important in Great Britain and the European Union. On July 28, 2010, the House of Lords in Great Britain issued a call for evidence in regard to the consequences of Big 4 market concentration, and specifically posed the question of whether concentration and the lack of competition impairs audit quality (House of Lords 2010). The final report did not directly address audit quality, but the report is critical of the performance of Big 4 accounting firms during the financial crisis and speculates that this could be a consequence of audit market concentration in the financial sector.⁴ In another development, on October 13, 2010, the European Commission issued a "green paper" which expresses continuing concern over Big 4 dominance of audit markets and proposes a number of mechanisms to reduce concentration and increase competition from the non-Big 4 accounting firms (European Commission 2010). As a follow-up, the European Commission indicated in September 2011 that it would be recommending to the European Parliament a number of measures to reduce Big 4 dominance, as well other reforms, including banning audit firms from providing any nonaudit services (the creation of pure audit firms), mandatory auditor rotation, and mandatory joint audits in which one auditor must be a non-Big 4 firm. The latter requirement is intended to broaden audit market participation by smaller non-Big 4 firms in order to reduce Big 4 dominance (Accountancy Age 2011). However, on November 30, 2011, the European Commission issued a far more modest proposal with the main changes being mandatory rotation of audit firms every six years, and the prohibition of nonaudit services for audit clients (the press release is available at http://ec.europa.eu/internal_market/auditing/reform/index_en.htm).

Audit market concentration has also been widely discussed in the United States. Following the collapse of Arthur Andersen, the 2002 Sarbanes-Oxley legislation mandated a study of U.S. audit market concentration by the General Accounting Office 2003 which concluded:

Domestically and globally, there are only a few large firms capable of auditing large public companies, which raises potential choice, price, quality, and concentration risk concerns. (Preface)

While the report found no evidence of negative consequences arising from Big 4 market domination, it warned that "the significant changes that have occurred in the profession may have implications for competition and public company choice, especially in certain industries, in the future". A follow-up report by the Government Accountability Office 2008 continues to warn of potentially negative effects from market concentration, although the report does note the paucity of research on which to base this assessment.⁵

4. The final report was issued on March 30, 2011 and recommends a broader investigation by the U.K. Office of Fair Trade of the potential harm caused by audit market concentration. The full report is available at <http://www.parliament.uk/business/committees/committees-a-z/lords-select/economic-affairs-committee/inquiries/auditors-market-concentration-and-their-role/>.

5. A more negative assessment of market concentration was made in the United Kingdom in a report by Oxera 2006 prepared jointly for the Department of Trade and Industry and the Financial Reporting Council. The report did not examine audit quality but focused on other consequences of limited auditor choice for larger companies. The report found among other things that audit fees had increased as the result of market concentration, which is in contrast to the United States where the United States Treasury (2008) concluded there was no evidence linking market concentration with higher audit fees.

Concerns over audit market concentration heightened in the United States in 2005 and 2006. In a speech at the 2005 AICPA national conference, SEC Chairman Christopher Cox noted that:

. . . within the accounting profession and within the SEC, we are forced to ask ourselves: Is this intense concentration in the market for large public company auditing good for America? If you believe, as I do, that genuine competition is essential to the proper function of any market the answer is no. (AICPA 2005)

The same sentiment was echoed in 2006 by Secretary of the U.S. Treasury, Henry Paulson:

The big four [accounting] firms dominate the industry in terms of revenues and professional staff. The remaining accounting firms face significant barriers to competing with the big four, at a time when auditors are in real demand. The current situation forces us to ask questions about the industry's sustainability and effectiveness: Given the importance of accounting to our financial system, is there enough competition? (United States Treasury 2006)

Paulson's concerns about audit market concentration and the effectiveness of audits led to the formation of an ad hoc committee to undertake a comprehensive assessment of the accounting profession. The committee issued its final report in 2008. Section VIII addressed issues of concentration and competition and states (United States Treasury 2008, Sec. VIII: 2–3):

In analyzing these data on concentration and limited auditor choice in the large public company audit market, the Committee focused on the potential negative impact of concentration on *audit quality*. Some have suggested that the lack of competition may not provide sufficient incentive for the dominant auditing firms to deliver *high quality* and innovative auditing services. (emphasis added)

The report concludes that there is a continuing threat posed by Big 4 dominance and recommends that actions be taken to reduce the barriers that limit the growth of non-Big 4 firms, which would provide much needed competition to the Big 4 (United States Treasury 2008, Sec. VIII: 4). A similar idea was advanced by Oxera 2007 in a study of market concentration undertaken for the European Union. The Oxera report recommends decreasing market concentration and increasing competition through the growth of smaller accounting firms, and specifically recommends a change in ownership rules that would allow expansion through direct equity investments in accounting firms by nonaccountants. Most recently, the European Commission (2010, 16) suggests that the preference for a Big 4 auditor might be based on perception rather than merit, and advances several ideas to increase market participation by non-Big 4 firms, including the creation of a pan-European “quality certification” that would recognize the ability of non-Big 4 firms to audit large listed companies throughout EU countries.

The unsubstantiated claim in all of the above reports is that the concentration of supply in audit markets is harmful (in part) because the lack of competition reduces the incentives of Big 4 auditors to conduct high-quality audits. To assess the validity of this claim, we examine if variation in audit market concentration across countries has an observable effect on the quality of audited earnings. Two separate dimensions of market concentration are investigated: (1) the degree to which Big 4 accounting firms (as a group) have a dominant market share relative to other accounting firms in a country;

and (2) the degree to which supply is concentrated within the Big 4 group itself, that is, uneven market shares among the Big 4 in a country.⁶ The above-cited reports are focused on Big 4 dominance, per se. However, a further (and we believe underappreciated) aspect of audit market concentration is the degree to which individual firms within the Big 4 group are dominant relative to one another. In other words, if two Big 4 firms dominate the overall Big 4 market share in a country, there is an even greater level of market concentration in that country compared to a country in which the Big 4 have equal market shares.

What do we find? There is a *positive* association between a client's earnings quality and the overall Big 4 market share in a country. Specifically, Big 4 client accruals are smaller in magnitude, clients are more likely to report losses, and clients exhibit more timely loss recognition. Thus, contrary to the presumption by audit regulators that the concentration of supply by the Big 4 group is bad, we find the opposite: namely, the quality of Big 4 audits is higher on average when the Big 4 have a larger market share in a country relative to non-Big 4 auditors.

With respect to market concentration within the Big 4 group of accounting firms, we do find that there is some support for the concerns of regulators. Increased concentration within the Big 4 is *negatively* associated with audit quality. Specifically, when the Big 4 market share in a country is concentrated and dominated by one or two firms rather than shared equally, Big 4 clients have larger accruals, are less likely to report losses, and exhibit less timely loss recognition. These results suggest that a country's regulator should not necessarily be concerned with the overall Big 4 market share relative to non-Big 4 auditors. However, regulators should be concerned with another aspect of Big 4 dominance that might be underappreciated: the dominance by one or two Big 4 auditors within the Big 4 group, and the potentially adverse effect on the quality of audited earnings when there are unequal Big 4 market shares.

Our cross-country analysis and findings complement recent research that investigates audit market concentration within a single country, the United States (Boone, Khurana, and Raman 2012; Kallapur, Sankaraguruswamy, and Zang 2010; Numan and Willekens 2012). These papers examine variation in market structure and auditor concentration across U.S. cities. An advantage of a country-specific study is that institutions are held constant, so that observed variation in market structure across cities is unrelated to other institutional differences. This is not necessarily the case in cross-country studies, although our use of country fixed effects models is a strong control for omitted country-level variables. Numan and Willekens investigate the effect of city-level market structure on the pricing of audit services, while Kallapur et al. and Boone et al. are more closely related to our paper and report conflicting evidence on the effect of market structure on earnings quality. Specifically, Boone et al. find evidence that Big 4 auditors allow their clients greater discretion to manage earnings to meet or beat analysts' forecasts when the Big 4 have a more dominant market share in a city. In contrast, Kallapur et al. analyze abnormal accruals and find that accruals are smaller (suggesting less earnings management) in cities with more concentrated audit markets. The conflicting evidence in

6. Empirically, these two dimensions are uncorrelated, which indicates that they measure distinctly different aspects of market concentration. Dedman and Lennox (2009, 214) point out that market concentration metrics are not necessarily good measures of the competitiveness of market structures. However, in our context we are not testing market "competitiveness" per se but rather the concern by regulators that the concentration of supply may have adverse effects on audit outcomes. In other words, we only test the effect of market concentration on the quality of audited earnings and are not trying to make inferences about competition.

these two studies highlights the need for continued research on the effects of audit market concentration.⁷

The remainder of the paper is organized as follows. The next section presents the research design and sample. Model estimations and robustness tests are reported in sections 3 and 4, and the study concludes in section 5. As a caveat we recognize there may be other consequences of audit market concentration such as the limited choice of auditors, potentially higher fees, and systemic risk to the audit market as a whole if one of the remaining Big 4 firms were to collapse. Our study does not address these issues.

2. Research design and sample

The sample period in our study is 1999–2007, using data from the Global Vantage database. We compute market concentration measures using the Big 4 accounting firms (plus Arthur Andersen up to 2001). Untabulated results are robust to excluding the clients of Arthur Andersen in the analysis, as well as measuring market concentration for the six largest accounting firms, i.e., Grant Thornton and BDO Seidman, in addition to the Big 4 and Arthur Andersen.

We investigate two aspects of Big 4 audit market domination and the potentially negative effect it has on earnings quality.⁸ The first dimension, *B4SHARE*, is the Big 4 market share (as a group) relative to non-Big 4 accounting firms. *B4SHARE* is measured by the percentage of total clients audited by the Big 4 firms within country-industry-year groupings, where industries are defined using 2-digit SIC codes. Calculating *B4SHARE* within industry groupings allows Big 4 concentration to vary across industries in a country-year. Results are robust to alternative measures of industry market share using percentages of

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7. The concern over audit market concentration is typically focused at the overall country level which is, by definition, equivalent to the weighted average of individual city-specific audit markets within a country. We believe the *average* market concentration metric is meaningful for drawing a general conclusion about a country's overall audit market structure, and for the comparison of market structures across countries. We also note that most of the city-level audit research has been in the United States, which is a very large and decentralized country, both geographically and economically. In other countries, the Big 4 accounting firms have far fewer engagement offices, and the economies are more centralized and dominated by one or two large cities. For example, Basioudis and Francis (2007) report that London offices audit 39 percent of British listed companies, and over 65 percent of aggregate audit fees. Thus to the extent that audit markets in countries are dominated by a few large cities and engagement offices, the average market concentration in a country will map closely to the market structure of the dominant cities within a country. Nevertheless, we recognize that by focusing on the overall (average) audit market structure of a country, we ignore potential variation across cities within a country, and that single-country studies like Kallapur et al. 2010 and Boone et al. 2012 can provide insight on the effects of city-level variation in audit market structure that a country-level analysis cannot.
 8. The industrial organization literature is inconclusive regarding the general effect of market structure and the concentration of supply on product quality, and given these mixed findings the one-sided and negative view of market concentration by audit regulators is surprising. For example, Spence (1975) and Schmalensee (1978) develop models in which market concentration leads to lower product quality, while Demsetz (1973), Shaked and Sutton (1987) and Sutton (1991) develop models in which an increase in market share is associated with higher product quality. Recent papers undertake industry-specific analyses, and these results are also mixed. Some studies support the conclusion that a less concentrated market structure is associated with a better-quality service or product, for example industry-level studies of banking (Boyd and De Nicolò 2005; Beck, Demircuc-Kunt and Levine 2006), the healthcare sector (Sari 2008), and the airline industry (Mazzeo 2003). In contrast, Crespi and Marette (2009) examine the link between product quality and market concentration in 45 different industries and conclude that industry concentration is positively associated with quality. Crespi and Marette's findings complement those of a similar study by Robinson and Chiang 1996, and studies of the retail and supermarket sectors (Ellickson 2006, 2007) and of the banking industry by Dick 2007. Thus, as with attempts at a general theoretical link between market concentration and product quality, industry-specific studies provide ambiguous evidence, both across and within industries.

total clients' sales and assets audited, as well as calculating *B4SHARE* within country-year groupings without regard to industry.

The second dimension of market concentration, *CONCEN*, is the concentration of supply within the dominant Big 4 group of accounting firms. Big 4 supply will be least concentrated when market shares are equal, and more concentrated when one or two of the Big 4 firms have dominant market shares relative to the other Big 4 auditors. There may also be less contestability of audit clients due to capacity constraints when the Big 4 market share is dominated by one or two larger firms. A smaller Big 4 firm is less likely to have sufficient slack to bid for a large client of the more dominant Big 4 auditors. Further, given country-specific licensing rules, the Big 4 firms are limited in their ability to transfer senior personnel and increase capacity, at least in the short term. The result is less contestability of the market share held by the dominant Big 4 firm(s), and the concern is that the subset of dominant Big 4 auditors in such a setting will be exposed to even less competition, and therefore fewer incentives to innovate and produce high-quality audits (United States Treasury 2008).

CONCEN is measured using a Herfindahl index based on total client sales audited by each Big 4 firm in a country-industry-year, where industries are defined by 2-digit SIC codes. If Big 4 firms have equal shares in a country-industry-year grouping, the Herfindahl index will have a value of 0.25 (0.20 when Arthur Andersen is in the sample for 1999–2001), and if one firm has the entire Big 4 market share the index will have a value of 1.00. Results are robust to measuring concentration using total client assets, as well as a country-year measure (without regard to industry), and to an alternative metric discussed in section 4 which is the difference in market share between the largest and smallest Big 4 auditor in a country-industry-year.⁹ In untabulated tests, we also interact *B4SHARE* and *CONCEN* to determine if the two concentration metrics work together jointly to affect audit markets. However, the interaction terms are insignificant with no effect on the primary test variables, *B4SHARE* and *CONCEN*.

Given the cross-country nature of the study, there are likely to be country characteristics that are correlated with both the audit market structure in a country as well as firm-level earnings quality. This is a research design challenge in all cross-country research with respect to model identification and a potential omitted variables problem. Our primary approach to addressing this problem is to estimate a country-fixed-effects model. By including country fixed effects, we control for the average differences across countries in both observable and unobservable predictors of earnings equality. Thus to the extent that such predictors are time-invariant, the coefficients on the country fixed effects control for systematic cross-country differences and their effects on the dependent variables. A Hausman specification test indicates that a fixed effects model should be used rather than a random effects model, although the results are robust to using a random effects model as well (Hausman 1978).

As reported in section 4, we perform a robustness test to the country-fixed-effects model that adds two additional time-invariant country-level control variables in lieu of country fixed effects. These variables are *IAS_DIFF* from Bae, Tan and Welker 2008, which measures the quality of a country's accounting standards relative to International Accounting Standards, and *INV_PROT*, which is a composite measure of investor protection. All results for this alternative model specification are virtually the same as those using country fixed effects.

9. Results for *CONCEN* are also robust to trimming the sample and dropping those industries in country-years with fewer than four observations. This rules out that the full sample results are driven by smaller industries where the market might be more likely to be dominated by one or two of the Big 4 auditors.

Data on audit market structure and firm-level variables are obtained from the COMPUSTAT Global Vantage database for the years 1999 through 2007. A potential limitation of the study is that the measure of audit market structure is based on the Global Vantage population of firms which tends to be the larger listed companies in countries. However, this is not necessarily a problem in the context of our study, since the primary concern with respect to the concentration of supply is the limited choice faced by larger listed companies (General Accounting Office 2003; Oxera 2006; United States Treasury 2008).

Dependent variables measuring earnings quality

The dependent variable is measured by four statistical properties of *audited earnings*: total accruals, abnormal accruals, the likelihood of reporting a profit (avoiding a loss), and timely loss recognition. Following prior literature, firms are deemed to have higher earnings quality when accruals are smaller and firms do not avoid reporting losses (Burgstahler and Dichev 1997; Frankel et al. 2002; Graham, Harvey, and Rajgopal 2005; Jones 1991), and when earnings exhibit greater timely loss recognition (Basu 1997). We use the model in Ball and Shivakumar 2005, in which timely loss recognition is measured by the degree to which firms with negative cash flows (economic losses) have more timely recognition of accruals than do firms with positive cash flows.

Total accruals (*TOT_ACC*) is defined as the firm's net income before extraordinary items, less cash flows from operations, scaled by lagged total assets. The calculation of abnormal accruals (*AB_ACC*) is based on a modified Jones model of expected accruals which controls for concurrent firm performance (Dechow, Sloan, and Sweeney 1995; Jones 1991; Kothari, Leone, and Wasley 2005). Abnormal accruals are measured as the firm-specific residual in the following model of expected (normal) accruals:

$$TOT_ACC_t = \alpha + \beta_1(1/ASSETS_{it-1}) + \beta_2(\Delta SALES_{it} - \Delta AR_{it}) + \beta_3(PPE_{it}) + \beta_4(ROA_{it}) + Country/Year/Industry\ Fixed\ Effects + \varepsilon \quad (1),$$

where *ASSETS* is a firm's total assets, *SALES* is a net sales, *AR* is accounts 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, all things being equal.¹⁰

The final two models test the likelihood of reporting a profit (avoiding a loss) and timely loss recognition. Managers of firms prefer to avoid losses (Graham et al. 2005), and for this model the dependent variable *PROFIT* is coded one for firms that report a bottom-line positive net income and zero for loss firms. We code *PROFIT* as one to be consistent with the directional prediction for accruals. A higher-quality audit is expected to result in a lower likelihood of managers reporting a profit (i.e., reporting more losses), just as high-quality audits are expected to result in smaller accruals. The last analysis uses the model of timely loss recognition in Ball and Shivakumar 2005 and is explained in more detail in section 3.

Country-level controls

As discussed earlier, a country-fixed-effects model is our primary test to control for observable and unobservable country effects on earnings quality. In addition, we also include

10. We estimate abnormal accruals for pooled firm-year observations in the sample and control for industry, year, and country by estimating a fixed effects model. Results are robust to an alternative measure of abnormal accruals based on the expectation model in DeFond and Park 2001.

time-varying country-level measures of financial market development and rule of law as additional controls in the country fixed effects models because these have been shown to be associated with earnings quality (Leuz, Nanda, and Wysocki 2003). A country's yearly level of financial market development (*FIN_DEVEL*) is measured with yearly World Bank data and is defined as a country's aggregate stock market capitalization scaled by GDP. *RULE_OF_LAW* is also a yearly metric from the World Bank (Kaufmann, Kraay, and Mastruzzi 2009) and measures "the perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence". Higher values represent countries with stricter legal enforcement regimes. This variable is updated for every year of our sample period and thus allows us to include it in models with country fixed effects.¹¹

Sample

Table 1 summarizes the sample selection process using the Global Vantage database. We begin with all firm-year observations having positive values for assets in 1999 through 2007, which yields 116,358 firm-year observations.¹² Given that we are studying the effects of market concentration on Big 4 audits, we discard 42,568 firm-year observations with a non-Big 4 auditor, although all observations are used to calculate the percentage of Big 4 audits conducted in a country. We also exclude 9,570 observations in the financial and utility sectors, 3,617 observations from those countries which do not have data for the country-level control variables in our models, and 5,195 observations where data are missing to calculate firm-level variables. The final sample used to analyze total accruals, profit reporting, and timely loss recognition contains 55,408 firm-year observations from 42 countries for the time period 1999 through 2007. The sample used to analyze abnormal accruals is reduced to 54,734 due to missing data required to calculate abnormal accruals. A large portion of firm-year observations are from the United States ($n = 18,980$) and, as reported in section 4, the results are robust to excluding the U.S. observations from the analysis as well as other countries with more than 1,000 observations (Australia, Canada, France, Germany, Malaysia, Singapore, Sweden, Taiwan, United Kingdom). The final sample consists of 42 countries for the country-fixed-effects models.

Table 2, panel A presents descriptive statistics for country-level variables. *B4SHARE*, the percentage of firms audited by a Big 4 auditor in a country-industry-year, has a mean value of 59 percent, and ranges from a low of 17 percent of audits in China to a high of 93 percent in Hungary. The inter-quartile range is 54 to 74 percent.

CONCEN is measured using a Herfindahl index calculated as $H = \Sigma [s/S]^2$, where s is the dollar value of total client sales audited by one of the Big 4 auditors in a country-industry-year grouping (again, based on 2-digit SIC codes), S is the total value of sales audited in that country-industry-year grouping by all Big 4 auditors, and Σ is the summation over all Big 4 auditors that perform audits within a country-industry-year grouping. *CONCEN* ranges from a theoretical high of 1.0 when a single Big 4 auditor possesses the entire Big 4 market share, to a low of 0.25 when all Big 4 auditors in the market possess equal market share and 0.20 in test years when Arthur Andersen is operating (1999–2001). *CONCEN* has a mean value of 0.65, and there is considerable variation across the 42 countries, with the

11. To calculate the 1999 value for rule of law, we average countries' values for 1998 and 2000 as no data exists specifically for 1999.

12. The collapse of Arthur Andersen in early 2002 caused an unusually large number of auditor-client realignments in fiscal 2002. To assure our findings are not in some way driven by these unique auditor changes, or by the new auditors' reactions to absorbing the Andersen clientele, we exclude the 2002 firm-year observations and reestimate all models. These untabulated results are virtually unchanged in terms of coefficients and statistical significance from those reported in the study's tables.

TABLE 1
Sample selection

	<i>N</i>
Firm-year observations in COMPUSTAT Global Vantage with positive total assets 1999–2007	116,358
Less:	
Firms audited by a non–Big 4 auditor	(42,568)
Financial and utility firms	(9,570)
Firms from countries with missing country-level data	(3,617)
Firms with missing data necessary to calculate firm-level variables	<u>(5,195)</u>
Sample for analysis of total accruals, loss reporting, and timely loss recognition	<u>55,408</u>
Less: Firms with missing information to calculate abnormal accruals	(674)
Sample for abnormal accruals analysis	<u>54,734</u>

Notes:

Firms from Japan, South Korea, India, and Pakistan are excluded due to potential miscoding of the auditor identification variable in Global Vantage (Francis and Wang 2008). Bermuda is also excluded due to the unique operating characteristics of many of the firms there, consistent with Bermuda’s use as a tax haven.

lowest value of 0.38 in the United States (least concentration), and the highest value of 0.98 in Poland (greatest concentration). The inter-quartile range across countries is 0.50 to 0.71. Interestingly, there is only a very small and statistically insignificant increase in the average value of *CONCEN* following the collapse of Arthur Andersen. In the period 1999–2001, *CONCEN* averaged 0.63 compared to 0.66 in the period 2002–2007. Thus the reduction from the Big Five to the current Big 4 had little effect on the level of market concentration by the large accounting firms. Note that the variable *HIGH-LOW* is an alternative measure of concentration within the Big 4 group, and is discussed further in section 4.

Values of country-level control variables vary widely. Financial market development (*FIN_DEVEL*) has a mean of 0.91 and ranges from 0.05 in Venezuela to 3.89 in Hong Kong. *RULE_OF_LAW*, which theoretically ranges from –2.5 to +2.5, has a mean value of +0.83. Russia has the lowest rule of law at –0.93, and Switzerland the highest at +1.97. The variables *IAS_DIFF* and *INV_PROT* are used in an alternative estimation approach that is discussed further in section 4. *IAS_DIFF* is a measure of the quality of a country’s accounting standards based on closeness to International Accounting Standards (IAS). The mean value of *IAS_DIFF* is 8.9, with the fewest differences found in Singapore and South Africa (zero) and the most in Chile (all 21). *INV_PROT* is a composite measure of the strength of a country’s investor protection regime. It is calculated using the single significant factor that loads from a principal components analysis of six variables: *COMMON*, *ANTIDIR*, *DISC*, *LIAB*, *PUBENF* and *SEC_STAFF*. It has a mean value of zero by construction and ranges from a low of –1.56 in Germany to +2.18 in Singapore.

Correlations among the country-level variables are reported in panel B of Table 2. The Pearson (Spearman) correlation between the market structure variables *B4SHARE* and *CONCEN* is –0.11 (–0.05), but the correlation is not significant at the 0.10 level. Thus the two measures of Big 4 market concentration clearly capture distinctly different aspects of audit market structure. Big 4 market share (*B4SHARE*) is positively correlated with rule of law, but is not significantly correlated with the remaining country-level variables. Concentration within the Big 4 group (*CONCEN*) is negatively correlated with all of the country-level variables except *IAS_DIFF*, which shows a positive correlation. In other words, the market share is more evenly distributed among the Big 4 firms in countries with

TABLE 2
Descriptive statistics for the 42 countries in the study

Panel A: Country-level variables														
Country	N	B4SHARE	CONCEN	HIGH- LOW	FIN DEVEL	RULE OF_LAW	IAS DIFF	COMMON	ANTIDIR	DISC	LIAB	PUBENF	SEC STAFF	INV PROT
Argentina	53	0.47	0.96	0.77	0.47	-0.49	14	0	4	0.50	0.22	0.58	3.5	-0.49
Australia	2,335	0.71	0.46	0.26	1.21	1.77	4	1	4	0.75	0.66	0.90	34.4	1.34
Austria	270	0.50	0.67	0.54	0.30	1.84	12	0	2	0.25	0.11	0.17	10.0	-1.49
Belgium	404	0.54	0.63	0.44	0.74	1.45	13	0	0	0.42	0.44	0.15	13.8	-1.34
Brazil	534	0.51	0.66	0.50	0.50	-0.36	11	0	3	0.25	0.33	0.58	2.7	-0.87
Canada	3,111	0.69	0.47	0.23	1.18	1.77	5	1	5	0.92	1.00	0.80	38.9	1.91
Chile	499	0.77	0.70	0.50	1.03	1.18	21	0	5	0.58	0.33	0.60	9.9	-0.04
China	758	0.17	0.64	0.43	0.61	-0.42	9	0	-	-	-	-	-	-
Colombia	55	0.73	0.91	0.35	0.22	-0.79	-	0	3	0.42	0.11	0.58	3.9	-0.82
Denmark	699	0.83	0.61	0.39	0.65	1.88	11	0	2	0.58	0.55	0.37	10.9	-0.58
Finland	661	0.75	0.75	0.76	1.50	1.89	15	0	3	0.50	0.66	0.32	11.2	-0.47
France	1,687	0.45	0.52	0.18	0.90	1.34	12	0	3	0.75	0.22	0.77	5.9	-0.15
Germany	1,949	0.40	0.54	0.55	0.53	1.72	11	0	1	0.42	0.00	0.22	4.4	-1.56
Greece	192	0.33	0.67	0.50	0.76	0.74	17	0	2	0.33	0.50	0.32	12.2	-0.94
Hong Kong	675	0.72	0.69	0.47	3.89	1.22	3	1	5	0.92	0.66	0.87	59.6	2.01
Hungary	83	0.93	0.64	0.82	0.27	0.79	13	0	-	-	-	-	10.8	-
Indonesia	613	0.44	0.62	0.46	0.29	-0.85	4	0	2	0.50	0.66	0.62	2.0	-0.48
Ireland	292	0.79	0.74	0.36	0.64	1.62	1	1	4	0.67	0.44	0.37	23.3	0.44
Israel	149	0.42	0.76	0.55	0.78	0.85	6	1	3	0.67	0.66	0.63	18.8	0.62
Italy	772	0.86	0.60	0.63	0.51	0.67	12	0	1	0.67	0.22	0.48	7.3	-0.83
Luxembourg	66	0.78	0.83	0.62	1.67	1.89	18	0	-	-	-	-	315.1	-
Malaysia	3,136	0.53	0.43	0.33	1.47	0.46	8	1	4	0.92	0.66	0.77	22.4	1.25
Mexico	327	0.70	0.54	0.28	0.26	-0.45	1	0	1	0.58	0.11	0.35	5.2	-1.16
Netherlands	971	0.82	0.55	0.35	1.17	1.74	4	0	2	0.50	0.89	0.47	23.5	-0.16
New Zealand	291	0.57	0.69	0.34	0.39	1.84	3	1	4	0.67	0.44	0.33	8.9	0.21

(The table is continued on the next page.)

TABLE 2 (Continued)

Country	N	B4SHARE	CONCEN	HIGH LOW	FIN DEVEL	RULE OF_LAW	IAS DIFF	COMMON	ANTIDIR	DISC	LIAB	PUBENF	SEC STAFF	INV PROT
Norway	688	0.74	0.64	0.43	0.54	1.93	7	0	4	0.58	0.39	0.32	20.8	-0.28
Peru	97	0.55	0.68	0.48	0.39	-0.66	1	0	3	0.33	0.66	0.78	5.3	-0.32
Philippines	185	0.42	0.87	0.82	0.48	-0.53	10	0	3	0.83	1.00	0.83	4.3	0.55
Poland	30	0.30	0.98	0.81	0.26	0.46	12	0	-	-	-	-	4.6	-
Portugal	111	0.44	0.82	0.62	0.45	1.13	13	0	3	0.42	0.66	0.58	14.5	-0.28
Russia	55	0.40	0.73	0.45	0.56	-0.93	16	0	-	-	-	-	-	-
Singapore	2,242	0.72	0.41	0.24	2.05	1.64	0	1	4	1.00	0.66	0.87	77.7	2.18
South Africa	593	0.45	0.54	0.28	2.01	0.13	0	1	5	0.83	0.66	0.25	3.5	0.57
Spain	653	0.86	0.64	0.77	0.88	1.22	16	0	4	0.50	0.66	0.33	8.5	-0.33
Sweden	1,568	0.79	0.53	0.51	1.16	1.84	10	0	3	0.58	0.28	0.50	7.2	-0.54
Switzerland	999	0.76	0.64	0.37	2.59	1.97	12	0	2	0.67	0.44	0.33	8.9	-0.62
Taiwan	2,229	0.74	0.52	0.53	0.83	0.84	6	0	3	0.75	0.66	0.52	12.5	0.02
Thailand	913	0.40	0.60	0.46	0.57	0.18	4	1	2	0.92	0.22	0.72	6.5	0.34
Turkey	178	0.58	0.70	0.55	0.29	-0.02	14	0	2	0.50	0.22	0.63	6.2	-0.73
U.K.	5,277	0.50	0.42	0.25	1.49	1.72	1	1	5	0.83	0.66	0.68	19.0	1.18
United States	18,980	0.61	0.38	0.18	1.42	1.58	4	1	5	1.00	1.00	0.90	23.8	1.90
Venezuela	28	0.65	0.81	0.67	.05	-1.09	5	0	1	0.17	0.22	0.55	-	-
Means		0.59	0.65	0.48	0.91	0.83	8.9	0.29	3.0	0.61	0.49	0.54	22.6	0.00

(The table is continued on the next page.)

TABLE 2 (Continued)

Notes:

“_” indicates that data is not available for that country. *N* is the number of company-year sample observations per country. *B4SHARE* equals the percentage of listed companies in a country-industry grouping that use a Big 4 auditor in year *t*. *CONCEN* is the Big 4 audit market Herfindahl index calculated as $H = \sum [s/S]^2$ where *s* is the dollar value of total client sales audited by one of the Big 4 auditors in a country-industry grouping in year *t*, and *S* is the total value of sales audited by all Big 4 auditors in the same country-industry grouping in year *t*. Σ is summed over all Big 4 auditors that perform audits within a country-industry grouping in a given year. Industry groupings are based on 2-digit SIC codes. *HIGH-LOW* is the market share of the largest Big 4 auditor in a country-year minus the market share of the smallest Big 4 auditor in a country-year, based on client sales audited. *FIN_DEVEL* is a country’s total market capitalization in year *t* scaled by GDP. *RULE_OF_LAW* is the yearly measure of rule of law taken from Kaufmann et al. 2009. *IAS_DIFF* is the index of differences between a country’s domestic accounting standards and International Financial Reporting Standards (IAS) as of 2001 taken from Bae et al. 2008. *COMMON* equals 1 if a country’s legal origin is based on English common law, and 0 otherwise. *ANTIDIR* is the measure of anti-director rights from La Porta et al. 1998. *DISC* is the disclosure rights index from La Porta et al. 2006. *LIAB* is the liability standards index from La Porta et al. 2006. *PUBENF* is the public enforcement of securities laws index from La Porta et al. 2006. *SEC_STAFF* is the size of a country’s securities regulator staff scaled by total population, taken from Jackson and Roe 2009. *INV_PROT* is a factor analysis (principal components analysis) with varimax rotation of the variables *SEC_STAFF*, *COMMON*, *ANTIDIR*, *DISC*, *LIAB*, and *PUBENF*. All variables load on one factor. The values for *B4SHARE*, *CONCEN*, *HIGH-LOW*, *FIN_DEVEL*, and *RULE_OF_LAW* are the country-level means averaged across the years 1999–2007. All other variables are time-invariant.

Panel B: Country-level variable correlations (Pearson on lower left, Spearman on upper right)

	1	2	3	4	5	6
1 <i>B4SHARE</i>		-0.05	0.23	0.39	0.05	-0.05
2 <i>CONCEN</i>	-0.11		-0.45	-0.20	0.42	-0.28
3 <i>FIN_DEVEL</i>	0.22	-0.32		0.43	-0.15	0.56
4 <i>RULE_OF_LAW</i>	0.37	-0.38	0.43		0.04	0.05
5 <i>IAS_DIFF</i>	0.06	0.44	-0.17	0.05		-0.56
6 <i>INV_PROT</i>	-0.01	-0.41	0.59	0.20	-0.51	

(The table is continued on the next page.)

TABLE 2 (Continued)

Notes:

Bold text indicates two-tail significance at the 0.10 level or less. *B4SHARE* equals the percentage of listed companies in a country-industry grouping that use a Big 4 auditor in year *t*. *CONCEN* is the Big 4 audit market Herfindahl index calculated as $H = \Sigma [s/S]^2$ where *s* is the dollar value of total client sales audited by one of the Big 4 auditors in a country-industry grouping in year *t*, and *S* is the total value of sales audited by all Big 4 auditors in the same country-industry grouping in year *t*. Σ is summed over all Big 4 auditors that perform audits within a country-industry grouping in a given year. Industry groupings are based on 2-digit SIC codes. *FIN_DEVEL* is a country's yearly total market capitalization in year *t* scaled by GDP. *RULE_OF_LAW* is the yearly measure of rule of law taken from Kaufmann et al. 2009. *IAS_DIFF* is the index of differences between a country's domestic accounting standards and International Accounting Standards (IAS) as of 2001 taken from Bae et al. 2008. *INV_PROT* is a factor analysis (principal components analysis) with varimax rotation of the variables *SEC_STAFF*, *COMMON*, *ANTIDIR*, *DISC*, *LIAB*, and *PUBENF*. All variables load on one factor. *COMMON* equals 1 if a country's legal origin is based on English common law, and 0 otherwise. *ANTIDIR* is the measure of anti-director rights from La Porta et al. 1998. *DISC* is the disclosure rights index from La Porta et al. 2006. *LIAB* is the liability standards index from La Porta et al. 2006. *PUBENF* is the public enforcement of securities laws index from La Porta et al. 2006. *SEC_STAFF* is the size of a country's securities regulator staff scaled by total population, taken from Jackson and Roe 2009. The values for *B4SHARE*, *CONCEN*, *HIGH-LOW*, *FIN_DEVEL*, and *RULE_OF_LAW* are the country-level means across the years 1999–2007. Data on *B4SHARE*, *CONCEN*, *FIN_DEVEL*, and *RULE_OF_LAW* cover all 42 countries in the study, while the remaining variables are limited to a subset of 36 of these countries due to data availability.

TABLE 3
Descriptive statistics for firm-level variables

Variable	N	Mean	Std. Dev.	25%	Median	75%
<i>TOT_ACC</i>	55,408	-0.055	0.112	-0.100	-0.048	-0.002
<i>AB_ACC</i>	54,734	0	0.102	-0.045	0.003	0.050
<i>PROFIT</i>	55,408	0.725	n.a	0	1.000	1.000
<i>B4SHARE</i>	55,408	0.630	0.185	0.531	0.665	0.757
<i>CONCEN</i>	55,408	0.388	0.162	0.284	0.326	0.446
<i>LOG_SALES</i>	55,408	5.486	2.152	4.127	5.531	6.923
<i>CFO</i>	55,408	0.060	0.218	0.005	0.083	0.156
<i>LEV</i>	55,408	0.517	0.252	0.341	0.514	0.663
<i>SALES_GROWTH</i>	55,408	0.216	0.631	-0.019	0.102	0.259
<i>PPE_GROWTH</i>	55,408	0.177	0.493	0.003	0.083	0.209
<i>LAG_LOSS</i>	55,408	0.272	0.445	0	0	1.000
<i>MB</i>	55,408	2.049	2.282	1.326	1.470	1.557

Notes:

TOT_ACC is net income before extraordinary items less cash flows from operations, scaled by lagged total assets. *AB_ACC* is a firm's total accruals less expected accruals, scaled by lagged total assets. *PROFIT* is equal to 1 if a firm's net income in year t is above zero, and 0 otherwise. *B4SHARE* equals the percentage of listed companies in a country-industry grouping that use a Big 4 auditor in year t . *CONCEN* is the Big 4 audit market Herfindahl index calculated as $H = \sum [s/S]^2$ where s is the dollar value of total client sales audited by one of the Big 4 auditors in a country-industry grouping in year t , and S is the total value of sales audited by all Big 4 auditors in the same country-industry grouping in year t . Σ is summed over all Big 4 auditors that perform audits within a country-industry grouping in a given year. Industry groupings are based on 2-digit SIC codes. *LOG_SALES* is the natural log of a company's sales in year t . *CFO* is a company's cash flows from operations in year t scaled by lagged total assets. *LEV* is a company's total liabilities scaled by total assets in year t . *SALES_GROWTH* is a company's one-year growth in sales from year $t - 1$ to year t . *PPE_GROWTH* is a company's one-year growth in gross property, plant and equipment from year $t - 1$ to year t . *LAG_LOSS* is 1 if a company's net income is below zero in year $t - 1$, and 0 otherwise. *MB* is a company's market value of equity scaled by book value of equity at the end of year t .

(The table is continued on the next page.)

TABLE 3 (Continued)

Panel B: Firm-level correlations (Pearson on lower left, Spearman on upper right)

Variable	1	2	3	4	5	6	7	8	9	10	11	12
<i>TOT_ACC</i>		0.89	0.17	0.02	0.07	-0.03	-0.48	-0.10	0.08	-0.01	-0.11	-0.02
<i>AB_ACC</i>	0.64		0.04	-0.01	-0.02	-0.06	-0.56	-0.08	0.04	-0.02	-0.00	-0.01
<i>PROFIT</i>	0.18	0.04		-0.03	0.08	0.33	0.52	-0.05	0.19	0.13	-0.56	0.07
<i>B4SHARE</i>	0.03	0.01	-0.02		-0.11	0.08	-0.03	0.00	-0.03	-0.01	0.00	0.02
<i>CONCEN</i>	0.06	-0.03	0.07	-0.05		-0.10	0.01	0.06	0.04	-0.00	-0.07	0.02
<i>LOG_SALES</i>	0.01	-0.01	0.35	0.09	-0.08		0.28	0.35	0.03	-0.01	-0.33	0.09
<i>CFO</i>	-0.35	-0.32	0.49	-0.04	0.04	0.34		-0.04	0.14	0.14	-0.39	0.15
<i>LEV</i>	-0.11	0.05	-0.10	0.01	0.02	0.29	-0.01		-0.09	-0.13	0.04	0.03
<i>SALES_GROWTH</i>	-0.06	-0.02	-0.02	-0.02	0.00	-0.10	-0.11	-0.11		0.49	-0.08	0.24
<i>PPE_GROWTH</i>	-0.11	-0.06	-0.02	-0.01	-0.00	-0.10	-0.06	-0.13	0.50		-0.14	0.13
<i>LAG_LOSS</i>	-0.12	-0.01	-0.55	0.01	-0.06	-0.35	-0.39	0.08	0.10	0.00		-0.05
<i>MB</i>	-0.01	-0.02	0.01	-0.02	0.08	-0.01	0.03	0.05	0.04	0.03	0.00	

Notes:

Bold text indicates two-tail significance at the 0.05 level or less. *TOT_ACC* is net income before extraordinary items less cash flows from operations, scaled by lagged total assets. *AB_ACC* is a firm's total accruals less expected accruals, scaled by lagged total assets. *PROFIT* is equal to 1 if a firm's net income in year *t* is above zero, and 0 otherwise. *B4SHARE* equals the percentage of listed companies in a country-industry grouping that use a Big 4 auditor in year *t*. *CONCEN* is the Big 4 audit market Herfindahl index calculated as $H = \Sigma [s/S]^2$ where *s* is the dollar value of total client sales audited by one of the Big 4 auditors in a country-industry grouping in year *t*, and *S* is the total value of sales audited by all Big 4 auditors in the same country-industry grouping in year *t*. Σ is summed over all Big 4 auditors that perform audits within a country-industry grouping in a given year. Industry groupings are based on 2-digit SIC codes. *LOG_SALES* is the natural log of a company's sales in year *t*. *CFO* is a company's cash flows from operations in year *t* scaled by lagged total assets. *LEV* is a company's total liabilities scaled by total assets in year *t*. *SALES_GROWTH* is a company's one-year growth in sales from year *t* - 1 to year *t*. *PPE_GROWTH* is a company's one-year growth in gross property, plant and equipment from year *t* - 1 to year *t*. *LAG_LOSS* is 1 if a company's net income is below zero in year *t* - 1, and 0 otherwise. *MB* is a company's market value of equity scaled by book value of equity at the end of year *t*.

greater financial development, with stronger institutions that protect investors, and in countries where accounting standards are closer to the IAS standards.

Table 3, panel A reports firm-year descriptive statistics of the variables used in the models for the sample of firms from the 42 countries in the study. The mean (median) value of *TOT_ACC* is -0.055 (-0.048), the mean (median) value of *AB_ACC* is 0.0 (0.003), and profits are reported by 72.5 percent of firm-year observations. Table 3, panel B reports Pearson and Spearman correlations for firm-level variables as well as the test variables *B4SHARE* and *CONCEN*. Correlations among firm-level independent variables are generally low, and VIF values for all of the multivariate models are below 10.0, indicating that multicollinearity is not a threat (Kennedy 1992).

3. Model estimations

Accruals models and the probability of reporting a profit

The association of the test variables *B4SHARE* and *CONCEN* with accruals and the probability of reporting a profit is tested in the following model:

$$\begin{aligned} \text{TOT_ACC, AB_ACC or Prob. (PROFIT = 1)} = & \beta_0 + \beta_1 \text{B4SHARE} + \beta_2 \text{CONCEN} \\ & + \beta_3 \text{LOG_SALES} + \beta_4 \text{CFO} + \beta_5 \text{LEV} + \beta_6 \text{SALES_GROWTH} + \beta_7 \text{PPE_GROWTH} \\ & + \beta_8 \text{LAG_LOSS} + \beta_9 \text{MB} + \beta_{10} \text{FIN_DEVEL} + \beta_{11} \text{RULE_OF_LAW} \\ & + \text{Country Fixed Effects} + \text{Year Fixed Effects} + \text{Industry Fixed Effects} + \varepsilon \end{aligned} \quad (2).$$

All variables are defined in the appendix. OLS is used for the models that analyze total accruals (*TOT_ACC*) and abnormal accruals (*AB_ACC*), and a probit model for the likelihood of reporting a profit rather than a loss. Standard errors are clustered at the country-industry-year level as this is the level at which our test variables of interest are calculated, but the results are similar when standard errors are clustered at the individual company level.¹³ All coefficient estimates are reported as two-tailed *p*-values.

Table 4, panel A reports results of the country-fixed-effects estimations for all three dependent variables. All models are significant at $p < 0.01$, and the model *R*-squares are 29, 31 and 42 percent for the total accruals, abnormal accruals, and profit reporting, respectively. Firm-level control variables are generally significant and in the direction consistent with prior research.

B4SHARE measures total Big 4 market share in a country-industry-year. Results indicate that total accruals, abnormal accruals, and profit reporting of Big 4 clients are significantly lower in country-industry-year groupings where Big 4 auditors conduct a larger percentage of audits. In (1) the dependent variable is total accruals, and the coefficient on *B4SHARE* has a value of -0.012 and is significant at $p < 0.05$. When going from the 10th to 90th percentile value of *B4SHARE*, there is a 0.0054 decrease in the magnitude of total accruals, holding all other model variables constant at their mean values. Scaling by the mean absolute value of total accruals, this difference represents a 9.8 percent decrease in total accruals ($-0.0054/0.055$).

In (2) the dependent variable is abnormal accruals, and the coefficient on *B4SHARE* has a value of -0.009 and is significant at $p < 0.05$. When going from the 10th percentile to 90th percentile value of *B4SHARE* there is a 0.0040 decrease in abnormal accruals, holding all other model variables constant at their mean values. This represents a 7.3 percent decrease in abnormal accruals, scaled by the mean absolute value of average total accruals ($-0.0040/0.055$).

13. Clustering by country-industry-year adjusts standard errors that may be inflated due to the use of multiple firm-level observations where the values of *B4SHARE* and *CONCEN* are the same.

TABLE 4
Audit market concentration and tests of earnings quality

Panel A: Full sample period (1999 to 2007)

Variable	Pred.	Dependent variable		
		<i>TOT_ACC</i>	<i>AB_ACC</i>	Prob. (<i>PROFIT</i>)
		Model (1)	Model (2)	Model (3)
<i>Test variables:</i>				
<i>B4SHARE</i>	+/-	-0.012 **	-0.009 **	-0.068 ***
<i>CONCEN</i>	+/-	0.013 ***	0.013 ***	0.031 *
<i>Control variables:</i>				
<i>LOG_SALES</i>	+	0.008 ***	0.006 ***	0.056 ***
<i>CFO</i>	-	-0.259 ***	-0.289 ***	0.922 ***
<i>LEV</i>	-	-0.077 ***	-0.059 ***	-0.333 ***
<i>SALES_GROWTH</i>	?	-0.003	-0.004	0.068 ***
<i>PPE_GROWTH</i>	?	-0.029 ***	-0.027 ***	-0.028 ***
<i>LAG_LOSS</i>	-	-0.053 ***	-0.044 ***	-0.369 ***
<i>MB</i>	+	0.001 ***	0.001 ***	0.004 ***
<i>FIN_DEVEL</i>	?	0.017	0.001	0.102 *
<i>RULE_OF_LAW</i>	-	-0.028 *	-0.018 *	-0.129 *
<i>INTERCEPT</i>	?	-0.060 ***	0.016 *	-0.066
Country fixed effects		YES	YES	YES
Year fixed effects		YES	YES	YES
Industry fixed effects		YES	YES	YES
<i>N</i>		55,408	54,734	55,408
Model <i>p</i> -value		<0.001	<0.001	<0.001
<i>R</i> ² /Pseudo <i>R</i> ²		28.8 %	31.4 %	42.5 %

Panel B: Reduced sample period (1999 to 2004)

Variable	Pred.	Dependent variable		
		<i>TOT_ACC</i>	<i>AB_ACC</i>	Prob. (<i>PROFIT</i>)
		Model (1)	Model (2)	Model (3)
<i>Test variables:</i>				
<i>B4SHARE</i>	+/-	-0.050 ***	-0.013 *	-0.083 **
<i>CONCEN</i>	+/-	0.055 ***	0.024 ***	0.048 *
<i>Control variables:</i>				
<i>LOG_SALES</i>	+	0.008 ***	0.006 ***	0.050 ***
<i>CFO</i>	-	-0.232 ***	-0.294 ***	0.614 ***
<i>LEV</i>	-	-0.076 ***	-0.058 ***	-0.291 ***
<i>SALES_GROWTH</i>	?	-0.004 **	-0.007 ***	0.028 ***
<i>PPE_GROWTH</i>	?	-0.030 ***	-0.031 ***	-0.001
<i>LAG_LOSS</i>	-	-0.051 ***	-0.044 ***	-0.324 ***
<i>MB</i>	+	0.001	-0.001	0.004 ***
<i>FIN_DEVEL</i>	?	0.019 ***	0.003 *	0.017

(The table is continued on the next page.)

TABLE 4 (Continued)

Variable	Pred.	Dependent variable		
		<i>TOT_ACC</i>	<i>AB_ACC</i>	Prob. (<i>PROFIT</i>)
		Model (1)	Model (2)	Model (3)
<i>RULE_OF_LAW</i>	–	–0.045 ***	–0.025 ***	–0.128 *
<i>INTERCEPT</i>	?	–0.091	–0.010	–0.005
Country fixed effects		YES	YES	YES
Year fixed effects		YES	YES	YES
Industry fixed effects		YES	YES	YES
<i>N</i>		36,660	36,256	36,660
Model <i>p</i> -value		< 0.001	< 0.001	< 0.001
<i>R</i> ² / <i>Pseudo R</i> ²		24.9 %	30.7 %	41.1 %

Notes:

***, ** and * indicate significance at the 0.01, 0.05, and 0.10 respectively using two-tailed tests.

t-statistics are calculated based on robust standards errors clustered at the country-industry-year level because both independent variables of interest are calculated at this level. Coefficients on year and industry fixed effects are not reported for brevity. The dependent variable *TOT_ACC* is net income before extraordinary items less cash flows from operations, scaled by lagged total assets. The dependent variable *AB_ACC* is a firm's total accruals less expected accruals, scaled by lagged total assets. The dependent variable *PROFIT* is equal to 1 if a firm's net income in year *t* is above zero, and 0 otherwise. *B4SHARE* equals the percentage of listed companies in a country-industry grouping that use a Big 4 auditor in year *t*. *CONCEN* is the Big 4 audit market Herfindahl index calculated as $H = \sum [s/S]^2$ where *s* is the dollar value of total client sales audited by one of the Big 4 auditors in a country-industry grouping in year *t*, and *S* is the total value of sales audited by all Big 4 auditors in the same country-industry grouping in year *t*. Σ is summed over all Big 4 auditors that perform audits within a country-industry grouping in a given year. Industry groupings are based on 2-digit SIC codes. *LOG_SALES* is the natural log of a company's sales in year *t*. *CFO* is a company's cash flows from operations in year *t* scaled by lagged total assets. *LEV* is a company's total liabilities scaled by total assets in year *t*. *SALES_GROWTH* is a company's one-year growth in sales from year *t* – 1 to year *t*. *PPE_GROWTH* is a company's one-year growth in gross property, plant and equipment from year *t* – 1 to year *t*. *LAG_LOSS* is 1 if a company's net income is below zero in year *t* – 1, and 0 otherwise. *MB* is a company's market value of equity scaled by book value of equity at the end of year *t*. *FIN_DEVEL* is a country's total market capitalization in year *t* scaled by GDP. *RULE_OF_LAW* is the measure of rule of law taken from Kaufmann et al. 2009.

In (3) the dependent variable is the probability of reporting a profit. The marginal coefficient on *B4SHARE* has a value of –0.068 and is significant at $p < 0.01$.¹⁴ To assess economic significance given the use of a probit model, we first standardize *B4SHARE* so that it has a mean value of 0.0 and a standard deviation of 1.0. We then rerun the probit regression to obtain the *standardized* marginal coefficient on *B4SHARE* (–0.013 untabulated, $p < 0.01$). The standardized marginal coefficient is interpreted as the percentage decrease in likelihood a firm reports a profit given a one unit increase in *B4SHARE*

14. All reported coefficients in (3) are marginal coefficients due to the use of a probit model.

(Chamberlain 1984). Given that we have standardized *B4SHARE* so that its standard deviation is equal to one, firms are 2.6 percent less likely (-0.013 times two standard deviations) to report a profit when moving from one standard deviation below the mean value of *B4SHARE* to one standard deviation above the mean value.

The test variable *CONCEN* measures concentration *within* the Big 4 group of auditors. *CONCEN* is positively associated with total accruals and abnormal accruals at $p < 0.01$, and positively associated with reporting a profit at $p < 0.10$. All three results indicate that earnings quality is lower in countries when there is a higher level of concentration within the Big 4 group of auditors. Given the coefficient of 0.013 on *CONCEN* in (1), there is a 0.0021 increase in the magnitude of total accruals when going from the 10th to 90th percentile value of *CONCEN*, holding all other model variables constant at their mean values. Scaling by the mean absolute value of total accruals, this represents a 3.8 percent increase in total accruals ($0.0021/0.055$). In (2) the coefficient on *CONCEN* also has a value of 0.013. When going from the 10th to 90th percentile value of *CONCEN* there is also a 0.0021 increase in the magnitude abnormal accruals, holding all other model variables constant at their mean values, which also represents a 3.8 percent increase in value relative to the absolute value of average total accruals. Finally, after performing the same analysis on the profit reporting model described above for *B4SHARE*, firms are 1.1 percent more likely to report a profit when moving from one standard deviation below the mean value of *CONCEN* to one standard deviation above the mean.

Given the statistical significance of *CONCEN*, we undertake a further analysis to investigate separately the audits of the largest Big 4 auditor and the smallest Big 4 auditor in a country-industry-year. The purpose is to determine if low-quality audits occur only for the dominant Big 4 auditor (market leader), or if all of the Big 4 are affected. For this analysis, the sample is restricted to just those observations in the upper half of the sample for firm-level values of *CONCEN*, that is, those markets in which there is a greater concentration within the Big 4 group in a country-industry-year. We reestimate the models with an additional indicator variable for the leading Big 4 accounting firm (largest market share) in a country-industry-year. We repeat the same analysis using an indicator variable for the smallest Big 4 firm in a country-industry-year. These two analyses indicate that there are no statistically significant differences in the quality of client earnings for either the largest or the smallest Big 4 firm in a country-industry-year, relative to the other Big 4 firms, which means that a more concentrated market structure in a country seems to affect the quality of *all* Big 4 audits in that particular market structure. This result is consistent with the concerns of regulators that market concentration may lessen the incentives for all of the Big 4 accounting firms to provide high-quality audits to their clients.

Table 4, panel B presents a reduced sample covering the years 1999 through 2004. The reason we present this analysis is due to a problem in obtaining accurate auditor data from Global Vantage beginning in 2005, which is an issue that researchers should be aware of until COMPUSTAT resolves this problem.¹⁵ Due to these data problems, we assume the auditor for a company in 2005, 2006, and 2007 is the same as it was in 2004 in order to be able to retain a longer sample period, and given that research has shown that a company's auditor is relatively stable from year-to-year over a short time-period.

15. Based on private discussions with Global Vantage, there appears to be an auditor coding problem in the database beginning in 2005. To illustrate, for the 42 countries in our sample, the average Big 4 market share *decreased* by 21 percent between 2004 and 2005. Individual countries had particularly large decreases such as Spain (-68 percent) and the Netherlands (-48 percent). Unfortunately, the online version of Worldscope is not an alternative source of auditor data. The reason is that there is no historical auditor data in the database. That is, auditor data is available only for the auditor of record for the most recent fiscal year in the database. Finally, the CD version of Worldscope was discontinued as of July 2006 and, thus, annual auditor data are no longer available in this format for company year-ends for 2006 and after.

Krishnan (1994) reports switching rates of around 5 percent, and in our sample for 1999–2004 the switching rate averages 5.74 percent a year (excluding switches related to clients of Arthur Andersen). Results in Table 4, panel B of our reduced sample are almost exactly the same as those of our full sample in panel A. Thus, we conclude that our imposed assumption on the auditor data does not affect our main results.

We conclude that audit market structure has economic and statistical significance in the tests of accruals and profit reporting. In countries with greater Big 4 market shares relative to non-Big 4 auditors, Big 4 client accruals are smaller and these firms are more likely to report losses. However, in countries with greater concentration within the Big 4 auditor group, Big 4 clients have larger accruals and are less likely to report losses.

Timely loss recognition

Our final analysis uses a model of timely loss recognition that builds on the work of Ball and Shivakumar 2005 and Bushman and Piotroski 2006. There has been criticism of the Basu 1997 conservatism model when using earnings and returns in cross-country studies, due to the possibility that stock prices reflect economic income differently across countries (Holthausen 2003). Consequently, we employ the following model which measures the timeliness with which accruals are recognized for those firms with negative cash flows (a proxy for economic losses) relative to firms with positive cash flows:

$$\begin{aligned}
 TOT_ACC = & \beta_0 + \beta_1 NEG + \beta_2 CFO + \beta_3 NEG * CFO + \beta_4 B4SHARE \\
 & + \beta_5 NEG * B4SHARE + \beta_6 CFO * SHARE + \beta_7 NEG * CFO * B4SHARE \\
 & + \beta_8 CONCEN + \beta_9 NEG * CONCEN + \beta_{10} CFO * CONCEN \\
 & + \beta_{11} NEG * CFO * CONCEN + Firm - Level Controls/Interactions \\
 & + Country Fixed Effects + Year Fixed Effects + Industry Fixed Effects + \varepsilon \quad (3),
 \end{aligned}$$

where *NEG* equals one when a firm's cash flows from operations in year *t* are negative, and zero otherwise. The models also include firm-level controls for size, leverage, and market-to-book ratios, as prior research has shown them to be associated with accounting conservatism (Givoly, Hayn, and Natarajan 2006; LaFond and Roychowdhury 2008; LaFond and Watts 2008; Roychowdhury and Watts 2007).

The model predicts more timely recognition of accruals for firms with negative cash flows relative to firms with positive cash flows, and we test if this relation is further affected by audit market structure, that is, the concentration of supply for the Big 4 firms in a country, and the level of concentration within the Big 4 group. Formally, we test if the coefficients β_7 (*NEG*CFO*B4SHARE*) and β_{11} (*NEG*CFO*CONCEN*) are incrementally significant relative to β_3 (*NEG*CFO*). A positive sign would indicate more timely loss recognition as either test variable (*B4SHARE* or *CONCEN*) increases in value, while a negative sign would indicate less timely loss recognition as either variable increases in value.

Table 5 reports results of the timely loss model estimations for both our full sample period as well as the reduced sample period of 1999–2004 due to the auditor data coding problems discussed above. As in prior studies, there is evidence of timely loss recognition as the coefficient is positive and significant for *NEG*CFO*. The coefficient on *NEG*CFO*B4SHARE* reflects the incremental sensitivity of accruals to negative cash flows, *conditional on the level of Big 4 market share in a country-industry-year*. Results in Table 5 show that the coefficient on *NEG*CFO*B4SHARE* is positive and significant ($p < 0.05$) in both models, which provides evidence that accruals are recorded in a more timely manner for firms with negative cash flows in countries where *B4SHARE* is larger. This is consistent with the prior analyses in Table 4 and indicates that a larger Big 4 market share in

TABLE 5
 Audit market concentration and tests of timely loss recognition

Variable	Pred.	Dependent variable is <i>TOT_ACC</i>	
		Full sample	Reduced sample
<i>B4SHARE</i>		-0.029 ***	-0.047 ***
<i>NEG* B4SHARE</i>		0.043 ***	0.017
<i>CFO* B4SHARE</i>		0.148 ***	0.201 ***
<i>NEG*CFO*B4SHARE</i>	+/-	0.231 **	0.133 **
<i>CONCEN</i>		-0.007	0.036 ***
<i>NEG*CONCEN</i>		0.033 **	0.039 **
<i>CFO*CONCEN</i>		-0.094	-0.095
<i>NEG*CFO*CONCEN</i>	+/-	-0.360 **	-0.455 ***
<i>NEG</i>		-0.069 ***	-0.022 *
<i>CFO</i>		-0.684 ***	-0.363 ***
<i>NEG*CFO</i>		0.468 ***	0.130 *
<i>LOG_SALES</i>		0.003 ***	0.008 ***
<i>NEG*LOG_SALES</i>		0.015 ***	0.004 ***
<i>CFO*LOG_SALES</i>		0.040 ***	-0.027 ***
<i>NEG*CFO*LOG_SALES</i>		-0.070 ***	0.036 ***
<i>LEV</i>		-0.076 ***	-0.085 ***
<i>NEG*LEV</i>		-0.079 ***	-0.008
<i>CFO*LEV</i>		-0.484 ***	-0.142 ***
<i>NEG*CFO*LEV</i>		0.081	-0.025
<i>MB</i>		-0.001 *	0.001 ***
<i>NEG*MB</i>		0.005 **	-0.000 *
<i>CFO*MBG</i>		0.037 ***	0.003 **
<i>NEG*CFO*MB</i>		-0.041 ***	-0.002 *
<i>FIN_DEVEL</i>		0.003	0.001
<i>NEG* FIN_DEVEL</i>		0.006	-0.004
<i>CFO* FIN_DEVEL</i>		0.009	-0.019
<i>NEG*CFO* FIN_DEVEL</i>		0.029	-0.033
<i>RULE_OF_LAW</i>		-0.008	-0.012
<i>NEG* RULE_OF_LAW</i>		-0.017 ***	-0.019 ***
<i>CFO* RULE_OF_LAW</i>		-0.039 ***	-0.026
<i>NEG*CFO* RULE_OF_LAW</i>		0.208 ***	0.165 ***
<i>INTERCEPT</i>		-0.004	-0.004
Country fixed effects		YES	YES
Year fixed effects		YES	YES
Industry fixed effects		YES	YES
<i>N</i>		55,408	36,660
Model <i>p</i> -value		< 0.001	< 0.001
<i>R</i> ²		37.6 %	39.9 %

(The table is continued on the next page.)

TABLE 5 (Continued)

Notes:

***, ** and * indicate significance at the 0.01, 0.05 and 0.10 levels, respectively, using two-tailed tests. *t*-statistics are calculated based on robust standard errors clustered at the country-industry-year level as both independent variables of interest are calculated at this level. Coefficients on country and industry dummies are not reported for brevity. The dependent variable *TOT_ACC* is net income before extraordinary items less cash flows from operations, scaled by lagged total assets. *CFO* is a company's cash flows from operations in year *t* scaled by lagged total assets. *NEG* equals one when a firm's cash flow from operations is below zero, and 0 otherwise. *B4SHARE* equals the percentage of listed companies in a country-industry grouping that use a Big 4 auditor in year *t*. *CONCEN* is the Big 4 audit market Herfindahl index calculated as $H = \sum [s/S]^2$ where *s* is the dollar value of total client sales audited by one of the Big 4 auditors in a country-industry grouping in year *t*, and *S* is the total value of sales audited by all Big 4 auditors in the same country-industry grouping in year *t*. Σ is summed over all Big 4 auditors that perform audits within a country-industry grouping in a given year. Industry groupings are based on 2-digit SIC codes. *LOG_SALES* is the natural log of a company's sales in year *t*. *CFO* is a company's cash flows from operations in year *t* scaled by lagged total assets. *LEV* is a company's total liabilities scaled by total assets in year *t*. *LEV* is a company's total liabilities scaled by total assets in year *t*. *MB* is a company's total market value of equity scaled by total book value of equity. *FIN_DEVEL* is a country's total market capitalization in year *t* scaled by GDP. *RULE_OF_LAW* is the measure of rule of law taken from Kaufmann et al. 2009.

a country is associated with higher-quality Big 4 audits as reflected by greater conservatism of client earnings (i.e., more timely loss recognition).

In contrast, the coefficient on *NEG*CFO*CONCEN* is significantly negative ($p < 0.05$ in model 1 and $p < 0.01$ in model 2), which indicates total accruals are recorded in a less timely manner for firms with negative cash flows in countries where concentration of supply within the Big 4 group is greater. This is also consistent with results in Table 4. Earnings quality is lower (less conservative accounting) for Big 4 clients in countries where there is a greater level of market concentration within the Big 4 group of firms.

Together, the results in Tables 4 and 5 for *B4SHARE* and *CONCEN* indicate lower-quality audited earnings in countries with a low Big 4 market share and a high concentration within the Big 4 group. To get a better feel for the countries which have the least problematic audit market structures, we sort the 42 countries into those countries which are in both the upper half of *B4SHARE* and the lower half of *CONCEN*. This results in 14 countries with higher-quality earnings on both dimensions of market structure: Australia, Belgium, Canada, Denmark, Hong Kong, Ireland, Malaysia, Mexico, the Netherlands, Norway, Singapore, Switzerland, Taiwan, and the United States. To identify countries with the most problematic market structures we sort the countries into both the lower half of *B4SHARE* and the upper half of *CONCEN*. This results in 13 countries with lower-quality earnings on both dimensions: Argentina, Austria, Brazil, Colombia, Germany, Indonesia, Israel, Peru, the Philippines, Portugal, Russia, Thailand, and Turkey.

To further rule out that financial market development and investor protection do not drive the results in Tables 4 and 5, we code the above 27 countries into high and low quality (1 and 0), and calculate their correlations with *FIN_DEV* and *INV_PROT*. The 14 high-quality countries have a correlation of 0.405 with *FIN_DEV* and 0.323 with *INV_PROT*. The 13 low-quality countries have a correlation of -0.502 with *FIN_DEV* and -0.328 with *INV_PROT*. While these correlations are significant and in the expected

directions (higher-quality audits in countries with more developed financial markets and stronger investor protection regimes), the correlations are sufficiently low to rule out that the results are explained by country-level institutional factors alone. As noted before, controlling for the concurrent effects of country-level factors is a design challenge in cross-country accounting research.

Non-Big 4 auditors

Table 6 presents an analysis of the clients of non-Big 4 auditors in the 42 sample countries, similar to that in Table 4, panel A, for the clients of Big 4 auditors. The above findings that earnings quality increases for Big 4 clients in countries with higher values of *B4SHARE* suggests that audits may be of higher quality in those countries where there is strong underlying demand for high-quality earnings, and that lower-quality auditors are driven out of the audit market for listed companies in these countries. While this conjecture seems descriptive of what occurs, we acknowledge that the reason why higher-quality audits are demanded in a particular country is unclear, since we control for systematic cross-country differences through the country fixed effects model. Further, when we regress *B4SHARE* on all country-level variables in the study, the adjusted *r*-square is only 8.3 percent, which suggests that other idiosyncratic factors are also at play in explaining the demand for higher quality audits/earnings in a country.

Given the above, we expect that audits of non-Big 4 accounting firms are also of higher quality in those countries with larger Big 4 market shares (compared to non-Big 4 audits in countries with smaller Big 4 shares) because there is a demand in such countries for higher-quality audits. If this prediction is correct, we would expect to observe a positive association between *B4SHARE* and earnings quality metrics for the clients of non-Big 4 auditors.¹⁶ This conjecture is supported, as the coefficients on *B4SHARE* in Table 6 are negative and significant ($p < 0.10$, two-tailed) for the three models of earnings quality in Table 6.¹⁷ In contrast, the coefficients on *CONCEN* are never significant, indicating that the market concentration of audits within the Big 4 group of auditors in a country does not affect audit quality for non-Big 4 auditors in these countries. This is expected to be the case because there is no reason to believe the concentration of supply within the Big 4 group would flow through and affect the quality of non-Big 4 audits.

4. Additional analyses

Due to the large number of U.S. firm-year observations in the sample ($n = 18,980$), we delete these observations as a robustness test. The results reported in Tables 4 and 5 are qualitatively the same without the U.S. observations. We do the same exercise for each of the countries in the sample with more than 1,000 firm-year observations: Australia, Canada, France, Germany, Malaysia, Singapore, Sweden, Taiwan, and the United Kingdom. When each of these countries is deleted, one at a time, the results in Tables 4 and 5 are qualitatively unchanged.¹⁸

We control for the influence of country-level factors on earnings quality with a country-fixed-effects model which is a strong control for observable and unobservable country

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16. We calculate abnormal accruals for non-Big 4 client firms in the same manner as Big 4 clients, but using only the sample of non-Big 4 clients.
 17. In the untabulated test of timely loss recognition, there is no difference in non-Big 4 audits across countries, conditional on the country's Big 4 market share.
 18. The results in Tables 4 and 5 are also unchanged if we concurrently delete all eight countries in the study with less than 100 firm-year observations (Argentina, Colombia, Hungary, Luxembourg, Peru, Poland, Russia, and Venezuela), which means the study's results are not driven by those countries with relatively few observations.

TABLE 6

Test of non-Big 4 clients' earnings quality, conditional on audit market concentration

Variable	Pred.	Dependent variable		
		<i>TOT_ACC</i>	<i>AB_ACC</i>	Prob. (<i>PROFIT</i>)
		Model (1)	Model (2)	Model (3)
<i>Test variables:</i>				
<i>B4SHARE</i>	+/-	-0.010 *	-0.009 *	-0.084 *
<i>CONCEN</i>	+/-	-0.008	-0.007	0.012
<i>Control variables:</i>				
<i>LOG_SALES</i>	+	0.012 ***	0.009 ***	0.064 ***
<i>CFO</i>	-	-0.289 ***	-0.327 ***	0.667 ***
<i>LEV</i>	-	-0.105 ***	-0.075 ***	-0.301 ***
<i>SALES_GROWTH</i>	?	-0.001	-0.001	0.032 ***
<i>PPE_GROWTH</i>	?	-0.021 ***	-0.020 ***	-0.006
<i>LAG_LOSS</i>	-	-0.061 ***	-0.052 ***	-0.354 ***
<i>MB</i>	+	-0.002	0.000	0.003
<i>FIN_DEVEL</i>	?	0.014	0.003	0.124 ***
<i>RULE_OF_LAW</i>	-	-0.040	-0.043	-0.180 ***
<i>INTERCEPT</i>	?	0.039	0.073	-0.070
Country fixed effects		YES	YES	YES
Year fixed effects		YES	YES	YES
Industry fixed effects		YES	YES	YES
<i>N</i>		29,390	29,323	29,390
Model <i>p</i> -value		< 0.001	< 0.001	< 0.001
<i>R</i> ² /Pseudo <i>R</i> ²		28.9 %	38.2%	41.7 %

Notes:

***, ** and * indicate significance at the 0.01, 0.05 and 0.10 levels, respectively, using two-tailed tests.

t-statistics are calculated based on robust standards errors clustered at the country-industry-year level because both independent variables of interest are calculated at this level. Coefficients on country, year, and industry fixed effects are not reported for brevity. The dependent variable *TOT_ACC* is net income before extraordinary items less cash flows from operations, scaled by lagged total assets. The dependent variable *AB_ACC* is a firm's total accruals less expected accruals, scaled by lagged total assets. The dependent variable *PROFIT* is equal to 1 if a firm's net income in year *t* is above zero, and 0 otherwise. *B4SHARE* equals the percentage of listed companies in a country-industry grouping that use a Big 4 auditor in year *t*. *CONCEN* is the Big 4 audit market Herfindahl index calculated as $H = \sum [s/S]^2$ where *s* is the dollar value of total client sales audited by one of the Big 4 auditors in a country-industry grouping in year *t*, and *S* is the total value of sales audited by all Big 4 auditors in the same country-industry grouping in year *t*. Σ is summed over all Big 4 auditors that perform audits within a country-industry grouping in a given year. Industry groupings are based on 2-digit SIC codes. *LOG_SALES* is the natural log of a company's sales in year *t*. *CFO* is a company's cash flows from operations in year *t* scaled by lagged total assets. *LEV* is a company's total liabilities scaled by total assets in year *t*. *SALES_GROWTH* is a company's one-year growth in sales from year *t* - 1 to year *t*. *PPE_GROWTH* is a company's one-year growth in gross property, plant, and equipment from year *t* - 1 to year *t*. *LAG_LOSS* is 1 if a company's net income is below zero in year *t* - 1, and 0 otherwise. *MB* is a company's market value of equity scaled by book value of equity at the end of year *t*. *FIN_DEVEL* is a country's total market capitalization in year *t* scaled by GDP. *RULE_OF_LAW* is the measure of rule of law taken from Kaufmann et al. 2009.

effects. Even though the test variable *B4SHARE* is not highly correlated with the country control variables (Table 2, panel B) it is still possible that the test variable is confounded by a relation between innate country factors and Big 4 market shares. Specifically, past research suggests that countries with stronger institutions and greater levels of financial development are also more likely to have a larger percentage of audits by the Big 4 accounting firms (Choi and Wong 2007; Francis and Wang 2008; Michas 2011). Therefore it is possible that our results on *B4SHARE* are simply capturing these broader country-level characteristics, even though we do control for country factors through a country-fixed-effects model and an alternative specification with a set of country-level control variables.

To further assure the reported results are not confounded by country factors, we control directly for the effects of country factors on Big 4 market share by regressing *B4SHARE* on the set of all country-level control variables used in the study. We then use the residual from this model estimation to denote the Big 4 market share that is *unexplained* by country-level factors. When we substitute this residual value for *B4SHARE*, the test results are qualitatively unchanged. Untabulated results using the residual value to measure Big 4 market share are comparable in terms of statistical significance and directional signs of the coefficients in all of the tests in Tables 4 and 5. We conclude that *B4SHARE* is not capturing more general country-level characteristics and that Big 4 market share is positively associated with the quality of clients' earnings over and above the effects of other country-level factors.

We also test an alternative measure of concentration within the Big 4 group of auditors and replace *CONCEN* with the following variable, denoted *HIGH-LOW*. For each country-industry-year, we compute the market share of the largest Big 4 auditor, and subtract the market share of the smallest Big 4 auditor, where market share is based on percentage of total client sales audited by a firm. If all of the Big 4 firms have equal shares, the difference would be zero (25 percent minus 25 percent), whereas the difference would be 100 percent when one firm has the entire Big 4 market share. Table 2 reports that *HIGH-LOW* has a mean value of 48 percent and an inter-quartile range of 29 to 59 percent.

When *HIGH-LOW* is used to measure within Big 4 market concentration, the results are consistent with those in Tables 4 and 5. The signs of the coefficients are in a direction consistent with lower earnings quality when concentration increases, that is, greater differences in market shares of the largest and smallest Big 4 auditor in a country-industry-year, and seven of the eight coefficients in Tables 4 and 5 are significant at $p < 0.05$. We conclude that the results for *CONCEN* are robust to this alternative measure of concentration within the Big 4 group.

Finally, as an alternative to country fixed models, we reestimate all models by adding two additional time-invariant country-level control variables. To control for the differences between a country's accounting standards and International Accounting Standards, we include the variable *IAS_DIFF*, which is taken from Bae et al. 2008, who compile a list of 21 possible accounting standards that may be different in a country compared to IAS as of the period 2000–2001. Countries with zero differences have implemented substantially all IAS standards, whereas countries with 21 differences have implemented none of these standards. The second country control is a measure of a country's level of investor protection, which can potentially affect the quality of both auditing and financial reporting. This control is particularly important in our context to assure that the results on the audit market concentration variables (*B4SHARE* and *CONCEN*) are significant over and above the effects of investor protection. We calculate a single parsimonious measure of investor protection, using factor analysis with varimax rotation, based on six separate investor protection variables from the work of La Porta, Lopez-de-Silanes, Shleifer, and Vishny 1998 and

2006, and Jackson and Roe 2009.¹⁹ Untabulated results indicate that models with these two additional control variables are nearly identical to the country-fixed-effects models reported in the tables.

5. Conclusion

This study uses cross-country variation in the audit market structure of 42 countries to investigate if market structure (concentration of supply) harms the quality of audit outcomes. The quality of audit outcomes is measured by statistical properties of audited earnings with respect to total accruals, abnormal accruals, the likelihood of reporting a profit (loss avoidance), and timely loss recognition. Results indicate that both Big 4 audits and non-Big 4 audits are of higher quality in those countries where the Big 4 conduct a higher percentage of total audits (*B4SHARE*). These results suggest that Big 4 dominance, by itself, does not harm audit quality. In fact it appears that audit quality is greater for both Big 4 and non-Big 4 firms, which may be reflective of an underlying market demand for high-quality audits in these countries in which lower-quality auditors are driven out of the market. Specifically, total and abnormal accruals are smaller, suggesting less discretion to manage earnings and that firms are less likely to report profits, which also suggests less earnings management behavior to avoid losses, and that there is more timely loss recognition.

In contrast, the test of concentration within the Big 4 (*CONCEN*) indicate that earnings quality is lower for Big 4 clients in countries where there is greater market concentration (unequal market shares) within the Big 4 group: accruals are larger suggesting greater discretion to manage earnings and firms are more likely to report profits, which also suggests more earnings management behavior to avoid losses, and that there is less timely loss recognition. Thus it appears that market concentration within the dominant Big 4 group is potentially harmful to earnings quality.

These findings provide important evidence in response to the global concerns of regulators and policymakers over the dominance of Big 4 accounting firms in the audits of listed companies. Regulators and policymakers can benefit from this analysis as it provides unexpected insights into the consequences of audit market concentration. Specifically, our study concludes that Big 4 dominance per se does not harm audit quality, and in fact appears to be associated with higher-quality audits in a country by both Big 4 and non-Big 4 auditors (relative to countries with lower Big 4 market shares). However, concentration within the Big 4 group seems to be more problematic, and regulators and policymakers should be more concerned with market dominance by individual Big 4 firms. For example, market domination by the single largest Big 4 auditor is particularly striking for the 20 countries in the sample above the median value of *CONCEN*. For these 20 countries, on average the largest Big 4 accounting firm in an industry-country-year combination audits 78.6 percent of client assets and about half the companies (48.9 percent) in

19. The six variables are *COMMON*, *ANTIDIR*, *DISC*, *LIAB*, *PUBENF* and *SEC_STAFF* (defined in detail in the appendix). The six components of *INV_PROT* have the following distributions. There are 12 common law countries and 30 non-common law countries in the sample. *ANTIDIR* ranges from 0 in Belgium to 5 in Canada, Chile, Hong Kong, South Africa, the United Kingdom, and the United States. For the securities law variables, *DISC* varies from 0.25 in Austria and Brazil to 1.00 in Singapore and the United States; *LIAB* ranges from 0 in Germany to 1.00 in Canada, the Philippines, and the United States; and *PUBENF* ranges from 0.15 in Belgium to 0.90 in Australia and the United States. *SEC_STAFF* has a mean value of 22.6, with the smallest staff in Indonesia at 2.0 and the largest in Luxemburg at 315.1. All six of the individual investor protection variables are significantly related with correlations of +/- 0.70 or more, which supports our decision to construct a single investor protection metric (*INV_PROT*) using principal components analysis. Pearson correlations indicate that *INV_PROT* is correlated at the +/- 0.67 level or greater with all six of the variables used in its construction.

these industries. Thus our results, based on a multi-country sample, are consistent with U.K. studies by Beattie, Goodacre, and Fearnley 2003 and Oxera 2006, which find that a growing number of industries in the United Kingdom are dominated by a subset of the Big 4 accounting firms.

Our study is of importance to regulators and contributes to a better understanding of how audit market structure affects the quality of clients' audited earnings. The findings are potentially useful to investors as well, because audit market structure appears to affect the quality of earnings over and above other important country-level characteristics such as the quality of investor protection, and therefore is an important dimension to consider when evaluating the earnings of firms and choosing the countries and firms in which to invest. We also note that our study cannot determine if the "appropriate" level of audit quality is achieved under any particular market structure. Rather, the analysis can only determine if there are relative differences across existing market structures. Lastly, there may be other adverse consequences of audit market concentration such as limited choice, higher fees, and systemic market risk, but these issues are beyond the scope of our analysis.

Appendix

Variable definitions

Dependent variables

TOT_ACC = net income before extraordinary items less cash flows from operations, scaled by lagged total assets.

AB_ACC = the residual from a regression predicting nondiscretionary accruals as calculated in Dechow et al. 1995 and Kothari et al. 2005. The model specification used is: $TOT_ACC_t = \alpha + \beta_1 (1/ASSETS_{it-1}) + \beta_2 (\Delta SALES_{it} - \Delta AR_{it}) + \beta_3 (PPE_{it}) + \beta_4 (ROA_{it}) + Year\ Fixed\ Effects + Industry\ Fixed\ Effects + Country\ Fixed\ Effects + \epsilon$ where *TOT_ACC* is total accruals (net income less cash flows, scaled by lagged assets), *ASSETS* is a firm's total assets, *SALES* is sales, *AR* is accounts receivable, *PPE* is gross property, plant, and equipment, and *ROA* is return on assets. *AB_ACC* is the residual from this regression performed over separate industry-year groupings where industries are based on 2-digit SIC codes.

PROFIT = 1 when a firm's net income for the year is above zero, and 0 otherwise.

Test variables

B4SHARE = the percentage of listed companies in a country-industry grouping that use a Big Four auditor in year *t*. Industry groupings are based on 2-digit SIC codes.

CONCEN = Big 4 audit market Herfindahl index calculated as $H = \sum [s/S]^2$, where *s* is the dollar value of total client sales audited by one of the Big Four auditors in a country-industry grouping, and *S* is the total value of sales audited by all Big 4 auditors in the same country-industry grouping. Σ is summed over all Big 4 auditors that perform audits within a country in a given year.

Firm-level control variables

LOG_SALES = the natural log of a company's sales in year *t*.

CFO = a company's cash flows from operations in year *t* scaled by lagged total assets.

LEV = a company's total liabilities scaled by total assets in year *t*.

SALES_GROWTH = a company's one-year growth in sales from year *t* - 1 to year *t*.

PPE_GROWTH = a company's one year growth in gross property, plant, and equipment from year *t* - 1 to year *t*.

LAG_LOSS = 1 if a company's net income is below zero in year *t* - 1, and 0 otherwise.

MB = a company's market value of equity scaled by book value of equity.

Country-level control variables used in all analyses

FIN_DEVEL = country's total market capitalization in year t scaled by GDP, from World Bank.

$RULE_OF_LAW$ = measure of rule of law in year t , taken from Kaufmann et al. 2009.

Additional country-level control variables used only in section 4 (additional analyses)

IAS_DIFF = index of differences between a country's domestic accounting standards and International Accounting Standards (IAS) for 21 items as of 2001 from Bae et al. 2008.

$COMMON$ = 1 if a country's legal origin is based on English common law, and 0 otherwise, from La Porta et al. 1998.

$ANTIDIR$ = measure of anti-director rights taken from La Porta et al. 1998.

$DISC$ = disclosure index from La Porta et al. 2006.

$LIAB$ = liability standard index from La Porta et al. 2006.

$PUBENF$ = public enforcement of securities laws index from La Porta et al. 2006.

SEC_STAFF = size of a country's securities regulator staff scaled by total population from Jackson and Roe 2009.

INV_PROT = a factor analysis (principal components analysis) with varimax rotation of the variables $COMMON$, $ANTIDIR$, $DISC$, $LIAB$, $PUBENF$, and SEC_STAFF . All variables load on a single significant factor.

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