# Brain Drain or Brain Gain?
# Non-Big 4 Audit Quality after the Big 4's Entry to Local Audit Markets

Yong Huang
*Zhongnan University of Economics and Law*
huangyong@zuel.edu.cn

Like Jiang
*The University of Melbourne*
like.jiang@unimelb.edu.au

Zhifeng Yang
*Stony Brook University*
zhifeng.yang@stonybrook.edu

Junkun Zhao
*Xiamen University*
zhaojunkun@stu.xmu.edu.cn

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**Abstract:**

Relying on a unique dataset of first Big 4 audit offices established across different cities in China, we study how the entry of the Big 4 audit firms into local audit markets influences other local non-Big 4 audit offices. Implementing a difference-in-differences design, we find that audit quality of the non-Big 4 audit offices decreases after the Big 4's entry. The reduced audit quality is mainly attributable to the local non-Big 4 audit offices losing critical human capital (i.e., certified public accountants) when facing competition for talent from the newly established Big 4 audit offices. We do not find that the local non-Big 4 audit offices compete head-to-head with the new Big 4 audit office to attract or retain audit clients. Overall, our findings suggest that the Big 4's entry increases the competition for accounting professionals in the local labor markets, which in turn affects the human capital of other local non-Big 4 audit offices and their audit service quality.

**Keywords**: Audit office human capital; Audit quality; Big 4 expansion; Competition for talent.

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## 1. Introduction

Human capital is arguably the most important asset for public accounting firms (Aobdia and Petacchi 2023). While having sufficient competent personnel to perform audit engagements is essential for audit service quality, searching for and retaining talent is ranked as one of the top concerns of audit firms (Drew 2015). Regulators, such as the Public Company Accounting Oversight Board (PCAOB) in the U.S., have identified employee turnover as a potential root cause of inspection deficiencies (Hanson 2012) and listed the retention of professional personnel as one of the key audit quality indicators (PCAOB 2015; PCAOB 2024). Recent studies also offer evidence supporting the importance of labor and talent to audit quality (Beck, Francis, and Gunn 2018; Aobdia, Srivastava, and Wang 2018; Lee, Naiker, and Steward 2022; Frost, Jing, Shang, Su 2024). Conceivably, given the importance of human capital to audit service quality, audit firms are expected to compete for talent in the labor market. However, research on competition for talent in local audit markets is scant.

We advance the literature by investigating competition for talent in the local audit markets and the impact of such competition on audit quality. Specifically, we explore a unique setting in China where the largest international audit firms, including Ernst & Young (EY), Deloitte (DTT), KPMG, and PricewaterhouseCoopers (PwC) (hereafter the Big 4), establish the first office in a city (i.e., the Big 4's entry into a local audit market) and examine the impact of such entry on human capital and audit quality of local *non-Big 4* audit offices. An audit office represents a critical decision-making unit in retaining and allocating human resources (Francis and Yu 2009). They often rely on the local labor markets to build up human capital resources that are crucial to audit engagement quality (Lee et al. 2022). Prior studies of organization and strategic human capital (e.g., Batt 2002; Hausknecht, Trevor, and Howard 2009; McKendrick,

Wade, and Jaffee 2009; Tan and Rider 2017) suggest that the entry of the Big 4 audit firms into the local audit markets could have a "brain drain" or "brain gain" effect on other local non-Big 4 audit offices.

On the one hand, the Big 4's entry likely imposes a threat to non-Big 4 audit offices with respect to attracting and retaining local talent. Prior studies document a variety of benefits for individual auditors from gaining experience in working in the Big 4 audit firms, such as higher audit fees, greater future compensations, improved social status and reputation, and enhanced career outlook (Frecka, Mittelstaedt, Stevens 2022; Zimmerman, Bills, and Causholli 2021). The newly established Big 4 audit office in a city could be attractive to local individual auditors, especially those who are competent and seek career advancement. To the extent that human capital is the most critical input in audit engagements, the loss of local talent in non-Big 4 audit offices to the newly established Big4 audit office likely leads to an adverse impact on the audit service quality of the non-Big 4 audit offices. Such "brain drain" effect is observed in other service industries where losing employees to competitors diminishes service quality (Batt 2002; Hausknecht et al. 2009).

On the other hand, the Big 4 audit firms in general provide higher quality audit services due to their resources and expertise, high-quality control systems, and innovative audit technology (Che et al. 2020; Commerford et al. 2022). The entry of a Big 4 audit firm to the local audit market could bring in new audit knowledge and high-standard practices that can spill over to local non-Big 4 audit offices and thus benefits the overall local audit markets. Furthermore, prior research shows that employee departures force firms to hire replacements, resulting in inflows of new ideas and expertise, refreshment of talent pool, and enhanced appeal to potential talent due to signals of external mobility opportunities (McKendrick et al. 2009; Tan and Rider 2017). Such "brain gain" effect, if prevails, would result in improved audit practices of the local non-Big 4 audit offices after the Big 4's entry into the local audit markets,

leading to increased audit quality of the local non-Big 4 audit offices.

Collectively, it is an empirical question on how the Big 4's entry into a city could influence the human capital and audit quality of local non-Big 4 audit offices. We address this question using data from China that offers a number of advantages to examine our research question. Unlike many developed countries where the Big 4 audit firms had already established local audit offices before the start of this century, the Big 4 audit firms entered the Chinese audit market after the establishment of Shanghai and Shenzhen Stock Exchanges in the early 1990s and gradually established their local offices in the past two decades. This provides us with an opportunity to observe multiple, staggered events of the Big 4's entry into the local audit markets. In addition, while the Big 4 audit firms are dominant in most other major markets, the Chinese audit market is featured with a low market share of the Big 4 audit firms and a relatively large number of non-Big 4 audit firms competing fiercely for assurance services to public companies (Wang, Wong, and Xia 2008; Gul, Wu, and Yang 2013). The city-based non-Big4 audit offices tend to be locally oriented and provide audit services to listed companies in the same city and surrounding areas (Chan, Lin, Mao 2006).

We rely on first-time Big 4 entry into 23 cities in China during the period 1998 – 2020 to examine our research question. We use clients of non-Big 4 audit offices located in cities with the Big 4 entry as the treated clients and clients of non-Big 4 audit offices located in cities where the Big 4 audit firms never enter as the control clients. We perform a stacked difference-in-differences (DID) analysis, using three years before the Big 4 entry (i.e., the pre-entry period) and three years after the Big 4 entry (i.e., the post-entry period) as the testing window. Results show that the treated clients have an increased likelihood of accounting restatements and larger absolute values of discretionary accruals relative to the control clients in the post-entry period, suggesting that the audit quality of local non-Big 4 audit offices deteriorates after the Big 4 audit firms establish the first local audit office. The result remains unchanged in a battery of

robustness checks, including the test of parallel trends assumption, matching between treated and control groups, alternative proxies of audit quality, and different model specifications.

The above evidence is consistent with a "brain drain" effect on the local non-Big 4 audit offices after the Big 4's entry into the local audit markets. To further substantiate this argument, we perform additional tests to analyze how the Big 4's entry affects human capital of the non-Big 4 offices. First, we manually collect lists of certified public accountants (CPAs) in the local non-Big 4 audit offices from the websites of each provincial branch of the Chinese Institute of Certified Public Accountants (CICPA). We measure human capital of an audit office by the new CPA ratio relative to the total CPAs in the audit office and the growth rate of the total CPA numbers of the audit office. We are able to trace individual CPAs' data back to 2003 and obtain the information on individual CPAs for 45,311 audit office-year observations in the period 2003 – 2020. Within this sample, our DID analyses show that in the post-entry period, non-Big 4 audit offices affected by the Big 4's entry experience a reduced new CPA ratio and an overall decrease in CPA growth. This effect is more pronounced for the non-Big 4 audit offices that are licensed to offer securities business services. Since audit firms are required to maintain a certain number of CPAs to obtain and maintain the securities business license, the result suggests that the local non-Big 4 audit offices that are in need of accounting professionals are more likely to be affected by the Big 4's entry, consistent with our argument of the 'brain drain" effect resulted from the Big 4's entry into the local audit markets.

Second, as an alternative way to proxy for the demand for human capital in the non-Big 4 audit offices, we collect their job posting information from the CnOpendata platform for the period 2014 - 2020. By analyzing the job posting content of 4,270 audit office-year observations, we find that the non-Big 4 audit offices affected by the Big 4's entry lower the entry requirements and advertise more additional benefits (e.g., medical insurance) to new hires in their job posts. Collectively, the findings lend empirical evidence supporting that the Big 4's

entry likely intensifies competition for talent in the local labor markets for accounting professionals.

One may argue that the decreased audit quality of the non-Big4 audit offices after the Big4's entry into the local audit markets is due to increased competition for audit clients between the Big 4 and non-Big 4 audit offices. We consider this alternative explanation unlikely for several reasons and perform additional analyses to rule out this alternative explanation. First, the Big 4 audit firms in China mainly provide services to very large public companies that raise capital in the international capital markets and are thus unlikely to compete head-to-head with non-Big 4 audit firms in the local audit markets (Securities Daily 2020). Second, from the theoretical perspective, it is not clear whether increased audit market competitions between the Big 4 and non-Big 4 audit firms will increase or decrease audit quality. On the one hand, the increased competition in a local audit market can strengthen the need to curry favor to clients for client retention purpose and thus reduces audit quality (Pan, Shroff, and Zhang 2023); on the other hand, the increased competition could enhance reputation concerns that incentivize auditors to provide high quality audits (Hallman, Kartapanis, and Schmidt 2022). Third, from the empirical perspective, we manually track audit firm switches of non-Big 4's clients after a Big 4 audit firm enters the local audit market in our sample period. We only observe 11 cases in which the clients switched from a non-Big 4 audit firm to a Big 4 audit firm.[1] Moreover, we do not find the audit firm turnover ratio significantly increases for the non-Big 4 clients after the Big 4's entry into the local audit markets. As such, the empirical evidence does not support head-to-head competitions for audit clients between the Big 4 and non-Big4 audit offices after the Big 4's entry into the local audit markets.

Like all other studies using Chinese data, findings in this study should be interpreted with

[1] Panel A of Appendix C provides details of the 11 cases in which the clients switched from a non-Big 4 audit firm to a Big 4 audit firm after the Big 4's entry.

caution as they could be subject to a generalizability issue due to the unique institutional characteristics of the Chinese audit market (Lennox and Wu 2022). However, the theoretical premises in this study are broad and findings could potentially be generalizable to other countries. Overall, this study makes contributions to several streams of literature, and the findings should be of interest to regulators, audit professionals, and accounting academics.

First, it adds to emerging literature on the importance of human capital to audit quality. Accounting firms and regulators worldwide have expressed concerns about maintaining and growing human capital in the accounting profession (PCAOB 2024; FRC 2024). Prior studies show that audit quality is higher in cities with a large well-educated workforce (Beck et al. 2018) and when the audit office is located closer to feeder schools that audit firms target to recruit high-quality staff auditors (Lee et al. 2022). Knechel, Mao, Qi, and Zhuang (2021) explore the phenomenon of auditors leaving public accounting profession and show that audit quality is reduced for clients who stay with an audit firm that losses skilled auditors who move to corporate positions. Our study tackles the competitions for talent in the local labor markets of accounting professionals and investigates the "brain drain" issue in local non-Big 4 audit offices. We demonstrate that audit quality is impaired when local audit offices suffer from difficulties in recruiting and retaining key personnel (i.e., CPAs). This evidence is important to the human capital literature in auditing and, more broadly, to the literature on the importance of human capital quality in financial reporting (e.g., Call, Campbell, Dhaliwal, and Moon 2017).

Second, this study extends the literature on local audit market competition. Prior studies primarily focus on competition for audit clients among audit offices in the local audit markets (Chu, Simunic, Ye, and Zhang 2018; Pan et al. 2023). Our study takes a different perspective to explore the competition for talent and the consequences of such competition. Leveraging on the setting where a Big 4 audit firm establishes its first audit office in a city, we show that such entry intensifies competition for talent in the local audit markets and potentially gives rise to

human capital losses in other local non-Big 4 audit offices, leading to an adverse effect on their audit service quality. The evidence suggests that the competition among audit offices in a local audit market can be multidimensional. Their competition for professional personnel is an under-researched area that could have a profound impact on the audit service quality, especially for the local non-Big 4 audit offices that are likely in a disadvantageous position in competing for talent compared to the Big 4 audit offices.

Third and relatedly, the findings shed light on the influence of the Big 4 expansions. The Big 4 audit firms have had significant expansions in the U.S. and global audit markets over the past decades. Prior studies have investigated whether and how the Big 4's city-level market concentration and industry expertise influence local audit market competition, audit fees, and audit quality (e.g., Francis, Reichelt, and Wang 2005; Reichelt and Wang 2010; Fung, Gul, Krishnan 2012). While these studies offer important insights on the Big 4's role in the local audit markets, the evidence is largely drawn from the city-level audit markets where the Big 4 have already obtained significant market shares. Different from prior studies, we explore a setting where a Big4 audit firm establishes the first office in a city and provide new insights on the impact of such entry on the local labor market of audit professionals.

Fourth, this study complements emerging literature on non-Big 4 audit firms. Although non-Big 4 audit firms take a significant market share in performing public company audits,[2] they have received limited attention in academic literature. Many prior studies rely on the dichotomy between Big 4 and non-Big 4 as an audit quality indicator. Recent work shows that audit quality of non-Big 4 audit firms is higher if they are affiliated with accounting associations (Bills, Cunningham, and Myers 2016; Bills, Hayne, and Stein 2018). Our findings suggest that audit quality can vary significantly within the non-Big 4 group depending on their

[2] In the U.S., an approximately half of the public company audits are performed by non-Big4 audit firms (GAO 2008). During our sample period in China, non-Big 4 audit firms audit about 90 percent of public listed companies.

human capital resources and the challenges they face with attracting and retaining talent. In fact, the findings line up with recent regulatory concerns about the growth of smaller audit firms. In a recent survey study carried out by the Financial Reporting Council (FRC) in the U.K., smaller accounting firms indicate that one of the causes limiting their ability to meet the demand for audit services is the difficulty of attracting and retaining suitably qualified audit personnel at all levels (FRC 2024). More broadly, the findings have implications for the concerning trend of shortage of accounting professionals which are particularly salient for small accounting firms (Ellis 2023; Bills, Hayne, and Stein 2024).

## 2. Institutional Background, Prior Literature, and Hypothesis Development

### *2.1 Big 4 Audit Firms in China*

Foreign audit firms first entered China by establishing representative offices. From 1981 to 1985, all the Big 4 audit firms established their Chinese representative offices. However, these tentative representative offices were only allowed to provide consultancy services for foreign investors but were prohibited from conducting a statutory audit (Wen and Sonnerfeldt 2022). In 1992, China decided to implement its economic reform broadly, allowing the Big 4 audit firms to establish joint-venture accounting firms with Chinese audit firms and conduct statutory audits. By 2012, all the Big 4 audit firms transformed their Chinese joint-venture accounting firms into member firms, indicating that the Big 4 audit firms finished their localization in China.

Over the past two decades, the Big 4 audit firms gradually established local offices in different cities in China in order to expand their operations and increase their presence in the Chinese audit market. In most cases, the Big 4 audit firms open local audit offices either to better serve large, important existing clients located in the city or to provide service to new IPO

clients.[3] Appendix A presents detailed information about the establishments of the Big 4 audit offices in China for the period 1992 – 2021, including the entry years, the entry cities, and the names of the Big 4 audit firms, which we manually collected from the Enterprise Check website.[4] As of 2021, the Big 4 audit firms have established 85 local offices in 27 cities across China.

Unlike audit markets in most developed countries where the Big 4 audit firms dominate audit services to public listed companies, the Chinese audit market is characterized by a lower market concentration of the Big 4 audit firms and more intensive competition among local non-Big 4 audit firms. According to Accounting Yearbook of China (2022), there are 8,870 audit firms and 97,563 CPAs in China as of the year 2021. Although the Big 4 audit firms are usually at the top of the CICPA's ranking of audit firms, [5] their market share in terms of the number of listed companies is only eight percent in the year 2021. In contrast, the ratio of public listed clients audited by the top 10 domestic non-Big 4 audit firms reached 68 percent in 2021. However, in terms of the market shares by audit fees, the Big 4 audit firms collectively took 23 percent of the market shares in 2021, whereas the top 10 domestic audit firms accounted for 59 percent of the market shares. These descriptive statistics suggest that although the Big 4 audit much fewer listed companies in China, they likely capture the largest clients in the market.

Despite the relatively low market shares in China, the Big 4 audit firm are perceived to be reputable employers in the eyes of junior accountants and auditors. In several news outlets, accounting graduates express their desire to join one of the Big 4 audit firms, given the better career opportunities. Some of them explicitly state that they treat working experience in the

[3] For example, PwC started providing audit services to Tsingtao Brewery Company Ltd. (stock ID 600600) in 2002 when it did not have a local office in Qingdao where the company is located. To better serve this large and important client, PwC established the first local audit office in Qingdao in 2006. EY established its first local office in Hangzhou in 2014 and it obtained two new IPO clients (stock ID 603556 and stock ID 600926) in 2016.
[4] The Enterprise Check website (https://www.qcc.com) is operated by Qichacha Tec Co., Ltd, a leading organization providing business information on Chinese companies.
[5] This ranking has been published every year by the CICPA since 2003. The ranking is based on a comprehensive score including several indicators of an audit firm, such as revenues, the number of CPAs, and sanctions in the recent three years.

Big 4 audit firms as steppingstones for greater career outlook (China Economic Weekly 2021).

### *2.2 Importance of Human Capital to Audit Quality*

Existing literature offers abundant evidence supporting the vital role of human capital in improving audit service quality. One stream of literature focuses on audit partners and finds that various partners' characteristics (e.g., gender, industry expertise) influence the quality of audit engagements that they lead (Gul, Wu, and Yang 2013; Knechel, Vanstraelen, and Zerni 2015; Lennox and Wu 2018). Recent studies move from partners to managers and rank-and-file employees in accounting firms, showing that audit team members below the lead partner also affect audit quality. For example, Aobdia, Choudhary, and Newberger (2024) suggest that mid-level managers could have a significant effect on the effectiveness of audit engagements; Hoopes, Merkley, Pacelli, and Schroeder (2018) provide evidence supporting the importance of audit personnel in audit engagements by showing a significant association between audit personnel salaries and audit quality.

Given the importance of human capital to audit quality, another emerging stream of literature starts to demonstrate the importance of the quality of human capital to accounting firms and in particular to local audit offices. For example, both Aobdia et al. (2018) and Frost et al. (2024) uncover foreign immigrants as an essential labor force in the local audit markets that has a significant positive effect on the audit quality. Beck et al. (2018) and Lee et al. (2022) show that the education level of the city in which the audit offices are located and the proximity of audit offices to feeder schools affect the quality and availability of human resources to the audit offices, which in turn influences audit quality. Relying on the CPA Mobility provisions in the U.S., Cascino, Tamayo, and Vetter (2021) reveal that the removal of occupational licensing barriers significantly increases the labor supply in the accounting professionals and reduces audit pricing without affecting audit quality.

### *2.3 Human Capital Challenge Faced by Non-Big 4 Small Audit Firms*

Despite the importance of human capital to audit quality, the audit profession has long been facing an issue of attracting and retaining talent (Johnson and Pike 2018). Knechel, Mao, Qi, and Zhuang (2021) focus on the phenomenon of auditor leaving the profession for corporate positions in China and find that such auditor departure is not uncommon and could lead to reduced audit quality. Van Linden, Vandenhaute, and Zimmerman (2022) investigate the collective audit firm employee turnover and find that it is negatively associated with audit quality.

While most audit firms face the human capital challenge, this issue is particularly salient for non-Big 4, small audit firms. In the U.S., the Big 4 audit firms hire the bulk of accounting graduates (Lee et al. 2022) and they implement innovative strategies to attract, develop, and retain employees. For example, one of the Big 4 accounting firms, Deloitte, has made substantial investments in developing the Deloitte University, an employee training facility, as a way to improve employee recruitment and retention efforts (Blann, Kleppe, and Moon 2023). Compared with the Big 4 audit firms, non-Big4 audit firms are often in a disadvantageous position in the labor market. A recent survey conducted by the FRC in the U.K. indeed reveals that small audit firms rank the challenge of attracting and retaining suitably qualified audit personnel as the most important cause of resource constraints (FRC 2024). The small audit firms also indicate that the difficulty in recruiting auditors, especially recently qualified staff and audit managers, limits their ability to grow.

Recent empirical studies provide evidence consistent with small audit firms being vulnerable to local labor market fluctuations. For example, Beck et al. (2018) find that the association between city-level education quality and audit office quality is more pronounced for non-Big 4 audit firms that are tied to local labor markets. Similarly, Cascino et al. (2021) show that the competitive effects of CPA mobility mainly accrue to small local audit firms, since the Big 4 audit firms can always circumvent the licensing barriers through their national

networks. Extending prior studies, we attempt to shed light on the competition for talent faced by the non-Big 4 audit offices when a powerful player, i.e., the Big 4 audit firm, enters the local audit markets.

### *2.4 Hypothesis Development*

While human capital is recognized as a critical basis for competitive advantage, such advantage is tenuous because it is costly to attract talent and they can leave (Coff 1997).[6] Competition for talent exists in almost all industries and it is particularly fierce in knowledge-intensive industries such as the audit industry. When a Big 4 audit firm enters a local audit market, it likely imposes a threat to local non-Big 4 audit firms in the local labor market of accounting professionals. The Big4 accounting firms are known for their reputation and greater resources. The newly established Big 4 office in the local market could be attractive to local accounting talent at all levels, given that having Big 4 experience could bring a variety of benefits to individual auditors. For instance, Frecka et al. (2022) reveal that individual auditors' salaries are positively related to their Big N experience. Zimmerman et al. (2021) show that non-Big 4 partners with Big4 experience are able to charge higher fees, indicating that Big 4 experience is valued by the audit market. Indeed, the Big4 audit firms are perceived by both accounting students and accounting professionals to be more prestigious, offer better training, and provide greater career outlook (Bagley, Dalton, and Ortegren 2012).

The Big 4 audit firms are likely to target the local labor market when they open a new local office. Based on a survey, Kirsh, Laird, and Evans (2000) show that the Big 4 audit firms consider the availability and skill of local workforce as one of most important factors when deciding whether to enter a new market. Evidence from Che, Hope, and Langli (2020) suggests that Big 4 audit firms are able to poach high-performing auditors from non-Big 4 audit firms.

[6] The competition for talent is prevalent in the global labor markets and an important area of research in labor economics. For example, prior research in economics demonstrates a significant trend of international migration from poor to rich countries, making human capital even scarcer in countries where it is already scarce.

We refer to the potential flow of local accounting talent to the newly established Big 4 offices as the "brain drain" effect experienced by local non-Big 4 audit offices. Since most non-Big 4 audit offices rely on the local labor market as a source for audit personnel, the Big 4's entry likely results in human capital constraints on them. Prior literature in organizational studies and human resources management shows that losing human capital and failing to attract talent can lead to increased recruiting and training costs and diminished service quality (e.g., Batt 2002; Hausknecht et al. 2009; Backes-Gellner and Tuor 2010). In line with this stream of literature, the "brain drain" effect experienced by the local non-Big 4 audit offices will negatively impact their audit service quality.

However, the above prediction is not without tension. Prior literature suggests that knowledge spillovers across companies operating in the same local markets are prevalent (e.g., Audretsch and Feldman 2004). The establishment of a new Big 4 office in a city could bring in the Big 4's advanced audit technology and high-standard audit practices to the local audit market, which can be possibly learnt by the local non-Big 4 audit offices. Moreover, prior work suggests that talent outflows are not entirely detrimental, since such outflows could force firms to refresh their talent pools with new expertise (McKendrick, Wade, and Jaffee 2009) and might potentially enhance the firms' appeal to future candidates in the labor market by signaling external mobility opportunities (Tan and Rider 2017). We refer to the potential knowledge spillovers from the Big 4's entry as the "brain gain" effect on the local non-Big 4 audit offices. Such "brain gain" effect likely leads to increased audit quality of the non-Big 4 audit offices.

Collectively, the above discussions suggest that it remains an empirical question on how the Big 4's entry into the local audit market affects the human capital of the local non-Big 4 audit offices and their audit quality. Hence, we develop two null hypotheses:

**Hypothesis 1:** *Audit quality of local non-Big 4 audit office does not change after the Big 4 audit firms enter the local audit markets.*

**Hypothesis 2:** *Human Capital of local non-Big 4 audit office does not change after the Big 4 audit firms enter the local audit markets.*

## 3. Test of H1: Non-Big 4 Audit Quality after Big 4 Entry

### *3.1 Research Design*

We employ the following DID design to test whether the audit quality of non-Big 4 audit offices is affected by the Big 4's entry into the local audit markets:

$$AQ_{i,t} = \alpha + \beta_1\, Big4\ Entry_{i,t} + Control_{i,t} + Firm\ FE + Year\ FE + Audit\ Firm\ FE + \epsilon_{i,t} \quad (1)$$

where *i* and *t* represent client company and year, respectively. The dependent variable, *AQ*, is an audit quality proxy, which is either *Restate* or *AbsDA*. *Restate* is an indicator variable that equals one when a client firm's financial statements are subsequently restated, and 0 otherwise. We exclude financial restatements resulting from tax-related issues, changes in accounting policies, corporate mergers, and other non-malicious factors, following Gul et al. (2013). *AbsDA* is the absolute value of discretionary accruals calculated following Kothari, Leone, and Wasley (2005). While *Restate* captures material financial reporting misstatements that violate Generally Accepted Accounting Principles (GAAP), *AbsDA* allows for the observation of earnings management that does not necessarily violate GAAP.

In our DID design, we designate non-Big 4 clients headquartered in cities where the Big 4 have entered as the treated clients and those headquartered in cities where the Big 4 never enter as the control clients. For each Big 4 entry event, we consider the three years before the entry as the pre-entry period and the three years after the entry as the post-entry period. In the above Equation (1), *Big4Entry* is an indicator variable that equals one for treated clients in the post-entry period. *Firm FE*, *Year FE*, and *Audit Firm FE* represent client, year, and audit firm fixed effects, respectively. With both client and year fixed effects, *Big4Entry* captures whether the difference in audit quality between treated clients and control clients in the pre-entry period

significantly changes in the post-entry period.[7]

We control several client- and city-level characteristics that could influence client companies' financial reporting quality. Specifically, at the client level, we add client company size (*FirmSize*), leverage ratio (*Lev*), operating cash flows (*OCF*), operating profits measured by return on assets (*ROA*) and whether it experiences an operating loss (*Loss*), and firm age (*FirmAge*). Since the client-auditor relationship could influence audit quality (Myers et al., 2003), we further control auditor tenure (*Tenure*) and client importance to the auditor (*Importance*). At the city level, we control city-level GDP (*LnGDP*), GDP growth rate (*GDPGr*), population of the city (*LnPopulation*), and population growth rate of the city (*PopulationGr*). All continuous variables are winzorsized at both top and bottom 1 percent. Detailed variable definitions are presented in Appendix B.

### *3.2 Sample and Data*

As shown in Appendix A, it is common that the Big 4 audit firms establish multiple offices in a city. To obtain clean inferences with respect to the impact of the Big 4 entry, we only consider the establishment of the first Big 4 office in each city. We exclude the Big 4's entry into Beijing and Shanghai which occurred in 1992 and 1993, because of a lack of observations in the pre-entry period. In addition, we do not include the Big 4's entry into Taiyuan and Nanchang in 2021 due to limited observations in the post-entry period. Our sample hence includes the openings of the first Big 4 audit offices across 23 cities in China.

To construct our regression sample, we first obtain 48,678 client-year observations of all publicly listed companies in China from 1998 to 2020. We begin our sample in 1998 because listed companies in China started providing cash flow information in that year.[8] We end the sample period in 2020 because this is the last year of the post-entry period for the last entry

[7] Our results remain unchanged if we include audit firm×client fixed effects.
[8] Our results remain unchanged if we start our sample in 1999 when China completed the audit firm disaffiliation program to separate audit firms from local governments or public universities.

event considered in our analysis. As illustrated before, we do not consider the Big 4's entries to Beijing and Shanghai. In order to construct clean treatment and control groups, we remove 8,251 observations from these two cities. We further delete 587 observations in the financial industry, and 2,095 observations under special treatment (ST) in the stock exchanges. Because our research question focuses on the impact of Big 4's entry on other local non-Big 4 audit offices, we delete 1,899 client-years audited by Big 4 audit firms. Following Baker et al. (2022), we further remove 12,803 clients located in treatment cities (i.e., cities with the Big 4 entry) but not in the testing window. We further remove 1,124 observations with missing control variables. The final regression sample consists of 21,919 client-year observations (2,531 unique client companies) audited by non-Big 4 audit offices. Panel A of Table 1 outlines the sample selection procedures.

Pandl B of Table 1 summarizes the descriptive statistics of the variables used in the regression of audit quality. Our key variable of interest, *Big4Entry* has a mean value of 0.088, suggesting that nine percent of the client-years in our sample are affected by Big 4's entry to the local audit markets. This is consistent with the fact that we only consider the first Big 4 audit offices established in 23 cities in China over the past two decades, resulting in a relatively small portion of non-Big 4 clients being affected by the Big 4's entries. In our sample, the mean value of *Restate* suggests that about 13.6 percent of the observations experienced financial restatements. Untabulated results show that while the average *Restate* of control clients reduces from 0.156 in the pre-entry period to 0.136 in the post-entry period, such ratio for treated clients increases from 0.114 in pre-entry period to 0.145 in the post-entry period. The change of the difference between the two groups is statistically significant (difference = 0.051, $p < 0.01$). Similarly, *AbsDA* of control clients decreases from 0.057 in the pre-entry period to 0.055 in the post-entry period, whereas *AbsDA* of treated clients increases from 0.056 to 0.063. The change of the difference across the two groups is statistically significant (difference = 0.009, $p < 0.01$).

### *3.3 Regression Results*

Table 2 reports the regression results of Equation (1). Column (1) shows that the coefficient of *Big4Entry* is positive and statistically significant for the analysis of *Restate* (coefficient = 0.039, $p < 0.05$), consistent with the non-Big 4 clients in cities with Big 4 entries experience an increased likelihood of financial reporting restatements, compared with other non-Big 4 clients located in cities not affected by the Big 4's entry. Column (2) shows that the coefficient of *Big4Entry* appears positive and statistically significant for the analysis of *AbsDA* (coefficient = 0.006, $p < 0.01$), consistent with an increase in absolute discretionary accruals for treated clients in the post-entry period relative to the control clients. These results suggest that the audit quality of non-Big4 clients in cities with Big 4 entries declines in the three-year period after the Big 4 audit firms establish the first local offices. Regarding the economic significance of the results, compared to the non-Big 4 clients not affected by the Big 4 entry, the likelihood of financial restatements for the non-Big 4 clients affected by the Big 4 entry increases by 28.68 percent in the post-entry period and their absolute value of discretionary accruals increases by 10.34 percent in the post-entry period. Overall, results in Table 2 indicate reduced audit quality of local non-Big 4 audit offices after the Big 4 audit firms establish local audit offices.

## *4. Test of H2: Non-Big 4 Audit Office Human Capital Losses after Big 4 Entry*

### *4.1 Research Design*

The decreased audit quality of non-Big 4 clients is consistent with the "brain drain" effect of the Big 4's entry into local audit markets on other non-Big 4 audit offices. To provide more direct evidence on the "brain drain" effect and test our second hypothesis, we examine whether the Big 4's entry affects the attractiveness of local non-Big 4 audit offices to the key skilled labor in the audit profession, i.e., the CPAs. Like Equation (1), we employ the following

DID design to test whether talent inflows to the non-Big 4 audit offices are affected after the Big 4 audit firms establish the first local audit office:

$$Talent_{j,t} = \alpha + \beta_1\ Big4\ Entry_{j,t} + Control_{j,t} +\ Audit\ Office\ FE + Year\ FE + \epsilon_{j,t} \quad (2)$$

where *j* and *t* represent audit office and year, respectively. The dependent variable *Talent* is the talent inflow of an audit office, which is measured by either the ratio of newly recruited CPAs to the total number CPAs in the beginning of the year (*NewCPARatio*) or the growth rate of CPAs (*CPAGrowth*) of a non-Big 4 audit office. We designate non-Big 4 audit offices in cities where the Big 4 have entered as the treated offices and those in cities where the Big 4 do not enter as the control offices. Similar to the analysis of audit quality, for each Big 4 entry event, we use the pre-three and post-three years around the Big 4 entry event as the testing window. In the above Equation (2), *Big4Entry* is a dummy variable that equals one for treated audit offices in the post-entry period. Audit Office FE and Year FE represent audit office and year fixed effects, respectively.

We control several audit firm- and city-level characteristics that could influence audit offices' talent inflows. Specifically, at the audit firm level, we control whether the audit firm has the license to audit public companies (*SecQualification*) and whether it is one of the top 10 domestic audit firms in China (*DomBig10*). At the city level, we control city-level GDP (*LnGDP*), GDP growth rate (*GDPGr*), population of the city (*LnPopulation*), and population growth rate of the city (*PopulationGr*). We also add the total market value of all listed firms (*LnCity_ListedFirms*) and the total value of IPOs in a city *(LnCity_IPOs*) to control the attractiveness of a city for business activities. We further control the total number of CPAs (*LnCity_CPANums*) in a city and the city-level CPA growth rate (*City_CPAGrowth*). All continuous variables are winzorsized at both top and bottom 1 percent. Detailed variable definitions are presented in Appendix B.

### *4.2 Sample and Data*

We initially obtained 100,863 non-Big 4 audit office-year observations for the period 2003–2020. We start the sample in 2003 because this is the earliest year when we can trace the individual CPA data from the annual inspection reports issued on the provincial CICPA websites. We first remove 596 observations of the Big 4 audit offices. Like earlier, we delete 14,764 observations related to audit offices located in Beijing, Shanghai, Taiyuan and Nanchang. Since we use the new CPAs to measure the talent inflows for local non-Big 4 audit offices, we exclude 11,066 first-year audit office-year observations in the sample because all auditors are regarded as new CPAs when their affiliated audit offices first appear in the data. Similar to our analysis of audit quality, to conduct the DID analysis, we delete 24,692 audit office-year observations that are affected by the Big 4' entries but are not in the testing window (i.e., three years before and three years after the Big 4 entry event). We further remove 4,434 observations with missing control variables. The final regression sample consists of 45,311 non-Big 4 audit office-years. Panel A of Table 3 outlines the sample selection procedures.

Panel B of Table 3 summarizes the descriptive statistics of the variables used in the analysis of human capital of non-Big 4 audit offices. Our key variable of interest, *Big4Entry* has a mean value of 0.073, suggesting that 7.3 percent of the non-Big 4 audit office-year observations in our sample are affected by Big 4's entry to the local audit markets.[9] The mean values of *NewCPARatio* and *CPAGrowth* are 10.5 percent and 2.3 percent, respectively. These descriptive statistics indicate that, on average, newly recruited CPAs account for 10 percent of the total number of CPAs in the non-Big 4 audit offices and the non-Big 4 audit offices experience about an annual increase of 2 percent in the number of CPAs.

### *4.3 Regression Results*

Panel A of Table 4 reports the regression results of Equation (2). Column (1) shows that

[9] The mean value of *Big4Entry* in the sample used to test Hypothesis 2 is slightly smaller than the ratio in the sample for the analysis of Hypothesis 1. This is mainly because the sample period for Hypothesis 2 is shorter than that used for testing Hypothesis 1, leading to the exclusion of a few Big 4 entry events to big cities in China.

the coefficient of *Big4Entry* is negative and statistically significant for the analysis of *NewCPARatio* (coefficient = -0.023, $p < 0.01$), consistent with the non-Big 4 audit offices affected by the Big 4 entry suffer from a loss of new CPAs. Similarly, Column (2) presents the result for the analysis of *CPAGrowth* (coefficient = -0.032, $p < 0.01$), which also shows that the coefficient of *Big4Entry* appears negative and statistically significant, suggesting an overall reduction in CPA growth ratio in the non-Big 4 audit offices that are affected by the Big 4 entry. These results are economically significant. Compared to audit offices not affected by the Big 4 entry, the ratio of newly recruited CPAs for local non-Big 4 audit offices in cities affected by the Big 4 entry decrease by 21.90 percent in the post-entry period and their overall growth rate of CPAs reduces by 139.13 percent in the post-entry period. Collectively, the results presented in Table 4 provide supporting evidence for the "brain drain" effect, that is, an increased competition for talent in the labor markets of accounting professionals after the Big 4's entry into the local audit market, which results in the human capital losses in the local non-Big 4 audit offices.[10]

### *4.4 Cross-Sectional Analysis based on Securities Business License*

Only audit firms that have the securities business license can engage in securities business including providing assurance services to listed companies. According to the regulations issued by the Minister of Finance in China (MOF), to obtain and maintain the license, the audit firms are required to retain a certain number of CPAs who are active in

[10] Anecdotal evidence also supports the brain drain effect of Big 4's entries on other local non-Big 4 audit offices. We obtained private data on accounting graduates' employments from a university in Wuhan that offers an accounting program with high reputation in China for the period from 2013 to 2021. Wuhan is the biggest city in central China. In 2005, EY established its first office in Wuhan. After that, PWC, DTT, and KPMG established their offices in Wuhan in 2014, 2015, and 2020, respectively. Because our data starts from 2013, we are unable to examine the effect of EY's entry to Wuhan. Nevertheless, we observe that, before PWC's entry to Wuhan, the non-Big 4 audit offices in Wuhan were able to recruit six new graduates in 2013 and 2014 (i.e., three recruits per year). In contrast, after PWC's entry in 2014, the non-Big 4 audit offices only recruited five new graduates from 2015 to 2021 (i.e., 0.7 recruits per year). The majority of the graduates, with the total of 39, were recruited by the Big 4 audit offices in Wuhan. The evidence suggests that Big 4's entry not only weakens local non-Big 4 offices' ability to attract and retain CPAs but also their ability to recruit high-quality accounting graduates to fill entry-level positions.

providing assurance services to securities.[11] Given the focus on securities business of the Big 4 audit firms, the competition for talent between the Big 4 and local non-Big 4 audit offices is expected to be most salient for the non-Big 4 audit firms with securities business license where the CPAs are the key human capital to deliver the services.

To empirically test this conjecture, we re-estimate Equation (2) with the interaction term between *Big4Entry* and *SecuQualitication,* where *SecuQualitication* is an indicator variable equal to one for audit firms having the securities business license, and zero otherwise. Consistent with our expectation, results in Panel B of Table 4 show that while *Big4Entry* is negative but insignificant, the interaction term *Big4Entry*×*SecuQualitication* is negative and statistically significant for both the analysis of *NewCPARatio* (coefficient = - 0.056, $p < 0.05$) and the analysis of *CPAGrowth* (coefficient = -0.084, $p < 0.01$). This result suggests that it is the non-Big 4 audit offices where CPAs are the most important human capital asset that suffer from a loss of CPAs when the Big 4 establish local audit offices. This finding is in line with our main argument for increased competition for talent after the Big 4's entry into the local audit markets.

### *4.4 Rule out Alternative Explanation of Increased Competition for Audit Clients*

The decreased audit quality of non-Big 4 audit offices in our main analysis could be attributable to an alternative explanation of intensified competitions for audit clients in the local audit market after the Big 4's entry. Prior studies document that geographic proximity could influence auditor selection (Francis et al., 2021). It is possible that the newly established Big 4 audit offices engage in competition for local clients with other local non-Big 4 audit offices in the local audit markets. We assess this alternative explanation in this subsection.

[11] Based on the "Notice of the Ministry of Finance and the China Securities Regulatory Commission on Issues Concerning Accounting Firms Engaging in the Relevant Securities and Futures Businesses" issued by the MOF in 2007 and updated in 2012, an audit firm with the securities business license should have at least 200 CPAs, of whom, at least 120 have CPA certificates and have been continuously practicing in the last five years. This regulation was abandoned in 2020.

First, from the theoretical perspective, it is not clear whether increased competition in local audit markets would increase or decrease audit quality, since the increased competition can expose auditors to greater pressure to curry favor to clients to retain the clients or enhance the auditors' reputation concerns and motivate them to provide high quality audits. Consistent with the non-directional theoretical predictions, empirical evidence is also mixed. For example, while Pan et al. (2023) show that competition among audit firms decreases audit quality because it fosters the acquiescence of audit firms to client pressure, Hallman, et al. (2022) document increased audit quality when incumbent auditors facing competition from other auditors in the biding process. Second, the Big 4 and non-Big 4 audit firms in China target different clienteles and are less likely to compete head-to-head in the local audit markets. The Big 4 clients are mainly large financial institutions and industrial companies that need to raise capital from international capital markets. Descriptive statistics show that in our sample period 1998 – 2020, the mean (median) size of the Big 4 clients is 6,366 (258) hundred million RMB, whereas the mean (median) size of the non-Big 4 clients is 81 (22) hundred million RMB.[12] As mentioned before, the Big 4 audit firms only take about 8 percent of the market share in terms of the number of clients, but they often capture the very large clients in the high end. In contrast, the non-Big 4 audit firms compete fiercely for medium- or small-size clients. Third, to provide more direct evidence, we trace clients switching from local non-Big 4 audit offices to newly entered Big 4 audit offices in the three-year period after the Big 4's entry into the local audit markets. During our sample period, we only identify 11 clients located in cities affected by the Big 4's entry changed their auditor from non-Big 4 to the Big 4 audit firms after the Big4 entry events. Panel A of Appendix C lists the details of the 11 audit firm switches. Furthermore, we conduct an additional DID analysis of auditor turnovers of the non-Big 4 clients before and

[12] An example is Hangzhou where the Big 4 audit firms established the first office in 2016. In the three years after the entry, the Big 4 audit office only audited three clients but with a median total asset of 413 hundred million RMB. In contrast, the other local non-Big 4 audit offices audited 101 clients with a median size of 41 hundred million RMB.

after the Big 4's entry, using the similar model specification of Equation (1). Panel B of Appendix C presents the regression results, showing that the Big 4's entry does not have a significant influence on the likelihood of auditor switches of the non-Big 4 clients.[13] Moreover, an untabulated analysis shows that our main result of decreased audit quality of the non-Big 4 clients after the Big 4's entry remains unchanged if we only keep clients audited by the non-Big 4 audit firms throughout the sample period. Collectively, from both theoretical and empirical perspectives, the decreased audit quality of non-Big 4 audit offices is unlikely to be attributable to the pressure to compete for local clients after the Big 4's entry into the local audit markets.

## *5.* Robustness Checks and Additional Analyses

### *5.1 Validate Parallel Trends Assumption*

We conduct a battery of tests to ensure the robustness of our results. We first validate the parallel trends assumption in the DID design. Specifically, we replace *Big4Entry* in Equations (1) and (2) with five indicator variables *Pre3*, *Pre2*, *Post1*, *Post2*, and *Post3*. *Pre3* and *Pre2* represent the third year and the second year before the Big 4 entry event, respectively; *Post1*, *Post2*, and *Post3* represent the first year, the second year, and the third year after the Big4 entry event, respectively.

Using the year immediately before the entry event as the benchmark, the regression results of non-Big 4 audit quality are tabulated in Panel A of Table 5. It shows that, for both the analyses of *Restate* and *AbsDA,* the coefficients of *Pre3* and *Pre2* are not statistically significant, whereas the coefficients of *Post1*, *Post2*, and *Post3* are positive and statistically significant.

[13] A switch may not happen if a non-Big 4 office lowers audit quality to retain a client that threatens to switch to other auditors that are more willing to compromise their independence (Chen, Peng, Xue, Yang, and Ye 2016; Lennox 2001). This opinion shopping scenario is unlikely in our setting because Big 4 firms, which are commonly believed to be more independent, are unlikely to accommodate more discretion in financial reporting than non-Big 4 firms, rendering the switching threat of non-Big 4 clients uncredible.

These results indicate that while the differences in audit quality between treated and control clients in the pre-entry period are not significant, such differences become significant after the Big 4's entry into the local audit markets. Panel B of Table 5 reports the results for the analysis of parallel trends assumption in relation to human capital losses in the non-Big 4 audit offices after the Big 4's entry. Similar to the results presented before, for both the tests of *NewCPARatio* and *CPAGrowth*, the coefficients of *Pre3* and *Pre2* are not statistically significant while the coefficients of *Post1*, *Post2*, and *Post3* are negative and statistically significant, except for *Post2* in the analysis of *NewCPARatio.* These results further confirm that the non-Big 4 audit offices affected by the Big 4's entry suffer from human capital losses relative to other non-Big 4 audit offices in the control group in the post-entry period. Taken together, the results in Table 5 provide evidence supporting the parallel trends assumption.

*5.2 Alternative Proxies of Audit Quality and Human Capital Losses/Demand*

We rely on alternative proxies to measure audit quality and human capital demand in non-Big 4 audit offices. For the analysis of audit quality, we employ accounting irregularity (*Irregularity*) which takes into consideration of both accounting restatements and regulatory sanctions due to accounting misconduct, small profit *(SmlBeat*) which equals one if a client's ROA is positive but less than 1 percent, and zero otherwise, and total accruals (*TA*) as alternative audit quality proxies and re-estimate Equation (1). Regression results are tabulated in Panels A Table 6. Our findings of reduced audit quality of the non-Big 4 audit clients in the post-entry period remain unchanged.

For the analysis of human capital losses/demand, we use the total number of CPAs of the non-Big4 audit offices (*TotalCPA*) as an alternative proxy. Furthermore, we collect job posting data of the non-Big 4 audit offices from the CnOpendata platform for the period 2014 – 2020. We are able to retrieve job posting information of 4,270 audit office-year observations. We create two variables to measure the entry requirements for new hires. One

variable, *DemandExp*, is an indicator variable equal to one if working experience is required in the job posting, and zero otherwise; another variable, *Welfare*, measures the number of additional benefits advertised in the job posts to new hires, such as additional medical insurance, leaves, etc. If the Big 4' entry is associated with human capital losses in the non-Big 4 audit offices, we expect the non-Big 4 audit offices to lower the entry requirements in their job advertisements (i.e., reduced requirement of working experience and providing more additional benefits).

Regression results are tabulated in Panels B of Table 6. We find that in the post-entry period, the non-Big 4 audit offices affected by the Big 4's entry have reduced total number of CPAs. Furthermore, the affected non-Big 4 audit offices are less likely to require working experience and are more likely to provide additional benefits to new hires in their job advertisements. These results are consistent with human capital losses (and thus increased human capital demand) in the non-Big 4 audit offices affected by the Big 4's entry.

*5.3 Matching between Treatment and Control Groups*

In our main analysis, we include all cities not affected by the Big 4 entry in the control group. However, the Big 4 audit firms are unlikely to randomly select cities to establish local audit offices. Indeed, the cities affected by the Big 4 entry are generally large ones in China. To make our treatment and control groups more comparable, we match each treated city with the Big 4 entry and control cities without the Big 4 entry on several dimensions. Specifically, we require the treated city and its control peers to be in the same quartile of GDP, GDP growth, population, and population growth. In addition, we limit the control peers to those that are in same political hierarchy but from different provinces. We replicate the regressions of *Restate* and *AbsDA* within the matched group and the results are shown in Panel A of Table 7. The coefficients of *Big4Entry* are consistently positive and significant at the conventional level, in line with those reported in Table 3. Furthermore, consistent with the results presented in Tabel

4, results reported in Panel B of Table 7 show that the coefficient of *Big4Entry* is negative and statistically significant for the analyses of *NewCPARatio* and *CPAGrowth* when the matched sample is used for the tests, confirming increased competition for talent after the Big 4' entry into the local audit markets and human capital losses in local non-Big 4 audit offices.

*5.4 Alternative Ways of Identifying Treated Clients*

In the main analysis, we consider clients audited by the local non-Big 4 audit offices in the city where the Big 4 audit firms enter as the treated clients. Non-Big 4 audit offices could have clients located in multiple cities. It is possible that the influence of the Big 4 entry extends to other non-Big 4 clients in the surrounding areas. We rely on the distance between the city of the clients and the city of the non-Big4 audit offices as an alternative way to identify treated clients. Specifically, we use non-Big 4 clients located in cities within 25, 50, 75, or 100 km of the cities with the Big 4 entry as our treated clients. Untabulated results show that our findings regarding decreased audit quality of non-Big4 clients remain unchanged.

Alternatively, some client companies located in cities affected by the Big 4's entries are audited by non-local non-Big 4 audit offices from cities without the Big 4's entry events. When we use the subsample of client companies located in cities with the Big 4 entry events but audited by non-local non-Big 4 audit offices as the treated group and conduct the DID design, we do not find their audit quality decreases. The result further supports our argument of reduced human capital of local non-Big 4 audit offices leading to the decreased audit quality of local clients.

Furthermore, the Big 4 entry events could be accompanied by a large local company's initial public offering (IPO). Indeed, one of the reasons that the Big 4 audit firms open new offices in a city is to better serve their IPO clients. The new IPO company could possibly intensify product market competition, which in turn affects other local clients and their financial reporting. To alleviate this concern, we remove treated client companies that are in

the same industry as the IPO clients and re-estimate our main regression of audit quality. Our results remain unchanged. Taken together, the additional analyses alleviate the concern that our results are mainly attributable to the changes in the local economic environment brought by the Big 4's entries.

*5.5 Placebo Tests*

To further address the concern on spurious correlations resulted from non-random treatment, we follow Bertrand, Duflo, and Mullainathan (2004) and perform a placebo test in which we randomly assign cities as being affected by the Big 4 entry and designate non-Big 4 clients located in these cities as having pseudo-Big 4 entry events. We then re-estimate Equations (1) and (2) on pseudo *Big4Entry*. We repeat the regression 1000 times with randomly assigned cities of the Big 4 entry events and record the coefficient values of the pseudo *Big4Entry*. Table 7 presents the results of our placebo tests. Panel A of Table 8 shows that the documented coefficients of *Big4Entry* in the main analyses of *Restate* and *AbsDA* are 0.039 and 0.006, respectively, which are above the 90 percentiles of all coefficients of pseudo *Big4Entry*. Similarly, Panel B of Table 8 shows that the documented coefficients of *Big4Entry* in the main analyses of *NewCPARatio* and *CPAGrowth* are -0.023 and -0.032, respectively, which both fall in the range below the 90 percentiles of pseudo *Big4Entry*. The results of the placebo tests suggest that our results are unlikely to be attributable to unobserved spurious correlations.

*5.6 Other Robustness Checks*

We also perform several other analyses to ensure the robustness of our results. First, instead of using the testing window of three years before and after the Big 4 entry events, we specify an alternative testing window of either one year or five years before and after the Big 4's entry. Table 9 reports the results, showing that our findings remain unchanged. Second, there might be a concern that financial statements issued in the year of the Big 4's entry but

before the Big 4 office establishment date could also be affected by the Big 4 entry event. To mitigate this concern, we remove the year of the Big 4 entry from the analysis. Untabulated results confirm that we obtain similar results to our main findings with this alterative sample construction.

Third, for the analysis of competition for talent, the number of CICPA's annual check reports is limited in the early years of our sample. To ensure that our result in relation to the human capital losses in the non-Big 4 audit offices is not due to extreme cases in early years, we drop observations before 2006 when the CICPA's check reports were from less than 10 provinces. Untabulated results show that our findings of a decreased new CPA ratio and an overall reduction in the CPA growth ratio in the non-Big 4 audit offices after the Big 4's entry remain unchanged within this restricted sample.

## 6. Conclusion

We study the impact of the Big 4's entry into local audit markets on local non-Big 4 audit offices. Our findings suggest that audit quality of the local non-Big 4 audit offices decreases after the Big 4 audit firms establish their local offices. The reduced audit quality is mainly due to increased competition for talent in the local labor market of accounting professionals rather than head-to-head competition for local audit clients between the Big 4 and the non-Big 4 audit offices. Specifically, the local non-Big 4 audit offices experience losses of critical human capital, i.e., the CPAs, after the Big 4 audit firms establish local audit offices. The findings are consistent with recent surveys in which the non-Big 4, small audit firms claim that they suffer difficulties in employing and retaining talent (FRC 2024). While human capital is the most important asset to audit firms, research on factors that could influence human resources in local audit offices, in particular the non-Big 4 audit offices, is limited. Our findings shed new light on the competition for talent in the local labor markets of audit professionals and its impact on

the audit service quality of the non-Big 4 audit offices which are often in a disadvantageous position relative to the Big 4 audit offices in attracting local talent. These findings have broad implications for the audit profession and the development of local audit markets.

Although the study relies on Chinese data, findings in this study are potentially applicable to other countries, given the prevalence of co-existence of the Big 4 and local non-Big 4 audit offices in audit markets. However, like all other studies using Chinese data, it is worth noting that the Chinese audit market has unique institutional characteristics, such as a relatively small number of listed clients audited by the Big 4 audit firms and intensive competition among non-Big 4 audit firms, which might affect the generalizability of the findings. In addition, our findings of increased competition for talent after the Big 4's entry into the local audit markets and reduced audit quality of other local non-Big 4 audit offices indicate that there are costs to local non-Big 4 audit office with the Big 4's entry. However, the Big 4's entry into the local audit markets could bring other benefits to the local companies and economy at large. For example, the expertise and reputation of the Big 4 audit firms might help local companies prepare for initial public offerings and cross-listing in foreign stock exchanges. In addition, the establishment of Big 4 audit offices in a city might ultimately attract more accounting talent to the local markets. Exploring the potential benefits of the Big 4's entry into the local markets is a promising avenue for future research.

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## Appendix A: Establishments of Local Big 4 Audit Offices in China

| Entry City | 1st office | 2nd office | 3rd office | 4th office |
|---|---|---|---|---|
| Beijing | 1992 (KPMG) | 1992 (EY) | 1998 (DTT) | 2003 (PWC) |
| Shanghai | 1993 (DTT) | 1993 (PWC) | 1998 (EY) | 1999 (KPMG) |
| Guangzhou | 2000 (DTT) | 2001 (PWC) | 2002 (KPMG) | 2006 (EY) |
| Shenzhen | 2001 (PWC) | 2002 (DTT) | 2006 (EY) | 2007 (KPMG) |
| Dalian | 2002 (PWC) | 2002 (DTT) | 2006 (EY) | |
| Chongqing | 2002 (PWC) | 2014 (DTT) | 2019 (EY) | 2021 (KPMG) |
| Nanjing | 2002 (DTT) | 2014 (PWC) | 2014 (EY) | 2015 (KPMG) |
| Tianjin | 2002 (PWC) | 2002 (DTT) | 2014 (EY) | 2015 (KPMG) |
| Suzhou | 2005 (PWC) | 2006 (EY) | 2015 (DTT) | 2020 (KPMG) |
| Wuhan | 2005 (EY) | 2014 (PWC) | 2015 (DTT) | 2020 (KPMG) |
| Qingdao | 2006 (PWC) | 2014 (EY) | 2014 (KPMG) | |
| Xi'an | 2006 (PWC) | 2015 (EY) | 2018 (KPMG) | |
| Chengdu | 2007 (EY) | 2014 (PWC) | 2014 (KPMG) | 2016 (DTT) |
| Xiamen | 2014 (KPMG) | 2015 (PWC) | 2015 (DTT) | 2016 (EY) |
| Hangzhou | 2014 (EY) | 2014 (PWC) | 2015 (KPMG) | 2016 (DTT) |
| Changsha | 2015 (EY) | 2016 (PWC) | 2021 (KPMG) | |
| Ji'nan | 2015 (DTT) | 2016 (PWC) | 2020 (EY) | 2021 (KPMG) |
| Foshan | 2015 (KPMG) | | | |
| Ningbo | 2015 (PWC) | 2020 (KPMG) | 2021 (EY) | |
| Shenyang | 2015 (KPMG) | 2016 (PWC) | 2017 (EY) | |
| Zhengzhou | 2016 (EY) | 2017 (PWC) | 2021 (KPMG) | |
| Hefei | 2017 (PWC) | 2019 (DTT) | 2020 (KPMG) | 2021 (EY) |
| Kunming | 2017 (PWC) | 2019 (EY) | | |
| Haikou | 2018 (PWC) | 2018 (EY) | | |
| Guiyang | 2018 (PWC) | | | |
| Taiyuan | 2021 (EY) | | | |
| Nanchang | 2021 (DTT) | | | |

Notes: This table presents the cities in China where Big 4 audit firms established local offices from 1992 to 2021. Column (1) lists the city names and column (2) shows the years when the Big 4 audit firms opened the first local office in the cities and the names of the Big 4 audit firms. Columns (3) to (5) show the years and audit firm names when the second, third, and fourth offices were established. EY is Ernst & Young LLP, DTT is Deloitte LLP, KPMG is KPMG LLP, and PwC is PricewaterhouseCoopers LLP.

## Appendix B: Variable Definitions

| Variable | Definition |
|---|---|
| *Restate* | An indicator variable equals 1 if a client firm's financial statements are subsequently restated, and 0 otherwise. |
| *AbsDA* | Absolute abnormal discretionary accruals calculated based on Kothari et al. (2005). |
| *NewCPARatio* | The ratio of new auditors with CPA certification. New auditors are auditors that first appear in an audit office. |
| *CPAGrowth* | The growth of auditors with CPA certification. |
| *Irregularity* | An indicator variable equals 1 if a client firm's financial statements are subsequently restated and/or a client firm is sanctioned for financial misconduct, and 0 otherwise. |
| *TA* | Absolute value of total accruals deflated by beginning assets. Total accruals are defined as net income minus net cash flow from operations. |
| *SmlBeat* | An indicator variable equals 1 if the year-on-year change in ROA is positive and less than 1%, and 0 otherwise. |
| *TotalCPA* | The total number of auditors with CPA certification in an audit office. |
| *AuditfirmTurnover* | Dummy variable equals 1 if there is an audit firm turnover, and 0 otherwise. |
| *Big4Entry* | The dummy variable equals 1 if financial statements are post-three issuance of the Big4 entry, and 0 if financial statements are pre-three issuance of the Big4 entry (financial statements issued in the current year of the Big4 entry are regarded as pre-one issuance). For observations in cities without Big4 entry in the sample period, this dummy variable equals 0 all the time. |
| *FirmSize* | Natural logarithm of total assets of a firm. |
| *Lev* | The ratio of total liabilities to total assets of a firm. |
| *ROA* | The ratio of net income to total assets of a firm. |
| *FirmAge* | Natural logarithm of difference between the current fiscal year and the founding year of a firm. |
| *Importance* | Assets of a firm divided by the total assets of listed firms audited by an audit firm in a city. |
| *Loss* | The dummy variable equals 1 if the net income of a firm is negative, and 0 otherwise. |
| *OCF* | Net cash flow from operation divided by total assets of a firm. |
| *Tenure* | Natural logarithm of the tenure of the audit firm and client relationship. |
| *SecuQualification* | The dummy variable equals 1 if an audit firm is qualified for security business, and 0 otherwise. The security qualification information of audit firms is from the "Accounting Year Book of China". |
| *DomBig10* | The dummy variable equals 1 if the audit firm is a domestic audit firm and at the top 10 of CICPA's rank, and 0 otherwise. |
| *LnCity_ListedFirms* | Natural logarithm of the total market value of listed firms in a city. |

| | |
|---|---|
| *LnCity_IPOs* | Natural logarithm of the total net amount of funds raised from IPOs in a city. |
| *LnCity_CPANums* | Natural logarithm of the number of CPAs in a city. |
| *City_CPAGrowth* | Growth of the number of CPAs in a city. |
| *LnGDP* | Natural logarithm of GDP of a city. |
| *GDPGrowth* | Growth of GDP of a city. |
| *LnPopulation* | Natural logarithm of the population of a city. |
| *PopulationGrowth* | Growth of the population of a city. |

## Appendix C: Rule out Alternative Explanation of Competition for Audit Clients

**Panel A: Clients Switching from Non-Big4 to Big 4 Audit Offices after the Big 4's Entry**

| Entry Big 4 | Entry Year | City | Stock Code | Switch Year | Previous Audit Firm |
|---|---|---|---|---|---|
| PWC | 2001 | Shenzhen | 000022 | 2001 | Zhongtianqin |
| PWC | 2001 | Shenzhen | 000026 | 2001 | Zhongtianqin |
| DTT | 2002 | Shenzhen | 000024 | 2001 | Zhongtianqin |
| DTT | 2002 | Shenzhen | 000033 | 2001 | Zhongtianqin |
| DTT | 2002 | Shenzhen | 000066 | 2001 | Zhongtianqin |
| PWC | 2002 | Tianjin | 600751 | 2003 | Beijing Jingdu |
| PWC | 2006 | Xi'an | 600707 | 2006 | Wulianfangyuan |
| DTT | 2016 | Hangzhou | 002415 | 2016 | Pan-China |
| EY | 2016 | Zhengzhou | 001896 | 2017 | Ruihua |
| EY | 2016 | Zhengzhou | 002132 | 2017 | Ruihua |
| PWC | 2017 | Kunming | 000807 | 2019 | Ruihua |

**Panel B: Regression Analysis of Overall Audit Firm Turnovers**

| | (1)<br>AuditfirmTurnover |
|---|---|
| *Big4Entry* | -0.012 |
| | (-1.005) |
| Controls | Yes |
| Firm FE | Yes |
| AuditFirm FE | Yes |
| Year FE | Yes |
| N | 21563 |
| Adj. $R^2$ | 0.648 |

Notes: This table shows the results for the analyses aimed at ruling out the alternative explanation of increased competition for clients after the Big 4's entry into local audit markets. Panel A presents information about clients switching from the local non-Big4 audit office to the newly entered Big 4 audit office within three years of the Big 4's first entry. Panel B shows the results of a regression analysis of overall audit firm turnovers, with a similar difference-in-differences design to Equation (1). All variables are defined in Appendix B. T-statistics are reported in parentheses using robust standard errors double clustered by client firm and year. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

**Table 1: Test of Hypothesis 1 - Sample Selection and Descriptive Statistics**

**Panel A: Sample Selection**

| No. | Sample Composition | Unique Clients | Observations (Client-Years) |
|---|---|---|---|
| (1) | Chinese listed firms from 1998 to 2020 | 4,388 | 48,678 |
| (2) | Drop firms in Beijing, Shanghai | (718) | (8,251) |
| (3) | Drop firms from the financial industry | (59) | (587) |
| (4) | Drop firms that are in the ST or PT situation | (14) | (2,095) |
| (5) | Drop firms that are audited by Big 4 audit firms | (95) | (1,899) |
| (6) | Drop firms in treatment cities that are not in testing window | (923) | (12,803) |
| (7) | Drop firms with missing variables | (48) | (1,124) |
| (8) | Final observations | 2,531 | 21,919 |

**Panel B: Descriptive Statistics**

| VarName | Obs | Mean | Median | SD | Min | Max |
|---|---|---|---|---|---|---|
| *Restate* | 21,919 | 0.136 | 0.000 | 0.343 | 0.000 | 1.000 |
| *AbsDA* | 21,919 | 0.058 | 0.040 | 0.062 | 0.001 | 0.372 |
| *Big4Entry* | 21,919 | 0.088 | 0.000 | 0.284 | 0.000 | 1.000 |
| *FirmSize* | 21,919 | 21.708 | 21.586 | 1.143 | 19.452 | 24.907 |
| *Lev* | 21,919 | 0.431 | 0.424 | 0.201 | 0.057 | 0.912 |
| *ROA* | 21,919 | 0.034 | 0.036 | 0.064 | -0.274 | 0.193 |
| *OCF* | 21,919 | 0.048 | 0.046 | 0.072 | -0.170 | 0.256 |
| *FirmAge* | 21,919 | 2.564 | 2.639 | 0.539 | 0.693 | 3.401 |
| *Loss* | 21,919 | 0.107 | 0.000 | 0.309 | 0.000 | 1.000 |
| *Tenure* | 21,919 | 1.178 | 1.099 | 0.796 | 0.000 | 2.833 |
| *Importance* | 21,919 | 0.546 | 0.525 | 0.414 | 0.004 | 1.000 |
| *LnGDP* | 21,919 | 26.029 | 26.183 | 1.070 | 23.116 | 27.765 |
| *GDPGrowth* | 21,919 | 0.108 | 0.101 | 0.074 | -0.146 | 0.340 |
| *LnPopulation* | 21,919 | 15.265 | 15.368 | 0.618 | 13.236 | 16.297 |
| *PopulationGrowth* | 21,919 | 0.009 | 0.006 | 0.015 | -0.029 | 0.082 |

Notes: Panel A of this table presents sample construction procedure for testing audit quality of non-Big 4 audit offices (Hypothesis 1). Panel B of this table presents descriptive statistics of variables used in the regression analysis. All variables are defined in Appendix B.

**Table 2: Test of Hypothesis 1 – Regression Results**

| | (1)<br>*Restate* | (2)<br>*AbsDA* |
|---|---|---|
| *Big4Entry* | 0.039** | 0.006*** |
| | (2.728) | (2.819) |
| *FirmSize* | 0.001 | -0.001 |
| | (0.176) | (-1.057) |
| *Lev* | 0.092*** | 0.029*** |
| | (3.567) | (4.209) |
| *ROA* | -0.042 | 0.100*** |
| | (-0.629) | (3.249) |
| *OCF* | -0.055 | -0.069*** |
| | (-1.033) | (-4.195) |
| *FirmAge* | 0.005 | -0.010** |
| | (0.218) | (-2.326) |
| *Loss* | 0.025** | 0.009*** |
| | (2.159) | (4.034) |
| *Tenure* | 0.003 | -0.006*** |
| | (0.572) | (-4.487) |
| *Importance* | 0.009 | 0.001 |
| | (0.785) | (0.367) |
| *LnGDP* | -0.024 | 0.004 |
| | (-1.328) | (1.202) |
| *GDPGrowth* | -0.033 | -0.004 |
| | (-0.812) | (-0.524) |
| *LnPopulation* | 0.013 | -0.007 |
| | (0.359) | (-1.027) |
| *PopulationGrowth* | -0.177 | 0.001 |
| | (-0.639) | (0.019) |
| Firm FE | Yes | Yes |
| Audit Firm FE | Yes | Yes |
| Year FE | Yes | Yes |
| N | 21,638 | 21,638 |
| Adj. $R^2$ | 0.078 | 0.127 |

Note: This table presents the results for the analysis of non-Big4 audit quality after the Big 4's entry into local audit markets. Panel A presents the results for univariate analysis. Panel B reports the regression results. Column (1) reports the results when audit quality is measured by financial statements restatements (*Restate*), and Column (2) reports the results when audit quality is measured by absolute value of discretionary accruals (*AbsDA*). The sample size is slightly smaller than the one presented in Table 1 due to fixed effects. T-statistics are reported in parentheses using robust standard errors double clustered by client firm and year. All variables are defined in Appendix B. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

**Table 3: Test of Hypothesis 2 - Sample Selection and Descriptive Statistics**

**Panel A: Sample Selection**

| No. | Sample Composition | Unique Audit offices | Observations (Audit Office-Year) |
|---|---|---|---|
| (1) | Audit offices in China from 2003 to 2020 | 12,908 | 100,863 |
| (2) | Drop Big4 audit offices | (80) | (596) |
| (3) | Drop audit offices in Beijing, Shanghai | (1,395) | (12,038) |
| (4) | Drop audit offices in their first years of the sample | (1,369) | (11,434) |
| (5) | Drop audit offices in treatment cities that are not testing window | (2,832) | (24,690) |
| (6) | Drop audit offices with missing variables | (358) | (4,849) |
| (7) | Final observations | 6,874 | 47,256 |

**Panel B: Descriptive Statistics**

| Variable Name | Obs | Mean | SD | Min | P25 | Median | P75 | Max |
|---|---|---|---|---|---|---|---|---|
| *NewCPARatio* | 47,256 | 0.105 | 0.206 | 0.000 | 0.000 | 0.000 | 0.143 | 1.200 |
| *CPAGrowth* | 47,256 | 0.023 | 0.254 | -0.600 | -0.067 | 0.000 | 0.059 | 1.250 |
| *Big4Entry* | 47,256 | 0.070 | 0.255 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 |
| *SecuQualification* | 47,256 | 0.060 | 0.237 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 |
| *DomBig10* | 47,256 | 0.023 | 0.149 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 |
| *LnCity_ListedFirms* | 47,256 | 4.237 | 1.941 | 0.000 | 3.051 | 4.573 | 5.699 | 8.492 |
| *LnCity_IPOs* | 47,256 | 0.171 | 0.368 | 0.000 | 0.000 | 0.000 | 0.179 | 1.935 |
| *LnCity_CPANums* | 47,256 | 5.586 | 1.311 | 2.565 | 4.673 | 5.389 | 6.717 | 7.964 |
| *City_CPAGrowth* | 47,256 | 0.000 | 0.096 | -0.362 | -0.027 | 0.013 | 0.051 | 0.214 |
| *LnGDP* | 47,256 | 26.227 | 0.856 | 23.951 | 25.621 | 26.329 | 26.941 | 27.645 |
| *GDPGrowth* | 47,256 | 0.090 | 0.077 | -0.198 | 0.052 | 0.090 | 0.128 | 0.282 |
| *LnPopulation* | 47,256 | 15.349 | 0.580 | 13.788 | 14.989 | 15.438 | 15.819 | 16.296 |
| *PopulationGrowth* | 47,256 | 0.005 | 0.020 | -0.136 | -0.000 | 0.005 | 0.011 | 0.071 |

Notes: Panel A of this table presents sample construction procedure for testing human capital losses of non-Big4 audit offices (Hypothesis 2). Panel B of this table presents descriptive statistics of variables used in the regression analysis. All variables are defined in Appendix B.

**Table 4: Test of Hypothesis 2 – Regression Results**

**Panel A: Main Regression Results**

| | (1) *NewCPARatio* | (2) *CPAGrowth* |
|---|---|---|
| *Big4Entry* | -0.023*** | -0.031*** |
| | (-2.999) | (-4.334) |
| *SecuQualification* | 0.004 | 0.025 |
| | (0.282) | (0.579) |
| *DomBig10* | 0.020 | 0.056 |
| | (0.897) | (1.657) |
| *LnCity_ListedFirms* | 0.003 | 0.001 |
| | (1.165) | (0.273) |
| *LnCity_IPOs* | -0.000 | 0.002 |
| | (-0.178) | (0.337) |
| *LnCity_CPANums* | -0.043*** | -0.041 |
| | (-3.834) | (-1.386) |
| *City_CPAGrowth* | 0.211*** | 0.681*** |
| | (9.431) | (11.391) |
| *LnGDP* | -0.010 | 0.007 |
| | (-0.566) | (0.862) |
| *GDPGrowth* | 0.002 | 0.007 |
| | (0.071) | (0.314) |
| *LnPopulation* | 0.035 | -0.036 |
| | (0.498) | (-0.777) |
| *PopulationGrowth* | 0.085 | 0.065 |
| | (0.806) | (0.674) |
| Audit Office FE | Yes | Yes |
| Year FE | Yes | Yes |
| N | 46,601 | 46,601 |
| Adj. $R^2$ | 0.148 | 0.092 |

**Panel B: Cross-Sectional Analysis based on Securities Business License**

| | (1) | (2) |
|---|---|---|
| | *NewCPARatio* | *CPAGrowth* |
| *Big4Entry*SecuQualification* | -0.056** | -0.084*** |
| | (-2.124) | (-3.520) |
| *Big4Entry* | -0.017* | -0.022** |
| | (-2.015) | (-2.407) |
| *SecuQualification* | 0.005 | 0.028 |
| | (0.355) | (0.656) |
| *DomBig10* | 0.021 | 0.054 |
| | (0.894) | (1.605) |
| *LnCity_ListedFirms* | 0.002 | 0.001 |
| | (0.712) | (0.234) |
| *LnCity_IPOs* | 0.000 | 0.002 |
| | (0.013) | (0.332) |
| *LnCity_CPANums* | -0.045*** | -0.042 |
| | (-4.155) | (-1.394) |
| *City_CPAGrowth* | 0.207*** | 0.681*** |
| | (9.439) | (11.343) |
| *LnGDP* | -0.009 | 0.008 |
| | (-0.488) | (0.899) |
| *GDPGrowth* | -0.000 | 0.006 |
| | (-0.010) | (0.290) |
| *LnPopulation* | 0.039 | -0.035 |
| | (0.544) | (-0.745) |
| *PopulationGrowth* | 0.086 | 0.061 |
| | (0.808) | (0.618) |
| AuditOffice FE | Yes | Yes |
| Year FE | Yes | Yes |
| N | 46,601 | 46,601 |
| Adj. $R^2$ | 0.148 | 0.092 |

Note: This table presents the results for the analysis of human capital losses in non-Big4 audit offices after the Big 4's entry into local audit markets. Panel A presents the main regression results. Column (1) reports the result when human capital loss is measured by the new CPA ratio (*NewCPARatio*), and Column (2) reports the results when human capital loss is measured by total CPA growth (*CPAGrowth*). Panel B reports the cross-sectional analysis based on whether a non-Big4 audit firm has the securities business license (*SecuQualification*). T-statistics are reported in parentheses using robust standard errors double clustered by audit office and year. All variables are defined in Appendix B. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

**Table 5: Tests of Parallel Trends Assumption**

**Panel A: Parallel Trends Assumption for Analysis of Audit Quality**

| | (1) | (2) |
|---|---|---|
| | *Restate* | *AbsDA* |
| *Pre3* | 0.004 | 0.001 |
| | (0.153) | (0.475) |
| *Pre2* | -0.001 | 0.003 |
| | (-0.075) | (0.875) |
| *Post1* | 0.044** | 0.007* |
| | (2.088) | (2.042) |
| *Post2* | 0.040* | 0.007* |
| | (1.928) | (1.938) |
| *Post3* | 0.034* | 0.009** |
| | (1.857) | (2.756) |
| Controls | Yes | Yes |
| Firm FE | Yes | Yes |
| AuditFirm FE | Yes | Yes |
| Year FE | Yes | Yes |
| N | 21,638 | 21,638 |
| Adj. $R^2$ | 0.078 | 0.127 |

**Panel B: Parallel Trends Assumption for Analysis of Human Capital Losses**

| | (1) | (2) |
|---|---|---|
| | *NewCPARatio* | *CPAGrowth* |
| *Pre3* | 0.007 | 0.022 |
| | (0.635) | (1.191) |
| *Pre2* | -0.000 | -0.009 |
| | (-0.015) | (-0.424) |
| *Post1* | -0.020* | -0.024* |
| | (-1.852) | (-1.831) |
| *Post2* | -0.016 | -0.031** |
| | (-0.965) | (-2.148) |
| *Post3* | -0.027** | -0.030* |
| | (-2.317) | (-1.979) |
| Controls | Yes | Yes |
| AuditOffice FE | Yes | Yes |
| Year FE | Yes | Yes |
| N | 46,601 | 46,601 |
| Adj. $R^2$ | 0.148 | 0.092 |

Notes: Panel A of this table presents the results of the parallel trend assumption test for the analysis of audit quality. Panel B of this table presents the results of the parallel trend assumption test for the analysis of human capital losses. *Pre3* and *Pre2* are indicator variables which equal 1 for observations three years and two years before the Big 4 entry, respectively, and 0 otherwise. *Post3*, *Post2*, and *Post1* are indicator variables which equal 1 for observations three years, two years, and one year after the Big 4 entry, respectively, and 0 otherwise. T-statistics are reported in parentheses using robust standard errors double clustered by client firm and year for the analysis of audit quality and by audit office and year for the analysis of human capital losses. Other variables are defined in Appendix B. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

**Table 6: Alternative Measures of Audit Quality and Human Capital**

**Panel A: Alternative Measures of Audit Quality**

| | (1) *Irregularity* | (2) *SmlBeat* | (3) *TA* |
|---|---|---|---|
| *Big4Entry* | 0.039** | 0.026* | 0.005** |
| | (2.346) | (1.822) | (2.527) |
| Control | Yes | Yes | Yes |
| Firm FE | Yes | Yes | Yes |
| Audit Firm FE | Yes | Yes | Yes |
| Audit Office FE | No | No | No |
| Year FE | Yes | Yes | Yes |
| N | 22,066 | 22,066 | 21,884 |
| Adj. $R^2$ | 0.131 | 0.049 | 0.178 |

**Panel B: Alternative Measures of Human Capital**

| | (1) *TotalCPAs* | (2) *DemandExp* | (3) *Welfare* |
|---|---|---|---|
| Big4Entry | -0.035*** | -0.117* | 0.807* |
| | (-3.612) | (-2.099) | (2.180) |
| Control | Yes | Yes | Yes |
| Audit Office FE | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes |
| N | 47,044 | 4,037 | 4,037 |
| Adj. $R^2$ | - | 0.049 | 0.178 |

Notes: This table presents the results using alternative measures of audit quality and human capital losses/demand of non-Big 4 audit offices. Panel A presents the results for the analysis of audit quality, and Panel B presents the results for the analysis of human capital losses. T-statistics (z-statistics) are reported in parentheses using robust standard errors double clustered by firm and year. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively

## Table 7: Matching Between Treatment and Control Cities

### Panel A: Analysis of Audit Quality

| | (1) *Restate* | (2) *AbsDA* |
|---|---|---|
| *Big4Entry* | 0.102*** | 0.007* |
| | (4.066) | (1.935) |
| Controls | Yes | Yes |
| Firm FE | Yes | Yes |
| Audit Firm FE | Yes | Yes |
| Year FE | Yes | Yes |
| N | 3,732 | 3,732 |
| Adj. $R^2$ | 0.089 | 0.150 |

### Panel B: Analysis of Human Capital Losses

| | (1) *NewCPARatio* | (2) *CPAGrowth* |
|---|---|---|
| *Big4Entry* | -0.032*** | -0.038*** |
| | (-3.704) | (-4.022) |
| Controls | Yes | Yes |
| Audit Office FE | Yes | Yes |
| Year FE | Yes | Yes |
| N | 9,637 | 9,637 |
| Adj. $R^2$ | 0.157 | 0.094 |

Notes: This table presents the results using matched samples between treatment and control cities. Panel A presents the results for the analysis of audit quality, and Panel B presents the results for the analysis of human capital losses. For each treatment city in the sample which is affected by the Big 4's entry, we search for its similar peer cities in the same quartile of GDP, GDP growth, population, and population growth. We also require the cities in the control group to be in the same political hierarchy and from different provinces. Matchin is conducted on a yearly basis. T-statistics are reported in parentheses using robust standard errors double clustered by firm and year. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

**Table 8: Placebo Tests**

**Panel A: Analysis of Audit Quality**

| VarName | Obs | Mean | SD | P10 | P25 | Median | P75 | P90 | Documented effects |
|---|---|---|---|---|---|---|---|---|---|
| *Restate* | 1000 | -0.001 | 0.033 | -0.045 | -0.020 | -0.001 | 0.021 | 0.040 | 0.039 |
| *AbsDA* | 1000 | -0.001 | 0.006 | -0.008 | -0.004 | -0.001 | 0.003 | 0.006 | 0.006 |

**Panel B: Analysis of Human Capital Losses**

| VarName | Obs | Mean | SD | P10 | P25 | Median | P75 | P90 | Documented effects |
|---|---|---|---|---|---|---|---|---|---|
| *NewCPARatio* | 1000 | -0.007 | 0.026 | -0.028 | -0.017 | -0.006 | 0.004 | 0.015 | -0.023 |
| *CPAGrowth* | 1000 | -0.008 | 0.028 | -0.043 | -0.026 | -0.009 | 0.007 | 0.026 | -0.032 |

Notes: This table shows the results of the placebo tests by randomizing cities that are affected by the Big 4 entry. We regress the pseudo *Big4Entry* variable and other confounding factors on each dependent variable 1,000 times. Panel A presents the results for the analysis of audit quality, and Panel B presents the results for the analysis of human capital losses.

**Table 9: Alternative Testing Windows**

| | (-1:1) | | (-5:5) | | (-1:1) | | (-5:5) | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| | *Restate* | *AbsDA* | *Restate* | *AbsDA* | *NewCPARatio* | *CPAGrowth* | *NewCPARatio* | *CPAGrowth* |
| *Big4Entry* | 0.053** | 0.007* | 0.032** | 0.004** | -0.023* | -0.033** | -0.019** | -0.020*** |
| | (2.312) | (2.017) | (2.393) | (2.231) | (-2.112) | (-2.143) | (-2.651) | (-4.003) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm FE | Yes | Yes | Yes | Yes | No | No | No | No |
| Audit Firm FE | Yes | Yes | Yes | Yes | No | No | No | No |
| Audit Office FE | No | No | No | No | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 19,307 | 19,307 | 23,798 | 23,798 | 42,327 | 42,327 | 50,380 | 50,380 |
| Adj. $R^2$ | 0.075 | 0.119 | 0.078 | 0.131 | 0.142 | 0.095 | 0.150 | 0.089 |

Notes: This table presents the results when alterative testing windows are considered in the analyses. (-1:1) and (-5:5) indicate one year before and after the Big 4 entry and five years before and after the Big 4 entry, respectively. T-statistics are reported in parentheses using robust standard errors double clustered by client firm and year for the analysis of audit quality and by audit office and year for the analysis of human capital losses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.