

Competition in the Market for Assurance Services

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by

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ABSTRACT

This dissertation examines the effects of competition in the market for accounting services. I focus on the unique attributes that characterize public accounting and investigate whether competition helps or harms audit quality. I find that audit quality is highest when markets have an intermediate level of competition. Insufficient competition provides monopolist auditors little incentive to expend effort to improving audit quality while too intense competition erodes rents and pushes auditors to focus on alternate revenue streams, such as non-audit services. An oligopolistic market structure, with a small group of high quality audit firms, not only promotes healthy competition, that generates higher levels of audit quality, it preserves some rents for the competing firms and depresses the use of non-audit services, a tool shown to negatively impact audit outcomes. Further, I find that the training system used for integrating new auditors into the industry works to reinforce the oligopolistic market structure.

In the first chapter, I investigate the relationship between local competition and audit quality. I document empirically that audit quality does not follow monotonically with competition. The highest levels of audit quality are produced within markets that are neither intensely competitive nor monopolistic. A balance between these two extremes forces auditors to expend effort to provide high quality audits while still be able to extract sufficient rents such that their focus is not disproportionately shifted to more differentiated services.

In the second chapter, I study the role that non-audit services play within an audit firm's product mix in competitive markets. I empirically show that auditors respond to intensifying competition by increasing their emphasis on, and selling more, non-audit services. My results suggest that audit firms utilize their non-audit offerings to differentiate themselves as well as counterbalance reductions in audit fees. Additionally, my results show that the non-audit services

sold in competitive markets are more harmful to audit quality than those sold elsewhere. The results suggest that overly competitive audit markets push auditors to not only reduce their audit pricing, but also increase their use of non-audit services that degrade audit quality.

In my third chapter, I examine how labor enters into public accounting. Through a two-period matching model, I show how the centralized training of public accountants directs the flow of trained workers towards larger firms over smaller ones. This structure serves to further exacerbate the gulf between different tiers of public accounting firms, promoting an oligopoly in the output market. Over the long run, the model predicts that the growth of larger firms will outpace that of smaller firms. Smaller auditors will become boutique firms that cater to specialized clients. Further, I find that the efficiency of labor matchings is determined by the distinguishability of outputs between different worker types. If the outputs of different worker types are not sufficiently heterogeneous, then larger firms will have the incentive to free-ride on the training capacity of smaller firms. Fewer high ability workers will be trained by large auditors and overall audit quality will fall.

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Chapter 1

Trade-Offs in the Relationship Between Competition and Audit Quality

ABSTRACT

Fears over public accounting becoming increasingly concentrated have inspired several attempts to study the relationship between competition and audit quality. These studies have yielded conflicting results without a clear reason as to why. In this paper, I propose and empirically demonstrate a non-monotonic association between competition and audit quality. Using MSA level data from the United States over the period of 2000-2014, I show that the effect that changes in competition will have on audit quality depend upon the current competitive state of the market. Audit quality is maximized when competition is neither too high nor too low. In addition, I find that the point of inflection at which competition turns from being helpful to harmful is influenced by the saturation of the Big 4 auditors in the market and that audit fees are lower around the point of inflection. These findings can help explain the mixed results of the literature as well as provide insight to the role that regulators can play in modulating competition.

Keywords: audit quality, competition, market concentration, market structure

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1.1. Introduction

Auditors' ability and willingness to compete based on the quality of their output has long been difficult to measure. Even if auditors strive to provide the highest standards of assurance possible, there is no guarantee that the monetary costs of executing such a rigorous audit program paired with the stress that such an obtrusive audit would put on client relations would be outweighed by the benefits (McNair, 1991). Auditors are limited not only by their ability to provide different degrees of assurance but also the economic realities of operating a business within a competitive landscape. Given that audits are mandatory for public companies and the imperfections of contemporary audit quality measures (DeFond & Zhang, 2014), auditors' performance is all relative to their competition. Understanding if and how auditors compete based on audit quality is therefore critical.

This study examines the important question of if competition affects audit quality. Specifically, I focus on the intensity of local competition and how it impacts the average output quality of auditors operating within that area. By working to answer this question we can better understand how competitive landscapes shape firms' incentives to output high quality audited financial reports. This is necessary for financial statements to be useful and reliable for consumers.

Taking into account the particular set of attributes that characterize the public auditing market, with the mixed evidence seen in the literature (Boone, Khurana, & Raman, 2012; Ding & Jia, 2012; Kallapur, Sankaraguruswamy, & Zang, 2010), and theory from the chartered banking literature (Keeley, 1985, 1990), I propose a non-monotonic curvature for the relationship between competition and audit quality. My hypotheses predict that marginal increases in competition in highly concentrated (low competition) markets will spur auditors to

increase the quality of their audits in order to maintain market share and preserve long run rents. But, if competition becomes too fierce, eventually auditors will relax their focus on audit quality and begin to emphasize more myopic goals such as selling non-audit services and engaging in price competition.

Using various measures of audit quality and data on the market concentration for Metropolitan Statistical Areas (MSAs) throughout the United States over the sample period of 2000-2014, I empirically test these predictions and find a non-monotonic relationship between competition and audit quality. Client financial and location data is sourced from Compustat while the auditor-client matchings are obtained from AuditAnalytics. The regression results show improvements to audit quality from increased competition when competition is low. As it rises this effect weakens and eventually reverses, consistent with falling audit quality from additional competition when competition becomes too intense. The models used predict that the point of inflection lies within the Herfindahl-Hirschman Index (HHI) range of 0.563-0.631.

In order to confirm the non-monotonic association, each model is run partitioned using two different approaches. The first partitions observations based on the median HHI. The second partitions observations based on the model's predicted point of inflection. Both methods of splitting the sample produce similar results. In both cases I find a positive association between competition and audit quality for the sample of less competitive markets and a negative association between competition and audit quality for highly competitive markets. The difference in the effects observed on either side of the threshold is stark and statistically significant. Results are consistent with the predicted non-monotonic relationship.

Additional tests, using Big 4 presence in an MSA as a proxy for competition, reveal that this non-monotonicity in the response of audit quality to competition can also be observed as

large, high quality auditors enter or exit a market. The results suggest that the entry of these larger firms have such a dramatic influence on the market saturation of high quality firms that entry or exit of a single one of these behemoths can alter the directionality of the association between competition and audit quality.

I also find that the marginal entry of a Big 4 firm tends to improve the average audit quality of a market while the entrance of a Big 7 (but non-Big 4) auditor has little to no effect. Entrance of smaller non-Big 7 auditor yields a negative effect. This suggests conflicting effects when Big 4 firms enter already well populated MSAs. Individually, Big 4 firms produce a higher quality output relative to their competitors. But, as more members of the Big 4 file into a market, each additional entrant intensifies competition as such a high rate that it can become detrimental to audit quality.

Using PCAOB inspections as a shock to competition, I conduct change analyses and find evidence consistent with both highly competitive markets improving in audit quality after becoming less competitive, and monopolistic markets improving in quality after becoming more competitive. Additionally, I identify mergers and market entries that provide further consistent evidence for my main results.

All results are robust to a multitude of controls that proxy for the difficulty of audits and relative quantity of effort needed to conduct thorough audits for companies within the region. In addition, industry fixed effects and year fixed effects are used to mitigate bias stemming from industry composition or time varying effects. Clustered standard errors based on MSA are used throughout.

This study contributes to the literature in three key ways. The first is that this is the first paper to document a non-monotonic relationship between competition and audit quality. This is

an important finding if we are to truly understand how to maximize the quality of financial reporting. By introducing and exploring the validity of a non-monotonic component in the audit quality equation, we can determine which competitive structures generate the highest levels of audit quality and begin to estimate the costs associated with implementation. My results predict a narrow range of inflection points, in which only 5.85% of MSAs reside as of 2014, beyond which increased competition becomes harmful to audit quality.

The second key contribution of this study is in its ability to explain the mixed results found in the literature. Several previous studies have found competition to improve audit quality (Boone et al., 2012; Dunn, Kohlbeck, & Mayhew, 2013; Francis, Michas, & Seavey, 2013) while others have uncovered the conflicting results (Ding & Jia, 2012; Huang, Chang, & Chiou, 2016; Kallapur et al., 2010). Given the varied results and the wide range of data used, this set of incompatible findings may be the result of samples being differently weighted towards one side or another. Incorporating a non-monotonic response to competition could unify the findings of the literature.

Finally, the findings of this study are relevant to regulators and practitioners. Although this study has limitations in its inability to measure the costs and consider all tradeoffs involved with enforcing specific competitive structures, the results of this study can speak to types of markets that produce maximized audit quality. The results suggest that neither a monopolistic market structure nor a perfectly competitive market structure produces the highest levels of audit quality. This leaves a clear role for regulators to play in helping to either curtail or promote competition as is necessary. An interior solution for maximizing audit quality with respect to competition implies a need for regulations to exist, while also warning against the downfalls of overregulation.

The remainder of the chapter is organized as follows. Section 2 summarizes relevant literature. Section 3 develops hypotheses and provides background for the predictions made. Section 4 introduces the sample, discusses key variables and outlines testing procedures. Section 5 presents the results and their implications. Section 6 adds discussion of cases, reverse causality, and policy implications. Section 7 concludes.

1.2. Literature Review

Following the mergers of the late 20th century that formed Deloitte and Touché and PricewaterhouseCoopers, and with the demise of Arthur Andersen in 2002, the public accounting sector has become overwhelmingly dominated by four firms. The Big 4 now account for more than 90% of assurance services provided to S&P 1500 companies in United States and hold strangleholds on the market for assurance services worldwide (Bird, Ho, Li, & Ruchti, 2016; Francis et al., 2013). This has led many academics to worry about the effects of increased market concentration and the post-merger effects on competition (Ding & Jia, 2012; Dunn, Kohlbeck, & Mayhew, 2011; Gong, Li, Lin, & Wu, 2016).

The findings thus far on market competition/concentration's relationship with audit quality have been extremely mixed. Beginning with studies that have found a negative relationship between competition and quality, Kallapur et al. (2010) used data from the United States in the early 21st century to study the effects of competition on audit quality. They found a negative link between increased competition and audit quality, measured through absolute abnormal accruals and accruals quality. Ding and Jia (2012) studied the impact of increased market concentration following mergers in the late 20th century and found that the reduced competition led to better quality audits, characterized by smaller absolute discretionary accruals

and the increase value relevance of earnings. Huang et al. (2016) used Chinese data from the period of 2001-2011 and yielded a similar result. They linked lower competition (higher market concentration) to improved earnings quality and less modified audit opinions.

On the other hand, there have been just as many studies with opposing conclusions. Boone et al. (2012) examined U.S. data from 2003-2009. They found higher tolerances for earnings management (absolute discretionary accruals) in MSAs where competition was low. Similarly, Dunn et al. (2013) studied restatements in the same region over the period of 2004-2011, finding that increases in competition at the national level improved audit quality but increases in competition at the city level had no effect. Francis et al. (2013) used international data over the period of 1999-2007 and found the earnings quality of Big 4 clients was lower in countries where market concentration was high (competition was low).

The takeaway from all of these conflicting studies is unclear. Even alternate studies that use identical measure of audit quality for similar regions of the world yield mixed results. It appears that competition can serve to improve audit quality in certain scenarios but it appears to do the opposite in just as many situations. A new approach to modelling this relationship is required if we are to understand the true underlying dynamics and explain how previous findings have been so consistently inconsistent.

1.3. Hypothesis Development

Given the mixed evidence presented in the literature, examining the relationship between auditor competition and audit quality may merit a new approach. Surveying the current landscape, a large gulf still persists between the Big 4 and the next tier of smaller auditors, and desired assurance levels vary between the Big 4 and everyone else (Eshleman & Guo, 2014).

Searching for a framework that explains the inconsistent results and the tiered nature of public practice, I propose a non-monotonic relationship between competition and quality.

Let us first examine the two classic extreme ends of the competitive spectrum, the incentives they provide, and their predicted resulting levels of audit quality. If a local audit market is held by a single monopolist, and audits remain mandatory for public corporations, all companies within the market are forced to employ the monopolist auditor. Regardless of pricing or output quality, all companies use the single auditor to whom all rents will accrue. Because there are no alternatives, the monopolist charges the maximum that clients are able to pay and has no incentive to invest in audit quality as there are no competitors against which to compare. Such a market lacks the necessary competition required to compel an auditor to provide audit quality standards any greater than the bare minimum.

On the other end of the spectrum, if a local market is over competitive there are several qualified auditors vying for the opportunity to service clients. Competitors are constantly courting new clients and having their own clients courted by other firms. In this scenario, the bargaining power shifts to client companies and all rents accrue to them as auditors are forced to charge the competitive price or risk there being no companies willing to hire them. Because auditors are so plentiful in this scenario, clients have little incentive to stick with any individual auditor for an extended period of time as there will always be a comparable firm available to step into the role. For this reason, auditors will behave myopically, by lowering prices or focusing on non-audit differentiators in order to court clients (Maher, Tiessen, Colson, & Broman, 1992). This extreme downward pressure on prices has the tradeoff of reducing the investment that auditors make towards audit quality.

Neither extreme on the competitive spectrum predicts maximized levels of audit quality. A market with no opposition gives the monopolist auditor no competitors against which they need to be compared, and a market with too much competition incentivizes myopic behavior that foregoes audit quality in favor of competitive pricing and non-audit differentiators. These two competitive forces help drive incentives for auditors to produce high quality reports. The first foretells of the dangers from too little competition while the other describes the pitfalls of too much. In order to incentivize investment in audit quality, auditors need to have enough competition around them such that they are forced to compete on the quality of their outputs, but not too much as to drive them to myopic behavior. This naturally leads to the proposal of an interior solution which balances the pulls of the extremes and is emblematic of a non-monotonic relationship between auditor competition and audit quality.

Non-monotonicity in the quality of output, although untested in the audit literature, has been well documented in other industries, some of which have striking similarities in their structure to that of public accounting. The closest related and most relevant to auditing can be found in the literature on the value of bank charters. Keeley (1985) examined historical bank regulations that had implications for making banking more or less competitive and surprisingly concluded that several regulations that were considered anticompetitive did not actually result in increased profits for banks. Left with this puzzle, Keeley (1990) developed a model of market power in banking which found that anticompetitive regulation which made bank charters harder to get could actually incentivize banks to be more prudent and take fewer risks with their deposits. The arguments are as follows. Anticompetitive regulations place firms in an oligopolistic environment where entry is costly such that there is limited expansion in the number of competitors. This puts existing firms in a position where they can safely collect rents

and run profitable businesses. Combining the fact that firms are already sufficiently profitable with the realization that bank charters are extremely expensive to reacquire, banks become more risk averse and prudent when investing their deposits. At the same time, the direct competition with the existing firms in the market still forces banks to offer competitive rates to their clients and maintain healthy customer relations. This creates a balance where banks invest efficiently enough to satisfy customers without becoming overly aggressive and risking bankruptcy. Altogether, this suggests a non-monotone relationship between competition and investment efficiency.

Equating this literature with the audit environment, we can observe several similarities in the market structure. Rather than acquiring bank charters from the Office of the Comptroller of the Currency (OCC), public accounting firms in the United States must be registered with the Public Company Accounting Oversight Board (PCAOB) before they are permitted to perform audits of public companies. Beyond mere registration, firms must also maintain good standing by passing periodic inspections and having their employees participate in peer-review. By adjusting the standards for public practice and the harshness of penalties, regulators have shown the ability to curb entry and exit. One recent example was the mass exodus of smaller lower quality firms following the implementation of stricter guidelines and increased oversight following the Sarbanes-Oxley Act of 2002 (SOX) (DeFond & Lennox, 2011). Although this exodus was widespread, its effects were felt disproportionately on a local level dependent on where the exiting firms were operating. Very few auditors operate on a global scale and have an equal presence in every market. Entry or exit occurs at the local level, as an auditor grows or contracts in response to the viability of its profits in particular markets.

Beyond the regulations that can make entry costly and bankruptcy prohibitively expensive, public auditing also resembles banking from a profitability perspective. Due to the high startup costs and the specialization amongst competitors (DeAngelo, 1981; Gigler & Penno, 1995), history has shown assurance services to be a very lucrative business where established firms have been able to consistently extract rents. Without a massive influx of additional competition, there is no clear trend for this not to continue. In this environment, that is held firmly by existing firms with relationships and reputations that have been built up over decades, audit firms are incentivized to not upset the status quo by encouraging switching (DeAngelo, 1981). Although some auditor switches will still occur, switching that does not result in significant increases in market share or fees for an auditor only harms profits by requiring additional startup costs associated with new engagements. Therefore, firms have the incentive to focus on their current clients, ensure they maintain competitive assurance levels, and suppress myopic behavior in favor of long-term profits. This peculiar combination of regulated entry and established precedence for long-term profitability highlights key similarities between banking and auditing where a non-monotonic relationship between competition and output quality may be applicable.

Specific to the audit literature, DeAngelo (1981) also provides arguments for why we might expect audit quality to be particularly high in oligopolistic markets. If auditors are punished for negative outcomes by losing a percentage of their client base, the larger their client base is, the more an auditor has to lose if it is discovered that they have made egregious errors. Therefore, we should expect larger auditors to be performing stricter audits and the highest levels of audit quality should be observed when a market is split between fewer larger firms rather than several smaller ones.

The bank charter literature is just one of many that exemplify similarities to public accounting and predict the optimality of an oligopolistic competition structure. To demonstrate the frequency of such a result there is even another literature, within banking but unrelated to bank charters, that examines the relationship between competition and bank stability with similar notions. Although this is still a topic up for debate, analytical models and empirical evidence appears to suggest that neither a monopoly nor extremely high levels of competition is ideal in that market, lending credence to the idea of a non-monotonic relationship between competition and output quality (Allen & Gale, 2004; Boyd & De Nicolo, 2005).

With these arguments for why we might expect a non-monotonic relationship between competition and audit quality discussed, my central hypothesis is stated in Hypothesis 1.

H1: Audit markets display a non-monotonic relationship between the intensity of competition and audit quality.

I predict a non-monotonic relationship between competition and the resulting average audit quality. In order to test this hypothesis a specification of the following reduced form will be used.

$$Audit\ Quality = \beta_0 + \beta_1 Competition + \beta_2 Competition^2 + \beta_3 Controls + \varepsilon$$

The variables used for audit quality, competition, and controls will be defined and discussed along with the testing procedures in the Data and Methodology section of the paper (Section 4). For the central hypothesis to not be rejected we should observe both a positive coefficient for β_1 , consistent with an initial improvement in audit quality from marginal increases in competition,

followed by a negative coefficient on β_3 , indicative of an overpowering negative impact of competition on quality as competition grows¹.

While, to this point, I have only discussed similarities between public accounting and other industries, it is also important to acknowledge the unique traits of public accounting that set it apart in our predictions. Unlike many industries, the number of potential clients within a public accounting market is determined independently of the quality of outputs or the level of competition. Audited financial statements are mandatory for public companies. Therefore, the demand for public accounting services is relatively inelastic, assuming no major shocks to the number of newly listed or delisted corporations. Changes in demand largely come from changes in economic conditions and not the quality of financial reporting. Client companies have agency over which auditor they choose and what amount of fees they wish to pay but at the end of the day they must choose an external auditor from the set of available and certified firms. Given this, we should expect any pressures exerted on audit quality by competition to come from an auditor's direct competitors. This leads to my second hypothesis.

H2: Inflection points for audit quality are determined by the saturation of high quality firms.

When larger, higher quality firms enter a local market, they pose a much greater threat to incumbents than the entry of less qualified firms. The downward pressure exerted on audit quality from competition should largely stem from higher quality firms entering the market, making it more and more difficult for incumbents and other lower quality firms to compete based

¹ It is important to note that for all measures of audit quality used, audit quality improves when the value of the measure approaches zero. Therefore, we should observe a negative coefficient on β_2 and a positive coefficient on β_3 for results to be consistent with Hypothesis 1 for absolute accruals and restatements.

on quality alone. Therefore, we should expect any change in the response of audit quality to competition to become prevalent as more high-quality auditors become present.

To test this hypothesis, I can use the number of Big 4 and Big 7 auditors within a local market as a measure of competition and a proxy for the number of high quality auditors in the market. The literature has shown that on average these firms conduct the highest quality audits (Eshleman & Guo, 2014). The presence of these giants should impose a standard of quality that is difficult to match by lower quality auditors, leaving them with less and less incentive to devote their efforts towards providing high quality outputs and refrain from myopic behavior. For this hypothesis to not be rejected we should observe the same non-monotonic behavior (positive coefficient on competition and negative coefficient on the squared term for competition) in the results when using the number of Big 4 or Big 7 firms as the proxy for high-quality firm saturation.

Building off of this hypothesis, it is also important to determine what the net impact of Big 4/Big 7 presence is in the market, as compared to the marginal impact of additional smaller firms. Even if the entry of higher quality firms reduces the incentives for lower quality firms to exert maximum effort towards quality, we cannot ignore the positive effects of a high-quality producer. It is much more efficient for a higher quality firm to produce well audited reports than it is for their lower skilled counterparts. As a result, their natural output will be of a higher quality, increasing the average audit quality within a market. The net of this positive impact combined with the negative effect of reducing lesser firms' incentives to focus on quality will determine whether or not the market has reached an inflection point.

Conversely, entry of lower quality auditors into a market provides fewer positive incentives towards audit quality. High quality firms are at risk of losing rents to the new entrant

if the newcomer is able to exert downward pressure on pricing and other lower quality firms will see their potential for rent extraction dissipate as the market becomes more crowded. I can test this examining the entry and exit of non-Big 7 smaller auditors.

1.4. Data and Methodology

1.4.1. Data Sources and Sample Construction

My sample is composed of data on public companies within the United States during the period of 2000-2014. Firm financial and location data is gathered through Compustat and auditor-client matchings are sourced from AuditAnalytics. After eliminating firm-years with missing data the usable sample contains 116,779 firm-years across 3,465 MSA-years. The breakdown of the sample per year can be found in Table 1.1.

All analyses are conducted at the MSA level with MSA-years used as the base observational unit. This allows for analysis to encapsulate the entirety of a market and account for not only the composition of local businesses in terms of industry specializations but also the general financial health of other local companies, rather than trying to analyze individual engagements independent of their surroundings. Audit markets are measured at the MSA-level to reflect the regional nature of audit offices. A single or a small group of office locations service an MSA for any given auditor and capturing competition and performance at the MSA level considers the limited nature of local resources and the strength of local auditors that have disproportionately larger or smaller presences in particular areas. Auditors have been shown to fly in lead engagement partners from outside the MSA on certain occasions (Francis, Hallman, & Golshan, 2017), these non-local partners still often work with local audit teams. They have also been associated with reductions in audit quality suggesting that an examination of local resources should be the best representation of an audit office.

----- Table 1.1 here -----

1.4.2. *Measure of Audit Quality and Market Concentration*

Audit quality has proven to be very difficult to fully capture with any single measure. The use of multiple measures to capture different important aspects of audit quality is required (DeFond & Zhang, 2014). In order to capture a more complete picture of the state of audit quality within our areas of observation I utilize three measures of audit quality, to be used as the dependent variables for my analysis.

The first two measures are signed (*ACCRUALS*) and unsigned (*ABSACCRUALS*) performance matched abnormal accruals. All accruals are calculated in accordance to the Modified Jones model (Dechow, Sloan, & Sweeney, 1995; Jones, 1991) and performance matched based on return on assets within the industry and year (Kothari, Leone, & Wasley, 2005). Each firm-year's discretionary accruals are calculated separately and then aggregated by MSA-year and averaged across the number of firms that belong to the MSA-year. Complete descriptions of the procedures used to generate all variables used can be found in Appendix A.

Both variants of abnormal accruals provide estimates for the level of within-GAAP manipulation, but each measure has its own advantages and shortcomings. Signed accruals accounts for the directionality of manipulation which is particularly helpful if we are concerned about conservative versus aggressive accounting. The difficulty with this measure is that it can become obscured when aggregated across firms. For the purposes of calculation, two dramatically large results in opposing directions would offset to zero when aggregated, indicating no manipulation whatsoever and high audit quality, an improper representation of the true state. For this reason, we cannot use signed accruals alone and must check any results against those derived using absolute accruals. Absolute accruals have the advantage of being less

sensitive to aggregation and effectively measuring the total deviation in accruals, be it positive or negative. The disadvantage of this approach is the loss of context, not being able to determine if abnormal accruals are stemming from aggressive or conservative accounting policies. An absolute measure also suffers from the tendency to produce heteroskedastic errors. Given the trade-offs between these two measures, it is important that they are analyzed together in order to evaluate if they provide narratively consistent findings.

The third measure of audit quality used is the number of restatements issued for an MSA-year scaled by the total assets held by firms within the MSA. Restatements measure egregious errors in reporting, whether it be from honest mistakes that were not caught during the initial auditing process or procedural weaknesses left uncorrected until a future date. Either type of error would be a demonstration of an audit failure. The aggregate number of restatements is scaled by the total assets held within the MSA generates comparable figures across MSAs and account for the volume of audit work involved. The restatement announcements data is updated as of the end of 2016.²

To measure competition at the MSA level, I calculate a Herfindahl-Hirschman Index (*HHI*) using the number of active auditors with at least one client within the MSA and the total revenues of their clients. Following the intuition and reasoning outlined in the hypothesis section, a measure of market concentration is fitting proxy for competition. Auditors' profits are largely determined by the number of clients they engage with and the size of their respective clients. The higher the *HHI*, the more concentrated and less competitive a market is, and the higher the likelihood that active auditors are able to extract substantial rents. As the *HHI*

² This provides a 2-year gap after the end of our sample period for restatement announcements. This should provide ample time for misstatements to be disclosed given that over 95% of restatements in our sample are disclosed within 2 years after the end of the misreporting period.

decreases, market concentration falls and market share becomes split amongst more firms eroding away profits. Using the HHI, rather than a pure count of the number of active audit firms or other count-based measures of competition, allows me to link competition to the viability of auditors. Assuming a sticky number of local clients and stable audit pricing, in order to affect the HHI new auditors must not only enter the market but also affect the distribution of market share, improving their profitability and reducing the profitability of competitors.

It is important to note that all three audit quality proxies used signal improvements in audit quality with values closer to zero. Negative coefficients correspond with higher audit quality in the absolute accruals and restatement models given that these measures produce strictly positive values. For this reason, a non-monotonic relationship between competition and audit quality would be demonstrated with a negative coefficient on the non-squared term and a positive coefficient on the squared term. On the other hand, the direction of improvement for signed accruals will be dependent on the value of the mean. For this sample, the mean of signed abnormal accruals is negative. Therefore, a non-monotonic relationship between competition and quality for this variable would be characterized by a positive coefficient on HHI and a negative coefficient on HHI^2 , the opposite of what we should expect for absolute abnormal accruals and restatements.

For interpretation purposes, it is also vital to keep in mind that the HHI takes on a value between zero and one but smaller values within this interval represent observations of greater competition. Given this double negative, squaring the HHI is appropriate for evaluating the effects of intensifying competition.

1.4.3. Model Specification

With the dependent variables and independent variable of interest established, my main regression model used can be expressed with controls in the following reduced form. All control variables are scaled by the number of firms within the MSA.

$$\begin{aligned} \text{Audit Quality} = & \beta_0 + \beta_1 HHI + \beta_2 HHI^2 + \beta_3 CFO + \beta_4 ARIN \\ & + \beta_5 SEGNUM + \beta_6 TENURE + \beta_7 GROWTH \\ & + \text{Industry Fixed Effects} + \text{Year Fixed Effects} \\ \text{Audit Quality : } & ACCRUALS, ABSACCRUALS, RESTATE \end{aligned}$$

The controls included center around how difficult clients would be to audit and factors that affect the amount of effort an MSA will require to audit effectively. These include average cash flows, operating segments, proportion of assets taken up by receivables, auditor tenure, and sales growth (Becker, Defond, Jiambalvo, & Subramanyam, 1998; Butler, Leone, & Willenborg, 2004; DeFond & Zhang, 2014; Ettredge, Fuerherm, & Li, 2014). Dependent variables are all scaled by the total assets within the MSA and the number of clients within the MSA. Precise calculations of each control variable can be found in Appendix A.

Lastly, I include industry fixed effects and year fixed effects. Industries are identified using the Fama-French 12 standard industry classifications with each MSA-year assigned a value based on the proportion of firms within that MSA belonging to each industry classification. By including industry fixed effects, I control for the composition of firm types within each area. Year fixed effects mitigate the likelihood of results being skewed by time trends or time-sensitive events.

1.4.4. Describing the Data and Univariate Figures

Summary statistics are displayed in Table 1.2A³, accompanied by a correlation table in Table 1.2B. The mean HHI is 0.587 with a standard deviation of 0.275 and a median of 0.512. This suggests a right-skew to the distribution. However, examining the distribution of HHI, displayed in Figure 1.1, there is significant density at both the top and the bottom of the distribution. 36% of MSA-year observations generate an HHI below 0.4 while 13.5% of MSA-years are a monopoly with an HHI equal to 1. Nearly 50% of observations reside within these high-density tails. MSAs appear to be either clumped into very competitive markets or near perfect monopolies⁴.

----- Table 1.2 here -----

----- Figure 1.1 here -----

Sample observations generate average abnormal accruals of -0.027 with a standard deviation of 0.315 and median of 0.039. The negative mean is noteworthy given that it reverses the directionality for interpretation relative to the other measures of audit quality. For the analyses of abnormal accruals, positive coefficients will reduce, on average, the amount of abnormal accruals and a signal an improvement to audit quality. This will be the reverse of absolute abnormal accruals and restatements which will signal improvements through negative coefficients. The mean of absolute abnormal accruals is 0.186, with a standard deviation of 0.213 and a median of 0.128. The average restatement rate per dollar of assets is 0.001, with a standard deviation of 0.006 and a median of 0.001.

Before testing the hypotheses with regression analyses, the relationship between competition and audit quality can be overviewed by examining Figure 1.1, 1.2, and 1.3 which plot the average audit quality for varying levels of local competition. Each figure displays a fitted plot on the left and the actual

³ All continuous variables are winsorized to the 1st and 99th percentile.

⁴ It is likely that MSAs with an HHI equal to 1 still have other smaller auditors operating within them, but none of these competitors serve clients large enough to be found in Compustat and AuditAnalytics.

data from the sample used to generate the fitted plots on the right. The size of each circle is proportional to the density of observations represented. Fitted plots also include a 95% confidence interval highlighted by the shaded area.

----- Figure 1.2 here -----

----- Figure 1.3 here -----

----- Figure 1.4 here -----

All three figures tell a consistent story. Moving from right to left, as local markets move from a monopolistic setting towards a more competitive environment, predicted audit quality improves for all three measures. Audit quality peaks in the 0.5 to 0.6 range. Beyond that range additional competition begins to degrade the average audit quality and this trend continues as markets become more and more competitive.

Upon initial analysis, it appears that there is evidence for a non-monotonic relationship between competition and audit quality. Neither too much or too little competition produces maximized levels of audit quality. A balance is needed to incentivize auditors to compete on the quality of their outputs without resorting to extreme price competition or alternate forms of differentiation. What is also troubling is the fact that the majority of MSAs lie without the tails of the distribution rather than the center where audit quality is observed to be higher.

1.5. Results

1.5.1. Main Results

Results for the main model specification are presented in Table 1.3. Column (1) presents OLS regression results using signed abnormal accruals to measure audit quality. Column (2) does the equivalent but with absolute abnormal accruals and column (3) proxies for audit quality with restatements. Standard errors are clustered by MSA and industry and year fixed effects are present throughout.

----- Table 1.3 here -----

Examining column (1), we observe a positive coefficient on *HHI* and negative coefficient on *HHI*², with both being statistically significant at the 5% level (two-tailed). Given the negative mean for signed accruals, these results suggest an initial improvement in audit quality as competition increases but an eventually fall in audit quality as competition becomes increasingly intense. This is consistent with a non-monotonic relationship between competition and audit quality, with a predicted point of inflection when the Herfindahl-Hirschman Index is equal to 0.603.

Moving to column (2), we find a negative coefficient on *HHI* and a positive coefficient on *HHI*², again with both coefficients being statistically significant at the 5% level using two-tailed tests. These results for unsigned abnormal accruals are consistent with those from signed abnormal accruals, echoing the finding of an initial increase to audit quality from heightened competition but with an eventually reversing when competition becomes too heated. The results for unsigned accruals suggest a point of inflection of 0.631.

Column (3) produces qualitatively similar results to the previous two. *HHI* generates a negative coefficient that is statistically significant at the 10% level (two-tailed), while *HHI*² generates a positive coefficient that is statistically significant at the 5% level (two-tailed). These results for restatements tell the same story as the accruals measures suggesting a non-monotonic relationship between audit quality and competition. The restatement model suggests a point of inflection of 0.563. The three measures of audit quality produce points of inflection within a fairly narrow band between 0.563-0.631 where audit quality peaks, a range that only 5.37% of tested MSA-years fall within (5.85% for 2014, the most recent year in the sample).

Given this narrow band where audit quality is maximized predicted by these models, my results may be able to speak to the mixed results observed in the literature. Areas dominated by a single large firm can easily generate HHI scores above this range, especially if many of the Big 4 are not present. Even within my sample of the United States, where the Big 4 is far reaching, over one third of MSA-years have a HHI above 0.631 and over 40% of MSA-years have less than two members of the Big 4 present. Studies conducted with a sample comprised primarily of these types of areas would generate the result of competition improving audit quality. Meanwhile, analysis of samples comprised of mostly areas with less concentration would yield findings consistent with marginal increases in competition reducing audit quality. Both types of areas are common and concentrations vary wildly from region to region, especially internationally (Francis et al., 2013). This could be the source of the conflicting results in the literature.

A big concern for my results is ensuring that the non-monotonic curvature suggested by the results is indeed present and that the results are not simply driven by higher order testing introducing greater degrees of freedom and a spurious better fit. One way to check the viability of my findings is to partition out observations by their competitiveness. If a non-monotonic relationship truly does exist we should observe a distinct change in the directionality of coefficients when comparing strongly and weakly contested MSAs.

To address this concern, I conduct further tests partitioning the sample using two different approaches. The first is to partition observations based on if they fall above or below the median HHI. The results for these partitions are presented in Table 1.4A. The second is to partition observations based on the predicated points of inflection identified by the full sample

regression. Results for this approach are posted in Table 1.4B. For brevity and readability, results for controls are untabulated.

----- Table 1.4 here -----

The results in both tables show stark differences in the direction of effects when contrasting the partitions. The accruals models show a statistically significant improvement in the audit quality of weakly contested MSAs when competition is increased. Comparing this to the other side of the partition, the effects become non-existent and the coefficients often flip their sign, albeit with a statistically insignificant result. For the restatement model, we observe statistically significant degradations in audit quality when already competitive MSAs become marginally more competitive. Again, we observe a sign change on the other side of the partition, though the effects register as statistically insignificant for low competition areas. These results demonstrate an abrupt change in the relationship between audit quality and competition as market concentration rises or falls past certain thresholds. The association appears to be non-monotonic.

In order to address the possibility of reverse causality (audit quality levels determining which markets auditors choose to enter), I can examine the distribution of HHI's over time. If auditors are determining which markets to enter based on their current levels of quality, we should expect the most entry in either highly competitive markets or low competition markets, where audit quality is the lowest. Although there is a trend to MSAs becoming more competitive over time, the 75th percentile remains uncompetitive, with HHIs moving from 0.872 in 2001 to 0.907 in 2014 and markets that were previously already competitive (25th percentile), did become more competitive (0.423 to 0.352 over that same time period), by far the largest increase in competition was at the median MSAs moving from 0.635 to 0.497. The largest amount of

entry was seen in high quality MSAs which refutes the idea that quality is driving location choice, especially when paired with the data that shows that audits within the median of the distribution yield the lowest fee to client asset ratios.

1.5.2. Market Saturation of High Quality Auditors

The entry of larger higher quality auditors into a market comes with it conflicting effects. The primary effect on the market should be audit quality enhancing on average, driven by the higher quality outputs that these firms naturally produce. However, increases in saturation of high quality auditors also has the secondary effect of placing downward pressure on pricing as lower skilled firms struggle to keep up on quality. If the primary effect dominates the secondary effect, then we should observe a non-monotonic relationship between Big 4/Big 7 entry and audit quality, similar to those observed in the main results. If this is not the case then we should find either a null result or the opposite result if the secondary effect dominates the primary.

----- Table 1.5 here -----

Results using Big 4/Big 7 market saturation are presented in Table 1.5A/1.5B. *BIG4* is a count of the number of Big 4 auditors with at least one client within the MSA. *BIG7* does the equivalent for the Big 7⁵. Beginning with Table 1.5A, when using *BIG4* as the proxy for competition, we again observe a non-monotonic association between competition and audit quality. This is statistically significant at the 5% level (two-tailed tests) in the absolute accruals model and at the 1% level (two-tailed tests) in the restatements model. The signed accruals model produces coefficients consistent with a non-monotonic relationship but does not produce a statistically result when using two-tailed tests. Signed accruals would register as significant at the

⁵ The Big 4 include Ernst and Young, PricewaterhouseCoopers, KPMG, and Deloitte and Touche. The Big 7 adds McGladrey, BDO, and Grant Thornton

10% level if one-tailed tests were used. All together, these results echo my main findings but with Big 4 saturation. It appears that Big 4 entry into an MSA improves audit quality but only up to a certain point. Beyond that threshold the average audit quality put out by the market begins to decrease.

Examining Table 1.5B, we see results that initially are very reminiscent of the results observed in Table 1.5A. However, the magnitudes of the coefficients are smaller and size of the standard errors have increased in all three models. This suggests that adding in the remaining auditors of the Big 7 after the Big 4 has introduced attenuation bias. The next tier of auditors after the Big 4 appear to have very inconsistent effects on a market. This will be investigated in Section 5.3.

1.5.3. Entry of Lower Quality Competitors

Unlike high quality auditors entering a market, the entry of lower quality firms into an audit market is not accompanied by the same benefits. Additional small firms in the market only serve to dilute the rents of similarly small firms that need to employ additional effort if they wish to compete with high quality auditors. This should make pooling less appealing to smaller firms and reduce average output quality. In order to test this, I introduce two new variables alongside *BIG4*. *NEXT3* captures the number of Big 7 auditors that are present in a market, excluding the Big 4. *NONBIG7* counts the numbers of non-Big 7 auditors in the MSA.

----- Table 1.6 here -----

Results are displayed in Table 1.6. Looking first at the coefficients for *BIG4* and *BIG4*², we are greeted with the non-monotone pattern seen previously in Table 1.5A. This provides further evidence for the hypothesis that market saturation is determined by the number of large

auditors present in an MSA. The coefficients on *NEXT3* are statistically insignificant except for in the restatement model that suggests that the *NEXT3* contribute to reducing the number of restatements needed. Although statistically significant at the 5% level (two-tailed) the coefficient is miniscule, calling into question the economic significance of such an effect. The results for *NONBIG7* are mixed. The results from the signed and unsigned accruals suggest that non-Big 7 firms reduce average audit quality. However, the exception again is the restatement model that again shows a very small increase in audit quality from non-Big 7 firms. All in all, these results confirm the previous finding of non-monotone response to Big 4 presence and suggest that market entry by smaller firms may have a negative impact on audit quality.

1.6. Identification and Regulatory Implications

1.6.1 Changes in Competition Following the Introduction of PCAOB Inspections

After the erection of the PCAOB in 2002, PCAOB inspections of public auditing firms and offices had a significant impact on the sustainability of lower quality auditors. DeFond & Lennox (2011) document a large surge in auditor exits in the years immediately following the introduction of PCAOB inspections. Although this is not an ideal shock, due to the fact that the majority of auditor exits were from smaller low quality auditors, this large shock to the number of competing audit firms does provide an opportunity to examine how average local audit quality changes following shifts in competition. Using this exodus of audit firms, I can verify if movements in average audit quality align with my model's prediction based on the initial level of local competition pre-PCAOB and the actual observed changes seen in market concentration. If highly competitive markets improve in average audit quality as competition lessens and

monopolistic markets improve with increases in competition, this would provide evidence consistent with my main results.

The results of DeFond & Lennox (2011) show the largest exodus of auditors due to PCAOB inspections occurred during the period of 2003-2006. Using 2003 as the pre-treatment period and 2006 as the post-treatment period for a change analysis, I test both decreases to competition in highly competitive MSAs and increases to competition in monopolistic MSAs following the change⁶. It is important to note that although the PCAOB was known for the exits that they triggered, many markets, especially monopolistic markets, became more competitive following the implementation of inspections. Results of the change analysis (untabulated) provide evidence consistent with my main results, where audit quality increases as markets move away from highly competitive or monopolistic competitive environments and towards an intermediate level of local competition.

Because the exodus observed over this time period was not evenly distributed across different quality auditors, there are some alternative stories that could explain the observed results. One possibility is that competitive MSAs would mechanically improve in audit quality as they became less competitive because the PCAOB specifically eliminated low quality auditors. Because of this possibility, my change results can provide consistent evidence with the main results but is not a perfectly exogenous shock to competition.

An alternative explanation for monopolistic market results is that the improvements in audit quality as they became more competitive post-PCAOB inspections were not due to competition, but rather due to PCAOB inspections empowering high quality auditors. PCAOB

⁶ Highly competitive and monopolistic MSAs were identified as any MSA that fell outside of the closest quartile to the predicted inflection point in 2003. MSAs with an initial HHI below 0.460 were labelled as highly competitive while MSAs with an initial HHI greater than 0.734 were labelled as monopolistic.

provided external verification of high quality auditors which could have spurred them to expansion into monopolistic markets. This would result in similarly observed results with high quality auditors entering monopolistic markets and improving audit quality. However, if this were the case, we should expect to observe known high quality auditors, such as the Big 4, expanding over this period which I do not. There is no evidence in the data to support Big 4 expansion during 2003-2006, after the initial reshuffle of former Arthur Andersen offices.

As an alternate shock to competition, I also test the changes in audit quality immediately following the exit of Arthur Andersen. Results (untabulated) are statistically insignificant. This is expected given that 2002 produced more restatements and greater abnormal accruals than a typical year in the sample due to the large amount of turnover following the collapse of Arthur Andersen. It is also difficult to surmise the motive for accruals/restatements in this year as there is the possibility of opportunistic firms choosing to take baths in a period when they believe they can still compare favorably against competitors who are under increased scrutiny due to their past involvement with Arthur Andersen.

1.6.2 Example Shocks from Mergers and Changes in Competition

In addition to the regression analyses, evidence consistent with my results can also be found when examining mergers between auditors within my sample period. In 2010, Houston-based auditor MaloneBailey LLP merged with another local auditor John M. Thomas P.C. (MaloneBailey, 2010). At the time, Houston was a very competitive audit market (HHI = 0.238, 98th percentile in terms of competitiveness), where a reduction in competition should increase audit quality. By 2012, the merger reduced the intensity of local competition and increased the HHI by 5 percentage points (HHI = 0.289, 87th percentile). Over that time, both abnormal

accruals and the number of restatements per dollar of assets fell, signs of improved audit quality. There was no change in the number of Big 4 or Big 7 auditors present in the area over that time period.

Another example can be found in Chicago a few years later. In 2012, Plante Moran merged with Blackman Kallick LLP (Sachdev, 2012). Similar to Houston, Chicago was equally competitive with an HHI equal to 0.250 (97th percentile). The absorption of Blackman Kallick into Plante Moran reduced the HHI by 2 percentage points down to the 92nd percentile. Again, this reduction in competition coincided with a decrease in abnormal accruals and the rate of restatements with no change in Big 4 or Big 7 presence in the area. Both examples presented provide evidence for mergers in overly competitive markets helping to improve audit quality.

On the other end of the spectrum, there are also examples of MSAs improving in audit quality as they transition from a near monopoly to a more competitive landscape. Augusta, Georgia has no Big 4 or Big 7 auditors with local clients. However, from 2012 to 2014 the area saw a huge rise in competition between local auditors with the HHI starting at 0.686 (36th percentile) in 2012, then moving to 0.628 (40th percentile) in 2013, and eventually 0.578 (43rd percentile) in 2014. In each successive year, abnormal accruals fell for firms in the area with no restatements issued. This demonstrates the gains in audit quality that can be spurred by increases in competition when opposition is initially lacking.

1.6.3 Reverse Causality

In order to address the possibility of reverse causality (audit quality levels determining which markets auditors choose to enter), I examine the distribution of HHI's over time. If auditors are determining which markets to enter based on their current levels of quality, we

should expect the most entry in either highly competitive markets or low competition markets, where audit quality is the lowest. Although there is a general trend towards the majority of markets becoming more competitive over time, the 75th percentile remains uncompetitive, with HHIs increasing from 0.872 in 2001 to 0.907 in 2014. Markets that were previously already very competitive (25th percentile), did become more competitive moving from 0.423 to 0.352 over that same time. But, by far the largest increase in competition was felt at the median, moving from 0.635 to 0.497. The largest amount of entry was seen in high quality MSAs which refutes the idea that quality is driving competition⁷.

1.6.4 Regulatory Implications and Limitations

Expanding the narrow band of inflection points of HHI's between 0.563 and 0.631, which only 5.37% of MSA-years manage to fall within, the quartile nearest and inclusive of this band spans from 0.460 and 0.734. MSAs within this quartile yield above average audit quality for all three measures. Although this predicted range for maximized audit quality is far above the U.S. Department of Justice (DOJ) and Federal Trade Commission's (FTC) typical classification for highly concentrated markets, which sets the bar at 0.25 (U.S. Department of Justice, 2015), as of 2014 only 1.8% of MSAs tested would not be labelled as highly concentrated by the DOJ/FTC. Regardless, relative to the range reflective of the highest audit quality levels predicted by the model, large portions of the distribution remain too concentrated (25.3% of MSAs generated an HHI over 0.9 in 2014) or too competitive (22.1% of MSAs yielded an HHI below 0.35 in 2014). These large tails could be the source of the mixed literature with several studies finding benefits

⁷ One possible counterargument is that economic activity may have grown at a higher rate in the MSAs around the median which in turn enticed more competition in the audit market. However, I find that asset growth rate in these markets is comparable to the growth seen over the entire distribution over the same time period.

to competition (Boone et al., 2012; Francis et al., 2013) while others have found the opposite (Ding & Jia, 2012; Huang et al., 2016; Kallapur et al., 2010). Changes in the size of severity of the tails of the distribution over time would sway a linear relationship between competition and audit quality from one polarity to another.

If regulators are able to incentivize competition in heavily concentrated markets and promote consolidation in areas that are extremely competitive, local markets should observe increases in the quality of audits performed. This prediction cannot be made without several caveats on the limitations of this study. This study has been designed solely with the goal of showing conditions under which average audit quality improves. Given that, my results do not account for many of the tradeoffs that would need to be made in order to reorganize the competitive landscape. One large area of concern would be the costs of performing audits and the efficiency of the investment needed to improve audit quality beyond its current state. These costs could be borne by client companies, auditors, other stakeholders, governments, or regulators. My results cannot speak to the quantity of these costs or who should bear them. In the current climate, it appears that much of these costs may be borne by auditors. MSAs within the band where HHIs range from 0.430-0.734 collect significantly lower total fees per dollar of client assets audited than auditors in more or less competitive areas.

Beyond monetary costs, from a welfare perspective, it is unclear that all constituents would be made better off by the predicted improvements to audit quality. As competition levels change, client-auditor pairings may change in ways that harms uniquely beneficial engagements, such as companies in exotic industries that benefit from the presence of highly specialized

boutique auditors in large markets⁸. If competition was restricted, such boutique auditors may be absorbed into larger auditors with more general expertise. Additionally, many smaller markets are limited in the number of auditors they can feasibly support due to the low number of local client companies. Introducing competition into such markets could yield negative results if auditors cannot operate at a large enough scale to maintain profitability.

There are also other potentially harmful effects of regulating competition in the market for assurance services. Regulating competition could lead to stalls in long-term innovation. If competition is pinned to a target level, auditors may become less willing to invest in new techniques, practices, or services that could benefit their clients or the industry as a whole if their efforts will not be rewarded with additional market share. Alternatively, locking competition levels could lead to overinvestment in non-audit services if audit services become commoditized. These are just some of the potential risks in regulating competition. Further examination of natural experiments and pilot programs would be required before firm policy conclusions can be reached.

1.7 Conclusion

In this study, I propose and document a non-monotonic relationship between competition and audit quality. Measuring auditor competition at the MSA level, and using abnormal accruals, both signed and absolute, along with restatements as proxies for audit quality, I find that there exists a non-monotonic relationship between auditor competition and the average quality of audits performed. Audit quality is maximized within an intermediate band where markets are

⁸ Client companies in less competitive MSAs do not appear to be uniquely matched with ideal auditors; The percentage of client companies matched with national industry specialists is significantly lower in less competitive MSAs.

competitive enough to encourage auditors to compete based on the quality of their outputs but not so competitive as to incentivize myopic behavior and price competition. I also find evidence that the inflection points, where competition in a market turns from helpful to audit quality to harmful, is influenced by number of high quality auditors present, especially the Big 4.

These results can help to explain the mixed results found in the literature. Additional competition is not universally helpful or harmful to audit quality. Its effect is dependent on the current market structure and the quality of the entering or exiting firms. Although descriptive suggest that many of the monetary costs may be borne by auditors when they operate in areas with increased average audit quality, future work is needed in order to truly understand the costs associated with changing competitive landscapes as well as address externalities stemming from alternatives to current competitive structures.

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1.8 Appendix A – Variable Descriptions and Computations

Variables are marked in upper case and italics. Compustat item codes are listed in lower case and italics.

Dependent Variables:

Abbreviation	Calculations Using Compustat Data Item Codes (blank if variable is not constructed using database items)	Description
<i>ACCRUALS</i>	$\frac{1}{N} \sum_{i=1}^N \left(\frac{ACC_{i,t}}{AvgAT_{i,t,t-1}} - \widehat{\frac{ACC_{i,t}}{AvgAT_{i,t,t-1}}} \right)_i$	Average signed abnormal accruals where N is the number of firms within the MSA. Individual firm accruals are performance matched by two-digit SIC and year, based on return on assts. (Dechow et al., 1995; Jones, 1991; Kothari et al., 2005)
<i>ABSACCRUALS</i>	$\frac{1}{N} \sum_{i=1}^N \left(\left \frac{ACC_{i,t}}{AvgAT_{i,t,t-1}} - \widehat{\frac{ACC_{i,t}}{AvgAT_{i,t,t-1}}} \right \right)_i$	Average unsigned abnormal accruals where N is the number of firms within the MSA. Individual firm accruals are performance matched by two-digit SIC and year, based on return on assts.
$\frac{ACC_{i,t}}{AvgAT_{i,t,t-1}}$	$\beta_0 \left(\frac{1}{AvgAT_{i,t,t-1}} \right) + \beta_1 \left(\frac{\Delta REV_{i,t,t-1} - \Delta REC_{i,t,t-1}}{AvgAT_{i,t,t-1}} \right) + \beta_2 \left(\frac{PPE_{i,t}}{AvgAT_{i,t,t-1}} \right) + e_{i,t}$	Discretionary accruals scaled by average total assets following the Modified Jones model. $AvgAT$, ΔREV , ΔREC , and PPE represent average total assets, change in revenue, change in receivables, and property, plant and equipment, respectively.
<i>RESTATE</i>		Number of restatements issued for firms within the MSA divided by the total assets of firms within the MSA.

Variables of Interest:

Abbreviation	Calculation	Description
<i>HHI</i>	$\sum_{i=1}^N x_i^2$	Herfindahl-Hirschman Index for the MSA calculated based on client revenues x is the market share of auditor i based on client revenues

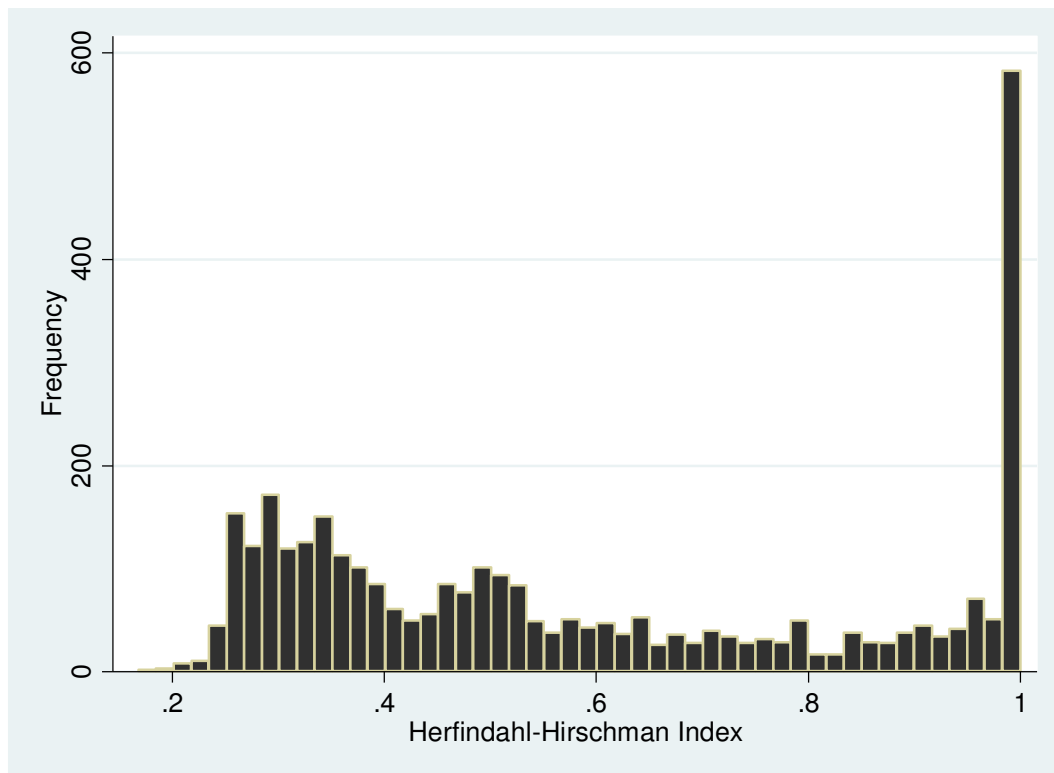
		N is the number of auditors in the MSA
<i>BIG4</i>		Count of the number of the Big 4 within the MSA with at least one client
<i>BIG7</i>		Count of the number of the Big 7 within the MSA with at least one client
<i>NEXT3</i>		Count of the number of Big 7 (but not Big 4) auditors within the MSA with at least one client
<i>NONBIG7</i>		Count of the number of non-Big 7 auditors within the MSA with at least one client
<i>HIGH_LESSCOMP</i>		Indicator for highly competitive MSAs (HHI < 0.460) that became less competitive between 2003-2006.
<i>LOW_MORECOMP</i>		Indicator for monopolistic MSAs (HHI > 0.734) that became more competitive between 2003-2006.

Controls:

Abbreviation	Compustat Data Item Code (blank if variable is not constructed using database items), N is the number of firms within the MSA	Data Source (CS/AA)	Description
<i>CFO</i>	$\frac{1}{N} \sum_{i=1}^N (oancf / at)_i$	CS	Average cash flow from operating activities scaled by total assets
<i>SEGNUM</i>		CS	The average number of operating segments that the firms within the MSA are comprised of
<i>ARIN</i>	$\frac{1}{N} \sum_{i=1}^N ((rect + invt) / at)_i$	CS	The average sum of receivables and inventory scaled by total assets
<i>TENURE</i>	Count variable, +1 if $auditor_fkey_i = auditor_fkey_{i-1}$, reset to 0 if $auditor_fkey_i \neq auditor_fkey_{i-1}$, then averaged for all firms within the MSA	AA	Average number of consecutive years that the current auditor has been auditing their current clients within the MSA
<i>GROWTH</i>	$\frac{1}{N} \sum_{i=1}^N \left(\frac{sale_i - sale_{i-1}}{sale_{i-1}} \right)_i * 100$	CS	Average growth rate of sales

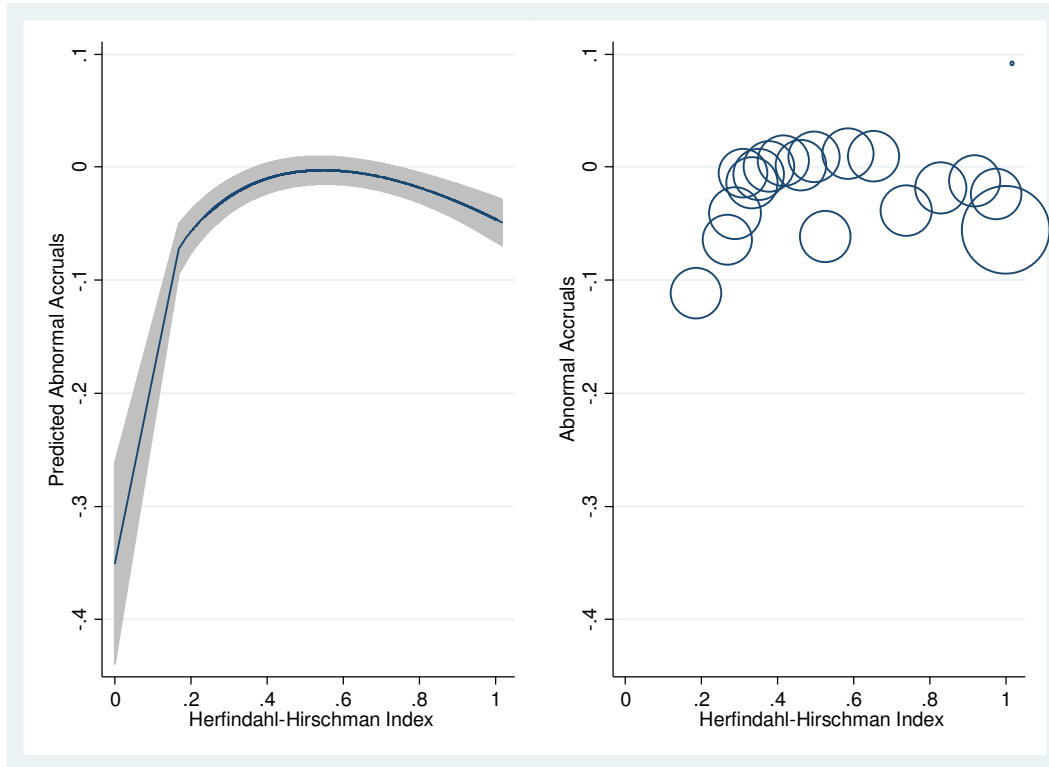
1.9 Figures and Tables

Figure 1.1: Herfindahl-Hirschman Index Distribution.



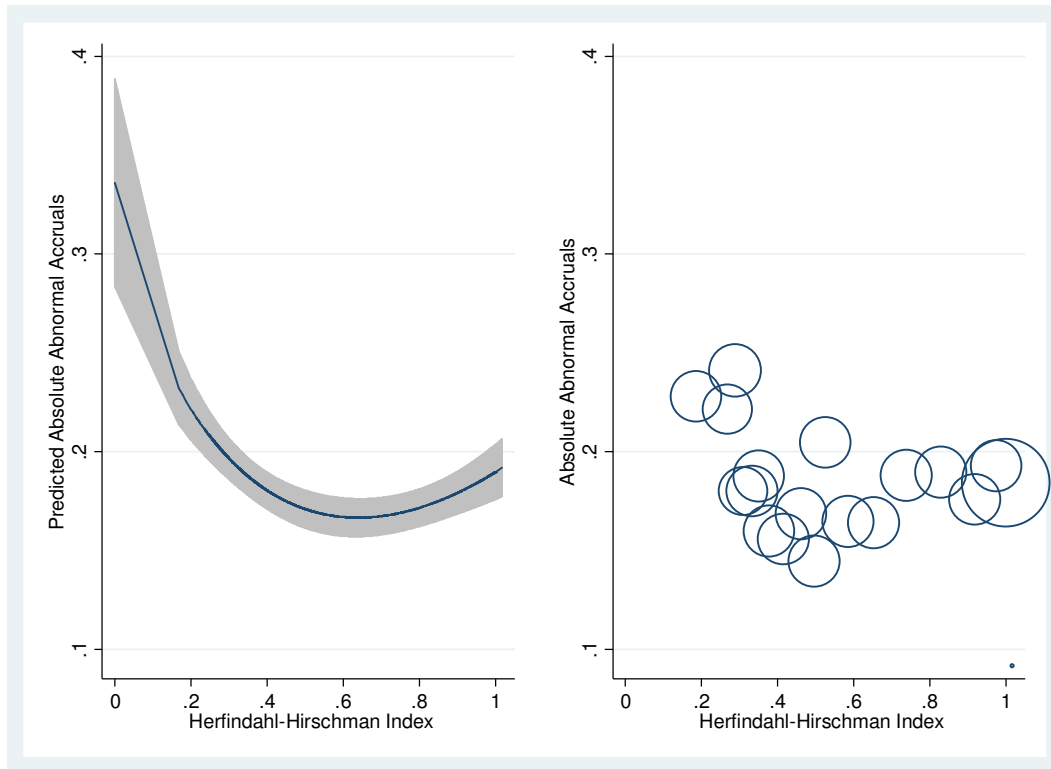
This figure displays the distribution of the Herfindahl-Hirschman Index for 3,465 MSA-year observations that comprise the sample. The average HHI is 0.587 and the median is 0.512.

Figure 1.2: Predicted vs Actual Relationship Between HHI and Abnormal Accruals



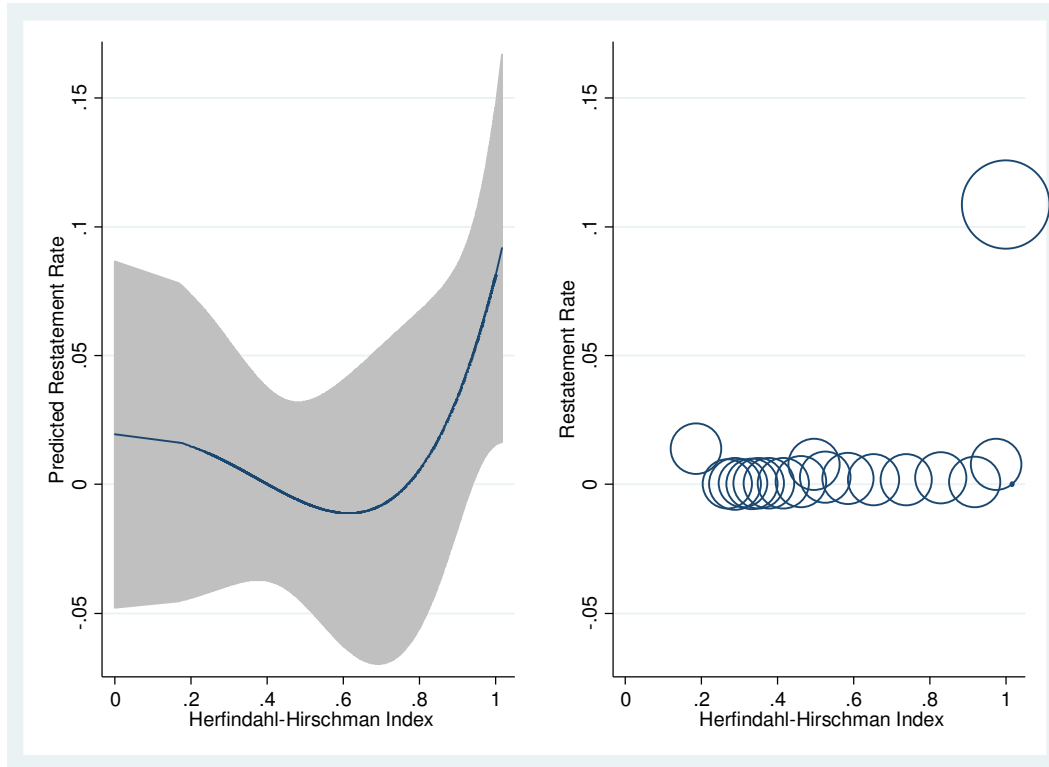
The graph on the left shows the predicted relationship between HHI and abnormal accruals. The blue line is a fractional polynomial plot with the 95% confidence interval shaded in grey. The right graph displays actual data plotting the relationship between HHI and abnormal accruals. The size of each circle is proportional to the density of observations represented.

Figure 1.3: Predicted vs Actual Relationship Between HHI and Absolute Abnormal Accruals



The graph on the left shows the predicted relationship between HHI and absolute abnormal accruals. The blue line is a fractional polynomial plot with the 95% confidence interval shaded in grey. The right graph displays actual data plotting the relationship between HHI and absolute abnormal accruals. The size of each circle is proportional to the density of observations represented.

Figure 1.4: Predicted vs Actual Relationship Between HHI and the Restatement Rate



The graph on the left shows the predicted relationship between HHI and the restatement rate. The blue line is a fractional polynomial plot with the 95% confidence interval shaded in grey. The right graph displays actual data plotting the relationship between HHI and the restatement rate. The size of each circle is proportional to the density of observations represented.

Table 1.1: Sample Construction

Observations by year:	Firms	MSAs
2000	3,383	211
2001	5,393	236
2002	8,223	247
2003	8,811	244
2004	8,889	248
2005	8,904	240
2006	8,735	234
2007	8,232	229
2008	8,166	225
2009	7,879	223
2010	8,184	225
2011	8,131	226
2012	8,048	228
2013	8,201	227
2014	7,600	222
Firm/MSA-years used in analysis	116,779	3,465

This table details the construction of the sample and the distribution of MSA-years.

Table 1.2A: Descriptive Statistics

Variable	N	Mean	Std. Dev.	25 th	50 th	75 th
<i>ACCRUALS</i>	3,465	-0.027	0.315	-0.047	0.039	0.087
<i>ABSACCRUALS</i>	3,465	0.186	0.213	0.083	0.128	0.212
<i>RESTATE</i>	3,465	0.001	0.006	0.000	0.001	0.001
<i>HHI</i>	3,465	0.587	0.275	0.344	0.512	0.883
<i>BIG4</i>	3,465	2.218	1.463	1.000	2.000	4.000
<i>BIG7</i>	3,465	2.822	2.019	1.000	2.000	5.000
<i>NEXT3</i>	3,465	0.603	0.768	0.000	0.000	1.000
<i>NONBIG7</i>	3,465	9.012	14.289	1.000	3.000	8.000
<i>CFO</i>	3,465	-0.345	2.388	-0.249	0.014	0.088
<i>SEGNUM</i>	3,465	1.132	0.864	1.000	1.000	1.000
<i>ARIN</i>	3,465	0.256	0.145	0.186	0.238	0.331
<i>TENURE</i>	3,465	10.945	15.563	5.000	8.772	11.750
<i>GROWTH</i>	3,465	24.639	79.563	0.083	10.240	28.727

This table presents descriptive statistics on the sample used. The continuous variables are winsorized at the 1st and 99th percentile.

Table 1.2B: Correlation Table

	<i>ACCRUALS</i>	<i>ABS ACCRUALS</i>	<i>RESTATE</i>	<i>HHI</i>	<i>BIG4</i>	<i>BIG7</i>	<i>NEXT3</i>	<i>NONBIG7</i>	<i>CFO</i>	<i>SEGNUM</i>	<i>ARIN</i>	<i>TENURE</i>	<i>GROWTH</i>
<i>ACCRUALS</i>	1												
<i>ABSACCRUALS</i>	-0.8469	1											
<i>RESTATE</i>	-0.1152	0.122	1										
<i>HHI</i>	0.0049	-0.037	0.0925	1									
<i>BIG4</i>	0.0283	0.0133	-0.1901	-0.6496	1								
<i>BIG7</i>	0.0213	0.0149	-0.1695	-0.6466	0.9523	1							
<i>NEXT3</i>	0.002	0.0137	-0.0835	-0.4622	0.5984	0.8142	1						
<i>NONBIG7</i>	-0.0553	0.1195	-0.0847	-0.5253	0.6145	0.6274	0.4786	1					
<i>CFO</i>	0.3393	-0.3174	-0.0063	0.0014	-0.0052	-0.0013	0.0065	-0.0618	1				
<i>SEGNUM</i>	0.0232	-0.0281	-0.0265	0.0364	0.0119	-0.0084	-0.0448	-0.024	0.0143	1			
<i>ARIN</i>	0.2135	-0.1365	-0.042	0.1622	-0.1007	-0.1043	-0.0823	-0.1429	0.1059	-0.0408	1		
<i>TENURE</i>	0.0521	-0.0796	-0.017	0.0016	0.0916	0.0793	0.0339	0.0784	0.0165	0.069	-0.0412	1	
<i>GROWTH</i>	-0.0194	0.0904	0.0591	-0.0369	0.0721	0.0846	0.0849	0.0602	0.0017	-0.0277	-0.0656	-0.0307	1

All remaining errors are my own. I would like to thank my dissertation committee (Thomas Ruchti, Jack Stecher, Pierre Liang, and Chan Li) for their guidance, the faculty and students of Carnegie Mellon University for their helpful comments. I gratefully acknowledge financial support from the Tepper School of Business at Carnegie Mellon University.

Table 1.3: Audit Quality as a Function of Local Competition/Concentration

VARIABLES	Expected Sign	(1) <i>ACCRUALS</i>	(2) <i>ABSACCRUALS</i>	(3) <i>RESTATE</i>
<i>HHI</i>	+ / - / -	0.516** (2.004)	-0.347** (-2.214)	-0.009* (-1.703)
<i>HHI</i> ²	- / + / +	-0.428** (-2.148)	0.275** (2.247)	0.008** (2.072)
<i>CFO</i>	+ / - / -	0.041*** (3.448)	-0.026*** (-3.859)	-0.000 (-0.148)
<i>SEGNUM</i>	- / + / +	0.008** (2.187)	-0.005 (-1.421)	-0.000* (-1.914)
<i>ARIN</i>	- / + / +	0.390*** (4.271)	-0.140** (-2.159)	-0.001 (-0.950)
<i>TENURE</i>	+ / - / -	0.000 (1.053)	-0.001*** (-2.609)	0.000 (0.600)
<i>GROWTH</i>	- / + / +	-0.000 (-0.443)	0.000** (2.290)	0.000 (1.054)
Industry Fixed Effects			Included	
Year Fixed Effects			Included	
Constant		-0.224*** (-2.695)	0.263*** (5.412)	0.004** (2.304)
Observations		3,465	3,465	3,465
R-squared		0.188	0.168	0.039

Clustered t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

This table presents the results of ordinary least squares regressions using clustered standard errors. Errors are clustered by MSA. The dependent variable for column (1) is average performance-matched abnormal accruals for all client companies within the MSA-year. The dependent variable for column (2) is average performance-matched absolute abnormal accruals for all client companies within the MSA-year. The dependent variable for column (3) is the number of restatements issued by client companies within the MSA-year observation scaled by the total assets of the client companies within the MSA-year. The variables of interest are *HHI* and *HHI*² which are the Herfindahl-Hirschman Index calculated based on the revenue of client companies. Industry and year fixed effects are included. Industry fixed effects are determined used the Fama-French 12 standard industry classifications.

All remaining errors are my own. I would like to thank my dissertation committee (Thomas Ruchti, Jack Stecher, Pierre Liang, and Chan Li) for their guidance, the faculty and students of Carnegie Mellon University for their helpful comments. I gratefully acknowledge financial support from the Tepper School of Business at Carnegie Mellon University.

Table 1.4A: Effects of Varying Levels of Competition (Partitioned by Median HHI)

VARIABLES	LOW COMPETITION			HIGH COMPETITIVE		
	(1) <i>ACCRUALS</i>	(2) <i>ABS ACCRUALS</i>	(3) <i>RESTATE</i>	(4) <i>ACCRUALS</i>	(5) <i>ABS ACCRUALS</i>	(6) <i>RESTATE</i>
<i>HHI</i>	0.491*** (2.642)	-0.366*** (-3.952)	-0.005 (-1.571)	-0.091 (-0.991)	0.043 (0.774)	0.003* (1.824)
Controls			Included			
Industry FE			Included			
Year FE			Included			
Observations	1,730	1,730	1,730	1,735	1,735	1,735
R-squared	0.119	0.190	0.043	0.194	0.176	0.039

Clustered t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

This table presents the results of ordinary least squares regressions using clustered standard errors. Errors are clustered by MSA. The dependent variable for column (1) and (4) is average performance-matched abnormal accruals for all client companies within the MSA-year. The dependent variable for column (2) and (5) is average performance-matched absolute abnormal accruals for all client companies within the MSA-year. The dependent variable for column (3) and (6) is the number of restatements issued by client companies within the MSA-year observation scaled by the total assets of the client companies within the MSA-year. Industry and year fixed effects are included. Industry fixed effects are determined used the Fama-French 12 standard industry classifications. All controls from Table 1.3 are included in the regression.

The results are partitioned based on the median Herfindahl-Hirschman Index of the sample. MSAs above the median are marked as low competition while those equal to or below the median are labeled as high competition.

Table 1.4B: Effects of Varying Levels of Competition (Partitioned by Predicted Points of Inflection)

VARIABLES	LOW COMPETITION			HIGH COMPETITIVE		
	(1) <i>ACCRUALS</i>	(2) <i>ABS ACCRUALS</i>	(3) <i>RESTATE</i>	(4) <i>ACCRUALS</i>	(5) <i>ABS ACCRUALS</i>	(6) <i>RESTATE</i>
<i>HHI</i>	0.236*	-0.185***	-0.002	-0.074	-0.012	0.004*
	(1.853)	(-2.758)	(-0.709)	(-0.738)	(-0.173)	(1.846)
Controls			Included			
Industry FE			Included			
Year FE			Included			
Observations	2,037	2,109	1,922	1,428	1,356	1,543
R-squared	0.131	0.164	0.056	0.265	0.217	0.046

Clustered t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

This table presents the results of ordinary least squares regressions using clustered standard errors. Errors are clustered by MSA. The dependent variable for column (1) and (4) is average performance-matched abnormal accruals for all client companies within the MSA-year. The dependent variable for column (2) and (5) is average performance-matched absolute abnormal accruals for all client companies within the MSA-year. The dependent variable for column (3) and (6) is the number of restatements issued by client companies within the MSA-year observation scaled by the total assets of the client companies within the MSA-year. Industry and year fixed effects are included. Industry fixed effects are determined using the Fama-French 12 standard industry classifications. All controls from Table 1.3 are included in the regression.

The results are partitioned based on the predicted Herfindahl-Hirschman Index inflection points from the main analysis (Table 1.3). MSAs above the inflection points are marked as low competition while those equal to or below are labeled as high competition. The predicted inflection points are 0.603, 0.631, and 0.5625 for columns (1), (2), and (3) respectively.

Table 1.5A: Market Saturation of High Quality Auditors (Big 4)

VARIABLES	Expected Sign	(1) <i>ACCRUALS</i>	(2) <i>ABSACCRUALS</i>	(3) <i>RESTATE</i>
<i>BIG4</i>	+ / - / -	0.071 (1.581)	-0.058** (-2.348)	-0.003*** (-4.225)
<i>BIG4</i> ²	- / + / +	-0.014 (-1.531)	0.013** (2.470)	0.001*** (3.702)
Controls			Included	
Industry FE			Included	
Year FE			Included	
Observations		3,465	3,465	3,465
R-squared		0.188	0.171	0.079

Clustered t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

This table presents the results of ordinary least squares regressions using clustered standard errors. Errors are clustered by MSA. The dependent variable for column (1) and (4) is average performance-matched abnormal accruals for all client companies within the MSA-year. The dependent variable for column (2) and (5) is average performance-matched absolute abnormal accruals for all client companies within the MSA-year. The dependent variable for column (3) and (6) is the number of restatements issued by client companies within the MSA-year observation scaled by the total assets of the client companies within the MSA-year. The variables of interest are *BIG4* and *BIG4*² which reflect the number of Big 4 auditors with at least one client in the MSA. Industry and year fixed effects are included. Industry fixed effects are determined used the Fama-French 12 standard industry classifications. All controls from Table 1.3 are included in the regression.

Table 1.5B: Market Saturation of High Quality Auditors (Big 7)

VARIABLES	Expected Sign	(1) <i>ACCRUALS</i>	(2) <i>ABSACCRUALS</i>	(3) <i>RESTATE</i>
<i>BIG7</i>	+ / - / -	0.040 (1.598)	-0.024* (-1.713)	-0.002*** (-4.078)
<i>BIG7</i> ²	- / + / +	-0.005 (-1.575)	0.004* (1.877)	0.000*** (3.241)
Controls			Included	
Industry FE			Included	
Year FE			Included	
Observations		3,465	3,465	3,465
R-squared		0.186	0.166	0.067

Clustered t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

This table presents the results of ordinary least squares regressions using clustered standard errors. Errors are clustered by MSA. The dependent variable for column (1) and (4) is average performance-matched abnormal accruals for all client companies within the MSA-year. The dependent variable for column (2) and (5) is average performance-matched absolute abnormal accruals for all client companies within the MSA-year. The dependent variable for column (3) and (6) is the number of restatements issued by client companies within the MSA-year observation scaled by the total assets of the client companies within the MSA-year. The variables of interest are *BIG7* and *BIG7*² which reflect the number of Big 7 auditors with at least one client in the MSA. Industry and year fixed effects are included. Industry fixed effects are determined used the Fama-French 12 standard industry classifications. All controls from Table 1.3 are included in the regression.

Table 1.6: Effects of Market Entry for Different Tiers of Auditors

VARIABLES	Expected Sign	(1) <i>ACCRUALS</i>	(2) <i>ABSACCRUALS</i>	(3) <i>RESTATE</i>
<i>BIG4</i>	+ / - / -	0.070*** (2.807)	-0.052*** (-3.525)	-0.003*** (-6.074)
<i>BIG4</i> ²	- / + / +	-0.013** (-2.535)	0.010*** (3.182)	0.001*** (5.399)
<i>NEXT3</i>	?	0.005 (0.726)	-0.004 (-0.811)	-0.000** (-2.084)
<i>NONBIG7</i>	?	-0.001* (-1.731)	0.002*** (7.416)	-0.000*** (-3.320)
Controls			Included	
Industry FE			Included	
Year FE			Included	
Observations		3,465	3,465	3,465
R-squared		0.188	0.176	0.080

Clustered t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

This table presents the results of ordinary least squares regressions using clustered standard errors. Errors are clustered by MSA. The dependent variable for column (1) and (4) is average performance-matched abnormal accruals for all client companies within the MSA-year. The dependent variable for column (2) and (5) is average performance-matched absolute abnormal accruals for all client companies within the MSA-year. The dependent variable for column (3) and (6) is the number of restatements issued by client companies within the MSA-year observation scaled by the total assets of the client companies within the MSA-year. The variables of interest are *NEXT3* and *NONBIG7*. *NEXT3* reflects the number of Big 7 auditors that are not Big 4 auditors with at least one client in the MSA. *NONBIG7* reflects the number of non-Big 7 auditors with at least one client in the MSA. Industry and year fixed effects are included. Industry fixed effects are determined used the Fama-French 12 standard industry classifications. All controls from Table 1.3 are included in the regression.

Chapter 2

Local Competition and Auditors' Use of Non-Audit Services

ABSTRACT

Non-audit services provide auditors a platform to market their unique expertise and provide services far surpassing the necessities of an audit. In this paper I study the effect of local competition on auditors' use of non-audit services. My findings show that auditors respond to intensifying competition by increasing their emphasis on selling non-audit services. This response is especially strong when there exists a wide range in the audit qualities being offered by competing firms or when audit fees are depressed. The results suggest that non-audit services function as both a differentiation tool for higher quality firms as well as a supplementary revenue stream when audit fees are reduced. I also find that the use of non-audit services reduces audit quality, especially in highly competitive environments, indicating that the types of non-audit services being sold in competitive markets are more detrimental to audit quality than those sold elsewhere.

Keywords: non-audit services, local competition, fee pressure, differentiation, audit quality

All remaining errors are my own. I would like to thank my dissertation committee (Thomas Ruchti, Jack Stecher, Pierre Liang, and Chan Li) for their guidance, the faculty and students of Carnegie Mellon University, Brock University, and the participants of the 2018 AAA Auditing Midyear Meeting for their helpful comments. I gratefully acknowledge financial support from the Tepper School of Business at Carnegie Mellon University and the Goodman School of Business at Brock University.

2.1. Introduction

The role and value of the auditor provided non-audit services (NAS) offered by public accounting firms to their clients has long been questioned by academics and regulators (Antle, Gordon, Narayanamoorthy, & Zhou, 2006; Gigler & Penno, 1995; Tysiac, 2013; Whisenant, Sankaraguruswamy, & Raghunandan, 2003). Traditionally, non-audit services consist of advisory and other compliance-related services performed by a company's external auditor that are designed to help the operate more effectively (Ernst & Young, 2013). This arrangement, where the same firm is contracted to conduct both an independent audit of the company's financials as well as provide guidance on business matters has led many to raise concerns about auditor independence (Ashbaugh, LaFond, & Mayhew, 2003; DeFond, Raghunandan, & Subramanyam, 2002; Kinney, Palmrose, & Scholz, 2004). Some studies have found evidence that audit quality falls when a company increases its use of their auditor's non-audit services (Frankel, Johnson, & Nelson, 2002; Srinidhi & Gul, 2007), though the consensus is unclear as to the exact conditions under which NAS are harmful to audit quality (Antle et al., 2006; Ashbaugh et al., 2003; Knechel, Sharma, & Sharma, 2012; Lim & Tan, 2008). By definition, these services are non-essential to the audit process. Nevertheless, clients are compelled to spend millions of dollars annually on them in addition to the standard audit fees (Harris, 2014). One important question that remains difficult to answer is how auditors approach negotiations over the quantity of non-audit services to be provided. Are NAS a value add offered by the auditor that stand independent of the audit fee negotiations? Or do non-audit services feature prominently in a firm's ability to court clients and differentiate itself in competitive landscape.

This paper aims to address two central questions. The first is does the intensity of local competition affect the quantity of non-audit services sold. And if so, through what channels does

competition make itself apparent? The second question is are the non-audit services sold in competitive markets different in their impact on audit quality relative to those sold in less competitive markets? By exploring these questions, we can better understand auditor-client fee negotiations, as well as the dynamics within audit firms as they seek to optimize the combined profits of their two chief revenue streams. By tackling these questions, we are also able to gain insight on how bargaining power between auditors and their clients shifts based on the strength of the alternate suppliers of accounting services and what affect that can have on the resulting audit quality.

In this study I examine the relationships between non-audit service fees, audit quality, and two different measures of local market competitiveness, each of which captures a different aspect of the competitive landscape. The first measure of local competition is a Herfindahl-Hirschman Index (HHI) calculated using audit fees paid by client companies to determine market share. This allows me to measure competition as a function of the audit fees that clients generate, going beyond a client company's size and giving insight into how valuable particular clients are from a revenue perspective. My second measure of local competition is a count of the number of auditors actively engaged with at least one client within the area.⁹ This second measure captures new entrants and departures as competing audit firms acquire at least one client or lose their remaining clients within the area. This allows me to look past the major auditors in the market and test the sensitivity of firms to even a relatively small addition or subtraction to the local supply of active accounting firms. Local markets are measured at the U.S. Metropolitan Statistical Area (MSA) level¹⁰.

⁹ From a practical standpoint, I only capture companies that appear in both AuditAnalytics and Compustat, and thus are fairly large relative to the range of all possible companies.

¹⁰ Given my lack of access to local office level data, I define a local market based on a contiguous geographic plot. Although some offices may service many MSAs (such as in rural areas) or many offices may serve one MSA (such

My sample spans the period of 2000-2014 and contains 103,002 firm-year observations across 3,465 MSAs. The data on audit and non-audit service fees as well as auditor-client matchings is gathered from AuditAnalytics, with the remaining variables are either sourced directly from or calculated using Compustat data. My first set of analyses addresses competition's impact on the use of non-audit services with my second set of analyses investigates the effect of non-audit services on audit quality.

Results from the initial analyses suggest that, on average, the quantity of non-audit services provided to each client increases when local markets become more competitive.¹¹ When the market share amongst audit firms becomes less concentrated or additional firms enter the market, auditors respond by placing increased emphasis on selling and providing non-audit services. The results suggest that a one standard deviation decrease (increase) in the HHI (number of competing audit firms) corresponds with an estimated 2% (5%) increase in the amount of NAS sold. The results provide evidence that the allocation of an auditor's resources devoted to NAS is tied to the competition that it faces in the audit market, suggesting that non-audit services and their role within the audit firm cannot be considered independently of the firm's audit-related offerings.

From my second set of analyses investigating the effect of NAS on audit quality, I find a universally negative response to non-audit services from audit quality as well as an increase to the strength of NAS' negative effect on audit quality as competition rises. These findings suggest

as in densely populated cities), the MSA level functions as an approximation of an area that must be served by an auditor's local resources.

¹¹ My primary tests use the log non-audit service fees for the dependent variable, as it serves as a proxy for the quantity of NAS provided. The major assumption needed in interpreting results using this measure is that we must be assured that the pricing of non-audit services either does not vary across observations or that any systematic variation can be sufficiently controlled for. In order to guard my results against bias stemming from variations across time, industry, auditor, or area I include year fixed effects, industry fixed effects, auditor fixed effects, and cluster standard errors by MSA.

that non-audit services not only negatively impact audit quality, but as competition rises the types of non-audit services being provided become increasingly detrimental to audit quality. To proxy for audit quality I utilize restatements as well as abnormal accruals measures.

As a historical test of an unexpected shock to competition, I study the dissolution of Arthur Andersen in 2002. Using a difference-in-differences approach I find that engagements in areas where Arthur Andersen was operating in 2001 and then exited in 2002 saw larger decreases in non-audit services use than areas in which Arthur Andersen had never operated. My results suggest that areas that saw a negative shock to competition significantly reduced their use of non-audit services, even after controlling for the general effects of SOX and auditor changes. I also find consistent results when using pre-collapse market shares to predict post-collapse HHIs in a two-stage least squares framework.

I perform several additional tests to determine the channels through which competition is sparking increases in non-audit services. In particular, I examine firm-years in which the difference in audit quality between competing firms is large or audit service fees are depressed. I find evidence that suggests that increases in NAS as a response to tougher competition is prevalent in both scenarios. Firm-years in which there is a greater difference in the average audit quality provided by the highest quality firms as compared to the lowest quality firms show heightened sensitivity to both measures of competition. Further, these effects appear to be driven by the higher quality firms, suggesting that high audit quality firms capitalize on the superior quality of their audit services in order to promote their non-audit services.

Additionally, I find increased sensitivity to competition in firm-years where audit fees are relatively underpriced given the size and characteristics of client companies. This suggests that there is an increase in the emphasis placed on non-audit fee revenue when audit fees are

depressed. The reduction in incoming audit fees puts pressure on auditors to generate additional income from alternate revenue streams and we see this manifest itself through increases in the use of non-audit services. However, the increases in NAS are not solely due to fee pressure. Even in firm-years without underpriced audit fees I still observe increases in NAS for companies in areas with a higher number of active auditors. Entry from new competitors is felt regardless of its impact on audit fees.

Lastly, I find that Big 4 auditors are affected by competition at both the market share distribution level and the market entry level, meanwhile non-Big 4 auditors solely respond to changes in the number of market participants. Auditors at all levels respond to competition with an increased focus on non-audit services. However, different tiers of auditors feel competition from different sources. The Big 4 are concerned with market distribution as a whole in addition to the entry of new competitors while smaller auditors are primarily concerned with the presence of other boutique auditors who are more likely to be their direct competitors.

This study contributes to the literature in several ways. The first is that it demonstrates a clear relationship between local competition and the use of non-audit services. Linking competition directly to the diversion of limited local resources from audit to non-audit services raises an important issue in our understanding of the relationship between non-audit services and audit quality. If local competition is driving auditors to focus their efforts more on non-audit services, the observed reductions in audit quality when non-audit services increases may be purely, or at least partially, a result of resource allocation rather than violations of independence. Any incentive that diverts resources or effort away from audit services have the potential to reduce audit quality (Ho, 2019). It is important that future work distinguish between the

compromising of auditors' ethical standards and reductions in the resources spent on assurance that are the direct result of increased emphasis towards NAS.

A second major contribution is the documentation of auditors using non-audit services as a differentiation tool. Following recent studies citing the commoditization of audit services (Christensen, Omer, Sharp, & Shelley, 2014), the results of my paper show that auditors use non-audit services to differentiate themselves from the competition. This is also the first paper to document different responses to competition with respect to non-audit services based on the quality of the firms' assurance outputs. This furthers the literature on the joint determination of audit and non-audit fees showing that higher quality auditors do bargain for more non-audit services fees based on their audit quality.

The third way in which this study contributes to the literature is that it provides insight on the relationship between competition, non-audit services, and audit quality. In addition to finding evidence consistent with prior studies that suggest fee pressure from reduced audit fees pushes auditors to increase their non-audit service fees (Beardsley, Lassila, & Omer, 2016), I also find that the non-audit services contracted in highly competitive markets are more harmful to audit quality. This suggests that not all non-audit services have identical effects and the types of non-audit services provided in competitive markets may be adapted in ways that are undesirable.

Finally, the results of this study are of practical use to regulators. In recent years, Europe has begun to cap the value of non-audit services that an auditor can provide relative the value of the assurance fees paid (Ritter, 2015). My findings suggest that such a cap may be effective in the US as well as it would limit the potential profitability of diverting additional resources to non-audit services. By limiting firms in this way, regulators can incentivize firms to prioritize

audit services as their primary source of income and ensure sufficient resources are allocated to assurance.

The remainder of this chapter is structured as follows. Section 2 provides background information and summarizes relevant literature. Section 3 develops hypotheses for testing. Section 4 outlines the data and the methodology used. Section 5 discusses results and their implications. Section 6 concludes.

2.2. Background and Literature Review

The study of the multiproduct firm has its roots in the theory of the firm in economics. Early work on multiproduct firms focused on barriers to entry such as economies of scale, scope, or the contestability of markets that would determine feasible sustainable market structures (Willig, 1979; Baumol, Panzar, & Willing, 1982; Bailey & Friedlaender, 1982) or varying quality within a single firm's product line (Katz, 1984; Champsaur & Rochet, 1989). Although economies of scale, scope, and the contestability of markets are all relevant factors in determining competition in audit markets, my pursuit in this paper is not to explain the cause of market entry or exit. Rather, I will focus on the changes observed after market entry/exit decisions have already been made. Although there is some evidence linking reputationally higher quality auditors to price premiums (Basioudis & Francis, 2007; Carson, Simnett, Soo, & Wright, 2012), offering services of varying qualities within the same firm is not a common practice in auditing.

One strain of economic research on multiproduct firms is directly applicable to the case of audit and non-audit services. Johnson & Myatt (2003) model the response of multiproduct firms to new entrants in the market. Their model predicts that after new competitors enter,

incumbents will expand their production of products/services whose marginal revenues are the least sensitive to outside competition. This provides a theoretical foundation for why auditors may opt to focus more heavily on non-audit services, a differentiated product that is negatively affected less by competition, when competition intensifies.

However, audit and non-audit fees still present a unique challenge for study. Though they can be purchased separately, they often resemble complementary goods where one is not purchased/produced without the other. The relationships between audit fees, and non-audit services has been a constantly evolving challenge for researchers to understand. In early work, Simunic (1984) found a positive relation between audit fees and non-audit service fees, which he theorized to be evidence of knowledge spillovers between the two categories of services. However, shortly after Palmrose (1986b) discovered that this relationship extended beyond accounting related managerial advisory services which further suggested a joint determination of audit and non-audit fees. This work was followed by Davis, Ricchiute, and Trompeter (1993) who found consistent results with a positive association between audit fees and non-audit fees with new data but, contrary to previous belief, they attributed the effect to increased effort on the part of auditors, rather than any knowledge spillovers. Whisenant et al. (2003) posited that the previously observed mixed results could be explained by simultaneous-equations bias and that audit and non-audit fees were simultaneously jointly determined. They warned against inferences using fees and called for the documentation of joint-supply benefits before proper inference could be drawn about the existence of knowledge spillovers. Answering the call, Antle et al. (2006) have provided such evidence using United States and United Kingdom data meanwhile Knechel et al. (2012) have shown a connection between non-audit services and reduced audit lags in New Zealand.

Recently, new trends have emerged with data showing the growth of non-audit service fees outpacing the growth of audit fees within the Big 4 (Harris, 2014) but not at the rest of the audit firms (Hannen, 2015). These opposing trends suggest that the competitive landscape in which audit firms operate and sell their non-audit services may be a key driver in their use. While there was consolidation at the top of the audit industry from the Big 5 to the Big 4 with the fall of Arthur Andersen in 2002, when Dunn, Kohlbeck, and Mayhew (2011) studied the effect of the consolidations following SOX they only found increased market concentration for industry leaders. While there has been past evidence that audit fees are sensitive to competition (Bandyopadhyay & Kao, 2001; Maher, Tiessen, Colson, & Broman, 1992; Sanders, Allen, & Korte, 1995), post-SOX data continues to indicate that the Big 4 continue to operate in a fee space that is very different from smaller accounting firms (Carson, Simnett, Soo, & Wright, 2012). While Aobdia, Enache, and Srivastava (2016) have identified signs that the stranglehold the Big 4 possesses on the audit market is loosening, the Big 4 still control an overwhelming majority of the market. Companies who opt for a Big 4 vs non-Big 4 audit still appear to have fundamental differences (Guedhami, Pittman, & Saffar, 2014; D. Hay & Davis, 2004; Hope, Kang, Thomas, & Yoo, 2008) which suggests competition will be felt within group rather than form the whole market.

There is also a growing literature on clients pressuring auditors to lower audit fees in recent years. Ettredge, Fuerherm, and Li (2014) and Christensen et al. (2014) both document reductions in audit fees in the U.S. following the recession of the late 2000s. Beardsley et al. (2016) demonstrated this fee pressure's role in directly pushing audit offices to increase their focus on non-audit services. They also find that this effect is greater at small and mid-size auditors. Given that this office-level finding contradicts the overall trend that non-audit service

growth has not been widely observed at non-Big 4 firms, it may be the case that the behavior is a response to stickiness in the availability of local resources. This especially may be the case given that Numan and Willekens (2012) found evidence that local differentiation can be important to an auditor's success and Nagy, Sherwood, and Zimmerman (2017) found that audit office quality is associated with the quantity of local resources.

Continuing with the theme of fee reductions, the supply of non-audit services has also been linked to underpricing in the form of lowballing. Patel and Prasad (2013), examine lowballing in Fiji and find a positive relationship between the supply of non-audit services and lowball engagements. They also find that this association is stronger for non-Big 4 firms and that the amount of non-audit services provided to these engagements decreases with tenure. They position these results as evidence of opportunistic promotion of non-audit services on the part of auditors early in the client-auditor relationship.

Non-audit services have also been studied in relation to audit quality with extremely mixed results. Frankel et al. (2002) concluded that NAS were associated with higher discretionary accruals but then were later rebuffed by Ashbaugh et al. (2003) which found no association between NAS and discretionary accruals after controlling for firm performance. Antle et al. (2006) found NAS to reduce discretionary accruals, suggesting that non-audit services provided knowledge spillovers that would aid in conducting the audit. Srinidhi and Gul (2007) examined accruals quality and concluded that non-audit service fees were negatively related to accruals quality. Lim and Tan (2008) studied the relationship between NAS and the issuance of going-concern opinions, the propensity of firms to miss analysts' forecasts, and earnings-response coefficients. They found that NAS' effect was dependent on whether or not

the client employed an auditor that was an industry specialist. Later on, Knechel et al. (2012) found no negative effects of non-audit services if the NAS coincided with a shorter audit lag.

Although non-audit services in the vast majority of cases will not lead to fraud, it is clear that they are closely connected to the way firms compete and reporting outcomes. They are not an accessory to the audit but rather a key component in the package of services offered to clients. The better we can understand the link between competition and non-audit services the more informed we will be when it comes to interpreting the risk of fraud, comprehending the nature of the auditor-client relationship, and forecasting trends in the long-term viability of audit markets.

2.3. Hypothesis Development

Broadly defined, non-audit services can be comprised of any services provided by an auditor to a client outside of the formal audit proceedings that is not specifically cited in Section 201 of the Sarbanes Oxley Act as one of the nine non-permissible classes of non-audit services. These services must also be approved by the client's audit committee and should not impair an auditor's independence during the auditing process. But even with these strict guidelines in place, non-audit services can still take many forms and vary across different firms (Ernst & Young, 2013), though for the most part they manifest themselves in the form of advisory services. These advisory services can include guidance on how to conform to laws and regulations, handle mergers and acquisitions, or general business advice. These services add value by providing clients with insightful guidance on operational decisions (Ciconte III, Knechel, & Mayberry, 2014) while simultaneously providing auditors with a deeper understanding of their clients' business activities (Antle et al., 2006; Knechel et al., 2012; Wu, 2006). Advisory services help auditors better understand the business challenges that their clients

face, generating both expertise about the client's unique circumstances and the opportunity for auditors to contribute to and empathize with the decisions that their clients make (Ciconte III et al., 2014). These knowledge spillovers may reduce conflict during the audit as the auditor should already be familiar with why certain decisions by the client have been made but come at the cost of possible threats to independence.

If auditors have the capacity to provide additional non-audit services and these services earn positive profits, we should expect auditors to attempt to maximize the quantity of non-audit services provided at all times. However, given that non-audit services come at a monetary cost to clients and a resource cost to the auditor (Beardsley et al., 2016), audit firms may wish to be selective about when and how much they try to sell NAS to their clients. If local audit offices have sticky short run resources, auditors will face a trade-off between allocating resources between NAS and the audit function. Further, increases in the use of NAS may overwhelm the natural capacity of an auditor's NAS staff and lead to reductions in service quality (Khanna, Noe, & Sonti, 2008).

One situation in which auditors may have incentive to alter their behavior with respect to non-audit services is in the presence of heightened levels of competition. There are several reasons why auditors may decide to do this. I will begin by discussing some of the reasons why we might observe increased use of non-audit services in highly competitive markets, followed by reasons to the contrary.

The first reason why auditors may decide to raise their emphasis on non-audit services in areas where there exists intense competition is that NAS may act as tool for differentiating their offerings from those of competing firms. The type and quality of the advisory services than any individual firm can offer will vary depending on their personnel, their experiences, and the

personal and professional networks they have to draw upon (Bird, Ho, & Ruchti, 2016; Ernst & Young, 2013). In this way, each audit firm can position its non-audit services as a unique offering that cannot be identically replicated. This differentiation could become especially important if auditors believe that clients cannot easily distinguish between the quality of the outputs of competing auditors. Oddly, we may also expect to observe this behavior on the other end of the spectrum as well, where clients can easily distinguish between the quality of the outputs of competing auditors. If outputs are sufficiently distinguishable then non-audit services could be employed by low quality firms to try and reduce the perceived gap between them and higher quality firms in terms of the total value offered to clients. Simultaneously, if outputs are easily distinguishable then higher quality firms may use their bargaining power and credibility as known superior quality firms to impose greater usage of non-audit services on clients who wish to engage with them, just as they do when negotiating audit fee premiums (Carson et al., 2012).

A second reason why auditors may be inclined to push for the increased usage of non-audit services in competitive markets comes from their inability to extract sufficient rents from assurance services alone. In markets where audit competition is high, firms have been observed to begin competing based on price (Maher et al., 1992). This price competition can drastically reduce the profitability of assurance services. If this is the case then it would be natural for audit firms to look for alternate revenue sources from which to derive profits. One of these sources being non-audit services (Beardsley et al., 2016).

A third reason why auditors may seek to increase their production of NAS in competitive markets is that NAS may provide knowledge spillovers that increase the quality of their audits (Antle et al., 2006). If the in-depth knowledge of clients gained from providing non-audit

services is beneficial to the audit, then auditors may wish to provide additional NAS in competitive markets in order to improve their audits.

There are also many reasons why we might expect the opposite result, with audit firms reducing their use of non-audit services in more competitive markets. For one, this could occur if clients do not see the value in non-audit services. If clients view these services to be more of an add-on that functions as a tool to appease the auditor rather than to actually add value then we would expect client companies to use a competitive supply market to minimize the amount of non-audit services they pay for. In this case the observed usage of non-audit services would be driven by the relative bargaining power of auditors and potential clients, and we would expect to see very little usage of non-audit services in highly competitive markets.

Similarly, even if non-audit services are deemed as valuable by client companies, we may see the fees that they generate reduced in highly competitive markets due to price competition. It is already established in the literature that auditors have been observed to reduce their audit fees in competitive markets in order to court clients (Maher et al., 1992). If markets are sufficiently competitive, they may choose to do the same with non-audit services and reduce the fees they charge for advisory work in order to gain favor with potential clients.

Lastly, auditors may be reluctant to increase their use of NAS due to fears of reduced audit quality or breaches to independences (in practice or perception). If local audit offices are limited in their resources, allocating additional resources to non-audit services will detract from the attention that will be paid to the audit function. Auditors may have quality and reputational concerns with respect to their assurance services that prevent them from increasing NAS production in competitive markets.

Taking all of these arguments into consideration it is unclear how we should expect the use of non-audit services to respond to competitive markets, thus creating the need for empirical investigation. The effects that we observe on the usage of non-audit services will depend on if auditors are able to retain their bargaining power to sell their monopolistic product (NAS) when faced with high levels of competition or if the increased competition will shift bargaining power to the side of client companies, forcing reductions in the price or the use of non-audit services. I express my two hypotheses without an expected sign as follows:

H1: The competitiveness of suppliers in the audit services market will affect the usage of non-audit services

In order to test this hypothesis, I have developed the following regression:

$$\text{Non-Audit Service Fees} = \beta_0 + \beta_1 \text{Competition} + \beta_2 \text{Controls} + \varepsilon \quad (1)$$

H2: The effect of non-audit services on audit quality will be affected by the competitiveness of the audit market

To test this hypothesis, a regression of the following form will be used:

$$\begin{aligned} \text{Audit Quality} = & \gamma_0 + \gamma_1 \text{Non-Audit Service Fees} + \gamma_2 \text{Competition} \\ & + \gamma_3 \text{Non-Audit Service Fees} * \text{Competition} + \gamma_4 \text{Controls} + \varepsilon \end{aligned} \quad (2)$$

All variables and testing procedures will be discussed and defined in Section 4.

2.4. Data and Methodology

2.4.1. Data Overview and Sample Construction

My sample is constructed using all firm-years that can be matched across both the Compustat and AuditAnalytics databases within the time period of 2000-2014. This provides

114,643 potential firm-years for my study. Removing 11,641 observations with missing data leaves a total of 103,002 firm-years to be used in my NAS analysis. Missing data needed to calculate measures of audit quality and appropriate controls further limits the sample to 89,921 firm-years for the audit quality analysis. A breakdown of the number of observations taken from each year can be found in Table 2.1. Year fixed effects are used throughout the paper to combat time trends and period specific variation.

----- Table 2.1 here -----

2.4.2. *Main Variables*

My study uses non-audit service fees in order to measure a firm's usage of non-audit services. By using the log of a firm's non-audit services fees paid (*NAS*) as the central dependent variable I am able to proxy for the quantity of non-audit services used by the firm. Formulating *NAS* as a quantity rather than a proportion of total fees avoids mechanical issues stemming from audit fees reductions as competition rises. Nevertheless, there are potential issues with this measure as there could be differences in pricing across areas, industries, time, and auditors. To ensure that my results are not affected by local pricing that is unique to individual MSAs, I utilize standard errors clustered by MSA throughout the analyses. To mitigate any issues stemming from auditor specific, industry dependent, or time trend pricing I include auditor, industry, and year fixed effects. After implementing these controls that target pricing variation, what remains should be a good approximation for changes in quantity.

To proxy for audit quality, I utilize restatements (*RESTATE*) and performance-matched absolute abnormal accruals (*ACCRUALS*) calculated using the Modified Jones model (Dechow, Sloan, & Sweeney, 1995; Jones, 1991; Kothari, Leone, & Wasley, 2005). Restatements capture

egregious reporting errors while accruals estimate the level of within-GAAP manipulation. Each measure captures a different aspect of audit quality that could potentially be affected by the use of non-audit services.

As previously mentioned, this study calculates local competition at the MSA level. In order to provide more comprehensive results, I use two distinct measures of competition. The first measure of competition is a Herfindahl-Hirschman Index (*HHI*) which is designed to capture the degree of concentration among client firms within the market. Taking on values between zero and one, a lower score on the index indicates that an MSA is very competitive, with market share being distributed well across several auditors. On the opposite end, a higher score closer to one indicates that an MSA is less competitive and is heavily dominated by a single auditor who has managed to court a large share of the market. The measure uses audit fees earned for calculating market share (*HHI*) which gives us a measure of competition weighted by the revenues earned by auditors.

My second measure of local competition is a count of the number of auditors with at least one client¹² within the MSA (*AU_COUNT*). Measuring competition in this way allows us to test the sensitivity of auditors to new entrants/departures. Having both the HHI measure, that tests the sensitivity of participants to the market concentration, along with a raw count of the number of competitors will help me discern between if auditors change their behavior immediately upon entry of new competition or if they respond more sensitively to the capturing of market share after new entrants are established¹³.

¹² Client-auditor matches are taken from AuditAnalytics, thus I only consider firms within the MSA that also appear in AuditAnalytics.

¹³ Auditors excluded from the count are auditors with clients that are either privately held or too small as to not appear in AuditAnalytics (measure of competitions are calculated based on the whole sample of AuditAnalytics). Auditors who hold these client portfolios are unlikely to be direct competition for accounting firms that audit

With both the dependent and independent variables of interest described, regressions will take on the following forms:

$$\begin{aligned}
 NAS &= \beta_0 + \beta_1 Competition + \beta_2 Controls + \varepsilon \\
 Competition &: HHI, AU_COUNT
 \end{aligned}
 \tag{3}$$

$$\begin{aligned}
 AQ &= \gamma_0 + \gamma_1 NAS + \gamma_2 Competition + \gamma_3 NAS * Competition + \gamma_4 Controls + \varepsilon \\
 AQ &: RESTATE, ACCRUALS \\
 Competition &: HHI, AU_COUNT
 \end{aligned}
 \tag{4}$$

2.4.3. Controls

The primary NAS specification with controls will be as follows:

$$\begin{aligned}
 NAS &= \beta_0 + \beta_1 Competition + \beta_2 AUDIT_FEES + \beta_3 TOTAL_ASSETS \\
 &+ \beta_4 SEGNUM + \beta_5 DEBTASSETS + \beta_6 LITIGATION + \beta_7 TENURE \\
 &+ \beta_8 BIG4 + \beta_9 SPECIALIST_MSA + \beta_{10} SPECIALIST_NAT \\
 &+ \text{Industry Fixed Effects} + \text{Auditor Fixed Effects} + \text{Year Fixed Effects} + \varepsilon \\
 Competition &: HHI, AU_COUNT
 \end{aligned}
 \tag{5}$$

AUDIT_FEES is the log of the firm's fee paid for audit services. Prior literature (Firth, 1997; Palmrose, 1986b; Whisenant et al., 2003) has shown positive associations between the audit and non-audit service fees paid as they both proxy for the level (both quality and quantity) of services provided and there should be some knowledge spillover between these services (Simunic, 1984; Wu, 2006) or increased effort (Davis et al., 1993). I expect a positive association between audit fees paid and non-audit fees paid for all three specifications.

TOTAL_ASSETS and *SEGNUM* are the log of total assets and the number of geographic segments of the client company. We would expect larger and more complex companies to be more difficult to manage effectively and thus be excellent candidates for advisory services. For

clients within the sample. On average, I observe 36.6 auditors per MSA which should be a fairly representative number of the active auditors in the area capable of competing for publicly held corporations.

that reason, I expect to observe a positive relationship between non-audit service fees and both *TOTAL_ASSETS* and *SEGNUM* (Antle et al., 2006; DeFond et al., 2002; Firth, 1997).

The next two controls proxy for the relative riskiness of the client for the audit firm. *DEBTASSETS* is the client's debt-to-assets ratio while the *LITIGATION* variable indicates whether or not the client company is in a high litigation industry. Industries with high litigation risk are identified following Kim and Skinner (2012)¹⁴. Highly levered companies are at greater risk of encountering financial distress, increasing the audit risk associated with maintaining an engagement (Antle et al., 2006; DeFond et al., 2002; D. C. Hay, Knechel, & Wong, 2006). Therefore, we should expect a positive relationship between non-audit services and the debt-to-assets ratio as the advisory services provided from NAS can help guide clients away from financially risky maneuvers and manage the risk the auditor takes on. Companies in industries with high litigation rates also pose risk to the auditor of being jointly named in any litigation that transpires should a company falter. Nonetheless, the directionality of the relationship between litigation risk and non-audit services remains ambiguous. Similar to scenario described for highly levered clients, auditors may seek to impose greater use of non-audit services to raise revenues to compensate them for the added risk. At the same time, the auditor may instead decide to refrain from engaging the client in non-audit services as it may appear to strengthen the relationship with the client and increase the potential damages if litigation were to be pursued (DeFond et al., 2002). Given these conflicting factors, I have no prediction for the sign generated by the litigation control.

The *TENURE* control, calculated as the number of years of tenure that the auditor has with the specific client company, proxies for how established the relationship is between the

¹⁴ Companies with a 4-digit SIC code between 2833 and 2836, 8731 and 8734, 3570 and 3577, 7370 and 7374, 3600 and 3674, or 5200 and 5961 are identified as having high litigation risk.

audit firm and their client. As auditor tenure increases, the relationship with the client should, on average, be strengthening giving the auditor more opportunity to introduce additional fees such as their non-audit services to the client. I expect a positive coefficient on the tenure variable.

BIG4 indicates whether or not a company's auditor is one of the Big 4 auditors. Including this variable controls for any non-audit service fee premium associated with choosing a Big 4 firm as your external auditor. Big 4 firms should have relatively more bargaining power when it comes to negotiating non-audit services given their superior reputations and immense resources that give them the ability to offer a wider range of non-audit services. For those reasons, I expect to observe a positive relationship between Big 4 auditors and non-audit service fees (Antle et al., 2006; DeFond et al., 2002).

The last pair of controls, *SPECIALIST_MSA* and *SPECIALIST_NAT*, indicate whether or not a client's auditor is the MSA or national market share leader within their industry. Auditors are defined as specialists if they have more clients in the specified region than any other firm. Specialists carry with them a strong reputation for being experience with working in particular industries. Advisory services may be seen as more valuable from specialists and if so, client companies should partake in more non-audit services. However, the literature linking specialists to audit fee premiums is mixed (Craswell, Francis, & Taylor, 1995; Francis, Reichelt, & Wang, 2005; Palmrose, 1986a) with no clear guidance for the relationship between the use of specialists and non-audit services. Additionally, if clients exhibit some of the behavior seen with audit fees and bargain for some of the cost savings achieved by specialists (Casterella, Francis, Lewis, & Walker, 2004; Mayhew & Wilkins, 2003), lower non-audit service fees may be recorded. or that auditors no longer feel the need to differentiate themselves through non-audit services in markets where they are specialists, I may actually observe a negative association between specialists and

non-audit services. With no overwhelming evidence that one force should dominate the other I will make no prediction on the sign for specialist auditors.

Finally, as noted above, I include year fixed effects, auditor fixed effects, industry fixed effects, as well as clustered standard errors by MSA in order to further protect the results from being subject to other variations across time, auditor, industry, or area.

The audit quality specification with controls will be as follows:

$$\begin{aligned}
 AQ = & \beta_0 + \beta_1 NAS + \beta_2 Competition + \beta_3 NAS * Competition + \beta_2 AUDIT_FEES \\
 & + \beta_3 TOTAL_ASSETS + \beta_4 SEGNUM + ROA + \beta_5 DEBTASSETS \\
 & + CURRENT_RATIO + \beta_6 LITIGATION + \beta_7 TENURE + \beta_8 BIG4 \\
 & + \beta_9 SPECIALIST_MSA + \beta_9 SPECIALIST_MSA * NAS \\
 & + \beta_9 SPECIALIST_MSA * AUDIT_FEES + \beta_{10} SPECIALIST_NAT \quad (6) \\
 & + \beta_9 SPECIALIST_MSA * NAS + \beta_9 SPECIALIST_NAT * AUDIT_FEES \\
 & + \text{Industry Fixed Effects} + \text{Auditor Fixed Effects} + \text{Year Fixed Effects} + \varepsilon
 \end{aligned}$$

Audit Quality : RESTATE, ACCRUALS
Competition : HHI, AU_COUNT

In order to test if the combination of non-audit services paired with competitive audit markets drives changes in audit quality, I introduce an interaction term between the measures of competition and non-audit services. Supplementary controls that have been shown to affect audit quality such as return on assets, current ratio, and cash flow from operations (Becker, Defond, Jiambalvo, & Subramanyam, 1998; Menon & Williams, 2004; Zmijewski, 1984) have been added for this analysis along with specialist interactions for both audit and non-audit fees (Lim & Tan, 2008).

2.4.4. Describing the Data

Formal definitions of each variable used are listed in Appendix A. Descriptive statistics are provided in Table 2.2A with an accompanying correlation table in Table 2.2B. The average

NAS within the sample is 11.639 with a median of 11.655. This is on average 54% of audit fees paid. The HHI index averages 0.315 (median of 0.274). The average number of active local auditors is 36.601, with a median of 34. 70.3% of observed firm-years are audited by one of the Big 4.

----- Table 2.2 here -----

Before conducting regression analyses, we can first examine the data in graphical form to see if discernable patterns emerge. Figure 2.1 and 2.2 are scatter plots showing the relationship between the average NAS purchased per firm and an MSA's Herfindahl-Hirschman Index/auditor count. For readability observations are grouped into intervals and the size of each circle is proportional to the number of MSAs that it represents.

Examining Figure 2.1 we observe a clear downward trend in the average amount of NAS purchased as an MSA's HHI increases. This provides preliminary evidence suggesting that as a local market gets less competitive, the average amount of non-audit services provided decreases. Congruently, as a local audit market becomes more competitive, the average amount of NAS purchased rises. Figure 2.2 tells a similar story with respect to auditor count. As the number of active auditors within an MSA increases, the average amount of NAS used also increases. The one notable outlier we observe that is inconsistent with this trend is at the right tail of the distribution where the auditor count is over 50. This suggests that there may be a limit to the effect that local competition exerts on non-audit services. Under extreme levels of competition audit firms may begin to deemphasize non-audit services as firms lose their ability to differentiate themselves in such a crowded marketplace.

----- Figure 2.1 here -----

----- Figure 2.2 here -----

2.5. Results

2.5.1. Main Results

The results of the primary specification are presented in Table 2.3. Standard errors are clustered by MSA and auditor, industry, as well as year fixed effects are used throughout. The variables of interest for columns (1) and (2) are the Herfindahl-Hirschman Index (*HHI*) calculated using audit fees and a count of the number of active auditors within the MSA (*AU_COUNT*), respectively. It is important to reiterate that the HHI and the auditor count measure have opposite interpretations in terms of sign. A larger HHI represents markets that are less competitive meanwhile a higher auditor count is typical of an MSA with greater competition.

----- Table 2.3 here -----

Both variables of interest produce consistent results. Using the HHI to measure competition results in a negative and statistically significant result at the 10% level (two-tailed p-value = 0.067). For the auditor count we observe a positive and statistically significant coefficient at the 1% level (two-tailed p-value = 0.000). These results suggest that the usage of non-audit services increases in more competitive markets. Whether it be more competitive in terms of a more widely distributed market share or more competitive with regards to the number of suppliers of audit services in the market, when local competition increases so does the average engagement's usage of non-audit services.

The results suggest that a one standard deviation decrease in the HHI corresponds with an estimated 2% increase in the amount of NAS sold. A one standard deviation increase in the number of auditors competing in the market increases NAS by an estimated 5%. This is

economically significant given that the average non-audit services fees are approximately \$874,000 per engagement.

Turning our attention to the controls, we observe remarkably consistent results across all three specifications. As expected, firms who pay larger audit fees, have more total assets, consist of more geographic segments, are more highly levered, have longer relationships with their current auditor, and have a Big 4 auditor utilize more non-audit services. Firms with higher litigation risk engage in less non-audit services which suggests that auditors prefer on average to act aversely towards litigation risk reduce ties to high risk clients rather than approach high risk clients as candidates for increased advisory. We also find that both MSA specialists and national specialists provide additional non-audit services on average, although the coefficient for MSA specialists is not statistically significant.

2.5.1.1. Non-Audit Services, Competition, and Audit Quality

My NAS results suggest that local competition can drive audit firms to shift their emphasis towards providing additional non-audit services, especially when audit firms face fee pressure from depressed audit prices. Given the limitations of local resources, this shift may consequently correspond with a reduction in an audit firm's ability to maintain high levels of audit quality. Previous studies have found mixed evidence when examining if the association between non-audit services and audit quality (Ashbaugh et al., 2003; Frankel et al., 2002; Kinney et al., 2004; Lim & Tan, 2008). Nonetheless, recent works have documentation of a positive relationship between fee pressure and reductions in audit quality (Ettredge et al., 2014), especially when fee pressure is accompanied by increases in non-audit services (Beardsley et al., 2016). Pushing further down to the root cause of this fee pressure, the observed effects could be

derived from the non-audit services sold specifically in highly competitive markets, regardless of fee pressure.

----- Table 2.4 here -----

Results are presented in Table 2.4. Columns (1) and (3) display results using restatements as a proxy for audit quality with columns (2) and (4) utilize absolute abnormal accruals. To aid with interpretation the inverse of the *HHI* is taken before being interacted with *NAS* in order to align the directionality of the inputs. The interaction term as constructed increases both with increases in competition and increases in non-audit services.

Reviewing the results, we observe a universally positive coefficient and statistically significant coefficient on *NAS* all four models, suggesting that increases in the use non-audit services reduces audit quality (p-values = 0.022, 0.000, 0.001, and 0.000 respectively). The coefficients on measures of competition, although statistically significant in some cases, return no consistent trend for the response of audit quality to changes in competition. On the other hand, examining the interaction between competition and non-audit services, we observe positive and statistically significant coefficients in three of the four models (p-values = 0.001, 0.000, and 0.003 respectively), with the exception being the restatement model using auditor count. These results suggest that the falls in audit quality from increased use of non-audit services are further compounded in highly competitive markets. The additional non-audit services sold in competitive markets are more detrimental to audit quality than the non-audit services sold in less competitive markets. This is consistent with auditors selling non-audit services that are more likely to have a negative impact of audit quality in competitive markets. As an additional untabulated test, I also rerun these tests after partitioning the sample based on the intensity of fee pressure. I find no statistically significant difference between results derived from firm-years

with more fee pressure versus those with less fee pressure. This suggests that competition, rather than just fee pressure, is the driving force that when combined with NAS leads to reductions in audit quality.

Given these results, it is important to keep in mind that the production of additional non-audit services is not the only byproduct of competition. Ho (2019) documents increases audit quality when monopolistic markets become more competitive, suggesting that some competition is necessary to incentivize auditors to expend effort towards conducting high quality audits. It is also important to acknowledge that a negative sign on *NAS* does not eliminate the possibility of positive contributions to audit quality from non-audit services. Positive components, such as knowledge spillovers, just may not be strong enough to outweigh the negative effects over the entire distribution. Taking this all into consideration, a non-zero amount of NAS with a moderate level of competition may be desirable if the maximization of audit quality is the priority. Nonetheless, these results provide corroborating evidence for the argument in Ho (2019) that audit firms shift their focus away from audit quality being the sole objective in highly competitive markets.

2.5.2. *The Exit of Arthur Andersen*

An extremely important historical event that occurred during my sample period was the demise of Arthur Andersen in 2002 following the Enron scandal. Not only was this significant due to the large number of clients that required new engagements, but also because of the nature of Arthur Andersen dissolution. Arthur Andersen was guilty of providing non-audit services that led to violations of independence and fraud. As a result, the role of non-audit services was put under a microscope and regulators directly addressed which non-audit services would be permitted, and which would not be, in the Sarbanes-Oxley Act of 2002 (SOX). Strict guidelines

were also put into place that mandated that a client's audit committee approve non-audit services before they could be provided.

With this spotlight on the potential negative consequences of non-audit services, it is important that I investigate if the relationship between local competition and NAS changed after the fall of Arthur Andersen and how the exit of Arthur Andersen affected the local markets in which they were present. Following the dissolution of Arthur Andersen, the markets in which they were operating should have become less competitive and because Arthur Andersen did not operate in all local markets, the shock to competition affects the sample of MSAs unequally, creating the needed variation. If my hypothesis is correct, we should see a disproportionate reduction in the use of non-audit services in these markets relative to other unaffected areas in which Arthur Andersen did not operate¹⁵.

To test this, I employ a differences-in-differences approach, using observations from fiscal years 2001 and 2002 as a source of time and treatment variation pre and post the exit of Arthur Andersen.

$$\begin{aligned} NAS = & \beta_0 + \beta_1 Competition + \beta_2 Treatment + \beta_3 Post \\ & + \beta_4 Post * Treatment + \beta_5 Controls + \varepsilon \end{aligned} \tag{7}$$

I identify the MSAs in which Arthur Andersen held clients in 2001 but not in 2002 to use as the treatment group. MSAs in which Arthur Andersen had no presence in either year are used as the control group. The treatment group consists of 150 MSAs while the control group is comprised of 97 MSAs. I find no statistical difference between Arthur Andersen and the other

¹⁵ Although Arthur Andersen was one of the five largest auditors, examining the pre-treatment period there is no statistical difference between areas where AA operated and area where they did not. Further, Arthur Andersen as not statistically different from the other members of the Big 4 with respect to audit fees, non-audit fees, or audit quality before their collapse. The only statistical difference between them and a generic auditor is their number of clients, with which aids in increasing the size of the shock to competition.

Big 4 clients in terms of audit fees, non-audit fees, or audit quality to suggest that Arthur Andersen was a non-generic large auditor.

----- Table 2.5 here -----

Results are presented in Table 2.5. The *AA_EXIT* term identifies observations from areas where Arthur Andersen was present in 2001 and later exited in 2002. The interaction identifies observations post-treatment areas where Arthur Andersen used to be present but no longer operated in as of 2002. It is also worthwhile to note that year fixed effects are included as well to control for the impact of SOX along with the standard auditor and industry fixed effects. Examining first the *AA_EXIT* coefficients, we observe no statistically significant difference between the treatment and control groups. The treatment group appears comparable to the control group. Turning next to the interaction term, we find statistically significant and negative coefficients in both models (1% level, p-value = 0.035 and 0.002). These results indicate that areas where Arthur Andersen exited saw a significant reduction in non-audit services, in excess of the reductions caused from SOX and auditor changes, following the fall in competition. This provides further evidence for my hypothesis that non-audit services play a more prominent role when local competition is high.

One possible alternative explanation for these findings could be that the lower NAS fees observed in the post period are driven by capacity constraints within the surviving audit firms after the collapse of Arthur Andersen. If surviving firms became engaged with former Arthur Andersen clients, without additional staff to support the new clients the audit firms would likely become capacity constrained and forced to sell fewer NAS per engagement due to their physical inability to provide them. This would generate similar results to what we observe in the post period. However, due to pre-collapse statistics and the findings of Kohlbeck, Mayhew, Murphy,

and Wilkins (2008). I do not believe this is the case. They found that 60% (39 out of 65) of Arthur Andersen offices were purchased whole by either Deloitte, KPMG, or Ernst and Young. Those offices appear to have purchased with the intentions of expanding the purchasers' market share and they retained 70% of the Arthur Andersen clients belonging to those offices at the time of purchase. This accounts for 42% of former Arthur Andersen clients that were able to remain with their original audit team and did not strain the capacity of a new auditor. Given, Arthur Andersen's pre-collapse market share of 19%, if capacity constraints drove post-collapse reductions in NAS we should expect the effect to be in the neighborhood of 10%. Results show that NAS fell on average between 19-26% due to the shock to local competition. Thus, the data suggests that the fall in NAS cannot be solely due to capacity constraints.

As an additional examination of the collapse of Arthur Andersen, I also perform a two-stage least squares analysis based on predicted changes in competition levels solely driven by to the exit of Arthur Andersen. To do this, I recalculate the HHI for each MSA in 2001 excluding all Arthur Andersen clients. These recalculated HHIs excluding Arthur Andersen (*HHI_NOAA*) are then used as an instrument in the first stage to predict the 2002 HHIs for each MSA.

$$HHI_{2002} = \alpha_0 + \alpha_1 HHI_NOAA_{2001} + \alpha_2 Controls + \varepsilon \quad (8)$$

In the second stage, NAS are regressed on the predicted HHIs (\widehat{HHI}) in order to derive a coefficient that reflects the effects on NAS attributable to changes in competition derived from the exit of Arthur Andersen.

$$NAS_{2002} = \beta_0 + \beta_1 \widehat{HHI}_{2002} + \beta_2 Controls + \varepsilon \quad (9)$$

----- Table 2.6 here -----

Results are displayed in Table 2.6. In the first stage I observe a strong positive relationship between *HHI_NOAA* and *HHI*. The t-stat is greater than 10, suggesting that *HHI_NOAA* is a

suitable instrument. A coefficient less than one suggests that Arthur Andersen's clients were not perfectly distributed proportionally based on pre-exit market shares. That variation that is captured by the coefficient is the portion of the change in *HHI* that is directly attributable to the exit of Arthur Andersen.

Results for the second stage are consistent with my main findings and previous tests. I find a negative and statistically significant (1% level, two-tailed tests) relationship between the predicted *HHIs* and *NAS*. This is evidence that firms in *MSAs* where competition was predicted to decrease following the exit of Arthur Andersen saw decreases in the use of *NAS*, and vice versa. To complement my two-staged tests, I also run change analyses for the year 2002 and find consistent results.

2.5.3. Competition Channels

Given that observed changes in the usage of non-audit services based on local market competition, it is critical that I be able to identify the channels through which these changes were derived. In order to isolate and distinguish between the possible channels through which auditors are being forced to alter their behavior, I have developed several tests based on the potential reasons for the usage of non-audit services to change.

2.5.3.1. Using Non-Audit Services as a Tool for Differentiation

Increases in the usage of non-audit services can be driven by either an extreme similarity or an extreme dissimilarity in the audit quality of competing firms. If an increase in usage is caused by auditors' fear that they cannot sufficiently distinguish themselves from the competition based on audit quality alone, then we should observe an especially prevalent

increase in the usage of non-audit services in areas where competing firms are very similar in their audit quality. If increases are instead spurred by easily distinguishable outputs when comparing competing firms then we should observe the effect to be more noticeable in areas where audit quality is more varied.

To test this, I divide observations into two categories, those who operate within MSAs where auditors are more similar in their audit quality and those who operate within MSAs where the audit quality is more dissimilar. I define (dis)similarity in audit quality as the difference in average audit quality between the highest quality and lowest quality auditors within the MSA. The calculation of average audit quality only factors in local clients belonging to that MSA which would have been handled by the local audit office. Audit quality is measured using performance matched absolute abnormal accruals calculated under the Modified Jones model (Dechow et al., 1995; Jones, 1991; Kothari et al., 2005). Observations taken from areas in which this difference is low are labelled as having similar quality amongst local auditors and those taken from areas where the difference is high are labelled as dissimilar in quality. All classifications are made relative to the median.

----- Table 2.7A here -----

Results are shown in Table 2.7A. Columns (1) and (2) include firm-years from MSAs with similar audit quality while columns (3) and (4) display results for firm-years from MSA with dissimilar audit quality. Examining first the results in columns (1) and (2), the coefficients on the variables of interest maintain the same directionality of the main results but they are much smaller in magnitude and statistical significance is achieved for either measure. On the contrary, in columns (3) and (4) we see the same consistent directionality, but now with much greater magnitudes than the main results and statistical significance on all variables of interest (two-

tailed p-values = 0.011 and 0.000, respectively). This suggests that the results are primarily driven by firms in MSAs where the dispersion in audit quality amongst local auditors is large. Increases in the usage of non-audit services in competitive markets stem from auditors' ability to differentiate on audit quality rather their inability to do so.

To find out if these results were solely caused by either high- or low-quality auditors, I further partitioned the firm-years within dissimilar quality MSAs based on the median average audit quality of their external auditor. Results (shown in Table 2.7B) indicate that the large majority of the observed effects come from above median quality firms. This suggests that higher quality auditors take advantage of their position as market leaders in audit quality and capitalize by promoting their expertise in the form of non-audit services. On the other side, lower quality firms are aware of their position in the audit market and refrain from increasing the use of their non-audit services in areas where a wider range of audit qualities is offered.

----- Table 2.7B here -----

2.5.3.2. *Using Non-Audit Services to Compensate for Lower Audit Fees*

Another possible explanation for my main findings could be that changes in the usage of non-audit services is the result auditors seeking a compensating revenue stream due to reduced audit fees in competitive markets. If this is the case then I should be able to isolate the results to areas in which audit fees are depressed. I test this hypothesis in two ways. The first method partitions firm-years based on actual audit fees paid relative to predicted audit fees. Predicted audit fees are estimated by regressing characteristics shown to affect fees on audit fees paid. The coefficients from this regression are then used to generate predicted fitted terms. Firm-years who fall below the median ratio of actual fees to predicted fees are marked as most underpriced while firm-years equal to or above the median marked as least underpriced. The exact regression used

is outlined in the description to Table 2.7C. The second method uses the squared value of a company's total assets as a benchmark on which to base audit fees (Aobdia et al., 2016). I then divide actual audit fees by that value in order to form a measure that compares the audit fees paid to the benchmark. The smaller the result, the more underpriced the audit engagement was, and vice versa.

----- Table 2.7C here -----

Results are given in Table 2.7C. Columns (1) and (2) display results for firm-years that are considered to be the most underpriced while columns (3) and (4) represent firm-years that are the least underpriced. Consistent with my hypothesis, I uncover similar results to my main findings for the most underpriced group but not for the least underpriced partition. In column (1) the HHI variable of interest takes on a negative coefficient that is statistically significant at the 1% level for both methods (two-tailed p-value = 0.000 and 0.000 respectively). Meanwhile, the count variable in column (2) generates a positive coefficient that is also statistically significant at the 1% level using either method (two-tailed p-value = 0.000 and 0.004). These results consistently indicate that engagements that are underpriced in terms of audit fees on average entail larger amounts of non-audit services. On the other side of the partition, the only variable of interest that produces a statistically significant result is the auditor count (two-tailed p-value = 0.001 and 0.000). It is also of note that the magnitudes of the coefficients are identical on either side of the partition using either method. The HHI for the least underpriced engagements produces statistically insignificant results and even produces a coefficient of opposite sign to the main results.

Putting all of these findings together suggests that all firms appear to respond equally to increases in the number of auditors within the market, regardless of audit fee pricing. This

creates the need to make a distinction between responses to competition and responses to fee pressure that are the result of competition. From my results on the HHIs we observe what appears to be reductions in market concentration driving down audit fees which in turn inspires increased emphasis on non-audit services. This is a demonstration of a response to fee pressure brought on by competition and suggests that non-audit services are being used to compensate for lost revenue elsewhere. On the other hand, when analyzing auditor counts, we witness entry of additional competitors into the market directly affecting the use of non-audit services even if they do not exert downward pressure on audit fees. This suggests that non-audit services are also being used instinctually as a response to any competition.

2.5.4. Big 4 vs non-Big 4

Just over 70% of the sample is audited by a Big 4 firm. With such dominant positions in the market we might expect Big 4 firms to react differently to local competition. Given their reputation for better audit quality (Eshleman & Guo, 2014), Big 4 firms may feel less pressure from competitors and either not react as intensely or not react at all to new entrants and/or small shifts in the market share distribution. If this is the case, we would expect to see insignificant coefficients on the variables of interest if the sample is restricted to Big 4 audited firms. On the other hand, the Big 4's towering size comes with industry specialists that allow Big 4 auditors the capability to cater to almost any type of client, both in terms of audit and non-audit services. With these resources, we might also suspect that it is less costly for the Big 4 to respond to emerging competition with additional non-audit services. Conversely, non-Big 4 firms would likely be much more constrained in the variety and competency of their non-audit offerings. If we observe results consistent with my main findings when isolating to a sample of only non-Big

4 audited companies, then it would lend further support to the argument that auditors are redirecting resources to non-audit services when local competition intensifies.

----- Table 2.8 here -----

Table 2.8 presents results partitioned by Big 4 utilization by client companies. Columns (1) and (2) include only firm-years audited by the Big 4 while columns (3) and (4) are restricted to observations not audited by the Big 4. Starting with columns (1) and (3) which use the HHI, we observe a negative and statistically significant coefficient (two-tailed p-value = 0.048) for firm-years where one of the Big 4 is used and a null result for non-Big 4 firm-years. This suggests that the Big 4 are sensitive to changes in market share distribution while the non-Big 4 are not. This makes intuitive sense given that the Big 4 make up such a large portion of the market. The Big 4 are more likely to measure success by the portion of the market than they control whereas smaller firms are more likely to focus on having a few large clients or specializing in an industry. It is important to note that the results for non-Big 4 firms, although statistically insignificant, would be significant if one-tailed tests were used. It may be the case that non-Big 4 firms still respond to changes in market share distribution but just do so in less dramatic fashion. Turning to columns (2) and (4) which use the auditor count, we observe similar results for Big 4 and non-Big 4 firm-years. Both coefficients are statistically significant at the 1% level (two-tailed p-value = 0.000 for both) and provide consistent results to my main findings. This shows that all auditors, regardless of Big 4 membership, respond to the entry of additional competitors with an increased emphasis on non-audit services.

2.5.5. *Limitations and Robustness*

A major limitation of my data is that I only observe the fees paid and cannot observe the true demand and supply functions. One possible alternative story that could explain my results is

that more competitive MSAs may have higher competition amongst auditors due to their higher demand for audit and non-audit services. In order to address this hypothesis, I compare more versus less competitive MSAs along dimensions that are associated with audit complexity, such as the number of operating segments that a client has and how many receivables and inventory they carry. Partitioning at the sample mean HHI of 0.31, I find no statistically significant difference between the two groups with respect to each clients' average number of operating segments. Further, I find that the above median group (less competition) on average carry more receivables and inventory which would suggest that they should require additional audit and non-audit services. This is also consistent with the data that shows that the above median group are more likely to employ a national specialist auditor. These results suggest that the results are not demand driven and supports the conclusion that the increased NAS use in competitive markets is supply driven.

A related limitation to my data is that I cannot observe any non-audit services purchased from firms that are not also serving as the external auditor. This would only be an issue if we believe that auditors are more/less likely to allow other competitors to perform NAS for their clients as competition rises/falls. Given that a company's auditor is already engaged with the firm, they should have a cost advantage in providing NAS relative to competitors. Thus, they should always be willing to provide NAS in any capacity that a competitor might so long as it is in their capability. There should not be a scenario under which an auditor systematically prefers a competitor provide their client with non-audit services. Therefore, the unobserved NAS should not negatively impact my results.

It is also possible that my results are driven by the presence of the Big 4 rather than other competing firms. Big 4 activity within an MSA can significantly increase the level of local

competition. To address this hypothesis, I rerun the main regression models using the number of Big 4 auditors present as the measure of competition. This yields null results. Adding the number of Big 4 present as an additional control in the other models results in multicollinearity issues with the central proxies for competition. This suggests that either Big 4 presence does not affect NAS usage or there is simply not enough variation in Big 4 presence to generate results. The latter is likely to be the case given that 89% of observations come from MSAs in which all Big 4 auditors are present.

As a final set of robustness checks, to mitigate the effects of unobserved individual MSA heterogeneity, all main results are tested with MSA fixed effects (Eshleman & Lawson, 2017). Tests are also rerun after controlling for the ratio of auditors to clients in the MSA and whether the audits are conducted during busy season. Results from these remain consistent and statistically significant in all tests, providing more evidence consistent with the main results.

2.6. Conclusion

This study examines auditors' use of non-audit services as a response to local competition. Measuring competition at the MSA level and using non-audit service fees as a proxy for the quantity of non-audit services provided, I find that auditors increase their use of non-audit services in engagements in areas where local competition is higher. This is especially pronounced in areas where the range in the quality of local auditors is large or audit fees are depressed. The results are consistent with higher quality auditors capitalizing on their expertise in the audit space in order to push sales of their non-audit services as well as auditors turning to non-audit services to supplement revenue when auditing services become less lucrative.

I conduct difference-in-differences analyses using the exit of Arthur Andersen to test the impact of a negative shock to local competition on the use of non-audit services. I find evidence consistent with my main findings, with results showing that areas affected by the exit of Arthur Andersen having greater reductions in non-audit services than unaffected areas, regardless of whether auditor switches took place and after controlling for the effect of SOX.

Additionally, I find that non-audit services are negatively correlated with audit quality, and that non-audit services are particularly harmful to audit quality when competition is high. This suggests that the added emphasis placed on non-audit services in competitive markets is especially costly to audit quality as auditors not only shift limited local resources away from the audit function and towards their advisory services but also sell more non-audit services that are likely to negatively impact audit quality.

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2.7. Appendix A – Variable Descriptions and Computations

Variables are marked in upper case and italics. Compustat item codes are listed in lower case and italics.

Dependent Variables:

Abbreviation	Compustat/AuditAnalytics Data Item Code (blank if variable is not constructed using database items)	Data Source (CS/AA)	Description
<i>NAS</i>	$\log(non_audit_fees)$	AA	Log of non-audit service fees
<i>RESTATE</i>	1 if a restatement was issued pertaining to that year, 0 otherwise		Indicator for if a restatement was issued pertaining to that fiscal year
<i>ACCRUALS</i>			Performance-matched absolute abnormal accruals under the Modified Jones model.

Variables of Interest:

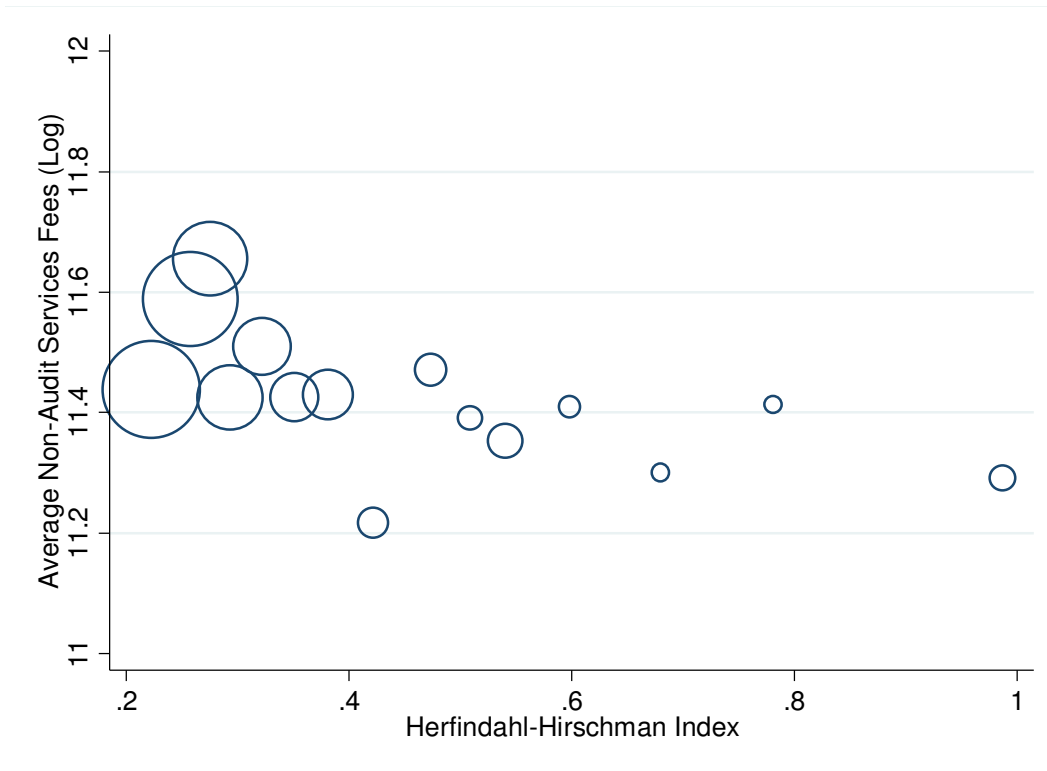
Abbreviation	Calculation	Description
<i>HHI</i>	$\sum_{i=1}^N x_i^2$	Herfindahl-Hirschman Index for the MSA in which the company is located, calculated based on audit fees <i>x</i> is the market share of auditor <i>i</i> based on audit fees <i>N</i> is the number of auditors in the MSA
<i>AU_COUNT</i>	$\sum_{i=1}^N 1_i$	Count of the number of auditors within the MSA with at least one client <i>N</i> is the number of auditors in the MSA
<i>AA_EXIT</i>	1 if fiscal year is 2001 and Arthur Andersen holds at least one client in the MSA or fiscal year is 2002 and Arthur Andersen held at least one client in the MSA in the previous year and none now, 0 otherwise	Indicates firm-years in MSAs where Arthur Andersen was present in 2001 and then left in 2002.
<i>AU_CHANGE</i>	1 if an auditor change took place before the current year's audit, 0 otherwise	Indicates firm-years in which an auditor change took place.
<i>HHI_NOAA</i>		<i>HHI</i> calculated using only firms not audited by Arthur Andersen

Controls:

Abbreviation	Compustat/AuditAnalytics Data Item Code (blank if variable is not constructed using database items)	Data Source (CS/AA)	Description
<i>AUDIT_FEES</i>	$\log(\text{audit_fees})$	AA	Log of audit service fees
<i>TOTAL_ASSETS</i>	$\log(at)$	CS	Log of total assets
<i>SEGNUM</i>		CS	Log of the number of geographic segments that the firm is comprised of
<i>ROA</i>	ib / at	CS	Return on assets
<i>DEBTASSETS</i>	lt / at	CS	Debt to assets ratio
<i>CURRENT_RATIO</i>	lct / act If current assets is missing in Compustat then Cash + Short-term investments + Receivables + Other Current Assets + Inventory is used, Compustat codes: $che + rect + aco + invt$. If current liabilities is missing in Compustat then Accounts Payable + Other Current Liabilities + Debt in Current Liabilities + Income Taxes Payable is used, Compustat codes: $ap + lco + dlc + txp$	CS	Current ratio.
<i>LITIGATION</i>	Companies with a 4-digit SIC code between 2833-2836, 8731-8734, 3570 -3577, 7370-7374, 3600-3674, or 5200-5961 receive a value of 1, 0 otherwise	CS	Indicator of if the company is in a high litigation industry
<i>TENURE</i>	Count variable, +1 if $auditor_fkey_t = auditor_fkey_{t-1}$, reset to 0 if $auditor_fkey_t \neq auditor_fkey_{t-1}$	AA	Number of consecutive years that the current auditor has been auditing the firm
<i>BIG4</i>	1 if $auditor_fkey = \{1, 2, 3, 4\}$, 0 otherwise	AA	Indicator of if the company's external auditor is one of the Big 4 auditors
<i>SPECIALIST_MSA</i>	1 if the auditor is the MSA's market share leader in terms of the number of audits done for that industry, 0 otherwise		Indicator of if the company's external auditor is a local specialist
<i>SPECIALIST_NAT</i>	1 if the auditor is the national market share leader in terms of the number of audits done for that industry, 0 otherwise		Indicator of if the company's external auditor is a national specialist

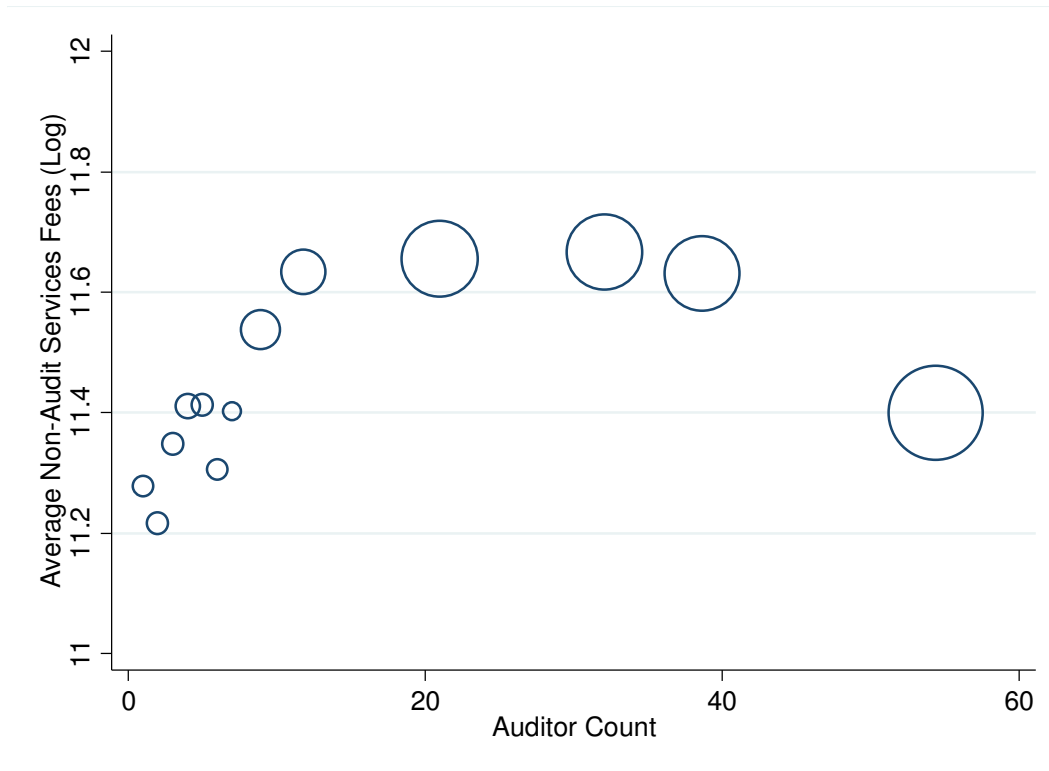
2.8. Figures and Tables

Figure 2.1: Average Non-Audit Service Fees for Varying Levels of Local Competition (Herfindahl-Hirschman Index)



This figure shows the average amount of non-audit service purchased by client companies relative to their placement on the Herfindahl-Hirschman Index. The size of each circle is proportional to the density of observations represented.

Figure 2.2: Average Non-Audit Service Fees for Varying Levels of Local Competition (Active Auditor Count)



This figure shows the average amount of non-audit service purchased by client companies relative to the number of auditors present within their MSA. The size of each circle is proportional to the density of observations represented.

Table 2.1: Sample

	NAS Analysis	Audit Quality Analysis
Firm-years available in Compustat from 2000-2014	168,699	168,699
Firm-years available in AuditAnalytics from 2000-2014	185,939	185,939
Overlapping firm-years within both databases	114,643	114,643
Firm-years with missing values	11,641	24,722
Firm-years used in analysis	103,002	89,921
Observations by year:		
2000	3,495	3,252
2001	5,087	4,784
2002	7,641	7,062
2003	8,121	7,659
2004	8,016	7,534
2005	8,594	7,566
2006	7,965	6,753
2007	7,209	6,012
2008	7,053	5,792
2009	6,807	5,751
2010	6,484	5,563
2011	6,558	5,518
2012	6,510	5,343
2013	6,844	5,661
2014	6,618	5,671
Firm-years used in analysis	103,002	89,921

This table details the construction of the sample and the distribution of firm-years.

Table 2.2A: Descriptive Statistics

Variable	N	Mean	Std. Dev.	25 th	50 th	75 th
<i>NAS</i>	103,002	11.639	2.013	10.289	11.655	12.988
<i>HHI</i>	103,002	0.315	0.125	0.246	0.274	0.334
<i>AU_COUNT</i>	103,002	36.601	26.974	19.000	34.000	43.000
<i>RESTATE</i>	89,921	0.195	0.396	0.000	0.000	0.000
<i>ACCRUALS</i>	89,921	0.219	0.106	0.145	0.213	0.279
<i>AUDIT_FEES</i>	103,002	13.210	1.625	12.095	13.205	14.221
<i>TOTAL_ASSETS</i>	103,002	6.102	2.776	4.332	6.276	7.947
<i>SEGNUM</i>	103,002	0.998	0.785	0.000	1.099	1.609
<i>ROA</i>	89,921	-0.070	0.269	-0.064	0.023	0.067
<i>DEBTASSETS</i>	103,002	0.796	2.551	0.330	0.540	0.758
<i>CURRENT_RATIO</i>	89,921	3.045	4.827	1.120	1.795	3.042
<i>LITIGATION</i>	103,002	0.286	0.452	0.000	0.000	1.000
<i>TENURE</i>	103,002	6.868	7.539	2.000	5.000	9.000
<i>BIG4</i>	103,002	0.703	0.457	0.000	1.000	1.000
<i>SPECIALIST_MSA</i>	103,002	0.033	0.178	0.000	0.000	0.000
<i>SPECIALIST_NAT</i>	103,002	0.322	0.467	0.000	0.000	1.000

This table presents descriptive statistics on the sample used. The continuous variables are winsorized at the 1st and 99th percentile.

Table 2.2B: Correlation Table

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)		
(1) <i>NAS</i>	1.000															
(2) <i>HHI</i>	-0.001	1.000														
(3) <i>AU_COUNT</i>	-0.018	-0.404	1.000													
(4) <i>RESTATE</i>	0.146	0.016	0.003	1.000												
(5) <i>ACCRUALS</i>	-0.149	-0.006	0.063	0.043	1.000											
(6) <i>AUDIT_FEES</i>	0.697	-0.051	0.047	0.114	0.042	1.000										
(7) <i>TOTAL_ASSETS</i>	0.675	0.032	-0.036	0.040	-0.035	0.804	1.000									
(8) <i>SEGNUM</i>	0.276	-0.028	-0.011	0.064	-0.018	0.336	0.195	1.000								
(9) <i>ROA</i>	0.304	0.049	-0.039	-0.016	-0.294	0.370	0.551	0.240	1.000							
(10) <i>DEBTASSETS</i>	-0.128	-0.005	0.036	-0.007	0.036	-0.143	-0.271	-0.105	-0.309	1.000						
(11) <i>CURRENT_RATIO</i>	-0.125	-0.033	0.014	-0.053	-0.031	-0.154	-0.115	-0.054	0.011	-0.094	1.000					
(12) <i>LITIGATION</i>	0.014	-0.063	-0.001	0.092	-0.006	0.005	-0.148	0.112	-0.148	0.001	0.027	1.000				
(13) <i>TENURE</i>	0.231	-0.007	-0.019	0.048	-0.021	0.288	0.206	0.132	0.121	-0.013	-0.013	-0.020	1.000			
(14) <i>BIG4</i>	0.476	0.006	-0.069	0.026	-0.068	0.555	0.543	0.247	0.313	-0.134	-0.070	0.011	0.222	1.000		
(15) <i>SPECIALIST_MSA</i>	-0.013	-0.074	0.163	0.016	0.162	-0.031	-0.042	-0.025	-0.045	0.020	0.011	0.011	0.012	0.037	1.000	
(16) <i>SPECIALIST_NAT</i>	-0.173	0.051	-0.021	-0.034	-0.024	-0.212	-0.187	-0.054	-0.111	0.066	-0.014	-0.082	0.116	0.199	0.096	1.000

Table 2.3: Main Results

VARIABLES	Expected Sign	(1) NAS	(2) NAS
<i>HHI</i>	?	-0.164* (-1.841)	
<i>AU_COUNT</i>	?		0.002*** (4.787)
<i>AUDIT_FEES</i>	+	0.535*** (33.551)	0.529*** (41.600)
<i>TOTAL_ASSETS</i>	+	0.267*** (29.933)	0.270*** (33.503)
<i>SEGNUM</i>	+	0.053*** (4.998)	0.054*** (5.015)
<i>DEBTASSETS</i>	+	0.037*** (11.313)	0.037*** (11.564)
<i>LITIGATION</i>	?	-0.083*** (-4.586)	-0.086*** (-4.918)
<i>TENURE</i>	+	0.008*** (7.031)	0.008*** (6.888)
<i>BIG4</i>	+	0.215* (1.900)	0.227* (1.934)
<i>SPECIALIST_MSA</i>	?	0.109 (1.420)	0.059 (1.245)
<i>SPECIALIST_NAT</i>	?	-0.084*** (-4.248)	-0.080*** (-4.397)
Industry Fixed Effects			Included
Auditor Fixed Effects			Included
Year Fixed Effects			Included
Constant		3.765*** (18.966)	3.734*** (19.442)
Observations		103,002	103,002
R-squared		0.596	0.596

Clustered t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

This table presents the results of ordinary least squares regressions using clustered standard errors. Errors are clustered by MSA. The dependent variable for all columns are the log of non-audit service fees. Industry, auditor, and year fixed effects are included. Industry fixed effects are determined used the Fama-French 12 standard industry classifications.

Table 2.4: The Effects of Non-Audit Services on Audit Quality when Combined with Competition

VARIABLES	Expected Sign	(1) <i>RESTATE</i>	(2) <i>ACCRUALS</i>	(3) <i>RESTATE</i>	(4) <i>ACCRUALS</i>
<i>NAS</i>	+	0.005** (2.307)	0.010*** (5.022)	0.010*** (3.461)	0.011*** (5.271)
<i>HHI</i>	?	0.060** (2.274)	0.030 (0.816)		
<i>(1/HHI)*NAS</i>	+	0.001*** (3.403)	0.001*** (2.692)		
<i>AU_COUNT</i>	?			-0.001 (-1.589)	0.001** (2.103)
<i>AU_COUNT*NAS</i>	+			0.000 (1.120)	0.001*** (3.014)
<i>AUDIT_FEES</i>	-	0.062*** (15.153)	0.022*** (4.970)	0.066*** (15.122)	0.022*** (4.903)
<i>TOTAL_ASSETS</i>	+	-0.016*** (-8.745)	-0.040*** (-9.327)	-0.015*** (-8.301)	-0.039*** (-9.471)
<i>SEGNUM</i>	+	-0.017*** (-3.555)	-0.014*** (-4.459)	-0.018*** (-3.652)	-0.014*** (-4.534)
<i>ROA</i>	-	0.000 (0.889)	-0.000* (-1.730)	0.000 (0.886)	-0.000* (-1.729)
<i>DEBTASSETS</i>	+	-0.002*** (-3.207)	0.174*** (17.988)	-0.002** (-2.589)	0.174*** (17.991)
<i>CURRENT_RATIO</i>	-	-0.002*** (-7.197)	0.001 (1.233)	-0.002*** (-6.917)	0.001 (1.235)
<i>CFOPS</i>	-	0.000** (2.253)	-0.004 (-0.793)	0.000** (2.220)	-0.004 (-0.793)
<i>TENURE</i>	?	0.001* (1.731)	-0.000* (-1.816)	0.001 (1.534)	-0.000* (-1.790)
<i>BIG4</i>	-	0.041** (2.036)	-0.148 (-0.982)	0.036* (1.748)	-0.146 (-0.970)
<i>SPECIALIST_MSA</i>	?	0.275 (1.453)	0.745*** (3.475)	0.299 (1.371)	0.731*** (3.347)
<i>SPECIALIST_MSA*NAS</i>	?	-0.023** (-1.976)	-0.004 (-0.630)	-0.022* (-1.773)	-0.004 (-0.658)
<i>SPECIALIST_MSA*AUDIT_FEES</i>	?	0.001 (0.108)	-0.051*** (-3.428)	-0.001 (-0.110)	-0.051*** (-3.353)
<i>SPECIALIST_NAT</i>	?	0.305*** (7.379)	0.127 (1.320)	0.333*** (7.456)	0.129 (1.338)
<i>SPECIALIST_NAT*NAS</i>	?	0.021*** (5.077)	0.002 (0.432)	0.020*** (4.730)	0.002 (0.499)
<i>SPECIALIST_NAT*AUDIT_FEES</i>	?	-0.044*** (-7.379)	-0.010 (-1.256)	-0.045*** (-7.403)	-0.010 (-1.302)
Industry FE				Included	
Auditor FE				Included	
Year FE				Included	
Constant		-0.628*** (-11.981)	0.076 (0.502)	-0.699*** (-10.748)	0.076 (0.500)
Observations		89,921	89,921	89,921	89,921
R-squared		0.092	0.386	0.087	0.386

Clustered t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

This table presents the results of ordinary least squares regressions using clustered standard errors. Errors are clustered by MSA. The dependent variable for columns (1) and (3) is equal to 1 if a restatement was issued for the firm-year, and 0 otherwise. The dependent variable for columns (2) is performance-matched absolute abnormal accruals measured using the Modified Jones model (Dechow et al., 1995; Jones, 1991; Kothari et al., 2005). In order to generate an interaction term that is consistent in the directionality of its components *HHI* is divided from 1 before being interacted with *NAS*.

Table 2.5: The Exit of Arthur Andersen (Difference-in-Differences)

VARIABLES	Expected Sign	(1) NAS	(2) NAS
<i>HHI</i>	–	-0.695*** (-4.785)	
<i>AU_COUNT</i>	+		0.003*** (4.843)
<i>AA_EXIT</i>	null	-0.125 (-1.240)	0.041 (0.480)
<i>AA_EXIT*FYEAR=2002</i>	–	-0.186** (-2.117)	-0.259*** (-3.091)
<i>AU_CHANGE</i>	–	-0.115*** (-3.341)	-0.122*** (-3.613)
Controls		Included	
Observations		12,728	12,728
R-squared		0.744	0.744

Clustered t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

This table presents the results of ordinary least squares regressions using clustered standard errors. Errors are clustered by MSA. The dependent variable for all columns are the log of non-audit service fees. The sample for this analysis is restricted to observations from 2001 and 2002. The *AA_EXIT* variable is equal to 1 for all observations for MSAs where Arthur Andersen held at least one client in 2001 and zero otherwise. The *AA_EXIT*FYEAR=2002* interaction is equal to 1 for all observations from the year 2002 in MSAs where Arthur Andersen no longer operated but had in the previous year, and zero otherwise.

The included controls are inclusive of all controls included for the main results found in Table 2.3. Industry, auditor, and year fixed effects are included as well. Industry fixed effects are determined used the Fama-French 12 standard industry classifications.

Table 2.6A: The Exit of Arthur Andersen (2SLS: First Stage)

VARIABLES	Expected Sign	(1) <i>HHI</i>
<i>HHI_NOAA</i>	+	0.359*** (10.101)
Controls		Included
Observations		7,359
R-squared		0.452

Clustered t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

This table presents the results of the first stage of a two-stage least squares regression using clustered standard errors. Errors are clustered by MSA. The dependent variable is the Herfindahl-Hirschman Index. The sample for this analysis is restricted to observations from 2002. The *HHI_NOAA* variable is the Herfindahl-Hirschman Index calculated for year 2001 MSAs after excluding Arthur Andersen clients.

The included controls are inclusive of all controls included for the main results found in Table 2.3. Industry, auditor, and year fixed effects are included as well. Industry fixed effects are determined used the Fama-French 12 standard industry classifications.

Table 2.6B: The Exit of Arthur Andersen (2SLS: Second Stage)

VARIABLES	Expected Sign	(1) NAS
\widehat{HHI}	–	-3.072*** (-5.814)
Controls		Included
Observations		7,359
R-squared		0.729

Clustered t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

This table presents the results of the second stage of a two-stage least squares regression using clustered standard errors. Errors are clustered by MSA. The dependent variable is the log of non-audit service fees. The sample for this analysis is restricted to observations from 2002. The \widehat{HHI} variable is the 2002 Herfindahl-Hirschman Index as predicted from the first stage outlined in Table 6A.

The included controls are inclusive of all controls included for the main results found in Table 2.3. Industry, auditor, and year fixed effects are included as well. Industry fixed effects are determined used the Fama-French 12 standard industry classifications.

Table 2.7A: Non-Audit Services as Differentiation

VARIABLES	Expected Sign	<i>SIMILAR QUALITY</i>		<i>DISSIMILAR QUALITY</i>	
		(1) <i>NAS</i>	(2) <i>NAS</i>	(3) <i>NAS</i>	(4) <i>NAS</i>
<i>HHI</i>	-	-0.061 (-0.835)		-0.470** (-2.568)	
<i>AU_COUNT</i>	+		0.000 (0.240)		0.003*** (9.432)
Controls			Included		
Observations		51,226	51,226	51,776	51,776
R-squared		0.593	0.593	0.604	0.605

Clustered t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

This table presents the results of ordinary least squares regressions using clustered standard errors. Errors are clustered by MSA. The dependent variable for all columns are the log of non-audit service fees. The sample is partitioned by differences in the average audit quality of the highest audit quality and lowest audit quality active auditor within each MSA. MSAs in which this difference is below the median are identified as similar quality MSAs while those at or above the median are identified as dissimilar quality MSAs. Audit quality is determined using performance-matched absolute abnormal accruals.

The included controls are inclusive of all controls included for the main results found in Table 2.3. Industry, auditor, and year fixed effects are included as well. Industry fixed effects are determined used the Fama-French 12 standard industry classifications.

Table 2.7B: Non-Audit Services as Differentiation, Lower vs Higher Quality Auditors

VARIABLES	Expected Sign	<i>LOWER QUALITY AUDITOR</i>		<i>HIGHER QUALITY AUDITOR</i>	
		(1) <i>NAS</i>	(2) <i>NAS</i>	(3) <i>NAS</i>	(4) <i>NAS</i>
<i>HHI</i>	-	-0.080 (-0.946)		-0.499** (-2.207)	
<i>AU_COUNT</i>	+		0.001 (1.419)		0.003*** (6.552)
Controls			Included		
Observations		26,910	26,910	27,276	27,276
R-squared		0.632	0.632	0.658	0.659

Clustered t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

This table presents the results of ordinary least squares regressions using clustered standard errors. Errors are clustered by MSA. The dependent variable for all columns are the log of non-audit service fees. The included sample consists of only firms-years labelled as having dissimilar quality from Table 7A. In this table, that sample is further partitioned based on the average audit quality of the auditor for each firm-year. Firm-years with an auditor whose average audit quality for the MSA is below the median are labelled as lower quality auditors with the remaining auditors labelled as higher quality auditors. Audit quality is determined using performance-matched absolute abnormal accruals.

The included controls are inclusive of all controls included for the main results found in Table 2.3. Industry, auditor, and year fixed effects are included as well. Industry fixed effects are determined used the Fama-French 12 standard industry classifications.

Table 2.7C: Non-Audit Services as an Alternate Revenue Stream

VARIABLES	Expected Sign	<i>MOST UNDERPRICED</i>		<i>LEAST UNDERPRICED</i>	
		(1) <i>NAS</i>	(2) <i>NAS</i>	(3) <i>NAS</i>	(4) <i>NAS</i>
Partitioned using Method 1					
<i>HHI</i>	-	-0.411*** (-4.124)		0.030 (0.252)	
<i>AU_COUNT</i>	+		0.002*** (5.323)		0.002*** (3.213)
Controls			Included		
Observations		51,511	51,511	51,491	51,491
R-squared		0.489	0.489	0.605	0.605
Partitioned using Method 2					
<i>HHI</i>	-	-0.407*** (-4.396)		0.164 (1.200)	
<i>AU_COUNT</i>	+		0.002*** (2.903)		0.002*** (5.082)
Controls			Included		
Observations		50,047	50,047	52,955	52,955
R-squared		0.510	0.509	0.651	0.652

Clustered t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

This table presents the results of ordinary least squares regressions using clustered standard errors. Errors are clustered by MSA. The dependent variable for all columns are the log of non-audit service fees. Firm-years are partitioned based on audit fees paid relative to the benchmarks outlined below.

The included controls are inclusive of all controls included for the main results found in Table 2.3. Industry, auditor, and year fixed effects are included as well. Industry fixed effects are determined used the Fama-French 12 standard industry classifications.

Method 1: Firm-years which have below median audit fees relative to predicted audit fees are marked as being the most underpriced while firm-years equal to or above the median are labeled as least underpriced.

Predicted audit fees determined using the following OLS regression:

$$AUDIT_FEES = \beta_0 + \beta_1 SEGNUM + \beta_2 DEBTASSETS + \beta_3 LITIGATION + \beta_4 TENURE + \beta_5 BIG4 + \beta_6 SPECIALIST_MSA + \beta_7 SPECIALIST_NAT + \varepsilon$$

Method 2: Firm-years which have below median audit fees relative to total assets are marked as being the most underpriced while firm-years equal to or above the median are labeled as least underpriced.

$$\text{Audit fees relative to total assets benchmark} = AUDIT_FEES / (TOTAL_ASSETS$$

Table 2.8: Big 4 vs Non-Big 4 Audited

VARIABLES	Expected Sign	<i>BIG 4 AUDITED</i>		<i>NON-BIG 4 AUDITED</i>	
		(1) <i>NAS</i>	(2) <i>NAS</i>	(3) <i>NAS</i>	(4) <i>NAS</i>
<i>HHI</i>	–	-0.213** (-1.985)		-0.146 (-1.413)	
<i>AU_COUNT</i>	+		0.002*** (4.327)		0.002*** (4.446)
Controls			Included		
Observations		72,430	72,430	30,572	30,572
R-squared		0.505	0.505	0.455	0.457

Clustered t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

This table presents the results of ordinary least squares regressions using clustered standard errors. Errors are clustered by MSA. The dependent variable for all columns are the log of non-audit service fees. Column (1) and (2) contain results from companies that were audited by the Big 4. Column (3) and (4) present results from companies that were not audited by the Big 4.

The included controls are inclusive of all controls included for the main results found in Table 2.3. Industry, auditor, and year fixed effects are included as well. Industry fixed effects are determined used the Fama-French 12 standard industry classifications.

Chapter 3

Labor Flow and the Hiring of Aspiring

Public Accountants

ABSTRACT

In this paper, I model the two stages of staffing that public accounting firms face in a two-period matching model. In the first stage, firms compete for the opportunity to hire and train workers, and in the second stage workers are given the opportunity to rematch after training is complete and their productivity is revealed. I find that, given that larger firms produce more efficiently than smaller firms, the first period equilibrium in which training is done is determined by the distinguishability among worker types. If worker types are sufficiently distinguishable, then larger firms will bear the cost of training the most talented workers. However, if worker types are not sufficiently distinguishable then larger will have incentive to free-ride on the training ability of smaller firms with the hopes of luring away workers from smaller firms after training is complete. I also find that larger firms, on average, will retain a higher percentage of trainees and grow faster in expectation. Additionally, if worker types are not sufficiently distinguishable, overall industry output quality will decrease.

Keywords: public accounting labor, labor flow, hiring

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3.1. Introduction

The hiring and training of new employees and the subsequent retention of trained staff are important issues for contemporary public accounting firms¹⁶. Each employee takes time and resources to onboard and the ability of individual accounting employees have been shown to impact a firm's ability to produce a high quality output and keep clients satisfied (Chen et al, 2016; Gul, Wu, & Yang, 2013). Regardless of a firm's ability to attract initial clients on the demand side, it is all for not if a firm cannot keep up on the supply side with the quantity of qualified labor required to complete the work. Given the labor-intensive nature of public accounting it is important that we understand its labor market dynamics and how they feed into the overall industry structure.

On the output side, the current competitive landscape sees public accounting dominated by the Big 4 (Pricewaterhouse Coopers, Ernst and Young, KPMG, and Deloitte and Touche) with the gap between them and the next tier of public auditors being very large¹⁷. Yet, beyond these industry giants there still exists a range of mid-sized and smaller boutique firms who still manage to thrive. This begs the question of how this industry structure, with an oligopoly at the top and several much smaller competitors surrounding them, arose and if it should be expected to remain stable as a long run equilibrium. In this paper I study the input market, specifically labor

¹⁶ The PCPS CPA Firm 2013 Top Issues Diagnostic Report found that finding qualified staff and retaining qualified staff (separate issues) were both ranked in the top five issues facing firms with 6-10, 11-20, and 21+ professionals.

¹⁷ Data gathered by the United States Government Accountability Office in 2008 indicated that the smallest Big 4 firm was 2.15x as large in terms of partners and 3.07x as large in terms of professional staff as the next largest public accounting firm. More recent data from the 2014 AccountingToday Top 100 Firms indicated that this gap has grown with the smallest Big 4 firm now 2.86x larger than the next largest public accounting firm and 3.76x larger in terms of professional staff. This trend persists if we look at the average size of the Big 4 compared to the next four largest accounting firms.

hiring and training, to investigate if we can help explain the trends we see in the output market through the lens of the current labor market structure.

This paper looks to answer the following questions: Which types of firms choose to hire and train which types of workers? What do these initial matchings say about future career paths and overall labor flow? Do large gaps in size between large and small firms occur in equilibrium? With these questions in mind, I formulate a model that incorporates defining features of the accounting labor market in order to explore how the choices the industry has made in structuring the labor market has shaped the competitive landscape of public practice.

Within the industry's current labor structure there are several defining characteristics that differentiate it from a typical profession. The first is that earning an accounting designation requires that candidates obtain a minimum amount accounting related work experience (typically one to two years) at an accredited workplace. This goes farther than the mere suggestion of work experience as a catalyst for success in the field and makes it a requirement in order to even gain entry as a full-fledged practitioner. This gives current accountants the ability to act as gatekeepers and exert control over the individuals allowed to enter. A second important aspect of the accounting labor market is the incorporation of on-the-job training. Similar to many other industries with apprentice-style training, an aspiring accountant's first job and training hours will contribute greatly to their proficiency in the field and may drastically alter their career path. Individuals are not considered to be endowed with and cannot obtain this training outside of actually working for an accounting firm. This places a great responsibility on the firms who inevitably shape the skill sets of newcomers to the profession. Third, training traditionally takes place over a series of rotations with many different supervisors. This is different from most on-the-job training industries where a trainee is typically paired with a single supervisor or a small

group of invested individuals¹⁸. This normalizes training but also introduces an element of randomness to the experience that trainees will have.

Beyond initial hiring and training of new staff, public accounting firms face the challenge of retaining their employees¹⁹. In addition to the idiosyncratic turnover that exists in any business, public accounting firms endure systematic turnover as staff are commonly hired away from one firm to another or lured into industry (accounting related non-public accounting jobs). This is especially noteworthy given that industry firms, who need accredited accounting professionals, often do not have the certifications necessary to train their own staff from scratch and therefore must hire already trained workers from other firms.

After incorporating these traits into a two-stage matching model I arrive at three distinct equilibria, each with different implications. The first, which I label as the natural equilibrium, provides an intuitive result in which firms and workers match in descending order based on type. Large firms match with the most talented workers and smaller firms match with the next best available worker type. The second equilibrium, which I refer to as the alternative equilibrium, sees big firms pass up on high ability workers in the first stage and instead opt to train low types. This arises if the difference in expected return between differing worker types is not large enough to offset the increased wages they would need to offer in order to outbid small firms for the most talented workers. This alternative equilibrium occurs when the difference between high and low type workers is relatively small and small firms value high ability workers so much that

¹⁸ Some firms do employ sponsor programs that are aimed to give trainees mentoring from a direct supervisor. Respondents to the 2011 PCPS Top Talent Study reported that only 16% of high potential CPAs received any type of sponsorship.

¹⁹ The 2013 Rosenberg National MAP Survey of CPA Firm Statistics reported a turnover rate of 16-18% for U.S. CPA firms. The top four reasons for turnover was staff leaving to go into industry (accounting related job at a non-CPA firm), staff being counseled out of the firm, staff moving to another CPA firm, and spouse relocation/family reasons.

they are willing to forego surplus in the training period for the chance to retain these workers in the second period. Lastly, the third equilibrium, which I label as the extreme equilibrium, occurs if the probability that a small firm cannot retain a worker in the second period is so great that small firms opt to not hire trainees at all. In this equilibrium big firms match with high types and small firms match with no one.

In either the natural or the alternate equilibrium it can be shown that larger firms have a higher probability than smaller firms of retaining their trainees. In some realizations where agents at small firms receive moderate amounts of general training big firms can even hire trained workers away from small firms after training is complete. This results in a divergence in firm sizes as large firms can grow much more quickly and steadily than smaller firms.

Additionally, if the market settles into the alternative equilibrium, overall industry output quality is predicted to decrease relative to if markets were operating at the natural equilibrium. This is because in the alternative equilibrium larger firms are more heavily composed of low types compared to the natural or extreme equilibrium. The extreme equilibrium actually produces the highest output quality since in that scenario only high types are ever matched with firms. However, such an equilibrium would have bigger implications on the industry since small firms would never hire, remain stagnant and eventually disappear.

This chapter is organized as follows: Section 2 outlines relevant literature. Section 3 describes the model. Section 4 solves the model and analyses the results. Section 5 concludes and provides direction for possible future work.

3.2. Literature Review

Providing novice auditors with training in the form of work experience has been shown to deliver value beyond that which can be achieved by education alone (Ferguson, Richardson, and Wines, 2000). However, issues of on-the-job and firm-sponsored training are not new to academic research. One of the earliest works was done by Pigou (1912) who initially posited that it would not be efficient for firms to invest in worker training since the workers could always take their newly acquired skills to another firm. This basic idea would later be extended in one of the field's seminal works by Becker (1962, 1964) who split training into general and specialized training. His theories stated that in perfect labor markets firms would only be willing to pay for firm-specific training that would not be transferrable to other employers and the rents from this training could be split between the worker and firm. Any general training costs should be borne solely by the worker.

Despite these theories, many real-world firms continued to endorse on-the-job or firm-sponsored training for non-specialized skills. Furthermore, empirical evidence from studies such as Loewenstein and Spletzer (1999) showed results consistent with firms extracting some of the rents from the general training they provided and Hashimoto (1979) even found that on-the-job training was more profitable in larger firms. In addition, Oosterbeek, Sloof, and Sonnemans (2001) found that firms invest in their employees based on the strength of external demand.

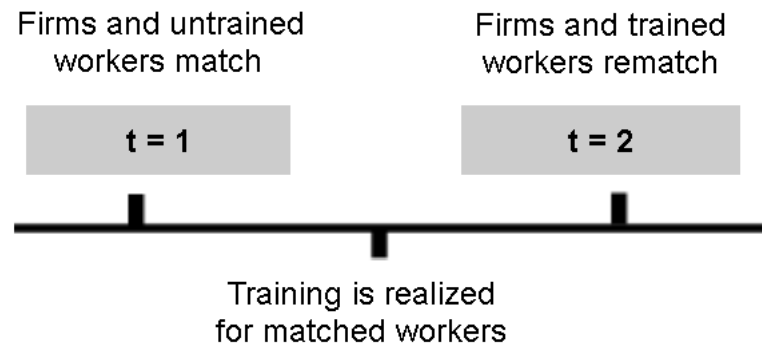
Work by Acemoglu and Pischke (1999) theorizes that firm-sponsored training could be optimal in scenarios with imperfect labor markets. One imperfection, which is observed in the public accounting market is that firm-sponsored training is required in order to have inexperienced laborers enter the industry. Without firm-sponsored training no new accountants could ever complete their designation requirements and the industry would find itself with an

ever shrinking labor force. Bilanakos, Green, Heywood, and Theodoropoulos (2016) found that dominant firms offer their experienced employees more access to further general training and theorize that this occurs because dominant product market firms are more likely to benefit from the added training. However, the applicability of such a result cannot be easily applied to the public accounting space because training in public accounting occurs over a relatively fixed time period and is less a matter of quantity and more a matter of composition. More dominant firms may be able to offer additional resources to help trainees study for their CPA examinations but they cannot increase the quantity of training hours within the training period. Further, it has also been shown by Collins, Greenhaus, Parasuraman, and Singh (1997) that one of the leading reasons for workers choosing to leave public accounting is work overload, so cramming additional training into the training period may not be beneficial for firms as it may reduce their likelihood to retain their trainees.

Turning our attention to the literature on accounting firm size and quality, DeAngelo (1981) developed a model that suggested that audit quality and auditor size were not independent, even if all firms possessed identical technological capabilities, and that larger firms should produce a higher audit quality because they have more to lose from a poorly executed engagement and so they have more incentive to report bad news. Industry perception and empirical results have been consistent with this notion. Davidson and Neu (2010) and Choi et al. (2010) found evidence that larger audit firms perform higher quality audits as well. Nagy, Sherwood, and Zimmerman (2018) also show an association between an audit office's output quality and how heavily worked their qualified personnel are.

3.3. Model

The following is a model of hiring, training, and labor flow in the public accounting sector. Although this particular setup is designed with the unique characteristics of public accounting in mind, there exist other fields with similar environments where this model could be generalized to a broader set of sectors where on-the-job training is necessary.



The model consists of two time periods $t = 1, 2$. In first period firms decide what type of untrained workers to hire and train (or not to hire at all). During the hiring period the bargaining power is held by firms as agents are searching for employment in order to gain entry to the profitable public accounting industry and training at an established firm is the sole point of entry. This initial period mimics the time within which aspiring accountants have just completed, or are in the process of completing, their formal education in accounting but still require work experience before their designation can be conferred.

In the second period the power shifts as the scarce newly trained workers are presented with the option to stay with their current firm, take a job with another public accounting firm, or exit to industry/work as their own firm. This emulates the period immediately after a public accountant has their designation conferred. At this stage, their range of job opportunities is much

greater as they are sought after by other accounting firms seeking qualified staff as well as corporations that require accounting expertise but are unable to develop it internally.

The model features two firm types: big and small $\theta \in \{B, S\}$ ²⁰ where $B, S \in \mathbb{R}_{++}$. Big firms are more productive per worker than smaller ones due to economies of scale²¹ $B > S$ (Banker, Chang, and Cunningham, 2003; Ferguson, Pinnuck, and Skinner, 2018). The objective of firms will be to maximize their profits which will be defined as firm production minus wages paid.

There are two agent/worker types²²: low and high $\tau \in \{L, H\}$, $L, H \in \mathbb{R}_{++}$. These types represent the agents' ability where $H > L$. All agents begin with zero experience in the first period and receive an experience value of one if employed and trained $e \in \{0, 1\}$. The objective of workers is to maximize lifetime wages²³ $U = w_1 + w_2$ where w_1 is the wage earned in period 1 and w_2 is the wage earned in period 2²⁴. Types for both firms and agents are fully observable by both groups.

Each agent has a reservation wage R in the first period which is equal for all types. The alternative to working is not only unemployment but also leaving the industry which is equally

²⁰ This can be extended to more firm types or a continuum but the results will be qualitatively similar and two starting firm types is enough to illustrate the results.

²¹ The model is designed with the Big 4 modelled a big firms and the next tier of accounting firms acting as small firms. However, there is no overwhelming reason why it should not be applicable to comparisons between smaller accounting firms.

²² The real world contains a continuum of types and numerous dimensions along which ability must be measured. For the simplicity of the model, two discrete types is sufficient to demonstrate my results. Future work can be done to extend the model into multiple dimensions.

²³ To reduce clutter in viewing results, I ignore discounting of second period wages. Adding a discount on second period wages would not change the implications of results.

²⁴ Modelling period 1 with homogenous wages among types correlated well to the real world with many accounting firms having standard wages for entry level positions. Wages are much more heterogenous in period 2. This is reflected with different realized wages based on the worker's realization of general training.

undesirable by all worker types. In the second period each agent's reservation wage is equal to his available earnings from going out and acting as their own firm (the productivity of which will be defined later in this section).

$$w_1 \geq R = R_H = R_L$$
$$w_2 \geq a\theta_i$$

The matching algorithm that will be used is adapted from the college admissions matching model described in Roth and Sotomayor (1992). The first period begins with each agent applying to all firms to which they would like to be matched with based on their preferences. They may choose to apply to as many or as few firms as they would like. Firms respond by offering wage contracts to their most preferred applicants to which agents can accept or reject. Firms cannot offer wages greater than the maximum of the marginal production of that worker in that period or the reservation wage. Put simply, a firm cannot borrow funds in order to finance a wage contract that exceeds the reservation wage²⁵. If an offer is accepted the firm and agent are paired. If all offers to an agent are rejected then that agent goes to the next round in which the process begins again with any remaining unmatched firms and agents. This continues until all parties are matched or at the least one side of the remaining parties prefers to be left unmatched. This process corresponds well with to the hiring process observed at colleges and universities where accounting students match with firms in rounds, typically but not always, with larger firms matching first.

I assume both limited training capacity of firms and a limited number of each agent type available to be hired. Agents are scarce such that there is only enough of each agent type to pair

²⁵ In reality, accounting firms could borrow to finance wage contracts to trainees. However, this condition is necessary to place an upper bound on first period wages to make the model solvable.

with a single firm type. Likewise, each firm can hire a limited number of new workers each period. This simplifies my model to one with two firms and two workers where each firm can be paired with at most one worker in the first period²⁶. In the second period, firms become no longer bound by their limited training capacity and can hire as many trained workers as are willing to accept the wage contracts they offer.

Firm productivity F will be defined as follows:

$$F = \text{sum of marginal production from all workers} \\ = \sum_{i=1}^n b\theta\pi_i$$

b is a positive constant representing the base marginal productivity of additional labor.

n is the number of laborers employed.

π is worker productivity where:

$$\pi_i = (\text{experience} \times \text{training} + \text{default productivity}) \times \text{agent type} \\ = (e_i(x_i + h_{ij}y_i) + d)\tau_i$$

x_i is the amount of general training realized, y_i is the amount of firm-specific training realized, h_{ij} is a continuum $[0,1]$ that identifies how well matched an agent's firm specific training is with their current firm, and d is a positive constant representing a worker's minimum default productivity. If the worker is employed at their training firm h is assigned a value of one.

$$x_i + y_i = T \\ \pi_i = (e_i((T - y_i) + h_{ij}y_i) + d)\tau$$

²⁶ Limited training capacity and a scarcity of talent are realistic tensions of the hiring/training process. The assumption of talent scarcity exactly matching limited training capacity is a choice made to simplify a very complex problem that will vary with local labor markets.

During the first period each matched worker is trained and receives an amount of firm specific training y that is uncertain to all parties until it is realized. Firm-specific training includes exposure to activities or practices that are not ubiquitous to every firm in the industry. The realization of y is stochastically generated from a known Normal distribution $N\left(\frac{T}{2}, \sigma^2\right)$ and all realizations of $T \geq y \geq 0$. The total of general and firm specific training is equal to a fixed positive value T .

This formulation encapsulates many facets of the training commonly done in public accounting. Fulfilling the requirements of an accounting designation involves completing a specified number of work hours (typically one to two years). After this time the agent is eligible to become a full-fledged accountant that demands a much higher salary and has many more options with respect to job opportunities at or outside of their training firm. Therefore, there is a finite period during which training can occur.

Typically, a trainee is rotated through many work teams and engagements. At each stop the trainee receives on-the-job training in the form of tasks relevant to their team's engagement. Although, the tasks completed by a trainee are monitored by their current supervisor, each time a trainee is rotated to a new team their tasks are typically chosen by a new supervisor based on client/team need, without perfect knowledge of past experiences. This creates the possibility for both limited exposure to several aspects of the firm, which translates to the acquisition of general skills that can be applied broadly across the accounting profession, or firm specific training, in the form of knowledge that can only be applied to certain firm clients or specialized skills unique to the way that firm conducts their public practice. Furthermore, supervisors traditionally are not given the incentives to invest in a trainee's work beyond the short-term work they do for them so

there is no impetus to train them in any particular way. Therefore, trainees can finish their work hours with varying amounts of general and firm specific training that is not necessarily consciously chosen by the firm and unknown until after the completion of training.

Beyond staying at their current firm, after training is complete agents also have the ability to go out and either form their own firm or take a position outside of public accounting in industry. In that case, the agent is acting as their own firm and will have a productivity of $a\theta_i$ where $\theta_i = (x_i + d)\tau_i$ and a is a positive constant. This formulation reflects the notion that the more general an agent's training is, the easier it is for them to translate that training into production at a new firm since they have spent more time on tasks that will be directly transferable to the new venture.

A third option for an agent after training is to move to another firm within the public accounting sector. When this happens the agent's h_{ij} is randomly draw from the continuum $[0,1]$ with uniform distribution. This encapsulates the idea that some of the specializations from training at their old firm may carry over to their new firm but not perfectly and the strength of the matching will not be realized until they have begun working at the new firm. This treatment is based on that of Owan (2004).

Lastly, a final assumption that must be made is that for all firms, hiring at least one type of worker at their reservation wage of R provides a positive net payoff in expectation over the two periods. This is a natural assumption that says hiring workers of some type must be, at least in expectation, a positive action which is necessary for any hiring to ever occur.

3.4. Results and Analysis

The model is solved using backwards induction. The complete list of the nine possible first and second period matchings are documented in Appendix A. There are seven possible first period matchings and nine possible second period matchings. The additional two matchings are due to the lifting of the training capacity constraints in the second period which allows firms to hire as many trained workers as they can afford to.

The eighth matching, which is only possible in the second period, is one in which big firms match with both agent types simultaneously. In the ninth matching small firms match with both workers, but this scenario would never occur given the most a worker moving from a big firm to a small firm could potentially produce is equal to their production at the larger firm and is in expectation less. This allows the elimination of the ninth matching immediately and we will proceed with seven possible first period matchings and eight possible second period matchings.

We begin by considering all possible outcomes in the second period and the probability that each outcome occurs given first period matchings. In the second period each worker matches with the employer (either their training firm, a competing public accounting firm, or a firm in industry) with whom they are most productive and can consequently offer them the highest wage while still maintaining positive marginal profits from labor. Workers are paid equal to their second highest wage offer plus ε where ε is an arbitrarily small positive amount. Upon examining each worker's productivity in each possible scenario we can induce Lemma 1.

Lemma 1: The probability of trainee retention is independent of worker type.

This is a small but important result. If we consider the productivity of a worker in each scenario:

$$\text{Job in industry: } a(x_i + d)\tau_i$$

$$\text{Current firm: } b\theta_j(T + d)\tau_i$$

$$\text{Competing firm: } b\theta_{-j}\left(x_i + \frac{y_i}{2} + d\right)\tau_i$$

Worker type is multiplicative for all options. Therefore, when a firm looks to hire in the first period worker type only affects the scale of second period outcomes but not the retention rate of trainees. What does affect retention rates is the industry demand for and the marginal productivity rates of agents (a and b), the relative productive of firm types (θ_j and θ_{-j}), and the realizations of training composition. Given that none of these factors that affect retention are chosen by the firm second period decisions are purely mechanical as labor flow is determined by the stochastic realizations of training. It is important to note that firms do not control the quantity of training, nor the composition during the training period. This creates a different scenario and prevents strategies from models such as Bilanakos et al. (2016) in which dominant firms can simply provide additional training. Firms choose only the wages they offer to different worker types in the first period.

With this established we can turn our attention to the first period where firms and agents will evaluate initial matchings and first period wages with full knowledge of the probabilities that each possible second period outcome will occur. Upon comparing the expectation of net payoffs across both periods for big and small firms for each of the feasible matchings we can discern Lemma 2.

Lemma 2: All firms will always prefer to hire a high type worker over a low type worker if both are available at the same wage.

Lemma 2 provides an intuitive result that also has some subtle implications. One of these is if big firms wish to hire high type workers in the first period they will face competition and are forced to offer wages at least as desirable as the highest wage that can feasibly be offered by small firms. Additionally, if big firms ever find it optimal to hire a non-high type worker they will only have to offer the reservation wage as it must mean that small firms are committed to hiring high types at a wage beyond the reservation wage. If this were not the case, large firms would have already chosen to hire a high type to begin with.

Having just examined the spectrum of total payoffs for firms it is also a good time to touch on the scenarios under which firms will not hire at all. Because large firms have a higher expected output for all types of workers compared to smaller firms, big firms will always be able to outbid small firms for a worker if they desire to. If they do not, it must be the case that it is optimal to hire a different type of worker. Therefore, big firms will always hire due to our assumption that hiring at least one type of worker must yield a positive net payoff in expectation. Small firms, on the other hand, may not have that opportunity if big firms outbid them for high types. This leaves them to choose to hire low types if and only if the expected total payoff from hiring that type is positive. If a positive expected total payoff from low types is not available to them then their optimal decision will be to not hire at all.

Using Lemma 1 and 2 we can now proceed to use backwards induction to solve for subgame Nash equilibria. The end result is Proposition 1.

Proposition 1: The equilibrium first period matching is

a. $\mu_1 = \begin{matrix} \theta_B & \theta_S \\ \tau_H & \tau_L \end{matrix}$ (natural equilibrium) if worker types are sufficiently distinguishable and

small firms can yield a positive net expected payoff from hiring low type workers

b. $\mu_4 = \begin{matrix} \theta_B & \theta_S \\ \tau_H & (\theta_S) \\ & \tau_L \end{matrix} (\tau_L)$ (extreme equilibrium) if worker types are sufficiently

distinguishable and small firms cannot yield a positive net expected payoff from hiring low type workers

c. $\mu_2 = \begin{matrix} \theta_B & \theta_S \\ \tau_L & \tau_H \end{matrix}$ (alternative equilibrium) if worker types are not sufficiently distinguishable

and the probability that a big firm can hire a trained worker away from a small firm in the second period is sufficiently high

The equilibrium matchings are largely dependent on the distinguishability of worker types, and can be characterized by the following equality:

$$\tau_H - \tau_L = \frac{(Payoff_{B,2,t=2} - Payoff_{B,1,t=2}) + (\max[b\theta_S d\tau_H, R] - R)}{b\theta_B d}$$

$Payoff_{B,2,t=2}$ refers to the expected net payoff for a big firm in the second period when matching μ_2 (in which big firms hire low types and small firms hire high types) is imposed in the first period. Likewise, $Payoff_{B,1,t=2}$ refers to the expected net payoff for a big firm in the second period when matching μ_1 (in which big firms hire high types and small firms hire low types) is imposed in the first period.

If the agent types are distinguishable enough such that the difference between types $\tau_H - \tau_M$ is larger than the difference between the expected second period payoffs of hiring a low type rather than a high type for the big firm $Payoff_{B,2,t=2} - Payoff_{B,1,t=2}$, plus the premium beyond the reservation wage a big firm would need to pay to outbid a small firm for a high type $\max[b\theta_S d\tau_H, R] - R$, then big firms will match with high types. The intuition for this result

stems from the implications of Lemma 2. If big firms try to hire high types, they will be forced to pay a premium in excess of the reservation wage because both firm types find high types more desirable than low types. In order to outbid the small firms, large firms will need to offer wages just higher than the marginal productivity of a high type worker for a small firm (the highest wage that a small firm can offer). This is especially worth noting because the only situation in which any firm will face competition in hiring and be forced to pay a greater wage than the reservation wage is when both firms want to hire high types. Given this, in order for hiring high types to be optimal for big firms the difference in expected return from employing the higher type must exceed the premium paid to acquire them.

When big firms are matched with high types, small firms are left to match with either the next best available type, which is lows, or no one. If the net expected payoff for small firms from hiring lows is positive then the first period equilibrium matching will be big firms matching with high types and small firms matching with low types, in what I refer to as the natural equilibrium. If small firms do not yield an positive expected net payoff from hiring low types then they will choose not to hire at all. Only big firms will match with high types and the remaining firms and workers will remain unmatched in what I label the extreme equilibrium. This occurs when the probability of a small firm retainomg its trainees in the second period is too low to offset the costs of training. The threshold for the probability of retention is

$$\Pr \left(\begin{matrix} x_s < D \\ x_s < B \end{matrix} \right) > \frac{R - b\theta_s d\tau_L}{\tau_L \left[b\theta_s (T + d) - \max E \left[\left[b\theta_B \left(x_s + \frac{y_s}{2} + d \right), a(x_s + d) \right] \middle| \begin{matrix} x_s < D \\ x_s < B \end{matrix} \right] \right]}$$

Below this threshold the extreme equilibrium prevails. x_s and x_b are the realizations of general training for workers trained by small and big firms respectively and A-E are defined in Appendix B.

If the wage premium exceeds the expected benefit of hiring a high type over a low type then big firms will opt to concede the high type workers to small firms and instead hire low types at the reservation wage. This makes the training period less costly for big firms and they still have the potential to hire high types away from the small firms in the second period. This equilibrium, which I refer to as the alternative equilibrium, occurs when types are less distinguishable and the probability that big firms can hire a worker away from small firms in the second period is sufficiently high.

With our equilibria solved we can examine their implications on labor flow. Both the natural and alternative equilibria have a worker being hired at both firms. Figure 1 shows the second period labor flow for workers trained at big firms. Figure 2a and 2b show the second period labor flow for workers trained at small firms. The difference between 2a and 2b is the size of the parameter a which can be interpreted as the demand for accountants in industry. When a is sufficiently large all labor movement in the second period is workers being pulled from public accounting into industry. When a is below the threshold then not only do more workers stay within public accounting, but there is also the possibility for agents trained at small firms to find it optimal to be move to a larger firm. We can formally define this threshold by examining the equality

$$\frac{2\theta_s(T+d)}{\theta_b} - T - 2d = \min \left[\frac{b\theta_s(T+d)}{a}, \frac{b\theta_b(T+2d) - 2ad}{2a - \theta_b b} \right]$$

The left side of the equality is the threshold for general training above which labor flows from small firms to big firms. The right side of the equality is the threshold for general training above which labor flows from small firms into industry/entrepreneurship. Isolating a we find that the threshold at which industry demand completely outweighs any pull from small firms to large firms is

$$a = \frac{b\theta_B\theta_S(T+d)}{2\theta_S(T+d) - \theta_B(T+d)}$$

Given that a is strictly positive, for there to exist a scenario where big firms can hire away workers from small firms and outbid industry demand $2\theta_S > \theta_B$.

The figures are applicable to both the natural and alternative equilibria. We need not examine the extreme equilibrium because in that scenario the small firms do not hire and only large firms will grow. These figures are for illustrative purposes and the density of each area will vary depending on the parameters.

Figure 1: Distribution of Labor Flow for Workers Trained at Big Firms

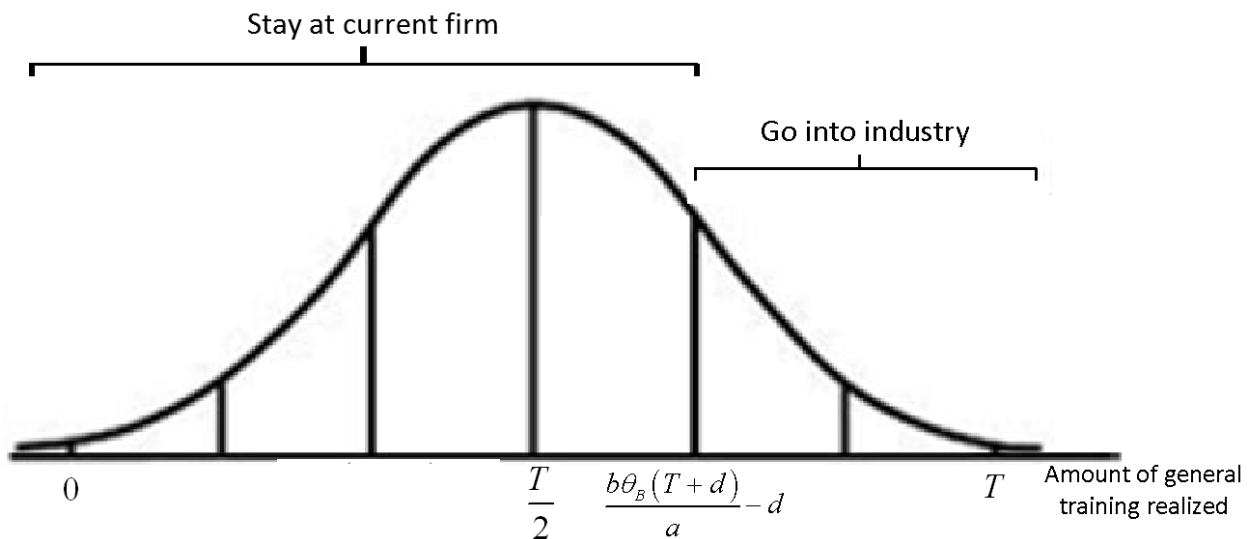


Figure 2a: Distribution of Labor Flow for Workers Trained at Small Firms

(When industry demand is not large, $a < \frac{b\theta_B\theta_S(T+d)}{2\theta_S(T+d) - \theta_B T - \theta_B d}$)

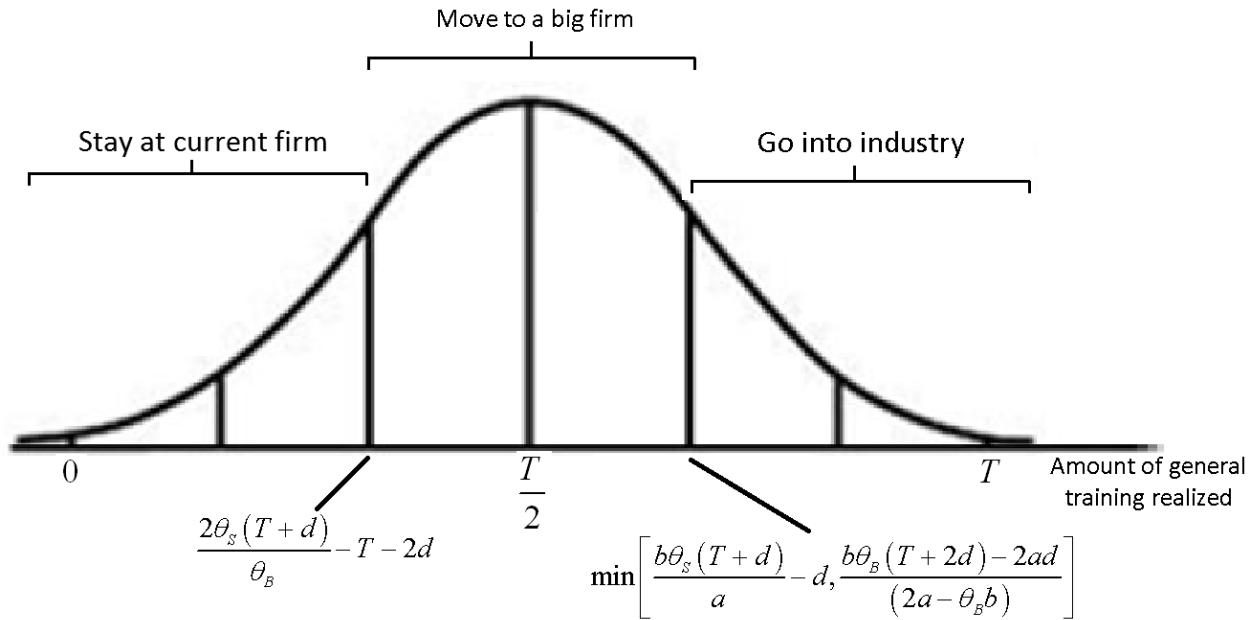
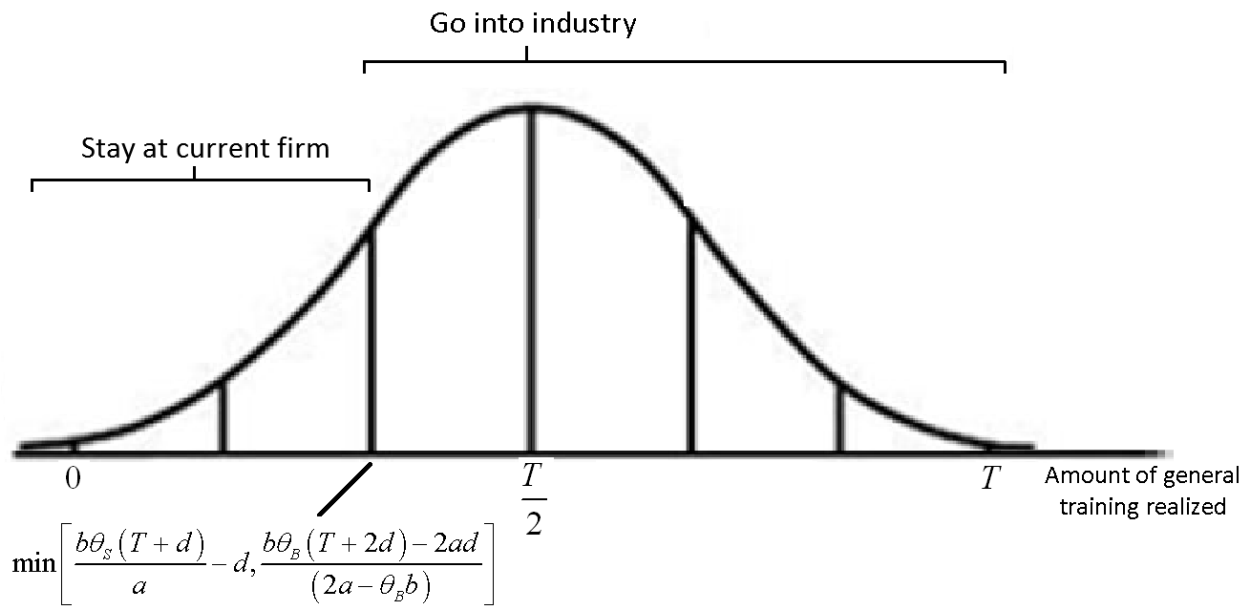


Figure 2b: Distribution of Labor Flow for Workers Trained at Small Firms

(When industry demand is large, $a > \frac{b\theta_B\theta_S(T+d)}{2\theta_S(T+d) - \theta_B T - \theta_B d}$)



Corollary 1: Under either equilibrium

a. Big firms will retain their workers if $x_B < \frac{b\theta_B(T+d)}{a} - d$

b. Small firms will retain their workers if $x_S < \frac{2\theta_S(T+d)}{\theta_B} - T - 2d$ and

$$x_S < \min \left[\frac{b\theta_S(T+d)}{a} - d, \frac{b\theta_B(T+2d) - 2ad}{2a - \theta_B b} \right]$$

c. Workers trained at small firms will move to big firms if

$$\frac{2\theta_S(T+d)}{\theta_B} - T - 2d < x_S < \min \left[\frac{b\theta_S(T+d)}{a} - d, \frac{b\theta_B(T+2d) - 2ad}{2a - \theta_B b} \right]$$

d. If all of the conditions in a.-c. are not met then the worker will opt for the outside option of going into industry

Big firms have a higher probability to retain their trainees than small firms due to their inherent advantage in their marginal production from workers' general training. This allows them to have a higher threshold for realized general training before workers will find it optimal to explore the outside option of taking an industry position. This also allows them to effectively hire workers who do not have extreme realizations of general or specialized training away from small firms. This is asymmetrical given small firms cannot yield marginal productivity levels that allow them to recruit trained workers from larger firms. The result is that only workers with high realizations of firm-specific training will stay at small firms while big firms will be comprised of both very specialized workers and agents with balanced training outcomes. Under either equilibrium big firms will grow at a faster rate than small firms and in the long run firm sizes will separate into distinct groups of larger and smaller firms.

Although the movement of workers between big and small firms is based on the relative differences in firm types, labor flow between the public accounting firms and industry is

governed by the strength of industry demand. The threshold for general training realizations beyond which agents will move into industry is larger for big firms so they lose a smaller proportion of their work force to industry. Nonetheless, if industry demand is great enough, both large and small firms could find retention to be difficult.

Statistics from Bird, Ho, and Ruchti (2015) are consistent with the models predictions as they find a significantly larger proportion of non-Big 4 alumni working in industry than Big 4 alumni when compared to their relative market shares. It does appear that smaller firms are having a more difficult time retaining talent after the training process is complete.

A final area that we can draw conclusions about with respect to the equilibria is output quality.

Corollary 2: If the alternative equilibrium is realized then overall industry output quality will decrease.

In the alternative equilibrium big firms match with low types while small firms match with high types in the first period. Because of these initial matchings, in the second period, compared to the natural equilibrium, more low types and less high types will end working in big firms. This reduces the output quality of big firms and increases the output quality of small firms. However, because big firms serve a larger number of clients, the industry's overall output quality decreases. This is assuming that the characteristics of the audits taken on at each firm type being relatively similar with only the proportion of the industry served being different.

If we continue to use employee input types as a direct proxy for output quality, the extreme equilibrium would produce the highest industry output quality because in that scenario only high types are ever employed. Low types never receive training and the reduced workforce

only consists of high ability workers. However, this does not consider the larger impact on firm incentives caused by the shrinking number of firms that the extreme equilibrium would cause in the long run and the possible overworking of the employed labor in order to conduct all the needed audits.

From a social welfare perspective, if we measure social welfare using overall public accounting output quality, the extreme equilibrium is optimal given that it allows only high types to be matched and subsequently trained. The second best outcome is the natural equilibrium in which high types are matched with large firms and low types with small firms.. This results in a composition of mostly high types and only some lows at large firms. The worst outcome is the alternative equilibrium in which high types are hired by small firms, where they have a smaller impact on industry output. Again, it is important to reiterate that the extreme equilibrium is only optimal if we consider the result strictly over two periods and we ignore larger implications on long run market structure. The extreme equilibrium predicts that small firms will never grow and a smaller number of firms operating in a strengthened oligopoly is ideal for output quality. This is unlikely to be quite that simple in the long run since firms will lose their incentive to compete on quality in the output market when competition is reduced.

If we assume our parameters to fall within ranges that produce the natural equilibrium the predictions of this model are consistent with the data and empirical results. Large firms will in expectation retain their workers more often and grow at a faster rate, even before allowing for the possibility that large firms have a greater training capacity than smaller firms. This is consistent with the empirical findings of Hashimoto (1979). In addition, in this model if the market operates within the natural equilibrium then large firms will have a higher output quality

which is consistent with the findings of Davidson and Neu (2010) and Eshleman and Guo (2014).

3.5. Implications, Current Trends, and Future Research

One major implication of the model is the need for there to be a sufficient return to ability for optimal matching to take place. This is a aspect that cannot be overlooked when discussing the accounting industry. Ability, is traditionally defined using IQ or physical characteristics. However, the skills and character traits that make up a proficient and productive accountant are not necessarily the same hard skills upon which students and job applicants are typically evaluated. The moral character that motivates auditors to maintain professional ethics and the soft skills that enables accountants to maintain healthy relationships with clients are key components that make up ability within this field. Personality and emotional intelligence evaluations are critical, especially given the results of Buchan (2005) showing the interconnected nature of attitudes, social norms, and ethical intentions in public accounting. If researchers or employers narrow their scope of evaluation to hard skills, sufficient returns to ability may not be observed and suboptimal labor matchings may occur.

My model cannot speak to the role of talent evaluation technologies given that I assume perfect information with respect to worker talent. Nonetheless, talent evaluation is a critical aspect of the hiring and training process. Even if ability is defined correctly, the process by which firms evaluate applicants will provide crucial information for personnel decisions. How effective firms are in their evaluations of both hard and soft skills will directly affect how they value their workforce. With the rise of new technologies, accounting firms have begun to use artificial intelligence to conduct and score interviews. These advancements may reduce the

idiosyncratic risks/biases associated with traditional interviews but it they may also expose firms to systematic flaws in their hiring. Future research is needed as technology becomes more and more common in the hiring process.

The need to define ability within the context of public accounting in order to properly evaluate returns on ability also raises the issue of how to attract talent to the profession and how the industry can set itself up to have the right types of individuals self-select into it. If the best prospective trainees need to possess traits that are not traditionally tested in the classroom, future research is needed to determine how to best identify accounting talent. This would also further our knowledge of talent availability with respect to public accounting. Studies such as Collins et al. (1997) and the Rosenberg Survey have examined why individuals choose to leave public accounting. A next step for future research would be to examine those who stay and determine whether those individuals are consistent with the traits of high or low ability workers.

The model predicts that in the long-run the gulf in size between large and small auditors will widen. As it widens, it will become increasingly difficult for smaller firms to retain employees with any general training, leaving them with only the most specialized employees who are perfectly suited to work in their particular firm, serving their particular clients. These highly specialized firms should excel in servicing exotic clients which demand a set of skills not commonly found. Such a description is fitting of what are referred to as boutique firms. These are auditors who excel in auditing specific industries and have specialized with such a focus that they can compete with auditors of any size (Gigler and Penno, 1995).

This model predicts that audit quality will be greatest in markets where the natural equilibrium prevails and assortative matching occurs. This requires sufficient differentiation between the outputs of different worker types, but does not necessarily prescribe an ideal form of

industrial organization. This creates the demand for empirical examination of whether highly competitive, oligopolistic, or monopolistic markets generate the highest levels of audit quality.

Combatting the predicted trajectory of industrial organization, there have also been disruptive trends in the assurance market, especially on the labor side, that have slowed the growth rate of larger firms. The mobility of workers greatly increased in the later half of the 20th century (Lee and Wolpin, 2006), especially for service industries, and accounting has seen a surge in the demand for CPAs amongst industry firms. This suggests that the value and demand for generalized training has risen and firms remain unable to implement training programs consisting solely of specialized training. This would make it more difficult for all public accounting firms to retain employees, and if this demand is strong enough it could explain the lack of a significant increase in the labor gap between themselves and smaller firms.

Aobdia, Enache, and Srivastava (2016) even find a shrinking gap between the Big 4 and their next tier of competitors. These contrasting results suggest that the shrinking of the gap may in part be due to changes in the demand for auditor-client specialization matchings, as new industries arise and smaller auditors are able to adapt faster to unique needs. Alternatively, there is also evidence that the shrinking of the gap may in part be due to better cultural and social fits within smaller firms that have helped retain labor and recruit clients (Chatman, 1991; Taylor and Cosenza, 1998).

Another key conclusion of their analyses, that is not incorporated in my model, is the willingness of smaller auditors to accept clients with higher audit risk. Newer auditors that are eager to grow their client portfolios have been observed to be more willing to take on riskier clients, especially those from new industries with less traditional asset compositions, while larger, more established auditors are more selective and conservative about the clients they

accept. Alone, the fact that larger auditors would require a higher premium for taking on riskier clients may not inherently lead to a shrinking or extending of the gap between bigger and smaller auditors. However, if these riskier clients from emerging industries are able to grow disproportionately quickly and sustain their success, smaller auditors will grow alongside them, reducing the gap between themselves and larger auditors. Aobdia et al. show that this has been the case over the later half of the 20th century. The continuation of this trend will depend on if new companies and industries will continue to spring up and find success through innovation or if legacy firms will be successful in cementing their place in the economy.

Refocusing on labor supply trends, recent statistics show a large gap between the number of accounting graduates and the number of workers that go on to pass the CPA exam (Gonzalez, 2017; Monga, 2017). Concerns over shortages of trained accountants continue to persist at both public auditors and industry companies. Discussions at the Standing Advisory Group Meetings for the PCAOB in May 2017 noted generational changes in modern graduates versus those of the past and rising demand for skills such as data analytics and technology combined with competition from consulting, making attracting top talent to the profession more difficult (Bhatt et al., 2017). The increasing gap between the supply and demand for trained employees further emphasizes the importance of employee retention and increases value of high ability untrained labor that are more likely to complete CPA testing. Bilanokas et al. (2016)'s results suggesting that more dominant firms provide their employees more access to additional general training could prove pivotal here if larger public accounting firms are providing more support for trainees leading up to CPA examinations.

Going forward, one major trend to monitor is the implementation of new CPA training guidelines such as those that have been adopted in Canada which have allowed industry firms to

start training their own CPAs internally. This change has the potential to significantly decrease both the gatekeeping power of public accounting firms to shape the incoming workforce and the burden placed on public accounting firms of having to compete directly with industry firms for their internally trained staff. If industry firms are able to self-train all their needed accounting staff then larger public firms may face no systematic threat in retaining their staff, thereby lowering their incentive to provide specialized training.

In future work, one potentially important extension to this model comes from the findings of Ho (2019). The results of that study uncover a shifting of accounting resources from audit services to non-audit services as markets become more competitive. Although, the labor hours of untrained workers cannot be allocated to non-audit services due to designation requirements that necessitate trainees perform tax or audit functions to earn work experience hours, non-audit services provide a crucial vehicle for firms of all sizes to earn additional revenue from their trained workforce. Non-audit services are a differentiated product that should be relatively more profitable than audit services. They are also a direct application of firm specific training as previous experience with the firm's clients will greatly aid in a worker's ability to provide client-specialized non-audit services. Adding non-audit services to the model would also provide smaller firms with additional tool for retention as it allows them to offer their internally trained talent a higher wage.

3.6. Conclusion

The model developed in this paper uses prominent features of the contemporary accounting labor market to study the matching of heterogeneous workers with heterogeneous firms before and after training. Important characteristics of the accounting labor market that are

observed in practice and incorporated into this model include distinct markets for untrained and trained workers, the presence of the non-public accounting sector that is limited to only hiring trained accountants, and stochastic training composition realizations for general and specific training.

The main result is that the prevailing first period equilibrium is driven by the distinguishability of worker types. If workers are sufficiently distinguishable then larger firms have the incentive to ensure they match with the most talented workers. Firms types and worker types will match in descending order with larger firms bearing the cost of training the most talented workers. If workers are not sufficiently distinguishable, the incentive to pursue top talent is not as strong and big firms will concede the high ability workers to smaller firms and instead opt to free ride on the training capacity of smaller firms. They will train lower ability workers instead, with the hopes of later hiring high skilled workers away from small firms after training is complete. In either case I find that, if larger firms can convert ability to output more efficiently than their smaller counterparts, big firms will always retain a higher percentage of their trainees and grow faster in expectation. This finding is consistent with the data on the current competitive environment in public accounting that shows a large gap in labor retention between the Big 4 and the next tier of public accounting firms (Bird et al., 2015). I also find that if worker types are not sufficiently distinguishable then overall public accounting output quality will decrease due to the smaller proportion of high ability workers that will be matched with large firms post training.

The results of the model spotlight the distinguishability of worker types as a key factor for the maintenance of efficient labor matching in public accounting. Firms' aptitude for correctly identifying ability within the context of public accounting and allocate it effectively will not only affect the productivity of individual firms, but the industry as a whole. It is

imperative that researchers and practitioners strive to understand how to correctly quantify ability and distinguish between worker types. Losses from inefficient matching will not only reduce productivity today but may influence the distribution of future worker types that choose to enter public accounting.

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3.7. Appendix A – List of All Feasible Matchings

Matchings 1-7 are feasible in both periods. Matchings 8 and 9 are exclusive to period 2.

1. $\theta_B \quad \theta_S$
 $\tau_H \quad \tau_L$
2. $\theta_B \quad \theta_S$
 $\tau_L \quad \tau_H$
3. $\theta_B \quad \theta_S \quad (\tau_H) \quad (\tau_L)$
 $(\theta_B) \quad (\theta_S) \quad \tau_H \quad \tau_L$
4. $\theta_B \quad \theta_S \quad (\tau_L)$
 $\tau_H \quad (\theta_S) \quad \tau_L$
5. $\theta_B \quad \theta_S \quad (\tau_L)$
 $(\theta_B) \quad \tau_H \quad \tau_L$
6. $\theta_B \quad \theta_S \quad (\tau_H)$
 $\tau_L \quad (\theta_S) \quad \tau_H$
7. $\theta_B \quad \theta_S \quad (\tau_H)$
 $(\theta_B) \quad \tau_L \quad \tau_H$
8. $\theta_B \quad \theta_S$
 $\tau_H, \tau_L \quad (\theta_S)$
9. $\theta_B \quad \theta_S$
 $(\theta_B) \quad \tau_H, \tau_L$

3.8. Appendix B – Proofs

Please note that for this section, for readability all $E[x_S | \dots]$ and $E[x_B | \dots]$ will be written simply as x_S and x_B where $[\dots]$ presents the conditions outlined with the probabilities multiplied by the term.

Definitions of A-E:

$$A = \frac{b\theta_B(T+d)}{a} - d$$

$$B = \frac{b\theta_S(T+d)}{a} - d$$

$$C = \frac{2\theta_B(T+d)}{\theta_S} - T - 2d$$

$$D = \frac{2\theta_S(T+d)}{\theta_B} - T - 2d$$

$$E = \frac{b\theta_B(T+2d) - 2ad}{(2a - b\theta_B)}$$

Proof of Lemma 2: The total payoffs (across both periods) for each viable first period matching for small firms if all hiring is done at the reservation wage listed below

$$\begin{aligned} TPayoff_{s,1} = & \Pr\left(\begin{matrix} x_B < A, \\ x_S < D, x_S < B \end{matrix}\right) \left[\begin{matrix} b\theta_S(T+d)\tau_L \\ -\max\left[b\theta_B\left(x_S + \frac{y_S}{2} + d\right)\tau_L, a(x_S + d)\tau_L\right] \end{matrix} \right] \\ & + \Pr\left(\begin{matrix} x_B > A, \\ x_S < D, x_S < B \end{matrix}\right) \left[\begin{matrix} b\theta_S(T+d)\tau_L \\ -\max\left[b\theta_B\left(x_S + \frac{y_S}{2} + d\right)\tau_L, a(x_S + d)\tau_L\right] \end{matrix} \right] + b\theta_S d \tau_L - R \end{aligned}$$

$$\begin{aligned}
TPayoff_{s,2} &= \Pr \left(\begin{array}{l} x_B < A, \\ x_S < D, x_S < B \end{array} \right) \left[\begin{array}{l} b\theta_S (T+d) \tau_H \\ -\max \left[b\theta_B \left(x_S + \frac{y_S}{2} + d \right) \tau_H, a(x_S + d) \tau_H \right] \end{array} \right] \\
&+ \Pr \left(\begin{array}{l} x_S < D, x_S < B, \\ x_B > A \end{array} \right) \left[\begin{array}{l} b\theta_S (T+d) \tau_H \\ -\max \left[b\theta_B \left(x_S + \frac{y_S}{2} + d \right) \tau_H, a(x_S + d) \tau_H \right] \end{array} \right] + b\theta_S d \tau_H - R
\end{aligned}$$

$$TPayoff_{s,3} = 0$$

$$TPayoff_{s,4} = 0$$

$$TPayoff_{s,5} = \Pr \left(\begin{array}{l} x_S < D, \\ x_S < B \end{array} \right) \left[\begin{array}{l} b\theta_S (T+d) \tau_H \\ -\max \left[b\theta_B \left(x_S + \frac{y_S}{2} + d \right) \tau_H, a(x_S + d) \tau_H \right] \end{array} \right] + b\theta_S d \tau_H - R$$

$$TPayoff_{s,6} = 0$$

$$TPayoff_{s,7} = \Pr \left(\begin{array}{l} x_S < B, \\ x_S < D \end{array} \right) \left[\begin{array}{l} b\theta_S (T+d) \tau_L \\ -\max \left[b\theta_B \left(x_S + \frac{y_S}{2} + d \right) \tau_L, a(x_S + d) \tau_L \right] \end{array} \right] + b\theta_S d \tau_L - R$$

All non-zero payoffs where the firm hires a high type are positive by assumption which eliminates matching 3, 4, and 6.

$$TPayoff_{s,5} > TPayoff_{s,7}$$

$$TPayoff_{s,2} > TPayoff_{s,1}$$

Matching 5 dominates matching 7 and matching 2 dominates matching 1 so matching 7 and 1 is eliminated.

$$TPayoff_{s,2} = TPayoff_{s,5}$$

The remaining matches are 2 and 5 are equal in expected total payoff and both have small firms hiring high type workers. Therefore, when hiring wages are equal small firms will always opt to hire high type workers over all other types.

The total payoffs (across both periods) for each viable first period matching for big firms if all hiring is done at the reservation wage listed below

$$\begin{aligned}
TPayoff_{B,1} &= \left[\Pr \left(\begin{matrix} x_B < A, \\ x_S < D, x_S < B \end{matrix} \right) + \Pr \left(\begin{matrix} x_B < A, \\ x_S > E, x_S > B \end{matrix} \right) \right] \\
&* \left[b\theta_B (T+d) \tau_H - \max \left[b\theta_S \left(x_B + \frac{y_B}{2} + d \right) \tau_H, a(x_B+d) \tau_H \right] \right] \\
&+ \left[\Pr(D < x_S < E) \right] * \left[\begin{aligned} &\Pr(x_B > A) \left[b\theta_B \left(x_S + \frac{y_S}{2} + d \right) \tau_M - \max \left[b\theta_S (T+d) \tau_M, a(x_S+d) \tau_M \right] \right] \\ &+ \Pr(x_B < A) \left[\begin{aligned} &b\theta_B (T+d) \tau_H - \max \left[b\theta_S \left(x_B + \frac{y_B}{2} + d \right) \tau_H, a(x_B+d) \tau_H \right] \\ &+ b\theta_B \left(x_S + \frac{y_S}{2} + d \right) \tau_L - \max \left[b\theta_S (T+d) \tau_L, a(x_S+d) \tau_L \right] \end{aligned} \right] \end{aligned} \right] \\
&+ b\theta_B d \tau_H - R \\
TPayoff_{B,2} &= \left[\Pr \left(\begin{matrix} x_B < A, \\ x_S < D, x_S < B \end{matrix} \right) + \Pr \left(\begin{matrix} x_S > E, x_S > B, \\ x_B < A \end{matrix} \right) \right] \left[\begin{aligned} &b\theta_B (T+d) \tau_L \\ &- \max \left[b\theta_S \left(x_B + \frac{y_B}{2} + d \right) \tau_L, a(x_B+d) \tau_L \right] \end{aligned} \right] \\
&+ \Pr \left(\begin{matrix} D < x_S < E, \\ x_B > A \end{matrix} \right) \left[\begin{aligned} &b\theta_B \left(x_S + \frac{y_S}{2} + d \right) \tau_H \\ &- \max \left[b\theta_S (T+d) \tau_H, a(x_S+d) \tau_H \right] \end{aligned} \right] \\
&+ \Pr \left(\begin{matrix} D < x_S < E, \\ x_B < A \end{matrix} \right) \left[\begin{aligned} &b\theta_B \left(x_S + \frac{y_S}{2} + d \right) \tau_H - \max \left[b\theta_S (T+d) \tau_H, a(x_S+d) \tau_H \right] \\ &+ b\theta_B (T+d) \tau_L - \max \left[b\theta_S \left(x_B + \frac{y_B}{2} + d \right) \tau_L, a(x_B+d) \tau_L \right] \end{aligned} \right] \\
&+ b\theta_B d \tau_L - R \\
TPayoff_{B,3} &= 0
\end{aligned}$$

$$TPayoff_{B,4} = \Pr(x_B < A) \left[\begin{array}{l} b\theta_B(T+d)\tau_H \\ -\max \left[b\theta_S \left(x_B + \frac{y_B}{2} + d \right) \tau_H, a(x_B+d)\tau_H \right] \end{array} \right] + b\theta_B d \tau_H - R$$

$$TPayoff_{B,5} = \Pr(D < x_S < E) \left[\begin{array}{l} b\theta_B \left(x_S + \frac{y_S}{2} + d \right) \tau_H \\ -\max \left[b\theta_S(T+d)\tau_H, a(x_S+d)\tau_H \right] \end{array} \right]$$

$$TPayoff_{B,6} = \Pr(x_B < A) \left[\begin{array}{l} b\theta_B(T+d)\tau_L \\ -\max \left[b\theta_S \left(x_B + \frac{y_B}{2} + d \right) \tau_L, a(x_B+d)\tau_L \right] \end{array} \right] + b\theta_B d \tau_L - R$$

$$TPayoff_{B,7} = \Pr(D < x_S < E) \left[\begin{array}{l} b\theta_B \left(x_S + \frac{y_S}{2} + d \right) \tau_L \\ -\max \left[b\theta_S(T+d)\tau_L, a(x_S+d)\tau_L \right] \end{array} \right]$$

All non-zero payoffs where the firm hires a high type are positive by assumption which eliminates matching 3.

$$\begin{aligned} TPayoff_{B,2} &> TPayoff_{B,5} > TPayoff_{B,7} \\ TPayoff_{B,4} &> TPayoff_{B,6} \end{aligned}$$

Matching 2 dominates matching 5 which dominates 7 and matching 4 dominates matching 6.

This eliminates matching 5, 6, and 7. This leaves matching 1, 2, and 4 as viable matchings for big firms.

$$\begin{aligned} TPayoff_{B,1} &> TPayoff_{B,2} \\ TPayoff_{B,1} &> TPayoff_{B,4} \end{aligned}$$

Matching 1 dominates all remaining options. However, matching 1 feasibility relies on the smaller firms ability to hire a low type worker with positive net expected payoff. If this is not possible then the result is matching 4. Nonetheless, both matching 1 and 4 have big firms hiring

high type workers. Therefore, we can conclude that big firms will prefer to hire high type workers if all types are available at the same wage.

Proof of Proposition 1:

The total payoffs (across both periods) for each viable first period matching for big firms if they are forced to pay competitive wages is listed below

$$\begin{aligned}
TPayoff_{B,1} &= \left[\Pr \left(\begin{matrix} x_B < A, \\ x_S < D, x_S < B \end{matrix} \right) + \Pr \left(\begin{matrix} x_B < A, \\ x_S > E, x_S > B \end{matrix} \right) \right] \\
&* \left[b\theta_B (T+d) \tau_H - \max \left[b\theta_S \left(x_B + \frac{y_B}{2} + d \right) \tau_H, a(x_B+d) \tau_H \right] \right] \\
&+ \left[\Pr(D < x_S < E) \right] * \left[\Pr(x_B > A) \left[b\theta_B \left(x_S + \frac{y_S}{2} + d \right) \tau_L - \max \left[b\theta_S (T+d) \tau_L, a(x_S+d) \tau_L \right] \right] \right. \\
&\quad \left. + \Pr(x_B < A) \left[b\theta_B (T+d) \tau_H - \max \left[b\theta_S \left(x_B + \frac{y_B}{2} + d \right) \tau_H, a(x_B+d) \tau_H \right] \right] \right. \\
&\quad \left. + b\theta_B \left(x_S + \frac{y_S}{2} + d \right) \tau_L - \max \left[b\theta_S (T+d) \tau_L, a(x_S+d) \tau_L \right] \right] \\
&+ b\theta_B d \tau_H - \max [b\theta_S d \tau_H, R] \\
TPayoff_{B,2} &= \left[\Pr \left(\begin{matrix} x_B < A, \\ x_S < D, x_S < B \end{matrix} \right) + \Pr \left(\begin{matrix} x_S > E, x_S > B, \\ x_B < A \end{matrix} \right) \right] \left[b\theta_B (T+d) \tau_L \right. \\
&\quad \left. - \max \left[b\theta_S \left(x_B + \frac{y_B}{2} + d \right) \tau_L, a(x_B+d) \tau_L \right] \right] \\
&+ \Pr \left(\begin{matrix} D < x_S < E, \\ x_B > A \end{matrix} \right) \left[b\theta_B \left(x_S + \frac{y_S}{2} + d \right) \tau_H \right. \\
&\quad \left. - \max \left[b\theta_S (T+d) \tau_H, a(x_S+d) \tau_H \right] \right] \\
&+ \Pr \left(\begin{matrix} D < x_S < E, \\ x_B < A \end{matrix} \right) \left[b\theta_B \left(x_S + \frac{y_S}{2} + d \right) \tau_H - \max \left[b\theta_S (T+d) \tau_H, a(x_S+d) \tau_H \right] \right. \\
&\quad \left. + b\theta_B (T+d) \tau_L - \max \left[b\theta_S \left(x_B + \frac{y_B}{2} + d \right) \tau_L, a(x_B+d) \tau_L \right] \right] \\
&+ b\theta_B d \tau_L - R \\
TPayoff_{B,3} &= 0
\end{aligned}$$

$$TPayoff_{B,4} = \Pr(x_B < A) \left[\begin{array}{l} b\theta_B(T+d)\tau_H \\ -\max \left[b\theta_S \left(x_B + \frac{y_B}{2} + d \right) \tau_H, a(x_B+d)\tau_H \right] \end{array} \right] + b\theta_B d\tau_H - \max[b\theta_S d\tau_H, R]$$

$$TPayoff_{B,5} = \Pr(D < x_S < E) \left[\begin{array}{l} b\theta_B \left(x_S + \frac{y_S}{2} + d \right) \tau_H \\ -\max [b\theta_S (T+d)\tau_H, a(x_S+d)\tau_H] \end{array} \right]$$

$$TPayoff_{B,6} = \Pr(x_B < A) \left[\begin{array}{l} b\theta_B(T+d)\tau_L \\ -\max \left[b\theta_S \left(x_B + \frac{y_B}{2} + d \right) \tau_L, a(x_B+d)\tau_L \right] \end{array} \right] + b\theta_B d\tau_L - R$$

$$TPayoff_{B,7} = \Pr(D < x_S < E) \left[\begin{array}{l} b\theta_B \left(x_S + \frac{y_S}{2} + d \right) \tau_L \\ -\max [b\theta_S (T+d)\tau_L, a(x_S+d)\tau_L] \end{array} \right]$$

We will consider payoffs for big firms first since they have the means to outbid small firms for any worker in the first period since $b\theta_H d\tau > b\theta_B d\tau$. Similar to the proof of Lemma 2 all non-zero payoffs where the firm hires a high type are positive by assumption which eliminates matching 3.

$$\begin{aligned} TPayoff_{B,2} &> TPayoff_{B,5} > TPayoff_{B,7} \\ TPayoff_{B,4} &> TPayoff_{B,6} \end{aligned}$$

Matching 2 dominates matching 5 which dominates 7 and matching 4 dominates matching 6. This eliminates matching 5, 6, and 7. This leaves matching 1, 2, and 4 as viable matchings for big firms. Again, technically matching 1 dominates matching 4 but this matching cannot be eliminated as a possible equilibrium because the big firm cannot force the small firm to match with any worker type. They can only ensure that they outbid the small firm for a type.

If we turn our attention to remaining matchings they are:

$$\mu_1 = \begin{matrix} \theta_B & \theta_S \\ \tau_H & \tau_L \end{matrix} \quad \mu_2 = \begin{matrix} \theta_B & \theta_S \\ \tau_L & \tau_H \end{matrix} \quad \mu_4 = \begin{matrix} \theta_B & \theta_S & (\tau_L) \\ \tau_H & (\theta_S) & \tau_L \end{matrix}$$

Although there are three matchings, there is only one decision that the big firm has to make, whether to hire a high type or a low type. If they hire high types they will have pay a premium in order to outbid small firms for them but if they hire low types they can hire them at the reservation wage. We can inspect the threshold at which each of these options is optimal by examining the equality that makes big firms indifferent between the two types.

$$Payoff_{B,1,t=1} + Payoff_{B,1,t=2} = Payoff_{B,2,t=1} + Payoff_{B,2,t=2}$$

If $Payoff_{B,1,t=1} + Payoff_{B,1,t=2} > Payoff_{B,2,t=1} + Payoff_{B,2,t=2}$ then a big firm will be willing to

pay the premium to hire a high type in the first period and matching 1 of $\mu_1 = \begin{matrix} \theta_B & \theta_S \\ \tau_H & \tau_L \end{matrix}$ or

matching 4 of $\mu_4 = \begin{matrix} \theta_B & \theta_S & (\tau_L) \\ \tau_H & (\theta_S) & \tau_L \end{matrix}$ will be the equilibrium. This occurs when:

$$\begin{aligned} b\theta_B d\tau_H - \max[b\theta_S d\tau_H, R] + Payoff_{B,1,t=2} &> b\theta_B d\tau_L - R + Payoff_{B,2,t=2} \\ b\theta_B d\tau_H - b\theta_B d\tau_L &> \max[b\theta_S d\tau_H, R] - R + Payoff_{B,2,t=2} - Payoff_{B,1,t=2} \\ b\theta_B d(\tau_H - \tau_L) &> (\max[b\theta_S d\tau_H, R] - R) + (Payoff_{B,2,t=2} - Payoff_{B,1,t=2}) \\ \tau_H - \tau_L &> \frac{(\max[b\theta_S d\tau_H, R] - R) + (Payoff_{B,2,t=2} - Payoff_{B,1,t=2})}{b\theta_B d} \end{aligned}$$

The realization of matching 1 or matching 4 is left to the small firm. After the big firms have matched they are left to choose between the remaining available types. If the expected total payoff from hiring the next best available type is positive $TPayoff_{S,\tau_L} \geq 0$ then they will hire and

the equilibrium will be $\mu_1 = \frac{\theta_B}{\tau_H} \frac{\theta_S}{\tau_L}$. If not small firms will remain unmatched and choose not to

hire at all and the prevailing equilibrium first period matching will be $\mu_4 = \frac{\theta_B}{\tau_H} \frac{\theta_S}{(\theta_S)} \frac{(\tau_L)}{\tau_L}$.

If $\tau_H - \tau_L < \frac{(\text{Payoff}_{B,2,t=2} - \text{Payoff}_{B,1,t=2}) + (\max[b\theta_S d\tau_H, R] - R)}{b\theta_B d}$ then the big firms will

not be willing to pay the premium and will leave high types to be hired by the smaller firms and

the equilibrium matching will be $\mu_2 = \frac{\theta_B}{\tau_L} \frac{\theta_S}{\tau_H}$.