

**TECHNOLOGICAL INNOVATION'S IMPACT ON AUDIT QUALITY AND AUDIT
FEES: EVIDENCE FROM DISTANT AUDITS**

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ABSTRACT

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This paper examines the impact of advances in communication technology on audit quality and audit fees over the first two decades of the twenty-first century. Using theories on virtual teams from the management literature and distant audits as a setting where auditors and clients are most reliant on communication technology, I hypothesize that advances in communication technology improve audit quality over time for distant audits, specifically, and when compared to local audits. With two measures of audit quality (discretionary accruals and misstatements) and an analysis that identifies three “eras” of communication technology in the 2000s, I find evidence that audit quality has seen statistically significant improvement over time with advances in communication technology for distant audits and that this improvement is statistically significant when compared to local audits as a control group. In an additional test, I find evidence that advances in communication technology also impact audit fees. Specifically, audit fees of distant audits increase over time at a lower rate than local audits suggesting that distant audits benefit more from advances in communication technology. These results are important because they provide evidence that communication technology has benefited audits by increasing quality and reducing fees, particularly for distant audit clients. This is relevant to the current audit environment where firms are considering long-term remote working strategies that will be heavily reliant on these technologies.

This dissertation is dedicated to Mom and Dad.
Thank you for your support and belief in me.

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CHAPTER 1: INTRODUCTION

“Driven by the proliferation of technology, the audit has likely changed more in the last decade than it has ever before.”

— Jon Raphael, Deloitte Chief Innovation Auditor, in 2017

The first two decades of the twenty-first century have seen tremendous advancements in communication technology. In the business setting, methods of communication such as telephone calls and emails have been enhanced by, and sometimes replaced by, more advanced technologies enabling videoconferencing, collaboration tools, and instant communication. This change has the potential to redefine the way teams interact (Gilson, Maynard, Young, Vartiainen, and Hakonen. 2015). Audit teams, in particular, are uniquely placed to be affected by new communication technologies. Performing a successful audit requires effective communication between auditors and their clients, as well as among audit team members. Therefore, the evolution of communication technology is especially relevant to auditing. In this paper, I examine how technological advances in communication impact audit quality and audit efficiency by testing the association between innovations over time and audit quality and audit efficiency for distant audits that rely most heavily on communication technology.

The technological innovations of the early 2000s have been described as innovations of social interaction (Cascio and Montealegre 2016). Arguably, the most impactful invention of the 2000s, the smartphone, revolutionized how individuals communicate on a personal and professional level by providing constant access to email, internet, and other individuals. High-speed broadband and mobile networks allowed for faster and more efficient data transfer. New types of communication appeared in the form of social media, which quickly spread to millions of individuals and businesses, while new software and computing abilities, like collaboration

tools and cloud-computing provided individuals with more effective ways to work together over distance. In the audit industry, these innovations have obvious effects on their own; however, they also inspired a new focus on audit technologies. Audit firms have invested in new software and tools to make auditing more efficient, to allow auditors to focus on other areas like risk assessment, and to easily communicate with each other and clients. Given all the changes in tools available to auditors, it is an appropriate time to study how advances in communication technology impact performance.

While new communication technologies can affect all audits, their impact is likely to be greater on distant audits. Prior research documents that geographic distance between auditors and clients is negatively associated with audit quality (Choi, Kim, Qiu, and Zang 2012; Francis, Golshan, and Hallman 2021). A common explanation offered for the negative association is that distant audits lack the level of face-to-face contact and familiarity that exists in local audits. Distant audits are similar to remote, or virtual, audits. Virtual audits use communication methods like videoconferencing, email and telephone to perform audit tasks remotely (CQI 2020). These auditors spend less time in the field, have a higher level of geographic dispersion among audit team members and client contacts, and more heavily rely on technology to communicate as compared to local auditors. These characteristics align well with theories of virtual teams found in the management literature, such as social presence theory and media richness theory that suggest a negative association between the extent of virtuality and team performance. Management researchers define virtual teams as ones where the team is geographically dispersed and use technology-mediated communication to a significant extent. The similarities between distant audits and virtual teams make the construct of virtuality well suited to this study.

Much like the results of prior audit literature on distant audits, traditional virtual team research provides evidence of a negative association between virtuality and team performance. However, researchers have recently suggested that traditional theories may not hold in the current environment because of the changes to technology and demographics (Gilson et al. 2015). To date, these changes have received little attention in the literature. Following this reasoning, I propose that new types of communication with higher levels of social presence and media richness likely impact audits, particularly distant audits. I make three hypotheses. First, I expect that with advances in communication technology audit quality improves for distant audits. Second, I expect that compared to local audits, advances in communication technology improve audit quality for distant audits to a greater extent. Third, I expect that advances in communication technology reduce the gap between audit fees of distant audits compared to local audits.

To test my hypotheses, I define three “eras” or periods of technology in the early 2000s: 2004-2007, 2008-2013, and 2014-2018 (first, second, and third period, respectively). Each era is defined by the communication technology of the time and is separated by major technological advancements. The first period includes the large buildout of high-speed broadband internet access and ends before the widespread adoption of the smartphone, beginning with the iPhone in 2007. The second period includes the years where smartphones became ubiquitous, faster 4G networks were built out and new tools such as Dropbox and cloud computing became mainstream. Finally, the third period enters a phase that has been described as “ubiquitous computing” (Cascio and Montealegre 2016). There are fewer groundbreaking innovations to communication technology during this period, but there is an enhanced focus on integrating communication tools into everyday life. Also, during this period auditors have shown their

commitment to technology in the audit by developing new sophisticated tools with the potential to improve audit efficiency.

The sample used in my analyses includes 43,136 firm-year observations between 2004 and 2018. The sample period begins in 2004 after the implementation of the Sarbanes-Oxley Act and ends in 2018 to allow for adequate time for financial statement misstatements to be identified and reported. I construct three measures of auditor-client distance similar to measures used in prior literature (Choi et al. 2012; Francis et al. 2021). The first measure is an indicator variable for auditors and clients not located in the same metropolitan statistical area (MSA). The second measure is an indicator variable for auditors and clients whose cities are located more than 100 kilometers apart. The third measure is the natural logarithm of the number of kilometers between the auditor and client cities. Of the 43,136 observations 11,234 (26 percent), have auditors in a different MSA, while 7,312 observations (17 percent), have auditors located more than 100 kilometers apart. The average distance between auditors and clients is 187 kilometers and this measure spans from zero kilometers to nearly 8,000 kilometers. The proportion of observations meeting these classifications show that distant audits are rather common in practice.

I test my first hypothesis on a sample restricted to firm-year observations that have distant auditors (observations located either in a different MSA or, separately, observations located more than 100 kilometers from their auditor). I then regress audit quality on a variable that captures the three “eras” of communication technology. As proxies for audit quality, I use performance adjusted discretionary accruals and financial statement misstatements, both of which capture different aspects of audit quality. Discretionary accruals measure earnings management of varying degrees, while misstatements identify the most egregious audit failures. Using both discretionary accruals and misstatements as inverse proxies for audit quality, I find

that the association between these variables and eras of communication technology is negative and statistically significant. This provides initial evidence consistent with the hypothesis that distant audit quality improves with advances in communication technology. However, it is important to note that this test is limited in its ability to determine whether the improvement seen in distant audits is due to general time trends or advances in communication technology. As such, these results are a starting point for analyzing the effect of advances in communication technology on audit quality, but it is necessary to achieve better identification in order to attribute a change in quality to advances in communication technology. To address this issue, I utilize a setting where advances in communication technology are likely to have a greater impact on audit quality. Specifically, distant audits are a subset of audits where advances in communication technology would be expected to have a greater impact on audit quality relative to local audits.

My second hypothesis predicts that compared to local audits, advances in communication technology improve audit quality for distant audits to a greater extent. By using local audits as a control group, I am able to control for general trends in audit quality. Prior literature finds that distant audits/auditors are associated with lower audit quality as measured by discretionary accruals (Choi et al. 2012) and misstatements (Francis et al. 2021). Consistent with virtual team research, these studies argue that the lower audit quality in distant audits is due to distant audits having less face-to-face interaction between auditors and clients and within audit teams that can impair information quality and result in a lack of common understanding between parties (Daft and Lengel 1986). This disparity in communication quality between distant and local audits places distant audits in a position to benefit from advances in communication technology to a greater extent than local audits.

To test this hypothesis, I regress audit quality on a variable identifying the era of communication technology, one of the three proxies of auditor distance, and an interaction of the era and auditor distance variables, in addition to relevant control variables. The interaction variable measures the difference in the change in audit quality from one era to the next between distant and local audits. In my analysis, I find consistent evidence in five of six specifications that distant audits had greater improvement in audit quality from one era of communication technology to the next, compared to local audits. This supports my second hypothesis.

In addition to effects on audit quality, the performance of distant audits presents communication and logistical challenges that can lead to greater effort, time, and cost. Advances in communication technology that can alleviate these challenges can then affect the efficiency of distant audits to a greater extent than local audits. For example, advances in communication technology can reduce the cost in time and money of travel through the use of technology such as video conferencing and cloud data storage which allow the audit team to communicate and share data in a manner closer to face-to-face interaction. Further, advances in communication technology can improve the timeliness of information exchange by increasing the speed with which distant teams share and understand information (Daft and Lengel 1986). While local audits benefit from such communication advances as well, I expect the advantages to distant audits are greater because of the greater likelihood that distant audits will utilize communication technology as a replacement for face-to-face interaction.

Following a similar process as the second hypothesis, I test my third hypothesis by comparing audit fees for distant and local audits from one era to the next using an interaction between era and distance. I find that while audit fees grew over the time period in my sample, they grew significantly less for distant audit clients with advances in communication technology.

Although audit fees increase across the three eras, the findings are consistent with improvements in efficiencies for distant audits. Distant audits have statistically significant lower increases in audit fees across the three eras compared to the increases in audit fees for local audits. This suggests that advances in communication technology allow distant audits to save on costs, time, and effort in ways that local audits do not. The results of this test support Hypothesis 3.

After the main analyses, I perform additional sensitivity and robustness tests. To address concerns of an unbalanced treatment/control sample, I re-perform the analyses of the second and third hypotheses on a propensity-score matched sample and find similar results. Also, because I make certain research design choices in defining a variable for internal control weaknesses, I re-perform the analyses controlling for missing internal control observations and find the conclusions are consistent with the main analyses. In summary, these tests provide evidence that the results of the main analyses are robust to certain research design choices and characteristics of the sample.

My study makes several important contributions to the literature and practice. First, this study contributes to literature on the impact of technological advancements in communication on auditing. Technology available to auditors today is vastly different than in the early 2000s and it remains an open question of how it affects audit quality. Existing research in finance and accounting is motivated by theories suggesting that communication through technology is inferior to face-to-face interaction but fails to incorporate the changes in technology. However, this paper provides evidence that can revise our prior understanding of how communication technology impacts audit quality. This study provides evidence of an improvement in audit quality among distant audits as communication technology advances and as compared to local audits. This could lead to further research into specific technologies and settings.

Second, this study contributes to the literature on the negative impact of auditor-client distance on audit quality by providing evidence that audit quality has improved over time for distant audits. Prior research has not considered the impact of advances in communication technology on distant audits. Further, this study contributes to this literature by presenting evidence that suggests that the negative effects of distance on audit quality may have decreased.

Third, as it relates to practice, the subject and results of my paper provide insight to an important current issue in the profession. The COVID-19 pandemic beginning in 2020 has forced audit teams to work remotely, both from other audit team members and from the client. Further, when the industry recovers from the COVID-19 pandemic, there is uncertainty on how audit teams will be constructed. Audit firms have publicly stated a desire to keep a flexible working arrangement for their professionals and such an arrangement will be heavily affected by geographic dispersion and communication technology. Therefore, the results of this paper can provide preliminary evidence of how audit quality is affected by communication technology.

CHAPTER 2: BACKGROUND AND HYPOTHESIS DEVELOPMENT

2.1. Advances in Communication Technology

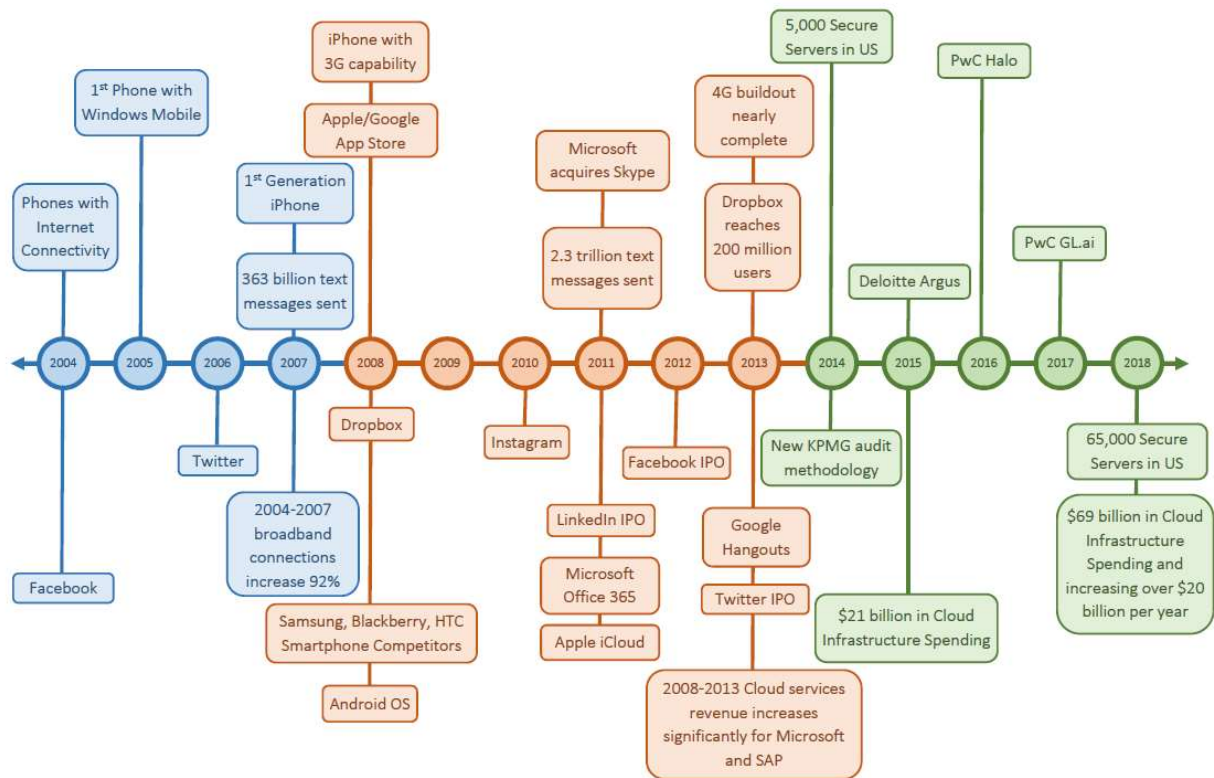
To examine whether advances in communication technology have affected audit quality and audit efficiency, it is first important to describe the types of innovations that have occurred. The technological innovations that potentially affect audit quality have occurred continuously over the last twenty years making it difficult to identify a specific technology as the single influential change. Therefore, I classify advances in communication technology into “eras” of technology.

As a starting point for classification, I first refer to organizational behavior researchers who offer a breakdown of the digital era (Cascio and Montealegre 2016). They identify the late 1990s through the mid-2010s as the era of “strategic computing,” where “communication technology and enterprise systems empower/enhance effectiveness of dispersed groups and individuals.” This era saw the proliferation of the global Internet and companies’ integration of the Internet into their enterprise systems. Beginning in the mid-2010s, Cascio and Montealegre (2016) describe the era of “ubiquitous computing” where computers and networks are pervasive and even connect physical and digital spaces. They point out that one advantage of ubiquitous computing is the ability of employees to work from anywhere and anytime. I use these two eras, strategic computing and ubiquitous computing, as a starting point for discussing technological advancements.

Perhaps one of the most influential inventions in recent memory, the smartphone, debuted in late 2007 with the iPhone and soon after its capabilities and competitors expanded dramatically. The smartphone has clearly impacted everyday personal and professional lives by allowing constant communication and access to information from nearly any location, providing

a stark contrast between the world before smartphones and the world after smartphones. Therefore, 2007 is an appropriate distinguishing year in the era of strategic computing. The years 2008-2013 saw further refinements on devices and a buildout of a much faster and more efficient network. Finally, in the era of ubiquitous computing, the years after 2013 have seen an increase in the use of technologies like cloud computing that, among other benefits, allow groups of individuals to manage large datasets and collaborate. Figure 1 presents a timeline of technological advances separated into each period as described in detail below.

FIGURE 1. TIMELINE OF ADVANCES IN COMMUNICATION TECHNOLOGY



2.2. Innovation from 2000-2007

In the context of communication technology, the early 2000s through 2007 are distinct from other years for several reasons. First, cell phones and smartphones were neither as capable nor as universal compared to later years. Devices during these years slowly began to offer internet access and global roaming capability as well as the first Windows Mobile operating system, but not the functionality seen today (WDD 2009). However, functionality improved tremendously with the debut of the iPhone in 2007 (Verizon 2020). This led to iPhone sales of 11.6 million units in 2008, nearly ten times that of 2007 (Apple Inc. 2008), providing evidence of the contrasting environments of pre- and post-2007.

Second, high-speed internet access also grew rapidly during this period. Between 2004 and 2007, the number of fixed broadband subscriptions in the United States increased by around 10 million per year (O'Dea 2021). This represented an increase of 37 percent from 2004-2005, 18 percent from 2005-2006, and 19 percent from 2006-2007. After 2007, broadband internet access has continued to increase. However, annual increases have been less than 10 million subscriptions, or 7.5 percent, per year. This suggests a major build-out took place before the end of the 2010s. Third, another defining innovation of the time was social media. Facebook launched in 2004, allowing corporations to join in 2006, and Twitter launched in 2006, giving companies new access to consumers and new lines of communication among individuals. The rise of social media also indicates the broader acceptance of new technology.

This was also an era of transformation for the audit profession. For example, in the years following the Enron scandal Deloitte reorganized the firm into separate legal entities for audit, tax, consulting, and financial advisory services (Deloitte 2022a). New audit regulations from the Sarbanes-Oxley Act introduced auditor reporting on internal control effectiveness beginning in

2004 (SOX 2002). Changes to the audit industry such as these may have impacted the lines of communication and complexity of audit tasks; therefore, they can be considered distinguishing factors of the early 2000s.

2.3. Innovation from 2008-2013

The next period I identify begins in 2008 and continues through 2013. This period is defined by refinements and improvements to communication technology and an increase in usage. First, significant improvements were made to mobile devices and networks. iPhone sales increased nearly ten-fold in 2008 as they gained traction with consumers and as Apple introduced the first iPhone with third-generation, or 3G, technology (Apple Inc. 2008). In the same year, Apple's competitors such as Samsung and HTC entered the market with the first smartphones offering the Android operating system and smartphone capabilities expanded with the launch of the Apple and Google app stores (WDD 2009; Verizon 2020; Dudley 2018). The explosion of text messages sent during this period provides further evidence of the pervasiveness of smartphones into personal and professional lives. In the United States, the number of text messages sent were reported to be 363 billion in 2007. This figure increased to 1 trillion in 2008, 1.6 trillion in 2009, 2 trillion in 2010, 2.3 trillion in 2011, before settling at around 1.7 to 2 trillion in the following years (O'Dea 2020). Not only did the devices allow for improved communication, but the network itself was upgraded between 2008 and 2013. Specifically, between 2010 and 2013, the major carriers in the United States (Verizon, AT&T, Sprint, and T-Mobile) built out extensive fourth generation (4G) networks and LTE (Dano 2011). These networks offer important advantages to professionals, such as increased speeds and lower costs while enabling a wide variety of capabilities for the user (CTIA 2020).

In addition to device and network upgrades, new software appeared during this period. For example, the collaboration platform Dropbox launched in 2008 and quickly grew to 200 million global users by 2013 (Constine 2013). Microsoft acquired the video chat platform Skype in 2011, which was then incorporated into the Microsoft suite. Microsoft and Apple also launched their own document sharing and collaboration tools, Office 365 and iCloud in 2011.

Social media and other communications apps expanded both in the number of platforms and in scale between 2008 and 2013. WhatsApp launched in 2008, Instagram launched in 2010, and video chat service Google Hangouts launched in 2013. The popularity of social media platforms is evidenced by major IPOs that occurred during this era, including LinkedIn in 2011, Facebook in 2012, and Twitter in 2013. Lastly, cloud computing grew in significance during this period. In 2009, Microsoft's 10-K filing contained only five instances of "cloud" whereas its 2013 filing contained 66 instances (Microsoft Corporation 2009; 2013). By 2013, Microsoft disclosed an extensive list of their cloud computing offerings such as Bing, Azure, Office 365, OneDrive, Skype, and others. The filing also stated that "Helping businesses move to the cloud is one of our largest opportunities." Also, from 2011-2013, SAP separately disclosed cloud subscriptions and support revenue (SAP Group 2013). During these years cloud revenue increased by over 500 million Euros.

2.4. Innovation from 2014-Present

The final period starts in 2014 and continues through the present. These years are defined not by new innovations and improvements to networks, but rather the expansion of use of the technologies from earlier periods. Few major innovations occurred on smartphone devices, apart from upgrades to batteries, cameras, size, etc. Also, the 4G buildout in the United States had largely been completed by this period and broadband internet access was available to nearly all

of the US population (Dano 2011; FCC 2017). However, major growth did occur in the areas of data storage and cloud computing. For example, the number of secure servers per one million people in the US increased from about 5,000 in 2014 to over 65,000 in 2018 (The World Bank). Similarly, business spending on cloud storage and data centers increased by over \$20 billion per year at the end of the period and cloud infrastructure spending increased from \$21 billion in 2015 to \$69 billion in 2018 (Mlitz 2021).

This period also includes major innovations for auditors specifically. Auditors, especially the largest firms, began to embrace cloud computing, data-driven analysis, and collaboration tools, as evidenced by the annual “Audit Innovation of the Year” awards presented by the International Accounting Bulletin. In 2014, KPMG won this award for its “Lean in Audit” methodology designed to increase efficiency. KPMG also discussed their commitment to data and analytics through new technologies in their annual review (KPMG 2014). Deloitte won in 2015 for its Argus platform, which uses machine learning to identify and extract information in documents typically examined by auditors (Deloitte 2022b). PwC earned the 2016 innovation of the year with Halo and the 2017 winner with its GL.ai platform. Halo analyzes data to improve risk assessment and provide dashboards and insights to auditors to improve their efficiencies (PwC 2022a). GL.ai also uses machine-learning techniques to analyze client data in order to allow auditors to focus on other tasks (PwC 2022b). Finally, Deloitte won this award for its Cortex software in 2018. Cortex is another cloud-based system that brings together data acquisition with data preparation and analytics to improve auditor efficiencies (CPA Practice Advisor 2018). While audit firms may not have designed these audit innovations specifically for communication, their commitment to transforming audit technology points to the importance that

auditors place on new technology. Across the award winners discussed above, there is a common goal of firms to increase the efficiency and value of the audit through technology.

2.5. Demographic Changes

Advancements in communication technology are not the only major changes to business in the first two decades of the 2000s. The rise of the Millennial generation into the workforce brings about a different relationship with technology than previous generations. Millennials are those born between 1981 and 1997 (Fry 2018). Since the early 2000s to the present, Millennials have been joining the workforce, and since 2016 have been the highest represented generation in the United States workforce (Fry 2018). As the first generation with widespread internet access from a young age, Millennials have a higher comfort level around technology than earlier generations and the ability to leverage digital communication technology more effectively and efficiently (Gilson et al. 2015; Gorman, Nelson, and Glassman 2004). Throughout their lives, transformative technologies have been invented and proliferated including the internet TCP/IP protocol, cellular and smart phones, and social media (Hershatter and Epstein 2010) immersing them into digital communication. Millennials' comfort with technology likely extends to the workplace and may have implications for auditors.

The demographic changes described above are evident within audit firms. Millennials are now of age to be working at all levels within the firms. In fact, the Chief Innovation Officer at Deloitte reported in 2017 that three-quarters of the audit practice were Millennials (Raphael 2017). With respect to demographic changes, firms are changing their business models to appeal to Millennials and the generation following them, such as greater flexibility and benefits. A greater emphasis on work-life balance and flexibility requires audit firms to use advanced communication technologies to maintain their competitiveness and high quality.

These examples of advancements and innovations in communication technology provide evidence that personal and professional lives have changed dramatically in the last twenty years. Therefore, it is reasonable to question how these changes impact team performance, especially in settings where teams connect virtually.

2.6. Virtual Teams

The management literature develops a stream of research studying virtual teams (or virtuality). The traditional definition of a team is a “set of individuals interdependent for a common purpose” (Wageman, Gardner, and Mortensen 2012) and virtual teams have two additional characteristics: 1) geographic dispersion (Gibson and Cohen 2003; Gilson et al. 2015) and 2) extensive use of technology-mediated communication (TMC) (Kirkman and Mathieu 2005; Breuer, Huffmeier, and Hertel 2016; Perry, Lorinkova, Hunter, Hubbard, and McMahon 2016). In today’s business environment, all teams, even co-located teams, use TMC such as email, instant messaging, and telephones. Therefore, virtuality is often thought of as a continuum from less virtual teams to more virtual teams (Kirkman and Mathieu 2005).

Much of the theory for virtual teams centers on the differences between face-to-face communication and communication using technology. When originally published, the theories and associated empirical tests focused on what are now considered more basic or conventional communication technologies, such as email and instant messaging. Two theories often cited in empirical research on virtuality are social presence theory (SPT) and media richness theory (MRT). These theories both propose that face-to-face interaction is the gold standard of communication, and that the effectiveness of communication degrades depending on the type of technology used. SPT was developed by Short, Williams, and Christie (1976) and broadly defines social presence as how present or real a person is perceived when communicating (Short

et al. 1976; Gunawardena 1995). SPT suggests that social presence decreases with the use of technology-mediated communication. That is, email (text) communication has less social presence than phone (audio) communication, which has less social presence than video (visual) communication. The relative lack of social presence in these technologies results in social cues being filtered out or lost, creating a deficit of cues when compared to face-to-face interaction. MRT, developed by Daft and Lengel (1986), is not focused on the social presence of the communicators; rather it describes technologies' abilities to contain information, or its media richness. For example, communication media differ in their ability to provide immediate feedback, social cues, and extent of personalization. According to MRT, face-to-face communication is superior in all of these abilities.

Most of the existing research on virtual teams provides evidence that performance either suffers when using TMC or is unaffected (Gilson et al. 2015). For example, using TMC can limit the collective contribution of a team and their critical analysis of information (Andres 2012). Team performance and interactions can also suffer in a virtual environment (Schweitzer and Duxbury 2010). Team conflict in virtual teams can take longer to identify and address and create misunderstandings (Armstrong and Cole 1995).

Despite results in early research generally finding less effective outcomes for virtual teams, there is a need to continue research in this area (Gilson et al. 2015). Due to the rapidly evolving virtual work environment, management researchers have taken note of the technological and demographic changes that have occurred in the past two decades. As early as 2003, Hinds and Bailey (2003), studying conflict in distributed teams, suggested "it is worth considering the extent to which our conclusions are contingent upon the state of technology." Blaskovich (2008) proposes that workers' comfort with technology necessitates re-examining the

results of older virtual team research. In her case, she believed comfort with computers created more distraction than production for virtual workers, but the idea is consistent that technology has changed and research should examine the new environment. Gilson et al. (2015) and Lowry Roberts, Romano, Cheney, and Hightower (2006) believe that newer technologies challenge what we know about media richness and offer more social presence than the types of technology initially studied. Researchers have identified several technologies of interest that could greatly impact virtual teams: collaboration tools, document sharing, meeting tools, social media, and cloud computing (Gilson et al. 2015). It is through these technologies and others that the effectiveness of virtual teams may have improved over time.

2.7. Distance Effect in Finance and Accounting

Geographic dispersion, one distinguishing factor of virtual teams, has been incorporated by the finance literature into studies of investment decisions. At first, distance between investors and investments was measured at the country level, where investors and investees are located in different countries. These studies led to the phenomenon of “home bias.” Two main causes of home bias were identified: information advantage and institutional differences (tax differences, political uncertainty, and language barriers). Of the two causes, local investor information advantage receives the most attention (French and Poterba 1991; Dvořák 2005). Domestic investors prefer local, or domestic, investments because of their familiarity with the markets, institutions, and firms (French and Poterba 1991). Home bias tendencies and local informational advantages are not restricted to individual investors, but have also been documented among mutual fund managers (Coval and Moskowitz 2001) and analysts’ forecast accuracy (Malloy 2005). In the banking industry, Petersen and Rajan (2002) show that soft information such as that used to determine lending decisions, should be collected near the source of the information,

rather than at a distance. Finally, local investment may simply be a matter of preference (Huberman 2001).

With early finance studies documenting international investor home bias, Coval and Moskowitz (1999) provide initial evidence that a geographic bias could also be found within the United States. By examining investors/investees within the United States, their study essentially holds institutional differences such as language, cultural, and taxation differences constant, leaving only the information advantage of investor/investee location. Coval and Moskowitz (1999) show a similar home bias within the United States and pinned their findings on local investors having a relative information advantage over distant investors. According to their theory, this information advantage stems from local investors' abilities to have face-to-face interaction, receiving valuable information from local media outlets, and even have personal or social ties with executives. Further, local investors may feel inclined to invest in companies with whom they are familiar or simply want to keep their capital in the community. The explanation offered by Coval and Moskowitz (1999) for investor home bias is the foundation for many studies in the finance literature.

Accounting research has brought the informational advantage explanation offered by Coval and Moskowitz (1999) into the auditing literature. For instance, Kedia and Rajgopal (2011) examine the relationship between an auditor's proximity to an SEC regional office and the likelihood of a financial statement misstatement, documenting a negative association. They argue that when managers and auditors of other firms are in proximity to an SEC office, they can more quickly discover and react to the issues and enforcement actions pursued by the SEC. Similarly, Defond, Francis, and Hallman (2018) provide evidence that non-Big 4 auditors located farther from an SEC regional office are less likely to issue a going concern opinion. In other

words, there is an information advantage for auditors who are located near regulators that alters their behavior.

Other studies focus on the distance between auditors and their clients. Choi et al. (2012) find evidence that auditor proximity (being co-located in the same metropolitan statistical area (MSA)) is positively associated with audit quality (proxied by discretionary accruals and accrual quality). More recently, Francis et al. (2021) revisit the research of auditor proximity. The authors use newly available data on audit partners in PCAOB Form AP to calculate the distance between an audit partner's home area to their client's location. They find that the distance between an audit partner and client is negatively associated with audit quality (proxied by misstatements and the propensity to meet or just beat earnings forecasts). Both of these studies suggest that geographic distance effect is an important factor for audit quality.

2.8. Setting and Hypothesis

Auditing provides an interesting setting to study the effects of advances in communication technology. Previous audit literature identifies that a distance effect exists for auditors and clients located in different cities and their explanations for these findings are in line with early theories of virtual teams (Choi et al. 2012; Francis et al. 2021). For example, Choi et al. (2012) state, "we believe that geographic proximity will improve communication and information quality because it facilitates more face-to-face communication. Prior studies in psychology, communication, information systems, and organizational behavior suggest that face-to-face communication is more effective through the support for a higher level of interaction than other electronic forms of communication, such as email and videoconferencing." Similarly, Francis et al. (2021) alludes to the higher frequency of face-to-face interaction between audit partners and clients when the partners are local.

Management researchers have begun to question whether traditional virtual teams theories, namely social presence theory and media richness theory, hold up in light of new communication technology (Gilson et al. 2015). Contemporary communication technology can provide more social presence than was possible in the past and “transcend much of what we know about media richness” (Lowry et al. 2006). For example, internet-based writing collaboration tools have been shown to improve productivity, quality, relationships and communication over face-to-face groups (Lowry and Nunamaker 2003). These tools are not unlike many of the tools available to auditors, such as cloud-based distributed audit files and other document sharing services. Therefore, it is possible that the effects of new technology will be statistically significant in the audit setting.

2.9. Hypothesis 1

To address my research question of whether advances in communication technology impact audit quality, I investigate how audit quality has changed over time as innovations have occurred. I expect that new communication technology, both general and audit-specific, has higher levels of social presence and media richness, in line with views expressed in the virtual teams literature. Therefore, auditors reliant on communication technology between team members and clients should experience an improvement in their ability to share information, leading to higher audit quality. Following the results and discussion in prior research (Choi et al. 2012; Francis et al. 2021), I expect that distant audits are reliant on this technology and, thus, will see improved audit quality as innovations in technology occur. This leads to my first hypothesis:

H1: Audit quality improves with advances in communication technology for distant audit clients.

2.10. Hypothesis 2

Hypothesis 1 predicts that audit quality improves for distant audits as communication technology improves. However, support for this hypothesis cannot rule out that audit quality may improve for distant audits because of a more general improvement in audit quality over time or for other reasons. One noteworthy influence on audit quality in the 2000s is the PCAOB inspection program. Researchers document that the discovery of inspection deficiencies on individual engagements leads to improvements in audit quality across a firm's clientele. Defond and Lennox (2017) show evidence that auditors respond to deficiencies in internal controls audits by increasing the issuance of appropriate adverse internal control opinions. They also document an increase in audit fees following the deficiency, which is consistent with audit firms making costly changes. Aobdia (2017) also supports that audit firms respond to PCAOB inspections. Specifically, audit firms respond on both the inspected engagement and other engagements, creating a spillover effect. These improvements are expected to affect both distant and local audits alike. In addition to the responses to PCAOB inspections, the largest firms use national training centers and events for onboarding, promotion, and continuing education to create a consistent set of audit procedures. Bringing auditors together from all offices and using common audit guidance could lead to improvements in audit quality across a firm for both distant and local clients. As a result of these trends and characteristics of audit firms that likely affect all audit engagements, it is necessary to achieve better identification in order to attribute a change in quality to advances in communication technology. To address this issue, I utilize local clients as a control group in order to control for general trends in audit quality and isolate the effects of advances in communication technology.

The distant and local audit setting provides an opportunity to see the effects of advances in communication technology because distant audits are more heavily reliant on communication technology. This reliance can be seen in prior finance and accounting literature as well as virtual team theories. The early finance literature on investment home bias highlights face-to-face communication as a probable factor in creating home bias among investors. Coval and Moskowitz (1999) state that “Local investors can talk to employees, managers, and suppliers” and “they may have close personal ties with local executives.” The implication is that distant investors do not have this level of face-to-face interaction and must rely on other less informative sources from other communication methods. While Kedia and Rajgopal (2011) are focused on audit regulation as compared to audit quality, they also suggest that geographic proximity is helpful because close business contacts may only disclose information through casual conversations. They conclude that “[their] results suggest that regulation is most successful when it is local.” Studying audit quality, Choi et al. (2012) argue that face-to-face communication in auditing is more effective than electronic communication and local clients experience higher audit quality because of the greater level of communication. These studies help to establish that distant auditors rely on forms of communication other than the face-to-face interactions available to local auditors. Thus, it follows that advances in communication technology should be more influential for distant audits than for local audits.

The discussion of face-to-face communication, or lack thereof, in auditing fits well into the theories of virtual teams where virtual teams are often defined as geographically dispersed with a reliance on technology to communicate. Traditionally, social presence and media richness theories hold face-to-face communication as the gold standard of team communication, in line with how prior audit literature discusses the disadvantages of distance. However, the recent

dramatic changes in communication technologies necessitate a reconsideration of technologies' roles in team performance (Gilson et al. 2015).

Communication technology has advanced steadily in the past two decades. As described previously, the gradual progression of technology can be separated into three distinct eras of technology. Each brings technology that are likely to affect distant audits. The first era of 2000-2007 included the invention of smartphones and expansion of broadband internet in the United States. The implications of these technologies, while indirect, are inseparable from auditing and useful for distant audits. The speed, access, and mobility of communication improved dramatically with smartphones and broadband internet allowing audit teams and clients to communicate among themselves and with each other. The second era of 2008-2013 experienced a tremendous increase in the use of smartphones, new forms of communication such as text messages, and social media. Notably, cloud services and collaboration tools were more prevalent. Cloud and collaboration tools likely improved distant auditors' access to data from the client and new ways to exchange workpapers among the audit team members. Even though auditors may use their own proprietary collaboration tools, I believe the appearance of mainstream services like Dropbox indicate that these types of tools were in use during this era. Finally, the last era of 2014 to the present saw an increasing integration of the aforementioned communication technologies and the development of new audit specific tools. Technologies allowing for fast, safe, and reliable movement of data from client to auditor and among auditors should have a positive impact on audit quality, especially for distant audits.

Although I expect that advances in communication technology will have a greater effect on distant audits than local audits, it is possible that there is no difference between local audits and distant audits. The benefits of improved social presence and media richness are applicable to

local auditors as well. Even though audit literature supports that local auditors have access to information from face-to-face communication, local auditors are still likely to use most if not all of the communication tools discussed above. Local auditors may not rely on communication technology to perform significant aspects of the audit, but they should benefit from the conveniences afforded by the new technology. Thus, if there is an improvement in audit quality for distant auditors compared to local auditors it speaks to how important communication technology is to distant audits.

In summary, existing audit literature supports that distant audits are of lower quality than local audits because of their lack of face-to-face communication and a reliance on communication technology. Advances in communication technology, which have occurred in three distinct eras in the last two decades, should therefore affect distant audits to a greater extent than local audits. Comparing distant and local audits holds common trends in audit quality constant to isolate the effects of communication technology in order to address my research question. Therefore, my second hypothesis is stated as the following:

H2: Advances in communication technology have a greater impact on audit quality for distant clients as compared to local clients.

2.11. Hypothesis 3

In addition to the expectation that advances in communication technology improve audit quality, it is likely that these advances will affect audit efficiency. Specifically, I expect audit fees of distant audits to be impacted as new communication technology advancements occur. The auditing literature describes distant auditors as lacking face-to-face interaction, having fewer social relationships, and experiencing more information asymmetry with their clients compared to local auditors. These traits connect distant auditors to virtual teams because of their

geographic dispersion and reliance on communication technology. Traditional virtual teams theory, specifically media richness theory, provides reason to believe that communication technology can affect team efficiency in situations that are not routine or easily conveyed to others. Daft and Lengel (1986) describe media with high information richness as having a high ability to change understanding in a time interval. They state “Communication transactions that can overcome different frames of reference or clarify ambiguous issues to change understanding in a timely manner are considered rich”. This gives face-to-face communication the highest level of richness. Alternatively, lower levels of richness such as what is afforded by traditional communication technology “require a long time to enable understanding”. Applying this to the audit setting, it follows that difficult audit issues, and perhaps some routine issues, will take longer for all parties to understand when face-to-face communication is less available (such as distant audits). However, advances in communication technology that increase media richness could improve efficiency.

As described in previous sections, virtual teams researchers are now questioning whether advances in communication technology have closed the gap in communication for geographically dispersed teams. One advantage of face-to-face communication is that it allows for immediate feedback and social cues to be exchanged between individuals (Daft and Lengel 1986). However, new technologies may have the capabilities to mimic the advantages of face-to-face communication. Tools such as video conferencing provide more social presence and higher media richness than older tools such as phone calls and email. Cloud-based tools give teams the ability to share information quickly and view changes in real-time. For these reasons, I believe that compared to local audits, distant audits can take advantage of advances in communication technology to improve their efficiency.

In addition to the theoretical reasons for advances in communication to improve audit efficiency, there are practical examples of how this would impact audit fees. Travel costs to distant clients can be non-trivial for auditors. If audit partners and managers can come to an understanding and conclusion to major issues without being on-site, then travel costs can be minimized. There are certain times in which engagement leaders will need to travel, such as meetings with the audit committee, but travel for general oversight of the audit team could be reduced tremendously. Additionally, new audit platforms that allow for more efficient communication with clients can decrease the amount of time spent requesting and understanding audit evidence, especially when the auditor is located in a different city.

As with my prediction for audit quality, it is possible that there is no differential effect of advances in communication technology on audit fees for distant audits because advances in communication technology can lead to gains in efficiency in both local and distant audits experience. Few if any of the advances in communication technology exclusively benefit distant auditors. Local auditors will certainly be affected by faster internet connections, smartphone communication, new audit tools and cloud computing. However, it is because of the greater reliance of distant auditors on communication technology, in comparison to local audits, that I expect distant audits to experience greater gains in efficiency as advances in communication technology occur. As in H2, I compare distant audits to local audits to control for general trends in audit fees over time. This leads to my third hypothesis:

H3: Advances in communication technology have a negative impact on audit fees for distant clients as compared to local clients.

CHAPTER 3: RESEARCH DESIGN

3.1. Test of Hypothesis 1

To test Hypothesis 1, I estimate the following regression model, based on Choi et al. (2012), using OLS after restricting the sample to only distant audit observations (see below for definition of distant audit observations), where *Era* is the variable of interest:

$$AQ_{i,t} = \beta_1 + \beta_2 Era_{i,t} + \sum \beta_{3-17} Controls_{i,t} + Industry\ Fixed\ Effects \quad (1) \\ + Client\ City\ Fixed\ Effects + \varepsilon$$

3.2. Dependent Variables

DeFond and Zhang (2014) recommend multiple proxies for audit quality because they measure different aspects of quality. Following this recommendation, I use two measures of audit quality (*AQ*) frequently found in the literature (Aobdia 2019): performance-adjusted discretionary accruals (*DACC*) and financial statement misstatements (*MISSTATE*) (Choi et al. 2012; Francis et al. 2021). Both variables are inverse measures of audit quality; that is, lower levels of discretionary accruals and misstatements are associated with higher audit quality.

3.3. Construction of Discretionary Accruals Variable

Discretionary accruals are used as a proxy for audit quality in prior auditor distance literature (Choi et al. 2012). This is a relevant measure in this setting because auditors in distant audits are expected to have less client familiarity and engage in less or lower quality communication with their clients, which may lead to higher levels of earnings management. For example, inquiry related to analytical procedures designed to identify improper earnings management may be of worse quality when performed by auditors performing audits of distant clients. Therefore, I use discretionary accruals to proxy for the level of earnings management. I

measure performance-adjusted discretionary accruals using the model of Kothari Leone, and Wasley (2005), estimated for each industry (2-digit SIC) and year as follows:

$$TA_{i,t}/A_{i,t-1} = \alpha_0 + \alpha_1(1/A_{i,t-1}) + \alpha_2((\Delta S_{i,t} - \Delta AR_{i,t})/A_{i,t-1}) + \alpha_3(PPE_{i,t}/A_{i,t-1}) + \alpha_4(NI_{i,t-1}/A_{i,t-1}) + u_{i,t} \quad (2)$$

TA is defined as income before extraordinary items less operating cash flows from continuing operations. ΔS is year-over-year change in sales and ΔAR is year-over-year change in accounts receivables. *PPE* is net property, plant, and equipment. *NI* is prior year net income. All variables are scaled by lagged total assets.¹ Variable definitions are presented in Appendix A.

Performance-adjusted discretionary accruals (*DACC*) is then calculated as the absolute value of the residual for each observation. I use the absolute value of the residuals, rather than signed values, because the effects of auditor-client distance apply to both income-increasing and income-decreasing accruals.

3.4. Construction of Misstatement Variable

The variable *MISSTATE* is an indicator variable equal to one if the firm-year observation contained a non-reliance misstatement that was announced in future years, and zero otherwise, per the Audit Analytics Restatements database. Misstatements capture the most egregious audit failures. It is possible that distance between audit offices and clients leads to a lack of understanding of the client's risks resulting in inappropriate audit tests and unidentified material errors. Therefore, in this setting using audit office location, I include misstatements as a proxy for audit quality.²

¹ Prior to estimation, observations missing these variables are dropped. Additionally, variables are winsorized at the 1st and 99th percentiles and, following Choi et al. (2012), industry-years (based on two-digit SIC) with less than 10 observations are dropped.

² Choi et al. (2012) established that a positive relation between discretionary accruals and audit office distance exists, but did not use misstatements as a proxy for audit quality. More recently, Francis et al. (2021) find a positive relation between audit partner distance and misstatements.

3.5. Eras of Communication Technology

The variable of interest in Model 1 is *Era*. This is a categorical variable (0, 1, 2) identifying three “eras” of communication technology discussed in Section 2: 2004-2007 (0), 2008-2013 (1), and 2014-2018 (2). The year 2004 represents an appropriate starting point for this study because SOX 404 internal control reporting was not required until fiscal years ending on or after June 15, 2004. Likewise, 2018 is an appropriate end to allow adequate time to have passed to identify financial statement misstatements. Given that both dependent variables are inverse measures of audit quality, I expect the coefficient on *Era* in Model 1 to be negative. This would suggest that with advances in communication technology, audit quality improves for distant audits.

3.6. Determination of Auditor and Client Location

From the Audit Analytics database, I identify the city and state location of the signing audit office for each observation. I follow prior research that uses the signing audit office as the office performing the audit work (Choi et al. 2012). After identifying each auditor city and state, I review the list for obvious spelling errors in the Audit Analytics database. For example, “Alphretta”, GA is corrected to “Alpharetta”, GA. Any errors for which corrections cannot be made with certainty are dropped from the sample. Then with the Python package “geopy” I obtain the geographic coordinates (latitude and longitude) using city and state. With the coordinates of each city, I obtain the county in which the city is located through an interface offered by the Federal Communications Commission.³ The county is important to identify because MSAs are determined at the county level. Finally, with the county and state, I match

³ <https://geo.fcc.gov/api/census/>

each auditor location to a MSA (if it resides in one) and eliminate observations where the auditor is not located in a MSA.⁴

For the location of each client, I use company headquarters location in the “Augmented 10-X Header Data” made available by Bill McDonald and supplement it with the headquarters location in Audit Analytics.⁵ Audit Analytics retains only the current headquarters location from the SEC Header Data, which may have changed over time, while the McDonald data retains the historical SEC Header Data for each year.⁶ Prior to performing the analyses, I match the McDonald data to the observations to obtain its historical location. If a firm is not available in the McDonald data, I use the client headquarters location identified in Audit Analytics.

3.7. Construction of Distance Variables

For Model 1, I create two measures of *Distance*, both indicator variables (*DMSA*, *D100*), following Choi et al. (2012).⁷ *DMSA* is an indicator variable equal to one when the auditor and client are not located in the same MSA, and zero otherwise. *D100* is an indicator variable equal to one when the auditor’s city and client’s city are more than 100 kilometers apart, and zero otherwise.⁸ The threshold of 100 kilometers has been used in prior finance and accounting research as reasonable cutoff for daily commutes (Coval and Moskowitz 2001; Kedia and

⁴ I use the US Census Bureau Delineation File for “Core based statistical areas (CBSAs), metropolitan divisions, and combined statistical areas (CSAs)” from March 2020 filtered on MSAs to obtain the counties located in each MSA. See <https://www.census.gov/geographies/reference-files/time-series/demo/metro-micro/delineation-files.html>.

⁵ This data is available at: <https://sraf.nd.edu/data/augmented-10-x-header-data/>.

⁶ Client geographic data in Audit Analytics is populated from the SEC Header Data shown on the SEC EDGAR website. This data reflects the headquarters location as of the date of download and not necessarily the historical location. The Augmented 10-X Header Data helps to reduce measurement error in client location which can potentially influence results (Jennings, Kim, Lee, and Taylor 2020).

⁷ Choi et al. (2012) define *D100* as distant when the audit office and client headquarters are more than 100 kilometers apart, or in different MSAs. This results in nearly identical variables of *DMSA* and *D100* because there are only 35 observations in final sample that are in the same MSA but greater 100 kilometers apart. Therefore, I define *D100* as 1 when the audit office and client headquarters are more than 100 kilometers apart, regardless of MSA

⁸ Choi et al. 2012 define *DMSA* and *D100* as 1 for local clients and 0 for distant clients. For ease of interpretation define 1 for distant clients and 0 for local clients, to identify the effect of the treatment, distance, more easily.

Rajgopal 2011; Choi et al. 2012). Auditor and client cities are defined by their locations determined in the previous paragraph, rather than at the broader MSA level. MSAs contain smaller cities, suburbs, and other outlying counties. Therefore, an auditor could be located in the same MSA as their client but separated by a long distance. Distance in kilometers is calculated with the “geodist” function in Stata. “Geodist” measures the shortest distance between two geographic coordinates with an ellipsoidal model of Earth. In testing Model 1, the distance variables are not used in the regression estimation, but instead used to restrict the regression sample to only those observations with distant audit engagements (i.e., one regression restricts the sample to observations when $DMSA = 1$ and a second regression restricts the sample to observations when $D100 = 1$).

3.8. Control Variables

In Model 1, I include a set of control variables common in tests of audit quality and defined consistent with Choi et al. (2012). The variable *Size* is calculated as the natural logarithm of total assets. *Ln_Segments* controls for the complexity and geographic breadth of the firm and is calculated as the natural logarithm of the sum of business segments and geographic segments minus one. This definition is consistent with Choi et al. (2012) and results in a minimum value of 0. For observations that are not included in the Compustat Segments File, I designate their number of business segments and geographic segments as one each. Additional firm-level control variables capturing incentives for companies to manage earnings are change in sales (*Chg Sales*), book-to-market ratio (*BTM*), an indicator variable capturing whether the firm records a net loss (*Loss*), debt-to-assets ratio (*Lev*), financial distress (*Zmij*), debt and equity issuance (*Issuance*), cash flows from operations (*CFO*), and prior year total accruals (*Lag_ACCR*). I also include a variable indicating whether the firm’s management reported

ineffective internal controls (*ICW*) as one, or 0 when management deems internal controls effective or for observations not included in the Audit Analytics Internal Control database.⁹

I also include control variables for auditor characteristics that have been shown in prior research to be associated with discretionary accruals and misstatements (Choi et al. 2012; Aobdia 2019). *Big4* indicates whether the firm is audited by Deloitte, EY, PwC, or KPMG. *New Auditor* indicates whether the auditor is in their first year of performing the audit. *Non-Audit Services* measures the proportion of total fees earned by the auditor that come from non-audit services. Finally, *City_Spec* indicates whether the auditor has greater than 30 percent market share of the industry audited by the audit firms in their MSA and *Herf* measures auditor concentration at the office level. Appendix A includes detailed variable definitions. For each regression, I include 2-digit SIC industry fixed effects, client MSA fixed effects and cluster standard errors by client firm.

3.9. Test of Hypothesis 2

To test Hypothesis 2, I estimate the following model on the full sample (i.e., local and distant audit observations) using OLS:

$$AQ_{i,t} = \gamma_1 + \gamma_2 Era_{i,t} + \gamma Distance_{i,t} + \gamma_4 Era_{i,t} * Distance_{i,t} + \sum \gamma Controls_{i,t} \\ + Industry Fixed Effects + Client City Fixed Effects + \varepsilon \quad (3)$$

Rather than using distance to restrict the sample as in Model 1, this model includes one of three different distance variables (*DMSA*, *D100*, or *Ln_Distance*) and an interaction of the distance variable with *Era*. *DMSA* and *D100* are defined the same as in Model 1. I also include a continuous measure of distance, *Ln_Distance* (Francis et al. 2021). *Ln_Distance* is calculated as

⁹ The decision to code observations not included in the Internal Control Database is discussed in the “Additional Analyses and Robustness Tests” section.

the natural logarithm of the number of kilometers between the auditor and client cities, plus one.¹⁰ Including the distance variables allows for a control group (local audits) to which the treatment group (distant audits) can be compared and is necessary to test H2. This results in a stronger identification of the impact of technology on audit quality. By comparing local and distant audits, I can measure any incremental improvement in audit quality experienced by distant audits over that of local audits. I attribute the incremental improvement of distant audits to advances in communication technology because they more heavily rely on communication tools. All other variables are defined identically to Model 1 (see Appendix A). A strength of this design is that it addresses one of the concerns in Model 1, that audit quality improvement is simply a trend in time for all audit clients.

The reference group of Model 3 is local audits in the first period (2004-2007). Therefore, the main effect of *Era* represents the association between moving from one era to the next (first to second and second to third) on audit quality for local audits (*Distance* = 0). The main effect of the distance variable represents the effect that distance has on audit quality for clients in the first era. Finally, the coefficient on the interaction of *Era* and *Distance* is the difference in audit quality between local and distant audits from one era to the next. Hypothesis 2 predicts that the coefficient on the interaction of *Era* and *Distance* (γ_4) is negative, indicating that improvement in audit quality from one era to the next is greater for distant audits than local audits.

¹⁰ Auditors and clients located in the same cities have a value of 0.

3.10. Test of Hypothesis 3

To test Hypothesis 3, I estimate the following model on the full sample (i.e., local and distant audit observations) using OLS:

$$\begin{aligned} Ln_Fees_{i,t} = & \delta_1 + \delta_2 Era_{i,t} + \delta_3 Distance_{i,t} + \delta_4 Era_{i,t} * Distance_{i,t} + \sum \delta Controls_{i,t} \\ & + Industry\ Fixed\ Effects + Client\ City\ Fixed\ Effects + \varepsilon \end{aligned} \quad (4)$$

Ln_Fees is defined as the natural logarithm of total audit fees (in dollars) for each observation per Audit Analytics. All other variables, including all three $Distance$ variables, are defined identically to Model 3 (see Appendix A).

As in the test of Hypothesis 2, I control for general changes in audit fees over time by using local audits as a control group. Because distant audits more heavily rely on communication tools, advances in communication technology should have a greater benefit for distant audits than local audits. Therefore, the benefit of advances in communication technology on audit fees for distant auditors can be measured by the differential change in audit fees for distant auditors as compared to local auditors.

The reference group in the Era variable is local audits in the first period (2004-2007). Therefore, the main effect of Era represents the change in audit fees for local audits ($Distance = 0$) from one era to the next (first to second and second to third). The main effect of the distance variable represents the difference in audit fees between local and distant audits in the first era. Finally, the coefficient on the interaction of Era and $Distance$ is the difference in the change in audit fees between local and distant audits from one era to the next. Hypothesis 3 predicts that the coefficient on the interaction of Era and $Distance$ (δ_4) is negative, indicating that the change in audit fees of distant audits from one era to the next is less than that for local audits.

I do not make a prediction on the relationship between distance and audit fees, as ex ante it is unclear whether, holding all else constant, audit fees are positively or negatively related to auditor distance. Further, this is outside the scope of my research question. Likewise, I do not make a prediction on the relationship between advances in communication technology and audit fees. Implementing new technology could lead to an increase in audit fees if audit firms push these costs to their clients, while the efficiencies mentioned above may lead to a reduction in audit fees for all firms. My expectation, however, is that as communication technology advances distant audits are more efficient compared to local audits.

CHAPTER 4: SAMPLE DESCRIPTION AND EMPIRICAL RESULTS

4.1. Sample Construction

The datasets used in the analysis are Audit Analytics, Compustat, the Compustat Segments File, and “Augmented 10-X Header Data” made available by Bill McDonald. There are 286,235 observations in the Audit Analytics-Audit Opinion download for the period of 2004-2018. I drop all observations missing data such as audit fees reducing the sample to 215,283 observations. I drop observations where the client or auditor are not located in the United States, and ones missing geographic data such as city location. This reduces the sample by 25,918 observations and is an important step because the United States Census Bureau classification of a MSA is used in determining auditor-client distance. In instances where there is more than one filing in the Audit Analytics database for a period end (such as a 10-K followed by a 10-K/A), I eliminate duplicate filings, reducing the sample by 42,670 duplicate observations. Another 37,022 observations missing SIC industry codes are dropped. Lastly, I remove 4,880 observations where auditors or clients are not located in a MSA, consistent with Choi et al. (2012). I update the “auditorkey” variable in the database for audit firm mergers and name changes to ensure that the *New Auditor* variable is calculated appropriately.¹¹ The final population from the Audit Analytics database is 104,703 firm-year observations before merging with Compustat.

The Audit Analytics population is then merged with Compustat and the Compustat Segment File. Prior to merging, I remove observations from Compustat that are missing CIK

¹¹ Mergers and name changes are identified in the Audit Analytics Auditor Events file. I include events specified as Event Type 1 (Name Change) and Type 2 (Merger/Acquisition). I remove events with an event date listed as “0000-00-00” and include events through the end of the sample period. I then replace the auditorkey in my dataset with the updated key. For example, Deloitte (Key = 3) acquired Mintz & Partners LLP (Key = 474) on 1/28/2008. Any observations that were audited by Key 474 are updated to Key 3.

numbers (used in the merging process) and those with assets less than \$1 million. This results in a Compustat population of 124,591 firm-year observations. The Audit Analytics-Compustat merged population is 71,430 firm-year observations. To calculate discretionary accruals in Model 2, I drop observations in financial institutions (SIC 6000-6799) and utilities (SIC 4900-4999) industries because of their unique regulatory environments. Also, I drop observations in industry-years with fewer than 10 observations prior to calculating Model 2 because industry-years with few observations can generate imprecise accrual estimates (Kothari et al. 2005). Lastly, as a final step I eliminate observations missing necessary control variables in Compustat and Audit Analytics resulting in a final sample of 43,136 firm-year observations. Table 1 provides a reconciliation between the Audit Analytics and Compustat downloads and the final sample.

TABLE 1. SAMPLE SELECTION

This table presents the reconciliation of Audit Analytics and Compustat populations to the final sample.

	Firm-Years
Audit Analytics Population (2004-2018)	286,235
Less: Missing audit fees	(70,952)
Less: Missing Auditor Cities or States, Client Cities or States	(397)
Less: Duplicate filings (ex. 10-K and 10-K/A)	(42,760)
Less: Auditors/Clients not located in the United States	(25,521)
Less: Auditors not located in MSAs	(331)
Less: Missing SIC industries	(37,022)
Less: Clients not located in MSAs	(4,549)
Audit Analytics Population (2004-2018)	104,703
Compustat Population (2004-2018)	167,764
Less: Missing CIK	(37,195)
Less: Assets less than \$1 million	(5,978)
Compustat Population (2004-2018)	124,591
Audit Analytics and Compustat Merged Population (2004-2018)	71,430
Less: Financial and Utilities Industries	(18,801)
Less: Observations with missing variables for DACC calculation	(5,675)
Less: Industry-Years with less than 10 observations	(871)
Less: Missing variables for AQ Regression	(2,947)
Final Sample (2004-2018)	43,136

4.2. Descriptive Statistics

Descriptive statistics are presented in Table 2 Panel A. In terms of audit quality measures, *DACC* has an average of 0.10 and 4.5 percent of firm-years are found to have contained a non-reliance misstatement (*MISSTATE*). In Figures 2 and 3, average *DACC* and *MISSTATE* are plotted by year for (1) the full sample, (2) the sample where *DMSA* = 1 and (3) the sample where *DMSA* = 0. Both graphs show a consistent downward trend over the sample period. These trends are discussed further in the results section as they support the importance of including a control group in the analyses.

FIGURE 2: AVERAGE *DACC* ACROSS SAMPLE PERIOD

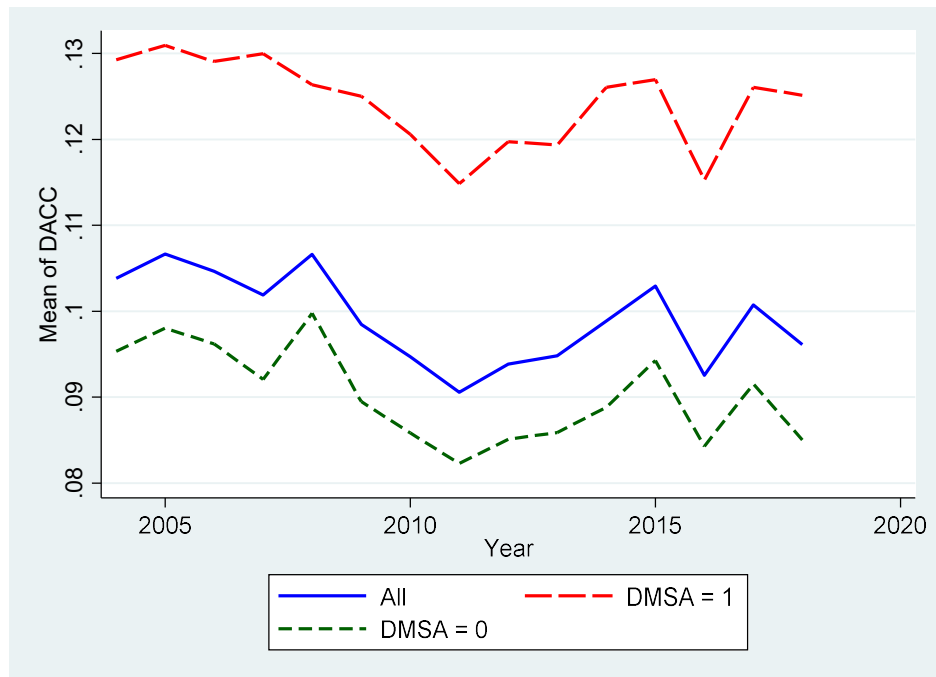
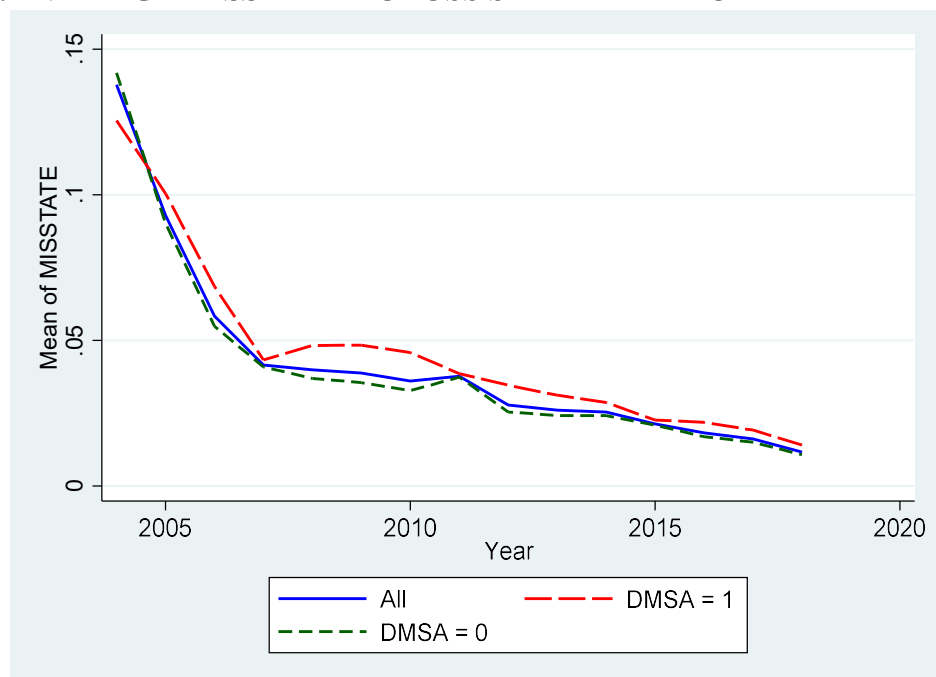


FIGURE 3: AVERAGE *MISSTATE* ACROSS SAMPLE PERIOD



The mean value of *DACC* of 0.100 is consistent with the mean value in Choi et al. (2012). The mean of *Size*, *Ln_Segments*, *City_Spec*, *Loss*, *Lev*, *Non-Audit Services*, *Chg_Sales*, and *Herf* are also similar to those in Choi et al. (2012). Given that my sample includes years from 2004-2018, while Choi et al. (2012) includes only observations from 2002-2005, differences in other control variables are not unexpected. The mean of misstatements (*MISSTATE*) of 0.045 is similar to that in Francis et al. (2021).

The average of *SIZE* is 12.550 (equal to approximately \$282 million in assets) with an average of *Ln_Segments* of 0.922 (equal to approximately 2.5 combined business and geographic segments). Auditors of these firms are city specialists in their industry in 51 percent of observations (*City Spec*), are Big 4 firms in 64 percent of observations (*Big4*), and are in the first year of an audit 6 percent of the time (*New Auditor*). Auditor and client pairs are located in different MSAs in approximately 26 percent of observations (*DMSA*) and more than 100 kilometers apart in approximately 17 percent of observations (*D100*).¹² The average distance between auditor and client cities is equal to 16 kilometers (*Ln_Distance* = 2.777). This shows that while distant auditors are not the norm, they do represent a non-trivial proportion of audits.

¹² Choi et al. (2012) report that approximately 20 percent of audits are conducted by auditors located in a different MSA. It is possible that my sample has a higher rate of distant audits, in part, due to changes in MSAs. For example, at the time of the Choi et al. (2012) analysis there was one MSA for Boston-Worcester-Lawrence, MA, NH, ME, CT, whereas this has since been separated into Boston-Cambridge-Newton, MA, NH and Worcester, MA, CT.

TABLE 2. DESCRIPTIVE STATISTICS

This table reports the summary statistics of the sample. Panel A presents the descriptive statistics of the full sample used in the main analysis. Panel B separates the sample by *DMSA* and reports univariate tests. Panel C reports the number of observations by year and *DMSA*. Panel D reports the most common distant auditor-client MSA pairs. Panel E ranks Auditor MSAs by the number of distant audits in the sample. Continuous variables are winsorized at the 1st and 99th percentiles. All variables are defined in Appendix A. ***, **, * denote p-values of less than 0.01, 0.05, and 0.10, respectively, with two-tailed t-tests.

Panel A: - Full Sample

Variables	Observations	Mean	SD	P25	P50	P75
<i>DACC</i>	43,136	0.100	0.142	0.022	0.052	0.111
<i>MISSTATE</i>	43,136	0.045	0.208	0.000	0.000	0.000
<i>Ln_Fees</i>	43,136	13.514	1.360	12.543	13.605	14.455
<i>DMSA</i>	43,136	0.260	0.439	0.000	0.000	1.000
<i>DI100</i>	43,136	0.170	0.375	0.000	0.000	0.000
<i>Ln_Distance (KM)</i>	43,136	2.776	2.239	0.000	3.048	3.937
<i>Ln_Segments</i>	43,136	0.922	0.792	0.000	1.099	1.609
<i>Size</i>	43,136	12.550	2.296	10.888	12.632	14.207
<i>Big 4</i>	43,136	0.643	0.479	0.000	1.000	1.000
<i>New Auditor</i>	43,136	0.061	0.239	0.000	0.000	0.000
<i>Non-Audit Services</i>	43,136	0.711	0.308	0.734	0.835	0.891
<i>City Spec</i>	43,136	0.514	0.500	0.000	1.000	1.000
<i>Chg Sales</i>	43,136	0.091	0.310	-0.020	0.051	0.172
<i>BTM</i>	43,136	0.432	0.876	0.192	0.392	0.693
<i>Loss</i>	43,136	0.415	0.493	0.000	0.000	1.000
<i>Lev</i>	43,136	0.565	0.472	0.296	0.487	0.681
<i>Zmij</i>	43,136	-0.971	2.968	-2.585	-1.518	-0.387
<i>Issuance</i>	43,136	0.744	0.436	0.000	1.000	1.000
<i>CFO</i>	43,136	-0.015	0.336	-0.025	0.073	0.137
<i>Lag_ACCR</i>	43,136	-0.134	0.362	-0.133	-0.065	-0.021
<i>HERF</i>	43,136	0.155	0.100	0.090	0.135	0.188
<i>ICW</i>	43,136	0.092	0.290	0.000	0.000	0.000

TABLE 2. (CONT'D)

Panel B: Descriptive Statistics separated by Distant and Local Classification

Variable	DMSA = 1		DMSA = 0		Difference	
	Mean	Median	Mean	Median	Mean	Median
<i>DACC</i>	0.125	0.061	0.091	0.049	0.034 ***	0.012 ***
<i>MISSTATE</i>	0.049	0.000	0.044	0.000	0.005 **	0.000 **
<i>Ln_Fees</i>	13.089	13.144	13.664	13.737	-0.589 ***	-0.593 ***
<i>Ln_Segments</i>	0.805	0.693	0.963	1.099	-0.158 ***	-0.405 ***
<i>Size</i>	11.831	11.871	12.804	12.879	-0.973 ***	-1.008 ***
<i>Big 4</i>	0.486	0.000	0.698	1.000	-0.212 ***	-1.000 ***
<i>New Auditor</i>	0.084	0.000	0.053	0.000	0.031 ***	0.000 ***
<i>Non-Audit Services</i>	0.654	0.815	0.731	0.841	-0.077 ***	-0.026 ***
<i>City Spec</i>	0.475	0.000	0.528	1.000	-0.053 ***	-1.000 ***
<i>Chg Sales</i>	0.092	0.043	0.091	0.054	0.002	-0.011 ***
<i>BTM</i>	0.388	0.381	0.448	0.395	-0.060 ***	-0.014 ***
<i>Loss</i>	0.507	1.000	0.383	0.000	0.124 ***	1.000 ***
<i>Lev</i>	0.613	0.487	0.549	0.488	0.064 ***	-0.001 *
<i>Zmij</i>	-0.588	-1.455	-1.106	-1.537	0.518 ***	0.083 ***
<i>Issuance</i>	0.764	1.000	0.737	1.000	0.027 ***	0.000 ***
<i>CFO</i>	-0.076	0.049	0.006	0.079	-0.082 ***	-0.030 ***
<i>Lag_ACCR</i>	-0.191	-0.073	-0.114	-0.063	-0.077 ***	-0.010 ***
<i>HERF</i>	0.168	0.140	0.150	0.134	0.018 ***	0.006 ***
<i>ICW</i>	0.130	0.000	0.079	0.000	0.050 ***	0.000 ***

TABLE 2. (CONT'D)

Panel C: Audits by Location

Variables	Total Audits	Distant Audits (DMSA = 1)	Local Audits (DMSA = 0)	%Distant of Total Audits
2004	3,558	893	2,665	25.10%
2005	3,454	906	2,548	26.23%
2006	3,342	861	2,481	25.76%
2007	3,203	831	2,372	25.94%
2008	2,985	767	2,218	25.70%
2009	2,863	723	2,140	25.25%
2010	2,744	699	2,045	25.47%
2011	2,652	673	1,979	25.38%
2012	2,629	664	1,965	25.26%
2013	2,647	705	1,942	26.63%
2014	2,716	732	1,984	26.95%
2015	2,667	707	1,960	26.51%
2016	2,570	685	1,885	26.65%
2017	2,536	677	1,859	26.70%
2018	2,570	711	1,859	27.67%
	43,136	11,234	31,902	

TABLE 2. (CONT'D)

Panel D: Most Common Distant Auditor-Client Pairs

Rank	Auditor MSA	Client MSA	Count	Avg. Dist. (KM)
1	San Jose-Sunnyvale-Santa Clara, CA	San Francisco-Oakland-Berkeley, CA	942	39
2	San Francisco-Oakland-Berkeley, CA	San Jose-Sunnyvale-Santa Clara, CA	263	54
3	New York-Newark-Jersey City, NY-NJ-PA	Bridgeport-Stamford-Norwalk, CT	171	61
4	New York-Newark-Jersey City, NY-NJ-PA	Phila.-Camden-Wilmington, PA-NJ-DE-MD	150	110
5	Los Angeles-Long Beach-Anaheim, CA	San Diego-Chula Vista-Carlsbad, CA	144	120
6	Denver-Aurora-Lakewood, CO	Boulder, CO	132	41
7	Baltimore-Columbia-Towson, MD	Wash.-Arling.-Alex., DC-VA-MD-WV	125	54
8	Boston-Cambridge-Newton, MA-NH	Worcester, MA-CT	122	60
9	Los Angeles-Long Beach-Anaheim, CA	Oxnard-Thousand Oaks-Ventura, CA	120	69
10	Hartford-East Hartford-Middletown, CT	New Haven-Milford, CT	103	45
11	Boston-Cambridge-Newton, MA-NH	Providence-Warwick, RI-MA	94	61
12	Los Angeles-Long Beach-Anaheim, CA	Santa Maria-Santa Barbara, CA	88	141
13	New York-Newark-Jersey City, NY-NJ-PA	Trenton-Princeton, NJ	81	52
14	New York-Newark-Jersey City, NY-NJ-PA	Miami-Fort Lauderdale-Pompano Beach, FL	79	1,695
15	Dallas-Fort Worth-Arlington, TX	Houston-The Woodlands-Sugar Land, TX	75	363
16	Phila.-Camden-Wilmington, PA-NJ-DE-MD	New York-Newark-Jersey City, NY-NJ-PA	74	103
17	Raleigh-Cary, NC	Durham-Chapel Hill, NC	72	33
18	Salt Lake City, UT	Provo-Orem, UT	72	55
19	Denver-Aurora-Lakewood, CO	Colorado Springs, CO	62	101
20	Bridgeport-Stamford-Norwalk, CT	New York-Newark-Jersey City, NY-NJ-PA	60	29
21	New York-Newark-Jersey City, NY-NJ-PA	Los Angeles-Long Beach-Anaheim, CA	60	3,948
22	Detroit-Warren-Dearborn, MI	Ann Arbor, MI	58	56
23	Phila.-Camden-Wilmington, PA-NJ-DE-MD	Trenton-Princeton, NJ	58	56
24	Hartford-East Hartford-Middletown, CT	Bridgeport-Stamford-Norwalk, CT	56	78
25	Dallas-Fort Worth-Arlington, TX	Austin-Round Rock-Georgetown, TX	51	287
Number of Observations			3,312	
Remaining Distant Auditor-Client Pairs			7,922	
Total Distant Auditor-Client Pairs			11,234	

TABLE 2. (CONT'D)

Panel E: Auditor MSAs Ranked by Most Distant Client-Year Observations

Rank	Auditor MSA	Number of Distant Observations
1	New York-Newark-Jersey City, NY-NJ-PA	1,283
2	San Jose-Sunnyvale-Santa Clara, CA	1,057
3	Los Angeles-Long Beach-Anaheim, CA	734
4	Boston-Cambridge-Newton, MA-NH	455
5	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	448
6	Denver-Aurora-Lakewood, CO	446
7	San Francisco-Oakland-Berkeley, CA	430
8	Houston-The Woodlands-Sugar Land, TX	399
9	Chicago-Naperville-Elgin, IL-IN-WI	372
10	Salt Lake City, UT	335
11	Dallas-Fort Worth-Arlington, TX	320
12	Tampa-St. Petersburg-Clearwater, FL	267
13	Minneapolis-St. Paul-Bloomington, MN-WI	235
14	Atlanta-Sandy Springs-Alpharetta, GA	228
15	Milwaukee-Waukesha, WI	208
16	Hartford-East Hartford-Middletown, CT	192
17	Cleveland-Elyria, OH	191
18	Miami-Fort Lauderdale-Pompano Beach, FL	184
19	Detroit-Warren-Dearborn, MI	175
20	Charlotte-Concord-Gastonia, NC-SC	174
21	Raleigh-Cary, NC	173
22	Baltimore-Columbia-Towson, MD	159
23	Washington-Arlington-Alexandria, DC-VA-MD-WV	142
24	Indianapolis-Carmel-Anderson, IN	128
25	Bridgeport-Stamford-Norwalk, CT	120
Number of Observations		8,855
Remaining Distant Observations		2,379
Total Distant Observations		11,234

Table 2 Panel B presents tests of differences in means and medians of the control group (local audits, $DMSA = 0$) and the treatment group (distant audits, $DMSA = 1$). The direction and significance of the mean differences are consistent with prior research (Choi et al. 2012; Francis et al. 2021). On average, clients with distant auditors have higher discretionary accruals, more misstatements, and are smaller. Local auditors are more likely to be Big 4 firms and city specialists, and have higher proportions of non-audit services, while they are less likely to be in the first year of the audit. The difference in Big 4 auditors is unsurprising given that Big 4 firms are widely distributed across the United States, operating offices in nearly all major cities. Other auditors that are annually inspected by the PCAOB over the sample period, such as those in Tier 2 firms (RSM, Crowe, Grant Thornton, and BDO) also have nationwide practices; however, as the size of the audit firm decreases it is likely that their footprint decreases, resulting in more distant audits.

FIGURE 4: AUDITOR MSAS IN SAMPLE

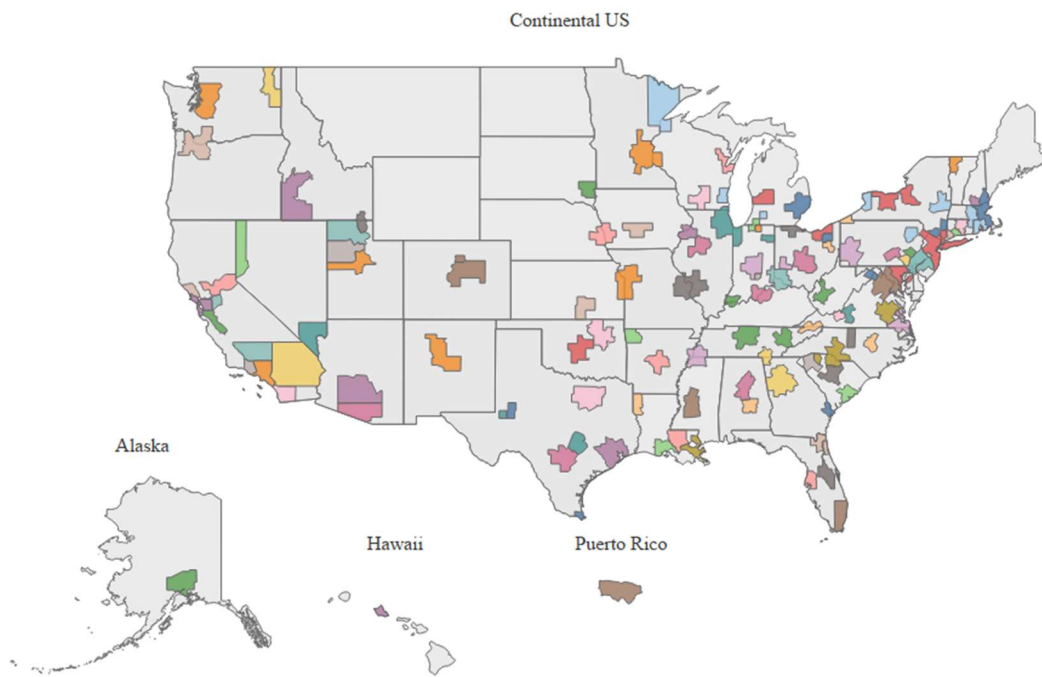


FIGURE 5: TOP FIVE AUDITOR MSAS FOR DISTANT CLIENTS

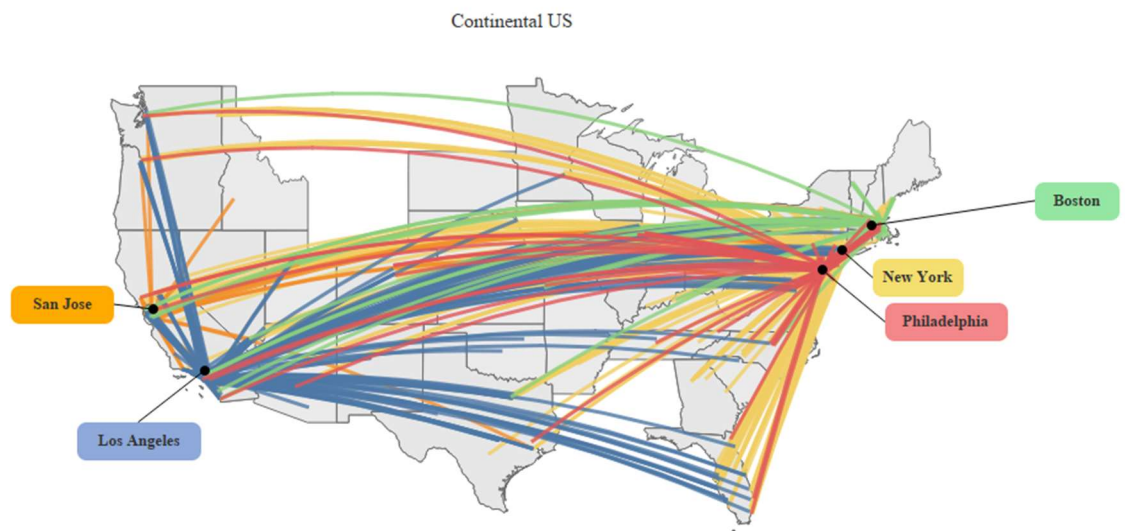


Table 2 Panel C provides additional detail on distant and local audits showing that the percentage of distant audits has been consistent over the sample period and remains around 25-27 percent. In terms of kilometers, the mean (median) distance between a client's city and an auditor's city when both are located in the same MSA is 15 (11) kilometers. The mean (median) distance (untabulated) between a client's city and an auditor's city when they are located in different MSAs is 678 (179) kilometers. In total, auditors in the sample are distributed across 142 MSAs in 48 states, the District of Columbia, and Puerto Rico (untabulated).¹³ Figure 4 presents a map of the United States showing the auditor MSAs included in the analysis. Most but not all MSAs (123 out of 142 MSAs) have auditors with clients outside of the MSA. For additional information, Panel D presents the top 25 distant MSA city pairs (based on *DMSA*), where auditors in San Jose with clients in San Francisco are the most common in the sample. While many of the distant auditor-client pairings are in close or adjacent MSAs, many of the pairs would still likely involve long commute times making it unreasonable for auditors to work in the field on a daily basis (for example, New York to Philadelphia, Los Angeles to San Diego, and Dallas to Houston). This panel also shows that long distance pairings are not uncommon. For example, New York to Miami and New York to Los Angeles are among the top 25 pairs. Panel E ranks auditor MSAs by the number of distant client observations (based on *DMSA*), where New York auditors perform the most distant audits in the sample. Figure 5 connects the top five MSAs in Panel E locations to illustrate that distant audits are often cross-country and require considerable travel.

The correlation matrix in Table 3 is consistent with the inferences from univariate tests in Table 2 Panel B. For example, the correlations between both proxies for audit quality and

¹³ There are no auditors located in North Dakota or Wyoming in the sample. There are no clients located in Montana in the sample.

auditor-client distance are positive and statistically significant. Additionally, *Size*, *Big4*, *Non-Audit Services*, and *City Spec* are negatively correlated with auditor-client distance, while *New Auditor* is positively associated with auditor-client distance.

TABLE 3. CORRELATION MATRIX

This table presents the pair-wise correlation matrix of all variables. Those in bold are significant at the 5% level. All variables are defined in Appendix A.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) <i>DACC</i>	1.00										
(2) <i>MISSTATE</i>	0.04	1.00									
(3) <i>Ln_Fees</i>	(0.32)	(0.02)	1.00								
(4) <i>DMSA</i>	0.10	0.01	(0.19)	1.00							
(5) <i>DI00</i>	0.12	0.02	(0.22)	0.76	1.00						
(6) <i>Log_Distance (KM)</i>	0.13	0.02	(0.23)	0.71	0.71	1.00					
(7) <i>Ln_Segments</i>	(0.23)	(0.01)	0.49	(0.09)	(0.12)	(0.09)	1.00				
(8) <i>Size</i>	(0.39)	(0.03)	0.89	(0.19)	(0.19)	(0.25)	0.44	1.00			
(9) <i>Big 4</i>	(0.26)	(0.02)	0.67	(0.19)	(0.24)	(0.25)	0.26	0.63	1.00		
(10) <i>New Auditor</i>	0.09	0.02	(0.14)	0.06	0.06	0.07	(0.06)	(0.15)	(0.19)	1.00	
(11) <i>Non-Audit Services</i>	(0.12)	0.02	0.27	(0.11)	(0.12)	(0.10)	0.19	0.30	0.25	(0.08)	1.00
(12) <i>City Spec</i>	(0.18)	(0.02)	0.37	(0.05)	(0.06)	(0.13)	0.15	0.39	0.43	(0.09)	0.15
(13) <i>Chg Sales</i>	0.07	0.05	(0.02)	0.00	0.01	0.01	(0.02)	0.01	(0.00)	0.00	0.03
(14) <i>BTM</i>	(0.17)	0.01	0.02	(0.03)	(0.03)	(0.03)	0.07	0.09	0.01	(0.01)	0.02
(15) <i>Loss</i>	0.29	0.01	(0.31)	0.11	0.09	0.12	(0.26)	(0.42)	(0.24)	0.09	(0.16)
(16) <i>Lev</i>	0.27	0.01	(0.04)	0.06	0.08	0.06	(0.09)	(0.11)	(0.09)	0.04	(0.04)
(17) <i>Zmij</i>	0.34	0.01	(0.09)	0.08	0.10	0.08	(0.13)	(0.19)	(0.13)	0.05	(0.07)
(18) <i>Issuance</i>	0.06	0.01	0.14	0.03	0.03	0.00	(0.01)	0.12	0.09	(0.00)	0.03
(19) <i>CFO</i>	(0.45)	(0.01)	0.33	(0.11)	(0.11)	(0.14)	0.27	0.44	0.24	(0.06)	0.15
(20) <i>Lag_ACCR</i>	(0.34)	(0.01)	0.21	(0.09)	(0.11)	(0.11)	0.18	0.25	0.17	(0.07)	0.10
(21) <i>HERF</i>	(0.06)	(0.01)	0.02	0.08	0.02	(0.05)	0.04	0.05	0.10	(0.03)	0.03
(22) <i>ICW</i>	0.13	0.15	(0.08)	0.08	0.09	0.09	(0.05)	(0.15)	(0.14)	0.11	(0.08)

TABLE 3. (CONT'D)

Variables	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
(12) <i>City Spec</i>	1.00										
(13) <i>Chg Sales</i>	(0.00)	1.00									
(14) <i>BTM</i>	0.02	(0.03)	1.00								
(15) <i>Loss</i>	(0.17)	(0.17)	(0.07)	1.00							
(16) <i>Lev</i>	(0.02)	(0.05)	(0.54)	0.19	1.00						
(17) <i>Zmij</i>	(0.05)	(0.06)	(0.53)	0.26	0.98	1.00					
(18) <i>Issuance</i>	0.06	0.03	(0.09)	0.12	0.21	0.21	1.00				
(19) <i>CFO</i>	0.16	0.08	0.14	(0.49)	(0.25)	(0.37)	(0.15)	1.00			
(20) <i>Lag_ACCR</i>	0.11	(0.05)	0.17	(0.23)	(0.25)	(0.31)	(0.09)	0.39	1.00		
(21) <i>HERF</i>	0.30	0.00	0.03	(0.05)	(0.05)	(0.06)	(0.01)	0.06	0.05	1.00	
(22) <i>ICW</i>	(0.06)	(0.00)	(0.06)	0.14	0.13	0.14	0.03	(0.10)	(0.11)	(0.01)	1.00

4.3. Empirical Results – Hypothesis 1

Hypothesis 1 predicts that audit quality improves over time with advances in communication technology for distant audit clients. I test this hypothesis using Model 1, restricted to only distant audits, and present results in Table 4. Panel A includes the estimation of Model 1 using discretionary accruals (*DACC*) as the dependent variable and *Era* as the variable of interest. The results in Column 1 are estimated over the sample of observations where the auditor and client are located in two different MSAs (*DMSA* = 1). Consistent with Hypothesis 1, Column 1 presents evidence that advances in communication technology have improved audit quality for clients that are located in different MSAs than their auditor. Discretionary accruals are an inverse measure of audit quality meaning a reduction in discretionary accruals suggests higher audit quality. The coefficient on *Era* is negative (-0.005) and statistically significant (p-value < 0.01). Therefore, compared to the reference era of 2004-2007, discretionary accruals of distant audits are significantly lower in the second and third eras. Results in Column 2 are estimated over the sample of observations where the auditor's city and client's city are located more than 100 kilometers apart (*DI00* = 1). These results are also negative (coefficient on *Era* of -0.007) and statistically significant (p-value < 0.01), again consistent with audit quality improving with advances in communication technology for distant audits.

The coefficients on control variables in Panel A are generally consistent with those in the discretionary accruals model test in Choi et al. (2012). Specifically, in Column 1, I find negative and statistically significant coefficients on business segments (*Ln_Segments*), assets (*Size*), Big 4 auditors (*Big4*), operating cash flows (*CFO*), and lagged accruals (*Lag_ACCR*). I also find positive and statistically significant coefficients on sales growth (*Chg_Sales*) and financial distress (*Zmij*).

TABLE 4. TEST OF HYPOTHESIS 1

This table reports the results of the main analysis estimating Model 1. Panel A (B) reports the results using *DACC* (*MISSTATE*) to proxy for audit quality. In each panel, Column 1 estimates Model 1 for observations where *DMSA* = 1 and Column 2 estimates Model 1 for observations where *D100* = 1. All variables are defined in Appendix A. ***, **, * denote p-values of less than 0.01, 0.05, and 0.10, respectively, with one-tailed t-tests. All reported t-statistics are calculated with robust standard errors. Differences in the number of observations relative to Table 2 are due to observations dropped because of collinearity when using fixed effects.

Panel A: Discretionary Accruals (*DACC*)

VARIABLES	(1) DMSA	(2) D100
Era	-0.005*** (-2.353)	-0.007*** (-2.594)
Ln_Segments	-0.005** (-2.024)	-0.003 (-0.926)
Size	-0.013*** (-9.981)	-0.013*** (-7.817)
BIG 4	-0.011*** (-2.510)	-0.011** (-1.972)
New Auditor	0.002 (0.391)	0.006 (0.925)
Non-Audit Services	0.005 (0.810)	0.003 (0.391)
City Spec	-0.002 (-0.455)	-0.008* (-1.551)
Chg Sales	0.051*** (8.698)	0.043*** (6.125)
BTM	-0.000 (-0.222)	-0.001 (-0.442)
Loss	-0.015*** (-3.733)	-0.017*** (-3.317)
Lev	-0.223*** (-3.850)	-0.182*** (-2.867)
Zmij	0.045*** (4.696)	0.037*** (3.570)
Issuance	0.002 (0.650)	0.003 (0.607)
CFO	-0.064*** (-4.941)	-0.078*** (-5.192)
Lag_ACCR	-0.037*** (-5.427)	-0.035*** (-4.437)
HERF	-0.010 (-0.603)	0.006 (0.332)

TABLE 4. (CONT'D)

ICW	0.017*** (3.060)	0.022*** (3.290)
Constant	0.440*** (10.764)	0.419*** (9.172)
Observations	11,221	7,298
R-squared	0.380	0.403
Industry FE:	Yes	Yes
Client Location FE:	Yes	Yes

TABLE 4. (CONT'D)Panel B: Misstatements (*MISSTATE*)

VARIABLES	(1) DMSA	(2) D100
Era	-0.033*** (-9.241)	-0.040*** (-8.258)
Ln_Segments	0.008** (1.667)	0.008 (1.169)
Size	0.002 (0.937)	0.004 (1.244)
BIG 4	0.000 (0.044)	0.000 (0.017)
New Auditor	-0.002 (-0.193)	-0.001 (-0.068)
Non-Audit Services	0.009 (1.198)	0.013* (1.316)
City Spec	-0.015*** (-2.347)	-0.008 (-0.906)
Chg Sales	0.017** (2.147)	0.024*** (2.461)
BTM	0.001 (0.267)	0.001 (0.209)
Loss	-0.004 (-0.673)	-0.009 (-1.056)
Lev	0.013 (0.414)	0.033 (0.864)
Zmij	-0.002 (-0.435)	-0.005 (-0.871)
Issuance	0.006 (0.931)	0.012* (1.396)
CFO	-0.016** (-1.652)	-0.030*** (-2.432)
Lag_ACCR	-0.002 (-0.312)	-0.001 (-0.140)
HERF	0.013 (0.402)	0.008 (0.209)

TABLE 4. (CONT'D)

ICW	0.087*** (8.350)	0.074*** (5.924)
Constant	0.023 (0.690)	-0.005 (-0.119)
Observations	11,221	7,298
R-squared	0.090	0.106
Industry FE:	Yes	Yes
Client Location FE:	Yes	Yes

Table 4 Panel B presents the results of estimating Model 1 using *MISSTATE* as the dependent variable. In Column 1 the sample is restricted to observations where the auditor and client are located in different MSAs (*DMSA* = 1). In this specification, I find that the coefficient on *Era* is negative (-0.033) and statistically significant (p-value < 0.01). The results of this test are consistent with Hypothesis 1 and suggest that the propensity to have a misstatement is lower in the second and third eras of communication technology than in the first era. In Column 2 the sample is restricted to observations where the auditor's city and the client's city are more than 100 kilometers apart (*D100* = 1). In this specification, the coefficient on *Era* is negative (-0.040) and statistically significant (p-value < 0.01). These results also support Hypothesis 1.

Regarding control variables, I find a negative and statistically significant coefficient on city-industry specialists (*City Spec*) in Column 1, but not in Column 2. I find a positive and statistically significant coefficient on internal control weaknesses (*ICW*) in both Columns 1 and 2. Most of the remaining control variables are not statistically significant. This lack of significance is consistent with other studies on misstatements (Lobo and Zhao 2013; Eshleman and Guo 2014).

4.4. Discussion of Hypothesis 1

Table 4 provides the results of the test of Hypothesis 1. I find that both discretionary accruals and the propensity for misstatements are lower in the second and third eras of communication technology, compared to the first. Further improvement in audit quality is economically meaningful. For the *DMSA* (*D100*) restricted samples, discretionary accruals are 4 (5) percent lower at the mean value of *DACC* and propensity to misstate is 67 (72) percent lower

at the mean value of *MISSTATE* from one era to the next.¹⁴ While these results are statistically significant and economically meaningful, they are limited in their ability to sufficiently address my research question of whether advances in communication technology affect audit quality. They are consistent with the expectation that distant audits, that are heavily reliant on communication technology, benefit from advances in technology but are unable to isolate the effect of the advances from other potential trends in audit quality. Figures 2 and 3 show that average discretionary accruals and misstatements declined over time for all types of clients. The decline could be related to advances in communication technology, other trends, or a combination of these factors. For this reason, I develop and test Hypothesis 2.

4.5. Empirical Results – Hypothesis 2

Hypothesis 2 predicts that compared to local audits, advances in communication technology have a greater impact on audit quality for distant audits. To test Hypothesis 2, I estimate the regression shown in Model 3 on the full sample. Model 3 also includes a variable for auditor-client distance and an interaction of auditor-client distance and *Era*. This allows for a comparison between a control group (local audits) and a treatment group (distant audits) to hold common trends in audit quality between the groups constant. The coefficient on the interaction term is the variable of interest.

Table 5 Panel A contains the results using *DACC* as the dependent variable. The panel is split into three columns, separately using *DMSA*, *D100*, and *Ln_Distance* as the proxy for distance. Across all three columns, the main effect between distance and discretionary accruals is positive and statistically significant. This is consistent with the results of Choi et al. (2012) and

¹⁴ Average *DACC* when *DMSA* = 1 is 0.125. On average effect is calculated as -0.005/0.125. Average *DACC* when *D100* = 1 is 0.137. On average effect is calculated as -0.007/0.137. Average *MISSTATE* when *DMSA* = 1 is 0.049. On average effect is calculated as -0.033/0.049. Average *MISSTATE* when *D100* = 1 is 0.055. On average effect is calculated as -0.040/0.055.

supports that distance between auditors and clients is associated with lower audit quality in the first era. The main effect of *Era*, which indicates the eras of advancement in communication technology, is not statistically significant in two of the distance specifications (*DMSA* and *Ln_Distance*) and only marginally statistically significant in the specification using *D100*. This indicates that, holding all else equal, advances in communication technology from the first era (2004-2007) to the second and third eras had little effect on discretionary accruals of local audits. Also, the lack of significance indicates that there is not a general trend in discretionary accruals over time that may have an alternative explanation (i.e., other than advancements in communication technology).

The coefficient on the interaction term of interest (*Era*Distance Variable*) provides the test of Hypothesis 2. Consistent with Hypothesis 2, the interaction term is negative and statistically significant in all specifications. Therefore, compared to local audits, distant audits had lower discretionary accruals from one era of communication technology to the next. That is, there was an incremental improvement in audit quality for distant audits across the communication technology eras, compared to local audits. Distant audit literature supports that audit quality differences between distant and local audits arise largely from the differences in communication. Thus, the results are consistent with advances in communication technology improving audit quality for distant audits.

The coefficients on control variables in the discretionary accruals analysis in Panel A are consistent with prior research on auditor distance (Choi et al. 2012). Specifically, I find a negative and statistically significant coefficient on business segments (*Ln_Segments*), assets (*Size*), Big 4 auditors (*Big4*), operating cash flows (*CFO*), and lagged accruals (*Lag_ACCR*). I

also find positive and statistically significant coefficients on sales growth (*Chg_Sales*) and financial distress (*Zmij*).

TABLE 5. TEST OF HYPOTHESIS 2

This table reports the results of the main analysis estimating Model 3. Panel A (B) reports the results using *DACC* (*MISSTATE*) to proxy for audit quality. In each panel, Column 1 uses *DMSA* as the distance variable, Column 2 uses *D100* as the distance variable, and Column 3 uses *Ln_Distance* as the distance variable. All variables are defined in Appendix A. ***, **, * denote p-values of less than 0.01, 0.05, and 0.10, respectively, with one-tailed t-tests. All reported t-statistics are calculated with robust standard errors. Differences in the number of observations relative to Table 2 are due to observations dropped because of collinearity when using fixed effects.

Panel A: Discretionary Accruals (*DACC*)

VARIABLES	(1) DMSA	(2) D100	(3) Ln_Distance
Era	-0.001 (-1.038)	-0.001* (-1.570)	0.001 (0.794)
Distance Variable	0.011*** (3.528)	0.015*** (3.958)	0.002*** (3.623)
Era*Distance Variable	-0.004** (-2.106)	-0.005** (-1.741)	-0.001*** (-2.708)
Ln_Segments	-0.004*** (-3.991)	-0.004*** (-3.975)	-0.004*** (-4.024)
Size	-0.010*** (-18.579)	-0.010*** (-18.570)	-0.010*** (-18.502)
BIG 4	-0.008*** (-4.100)	-0.007*** (-3.856)	-0.008*** (-4.240)
New Auditor	0.007*** (2.414)	0.007*** (2.422)	0.007*** (2.417)
Non-Audit Services	0.006** (2.146)	0.006** (2.187)	0.006** (2.085)
City Spec	0.001 (0.574)	0.001 (0.540)	0.001 (0.588)
Chg Sales	0.047*** (15.187)	0.047*** (15.172)	0.047*** (15.189)
BTM	0.001 (1.066)	0.001 (1.086)	0.001 (1.034)
Loss	-0.006*** (-3.002)	-0.006*** (-2.963)	-0.006*** (-2.965)
Lev	-0.156*** (-4.562)	-0.156*** (-4.553)	-0.156*** (-4.566)
Zmij	0.034*** (6.026)	0.034*** (6.017)	0.034*** (6.032)
Issuance	-0.001 (-0.806)	-0.001 (-0.823)	-0.001 (-0.755)

TABLE 5. (CONT'D)

CFO	-0.078*** (-9.996)	-0.077*** (-9.989)	-0.078*** (-10.005)
Lag_ACCR	-0.040*** (-9.584)	-0.040*** (-9.550)	-0.040*** (-9.596)
HERF	0.002 (0.201)	0.004 (0.362)	0.002 (0.218)
ICW	0.015*** (5.135)	0.015*** (5.099)	0.015*** (5.255)
Constant	0.345*** (14.017)	0.344*** (13.987)	0.342*** (13.873)
Observations	43,123	43,123	43,123
R-squared	0.341	0.341	0.341
Industry FE:	Yes	Yes	Yes
Client Location FE:	Yes	Yes	Yes

TABLE 5. (CONT'D)Panel B: Misstatements (*MISSTATE*)

VARIABLES	(1) DMSA	(2) D100	(3) Ln_Distance
Era	-0.033*** (-15.075)	-0.032*** (-15.528)	-0.029*** (-10.241)
Distance Variable	0.009* (1.295)	0.023*** (2.729)	0.003** (2.088)
Era*Distance Variable	-0.002 (-0.582)	-0.011** (-2.235)	-0.002** (-2.080)
Ln_Segments	0.000 (0.092)	0.000 (0.106)	0.000 (0.083)
Size	0.002** (1.697)	0.002** (1.690)	0.002** (1.711)
BIG 4	-0.003 (-0.737)	-0.003 (-0.573)	-0.003 (-0.748)
New Auditor	-0.008** (-1.709)	-0.008** (-1.751)	-0.008** (-1.741)
Non-Audit Services	0.009** (1.981)	0.009** (1.993)	0.009** (1.937)
City Spec	-0.006** (-1.752)	-0.006** (-1.783)	-0.006** (-1.758)
Chg Sales	0.024*** (5.333)	0.024*** (5.347)	0.024*** (5.352)
BTM	0.005*** (2.714)	0.005*** (2.736)	0.005*** (2.691)
Loss	0.004 (1.280)	0.004* (1.287)	0.004* (1.286)
Lev	0.022 (1.091)	0.022 (1.105)	0.022 (1.088)
Zmij	-0.003 (-0.952)	-0.003 (-0.970)	-0.003 (-0.950)
Issuance	0.006** (1.825)	0.006** (1.794)	0.006** (1.831)

TABLE 5. (CONT'D)

CFO	-0.010** (-1.771)	-0.010** (-1.746)	-0.010** (-1.774)
Lag_ACCR	0.004 (1.013)	0.004 (1.086)	0.004 (1.008)
HERF	0.021 (1.021)	0.022 (1.088)	0.021 (1.031)
ICW	0.109*** (17.048)	0.109*** (17.061)	0.109*** (17.119)
Constant	0.014 (0.768)	0.012 (0.649)	0.009 (0.461)
Observations	43,123	43,123	43,123
R-squared	0.055	0.056	0.056
Industry FE:	Yes	Yes	Yes
Client Location FE:	Yes	Yes	Yes

Table 5 Panel B presents the results of estimating Model 3 using misstatements (*MISSTATE*) as the dependent variable. In each column, the main effect of distance is positive and statistically significant. The coefficient for *DMSA* (0.009) is marginally statistically significant (p-value < 0.10), while *D100* (coefficient = 0.023, p-value < 0.01) and *Ln_Distance* (coefficient = 0.003, p-value < 0.05) are more highly statistically significant. Taken together this supports that distant audits (or more distant audits in the case of *Ln_Distance*) have a lower level of audit quality compared to local audits in the first era (2004-2007).. Across the distance variables in Columns 1-3, the main effects of *Era* are negative and statistically significant (p-values < 0.01). This result is consistent with misstatements decreasing with advances in communication technology for the base group of local audits, but also may be explained, at least in part, by general trends in misstatements over time for these audits due to alternative reasons, such as responses to regulatory oversight and audit firm improvements in their quality control. Prior research has shown a decline in misstatements for all audits (i.e., distant and local) of 81 percent from 2006 to 2020 (Audit Analytics 2021). Assuming that trends in misstatements due to regulatory oversight and improvements to quality control impacted local and distant audits equally, the *Era* variable, then, controls for these trends in misstatements over time. This leaves the interaction term *Era*Distance Variable* to measure the difference in misstatements for distance audits due to the differential impact advances in communication technology have on distant audits compared to local audits.

The coefficient on the interaction of interest in the *DMSA* specification in Column 1 is negative (-0.002) but not statistically significant. However, in Columns 2 and 3 the estimates of the interaction using *D100* (-0.011) and *Ln_Distance* (-0.002) are negative and statistically significant (p-values < 0.05). This implies that while misstatements overall decreased (audit

quality improved) from one era of communication technology to the next, distant audits had a greater decrease in misstatements (greater improvement in audit quality) in two of the three specifications. Taking the results in Table 5 Panels A and B together, the results indicate that audit quality improves for distant audits compared to local audits as advancements in communication technology occurred, supporting Hypothesis 2.

The coefficient on client size (*Size*) is positive and statistically significant in each specification of Panel B (Eshelman and Guo 2014). This suggest that larger firms experience higher rates of misstatements. *Chg_Sales*, *BTM*, and *Issuance* are also positive and statistically significant indicating that growth firms have higher levels of restatements. *ICW* is a positive and statistically significant predictor of misstatements as misstatements should be accompanied by internal control weaknesses. Surprisingly auditors in the first year of serving the client (*New_Auditor*) are associated with lower levels of misstatements, and city-industry specialist auditor (*City_Spec*) are also associated with lower levels of misstatements. Given the low frequency of misstatements and different research questions, research has not provided consistent associations between misstatements and control variables. However, the goodness of fit (R-squared) of the model in Panel B of approximately 5-6 percent is consistent with prior research (Lobo and Zhao 2013; Eshelman and Guo 2014).

4.6. Discussion of Hypothesis 2

The results in Table 5 are consistent with the expectations in Hypothesis 2 using both discretionary accruals and misstatements. Distant audits have lower discretionary accruals than local audits as communication technology advances. Interestingly, there is no main effect of advances in communication technology on discretionary accruals for local audits but a reduction in discretionary accruals for distant audits. Therefore, it appears that the advances in

communication technology uniquely affect distant audits. This effect is also economically meaningful. Distant audits' discretionary accruals are 4 percent lower than that of local audits as communication technology advances, when auditors and clients are located in different MSAs (Panel A Column 1).¹⁵

The empirical results for misstatements offer a slightly different perspective. Whereas the main effect of advances in communication technology was not statistically significant for discretionary accruals, it is highly negative and statistically significant for misstatements. For local audits, moving from one era of communication technology to the next is associated with a reduction in misstatements of over 70 percent, when auditors and clients are located more than 100 kilometers apart (Panel B Column 2).¹⁶ As mentioned above, this high level of reduction is possibly due to other trends for misstatements. Importantly though, the results in Panel B Columns 2 and 3 support that distant and local audits have been differentially affected by advances in communication technology in an economically meaningful way. For distant audits where auditors and clients are located more than 100 kilometers apart (Column 2), distant audits have a reduction in misstatements that is 24 percent greater than local audits.¹⁷ Results for both discretionary accruals and misstatements support that advances in communication technology have affected audit quality.

4.7. Empirical Results – Hypothesis 3

Hypothesis 3 focuses on the efficiency of the audit, predicting that advances in communication technology have a negative impact on audit fees for distant clients as compared to local clients. That is, advances in communication technology will increase the efficiency of

¹⁵ Average *DACC* is 0.100. On average effect is calculated as -0.004/0.100 in the *DMSA* specification.

¹⁶ Average *MISSTATE* is 0.045. On average effect is calculated as -0.032/0.045 in the *D100* specification.

¹⁷ Average *MISSTATE* is 0.045. On average effect is calculated as -0.011/0.045 in the *D100* specification.

distant audits to a greater extent than increases in efficiency to local audits, resulting in lower audit fees for distant audits relative to local audits. Model 4 is estimated over the entire sample period to test Hypothesis 3 and results are presented in Table 6. Columns 1 through 3 provide the results of the tests using each of three proxies for distance separately. In all three specifications, *Era* is positive and statistically significant. The main effect of *Era* indicates an increase in audit fees for local audits (*Distance* = 0) from one era of communication technology to the next (first to second and second to third). As in the misstatement test, this coefficient may also be explained, at least in part, by general trends in audit fees over time due to alternative reasons, such as increasing regulatory requirements and pressures. Assuming that trends in audit fees over the sample period impacted local and distant audits equally, the *Era* variable, then, controls for this trend in fees over time, leaving the interaction term *Era*Distance Variable* to measure the difference in audit fees for distant audits as compared to local audits due to the differential impact of advances in communication technology.

The main effect of the *Distance* variables (*DMSA*, *D100*, *Ln_Distance*) represent the difference in audit fees between local and distant audits in the first era. In Table 6, the coefficients on these variables are negative and statistically significant in each specification suggesting that distant audits have lower fees in the first era (2004-2007). This is somewhat surprising because these audits require more travel expenses and are expected to suffer from inefficiencies communicating with clients. The results may be explained by clients searching for lower fees outside of their market; however, no evidence of this has been found in a concurrent working paper (Lundstrom and Yore 2017).

The focus of my hypothesis is on the differential effect of advances in communication technology on audit fees of distant audits compare to local audits. In each specification, the

coefficient on the interaction of interest (*Era*Distance Variable*) is in line with my expectations and the predictions of Hypothesis 3. In the *DMSA* specification, the coefficient is -0.026 and statistically significant at the 0.01 level. In the *D100* and *Ln_Distance* specifications, the coefficients are -0.039 and -0.007, respectively, and are both statistically significant at the 0.01 level.

4.8. Discussion of Hypothesis 3

Considering both the main effect of advances in communication technology and distant audits, the results support that advances in communication technology have reduced the gap in audit fees between distant and local audits. These findings are consistent with distant audits that are more reliant on communication technology and have less face-to-face interaction with their clients, having more efficiency gains from advances in communication technology relative to local audits. The difference is also economically meaningful. For example, in the *DMSA* specification, advances in communication on technology reduce the gap between distant and local audits by 2.4 percent, on average.

TABLE 6. TEST OF HYPOTHESIS 3

This table reports the results of the main analysis estimating Model 4 using *Ln_Fees* as the dependent variable. Column 1 uses *DMSA* as the distance variable, Column 2 uses *D100* as the distance variable, and Column 3 uses *Ln_Distance* as the distance variable. All variables are defined in Appendix A. ***, **, * denote p-values of less than 0.01, 0.05, and 0.10, respectively, with one-tailed t-tests. All reported t-statistics are calculated with robust standard errors. Differences in the number of observations relative to Table 2 are due to observations dropped because of collinearity when using fixed effects.

Dependent Variable: Audit Fees (*Ln_Fees*)

VARIABLES	(1) DMSA	(2) D100	(3) Ln_Distance
Era	0.039*** (7.123)	0.039*** (7.573)	0.052*** (6.978)
Distance Variable	-0.033** (-1.797)	-0.041** (-1.896)	-0.006** (-1.810)
Era*Distance Variable	-0.026*** (-2.574)	-0.039*** (-3.121)	-0.007*** (-3.289)
Ln_Segments	0.186*** (20.966)	0.186*** (20.964)	0.186*** (21.068)
Size	0.482*** (114.223)	0.481*** (114.232)	0.481*** (114.053)
BIG 4	0.411*** (26.477)	0.408*** (26.322)	0.408*** (26.273)
New Auditor	0.043*** (3.545)	0.043*** (3.566)	0.043*** (3.563)
Non-Audit Services	-0.062*** (-3.865)	-0.063*** (-3.929)	-0.061*** (-3.820)
City Spec	0.086*** (7.609)	0.086*** (7.678)	0.086*** (7.616)
Chg Sales	-0.040*** (-3.799)	-0.040*** (-3.782)	-0.040*** (-3.796)
BTM	-0.009* (-1.560)	-0.009* (-1.567)	-0.009* (-1.558)
Loss	0.114*** (11.935)	0.113*** (11.877)	0.112*** (11.807)
Lev	0.039 (0.678)	0.034 (0.605)	0.035 (0.609)
Zmij	0.022*** (2.355)	0.022*** (2.432)	0.022*** (2.427)
Issuance	0.057*** (5.852)	0.058*** (5.909)	0.058*** (5.926)

TABLE 6. (CONT'D)

CFO	-0.145*** (-8.334)	-0.146*** (-8.429)	-0.145*** (-8.408)
Lag_ACCR	0.045*** (4.418)	0.044*** (4.327)	0.045*** (4.377)
HERF	-0.397*** (-6.109)	-0.409*** (-6.235)	-0.409*** (-6.238)
ICW	0.254*** (17.340)	0.257*** (17.574)	0.256*** (17.460)
Constant	6.967*** (114.491)	6.974*** (114.824)	6.990*** (112.777)
Observations	43,123	43,123	43,123
R-squared	0.875	0.875	0.875
Industry FE:	Yes	Yes	Yes
Client Location FE:	Yes	Yes	Yes

4.9. Additional Analyses and Robustness Tests

As shown in Table 2 Panel B, the differences in means and medians of the dependent and control variables are statistically significant along the treatment variable *DMSA*. This gives rise to concerns of functional form misspecification (Shipman, Swanquist, and Whited 2016). To address this risk, I use propensity score matching to create a balanced sample of treatment and control observations across the set of control variables and re-estimate the results in Tables 5 and 6 with this sample. I estimate the first stage determinants model of being treated ($DMSA = 1$ and $D100 = 1$) using a logistic regression by regressing the treatment variable on the set of control variables in Model 3. The results of this estimation are presented in Table 7 Panel A, where Column 1 presents results for *DMSA* and Column 2 presents results for *D100*. Variables of note negatively associated with each distance variable are *Size*, *Big4*, and *Non-Audit Services*, while positively associated with distance include *New Auditor* (p-values < 0.05) and *ICW* (p-values < 0.01). These are consistent with the correlations presented in Table 3. For the matching process, I match on the set of control variables in Model 3, without replacement, using a caliper of 25 percent of the standard deviation of the propensity score (0.028 for *DMSA*, 0.026 for *D100*) (Rosenbaum and Rubin 1985). This results in 21,846 observations in the matched sample on *DMSA* and 14,418 in the matched sample on *D100*. Panel B (C) presents the univariate tests of each variable in the *DMSA* (*D100*) matched sample. The results are indicative of a balanced matched sample, as the mean and median differences are not statistically significant across the treatment and control groups (with the exception of a small number of variables). I then perform a separate regression using the propensity score matching sample for each audit quality variable (*DACC* and *MISSTATE*) and for audit fees (*Ln_Fees*) using the alternative specifications of distance variables (*DMSA* and *D100*). The results presented in the first two columns of Table 7

Panels D and E are similar in sign and significance as those in the main analyses of audit quality in Table 5. Column 3 in Panels D and E are also similar in sign and significance as the analysis of audit fees in Table 6. These findings suggest that functional form misspecification is not a concern.

TABLE 7. PROPENSITY SCORE MATCHING ANALYSIS

This table reports the results of the propensity score matching analysis. Panel A reports the results of the determinants model (logit) of *DMSA* and *D100*. Panel B (C) reports the means and medians of each variable after performing the matching and reports univariate tests of differences for *DMSA* (*D100*). Panel D (E) reports the results of estimating Model 2 using *DMSA* (*D100*) as the distance variable with the propensity score matched sample. All variables are defined in Appendix A. ***, **, * denote p-values of less than 0.01, 0.05, and 0.10, respectively, with one-tailed t-tests. All reported t-statistics, other than Panel A are calculated with robust standard errors. Differences in the number of observations between Panels B and D and Panels C and E are due to observations dropped because of collinearity when using fixed effects.

Panel A: Determinants Model of *DMSA* and *D100*

VARIABLES	DV = <i>DMSA</i>	DV = <i>D100</i>
Era	0.018 (1.204)	0.049*** (2.784)
Ln_Segments	0.002 (0.128)	-0.137*** (-7.028)
Size	-0.084*** (-10.344)	-0.055*** (-5.814)
BIG 4	-0.640*** (-20.133)	-1.098*** (-28.918)
New Auditor	0.100** (2.227)	0.098** (1.986)
Non-Audit Services	-0.335*** (-9.236)	-0.352*** (-8.657)
City Spec	0.154*** (5.618)	0.319*** (9.622)
Chg Sales	0.059** (1.653)	0.060* (1.497)
BTM	-0.011 (-0.752)	0.022* (1.332)
Loss	0.131*** (4.690)	-0.026 (-0.795)
Lev	-0.189 (-1.140)	-0.156 (-0.899)
Zmij	0.037* (1.338)	0.047* (1.630)
Issuance	0.213*** (7.596)	0.259*** (7.755)
CFO	0.037 (0.788)	0.109** (2.076)
Lag_ACCR	-0.169*** (-5.326)	-0.235*** (-7.045)

TABLE 7. (CONT'D)

HERF	2.006*** (17.832)	0.753*** (5.882)
ICW	0.229*** (6.120)	0.322*** (7.767)
Constant	0.060 (0.417)	-0.427*** (-2.703)
Observations	43,136	43,136
Pseudo R-squared	0.054	0.080

TABLE 7. (CONT'D)

Panel B: Univariate Tests by DMSA – PSM Sample

Variable	DMSA = 1		DMSA = 0		Difference	
	Mean	Median	Mean	Median	Mean	Median
<i>DACC</i>	0.121	0.060	0.118	0.060	0.002	0.000
<i>MISSTATE</i>	0.048	0.000	0.045	0.000	0.004	0.000
<i>Ln_Fees</i>	13.135	13.194	13.171	13.162	-0.035 **	0.032
<i>Era</i>	0.999	1.000	0.998	1.000	0.001	0.000
<i>Ln_Segments</i>	0.819	0.693	0.828	0.693	-0.009	0.000
<i>Size</i>	11.909	11.951	11.905	11.824	0.003	0.127
<i>Big 4</i>	0.500	0.000	0.500	0.000	0.000	0.000
<i>New Auditor</i>	0.081	0.000	0.078	0.000	0.003	0.000
<i>Non-Audit Services</i>	0.663	0.817	0.663	0.820	0.000	-0.003
<i>City Spec</i>	0.467	0.000	0.471	0.000	-0.004	0.000
<i>Chg Sales</i>	0.093	0.044	0.090	0.047	0.003	-0.003
<i>BTM</i>	0.400	0.385	0.397	0.377	0.003	0.008
<i>Loss</i>	0.498	0.000	0.496	0.000	0.002	0.000
<i>Lev</i>	0.598	0.484	0.604	0.484	-0.006	0.000
<i>Zmij</i>	-0.699	-1.473	-0.661	-1.489	-0.038	0.016
<i>Issuance</i>	0.761	1.000	0.761	1.000	0.000	0.000
<i>CFO</i>	-0.066	0.051	-0.069	0.054	0.003	-0.003 **
<i>Lag_ACCR</i>	-0.172	-0.072	-0.170	-0.070	-0.002	-0.002
<i>HERF</i>	0.161	0.139	0.163	0.137	-0.002 *	0.002 ***
<i>ICW</i>	0.121	0.000	0.120	0.000	0.001	0.000
<i>Observations</i>	10,923		10,923			

TABLE 7. (CONT'D)

Panel C: Univariate Tests by D100 – PSM Sample

Variable	D100 = 1		D100 = 0		Difference	
	Mean	Median	Mean	Median	Mean	Median
<i>DACC</i>	0.133	0.064	0.130	0.064	0.003	0.001
<i>MISSTATE</i>	0.055	0.000	0.048	0.000	0.007 *	0.000 **
<i>Ln_Fees</i>	12.873	12.840	12.985	12.904	-0.112 ***	-0.064 ***
<i>Era</i>	1.021	1.000	1.026	1.000	-0.005	0.000
<i>Ln_Segments</i>	0.724	0.693	0.734	0.693	-0.010	0.000
<i>Size</i>	11.622	11.535	11.606	11.426	0.016	0.109
<i>Big 4</i>	0.397	0.000	0.399	0.000	-0.003	0.000
<i>New Auditor</i>	0.091	0.000	0.094	0.000	-0.003	0.000
<i>Non-Audit Services</i>	0.637	0.810	0.643	0.814	-0.006	-0.004
<i>City Spec</i>	0.448	0.000	0.449	0.000	-0.001	0.000
<i>Chg Sales</i>	0.096	0.038	0.098	0.049	-0.002	-0.011 **
<i>BTM</i>	0.385	0.392	0.364	0.366	0.022	0.026 **
<i>Loss</i>	0.508	1.000	0.507	1.000	0.001	0.000
<i>Lev</i>	0.633	0.509	0.656	0.493	-0.023 ***	0.016
<i>Zmij</i>	-0.449	-1.327	-0.301	-1.417	-0.148 ***	0.090 *
<i>Issuance</i>	0.768	1.000	0.771	1.000	-0.002	0.000
<i>CFO</i>	-0.085	0.048	-0.090	0.047	0.005	0.001
<i>Lag_ACCR</i>	-0.203	-0.078	-0.217	-0.075	0.014 *	-0.003
<i>HERF</i>	0.158	0.130	0.158	0.132	0.001	-0.003
<i>ICW</i>	0.143	0.000	0.148	0.000	-0.005	0.000
<i>Observations</i>	7,209		7,209			

TABLE 7. (CONT'D)

Panel D: DMSA Propensity Score Matched Sample

VARIABLES	(1) DV = DACC	(2) DV = MISSTATE	(3) DV = Ln_Fees
Era	-0.000 (-0.251)	-0.034*** (-10.520)	0.059*** (7.247)
Distance Variable	0.010*** (2.563)	0.009 (1.170)	-0.018 (-0.923)
Era*Distance Variable	-0.004* (-1.404)	0.001 (0.187)	-0.042*** (-3.563)
Ln_Segments	-0.005*** (-3.195)	0.002 (0.694)	0.188*** (18.404)
Size	-0.012*** (-13.955)	0.002* (1.512)	0.479*** (98.870)
BIG 4	-0.005** (-1.908)	-0.004 (-0.688)	0.427*** (24.149)
New Auditor	0.010** (2.300)	-0.001 (-0.095)	0.066*** (4.269)
Non-Audit Services	0.009*** (2.548)	0.008* (1.561)	-0.066*** (-3.861)
City Spec	-0.000 (-0.158)	-0.008** (-1.672)	0.067*** (4.953)
Chg Sales	0.049*** (11.224)	0.027*** (4.878)	-0.042*** (-3.329)
BTM	0.001 (0.842)	0.003* (1.387)	-0.005 (-0.772)
Loss	-0.014*** (-5.317)	-0.002 (-0.382)	0.113*** (9.929)
Lev	-0.194*** (-5.616)	0.005 (0.211)	-0.056 (-0.922)
Zmij	0.041*** (7.110)	-0.001 (-0.172)	0.035*** (3.540)
Issuance	-0.001 (-0.453)	0.009** (2.202)	0.075*** (6.188)
CFO	-0.077*** (-8.720)	-0.010* (-1.478)	-0.115*** (-6.023)
Lag_ACCR	-0.035*** (-7.412)	0.000 (0.097)	0.039*** (3.465)

TABLE 7. (CONT'D)

HERF	-0.002 (-0.190)	0.015 (0.706)	-0.363*** (-5.365)
ICW	0.019*** (4.940)	0.095*** (12.213)	0.214*** (12.418)
Constant	0.389*** (15.274)	0.020 (0.847)	7.046*** (104.401)
Observations	21,834	21,834	21,834
R-squared	0.355	0.064	0.870
Industry FE:	Yes	Yes	Yes
Client Location FE:	Yes	Yes	Yes

TABLE 7. (CONT'D)

Panel E: D100 Propensity Score Matched Sample

VARIABLES	(1) DV = DACC	(2) DV = MISSTATE	(3) DV = Ln_Fees
Era	-0.002 (-0.937)	-0.030*** (-7.442)	0.033*** (3.453)
D100	0.014*** (2.947)	0.022** (2.265)	-0.049** (-2.066)
Era * D100	-0.004* (-1.316)	-0.011** (-1.818)	-0.028** (-1.931)
Ln_Segments	-0.005** (-2.279)	0.001 (0.305)	0.181*** (14.189)
Size	-0.012*** (-11.003)	0.005*** (2.837)	0.487*** (83.217)
BIG 4	-0.009*** (-2.621)	-0.012* (-1.580)	0.412*** (19.713)
New Auditor	0.009** (1.916)	-0.005 (-0.688)	0.079*** (4.389)
Non-Audit Services	0.006* (1.359)	0.005 (0.703)	-0.065*** (-3.273)
City Spec	-0.003 (-0.771)	-0.010** (-1.710)	0.057*** (3.511)
Chg Sales	0.046*** (9.236)	0.029*** (4.189)	-0.061*** (-4.077)
BTM	-0.000 (-0.066)	0.002 (0.818)	-0.009 (-1.165)
Loss	-0.014*** (-4.067)	-0.003 (-0.543)	0.101*** (7.193)
Lev	-0.161*** (-4.168)	0.025 (0.981)	0.001 (0.018)
Zmij	0.034*** (5.411)	-0.004 (-0.935)	0.025*** (2.397)
Issuance	0.003 (1.043)	0.006 (1.088)	0.083*** (5.339)
CFO	-0.074*** (-7.089)	-0.025*** (-2.781)	-0.140*** (-6.247)
Lag_ACCR	-0.037*** (-6.870)	0.003 (0.535)	0.051*** (4.183)

TABLE 7. (CONT'D)

HERF	-0.008 (-0.573)	0.000 (0.007)	-0.360*** (-4.484)
ICW	0.023*** (4.710)	0.082*** (9.591)	0.180*** (9.251)
Constant	0.369*** (12.402)	-0.015 (-0.575)	6.921*** (89.847)
Observations	14,402	14,402	14,402
R-squared	0.376	0.069	0.871
Industry FE:	Yes	Yes	Yes
Client Location FE:	Yes	Yes	Yes

Next, in Section 3 the definition of *ICW* is defined as one when firm's management reported ineffective internal controls, or 0 when management deems internal controls effective or for observations not included in the Audit Analytics Internal Control database. The number of observations included in the sample but excluded from the Internal Control Database is 5,654. To ensure my analyses and results are unaffected by the decision to record these missing *ICW* observations as 0, I reperform the main analyses after including an indicator variable (*Missing_ICW*) equal to 1 for the 5,654 observations that are not included in the Audit Analytics Internal Control Database, and zero otherwise. Table 8 reports the results for Hypothesis 1, Table 9 reports the results for Hypothesis 2, and Table 10 reports the results for Hypothesis 3. After including *Missing_ICW* the significance of some variables is reduced; however, the coefficients of interest are similar in magnitude and direction to the main analyses and do not change the overall inferences.

TABLE 8. ROBUSTNESS TEST OF HYPOTHESIS 1

This table reports the results of the main analysis estimating Model after controlling for observations where the *ICW* variable was missing in Audit Analytics (*Missing_ICW*). Panel A (B) reports the results using *DACC* (*MISSTATE*) to proxy for audit quality. In each panel, Column 1 estimates Model 1 for observations where *DMSA* = 1 and Column 2 estimates Model 1 for observations where *D100* = 1. All variables are defined in Appendix A. ***, **, * denote p-values of less than 0.01, 0.05, and 0.10, respectively, with one-tailed t-tests. All reported t-statistics are calculated with robust standard errors. Differences in the number of observations relative to Table 2 are due to observations dropped because of collinearity when using fixed effects.

Panel A: Discretionary Accruals (*DACC*)

VARIABLES	(1) DMSA	(2) D100
Era	-0.003* (-1.362)	-0.005** (-1.656)
Missing_ICW	0.013*** (2.586)	0.014** (2.140)
Ln_Segments	-0.005** (-1.938)	-0.003 (-0.884)
Size	-0.012*** (-9.439)	-0.013*** (-7.426)
BIG 4	-0.011*** (-2.512)	-0.011** (-1.951)
New Auditor	0.001 (0.213)	0.005 (0.777)
Non-Audit Services	0.004 (0.738)	0.002 (0.333)
City Spec	-0.001 (-0.395)	-0.008* (-1.523)
Chg Sales	0.050*** (8.502)	0.042*** (5.990)
BTM	-0.000 (-0.142)	-0.001 (-0.375)
Loss	-0.015*** (-3.809)	-0.017*** (-3.390)
Lev	-0.225*** (-3.882)	-0.184*** (-2.893)
Zmij	0.045*** (4.726)	0.038*** (3.594)
Issuance	0.002 (0.622)	0.003 (0.577)

TABLE 8. (CONT'D)

CFO	-0.063*** (-4.865)	-0.078*** (-5.158)
Lag_ACCR	-0.036*** (-5.374)	-0.035*** (-4.398)
HERF	-0.010 (-0.639)	0.006 (0.304)
ICW	0.020*** (3.614)	0.025*** (3.728)
Constant	0.432*** (10.539)	0.410*** (8.913)
Observations	11,221	7,298
R-squared	0.380	0.404
Industry FE:	Yes	Yes
Client Location FE:	Yes	Yes

TABLE 8. (CONT'D)Panel B: Misstatements (*MISSTATE*)

VARIABLES	(1) DMSA	(2) D100
Era	-0.029*** (-7.508)	-0.032*** (-6.159)
Missing_ICW	0.033*** (3.839)	0.042*** (3.583)
Ln_Segments	0.009** (1.776)	0.008 (1.232)
Size	0.003* (1.458)	0.005** (1.741)
BIG 4	0.000 (0.046)	0.001 (0.056)
New Auditor	-0.004 (-0.481)	-0.004 (-0.345)
Non-Audit Services	0.008 (1.069)	0.012 (1.198)
City Spec	-0.015** (-2.266)	-0.008 (-0.851)
Chg Sales	0.015** (1.869)	0.022** (2.219)
BTM	0.001 (0.376)	0.001 (0.338)
Loss	-0.005 (-0.775)	-0.010 (-1.180)
Lev	0.008 (0.254)	0.027 (0.706)
Zmij	-0.001 (-0.273)	-0.005 (-0.716)
Issuance	0.006 (0.895)	0.012* (1.347)
CFO	-0.014* (-1.446)	-0.029*** (-2.333)
Lag_ACCR	-0.001 (-0.168)	-0.000 (-0.016)
HERF	0.011 (0.361)	0.006 (0.164)

TABLE 8. (CONT'D)

ICW	0.094*** (9.052)	0.083*** (6.672)
Constant	0.003 (0.101)	-0.033 (-0.747)
Observations	11,221	7,298
R-squared	0.092	0.109
Industry FE:	Yes	Yes
Client Location FE:	Yes	Yes

TABLE 9. ROBUSTNESS TEST OF HYPOTHESIS 2

This table reports the results of the main analysis estimating Model 3 after controlling for observations where the *ICW* variable was missing in Audit Analytics (*Missing_ICW*). Panel A (B) reports the results using *DACC* (*MISSTATE*) to proxy for audit quality. In each panel, Column 1 uses *DMSA* as the distance variable, Column 2 uses *D100* as the distance variable, and Column 3 uses *Ln_Distance* as the distance variable. All variables are defined in Appendix A. ***, **, * denote p-values of less than 0.01, 0.05, and 0.10, respectively, with one-tailed t-tests. All reported t-statistics are calculated with robust standard errors. Differences in the number of observations relative to Table 2 are due to observations dropped because of collinearity when using fixed effects.

Panel A: Discretionary Accruals (*DACC*)

VARIABLES	(1) DMSA	(2) D100	(3) Ln_Distance
Era	0.001 (0.649)	0.000 (0.172)	0.002** (1.723)
Distance Variable	0.011*** (3.387)	0.014*** (3.727)	0.002*** (3.279)
Era*Distance Variable	-0.004** (-1.876)	-0.004* (-1.443)	-0.001** (-2.292)
Missing_ICW	0.014*** (5.254)	0.014*** (5.219)	0.013*** (5.133)
Ln_Segments	-0.004*** (-3.898)	-0.004*** (-3.882)	-0.004*** (-3.935)
Size	-0.010*** (-17.226)	-0.010*** (-17.218)	-0.010*** (-17.175)
BIG 4	-0.008*** (-4.029)	-0.007*** (-3.795)	-0.008*** (-4.177)
New Auditor	0.007** (2.107)	0.007** (2.118)	0.007** (2.122)
Non-Audit Services	0.005** (1.878)	0.005** (1.922)	0.005** (1.825)
City Spec	0.001 (0.608)	0.001 (0.572)	0.001 (0.623)
Chg Sales	0.046*** (14.769)	0.046*** (14.754)	0.046*** (14.775)
BTM	0.001 (1.185)	0.001 (1.202)	0.001 (1.152)
Loss	-0.006*** (-3.193)	-0.006*** (-3.152)	-0.006*** (-3.147)
Lev	-0.159*** (-4.637)	-0.159*** (-4.627)	-0.159*** (-4.639)

TABLE 9. (CONT'D)

Zmij	0.035*** (6.096)	0.035*** (6.087)	0.035*** (6.099)
Issuance	-0.001 (-0.896)	-0.001 (-0.912)	-0.001 (-0.842)
CFO	-0.077*** (-9.847)	-0.077*** (-9.841)	-0.077*** (-9.857)
Lag_ACCR	-0.040*** (-9.512)	-0.040*** (-9.481)	-0.040*** (-9.528)
HERF	0.001 (0.134)	0.003 (0.294)	0.002 (0.148)
ICW	0.018*** (6.037)	0.018*** (5.988)	0.018*** (6.123)
Constant	0.337*** (13.693)	0.337*** (13.668)	0.335*** (13.574)
Observations	43,123	43,123	43,123
R-squared	0.341	0.342	0.341
Industry FE:	Yes	Yes	Yes
Client Location FE:	Yes	Yes	Yes

TABLE 9. (CONT'D)Panel B: Misstatements (*MISSTATE*)

VARIABLES	(1) DMSA	(2) D100	(3) Ln_Distance
Era	-0.029*** (-13.261)	-0.028*** (-13.624)	-0.026*** (-9.269)
Distance Variable	0.008 (1.121)	0.020*** (2.458)	0.002** (1.705)
Era*Distance Variable	-0.001 (-0.276)	-0.009** (-1.832)	-0.001* (-1.512)
Missing_ICW	0.034*** (7.315)	0.034*** (7.185)	0.034*** (7.154)
Ln_Segments	0.000 (0.188)	0.001 (0.201)	0.000 (0.176)
Size	0.003*** (2.931)	0.003*** (2.904)	0.003*** (2.918)
BIG 4	-0.003 (-0.661)	-0.002 (-0.508)	-0.003 (-0.681)
New Auditor	-0.011** (-2.195)	-0.011** (-2.229)	-0.011** (-2.213)
Non-Audit Services	0.007* (1.568)	0.007* (1.588)	0.007* (1.533)
City Spec	-0.006** (-1.715)	-0.006** (-1.746)	-0.006** (-1.719)
Chg Sales	0.021*** (4.681)	0.021*** (4.703)	0.021*** (4.707)
BTM	0.006*** (2.897)	0.006*** (2.913)	0.006*** (2.873)
Loss	0.003 (1.018)	0.003 (1.031)	0.003 (1.035)
Lev	0.014 (0.710)	0.015 (0.731)	0.014 (0.716)
Zmij	-0.002 (-0.568)	-0.002 (-0.592)	-0.002 (-0.574)
Issuance	0.005** (1.723)	0.005** (1.693)	0.005** (1.730)
CFO	-0.008* (-1.383)	-0.008* (-1.362)	-0.008* (-1.388)
Lag_ACCR	0.005 (1.214)	0.005 (1.280)	0.005 (1.202)

TABLE 9. (CONT'D)

HERF	0.019 (0.942)	0.021 (1.008)	0.019 (0.948)
ICW	0.115*** (18.252)	0.116*** (18.245)	0.116*** (18.286)
Constant	-0.005 (-0.259)	-0.006 (-0.356)	-0.009 (-0.462)
Observations	43,123	43,123	43,123
R-squared	0.058	0.058	0.058
Industry FE:	Yes	Yes	Yes
Client Location FE:	Yes	Yes	Yes

TABLE 10. ROBUSTNESS TEST OF HYPOTHESIS 3

This table reports the results of the main analysis estimating Model 4 after controlling for observations where the *ICW* variable was missing in Audit Analytics (*Missing_ICW*). Table 4 reports the results using *Ln_Fees* as the dependent variable. In each panel, Column 1 uses *DMSA* as the distance variable, Column 2 uses *D100* as the distance variable, and Column 3 uses *Ln_Distance* as the distance variable. All variables are defined in Appendix A. ***, **, * denote p-values of less than 0.01, 0.05, and 0.10, respectively, with one-tailed t-tests. All reported t-statistics are calculated with robust standard errors. Differences in the number of observations relative to Table 2 are due to observations dropped because of collinearity when using fixed effects.

Dependent Variable: *Ln_Fees*

VARIABLES	(1) DMSA	(2) D100	(3) <i>Ln_Distance</i>
Era	0.022*** (3.879)	0.022*** (4.134)	0.038*** (5.163)
Distance Variable	-0.028* (-1.522)	-0.031* (-1.445)	-0.004 (-1.198)
Era*Distance Variable	-0.032*** (-3.097)	-0.048*** (-3.826)	-0.009*** (-4.270)
Missing_ICW	-0.149*** (-12.586)	-0.150*** (-12.636)	-0.151*** (-12.724)
<i>Ln_Segments</i>	0.185*** (20.870)	0.185*** (20.867)	0.185*** (20.976)
Size	0.476*** (111.959)	0.475*** (111.974)	0.475*** (111.786)
BIG 4	0.409*** (26.590)	0.407*** (26.452)	0.407*** (26.389)
New Auditor	0.053*** (4.379)	0.053*** (4.402)	0.053*** (4.395)
Non-Audit Services	-0.054*** (-3.379)	-0.055*** (-3.442)	-0.053*** (-3.329)
City Spec	0.085*** (7.573)	0.086*** (7.643)	0.085*** (7.577)
Chg Sales	-0.027*** (-2.587)	-0.027*** (-2.565)	-0.027*** (-2.565)
BTM	-0.011** (-1.808)	-0.011** (-1.813)	-0.011** (-1.815)
Loss	0.117*** (12.330)	0.117*** (12.273)	0.116*** (12.199)
Lev	0.072 (1.278)	0.068 (1.207)	0.068 (1.213)
Zmij	0.016** (1.758)	0.017** (1.832)	0.017** (1.824)

TABLE 10. (CONT'D)

Issuance	0.059*** (6.019)	0.059*** (6.077)	0.059*** (6.095)
CFO	-0.155*** (-8.839)	-0.156*** (-8.941)	-0.156*** (-8.928)
Lag_ACCR	0.042*** (4.070)	0.041*** (3.983)	0.041*** (4.030)
HERF	-0.390*** (-5.978)	-0.401*** (-6.104)	-0.401*** (-6.101)
ICW	0.225*** (15.136)	0.228*** (15.370)	0.227*** (15.260)
Constant	7.048*** (114.760)	7.055*** (115.155)	7.067*** (113.194)
Observations	43,123	43,123	43,123
R-squared	0.876	0.876	0.876
Industry FE:	Yes	Yes	Yes
Client Location FE:	Yes	Yes	Yes

CHAPTER 5: CONCLUSION

The advances in communication technology in the past twenty years provide the motivation for this study. Given the tremendous technological change that has occurred, from landline telephones to smartphones which function nearly anywhere in the world and from email to cloud data storage, I study whether advances in communication technology have impacted the audit setting. Prior and concurrent audit literature suggest that audits performed by distant auditors experience less face-to-face interaction and rely on communication technology to perform substantial portions of the audit. These limitations have been shown to lead to lower audit quality. I use this setting to compare two groups of audits, distant and local, for the purpose of identifying the impact of advances in communication technology.

The characteristics of distant audits are similar to virtual teams – geographic dispersion and use of communication technology. Virtual team theories of social presence and media richness support that face-to-face interaction is the gold standard of communication and communication technology lacks many of the social cues and aspects of in-person interaction. Prior distant audit research echoes these theories, but recently virtual team researchers have questioned whether they still apply in light of advances in communication technology. I use this notion from virtual team researchers to hypothesize that distant audits, compared to local audits, will have improved audit quality and improved efficiency. This is because distant audits are more reliant on communication technology.

I find strong support for my hypotheses using discretionary accruals and misstatements as proxies of audit quality and audit fees as a proxy of audit efficiency. Specifically, I find that across three eras of communication technology from 2004-2018, distant audits have seen an improvement in audit quality that is significantly higher than the improvement seen in local

audits. Additionally I find that while all audits appear to have an increase in audit fees, the increase for distant audits is significantly less than that of local audits. This implies that distant audits can utilize new communication technology more efficiently than local audits.

My study makes several important contributions to the literature and practice. First, it contributes to our understanding of how advancements in communication technology impact auditing, which was previously an open question. Theories motivating existing auditing research suggest that communication through technology is inferior to face-to-face interaction leading to lower audit quality. However, this literature fails to incorporate the dramatic changes in communication technology experienced in the last twenty years. I contribute to the auditing literature by documenting changes in communication technology relevant to auditing over this period and by finding evidence of an improvement in audit quality among distant audits as compared to local audits. This result revises our prior understanding that communication technology is detrimental to audit quality by showing improvement in audit quality among audits most reliant on communication technology. This could lead to further research into specific technologies and settings.

Second, this study contributes to the existing literature on the auditor-client distance. Existing literature documents a consistent, negative impact of distance on audit quality. However, my study provides evidence that the effect of distance may diminish in recent years. This result revises our previous understanding of auditor-client distance and can motivate new research in the area. I also contribute to the theoretical basis of this literature by incorporating updated theories of virtual teams from management. The existing auditor distance research indirectly follows the traditional virtual teams theory that supports that face-to-face communication is the gold standard of communication. However, the management literature has

discussed and questioned this theory in light of the changes to communication technology.

Therefore, I contribute to the auditor distance literature by introducing this updated theory.

Finally, as it relates to practice, the subject and results of my paper provide insight to an important current issue in the profession. The COVID-19 pandemic beginning in 2020 has forced audit teams to work remotely, both from other audit team members and from the client. As the industry recovers from the COVID-19 pandemic, there is uncertainty on how audit teams will be constructed. Audit firms have publicly stated a desire to keep a flexible working arrangement for their professionals and such an arrangement will be heavily affected by geographic dispersion and communication technology. Therefore, the results of this paper can provide evidence of how audit quality is affected by communication technology that is useful to audit firms going forward.

APPENDIX

APPENDIX

Variable	Variable Definition
<i>DACC</i>	= the absolute value of performance-matched discretionary accruals (Kothari, Leone, and Wasley 2005);
<i>MISSTATE</i>	= an indicator variable set to 1 if the current year financial statements contained a non-reliance misstatement that was announced in future years, 0 otherwise;
<i>Ln_Fees</i>	= the natural logarithm of audit fees plus 1;
<i>DMSA</i>	= an indicator variable set to 1 when the auditor and client are not located in the same MSA, 0 otherwise;
<i>D100</i>	= an indicator variable set to 1 when (1) the auditor and client are not located in the same MSA, or (2) the auditor and client are located in the same MSA but more than 100 kilometers apart, 0 otherwise;
<i>Log_Distance (KM)</i>	= the natural logarithm of the number of kilometers between the auditor and client cities, plus one;
<i>Ln_Segments</i>	= the natural logarithm of the sum of business segments and geographic segments minus one (Compustat Segments File);
<i>Size</i>	= the natural log of total assets (AT);
<i>Big 4</i>	= an indicator variable set to 1 if the firm is audited by Deloitte, PwC, EY or KPMG, 0 otherwise;
<i>New Auditor</i>	= an indicator variable set to 1 if it is the first audit of the client performed by the audit firm, 0 otherwise;
<i>Non-Audit Services</i>	= the ratio of the natural log of non-audit fees plus one over the natural log of total fees plus one;
<i>City Spec</i>	= an indicator variable set to 1 if the firm is audited by a local-MSA industry specialist, 0 otherwise. A local-MSA industry specialist is defined as an auditor with greater than 30% industry market share in their MSA;
<i>Chg Sales</i>	= current year total revenue minus prior year revenue, scaled by prior year total assets (REVT, AT);
<i>BTM</i>	= ratio of stockholders' equity to market value (SEQ, MKVALT);
<i>Loss</i>	= an indicator variable set to 1 if net income is less than \$0, 0 otherwise (NI);
<i>Lev</i>	= ratio of total liabilities to total assets (LT,AT);
<i>Zmij</i>	= Zmijewski (1984) financial distress score;

Variable	Variable Definition
<i>Issuance</i>	= an indicator variable set to 1 if the sum of debt or equity issued during the past three years is more than 5% of total assets, 0 otherwise (NI, AT, LEV, ACT, LCT);
<i>CFO</i>	= cash flows from continuing operations scaled by prior year total assets (OANCF, AT);
<i>Lag_ACCR</i>	= prior year accruals (defined as income before taxes less cash flows from continuing operations, scaled by prior year total assets (IB, OANCF, AT);
<i>HERF</i>	= auditor concentration as measured by the Herfindahl index of the number of clients for each audit office;
<i>ICW</i>	= an indicator variable set to 1 if the firm management reports a SOX 302 internal control weakness, 0 otherwise;
Discretionary Accruals Variable:	
<i>TA</i>	= income before extraordinary items minus operating cash flows from continuing operations (IB, OANCF, XIDOC);
<i>A</i>	= lagged total assets (AT);
ΔS	= year-over-year change in sales (REVT);
ΔAR	= year-over-year change in accounts receivable (RECTR);
<i>PPE</i>	= net property, plant, and equipment (PPENT);
<i>NI</i>	= net income (NI).

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