

An Exploration of Bank Confirmation Process Automation: A Longitudinal Study

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ABSTRACT

This exploratory study examines automation of the bank confirmation process using longitudinal data set from the largest third-party U.S. confirmation service provider supplemented with informal interviews with practitioners. We find a significant increase in electronic confirmation use in the U.S. and internationally. Errors requiring reconfirmation were less than two percent of all electronic confirmations. Errors made by auditors were almost five times more likely than errors by bank employees. Most auditor errors involved use of an invalid account number, although invalid client contact, invalid request, and invalid company name errors increased recently. Big 4 auditors made significantly more confirmation errors than did auditors at non-Big 4 national firms. Error rates and error types do not vary between confirmations initiated in the U.S. and those initiated internationally. Three themes emerged for future research: authentication of evidence, global differences in technology use, and technology adoption across firms of different sizes.

Keywords: automation, audit confirmation, bank cash confirmation, audit technology, audit standards, audit firm size, international audit firms.

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INTRODUCTION

Accounting firms are automating time-consuming tasks including electronically confirming clients' cash and debt balances with banks (Harris 2017; Hamm 2019). Today, researchers and practitioners alike contend that automation and technology will significantly change audit processes and by extension, the audit profession (Kokina and Davenport 2017; Meek 2017; Sheedy 2017; Raschke, Saiewitz, Kachroo, and Lennard 2018; Salijeni, Samsonova-Taddei, and Turley 2018; Alles and Gray 2020). Some researchers and practitioners question whether automation will really improve the audit process and note that automation may be too costly and reduce the number of auditors needed (Bible, Graham, and Rosman 2005; Dowling and Leech 2007, 2014; Sheedy 2017; Sutton, Arnold, and Holt 2018).

This exploratory study investigates one aspect of automation, outsourcing the bank confirmation process to an outside service bureau. Electronically confirming cash and debt balances with banks increases not only response timeliness from weeks to less than 48 hours, but also the ability to better maintain control over the confirmation requests and to authenticate confirmation responses (Hanes, Porco, and Thibodeau 2014; Solieri and Hodowanitz 2016; Financial Reporting Council 2017).

Bank confirmations provide relevant and reliable evidence about the existence and accuracy of a client's financial accounts and help detect fraudulent cash overstatements (Caster, Elder, and Janvrin 2008). In addition, PCAOB Concept Release 2009-02 (PCAOB 2009) discusses how auditors should validate responses received electronically. While confirmation of bank balances is not required under existing U.S. auditing standards, discussions with auditors

suggest that confirmation of cash balances is used extensively, even for immaterial amounts (Caster et al. 2008). Further, PCAOB Staff Audit Practice Alert No. 8 (PCAOB 2011) notes that auditors are experiencing difficulties confirming cash balances in certain emerging markets. This raises questions about how automation may aid the confirmation process in general, specifically the quality of the electronic bank confirmation process outcome. While the use of automation in the bank confirmation process started in the late 2000s, researchers to date have been unable to investigate the process given most confirmation data is confidential and not accessible by academic researchers.

Data regarding electronic confirmations is generally proprietary. We obtain longitudinal data on electronic bank confirmation use and user error rates processed through Confirmation.com, the largest U.S. confirmation service provider, for the period 2006 to 2015. We examine two organizational factors (i.e., audit firm size and differences in regulation and culture) using a proprietary, longitudinal data set. Further, we provide the first evidence on the extent to which electronic confirmations are initiated outside the U.S., and how error rates in the use of electronic confirmations may have an effect on audit effectiveness and efficiency. Error rates are important because when errors are discovered, they have a negative effect on audit efficiency. Auditors must resolve the errors, which may result in audit delays as they determine the nature of the errors and resend revised confirmation requests. This study examines four types of confirmation errors: auditor provides incorrect or invalid account number to confirmation service provider, auditor submits invalid client company name, auditor provides invalid client contact information, and auditor submits invalid or incomplete request to the confirmation service.

Examining automation of the bank confirmation process through outsourcing to a third-party service provider is important for several reasons. Our study provides a first look at how this confirmation service works, and we use our analysis over time to provide guidance for future research. Second, although AICPA auditing standards address electronic confirmation and authentication (AICPA 1991; PCAOB 2004a, 2004b; AICPA 2007a, 2007b) and the PCAOB has articulated concerns regarding the confirmation process (PCAOB 2009; 2011), current U.S. auditing standards do not fully reflect the changes in authentication procedures electronic confirmation introduces. Our research provides information to standard setters regarding the authentication of confirmation responses when a third-party service provider is used.

Third, although research suggests that technology adoption is greater in larger firms (Janvrin, Bierstaker, and Lowe 2009; Lowe, Bierstaker, Janvrin, and Jenkins 2018), little evidence exists on possible differences in the use of electronic confirmations based on audit firm size. Further, Francis and Wang (2008, 160) call for additional research investigating the effects of regulation and culture on auditing practices around the world. Our study examines differences in the use and effectiveness of electronic bank confirmations in the U.S. compared to non-U.S. locations.

Three themes for future research emerged from our analysis: authentication of electronic evidence, global differences in technology use, and technology adoption across firm sizes. Each theme provides opportunities for future research. While the third party provides authentication, there is a need to understand how other forms of automated electronic evidence will be authenticated. Use of electronic confirmations is growing rapidly internationally, but it is not known if use of automated evidence differs across countries. Finally, while electronic

confirmations are accessible to firms of all sizes, this may not be true of other forms of automated evidence.

BACKGROUND AND DEVELOPMENT OF RESEARCH QUESTIONS

Recent Movement Toward Audit Automation

In the past few years, practitioners announced several new automation methods (Vasarhelyi, Warren, Teeter, and Titera 2014; Davenport and Raphael 2017; Psaila 2017). For example, technology has impacted several audit procedures from planning activities, such as risk assessment and planning analytics, to evidence gathering actions such as sampling and audit confirmations (Kokina and Davenport 2017; Raschke et al. 2018; Cooper, Holderness, Sorenson, and Wood 2019; Huang and Vasarhelyi 2019; Alles and Gray 2020). While practitioners argue in general that technology will improve the audit process, others question this argument and are concerned that technology may be too costly and may reduce the number of auditors needed (Dowling and Leech 2007, 2014; Sheedy 2017; Sutton, Arnold, and Holt 2018).

With the availability of third-party service providers, Aldhizer and Cashell (2006) called for increased automation of the confirmation process to improve audit confirmation practices. They suggest that the audit confirmation process is generally a routine and commonly accepted procedure that could benefit from automation. For example, as discussed in more detail below, electronic confirmations allow auditors to confirm account balances on a timelier basis while providing response authentication (Hanes et al. 2014; Solieri and Hodowanitz 2016). In addition, Dull, Tegarden and Schleifer (2006) proposed an automated, continuous auditing confirmation approach using a clearinghouse for confirmation requests and confirmation replies.

The Role of Authentication with the Audit Confirmation Process

Authenticating confirmation responses has long been an issue for auditors (Carmichael 1991). With paper confirmations, it is difficult to authenticate that the request was sent to the appropriate party. For example, many frauds involving cash confirmations, such as Parmalat and Peregrine Financial Group, went undetected by auditors for years because they were unable to authenticate the response (Edmondson 2003; Bunge, Patterson, and Steinberg 2012; Phillips, Leising, and Harris 2012). In the case of Peregrine, the external auditor and National Futures Association (NFA) auditors mailed bank confirmations to a P.O. Box controlled by the fraud perpetrator (Elder, Janvrin, and Caster 2014).

In addition to the challenges involved in verifying the confirmation recipient, auditors also need to authenticate the response received. In the Parmalat fraud, the client created a fraudulent response to cover up fictitious cash balances (Edmondson 2004). In addition, two recent international frauds, Longtop and China Media Express, involved false bank confirmations that were not discovered until auditors questioned the authenticity of the confirmation evidence (SEC 2011, 2013, 2014). In the Longtop fraud, the company's Big 4 auditor relied on false confirmations from Longtop's bank (SEC 2011). China Media Express overstated its year end 2009 cash balance by \$56 million and its September 30, 2010 cash balance by \$160 million before its auditor, Deloitte, followed up on false paper bank confirmations in early 2011 (SEC 2013, 2014). Authenticating the source of evidence auditors collect and evaluate may become even more important as auditors emphasize data analytics. As discussed in the following section, the confirmation service provider mitigates this risk by providing authentication of all parties (i.e., bank and auditor) involved in the confirmation process.

The Electronic Bank Confirmation Process

The Confirmation.com electronic bank confirmation process, as illustrated in Figure 1, works as follows. First, the audit firm registers with the service provider and sets up a user ID and password. Individual auditors then establish their own user accounts. The auditor also sets up details about the client, if the client is new. For existing clients already in the service provider's system, the auditor can request that a new audit team member be assigned when appropriate. The auditor then requests authorization from the client through the service provider. The service provider notifies the client, and the client signs in and authorizes the request. Once authorization is received, the system initiates the confirmation and the request is released to the client's bank.

<<Insert Figure 1 about here>>

Banks have employees who are registered with the service provider and are authorized to respond to confirmation requests. The registered bank employee fills out certain fields of information, such as the balance, and the bank can even attach a document if necessary. The employee then hits the "confirm" button. The service provider notifies the auditor by email each evening regarding completed confirmation requests. The auditor is able to check the system to see if the confirmation has been completed and received at any time.

The service provider has contracts with over 4,000 banks and departments. To ensure authentication, those contracts require use of secure sockets layer (SSL) technology and 2048-bit encryption when banks respond through the service provider's computer to auditors' confirmation requests. In addition, the banks are required to have log in IDs and to use passwords to control their access to the service provider's computer. As mentioned above, many banks have established service centers for handling auditors' confirmation requests. To ensure

authentication, the service provider also has similar security requirements for the CPA firms when they prepare confirmation requests.

Confirmation errors can be made by either the auditor or bank employee. An auditor may submit an invalid request¹, an incorrect client account number, or an incorrect client name. When an error occurs, the bank employee notifies the auditor through the service provider. The auditor investigates the problem and then resubmits the confirmation request (reconfirmation). The service provider monitors error rates by accounting firm. They contact the accounting firms if they find that error rates are unusually high and work with the accounting firm to resolve the issue, which may help keep error rates low. Finally, the bank employee may provide incorrect information. In this case, the auditor contacts the bank through the service provider to request corrected information. The service provider works to complete the reconfirmation request faster since the first confirmation has already gone through the service and came back with incorrect or incomplete information.

Confirmation.com undergoes annual System and Organization Controls for service organizations examinations. This provides assurance to banks and accounting firms about the service provider's internal controls to protect data privacy and confidentiality as well as system security, availability, and processing (McConnell and Schweiger 2008; McConnell et al. 2014).

Bank Confirmation Process Performance

As with confirmation research in general, measuring bank confirmation process performance and obtaining evidence to support the performance measures may be difficult. In general, bank confirmation process performance can be measured based on error rates.²

¹ An invalid request occurs when the auditor selects the wrong confirmation type or submits incorrect bank information.

² Our study measures bank confirmation process performance based on error rates. In contrast, Solieri and Hodowanitz (2016) report response rates of 71 percent for all paper confirmations and 100 percent of all electronic

Error Rates

While extensive research on exceptions (i.e., confirmation differences) for accounts receivable confirmation process exists (see Caster et al. 2008 for a review), there is minimal research on bank confirmation errors. Errors may occur when the bank fails to process the confirmation request properly or, as discussed earlier, when an auditor provides an incorrect client account number, incorrect client name, invalid client contact, or invalid requests (e.g., submit incorrect confirmation type or incorrect bank information). Whether automation impacts bank confirmation errors is unknown. Some researchers and practitioners argue that automation may improve auditor performance in general (Alles and Gray 2020). However, other studies find automation results in deskilling, which may increase error rates as discussed in Arnold and Sutton (1998) and Sutton et al. (2018). For example, Bible, Graham, and Rosman (2005) show that automating the workpaper environment had a negative effect on auditor performance, with fewer seeded errors being discovered by auditors compared to a paper environment. This raises several research questions as follows:

RQ1a: What is the error rate for cash confirmation requests?

RQ1b: Has the error rate changed over time?

RQ2: Are error rates different between banks and auditors?

RQ3: What is the breakdown of the various cash confirmation errors?

Firm Size

The meta-theory of AIS argues that organizational factors may have an effect on process performance (Mauldin and Ruchala 1999). One organizational factor that may influence the bank

confirmations using a service provider. Solieri and Hodowanitz (2016) do not break out response rates or response times by confirmation type (i.e., bank, accounts receivable, accounts payable, etc.). In addition, they indicate that average response times for electronic confirmations vary from one to five days. For paper confirmation, response times averaged between 21 to 40 days.

confirmation process is audit firm size. Prior research suggests that audit procedure use varies by audit firm size given Big 4 firms generally have more resources to adopt new technology (Janvrin et al. 2009; Lowe et al. 2018). Further, regulators are concerned with the perceived gap in IT capabilities between Big 4 and non-Big 4 firms and have questioned whether non-Big 4 firms are able to compete with larger firms in terms of IT investment (ACAP 2008; Keune, Mayhew, and Schmidt 2016). Interestingly, recent evidence suggests that non-Big 4 firms, particularly national non-Big 4 firms, may have caught up with the Big 4 (Lowe et al. 2018). Further, some smaller non-Big 4 firms have formed associations, networks, and alliances as a means to compete with Big 4 firms in regard to addressing technical accounting issues, national training, and IT resources (Bills, Cunningham, and Meyers 2016).³ These associations provide member audit firms with an opportunity to overcome many constraints by providing access to intellectual and other resources, including access to IT resources. Thus, our next research question examines whether error rates differ based on audit firm size:

RQ4: Do error rates differ based on audit firm size?

Regulation and Culture

Differences in a second organizational factor, the regulatory environment across countries and cultural differences, may have an effect on the confirmation process. For example, following the Parmalat fraud involving a non-U.S. company and a U.S. bank, the use of electronic confirmations grew substantially since some U.S. banks, including the one involved in the Parmalat fraud, discontinued accepting paper confirmations sent through the mail. This

³ Accounting firm associations are autonomous organizations in which all audit firm members are independent in legal name and structure. Member firms pay annual fees to belong to the association. Access to association resources enables smaller firms to perform high-quality, public company audits (as measured by lower instances of restatements, discretionary accruals, and inspections deficiencies), and enables these firms to charge higher audit fees (Bills et al. 2016).

suggests that the confirmation process may be affected by the regulatory and legal environment, as well as cultural differences. Academic research suggests that cross-country differences in legal institutions and investor protection impact accounting practices (La Porta, Lopez-de-Silanes, Shleifer, and Vishney 1998, 2000; La Porta, Lopez-de-Silanes, and Shleifer 2006; Francis and Wang 2008). Further, the PCAOB notes weak internal control and governance mechanisms in emerging markets, and that auditors should be alert to the effect of differences between local business practices and cultural norms in emerging and more developed markets (PCAOB 2011).

Further, Nolder and Riley (2014) review literature on cross-cultural differences in auditors' judgment and decision-making. Judgments and decisions most likely to be affected by cross-cultural differences include auditors' confidence, risk and probability judgments, risk decisions, conflict decisions, and ethical judgments. These cross-cultural differences suggest the possibility that differences in confirmation performance across countries may exist.

Our next research question addresses differences in error rates between confirmations initiated in the U.S. compared to non-U.S. locations:

RQ5: Do error rates differ between confirmations initiated in the U.S. and in other countries?

METHODOLOGY

Confirmation Service Proprietary Information

We contacted Confirmation.com, the largest U.S. electronic confirmation service provider.⁴ This service was willing to share summary level proprietary information. The confirmation service provided bank confirmation information for the years 2006 to 2015. The

⁴ The service provider offers several types of confirmations including bank, accounts receivable, accounts payable, employee benefits, and legal confirmations.

service provider indicated that no significant changes to their confirmation process or their software had been made over the ten-year period. Approximately two-thirds of the confirmation transactions involve cash accounts and the other one-third involve confirmation of loan balances with banks. The number of confirmations sent grew significantly throughout the period with growth averaging over 28% over the period 2010-2015.⁵ The service identified the number of bank and auditor errors and the types of auditor errors to address our research questions. The confirmation service classifies auditor errors into four types.⁶ First, auditors may provide an incorrect or invalid account number. Second, auditors may request confirmations for a client but provide the confirmation service with an invalid client company name. Third, auditors may provide invalid client contact information to the service. Finally, the auditors may provide an invalid or incomplete request to the confirmation service.

To address our research question on the impact of audit firm size, the confirmation service provider separated audit confirmation use and error information by firm size.⁷ Following prior research (Hogan and Martin 2009; Mascha, Lamboy-Ruiz, and Janvrin 2018; Aobdia 2020), three firm size categories were used. Big 4 firms include Deloitte, EY, KPMG, and PwC. National firms are BDO, Crowe Horwath, Grant Thornton, and RSM. All other firms were included in the third category. Transactions included confirmation of bank balances for both publicly traded and privately held clients.

⁵ We do not report the number of confirmations at the request of the service provider due to confidentiality considerations.

⁶ We held periodic phone conversations with the confirmation service provider to understand their data and how they classify auditor errors. This provider does not categorize the nature of bank errors.

⁷ During our phone conversations with the service provider, we discussed how they separated audit confirmation use and error information by firm size. Further, the service provider indicated that all Big 4 firms use their service and that each Big 4 firm has over 500 offices globally participating. Finally, the service provider stated that the split between Big 4, non-Big 4 national, and smaller firm transactions remained relatively similar from 2008 forward.

The audit confirmation service offers confirmation services in over 180 countries. To address the possible impact of regulatory environment and cultural differences, the audit confirmation use, error rate, and error type information were separated by location for U.S. vs non-U.S. confirmations. The service provider defined non-U.S. confirmations as those that are initiated outside the U.S. from non-U.S. audit firms for non-U.S. banks.

Contact with Professionals

Further, to understand how auditors use the audit confirmation service, we contacted 14 auditors employed by Big 4, national, and regional firms.⁸ Respondents included seniors, managers, and partners. We asked about the use of electronic compared to paper bank confirmations, use of internally developed platforms and/or competitors to Confirmation.com, experiences with both electronic and paper bank confirmations in terms of response times and error rates, international use of electronic bank confirmation requests, and existence of a national office memo regarding SOC 1 and/or SSAE16 reports covering the use of this service provider.

RESULTS

RQ1a addresses error rates for electronic cash confirmation requests. Figure 2 indicates that error rates are comparatively low, averaging less than two percent for the period. Error rates declined over the period, with a notable decrease in the year 2009. Total errors by the banks and auditors were over 4.5 percent for years 2006 and 2007 combined but were under two percent every year after 2009. The comparatively low error rates may reflect auditor experience with the process, as well as the service provider's monitoring of error rates. However, after reaching a low of 1.43 percent in 2012, the overall error rate increased to 1.96 percent in 2015. RQ1b addresses whether error rates have changed over time. The data indicates that error rates have

⁸ Human subjects' approval was obtained from the corresponding author's university.

declined, but this decline in error rates is not uniform across banks and auditors. When the error rates are regressed against time indicators (not tabulated), the overall decline in error rates was significant at $p < 0.05$. The decline for banks (auditors) was significant at $p < 0.01$ ($p < 0.05$).

<< Insert Figure 2 about here >>

RQ2 addresses differences in error rates for banks compared to auditors. The average auditor error rate of 1.55 percent is almost five times the bank error rate of 0.32 percent; the difference in error rates is statistically significant at the 0.01 level based on a paired t-test. Notably, bank error rates continued to decline to 0.22 percent in 2015, but auditor errors began to increase in 2013 and were 1.96 percent of all confirmation requests in 2015. This may reflect the rapid growth in use of the automated service, particularly internationally, and new auditor users' unfamiliarity with the process. If reconfirmation (i.e., resending the request) is costly because of increased audit time, audit firms may wish to institute procedures to verify confirmation information before transmittal of the requests.

RQ3 examines the causes of bank confirmation errors. The causes of auditor errors are summarized in Table 1. Not surprisingly, invalid account numbers were the cause of nearly 70 percent of the auditor errors. However, while invalid account numbers were 88.5 percent of all auditor errors in 2007, invalid account numbers decreased to 54.5 percent of all auditor errors in 2015. Requests involving invalid company names, invalid client contacts, and invalid requests increased in frequency and represented 8.8 percent, 11.8 percent, and 9.6 percent, respectively, of all auditor errors over the period. However, these errors represented 17.6 percent, 18.6 percent, and 9.3 percent respectively in 2015.

<< Insert Table 1 about here >>

Electronic Confirmation Error Rates by Audit Firm Size

The percent of confirmation transactions and errors by audit firm size (Big 4, national, and smaller) is included in Table 2. Consistent with the overall growth in the use of electronic confirmations, audit firms of all sizes experienced significant growth in the use of electronic cash confirmations. Somewhat surprisingly, initial use of electronic cash confirmations was higher among national firms and smaller firms, compared to Big 4 firms. However, the percent of confirmations sent by the Big 4 increased throughout the period, and the Big 4 accounted for 51 percent of the confirmation requests in 2015.

<< Insert Table 2 about here >>

RQ4 addresses whether error rates differ based on audit firm size. Table 2 also provides information on the percent of errors by audit firm size. Big 4 audit firms account for almost 54 percent of the confirmation errors, even though Big 4 auditors only account for 43.6 percent of transactions. Although counterintuitive, this finding is supported by industry practice. Confirmations sent by Big 4 firms may involve more auditors with less experience than smaller firms. For example, bank confirmation procedures within Big 4 firms are usually performed by first year staff personnel or interns, or by personnel in an offshore location. In the case of inexperienced staff, new individuals with little experience dealing with the third-party service providers make the request for confirmation. Offshore personnel may be less familiar with bank practices in other countries. In contrast, smaller audit firms often have the same auditors working with confirmation requests each year. Thus, more experience with the system leads to fewer auditor errors.

Figure 3 present information on errors by audit firm size scaled by the number of transactions. The average Big 4 firm error rate of 1.9 percent is greater than the average error rate of 1.4 (1.2) percent for national firms (smaller firms).

<< Insert Figure 3 about here >>

We perform paired t-tests of the annual error rate by audit firm size.⁹ Since years 2006 and 2007 involve comparatively fewer transactions, we run t-tests including and excluding these two years. The error rate for Big 4 firms is higher than the rate for national firms at $p < 0.05$ for the entire ten-year period, and $p < 0.01$ for the period 2008-2015. The Big 4 firm error rate is not significantly different than the error rate for smaller firms for the 2006 to 2015 period, but is higher at $p < 0.01$ when the years 2006 and 2007 are excluded.

U.S. vs. International Comparison of Electronic Confirmation Error Rates

Table 3 presents information on use of electronic confirmations in the U.S. and internationally. Although the majority of electronic confirmations are still sent in the U.S., electronic confirmation use is growing rapidly internationally. The percent of electronic confirmations sent internationally increased from 0.4 percent of transactions in 2006 to 37.7 percent of transactions in 2015. Big 4 firms represent a greater percent of electronic confirmations sent internationally compared to those sent in the U.S. Big 4 firms averaged 36.6 percent (75.1 percent) of U.S. (international) transactions; the difference is significant at $p < 0.01$ based on a paired t-test.

<< Insert Table 3 about here >>

RQ5 examines whether error rates differ between confirmations initiated in the U.S. and in other countries. Table 4 compares auditor error rates in the U.S. and internationally. Panel A

⁹ The test has comparatively low power because it is based on annual error rates, rather than the total population of individual confirmation transactions.

presents the percent of total errors by firm size in the U.S. and internationally. Big 4 firms were responsible for 45.8 percent of errors made with U.S.-based confirmation requests and 88.4 percent for international requests. These results were fairly consistent from 2008 through 2015. Other CPA firms were responsible for 34.8 percent of errors made with U.S.-based confirmation requests and 6.7 percent for international requests. Again, the results were consistent from 2008 through 2015.

<< Insert Table 4 about here >>

Since as noted above, the Big 4 firms represented a greater percent of electronic confirmations sent internationally compared to the U.S., we scale the number of errors by the number of transactions by firm size category for confirmations sent in the U.S. and internationally in Table 4, Panel B and Figure 4. The overall average error rate (un-tabulated) is 1.5 percent (1.6 percent) in the U.S. (internationally) and the difference is not statistically significant. The Big 4 error rate averaged 1.9 percent in the U.S. and internationally. Interestingly, international error rates were lower than U.S. error rates for non-Big 4 national firms and smaller firms.

<< Insert Figure 4 about here >>

Feedback from Informal Survey of Auditors

We informally surveyed 14 auditor contacts at Big 4, national, and regional firms. None of the auditors contacted were aware of any competitors to Confirmation.com and none of the CPA firms were known to be working on an internal platform for cash confirmations. Electronic cash confirmations were used for about 75 percent to 80 percent of cash confirmation requests. Paper confirmations or e-mail requests were used for the remaining confirmations, primarily when the client's bank was not a subscriber to Confirmation.com services. Response times were

one to two days for the electronic confirmations compared to at least a week or more with paper confirmation requests. Errors that occurred with electronic confirmation requests were blamed primarily on the client mis-specifying an account number. We consider these as auditor errors because the auditors did not verify the information provided by the client. Error rates were much higher using paper confirmation requests. Most of the practitioners we spoke to did not have personal knowledge of international use of Confirmation.com services.

MAJOR THEMES AND FUTURE RESEARCH DIRECTIONS

Three themes emerged from our analysis of the bank confirmation error data and informal survey of practitioners: authentication of electronic evidence, global differences in technology use, and technology adoption across different firm sizes. We discuss each theme and related future research opportunities, as summarized in Table 5. Future research is particularly important given the increasing importance of third party evidence in the era of data analytics, the increasing interest in how auditing is conducted internationally (Downey and Bedard 2019; Andiola, Downey, and Westermann 2020), and the emphasis on whether smaller audit firms may be able to compete with larger firms (ACAP 2008; Bills et al. 2016; Keune et al. 2016).

<< Insert Table 5 here >>

Authentication of Electronic Evidence

Auditors are responsible for authenticating confirmation request replies, whether they are cash balances, accounts receivable, marketable securities, accounts payable, or for other accounts. The responsibility exists whether the auditor uses paper confirmation requests through the mail, or electronic confirmation requests using e-mail or through an outside service provider. In this study, we found that the outside service provider had strong controls to provide assurance

to auditors that cash balance confirmation request replies were from authenticated bank employees. The study also raised several authentication issues for future research, including:

1. Is authentication occurring for cash balance confirmation requests when such requests are not made through the outside service provider?
2. With increased reliance on electronic information from third parties, is the need for authentication also increased? For example, when audit firms use bots to automate the accounts receivable confirmation process, how is authentication achieved?
3. Would electronic confirmation of receivables through a third-party service provider be cost-beneficial? Would it promote audit quality? And how would regulators and standard setters promote such a process?

In addition, with the increased emphasis on audit data analytics, authentication of evidence received either from the client or external sources will become increasingly important to ensure that the underlying data can be relied upon. With data analytics, auditors may examine 100% of recorded transactions. That may provide greater assurance for the existence, valuation, and rights or obligations assertions. But it does not provide any assurance for the completeness and cut off assertions. For example, Huang and Vasarhelyi (2019) note that one common human error for the confirmation process is that a request can mistakenly not be submitted, and a week or more may pass before auditors realize it never went through. Automation reduces the possibility that confirmation requests are not submitted. Further, Nehmer and Appelbaum (2020) discuss how another emerging technology, blockchain distributed ledgers, may impact the accounts receivable confirmation process. However, they note that confirmations and other procedures will still be necessary for public/private or private blockchains.

Global Differences in Technology Use

Cross-country and cultural difference may impact auditors' judgment and decision making (Nolder and Riley 2014). Further, regulation may vary by country (La Porta et al. 1998, 2000; La Porta et al. 2006; Francis and Wang 2008). While we do not find any statistically significant differences between confirmations initiated in the U.S. and those initiated in other countries, our sample is limited to those confirmations processed by one U.S.-based confirmation service provider. We encourage research examining the use of confirmation service providers based in other countries. Further, given the interest in audit procedures across cultures and regulation entities, we encourage future research broadening the confirmation process to include accounts receivable, related parties, and accounts payable confirmations. Even broader, we encourage research examining whether automation of other audit procedures may be uniform across countries or is dependent on local factors.

Technology Adoption Across Firm Size

We compare electronic confirmation use and error rates by firm size. Electronic confirmation use by firm size has held fairly constant since 2008. Interestingly, we find that non-Big 4 firms incurred fewer confirmation errors than Big 4 firms. Representatives from the service provider involved in this research suggested that smaller firms are more likely to have personnel continuity in the confirmation process. However, other explanations for this finding may exist. For example, the meta-theory of AIS notes that cognitive factors may impact process performance (Mauldin and Ruchala 1999). Specifically, researchers recently noted automation and technology may negatively impact auditors' knowledge acquisition and retention (Dowling and Leech 2014; Sutton et al. 2018). Perhaps the demands to move toward audit procedure automation are greater for auditors employed by Big 4 firms than for auditors employed by

smaller firms with less emphasis on audit procedure automation. Future research could investigate how the ability to acquire and retain confirmation procedure knowledge impacts the auditor confirmation error rates. In addition, the nature and extent of bank accounts held by clients of Big 4 firms may be more voluminous and complex than clients of smaller firms.

DISCUSSION, LIMITATIONS AND CONCLUSION

Today, practitioners are adopting technology including automation of audit procedures to improve the audit process (Kokina and Davenport 2017; Meek 2017; Sheedy 2017; Huang and Vasarhelyi 2019). We examine the impact of this automation on the bank confirmation process using an unique longitudinal proprietary data set. The rapidly increasing use of electronic confirmations provides an interesting environment to investigate how automation impacts a common but important audit procedure as auditors often view confirmation evidence as highly persuasive given it is provided by a third party. Proponents of electronic bank confirmations argue that automation will improve response timeliness, control over confirmation requests, and request authentication (Hanes et al. 2014; Solieri and Hodowanitz 2016; Financial Reporting Council 2017).

We develop research questions to investigate the impact of automation on the bank confirmation process. Specifically, following the meta-theory of AIS (Mauldin and Ruchala 1999), we examine the impact of both technological and organizational factors on the bank confirmation process. We obtained data from the largest U.S. confirmation service provider. Three themes emerge from our analysis: authentication of electronic evidence, global differences in technology use, and technology adoption across firm sizes. Results indicate that the use of electronic confirmations grew rapidly over the period. International use of electronic confirmations is growing rapidly and is more likely to be used by Big 4 firms. Interestingly, we

find that only 36.6 percent of U.S. confirmations were generated by Big 4 firms whereas 75.1 percent of international confirmations were from Big 4 firms. The percentage of international confirmations from Big 4 firms will likely decrease over time as smaller audit firms internationally increase their use of electronic confirmations.

Results suggest that the combined bank and auditor error rate is comparatively low and averaged less than two percent over the period. Auditor error rates were significantly higher than bank error rates, suggesting the need for review of confirmation information before transmittal. Auditor error rates varied by firm size, and errors were more likely to involve Big 4 firms than smaller audit firms. The most common reason for a confirmation error was an incorrect account number. The percent of errors due to incorrect account numbers declined over the period, while the percent of errors due to invalid company name and invalid client contact increased. Finally, we do not find any significant differences in auditor error rates for electronic confirmations sent in the U.S. compared to those sent internationally.

As with all studies, our results have limitations. First, as acknowledged in our discussion of error rates, minimal research on manual bank confirmation error rates exists. Thus, we are unable to compare error rates using electronic bank confirmations to benchmark manual error rates. Second, whether these results are generalizable to other confirmation service providers needs additional study. Third, our study examines only bank confirmations. We do not have a break-down between cash balance and loan balance confirmation requests. Further, whether our findings extend to account balances such as accounts receivable, investments, or inventory requires future research. Fourth, we were unable to determine what type of bank errors are made and whether specific types of bank errors have increased or decreased over time.

Fifth, we were unable to break down our international confirmation data by country. Future research could examine whether the country in which confirmations occur influences auditor and bank errors. In addition, we were unable to break down error rates by client industry. Further research could explore whether clients in industries that carry a significant amount of cash have higher or lower confirmation rates than clients in other industries. Finally, auditor errors were classified into one of four categories by the third-party service provider. Perhaps other error categories exist.

Despite these limitations, this study contributes to our knowledge about confirmations, a common and important audit procedure that usually provides highly persuasive evidence since the evidence comes from a third party. We are not aware of any other research that examines the impact of automation on the bank confirmation process. Overall, the results of our exploratory work suggest that the use of automation for bank confirmations is increasing and may potentially impact audit efficiency. Further, for this audit procedure, we provide evidence that Big 4 auditors are more likely to make errors than are auditors from smaller firms.

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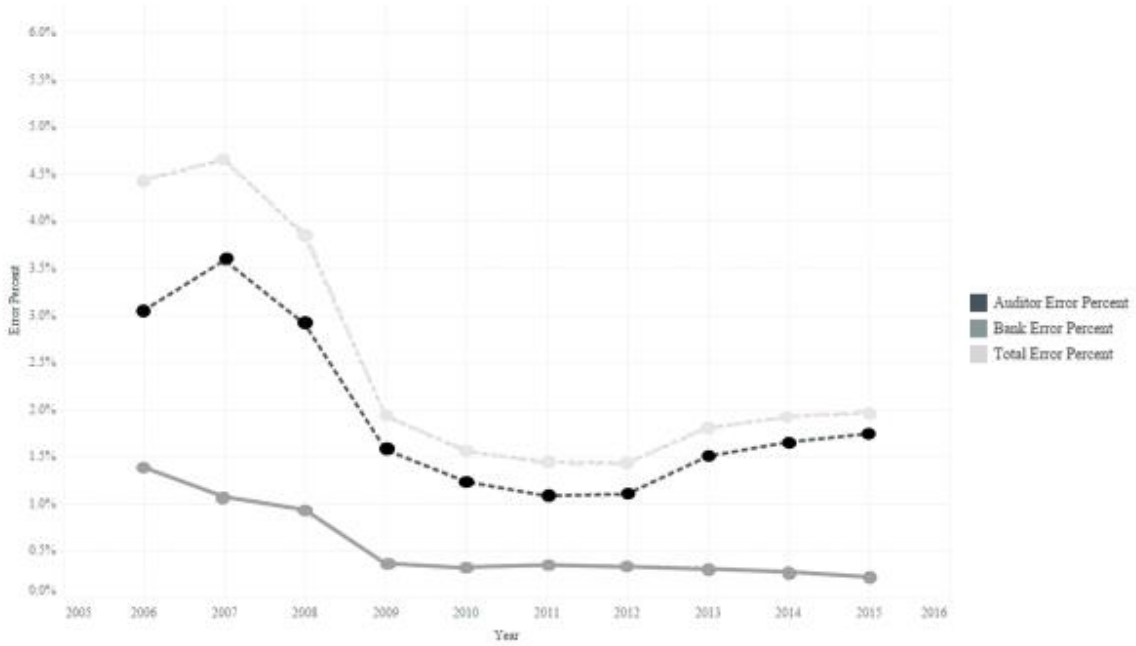
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FIGURE 1
Overview of Electronic Confirmation Process^a



^aSource: Confirmation.com

FIGURE 2
Graph of Bank^a, Auditor^b, and Total^c Error Percent

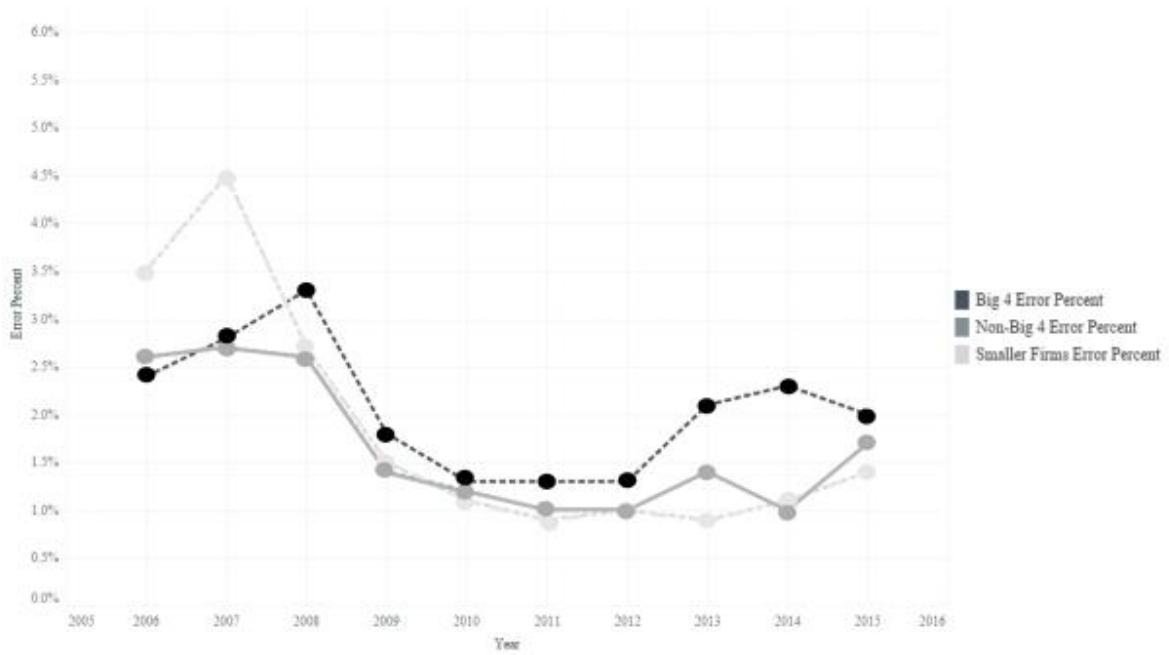


^a Percent of bank errors measured as number of bank errors/total confirmations sent.

^b Percent of auditor errors measured as number of auditor errors/total confirmations sent.

^c Percent of total errors measured as number of bank and auditor errors/total confirmations sent.

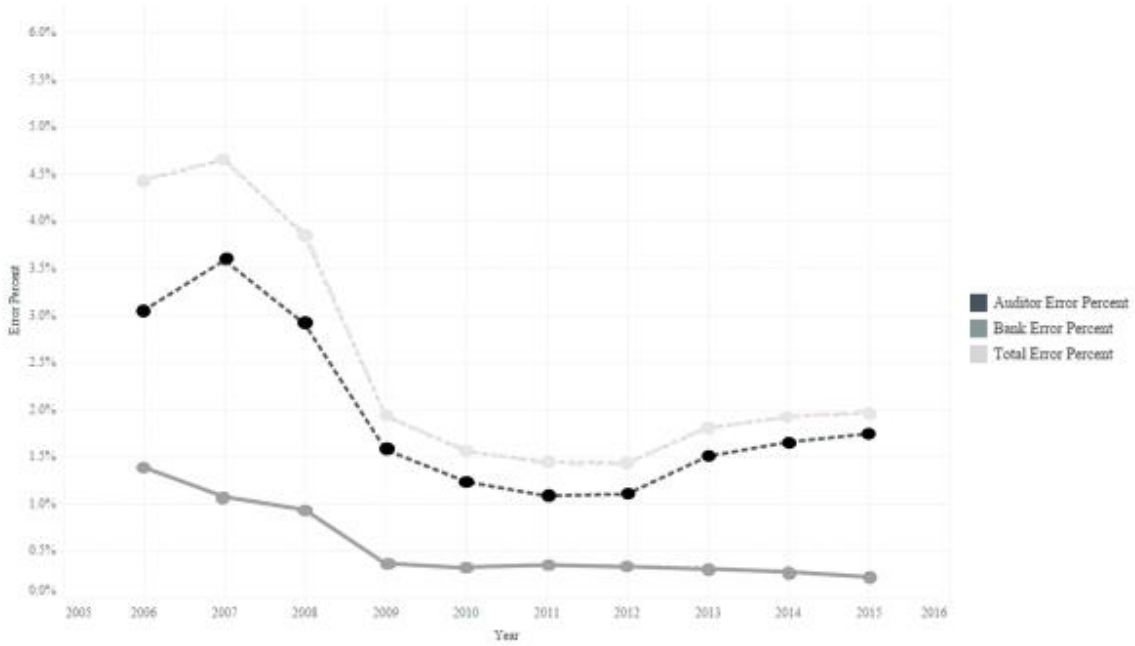
FIGURE 3
Graph of Error Distribution by Audit Firm Size as Percent of Transactions^a



^a Percent of transactions errors by firm size measured as number of auditor errors/total number of transactions for that auditor size.

FIGURE 4
Graph of Errors as a Percent of Transactions by Audit Firm Size and Location^a

Panel A: US Firms



^a Percent of transactions errors by firm size and location measured as number of auditor errors by geographic location/total number for that geographic location.

FIGURE 4
Graph of Errors as a Percent of Transactions by Audit Firm Size and Location^a

Panel B: International Firms

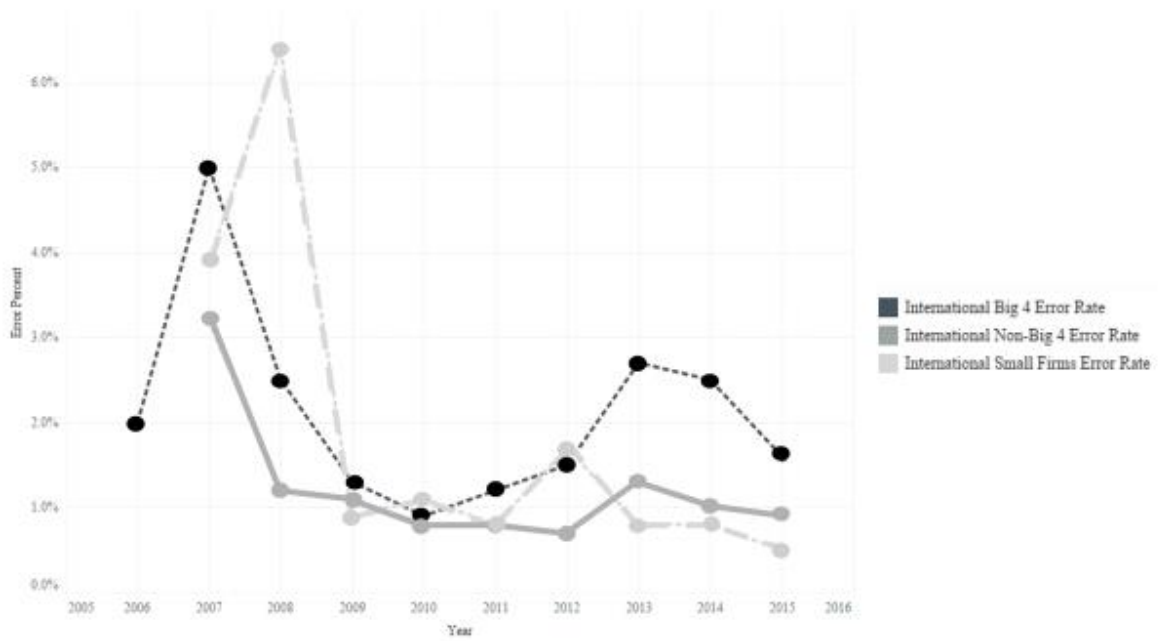


TABLE 1
Auditor Error Reason Distribution

<u>Year</u>	<u>Auditor Error Percent^a</u>	<u>Percent of Errors</u>			
		<u>Invalid Account Number^b</u>	<u>Invalid Company Name^b</u>	<u>Invalid Client Contact^b</u>	<u>Invalid Request^b</u>
2006	3.05%	82.5%	7.3%	9.5%	0.7%
2007	3.58%	88.5%	4.6%	0.0%	6.9%
2008	2.90%	84.7%	10.9%	1.3%	3.1%
2009	1.57%	82.5%	7.6%	2.6%	7.3%
2010	1.23%	84.2%	2.8%	4.0%	9.0%
2011	1.08%	83.8%	1.6%	4.7%	9.9%
2012	1.10%	83.7%	1.9%	5.3%	9.1%
2013	1.50%	74.6%	5.1%	8.2%	12.1%
2014	1.65%	63.5%	5.8%	18.8%	12.0%
2015	<u>1.74%</u>	<u>54.5%</u>	<u>17.6%</u>	<u>18.6%</u>	<u>9.3%</u>
Overall Average	1.55%	69.7%	8.8%	11.8%	9.6%

^a Percent of auditor errors measured as number of auditor errors/total confirmations sent.

^b Percent of total errors measured as number of errors of that type/total errors.

TABLE 2
Share of Transactions and Errors by Audit Firm Size

<u>Year</u>	<u>Percentage of Transactions^a</u>			<u>Percentage of Errors^b</u>		
	<u>Big 4</u>	<u>Non-Big 4 National</u>	<u>Smaller Firms</u>	<u>Big 4</u>	<u>Non-Big 4 National</u>	<u>Smaller Firms</u>
2006	5.6%	44.4%	49.9%	4.4%	38.4%	57.2%
2007	11.0%	38.7%	50.3%	8.5%	28.7%	62.9%
2008	40.3%	22.9%	36.8%	45.2%	20.3%	34.5%
2009	37.4%	21.1%	41.5%	42.7%	18.6%	38.6%
2010	36.2%	21.2%	42.6%	39.5%	21.3%	39.2%
2011	38.0%	21.3%	40.7%	45.8%	20.2%	34.0%
2012	39.8%	21.4%	39.0%	46.7%	19.2%	34.1%
2013	40.7%	16.8%	42.5%	57.1%	16.0%	26.9%
2014	47.7%	17.9%	34.3%	65.8%	10.8%	23.4%
2015	<u>51.0%</u>	<u>16.6%</u>	<u>32.4%</u>	<u>57.8%</u>	<u>16.6%</u>	<u>25.6%</u>
Overall Average	43.6%	19.0%	37.4%	53.9%	16.7%	29.4%

^a Percent of transactions by firm size measured as number of auditor transactions/total transactions.

^b Percent of errors by firm size measured as number of auditor errors/total number of errors.

TABLE 3
U.S. and International Transaction Distribution by Audit Firm Size

<u>Year</u>	<u>All Transactions</u>		<u>Big 4 Firms</u>		<u>Non-Big 4 National</u>		<u>Smaller Firms</u>	
	<u>U.S. Percent^a</u>	<u>International Percent^a</u>	<u>U.S. Percent^b</u>	<u>International Percent^b</u>	<u>U.S. Percent^b</u>	<u>International Percent^b</u>	<u>U.S. Percent^b</u>	<u>International Percent^b</u>
2006	99.6%	0.4%	5.3%	79.7%	44.5%	1.6%	50.2%	18.8%
2007	99.3%	0.7%	10.6%	77.7%	38.8%	12.1%	50.6%	10.2%
2008	98.3%	1.7%	39.5%	85.6%	23.2%	6.6%	37.3%	7.8%
2009	97.7%	2.3%	36.3%	83.6%	21.5%	6.2%	42.2%	10.2%
2010	97.3%	2.7%	34.9%	84.5%	21.7%	5.4%	43.5%	10.0%
2011	96.5%	3.5%	36.2%	85.2%	21.9%	5.5%	41.9%	9.3%
2012	93.9%	6.1%	36.7%	86.4%	22.5%	5.0%	40.9%	8.6%
2013	90.3%	9.7%	36.3%	82.0%	18.0%	6.1%	45.7%	11.9%
2014	72.3%	27.7%	37.8%	73.7%	21.3%	9.2%	41.0%	17.1%
2015	<u>62.3%</u>	<u>37.7%</u>	<u>37.4%</u>	<u>73.4%</u>	<u>21.4%</u>	<u>8.7%</u>	<u>41.2%</u>	<u>17.9%</u>
Overall Average	81.8%	18.2%	36.6%	75.1%	21.3%	8.4%	42.1%	16.5%

^a Percent of transactions by geographic location measured as number transactions by location/total transactions.

^b Percent of transactions by firm size measured as number of auditor transactions by auditor size and location/total transactions for geographic location.

TABLE 4
Error Distribution by Audit Firm Size and Location

Panel A: Percent of Errors by Firm Size and Location

<u>Year</u>	<u>Big 4 Percent of U.S. Errors^a</u>	<u>Big 4 Percent of International Errors^a</u>	<u>Non-Big 4 National Percent of U.S. Errors^a</u>	<u>Non-Big 4 National Percent of International Errors^a</u>	<u>Smaller Firms Percent of U.S. Errors^a</u>	<u>Smaller Firms Percent of International Errors^a</u>
2006	4.2%	100.0%	38.5%	8.3%	57.3%	-
2007	7.8%	83.3%	28.8%	2.9%	63.3%	8.3%
2008	44.7%	78.7%	20.6%	5.6%	34.7%	18.4%
2009	42.0%	86.7%	18.8%	5.1%	39.2%	7.7%
2010	38.6%	82.8%	21.6%	3.7%	39.8%	12.1%
2011	44.1%	89.9%	20.8%	2.5%	35.1%	6.4%
2012	43.2%	87.2%	20.7%	3.3%	36.1%	10.3%
2013	50.6%	92.7%	18.3%	4.5%	31.1%	4.0%
2014	53.5%	89.0%	14.1%	5.6%	32.4%	6.4%
2015	<u>45.8%</u>	<u>87.2%</u>	<u>21.1%</u>	<u>4.8%</u>	<u>33.0%</u>	<u>7.2%</u>
Overall Average	45.8%	88.4%	19.5%	8.3%	34.8%	6.7%

^a Percent of errors by firm size and location measured as number of auditor errors for that firm size by geographic location/total number of errors for that geographic location.

TABLE 4
Error Distribution by Audit Firm Size and Location

Panel B: Errors as a Percent Transactions by Firm Size and Location

<u>Year</u>	<u>Big 4 U.S. Error Rate^a</u>	<u>Big 4 International Error Rate^a</u>	<u>Non-Big 4 National U.S. Error Rate^a</u>	<u>Non-Big 4 National International Error Rate^a</u>	<u>Smaller Firms U.S. Error Rate^a</u>	<u>Smaller Firms International Error Rate^a</u>
2006	2.4%	2.0%	2.6%	-	3.5%	-
2007	2.7%	5.0%	2.7%	3.2%	4.5%	3.9%
2008	3.3%	2.5%	2.6%	1.2%	2.7%	6.4%
2009	1.8%	1.3%	1.4%	1.1%	1.5%	0.9%
2010	1.4%	0.9%	1.2%	0.8%	1.1%	1.1%
2011	1.3%	1.2%	1.0%	0.8%	0.1%	0.8%
2012	1.3%	1.5%	1.0%	0.7%	1.0%	1.7%
2013	2.0%	2.7%	1.4%	1.3%	1.0%	0.8%
2014	2.1%	2.5%	1.0%	1.0%	1.2%	0.8%
2015	<u>2.4%</u>	<u>1.6%</u>	<u>2.0%</u>	<u>0.9%</u>	<u>1.6%</u>	<u>0.5%</u>
Overall Average	1.9%	1.9%	1.4%	1.0%	1.3%	0.7%

^a Percent of transactions errors by firm size and location measured as number of auditor errors by geographic location/total number of transactions for that geographic location.

TABLE 5
Themes and Future Research Opportunities

Theme	Research Opportunities
Authentication of electronic evidence	<p>With increased reliance on electronic information from third parties, is there a need for authentication of this information? Does this authentication require the services of an outside intermediary?</p> <p>How will the authentication process be changed should audit firms begin to use bots and/or blockchain distributed ledgers extensively?</p> <p>Would electronic confirmation of receivables through a third party be cost-beneficial in promoting audit quality? How can regulators and standard setters promote such a process?</p>
Global differences in technology use	<p>Do results generalize to confirmation service providers based in other countries?</p> <p>Does the adoption of technology impact other types of confirmations such as accounts receivable, accounts payable, etc., similarly?</p> <p>Are automation changes in other audit procedures fairly uniform across countries or are these changes dependent on local factors?</p>
Technology adoption across firm sizes	<p>Does increased automation of the audit process improve audit quality? Does it negatively affect professional skepticism?</p> <p>How does the ability to acquire and retain confirmation procedure knowledge impact auditor confirmation error rates?</p> <p>Do differences in nature and extent of bank accounts held by clients of Big 4 firms differ from the nature and extent of bank accounts held by clients of smaller firms?</p>