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Integration of Big Data into Forensic Accounting Education and Practice: A Survey of Academics in China and the United States

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I. Introduction

Forensic accounting is defined as the use of applied accounting methods in civil and criminal investigations, which includes: fraud examination, expert witnessing, anti-corruption and anti-bribery, business valuation, litigation support, cybersecurity, among others (Rezaee et al., 2004; Crumbley et al., 2015). Forensic accounting practice has emerged as a major service in accounting firms (Rezaee, 2019). According to Association of Certified Fraud Examiners (ACFE, 2018) business organizations lose about 5 percent of their revenues to fraud each year exceeding 3.5 trillion (USD), which increases the demand for forensic accountants to detect such fraud. Ever-growing technological advances (e.g., cloud, social media, and analytics), enable an unprecedented amount of structured, semi-structured, and unstructured data be processed. Big data is defined in the literature as high-volume, high-velocity, and high-variety information that can be transformed to information for decision making (Gartner, 2014). Rezaee and Wang (2019) conduct a survey of a sample of academics and practitioners in China and find that these participants believe that big data should be integrated into forensic accounting education and practice. Rezaee et al. (2018) document that China lagged the United States in terms of integration of big data into forensic accounting education. For example, there are only three out of around 19 forensic accounting programs with a standalone big data course in China; in contrast, there are 46 out of 58 forensic accounting programs with a standalone big data course in the United States.

This study differs from Rezaee et al. (2018) and Rezaee and Wang (2019) on two grounds. First, as a response to underdevelopment of availability of big data in forensic accounting education in China compared with the United States (Rezaee et al., 2018), this study examines the impact of institutional factors on the current state regarding the use of big data in forensic accounting practices in China. Second, as a response to the increased in both big data and forensic accounting in China (Rezaee and Wang, 2019), this study conducts a survey from a sample of academics in China and the United States regarding the relevance, importance and integration of big data and data analytics into forensic accounting education worldwide. The insights from academics are important to business colleges and accounting schools, worldwide, that offer or planning to offer relevant forensic accounting programs.

Prior studies (Rezaee et al., 2016; Rezaee and Wang, 2019) show that there has been increasing use of big data in the forensic accounting practice in areas of predictive modeling and other advanced analytics to detect unusual transactions, high-risk events, potential fraudulent behaviors, or activities among records of historical activities or transaction data and data visualization techniques to present results in a transparent and clear manner to clients. Global Times (2017) predicts that there is a shortage of supply in 1.5 million big data professionals in China, compared with the demand of 1.8 million in the period of next three to five years. The demand for data scientists has increased to more than 28 percent in 2020 with the big data job is ranked as number three in top jobs (DuBois, 2020). To address the issue, Big 4 accounting firms are proposing data-driven accounting curriculum and competence frameworks. For example, PricewaterhouseCoopers (2015) recommends a data-driven accounting curriculum as part of its effort to facilitate the curriculum design and delivery with challenges of information technology (IT), big data and data analytics. EY (2019) introduces the competence framework of integration of the analytics mindset and skills into accounting education and training, to prepare students to "have a broad understanding of the way data and analytics are transforming business and how they will impact their role as an accountant when they start their career" (EY, 2019). Big data topics suggested by accounting firms are artificial intelligence, blockchain, data analytics techniques and tools, data characteristics, strategic thinking and problem-solving.

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The increasing demand for big data in forensic accounting practices raises the question of whether there is adequate training of big data in forensic accounting education to address the increasing demand. To answer this question, this study examines the effects of economic, legal, social-cultural, political, and professional factors on use of big data in forensic accounting practices in China and concludes an increasing demand for use of big data in forensic accounting practices. Then, to address the issue regarding the demand, interest, topics of big data in forensic accounting education to meet the increasing challenge, this study conducts a survey of academics in China and the United States. The results show that academics in both countries have similar views regarding the importance, demand, relevance, benefits, coverage and use of big data in forensic accounting education. There are no significant differences between the two groups relevant to nature, extent, and content of coverage of big data topics in forensic accounting education.

The research makes several contributions to the big data and forensic accounting education literature. First, results support initiatives taken by standard-setters in promoting big data and data analytics education. For example, the Association to Advance Collegiate Schools of Business (AACSB) Standard A7 (AACSB, 2014: page 3) states "the development of skills and knowledge related to data creation, data sharing, data analytics, data mining, data reporting, and storage within and across organizations". In line with educational standards of the AACSB International on accounting program to integrate information technology (IT) throughout academic curricula, this study underscores the importance of IT and big data education.

Second, the findings of this study have implications for forensic accounting practices and education. Analyses of institutional factors show that economic, legal, social-cultural, political, and professional factors affect the use of big data in forensic accounting practices in China. Although China lagged the United States regarding the coverage of big data in forensic accounting education, the results from a survey of both Chinese and United States academics show they have similar views in terms of integrating and coverage of related topics into the forensic accounting curriculum. This is consistent with that accounting students can be prepared to meet the challenges of use of big data in emerging practices, such as forensic accounting (Cao et al., 2015; Rezaee and Wang, 2019).

Third, this article is a response to the call by the accounting profession in making the accounting and business education align with advances in new technologies (e.g., big data) and the rapidly changing world and emerging fields of accounting (e.g., forensic accounting). Compared with 43 out of 58 forensic accounting programs with standalone big data courses in the United States, there are only three out of around 19 forensic accounting programs with a standalone big data course in China (Rezaee et al., 2018). The results of this study call for a need to advance forensic accounting education in China.

Finally, there is a consensus view between academics in China and the United States towards integrating big data into forensic accounting education. This consensus supports the globalization of accounting and forensic accounting education and the need for a global accounting education standard, such as the International Education Standards for Professional Accountants (IESs) by the International Accounting Education Standards Board (IAESB) to establish global benchmarks for initial professional development and continuing professional development for professional accountants.

The remainder of this article is organized as follows: Section II reviews the prior literature and presents the analyses of economic, legal, social-cultural, political, and professional factors; Section III illustrates the method of the questionnaire and procedures; Section IV reports the results and discussion; and Section V concludes.

II. Literature Review and Institutional Factors

II.1 Prior Research

The market for big data will be predicted to about $67 billion by 2021 (Markets and Markets, 2017). There is a shortage of supply of big data professionals in both the United States and China. Dong Laney (2012) predicted a shortage of over 100,000 analytics talents by 2020. McKinsey Global Institute (2016) reports a similar shortage of 250,000 professionals with analytical expertise in the near term in the United States. In contrast, there is a shortage of supply in 1.5 million big data professionals in China, compared with the demand of 1.8 million in the period of next three to five years (Global Times, 2017). DuBois (2020) states the demand for data scientists has increased to more than 28 percent in 2020 with the Big data and Data Analytics job is ranked as number three in top demanded jobs.

The demand for big data knowledge and skills is growing. This growth is consistent with the survey by New Vantage Partner (2016) of Fortune 1,000 firms that investment in big data is increasing and 54 percent have Chief Data Officers to

manage the investment in big data. Russom (2011) argues an increasing use of predictive analytics, machine learning, artificial intelligence, visualization techniques (dashboards), data warehouses, dedicated database management systems and big data technology (e.g., Hadoop, distributed file system). Prior studies also report the increased use of big data by accounting and auditing professionals. For example, Kelly (2016: 15) reports the use of data analytics and unsupervised machine learning by forensic accountants to detect hidden patterns and to improve the discovery of unexpected frauds and irregularities.

Other studies (Cao et al., 2015; Chen et al., 2012) describe the use of data analytics by auditors and support the improvements of detection of frauds by such technological tools. For example, Cao et al. (2015) argues that auditors can identify fraud risks and improve the efficiency and effectiveness in risk assessment, analytical procedures, and collection of audit evidence by using big data/analytics to process the voluminous information of clients' past activities or outcomes of past audits. Chen et al. (2012) compares the traditional methods and big data analytics with a meta-learning framework and find that traditional methods could detect less than 70 percent of financial fraud incidents, while big data analytics can detect around 80 percent in fraud cases. Keith Williamson, Alvarez & Marsal Managing Director states, "We can electronically analyze every single transition in a company's books and records for a certain period and then risk profile those transactions, risk profile their customers, suppliers, employees and only focus on the highest risk transactions" (Williamson, A Plus, 2019). Thus, big data analytics can improve the detection of financial fraud cases. Professional bodies, such as the Chinese Institute of CPAs and American Institute of CPAs, and an accreditation body such as Association to Advance Collegiate Schools of Business (AACSB A7, 2014) and accounting firms make proposals and partner with universities to upgrade their accounting curriculum to prepare accounting students for future careers provided by big data and forensic accounting.

The gap and shortage between demand and supply of big data professionals raise the question of whether there is adequate knowledge and training in the forensic accounting education to equip students with big data skills and tools. On one hand, prior studies report increased interests and demand in forensic accounting education and integration of big data topics into forensic accounting practice/education. For example, a survey of both academics and practitioners in the United States by Rezaee et al. (2004) provided evidence of the importance of an increased interest in forensic accounting education and practice. Another survey conducted by Rezaee et al. (2016) on both Chinese and international students regarding the importance, demand, relevance, benefits, coverage, and delivery of forensic accounting topics, conclude that many suggested forensic accounting topics are of interest and should be integrated into business and accounting curricula in universities in China. Rezaee et al. (2018) examine the forensic accounting syllabi of universities and find an increasing integration of big data topics in forensic accounting education in both China and the United States. Rezaee and Wang (2019) survey academics and practitioners in China and their results show the increased demand and interests in big data topics into forensic accounting education.

Prior studies show that China lagged far behind the U.S in terms of provision of forensic accounting education and integration of big data content/topics into forensic accounting education. For example, Seda and Kramer (2014) report that 422 universities and colleges offer forensic accounting courses, of which, 97 provide forensic accounting programs in the United States. In contrast, there are 19 of around 2,800 universities/colleges in Mainland China with forensic accounting courses or programs (Wang et al., 2016). Only three out of around 19 forensic accounting programs have a standalone big data course in China; in contrast, 43 out of 58 forensic accounting programs have a standalone big data course in the United States (Rezaee et al., 2018).

The International Education Standards (IESs) of the International Federation of Accountants (IFAC) are issued by the International Accounting Education Standards Board (IAESB) of IFAC and they can play a key role in standardization of accounting curricula globally (Kazuo, 2018). To respond to the call by IESs and address the gap in integration of big data into forensic accounting education between China and the United States, this study surveys both academics in China and the United States and compares their opinions regarding the demand and interest in forensic accounting education and big data topics in forensic accounting education.

This study differs from prior research (Rezaee et al., 2004; Rezaee et al., 2016; Rezaee et al., 2018 and Rezaee and Wang, 2019) and contributes to forensic accounting education literature in the era of technological advances. First, prior studies by Rezaee et al. (2004) and Rezaee et al. (2016) do not examine the issue of relevance of big data to forensic accounting education. Rezaee et al. (2004) survey both academics and practitioners in the United States and gather their opinions on the importance, relevance, and delivery of forensic accounting education. Rezaee et al. (2016) survey both

Chinese and international students on forensic accounting topics. This research differs from those of Rezaee et al. (2018), and Rezaee and Wang (2019) that examine the issue of integration of big data into forensic accounting practice and education by reviewing the syllabi and conducting a survey of practitioners and academics only in China respectively. This study: (1) investigates how the economic, legal, social-cultural, political, and professional factors affect the use of big data in forensic accounting practices in China; and (2) gathers insights from academics in China and the United States regarding the importance, demand, relevance, benefits, coverage of big data topics into forensic accounting education and practices.

II.2 Economic, Legal, Social/Cultural, Political, and Professional Factors

Prior Reports and studies (e.g., American Accounting Association, 1977; Choi and Mueller, 1984; Nobes, 1984; Radebaugh and Gray, 1997; Rezaee, 2019) provide a framework of the five environmental factors of economic, legal, social/cultural, political, and professional; which impact the development of accounting as "accounting is a product of its environment" (Radebaugh and Gray, 1997: page 35). Environmental/institutional theory is based on the promise that accounting is a product of environmental factors, such as economic, legal, social, cultural, and political factors. It predicts differences between China and the United States regarding the use of big data in forensic accounting practices.

Several factors of economic, legal, social/cultural, political, and professional can influence forensic accounting practices in China (e.g., American Accounting Association, 1977; Choi and Mueller, 1984; Nobes, 1984; Radebaugh and Gray, 1997). Economic factors are defined to include: economic system, stage of economic development, development of capital markets, business ownership, and business activities of the enterprise. Legal factors consist of legal system and the source of authority of accounting standards. Elements of social/cultural factors are mainly social climate, culture, and cultural accidents. Political factors refer to the political systems. Professional factors have elements, such as the profession, education/training and licensing, ethics and standards, professional organizations.

Economic Factors

Economic factors in China differ from those in the United States in several respects. First, China has a different economic system and is at different stages of economic development from the United States. The United States is at the stage of maturity, while China is in a transition from a planned economy to a market-based economy and at the economic development stage of fast growth moving to maturity, with more on innovation and technology. There are more incentives to engage in fraud and attempt to conceal it during a period of economic growth (ACCA, 2009). Financial institutions and real estates are two economic sectors with fast growth from 1978 to 2019. Financial institutions grow at 10,350 percent; while real estate grows at 5,062 percent (China Statistical Yearbook, 2020: Table 3-5 Indices of Gross Domestic Product). They account for 14.7 percent of added value in the economy (China Statistical Yearbook, 2020: Table 3-6 Value Added by Sectors). There is an increasing use of big data (data analytics) in the anti-money laundering due diligence (e.g., know your customers) in financial institutions. China built a database for real estate ownerships for regulations of property markets in Chinese cities in 2018 (South China Morning Post, 2018). The use of big data to monitor and detect real estate transactions, which are not compliant with regulations and laws.

Second, stock markets are less developed in China compared with those of the United States. Compared with the United States, Chinese stock markets are less developed. For example, Shenzhen and Shanghai stock exchanges opened in the 1990s in China and there are currently around 1,967 firms listed on Shanghai stock exchange (mainboard A 1,622; mainboard B 48; STAR market 297) and 2,485 firms on Shenzhen stock exchange (mainboard 1,469; mainboard B 44; ChiNext 972) by June 23, 2021. In contrast, the New York Stock Exchange was founded in the 1890s and NASDAQ in the 1970s. Currently, there are around 2,800 listed firms on New York Stock Exchange and 3,554 listed firms on NASDAQ by June 23, 2021. In July 2013, the regulator Securities and Exchange Commission (SEC) has an analytical Accounting Quality Model, nickname "Robot Cop" to detect securities law violations, issuer reporting and disclosure, and audit failures by taking advantage of around one billion records a day from each of the 13 national equity exchanges. Using big data, China Securities Regulatory Commission (CSRC) identified 375 insider trading cases through big data tools between mid-2013 to 2015 (China Daily, 2015)

Third, the ownership structure of firms in China is different from that of United States firms. Compared with firms diversely owned by institutional and individual shareholders in the United States, most Chinese firms are state-owned (Claessens et al., 2000). Differences in economic factors have implications for forensic accounting practice in detecting fraud to protect the interests of dispersed retail investors in the United States as opposed to protecting interests of minority shareholders in China. There are many related parties of state-owned firms as they are mostly owned by either government

units or state asset management bureaus. According to accounting rules for related party transactions issued on December 21, 2001, by the Ministry of Finance, the costs of related party sales with a mark-up of more than 20 percent should be booked as if transacted with non-related parties or average history costs if the costs with non-related parties are not available. With a large pool of accounting records and financial statements available, regulators and auditors can use big data to detect irregular and potentially fraudulent related party transactions by cross-examining these transactions.

Fourth, growing international business activities in China create a demand for forensic accounting services in investigation of corruption and bribery and tax frauds. There are threats of corruption and bribery faced by multinational firms and China government bureaus (Voreacos, 2013), such as the Foreign Corruption Practices Act (FCPA) of the United States enforced internationally since 1977 and the United Kingdom Bribery Act since 2011. For instance, China disciplined 180,200 officials and some multinational companies and expatriate executives in 2013 (Xinhua News Agency, 2014). As a result of complex international business activities, Chinese firms or individuals started to use complex tax planning and corporate structures to shift costs and profits for tax and economic benefits. State Administration of Taxation in China succeeded to fight against tax evasion and got back around HK$59 billion in tax revenues in 2013, which is 38 times more than in 2008 (South China Morning Post, 2014). Taxation administrations and professionals now use big data tools to visualize the global structures of Chinese firms or individuals to detect tax frauds and irregularities. The following example illustrates such tax issues. A Hong Kong individual set up a limited partnership in the Cayman Islands. In 2007, this Cayman Islands firm established a limited corporation in Hong Kong, with registered capital of HK$10,000. The actual capital received is HK$100. In 2007, the Hong Kong firm invested in a firm in Shenzhen, Mainland China, and took up 14 percent of its total equity. The Shenzhen firm went on to be listed on the SME board of Shenzhen Stock Exchange in 2009. In 2010, the restriction on selling of block stockholders was resolved and the Hong Kong firm sold the shares of the listed Shenzhen firm in the secondary market. According to Guoshuifa [2009] No.698 anti-avoidance provisions, Shenzhen Tax Bureau asked the non-resident enterprise to pay more than RMB12,000,000 corporate income tax (KPMG China, 2011). This leads to an increasing use of tax analytics to detect tax frauds and tax irregularities.

Finally, there is an increasing trend of using technology to improve operational efficiency and consequently a large amount of structured and unstructured big data information available in China. One example is the pervasive use of computers, mobile phones Apps, and e-payments. These valuable data stored in computers or mobile phones can be accessed by criminals and can cause great economic damage. Take facial recognition technology, for example, a research team RealAI at Qinghua University use photos to successfully hack 19 Apps with facial recognition system in different models of mobile phones (Sina, 2021). Forensic accountants need to be aware of the inherent risks of the facial recognition technology (e.g., machine learning and AI). Cybersecurity and cybercrimes are emerging because of increasing online transactions. Take Alibaba's Taobao for example. Two criminals use Web crawlers to access the platform of Taobao and stole the 1.18 billion records of users' accounts, mobile phone contacts and nicknames (Apple Daily, June 17, 2021). To prevent cybercrimes, professionals can use Web analytics (big data tool) to monitor and detect abnormal activities on online platforms. As a result of real-time pricing data available, big data tools such as Thomson Reuter Valuation Navigator, can currently provide real-time market data for valuation by collecting scattered financial data into a single, searchable repository, which can automate daily pricing and valuation workflows.

Legal Factors

The legal system in China is different from the United States. China adopts a code law jurisdiction and the United States a common-law one. The United States is more litigious than China, as its legal system encourages the resolution of business disputes by legal means (Hwang and Chang, 2010). The differences in legal infrastructure between the United States and China have different implications and effects on forensic accounting practice. Therefore, expert report service is more common in China, while expert witness service is predominant in the United States. Bankruptcy law (Wang et al., 2016). Both experts report and expert witness services can use visualization techniques to present evidence and involve use recovery of electronic evidence (e.g., Encase).

Social Culture Factors

There are many significant differences in the social culture infrastructure between U.S. and China that could affect forensic accounting practice in both countries. First, guanxi (which means social connections) is a significant part of social culture in China. However, Guanxi connections can result in bribery and corruption (Voreacos, 2013). In contrast, the United States business is conducted on an arm-length basis. According to the 2020 Corruption Perceptions Index by Transparency

International, China ranks 78th and the United States ranks 25th regarding corruption among 180 countries. Chinses are well connected through social media. There are more than 930.8 million active users of social media in China, such as WeChat and Sina Weibo (We Are Social and Hootsuite, 2021). There is an increasing demand to use text analytics and social network analytics to identify hidden relationships through the large amount of information in Chinese social network media, such as WeChat, Weibo, and Baidu. Secondly, China is evolving from an "acquaintance society" to an arm's length one (Fei, 1948). As the modern China moving from acquaintance society to arms' length transactions, alternative dispute resolutions beyond courts, such as arbitration and mediation, are common means to deal with business disputes. Unlike court cases, arbitration and mediation do not lead to public disclosure and consequently potential damage of reputation. This fact results in litigation support with use of big data visualization tools to present evidence. Thirdly, materialistic attitude in China is increasing as people tend to assess their "market values" such as a high-paid job with fringe benefits, homes and cars, club memberships, and lavish lifestyles as their social worth (Ho Wing Meng, 1983). Consequently, this attitude leads to increasing white-collar frauds and crimes. Saney (1986) describes the social-cultural of high political and social freedom, high economical vocational and social expectation, weakening religious beliefs and ethical relativity in the United States and its consequence with increasing crimes and frauds. Like the United States, there is an increasingly pervasive materialistic attitude in China, which leads to an increasing number of white-collar crimes. For example, Bernard Madoff's Ponzi Scheme got bigger and publicly apologized for his pride after he defrauded US$65 billion and jailed for 150 years (New York Times, 2009). Take the famous movie star Fan Bingbing in China for another example. She was on the front page of newspapers because of individual income tax evasion, and she paid the fine of the total amount of RMB 832 million as the administrative fine. In 2020, China disciplined 9,554 Communist Party officials for failing to fulfill their poverty-alleviation responsibilities. This action leads to the use of big data to profile the potential criminals, such as background, ownership structure of firms involved. For example, Chinese internet big data tool of company search (www.tianyancha.com) can provide ownership structures and capitals of unlisted small-medium-sized firms.

Political Factors

Political factors can significantly affect the accounting profession and practice in several ways. First, political factors can significantly affect the establishment and implementation of laws, rules, and regulations relevant to all professionals including forensic accountants. Ng (1999) and Tang (2000) argue that political systems affect the accounting profession and education development. For example, one requirement for accounting professionals or candidates for China CPA qualification exams is that they must love the mother country and support the socialist system (Blake, 1995). One evidence of political influence in the China's accounting education is the requirement for undergraduate accounting students to take the course of Marxism.

Second, there are politically connected firms in China as senior management or significant shareholders of state-owned firms elect for political offices or appointed as government officials. Using 3,323 commercial lawsuits involving listed firms in China, Lu et al. (2015) found that Chinese courts favor firms with personal political connections regardless of state and private firms, and the favours are in home courts but not courts outside home provinces. This can lead to the use of social media analytics to identify political connections of key management or employees in the pre-litigation support services.

Professional Factors

Many professional organizations influence forensic accounting practices. Modern CPA profession in China started only around three decades ago and lagged far behind the United States. The Chinese Institute of Certified Public Accountants (CICPA) was founded in 1988; while American Institute of Certified Public Accountants (AICPA) was established in 1887. By September 24, 2019, there are over 260,000 individual members (107,483 practicing members;153,891 non-practicing members) and nearly 9,118 corporate members (i.e., accounting firms) in the CICPA. Besides, there are two professional bodies: Chinese Appraisal Society for Certified Public Valuers (CPV) and Chinese Certified Tax Agent (CTA) Association. Chinese Appraisal Society was founded in 1993. In 2019, there are around 58,800 professional Certified Public Valuers (CPV), who mostly provide business/asset valuation services. Chinese Certified Tax Agent (CTA) Association was founded in 1995. By 2014, there were around 40,000 practicing members and 60,000 non-practicing members and around more than 5,400 corporate members. American Institute of Certified Public Accountants (AICPA) was founded in 1887. There are more than 428,000 members in 2020. AICPA started to be accredited in Business Valuation Credentials in 1998 and certified in Financial Forensic credentials in 2008. Professional bodies, such as CICPA, CPV, CTA, and AICPA have called for more training on big data to prepare for future practices.

Taken together, economic, legal, social/cultural, political, and professional factors affect the use of big data in forensic accounting services in China and the United States. Forensic accounting services in China focus on the field of use of big data in investigation of offshore assets, litigation support (export report), bribery and corruption investigation/prevention, cybercrimes/cybersecurity, business valuation, tax disputes and white-collar crimes related service; while forensic accounting services in the United States are in the areas of use of big data in Foreign Corrupt Practices Act (FCPA) investigations, fraud investigations of listed firms, cybersecurity, white-collar crimes and other litigation support services such as expert witnesses in court and economic damage valuation.

III. Questionnaire and Procedures

In this study, we review the prior literature (e.g., Rezaee et al., 2018) to identify big data topics related to forensic accounting education. Then, we conduct a survey of academics in the United States and China regarding the demand, importance and content of big data educational skills and topics for forensic accounting education and compare their responses. Finally, we perform our analyses in determining the differences in responses between academics in China and the United States regarding the coverage and integration of big data and data analytics into forensic accounting education.

III.1 Questionnaire

The draft of the four-page, six-section questionnaire was prepared, pretested, and refined. To conduct a pilot pretesting, questionnaires were sent to several academics known to authors and experts in the areas of forensic accounting and big data. These people are requested to review, correct, and suggest improvements and refinements to the draft of the questionnaire for its relevance, accuracy, content format and wordings. Then we use the revised, refined, and pre-tested four-page, six-section questionnaire to be sent to the participants. The six main sections of the survey include perceptions of the future demand for and interest in big data and forensic accounting, ways that forensic accounting and big data education can be integrated into the business curriculum and big data topics and educational contents in forensic accounting education. See Appendix for a copy of the questionnaire.

To improve the response rate, this study includes with each questionnaire a cover letter, which clearly states the survey objectives, defining forensic accounting and big data, assures the confidentiality of the responses, agrees to share the summary of findings, and gives respondents the appropriate amount of time needed to complete the questionnaire. The original draft of the questionnaire was double-checked by back-translation between Chinese and English and pre-tested by asking several academics to review it for content, format, completeness, and accuracy. We made corrections in the final draft delivered to participants through online surveys. In the e-mail of selected participants, which assured completely of their anonymous responses[1], there was a survey link generated by an automated survey system.

III.2 Sample

A survey was sent to academics in China and the United States. First, one of the authors conducted workshops on forensic accounting and big data at two universities in the mainland China and encourage colleagues to participate in the survey. Second, the questionnaires were sent to a large sample of business school academics in the United States universities/colleges based on Hassleback directory.

The survey of both groups of academics was conducted using the on-line questionnaire. As shown in Table 1, we sent the cover letters to 500 Chinese academics and 1, 000 United States academics. Participation was voluntary and with no compensation and all participants were ensured that no identifying information was collected and only summary results reported. To improve the response rate, we distributed the cover letter to participants and reminded them to complete the online questionnaires at the conference venue of the 6th World Business Ethics Forum and two universities in China and send e-mails to a large sample of business school academics in the United States universities/colleges to invite and remind them to complete the online questionnaires. We received responses from 95 Chinese academics, 172 United States academics, with a response rate of 19 percent and 17.2 percent respectively. The overall response rate is comparable to a prior study by Rezaee et al. (2004, 15.4 percent for academics).

[1] One condition that the participants agree to join the survey is that they remain anonymous. We distribute the survey to them through the group e-mail list. Thus, we are able to provide the profiles of the participants.

Table 1: Sample and Responses

	Chinese Academics	U.S. Academics	Total
Conducted	500	1,000	1,500
No responses	405	828	1233
Usable Responses	95	172	297
Response Rate	19%	17.2%	17.8%

We used the chi-square test of independence to test the differences in responses of categorical variables for different groups of respondents. We used Kruskal-Wallis non-parametric analysis of variance to examine the difference in the responses of ranked data. We also applied the t-test to test the differences in responses between the two groups of academics. The results are similar between chi-square tests and t-tests, which indicate the independence between these two groups.

To evaluate and determine the strength of responses from each group in a five-point Likert Scale, we follow Rezaee et al (2004) and Campbell and Mutchler (1988) and calculate the absolute value of the difference between the mean response of the group and the neutral response of 3.0. Mean responses falling within 0.5 point of the mean response 3.0 are considered as neutral ratings.

IV. Results and Discussions

Results are presented in four categories of: (1) the relevance of big data and forensic accounting practice; (2) the integration of big data and forensic accounting into business curriculum; (3) coverage of big data topics and the integration of big data into forensic accounting education. The results show that there are no significant differences between academics in China and the United States towards their opinions of coverage and integration of big data topics into forensic accounting education.

IV.1 Relevance of Big data and Forensic Accounting

Table 2 summarizes the responses to a question regarding the demand for and interest in big data and forensic accounting. A majority of Chinese and U.S academics report that the increased demand for and interest in big data and forensic accounting. The differences in responses regarding the demand for and interest in forensic accounting are not statistically significant between the two groups. Overall, there is more demand for and interest in big data than forensic accounting by both groups of respondents as more than 94 percent of participants believe that the demand for big data will increase, while the majority of them think that the demand for forensic accounting will increase. However, United States academics are more optimistic about the interest and demand in forensic accounting. Compared with 66 percent of Chinese academics, 82 percent of United States academics feel that there is an increased interest and demand in forensic accounting. This is consistent with the fact that 422 United States universities/colleges offer forensic accounting courses/programs and only 19 Chinese universities/colleges provide forensic accounting courses/programs (Rezaee et al, 2018). These results are also supported by anecdotal evidence from practitioners. For example, Keith Williamson, Alvarez & Marsal Managing Director (Williamson, A Plus, 2019) states, "one area I can see naturally marries up well is the forensic accounting skills with data analytics skills. If you have one person who can do the accountancy and the data analytics, they're going to be highly prized."

Table 2: Demand and Interest in Big Data and Forensic Accounting

Do you expect future demand and interest in the following two areas?

	Percentage			
	Big Data		**Forensic Accounting**	
	Chinese Academics	**U.S. Academics**	**Chinese Academics**	**U.S. Academics**
Increase?	94%	95%	66%	82%
Remain the same?	2%	3%	20%	13%

Decrease?	0%	0%	3%	1%
Unsure?	4%	2%	11%	4%
Total	100%	100%	100%	100%

Table 3 shows that a majority of both Chinese and United States academics believe that big data and forensic accounting courses should be offered at both graduate and undergraduate levels. Panel A of Table 3 shows that the majority of Chinese academics (71 percent) and U.S. academics (85 percent) believe that a big data course should be offered at both undergraduate and graduate levels with some support for graduate coverage (over 22 percent and 12 percent respectively) and not much in favor of an undergraduate course in big data.

Panel B of Table 3 indicates that most Chinese academics (65 percent) and about 70 percent of United States academics felt that a forensic accounting course should be offered at both undergraduate and graduate levels. Again, there is some support for offering a graduate forensic accounting course (over 27 percent and 26 percent respectively) whereas there are fewer preferences for an undergraduate coverage of forensic accounting (less than 7 percent) for both groups. Differences in responses between the two groups are not statistically significant. Similarly, there is no significant difference between 95 Chinese academics and 172 United States academics regarding the level that a big data course or a forensic accounting course should be offered.

These results suggest that both groups of respondents believe that forensic accounting and big data subjects are more advanced topics that require prerequisite accounting and business knowledge for students in lower undergraduate accounting and business courses. These findings are supported by statements from practitioners. For example, Chris Fordham, EY Asian Principal Partner of Forensic and Integrity Service states, "I can use the data analytic techniques to play out and analyze the data to see if I can see other aspects of those transactions within the whole population. Things like that just didn't exist 10 years ago" (Fordham, A Plus, 2019).

Table 3

Panel A: At what level do you think a Big Data course should be offered?

Level	**Chinese Academics**	**U.S. Academics**
Graduate	22%	12%
Undergraduate	6%	3%
Both graduate and undergraduate	71%	85%
None	1%	0
Total	**100%**	**100%**

Panel B: At what level do you think a Forensic accounting course should be offered?

Level	**Chinese Academics**	**U.S. Academics**
Graduate	27%	26%
Undergraduate	7%	4%
Both graduate and undergraduate	65%	70%
None	1%	0
Total	**100%**	**100%**

IV.2 Integration of big data and Forensic Accounting Education

Respondents were asked to express their opinions on outcome of the integration of big data into the forensic accounting education. We asked academics in both Chinese and United States to respond to nine related questions by ranking their responses on a five-point Likert scale, with "5" indicating "strongly agree" and "1" representing "strongly disagree". Table 4 shows results comparing responses from Chinese and United States academics and find that both groups agree that big data help students to: (1) perform data-mining and modeling in forensic accounting investigation (4.22 mean response for Chinese academics and 4.38 for United States academics); (2) have advanced analytical and other data management skills (4.21 and 4.30 mean responses for Chinese and United States academics respectively); (3) extract, transform and leverage syndicated data for use in forensic accounting practices (4.09 mean response for Chinese academics and 4.33 for United States academics); (4) have a clear and coherent database digital strategy (mean responses of 3.92 and 4.07 for Chinese and United States academics respectively); (5) use and interpret datasets that may not have standard data formats (3.87 and 4.24 respectively); (6) effectively present findings to diverse audiences using strong verbal, written and visual communication skills (3.81 and 3.99 respectively).

Overall, there are no significant differences between U.S and Chinese academics regarding most outcomes of integration of big data into forensic accounting education with one exception. Specifically, the United States academics are of the view that "connecting the dots in mining data for patterns that lead to evidence" is more important (rank 4th), while Chinese academics regard it less important (rank 7th). The importance of these forensic accounting topics and their coverage in accounting curriculum is supported by practitioners.

Table 4: Opinion on Big Data in Forensic Accounting Practice

Chinese Academics						**U.S. Academics**		
Rank	Mean Response	Standard Deviation	**Curriculum Content**	**Significantly Different**		Rank	Mean Response	Standard Deviation
				5%	**1%**			
1	4.22	0.38	Perform data mining and modeling in forensic accounting investigation	No	No	1	4.38	0.85
2	4.21	0.33	Have advanced analytical other data management skills	No	No	3	4.30	1.17
3	4.09	0.46	Extract, transform, and leverage syndicated data for use in forensic accounting practices	No	No	2	4.33	0.88
4	3.92	0.64	Have a clear and coherent database digital strategy	No	No	6	4.07	1.07
5	3.87	0.71	Use and interpret datasets that may not have standard data formats	No	No	5	4.24	1.17
6	3.81	0.74	Effectively present findings to diverse audiences using strong verbal, written, and visual communication skills	No	No	7	3.99	1.06
7	3.78	0.74	Connect the dots in mining data for patterns that lead to evidence	Yes	No	4	4.26	1.05
8	3.68	0.78	Share Big Data with others	No	No	8	3.93	1.03
9	3.67	0.71	Align people, processes and culture	No	No	9	3.74	1.19

IV.3 Coverage of big data in Forensic Accounting Education

Given that the demand for and interest in the use of big data in forensic accounting will increase, what should be the curriculum content of big data in forensic accounting education? We asked both groups of respondents to indicate the importance of 25 suggested big data topics by using a Likert scale of one to five, with five being the "most important" and one being the "least important". These 25 topics come from a review of existing literature (e.g. Business Intelligence Congress, 2012; Gupta et al., 2015; EY, 2014; EY, 2016; Rezaee et al., 2018).[2] Results reported in Table 5 show that both academics Chinese and the United States agree on the importance of most of 25 topics for the coverage in forensic accounting education, but differ in terms of ranking on the technical topics, including "database management" (rank number 2 and 4 for Chinese and United States academics respectively), "ethical issue in business intelligence" (rank number 3 and 10 for Chinese and the United States. academics respectively), "data structure/data warehouse" (rank number 5 and 21 respectively), "big data technologies" (rank 10 and 15 respectively), "expert system/artificial intelligence" (rank 12 and 22 respectively), "networks, internet and E-commerce" (rank 17 and 23 respectively), "cybercrimes, computers and auditors" (rank 21 and 1 respectively), "recovery of digital data" (rank 23 and 12 respectively) and "data encryption" (rank 25 and 6 respectively).

Overall, all the suggested 25 topics are considered by both groups of academics as important (with mean responses of greater than 3.79) to be integrated into forensic accounting and business education. However, the United States academics rank all the 25 big data topics higher with mean responses of greater than 4.00 than their Chinese counterparts.

Table 5: Big Data Curriculum Content

Chinese Academics						**U.S. Academics**		
Rank	Mean Response	Standard Deviation	**Curriculum Content**	**Significantly Different**		Rank	Mean Response	Standard Deviation
				5%	**1%**			
1	4.37	0.36	Forensic data analytics	No	No	2	4.52	0.64
2	4.33	0.27	Data base management	Yes	Yes	4	4.24	0.86
3	4.31	0.30	Ethical issue in business intelligence	Yes	Yes	10	4.34	0.97
4	4.29	0.31	Forensic analytical tools (EnCase)	No	No	3	4.46	0.90
5	4.28	0.32	Data structure/data warehouse	Yes	Yes	21	4.07	0.83
6	4.26	0.34	Data mining/predictive modeling analysis	Yes	No	4	4.42	0.98
7	4.21	0.40	Digital investigation	Yes	Yes	9	4.35	0.77
8	4.20	0.41	Data visualization	No	No	11	4.32	0.80
9	4.19	0.60	Information assurance and authentication	No	No	5	4.41	0.95
10	4.18	0.48	Big data technologies (Hadoop, Map Reduce)	Yes	No	15	4.23	0.93
11	4.18	0.47	Data integration	Yes	No	8	4.37	0.66
12	4.11	0.51	Expert system/artificial intelligence	Yes	Yes	22	4.07	0.90
13	4.08	0.62	Business Intelligence user tools (OLAP)	Yes	Yes	16	4.22	0.85
14	4.07	0.68	Data governance	Yes	Yes	18	4.15	0.83
15	4.06	0.56	Computer forensics	No	No	7	4.38	0.94
16	4.05	0.58	Mobile digital forensics	No	No	13	4.28	0.97

[2] We acknowledge the limitation of the 25 big data topics in the conclusion.

17	4.03	0.55	Networks, Internet and E-commerce	Yes	No	23	4.06	0.92
18	3.99	0.59	Data movement (in-memory data)	Yes	No	20	4.09	0.89
19	3.98	0.53	Text analytics	No	No	19	4.10	0.94
20	3.96	0.78	Dimensional Modeling	Yes	Yes	25	4.03	0.82
21	3.94	0.79	Cybercrime, computers and auditors	Yes	No	1	4.56	0.72
22	3.93	0.75	Data streaming management	Yes	Yes	24	4.05	0.97
23	3.87	0.70	Recovery of digital data	No	No	12	4.31	0.93
24	3.87	0.71	Digital evidence seizure	No	No	17	4.17	0.85
25	3.79	0.90	Data encryption	Yes	Yes	6	4.40	0.82

The results support global convergence of accounting standards and accounting education standards. Globalization of business and accounting standards have a significant impact on accounting education and accounting educators. As a result of globalization and convergence of business, accounting and auditing firms, accounting standards and accounting education, there are no significant differences between academics of the United States and China regarding their opinions towards integration of big data topics into forensic accounting education. For example, the adoption of International Financial Reporting Standards (IFRS) and IFRS for Small and Medium-Sized Entities (SMEs) by the International Accounting Standards Board (IASB) in most countries is part of globalization of business. The International Accounting Education Standards Board (IAESB) issues International Accounting Education Standards to coordinate accounting education globally by providing a global framework for accounting education (Needles, 2010).

The alternative explanation for insignificant differences between Chinese and the United States academics is that the Chinese academics surveyed in this study are well-educated and tend to be westernized and thereby insignificant differences from their United States counterparts. We cannot rule out this alternative explanation. As the survey is conducted anonymously, there is no data available to test the differences between Chinese and United States academics regarding their profile, such as age, position, years of experience, professional affiliation.

Respondents were given the opportunity to offer comments on all questions included in the questionnaire. Many respondents express their insights about the importance of the coverage of big data and data sciences in the forensic accounting education and practice. Indeed, Katy Wong, KPMG Hong Kong Head of Forensic states, “But nowadays it’s tones of electronic data from different systems and now we’re gonna need to find the best way to extract these data from different types of systems, as well as combine them, organize them, sort through them, filter them … we use our tools to map out the relationship, help our clients to visualize the issues in a very clear manner is also important” (Wong, A Plus, 2019).

V. Conclusions

Analyses of economic, legal, social cultural, political, and professional factors show that these factors affect the use of big data in forensic accounting practices in China, which has grown significantly in recent years. Forensic accounting services in China focus on the field of use of big data in investigation of offshore assets, litigation support (export report), bribery and corruption investigation/prevention, cybercrimes/cybersecurity, business valuation, tax disputes and white-collar crimes related service; while forensic accounting services in the United States are in the areas of use of big data in Foreign Corrupt Practices Act (FCPA) investigations, fraud investigations of listed firms, cybersecurity, white-collar crimes and other litigation support services such as expert witnesses in court and economic damage valuation.

We conduct a survey and compare the opinions of academics from China and the United States regarding the relevance of big data to forensic accounting education. The results show that there are no significant differences between academics in China and the United States regarding integration of big data into forensic accounting. Both academics in China and the United States agree that the demand for and interest in both forensic accounting and big data is expected to increase; forensic accounting and Big data should be offered at both undergraduate and graduate levels; and many of the

suggested 25 big data topics are considered important to be integrated into big data/forensic accounting courses, including performing data-mining and modeling in forensic accounting investigation, acquiring advanced analytical data management skills and extracting, transforming and leveraging data for usage in the forensic accounting practices. For example, the top-ranked topics of 1–10 can be labeled as "fundamentals of big data for forensic accounting". The ranked topics 11–20 can be covered in a module as "data analytics and techniques" whereas topics 21–25 can be considered as "big data application in forensic accounting". These results support the global convergence in terms of educational content of forensic accounting education.

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Appendix

Forensic Accounting and Big Data Questionnaire

This questionnaire is designed to determine the use of big data/analytics in forensic accounting. Forensic accounting is defined as the practice of rigorous data collection and analysis in the areas of litigation support consulting, expert witnessing, fraud examination, and cyber security. Big data is characterized by the high volume, velocity, and variety of data that can be transformed into information for decision making. The phrase analytics and big data are used interchangeably in this study. Thank you for your cooperation.

1. **Do you expect future demand for and interest in the following to?**

	Big Data	Forensic Accounting
Increase?	☐	☐
Remain the same?	☐	☐
Decrease?	☐	☐
Unsure?	☐	☐

2. **How could Big Data be integrated into the business curriculum?**

_____ Graduate _____ Undergraduate _____ Both graduate and undergraduate _____ None

3. **How could forensic accounting be integrated into the business curriculum?**

_____ Graduate _____ Undergraduate _____ Both graduate and undergraduate _____ None

4. **Please indicate the extent to which you would agree with the following statements by circling the appropriate responses where 1=strongly disagree and 5=strongly agree. If you have no opinion, please indicate by choosing 0 under N/A.**

	Big data skills and knowledge help forensic accounting students to be able to…	**Strongly Disagree**		**Neutral**		**Strongly Agree**	**N/A**
a.	Perform data mining and modeling in forensic accounting investigation	1	2	3	4	5	0
b.	Extract, transform, and leverage syndicated data for use in forensic accounting practices	1	2	3	4	5	0
c.	Use and interpret datasets that may not have standard data formats	1	2	3	4	5	0
d.	Have advanced analytical other data management skills	1	2	3	4	5	0
e.	Connect the dots in mining data for patterns that lead to evidence?	1	2	3	4	5	0
f.	Effectively present findings to diverse audiences using strong verbal, written, and visual communication skills?	1	2	3	4	5	0
g.	Share big data with others	1	2	3	4	5	0
h.	Have a clear and coherent database digital strategy	1	2	3	4	5	0
i.	Align people, processes and culture	1	2	3	4	5	0

5. Please indicate the importance of covering the following big data topics in a forensic accounting course or modules integrated into an auditing course by circling the appropriate number where 1=least important and 5=most important. If you have no opinion, please indicate by choosing 0 under N/A.

		Least Important		**Neutral**		**Most Important**	**N/A**
a.	Data structure/data warehouse	1	2	3	4	5	0
b.	Forensic data analytics	1	2	3	4	5	0
c.	Data governance	1	2	3	4	5	0
d.	Data base management	1	2	3	4	5	0
e.	Networks, Internet and E-commerce	1	2	3	4	5	0
f.	Text analytics	1	2	3	4	5	0
g.	Data visualization	1	2	3	4	5	0
h.	Dimensional Modeling	1	2	3	4	5	0
i.	Data encryption	1	2	3	4	5	0
j.	Data movement (in-memory data analysis)	1	2	3	4	5	0
k.	Cybercrime, computers and auditors	1	2	3	4	5	0
l.	Big data technologies (Hadoop, Map Reduce)	1	2	3	4	5	0
m.	Data integration	1	2	3	4	5	0
n.	Business Intelligence user tools (OLAP)	1	2	3	4	5	0
o.	Digital evidence seizure	1	2	3	4	5	0
p.	Data streaming management	1	2	3	4	5	0
q.	Recovery of digital data	1	2	3	4	5	0
r.	Data mining/predictive modeling analysis	1	2	3	4	5	0
s.	Forensic analytical tools (EnCase)	1	2	3	4	5	0
t.	Ethical issue in business intelligence	1	2	3	4	5	0
u.	Expert system/artificial intelligence	1	2	3	4	5	0
v.	Digital investigation	1	2	3	4	5	0
x.	Computer forensics	1	2	3	4	5	0
y.	Mobile digital forensics	1	2	3	4	5	0
z.	Information assurance and authentication	1	2	3	4	5	0