The revenue persistence of US accounting firms: impacts of SOX and financial crisis

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Received 9 November 2018
Revised 2 March 2019
2 May 2019
5 May 2019
Accepted 5 May 2019

Abstract

Purpose – Typical accounting firms offer three types of accounting services to their clients: accounting and auditing (AA), tax (TAX) and management advisory services (MAS). Each accounting service has a different revenue persistence. Moreover, revenue persistence is affected by exogenous events such as new regulations (e.g. Sarbanes-Oxley Act [SOX] in 2002) and market conditions (e.g. the financial crisis of 2008). This paper aims to examine the revenue persistence of accounting services and how it is affected by SOX and the financial crisis.

Design/methodology/approach – Using 742 firm-year observations from 100 of the largest US accounting firms from 1999 to 2015, this paper examines whether revenue from AA, TAX and MAS has different degrees of persistence and how SOX and the financial crisis in 2008 change the revenue persistence of each accounting service.

Findings – This paper finds that MAS generates more persistent revenue than AA and TAX. SOX enhances the revenue persistence of MAS. The financial crisis makes revenue from AA less persistent than during the pre-financial crisis period.

Originality/value – This paper contributes to the understanding of the revenue persistence of accounting services and the impact of exogenous events such as SOX and the financial crisis of 2008.

Keywords Auditing services, Management advisory services, Public accounting, Revenue persistence, Taxation services

Paper type Research paper

1. Introduction

The importance of service-producing industries has grown more than that of the traditional manufacturing industries during the post-industrial era. According to the Bureau of Economic Analysis published on April 21, 2017, the GDP generated by private service-producing industries is about 2.57 times bigger than that created by private goods-producing industry[1]. Despite the growing economic importance of service-producing industries, many unanswered research questions exist such as how service-producing industries increase firm performance and how external shocks such as new regulations (e.g. SOX) and the financial crisis in 2008 affect the revenue stream of these industries. Using the accounting industry, one of the representative professional service firms, this paper examines what kinds of accounting services generate a more sustainable revenue steam[2]. To examine whether accounting firms' revenue is sustainable, this paper assesses revenue persistence of accounting services. In addition, this paper investigates revenue persistence of accounting services as affected by exogenous events such as the enactment of SOX in 2002 and the financial crisis of 2008.

Pacific Accounting Review
Vol. 31 No. 3, 2019
pp. 523-548

0114-0582
DOI 10.1108/PAR-11-2018-0090

The accounting services can be categorized into four areas: accounting and auditing (AA), tax (TAX), management advisory services (MAS) and other services (OTHERS)[3]. Four accounting services have been adopted by researchers and have been documented to have different influences on the level of accounting firms' productivity. Banker *et al.* (2003) find the public accounting industry improved its productivity over the period 1995-1999 using MAS. Chang *et al.* (2011) show the accounting firms with higher growth in non-audit services gained higher productivity than those which remained focused on traditional audit services from 1993 to 2003.

The accounting firms and their services are affected by regulation and market changes. Being a regulated industry, accounting firms are often forced by regulation changes to change the services they provide (Thornburg and Roberts, 2008). For instance, SOX increases the proportion of AA service on the revenue of accounting firms by mandating auditors to assess and report their clients' internal control effectiveness as a part of the AA process. In addition, SOX bans accounting firms from providing non-audit services such as MAS and certain tax services to their audit clients if the firms were providing audit services simultaneously (Kinney *et al.*, 2004). Collectively, SOX forced accounting firms to change their game plans to improve their productivity and efficiency in the post-SOX era (Chang *et al.*, 2009).

Market conditions also affect the accounting industry. Banker *et al.* (2005) and Chen and Lee (2006) find an increase in market competition in the auditing services forcing accounting firms to put more weight on MAS. For example, the financial crisis of 2008 resulted in huge increases in the demand for audit services and at the same time reluctance for audit fee increases. Because the financial crisis of 2008 emphasized the importance of financial disclosures quality and audit quality, the demand for quality audits have soared (Chou *et al.*, 2014). At the same time, accounting firms were under pressure from increasing their audit fees because many of the firms' clients were collapsing and/or were sensitive to their operating costs (Knechel, 2015; Ettredge *et al.*, 2014).

As a result of prior research which demonstrated that the different accounting services have different impacts on accounting firms' productivity and efficiency (Banker *et al.*, 2003; Chen and Lee, 2006; Chang *et al.*, 2009; Chang *et al.*, 2011), we examine the revenue persistence of the different accounting services. We contribute to the current literature by examining how exogenous events such as regulation changes and the downturn of market conditions influence the sustainability of revenue from each of the accounting services, respectively. Prior literature mainly investigates how regulation changes such as SOX influence the service mix of accounting firms and productivity. Research to date does not address how regulation changes and market conditions change revenue streams over time. This paper is expected to motivate both practitioners and researchers to understand and further explore how accounting firms create sustainable profitability which has been limited to date because of data restrictions[4].

We can infer profit sustainability using revenue because the main operating expenses of the accounting industry tend to be homogenous within the accounting industry: the compensation of the industry's human capital (Banker *et al.*, 2003; Banker *et al.*, 2005). Further, the proportion of operating expenses to revenue of accounting firms is mostly affected by their size and the scope of their services (Media, 2000; Rosenberg, 2013). Prior research also documents that revenue is a principal outcome of an organization's main operation as well as a primary driver of earnings and earnings growth (Bradshaw *et al.*, 2016; Ghosh *et al.*, 2005). Moreover, Amir *et al.* (2011) argue that the persistence of revenue provides information about the persistence of earnings.

Wilson (2008) and Jegadeesh and Livnat (2006) confirm revenue persistence conveys information that predicts a firm's future performance such as earnings.

Using hand-collected 742 US accounting firm-year observations from *Top 100 Firms* (published annually by *Accounting Today* – one of the reputable practitioners' journals in accounting), this paper poses three main research questions. First, we examine which accounting service generates a more persistent revenue stream. Second, we explore whether SOX affects the revenue persistence of the accounting services. Third, we question whether the revenue persistence of the accounting services is affected by the financial crisis of 2008. We find MAS is a more sustainable source of accounting firms' revenue because it is a customized service facing limited competition. With SOX, the revenue persistence of MAS is enhanced because it enables accounting firms to develop a separate clientele for MAS. We also find AA services have become a less sustainable source of accounting firms' revenue after the financial crisis in 2008.

The remainder of this paper is structured as follows. In *Motivation and Hypotheses Development*, we review literature and develop our hypotheses. In *Model Estimation and Sample Selection*, we describe our data and develop models that we use to test our research questions. In *Results*, we present our results. In *Sensitivity Analysis*, we examine an additional issue regarding our findings. In *Conclusion*, we summarize our findings and conclude.

2. Motivation and hypotheses development

2.1 Accounting industry

Compared to manufacturing firms which rely on fixed assets (physical capital) to generate revenue, professional service firms rely on their human capital assets to generate revenue (Greenwood *et al.*, 2005). As typical professional service firms[5], accounting firms rely on professionals as the key revenue-generating resources (Greenwood *et al.*, 2005; Lowendahl, 2005). The intellectual knowledge of the professionals determines the quality of the accounting services and enables accounting firms to develop their reputation (Sander and Williams, 1992). The skilled professionals are developed over time with experience and cannot be replaced with inexperienced, new hires. To outperform their competitors, it is critical for accounting firms to retain such valuable professionals and to use partnership to retain them (Greenwood and Empson, 2003). As owners and managers of accounting firms, partners are the most valuable inputs[6]. By utilizing and allocating professionals' billable hours, accounting firms offer various types of accounting services to their clients to safeguard their clients and market dominance.

One of the distinctive characteristics of the accounting industry is dominance of the market leaders – the Big 4 accounting firms. Through merger and acquisition and the demise of Arthur Anderson, the accounting industry Big 4 now consists of Deloitte, PWC, Ernst and Young, and KPMG. There is a second tier of accounting firms, known as mid-tier, which includes Grant Thornton, BDO Seidman, RSM McGladrey and Crowe Horwath. The Big 4 firms are the market leaders in terms of size (revenue and clientele) and market dominance and followed by the Mid-tier. According to *Accounting Today* (1999/2015), the Big 4 firms are about 10 times larger than Mid-tier firms in terms of revenue (in dollars) and in the number of professionals (Table II, Panel C). The gap between the Big 4 and small firms (i.e. neither Big 4 nor mid-tier firms) is even greater. The average revenue for Big 4 firms is $7,724.58m as compared to $133.63m for small firms. The average number of professionals for Big 4 firms is 23,228.26 as compared to 386.04 for small firms. Because of market dominance, large-sized accounting firms are able to attract large corporations with

international operations by offering a wide variety of accounting services (Caban-Gacia and Cammack, 2009; Chen and Huang, 2011)[7].

The accounting services can be categorized as AA, TAX and MAS. AA services include preparing and auditing financial statements, investigating for fraud, assessing internal control, and providing financial accounting advices. Because AA services are law-regulated and statutory services, they are compliance-driven, highly structured and commoditized (Knechel, 2007). From the clients' perspective, the switching costs are relatively low. Consequently, the market for AA services is very competitive, which makes it difficult for accounting firms to charge a fee premium (Stein *et al.*, 1994). Prior to SOX, accounting firms obtained client-specific knowledge while providing AA services and used this knowledge to invite their existing clients to other accounting services (O'Keefe *et al.*, 1994; Vera-Muñoz *et al.*, 2006; Fraser, 2009). To strengthen auditor independence, SOX bans auditors from providing non-audit services to audit clients.

TAX services encompass tax planning and tax return preparation in income, property, and other taxation (Chang *et al.*, 2015). Similar to AA, TAX is a compliance-driven and commoditized service (Banker *et al.*, 2003). Further, preparing tax returns is a routine and template-based service that can be provided by non-professional accounting firms such as H&R Block. Owing to high competition in the TAX market, it is very difficult for accounting firms to charge a fee premium.

MAS includes the implementation of technological infrastructure as well as the provision of management advisory and consulting services. Traditionally, AA and TAX services were the major sources of accounting firms' revenue. Since 1980, non-audit services have become the major driving forces of accounting firms' revenue (Firth, 1997). In the late 1990s, many accounting firms invested in MAS areas because at a given level of human resources, MAS generates more revenue than AA and TAX services (Banker *et al.*, 2005; Chang *et al.*, 2009). AA and TAX services are relatively routine and standardized services that rely on professionals' billable hours rather than partners'. But MAS is a more customized and differentiated service, offered in less competitive markets (Trompeter and Wright, 2010). As a result, MAS has more opportunity for fee premium and likely to generate more revenue than other services (Banker *et al.*, 2005; Lee, 2015).

2.2 Effects of SOX and financial crisis on accounting services

Public accounting is a regulated practice (Thornburg and Roberts, 2008). Government regulations influence accounting firms' decisions on accounting services. During the past couple of decades, the enactment of SOX in 2002 was one of the most significant regulation changes which had ripple effects on the entire accounting industry. Section 404 of SOX requires auditors to verify managements' reports on its internal control effectiveness and to provide independent reports on the effectiveness of their clients' internal control systems.

SOX influences TAX services. Before SOX, accounting firms could invite their current audit clients to other non-AA services, especially TAX (Knechel, 2015). However, SOX bans auditors from providing non-audit and certain TAX services to their audit clients. Maydew and Shackelford (2005) and Gleason and Mills (2011) acknowledge client firms were less likely to purchase auditor-provided tax services because SOX requires their audit committee to pre-approve tax services provided by the auditor. As a result, accounting firms decouple AA and TAX services, which historically provided for their audit clients together.

SOX prohibits MAS provided by an incumbent auditor because this can jeopardize auditor independence. Like TAX services, MAS was bundled with AA before SOX (Knechel, 2015). Accounting firms used to "low-ball" initial audit engagements to obtain high margined MAS from their audit clients (Simon and Francis, 1988; Kinney *et al.*, 2004). After

fierce debate, SOX finally banned accounting firms from providing MAS to their existing audit clients. As a result, accounting firms have to develop a separate clientele for MAS in the post-SOX period.

The financial crisis in 2008 is another exogenous factor that changed the competitive environment of the accounting industry. Investors criticized accounting firms for not making extra effort to contest their clients' financial statements, even though the most responsible party for the financial crisis in 2008 were financial institutions (i.e. audit clients) that misapplied the fair value accounting (Sikka, 2009; Kothari and Lester, 2012; Fraser, 2009) and demanded high quality audits. Chou *et al.* (2014) argue the financial crisis highlighted the importance of the quality of financial disclosures and thus increased the demand for strengthened financial disclosures. As a result of the financial crisis in 2008, the market demands for quality audit services increased the importance of the external audit (Schilder, 2011).

As the supplier in the accounting industry, accounting firms have been suffering as a result of the financial crisis. Some accounting firms were reluctant to raise red flags for fear of losing their large audit clients including Bear Sterns, ING and Lehman Brothers during the financial crisis of 2008 (*The Economist*, 2014; Fraser, 2009). Many client firms were trying to cut costs and expected auditors to share in the economic pain by reducing audit fees (Knechel, 2015; Ettredge *et al.*, 2014). As a result, the accounting firms were under pressure to keep their audit fees down without sacrificing their audit quality. According to WebCPA (2010), many accounting firms suffered a decline in profits after the financial crisis in 2008. Ettredge *et al.* (2014) document even though accounting firms have put in extra effort and time to cope with the increased audit risk of their clients after the financial crisis, these firms were not able to command higher audit fees because of fee pressure from their clients. Sonu *et al.* (2017) also find audit fees decreased during the financial crisis especially for audit clients with high sensitivity to their expenses.

2.3 Revenue persistence of accounting services

The impact of SOX and the financial crisis of 2008 on the productivity and efficiency of accounting firms has been documented by some researchers. Banker *et al.* (2003) use the DEA (data envelopment analysis) method and find the productivity of the accounting industry has improved over the period from 1995 to 1999 mainly because of MAS. Using Taiwan data from the period 1993-2003, Chang *et al.* (2011) show higher productivity for the accounting firms with higher growth in non-audit services than those which remained focused on traditional audit services. Farag and Elias (2012) show AA is negatively associated with productivity because of its high level of resources requirements. In terms of efficiency, prior literature documents that accounting firms with emphasis on AA and TAX services tend to be less efficient than those whose emphasis is on MAS (Firth, 1997; Banker *et al.*, 2005; Lee, 2015).

Interestingly, the revenue persistence of accounting services has been unexplored. This paper aims to examine revenue persistence of accounting services for three reasons. First, revenue captures an organization's ordinary and ongoing operation. International Accounting Standards (IAS) 18 defines revenue as "the gross inflow of economic benefits arising from the ordinary operating activities of an entity." Therefore, revenue itself is a primary performance measure of an organization's operation. In 2013, Hans Hoogervorst, Chairman of the IASB, commented that revenue is a key performance indicator and is important to every business. Jones and Manuelli (1995) also mention revenue as a key performance metric to assess the past performance of a company.

Second, revenue conveys information on future prospects. Current revenue is the result of product quality and customer satisfaction. Nagar and Rajan (2001) argue high product quality increases customer satisfaction, which in turn increases future revenue because satisfied customers become loyal to firms' products. Banker *et al.* (2000) find customer satisfaction has a positive effect on future revenue. Thus, revenue powered by product quality and customer satisfaction tend to be persistent (Ertimur *et al.*, 2003). Bradshaw *et al.* (2016) document that prior period revenue explains more than 67 per cent of current period revenue. Third, revenue is a primary driver of earnings and growth (Bradshaw *et al.*, 2016; Ghosh *et al.*, 2005) and its persistence conveys information on earnings persistence and future earnings (Wilson, 2008; Jegadeesh and Livnat, 2006).

Earnings persistence is determined by persistence of both revenue and expenses. Therefore, we expect that factors which affect earnings persistence also influence revenue persistence of accounting firms[8]. Especially for accounting firms, using revenue to measure the economic outcome of the accounting firms' operations is adequate, just like earnings, because the firms' operating expenses are mainly the compensation of professionals[9]. Given the existence of the Big 4, market competition is one of the dominant determinants in the accounting industry[10]. Lev (1983) argues the degree of competition affects the persistence of profitability for individual firms as well as for industries. Competition determines the market power of each participant firm, thus enabling each firm to have sustainable earnings growth (Lev, 1983). The degree of competition depends on the product type: standardized or customized products or services (Baginski *et al.*, 1999). Contrary to standardized products or services, customized products or services are differentiated to meet the particular needs of its customers (Hansen *et al.*, 1999; Guy and O'Brien, 1983). Stump *et al.* (2002) argue that compared to standardized products, customized products protect the provider from future competition because the buyer has to bear switching costs. Therefore, firms selling customized goods or services can acquire relatively persistent revenue streams. For accounting firms, traditional service areas such as AA and TAX are law-regulated and statutory services; hence, they are more standardized practices. The switching costs of AA and TAX services tend to be relatively low for audit clients. In contrast, MAS are customized services, which require accounting firms to acquire client-specific knowledge and skills to provide tailor-made services. Chow *et al.* (2002) and Hood and Koberg (1991) argue that AA and TAX provide structured, ordered and "well defined services based on professional standards and tax regulations," while MAS provides "non-routine and non-standardized services adapted to the client." Hence, we argue AA and TAX, as standardized services, have relatively more competitive market partly because of lower switching costs to clients which brings less persistent revenue streams to accounting firms compared to MAS. Conversely, MAS, as customized services, faces relatively less competition because of heavier switching costs; therefore, MAS is more likely to bring in persistent revenue streams as compared to AA and TAX services.

To test whether MAS provides more persistent revenues than AA and TAX, we state our first hypothesis as follows:

H1. MAS provides more persistent revenue than AA and TAX.

Because accounting is one of the regulated industries, public accounting firms' services are regulated practices (Thornburg and Roberts, 2008). By forcing accounting firms to modify their services, changes in regulation influence their level of revenue and its persistence. During the past couple of decades, SOX is one of the most influential regulation changes which has impacted all three types of services as offered by public accounting firms (Lin

et al., 2008). For AA services, SOX increases the proportion of revenue from AA services by mandating auditors to assess their clients' internal control system and to report the effectiveness. Even though SOX has not strictly prohibited the auditor-provided tax services, these services have declined because SOX requires preapproval from client firms' audit committees if the incumbent auditor is also providing tax services. Also, some institutional investors do not favor auditor-provided tax services. Maydew and Shackelford (2005) find that client firms were seeking other accounting firms to get tax services rather than getting services from their incumbent auditors. As a result, SOX forces accounting firms to decouple AA and TAX services, which historically had been bundled together and provided as a service package to their audit clients. However, auditors are still allowed to provide certain TAX services to their audit clients in the post-SOX period because TAX is generally viewed as a reasonable add-on to the audit and helpful for the auditor to verify tax-related accounts in financial statements (Gleason and Mills, 2011).

To defend auditors' independence, SOX prohibits MAS provided by an incumbent auditor. Pre-SOX, MAS was bundled together with AA and provided to their clients (Knechel, 2015). Specifically, accounting firms had used AA to cross-sell MAS to their audit clients in the pre-SOX period by low-balling initial audit engagements (The Economist, 2014; Fraser, 2009; Simon and Francis, 1988; Kinney *et al.*, 2004). As a result, the revenue generation of MAS was conditional on AA services in the pre-SOX period. With an increasing number of accounting scandals, the provision of non-audit services to existing audit clients had been under the scrutiny of regulators and researchers (Kinney *et al.*, 2004). After SOX banned accounting firms from providing MAS to their existing audit clients, accounting firms are under pressure to develop a very separate clientele. As a result, MAS becomes a source of more persistent revenue streams in the post-SOX period than in the pre-SOX period. Collectively, we state our second hypothesis as follows:

H2. SOX has a positive effect on revenue persistence of MAS.

Accounting services are also sensitive to market changes such as the financial crisis of 2008. By changing the competitive environment of the accounting industry, the financial crisis of 2008 is documented as having had a mixed impact on the accounting industry. Some researchers find that the financial crisis increased the demand for quality audits. Chou *et al.* (2014) argue that the financial crisis highlighted the importance of financial disclosures quality and emphasized audit quality. As the external audit plays a major role in supporting the quality of financial reporting (Schilder, 2011), the financial crisis results in a huge increase in the market demand for high quality audit services.

At the same time, some researchers document that the financial crisis of 2008 decreased the overall demand for audit services because accounting firms lost some of their big corporate clients (e.g. Bear Sterns, ING and Lehman Brothers) and the firms needed to become more competitive in the audit market by sharing the financial burden with their clients during difficult periods. Abdel-Khalik (1990) documents that economic downturn reduces the demand for audit services and enhances competition among audit firms. Maher *et al.* (1992) find the increased competition in the US market for audit services significantly decreased audit fees from 1977 to 1981. Consistently, many researchers document that the financial crisis of 2008 created a suppressing pressure on audit fees (Knechel, 2015; Ettredge *et al.*, 2014; Krishnan and Zhang, 2014). Because of the increased competition in the audit market following the financial crisis, we expect the revenue persistence of AA to be lower in the post-financial crisis compared to that of the pre-financial crisis period among other accounting services.

We state our third hypothesis as follows:

H3. The financial crisis of 2008 had a negative effect on revenue persistence of AA.

3. Model estimation and sample selection

We hand-collect our sample from *Accounting Today's* annual publication *Top 100 Firms*[11]. Our sample includes financial and human capital information of the largest 100 US accounting firms. We delete non-CPA firms (e.g. H&R Block) and accounting firms that cease to exist during our sample period (e.g. Arthur Andersen and other firms owing to merger and acquisition). As a result, we have a balance panel of 48 accounting firms over 17 years (from 1999 to 2015), 816 firm-year observations. Because we use lag variable, the actual sample size used in the model estimation is 742 firm-year observations.

To examine our first hypothesis, we estimate our model as follows:

$$ln(AA_t) = \alpha + \beta_1 \ln(AA_{t-1}) + \beta_4 \ln(REV_t) + \sum_{i=5}^{14} \beta_i Controls + \varepsilon \quad (1)$$

$$ln(TAX_t) = \alpha + \beta_2 \ln(TAX_{t-1}) + \beta_4 \ln(REV_t) + \sum_{i=5}^{14} \beta_i Controls + \varepsilon \quad (2)$$

$$ln(MAS_t) = \alpha + \beta_3 \ln(MAS_{t-1}) + \beta_4 \ln(REV_t) + \sum_{i=5}^{14} \beta_i Controls + \varepsilon \quad (3)$$

Where, $\ln(AA_t)$ is the natural log of revenue from accounting and auditing services in millions of dollars at year t, $\ln(TAX_t)$ is the natural log of revenue from taxation services in millions of dollars at year t, and $\ln(MAS_t)$ is the natural log of revenue from management advisory (consulting) services in millions of dollars at year t[12]. $\ln(REV_t)$ is the natural log of net revenue in millions of dollars from US operations at year t[13]. In Model (1), (2) and (3), we add locational and firm characteristic control variables: *BIG4, MID-TIER, LEV, OFFICE, NCEO, CEO_CHANGE, NEAST, MWEST, WEST,* and *MERGE*. We have included *BIG4* and *MID-TIER* to control for size and scope of the accounting services they provide. *BIG4* is coded 1 if the accounting firm is one of the four largest accounting firms: PWC, Deloitte, KPMG and E&Y, and 0 otherwise. *MID-TIER* is 1 if it is one of the next four largest accounting firms: Grant Thornton, BDO Seidman, RSM McGladrey and Crowe Horwath, and 0 otherwise. We include *LEV* to control for the type of services: whether they rely on billable hours of professionals or reputation of partners[14]. *LEV* is the ratio of the number of professionals to the number of partners. *OFFICE* is a size variable measured as the number of offices within the USA, and we use it to control for firm size. We include *NCEO, CEO_CHANGE,* and *MERGE* to control for any changes in corporate culture in the accounting firms. *NCEO* refers to the number of CEOs during our sample period (1999-2015)[15]. *CEO_CHANGE* is a binary variable, equal to 1 if during that year, there is any change in CEO and 0 otherwise[16]. *MERGE* is 1 in the year the accounting firms merge with another firm, and 0 otherwise. We have four locational variables (*NEAST, MWEST, WEST* and *SOUTH*) based on the city and state of the accounting firms' headquarters to capture types of their service and clientele. *NEAST* is 1 if the accounting firm's headquarters state is in New York, NJ, PA, MD, VA and Connecticut, and 0 otherwise. *MWEST* is 1 if the accounting firm's headquarters state is located in Illinois, IN, MN, MI,

MO, WI, ND, KS and Ohio, and 0 otherwise. *WEST* is 1 if the accounting firm's headquarters is in California, WA, and Colorado, and 0 otherwise. *SOUTH* is 1 if the accounting firm's headquarters is located in Georgia, AL, FL, TN, NC and South Carolina, and 0 otherwise.

To test our second hypothesis on the SOX effect, we use Models (4), (5) and (6).

$$\ln(AA_t) = \alpha + \beta_1 \ln(AA_{t-1}) + \beta_4 \ln(AA_{t-1}) * SOX + \beta_7 SOX + \beta_8 \ln(REV_t) + \sum_{i=9}^{18} \beta_i Controls + \varepsilon \quad (4)$$

$$\ln(TAX_t) = \alpha + \beta_2 \ln(TAX_{t-1}) + \beta_5 \ln(TAX_{t-1}) * SOX + \beta_7 SOX + \beta_8 \ln(REV_t) + \sum_{i=9}^{18} \beta_i Controls + \varepsilon \quad (5)$$

$$\ln(MAS_t) = \alpha + \beta_3 \ln(MAS_{t-1}) + \beta_6 \ln(MAS_{t-1}) * SOX + \beta_7 SOX + \beta_8 \ln(REV_t) + \sum_{i=9}^{18} \beta_i Controls + \varepsilon \quad (6)$$

SOX is 1 if firm year observation is in the post-SOX period (2003-2015), and 0 otherwise[17]. The definition of all other variables is consistent with that in Models (1), (2) and (3).

We use the following models to test our third hypothesis on the effect of the financial crisis in 2008 on the revenue persistence of accounting services:

$$\ln(AA_t) = \alpha + \beta_1 \ln(AA_{t-1}) + \beta_4 \ln(AA_{t-1}) * CRISIS + \beta_7 CRISIS + \beta_8 \ln(REV_t) + \sum_{i=9}^{18} \beta_i Controls + \varepsilon \quad (7)$$

$$\ln(TAX_t) = \alpha + \beta_2 \ln(TAX_{t-1}) + \beta_5 \ln(TAX_{t-1}) * CRISIS + \beta_7 CRISIS + \beta_8 \ln(REV_t) + \sum_{i=9}^{18} \beta_i Controls + \varepsilon \quad (8)$$

$$\ln(MAS_t) = \alpha + \beta_3 \ln(MAS_{t-1}) + \beta_6 \ln(MAS_{t-1}) * CRISIS + \beta_7 CRISIS + \beta_8 \ln(REV_t) + \sum_{i=9}^{18} \beta_i Controls + \varepsilon \quad (9)$$

CRISIS is 1 if firm year observation is in the post-financial crisis period (2008-2015), and 0 otherwise[18]. The definition of all other variables is consistent with that in Models (1), (2) and (3).

We use year fixed effects to control for the variations in the dependent variable that change over time and standard errors clustered by firms. The definition of variables is in Table I.

4. Results

Table II reports descriptive statistics of our variables. Panel A includes descriptive statistics of all variables used in our models from Models (1) to (9). Panel B reports the trends of revenue from three accounting service areas: AA, TAX, and MAS during our sample period by all firms, Big 4 firms, mid-tier firms and small firms (non-Big 4 and non-mid-tier firms). After the implementation of SOX in 2002, Big 4 accounting firms experienced a sharp decrease in revenue from MAS compared to mid-tier and small firms. Big 4 accounting firms fill such decreases with AA services. In Panel C, we contrast Big 4, mid-tier, and small firms in terms of revenue (in millions of dollars), number of offices, number of partners, and number of professionals. In terms of revenue, Big 4 accounting firms are 10 times larger than the mid-tier firms and 60 times larger than the small accounting firms. We confirm that the public accounting industry is highly concentrated with a handful of significant players, the Big 4.

The correlation matrix is reported in Table III.[19] All three accounting service areas (*AA, TAX* and *MAS*) have a positive and significant relation with each other, implying that AA, TAX and MAS are complements, not substitutes, for one another. *BIG4* has positive relations with *AA, TAX,* and *MAS*.

Panel A of Table IV reports Models (1), (2) and (3) OLS results for our first hypothesis. We use year fixed effects to control for the variations in the dependent variable that change over time and standard errors clustered by firms. Col(1) is for Model (1) to test revenue persistence of AA. We find that $ln(AA_{t-1})$ has a positive and significant relation with *ln*

Variables	Definition
$Ln(REV_t)$	The natural log of net revenue from US operations in dollars (in millions) at year t
$Ln(AA_t)$	The natural log of revenue from accounting and auditing services (in millions) at year t
$Ln(TAX_t)$	The natural log of revenue from taxation services (in millions) at year t
$Ln(MAS_t)$	The natural log of revenue from management advisory (consulting) services (in millions) at year t
LEV_t	The number of professionals divided by the number of partners
$OFFICE_t$	Number of offices within the USA
$NCEO_t$	Number of CEOs during the sample period (1999-2015)
CEO_CHANGE_t	= 1 if in the year the firm changed CEO, = 0 otherwise
$NEAST_t$	= 1 if headquarter state is New York, New Jersey, Pennsylvania, Maryland, Virginia, Connecticut, = 0 otherwise
$MWEST_t$	= 1 if headquarter state is Illinois, Indiana, Minnesota, Michigan, Missouri, Wisconsin, North Dakota, Kansas, Ohio, = 0 otherwise
$WEST_t$	= 1 if headquarter state is California, Washington, Colorado, = 0 otherwise
$SOUTH_t$	= 1 if headquarter state is Georgia, Alabama, Florida, Tennessee, North Carolina, South Carolina, = 0 otherwise
$MERGE_t$	= 1 if in the year the firm merged with another accounting firm, = 0 otherwise
SOX	= 1 if year >=2003, = 0 otherwise
CRISIS	= 1 if year >=2008, = 0 otherwise
BIG4	= 1 for PWC, Deloitte, KPMG and E&Y, = 0 otherwise
MID-TIER	= 1 for Grant Thornton, BDO Seidman, RSM McGladrey and Crowe Horwath, = 0 otherwise

Table I.
Definition of variables

Panel A. Descriptive statistics for all variables

	N	Mean	Median	Q1	Q3	SD
REV	742	543.679	52.583	32.491	175.163	1,741.863
AA	742	228.303	22.926	12.942	72.079	738.320
TAX	742	143.652	17.892	10.512	54.459	433.071
MAS	742	153.031	8.442	3.950	34.588	589.341
BIG4	742	0.063	0.000	0.000	0.000	0.244
MID-TIER	742	0.086	0.000	0.000	0.000	0.281
LEV	742	6.703	6.097	4.960	8.103	2.435
OFFICE	742	18.960	9.000	3.000	20.000	27.581
NCEO	742	2.833	3.000	2.000	3.000	1.193
CEO_CHANGE	742	0.096	0.000	0.000	0.000	0.294
NEAST	742	0.363	0.000	0.000	1.000	0.481
MIDWEST	742	0.431	0.000	0.000	1.000	0.496
WEST	742	0.082	0.000	0.000	0.000	0.275
MERGE	742	0.016	0.000	0.000	0.000	0.126

Panel B. Trends of revenue sources

	All firms			Big 4 firms			Mid-tier firms			Small firms		
Year	AA	TAX	MAS	AA	TAX	MAS	AA	TAX	MAS	AA	TAX	MAS
2000	207	128	215	2,192	1,313	2,393	125	106	88	16	12	10
2001	157	107	123	1,989	1,315	1,649	137	113	86	18	13	10
2002	161	104	79	2,048	1,242	976	138	125	86	18	14	10
2003	143	90	56	2,511	1,461	906	160	133	78	20	15	10
2004	160	93	63	2,700	1,475	1,024	186	125	87	23	17	10
2005	274	126	77	3,378	1,431	860	296	168	117	26	18	11
2006	133	71	69	3,261	1,594	2,102	333	166	107	30	21	12
2007	183	96	99	2,774	1,366	1,811	382	191	112	33	23	12
2008	184	107	108	2,754	1,526	1,953	376	208	152	36	26	12
2009	173	109	107	2,487	1,531	1,908	366	209	148	39	28	13
2010	208	136	141	2,279	1,487	1,852	341	200	131	39	28	14
2011	480	284	253	2,476	1,606	1,976	313	205	135	297	160	93
2012	279	184	206	2,599	1,661	2,167	300	207	154	45	34	15
2013	280	198	243	2,588	1,784	2,573	307	218	173	47	37	17
2014	289	212	270	2,644	1,893	2,845	325	237	205	50	41	19
2015	313	229	301	2,861	2,036	3,157	351	270	248	54	44	21

Panel C. Comparison of Big 4, mid-tier and small firms

	Big 4 firms	Mid-tier firms	Small firms
Revenue (in millions of $)	6,341.257	602.624	105.868
Number of offices	99.872	52.313	9.550
Number of partners	2,370.702	395.563	66.189
Number of professionals	25,317.020	2,839.703	400.721

Table II.
Descriptive statistics

(AA_t) (β_1=0.538 at significance p-value = 0.007), implying that AA generates persistent revenue stream. Col(2) is for Model (2) to test whether TAX revenue is persistent. We find that $ln(TAX_{t-1})$ has a positive and significant relation with $ln(TAX_t)$ (β_2 = 0.415 at significance p-value = 0.043), implying that TAX also generates persistent revenue stream. The results of Model (3) for MAS and its revenue persistence is shown in Col(3). We find that $ln(MAS_{t-1})$ has a positive and significant relation with $ln(MAS_t)$ (β_3 = 0.741 at significance p-value = 0.000) which shows the revenue persistence of MAS. When comparing the revenue persistence of AA, TAX, and MAS, the magnitude of the coefficient for $ln(MAS_{t-1})$ is the

Table III.
Correlation matrix
(N = 742)

	REV	AA	TAX	MAS	BIG4	MID TIER	LEV
REV	1.000						
AA	0.970*** (0.000)	1.000					
TAX	0.980*** (0.000)	0.982*** (0.000)	1.000				
MAS	0.928*** (0.000)	0.815*** (0.000)	0.848*** (0.000)	1.000			
BIG4	0.866*** (0.000)	0.821*** (0.000)	0.859*** (0.000)	0.813*** (0.000)	1.000		
MID-TIER	0.010 (0.777)	0.020 (0.580)	0.026 (0.482)	−0.011 (0.763)	−0.080** (0.030)	1.000	
LEV	0.404*** (0.000)	0.352*** (0.000)	0.371*** (0.000)	0.438*** (0.000)	0.397*** (0.000)	0.046 (0.209)	1.000
OFFICE	0.713*** (0.000)	0.676*** (0.000)	0.708*** (0.000)	0.668*** (0.000)	0.763*** (0.000)	0.372*** (0.000)	0.337*** (0.000)
NCEO	0.351*** (0.000)	0.326*** (0.000)	0.346*** (0.000)	0.343*** (0.000)	0.347*** (0.000)	0.365*** (0.000)	0.030 (0.420)
CEO_CHANGE	0.091** (0.013)	0.078** (0.034)	0.086** (0.020)	0.092** (0.012)	0.104*** (0.005)	0.047 (0.202)	0.049 (0.180)
NEAST	0.300*** (0.000)	0.292*** (0.000)	0.297*** (0.000)	0.274*** (0.000)	0.345*** (0.000)	−0.232*** (0.000)	0.018 (0.631)
MIDWEST	−0.178*** (0.000)	−0.171*** (0.000)	−0.173*** (0.000)	−0.167*** (0.000)	−0.226*** (0.000)	0.353*** (0.000)	0.064* (0.081)
WEST	−0.079** (0.031)	−0.078** (0.034)	−0.078** (0.034)	−0.071* (0.054)	−0.078** (0.034)	−0.092** (0.012)	−0.021 (0.573)
MERGE	−0.025 (0.498)	−0.024 (0.510)	−0.022 (0.554)	−0.026 (0.478)	−0.033 (0.364)	−0.001 (0.971)	−0.006 (0.869)

Notes: Numbers in parentheses are Pr > |t| value, the estimated probability that the regression coefficient is equal to zero

(*continued*)

	OFFICE	NCEO	CEO_CHANGE	NEAST	MID WEST	WEST	MERGE
REV							
AA							
TAX							
MAS							
BIG4							
MID-TIER							
LEV							
OFFICE	1.000						
NCEO	0.546*** (0.000)	1.000					
CEO_CHANGE	0.131*** (0.000)	0.149*** (0.000)	1.000				
NEAST	0.083** (0.024)	0.038 (0.308)	−0.036 (0.332)	1.000			
MIDWEST	0.067* (0.068)	0.012 (0.734)	0.022 (0.549)	−0.657*** (0.000)	1.000		
WEST	−0.112*** (0.002)	0.030 (0.421)	0.036 (0.326)	−0.226*** (0.000)	−0.261*** (0.000)	1.000	
MERGE	0.042 (0.257)	0.027 (0.464)	0.031 (0.400)	−0.030 (0.414)	0.039 (0.284)	−0.038 (0.297)	1.000

Table III.

$$ln(AA_t) = \alpha + \beta_1 \ln(AA_{t-1}) + \beta_4 \ln(REV_t) + \sum_{i=5}^{14} \beta_i Controls + \varepsilon \quad (1)$$

$$ln(TAX_t) = \alpha + \beta_2 \ln(TAX_{t-1}) + \beta_4 \ln(REV_t) + \sum_{i=5}^{14} \beta_i Controls + \varepsilon \quad (2)$$

$$ln(MAS_t) = \alpha + \beta_3 \ln(MAS_{t-1}) + \beta_4 \ln(REV_t) + \sum_{i=5}^{14} \beta_i Controls + \varepsilon \quad (3)$$

Panel A. One-year ahead revenue from accounting services

		Col(1) $\ln(AA_t)$	Col(2) $\ln(TAX_t)$	Col(3) $\ln(MAS_t)$
$\ln(AA_{t-1})$	β_1	0.538*** (0.007)		
$\ln(TAX_{t-1})$	β_2		0.415** (0.043)	
$\ln(MAS_{t-1})$	β_3			0.741*** (0.000)
$\ln(REV_t)$	β_4	0.558** (0.013)	0.595*** (0.004)	0.398*** (0.009)
BIG4	β_5	−0.463*** (0.002)	−0.423*** (0.006)	−0.270 (0.209)
MID-TIER	β_6	−0.072 (0.223)	−0.167** (0.029)	−0.169 (0.116)
LEV_t	β_7	0.001 (0.897)	0.000 (0.982)	0.004 (0.602)
$OFFICE_t$	β_8	−0.000 (0.704)	0.002* (0.057)	−0.003 (0.167)
$NCEO_t$	β_9	−0.015 (0.309)	−0.003(0.845)	0.028(0.413)
CEO_CHANGE_t	β_{10}	0.008 (0.568)	−0.022* (0.061)	0.065 (0.118)
$NEAST_t$	β_{11}	0.056 (0.363)	−0.006 (0.862)	−0.147* (0.052)
$MWEST_t$	β_{12}	−0.073 (0.239)	−0.054 (0.244)	0.007 (0.929)
$WEST_t$	β_{13}	0.010 (0.914)	0.070 (0.507)	−0.172** (0.023)
$MERGE_t$	β_{14}	0.029 (0.661)	0.044 (0.488)	0.019(0.904)
Constant	α	−0.640** (0.046)	−0.652** (0.026)	−0.793** (0.042)
N		742	742	742
adj. R-sq		0.985	0.984	0.941
R-sq		0.985	0.985	0.943
Mean VIF		3.41	3.56	2.71
F-Statistics		1346.446	957.331	822.767
Prob > F		0.000	0.000	0.000

Panel B. Two-year/three-year ahead revenue from accounting services

		2-year ahead			3-year ahead		
		Col(1) ln(AA_t)	Col(2) ln(TAX_t)	Col(3) ln(MAS_t)	Col(4) ln(AA_t)	Col(5) ln(TAX_t)	Col(6) ln(MAS_t)
ln(AA_t-2)	β_1	0.456*** (0.009)					
ln(TAX_t-2)	β_2		0.347** (0.040)				
ln(MAS_t-2)	β_3			0.637*** (0.000)			
ln(AA_t-3)	β_1				0.396*** (0.010)		
ln(TAX_t-3)	β_2					0.301** (0.032)	
ln(MAS_t-3)	β_3						0.588*** (0.000)
Control Variables		Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes
N		694	694	687	648	648	636
adj. R-sq		0.982	0.983	0.918	0.980	0.982	0.905
R-sq		0.982	0.984	0.921	0.981	0.983	0.909
Mean VIF		3.29	3.39	2.66	3.24	3.29	2.62
F-Statistics		801.190	898.836	437.045	516.688	861.674	209.587
Prob > F		0.000	0.000	0.000	0.000	0.000	0.000

Table IV.
Revenue persistence of accounting services

Notes: Numbers in parentheses are Pr > |t| value, the estimated probability that the regression coefficient is equal to zero; *, **, ***indicate significantly different from zero at the 10%, 5% and 1% levels, respectively

biggest, followed by the coefficient for $ln(AA_{t-1})$ and $ln(TAX_{t-1})$. The coefficient for $ln(MAS_{t-1})$ is significantly different from that for $ln(AA_{t-1})$ and $ln(TAX_{t-1})$ *at 1 per cent* significance level. The results are consistent with our prediction: because MAS is a customized service and thus faces less competition than AA and TAX, MAS generates more persistent revenue than AA and TAX.

We also examine the revenue persistence of accounting services by using two-year and three-year ahead revenue as a robustness check. The OLS results are shown in Panel B of Table IV. Similar to Panel A, all of the coefficients for independent variables (i.e. $ln(AA_{t-2})$, $ln(AA_{t-3})$, $ln(TAX_{t-2})$, $ln(TAX_{t-3})$, $ln(MAS_{t-2})$, and $ln(MAS_{t-3})$) are significantly positive, which implies that revenue from AA, TAX, and MAS are persistent up to three years. Also, the coefficients for $ln(MAS_{t-2})$ and $ln(MAS_{t-3})$ are the most substantial in magnitude and confirm our prediction which is that MAS generates more persistent revenue than AA and TAX even when using two-year and three-year ahead revenue. The coefficient of $ln(MAS_{t-2})$ and $ln(MAS_{t-3})$ significantly different from that of $ln(AA_{t-2})$ *and* $ln(AA_{t-3})$, and $ln(TAX_{t-2})$ *and* $ln(TAX_{t-3})$, at 10 per cent and 1 per cent significance level, respectively. β_3, the coefficients for $ln(MAS_{t-1})$, $ln(MAS_{t-2})$, and $ln(MAS_{t-3})$ are 0.741, 0.637 and 0.588, respectively, when using contemporary revenue from MAS, $ln(MAS_t)$. The results show that revenue persistence of MAS is decreasing as the time horizon increases.

The results of Table IV support our first hypothesis on MAS's revenue persistence.

Table V provides the explanation on how SOX affects revenue persistence of accounting services. We use OLS with robust standard errors clustered by firm and year fixed effects in Table V. Col(1), Col(2), and Col(3) of Panel A, show the SOX effect on revenue persistence of AA, TAX, MAS when using one-year ahead revenue from the accounting services. Consistent with Table IV, $ln(AA_{t-1})$, $ln(TAX_{t-1})$, *and* $ln(MAS_{t-1})$ have a significantly positive effect on $ln(AA_t)$, $ln(TAX_t)$, *and* $ln(MAS_t)$ at the 1 per cent, 5 per cent, and 1 per cent significance level respectively. Again, the magnitude of the coefficient for $ln(MAS_{t-1})$ is the biggest, implying that MAS has the most persistent revenue stream. The SOX effect on the revenue persistence of accounting services is captured by the coefficients β_4, β_5, and β_6. $ln(AA_{t-1})$*SOX and $ln(TAX_{t-1})$*SOX have insignificant coefficients (β_4=0.004 at significance p-value = 0.827 and $\beta_5 = -0.011$ at significance p-value = 0.529). In contrast, $ln(MAS_{t-1})$*SOX has a positive and significant relation with $ln(MAS_t)$ ($\beta_6 = 0.093$ at significance p-value = 0.015). Unlike AA and TAX which are relatively standardized services, MAS is a customized service to meet the unique needs of clients. Hence, the MAS market is less competitive and generates a more persistent revenue stream than AA and TAX. In the pre-SOX period, MAS tended to be an add-on to AA services because auditors were more likely to provide MAS to their audit clients (Kinney *et al.*, 2004). As a result, accounting firms did not use the competitive advantage of MAS services in the pre-SOX period. However, SOX bans the provision of MAS by incumbent auditors. Thus, in the post-SOX period, accounting firms have developed MAS as a separate product and now fully use the competitive advantage of MAS services. Moreover, compared to AA and TAX, the market for MAS is less competitive. As a result, MAS contributes to a more persistent stream of revenue in the post-SOX period. Panel B of Table V shows the results using two- and three-years ahead revenue. The results are similar to Panel A of Table V. Only the coefficients for $ln(MAS_{t-2})$*SOX and $ln(MAS_{t-3})$*SOX have a significantly positive effect on $ln(MAS_t)$ [$\beta_6 = 0.072$ at significance p-value = 0.093 for two-year ahead MAS revenue (Col(3)) and $\beta_6 = 0.099$ at significance p-value = 0.020 for three-year ahead MAS revenue (Col(6))].

Table V supports our second hypothesis: SOX has a positive effect on the revenue persistence of MAS.

Table VI is the OLS result of our models for the third hypothesis. We use robust standard errors clustered by firm and year fixed effects in Table VI. The variables of

$$\ln(AA_t) = \alpha + \beta_1 \ln(AA_{t-1}) + \beta_4 \ln(AA_{t-1}) * SOX + \beta_7 SOX + + \beta_8 \ln(REV_t) + \sum_{i=9}^{18} \beta_i Controls + \varepsilon \quad (4)$$

$$\ln(TAX_t) = \alpha + \beta_2 \ln(TAX_{t-1}) + \beta_5 \ln(TAX_{t-1}) * SOX + \beta_7 SOX + \beta_8 \ln(REV_t) + \sum_{i=9}^{18} \beta_i Controls + \varepsilon \quad (5)$$

$$\ln(MAS_t) = \alpha + \beta_3 \ln(MAS_{t-1}) + \beta_6 \ln(MAS_{t-1}) * SOX + \beta_7 SOX + \beta_8 \ln(REV_t) + \sum_{i=9}^{18} \beta_i Controls + \varepsilon \quad (6)$$

Panel A. One-year ahead revenue from accounting services

		Col(1) $\ln(AA_t)$	Col(2) $\ln(TAX_t)$	(3) (MAS_t)
$\ln(AA_{t-1})$	β_1	0.535*** (0.006)		
$\ln(TAX_{t-1})$	β_2		0.425** (0.035)	
$\ln(MAS_{t-1})$	β_3			0.659*** (0.000)
$\ln(AA_{t-1})$ * *SOX*	β_4	0.004 (0.827)		
$\ln(TAX_{t-1})$ * *SOX*	β_5		−0.011 (0.529)	
$\ln(MAS_{t-1})$ * *SOX*	β_6			0.093**(0.015)
SOX	β_7	−0.153*** (0.008)	0.067 (0.412)	−0.511*** (0.001)
$\ln(REV_t)$	β_8	0.558** (0.014)	0.595*** (0.004)	0.394** (0.010)
BIG4	β_9	−0.464*** (0.002)	−0.420*** (0.006)	−0.293 (0.176)
MID-TIER	β_{10}	−0.073 (0.217)	−0.165** (0.031)	−0.186* (0.097)
LEV_t	β_{11}	0.001 (0.910)	0.000 (0.946)	0.002 (0.799)
$OFFICE_t$	β_{12}	−0.000 (0.766)	0.002* (0.069)	−0.002 (0.366)
$NCEO_t$	β_{13}	−0.016 (0.308)	−0.003 (0.869)	0.024 (0.473)
CEO_CHANGE_t	β_{14}	0.008 (0.566)	−0.022* (0.065)	0.064 (0.119)
$NEAST_t$	β_{15}	0.057 (0.360)	−0.007 (0.841)	−0.134* (0.067)
$MWEST_t$	β_{16}	−0.072 (0.244)	−0.055 (0.240)	0.015 (0.847)
$WEST_t$	β_{17}	0.011 (0.911)	0.069 (0.513)	−0.157** (0.033)
$MERGE_t$	β_{18}	0.028 (0.662)	0.045 (0.478)	0.009 (0.952)
Constant	α	−0.630* (0.072)	−0.680** (0.028)	−0.572 (0.151)
N		742	742	742
Adj R-sq		0.985	0.984	0.942
R-sq		0.985	0.985	0.945
Mean VIF		4.12	4.27	3.25
F-statistics		1,390.570	966.657	1,385.158
Prob > F		0.000	0.000	0.000

Panel B. Two-year/three-year ahead revenue from accounting services

		2-year ahead			3-year ahead		
		Col(1) ln(AA_t)	Col(2) ln(TAX_t)	Col(3) ln(MAS_t)	Col(4) ln(AA_t)	Col(5) ln(TAX_t)	Col(6) ln(MAS_t)
ln(AA_t-2)	β_1	0.455*** (0.007)					
ln(TAX_t-2)	β_2		0.366** (0.026)				
ln(MAS_t-2)	β_3			0.569*** (0.000)			
ln(AA_t-2)*SOX	β_4	0.002 (0.920)					
ln(TAX_t-2)*SOX	β_5		−0.020 (0.319)				
ln(MAS_t-2) *SOX	β_6			0.072* (0.093)			
ln(AA_t-3)	β_1				0.397*** (0.007)		
ln(TAX_t-3)	β_2					0.329** (0.015)	
ln(MAS_t-3)	β_3						0.493*** (0.000)
ln(AA_t-3)*SOX	β_4				−0.001 (0.962)		
ln(TAX_t-3)*SOX	β_5					−0.030 (0.161)	
ln(MAS_t-3)*SOX	β_6						0.099** (0.020)
SOX	β_7	−0.151** (0.019)	0.098 (0.225)	−0.177 (0.429)	−0.168** (0.018)	0.119 (0.137)	−0.246 (0.254)
Control variables		Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects		Yes	Yes	Yes	Yes	Yes	Yes
N		694	694	687	648	648	636
Adj R-sq		0.982	0.983	0.918	0.980	0.982	0.905
R-sq		0.982	0.984	0.921	0.981	0.983	0.909
Mean VIF		4.11	4.22	3.36	6.15	4.56	3.68
F-statistics		940.858	839.634	424.849	511.694	800.630	184.624
Prob > F		0.000	0.000	0.000	0.000	0.000	0.000

Notes: Numbers in parentheses are Pr > |t| value, the estimated probability that the regression coefficient is equal to zero; *, **, ***indicate significantly different from zero at the 10%, 5% and 1% levels, respectively

Table V.
Impact of SOX on revenue persistence of accounting services

Table VI. Impact of financial crisis on revenue persistence of accounting services

$$\ln(AA_t) = \alpha + \beta_1 \ln(AA_{t-1}) + \beta_4 \ln(AA_{t-1})*CRISIS + \beta_7 CRISIS + \beta_8 \ln(REV_t) + \sum_{i=9}^{18} \beta_i Controls + \varepsilon \quad (7)$$

$$\ln(TAX_t) = \alpha + \beta_2 \ln(TAX_{t-1}) + \beta_5 \ln(TAX_{t-1})*CRISIS + \beta_7 CRISIS + \beta_8 \ln(REV_t) + \sum_{i=9}^{18} \beta_i Controls + \varepsilon \quad (8)$$

$$\ln(MAS_t) = \alpha + \beta_3 \ln(MAS_{t-1}) + \beta_6 \ln(MAS_{t-1})*CRISIS + \beta_7 CRISIS + \beta_8 \ln(REV_t) + \sum_{i=9}^{18} \beta_i Controls + \varepsilon \quad (9)$$

Panel A. One-year ahead revenue from accounting services

		Full sample			Post SOX		
		Col(1) ln(AA_t)	Col(2) ln(TAX_t)	Col(3) ln(MAS_t)	Col(4) ln(AA_t)	Col(5) ln(TAX_t)	Col(6) ln(MAS_t)
ln(AA_t−1)	β_1	0.554*** (0.004)			0.515*** (0.009)		
ln(TAX_t−1)	β_2		0.430** (0.028)			0.385** (0.048)	
ln(MAS_t−1)	β_3			0.704*** (0.000)			0.756*** (0.000)
ln(AA_t−1)*CRISIS	β_4	−0.028 (0.135)			−0.041** (0.018)		
ln(TAX_t−1)*CRISIS	β_5		−0.026 (0.166)			−0.031 (0.109)	
ln(MAS_t−1)*CRISIS	β_6			0.054 (0.115)			0.014 (0.575)
CRISIS	β_7	−0.050 (0.381)	0.117 (0.250)	−0.418*** (0.007)	0.035 (0.454)	0.159* (0.061)	−0.055 (0.583)
ln(REV_t)	β_8	0.561** (0.012)	0.597*** (0.004)	0.400*** (0.009)	0.618*** (0.008)	0.642*** (0.002)	0.373** (0.034)
BIG4	β_9	−0.452*** (0.003)	−0.411*** (0.008)	−0.299 (0.185)	−0.454*** (0.003)	−0.443*** (0.004)	−0.116 (0.494)
MID-TIER	β_{10}	−0.069 (0.252)	−0.164** (0.034)	−0.177 (0.111)	−0.045 (0.512)	−0.200*** (0.010)	−0.147 (0.198)
LEV_t	β_{11}	0.002 (0.737)	0.001 (0.820)	0.001 (0.869)	0.001 (0.921)	0.004 (0.542)	0.002 (0.784)
OFFICE_t	β_{12}	−0.001 (0.549)	0.002 (0.127)	−0.003 (0.275)	−0.001 (0.512)	0.003** (0.018)	−0.003 (0.286)
NCEO_t	β_{13}	−0.014 (0.359)	−0.002 (0.900)	0.026 (0.431)	−0.012 (0.522)	−0.008 (0.616)	0.013 (0.739)
CEO_CHANGE_t	β_{14}	0.006 (0.652)	−0.023* (0.054)	0.071* (0.093)	−0.005 (0.765)	−0.011 (0.392)	0.065 (0.150)
NEAST_t	β_{15}	0.054 (0.387)	−0.008 (0.815)	−0.144* (0.055)	0.074 (0.329)	0.004 (0.929)	−0.155* (0.070)
MWEST_t	β_{16}	−0.075 (0.234)	−0.057 (0.229)	0.012 (0.881)	−0.070 (0.342)	−0.055 (0.309)	0.036 (0.608)
WEST_t	β_{17}	0.006 (0.948)	0.066 (0.525)	−0.163** (0.029)	0.025 (0.816)	0.084 (0.429)	−0.157* (0.057)
MERGE_t	β_{18}	0.030 (0.653)	0.046 (0.469)	0.011 (0.944)	0.024 (0.719)	0.034 (0.601)	0.030 (0.855)
Constant	α	−0.702** (0.046)	−0.704** (0.027)	−0.700* (0.074)	−0.870** (0.017)	−0.800** (0.011)	−0.936* (0.065)
N		742	742	742	602	602	602

(continued)

Table VI.

$$\ln(AA_t) = \alpha + \beta_1 \ln(AA_{t-1}) + \beta_4 \ln(AA_{t-1})*CRISIS + \beta_7 CRISIS + \beta_8 \ln(REV_t) + \sum_{i=9}^{18} \beta_i Controls + \varepsilon \quad (7)$$

$$\ln(TAX_t) = \alpha + \beta_2 \ln(TAX_{t-1}) + \beta_5 \ln(TAX_{t-1})*CRISIS + \beta_7 CRISIS + \beta_8 \ln(REV_t) + \sum_{i=9}^{18} \beta_i Controls + \varepsilon \quad (8)$$

$$\ln(MAS_t) = \alpha + \beta_3 \ln(MAS_{t-1}) + \beta_6 \ln(MAS_{t-1})*CRISIS + \beta_7 CRISIS + \beta_8 \ln(REV_t) + \sum_{i=9}^{18} \beta_i Controls + \varepsilon \quad (9)$$

Panel A. One-year ahead revenue from accounting services

	Full sample			Post SOX		
	Col(1) ln(AA_t)	Col(2) ln(TAX_t)	Col(3) ln(MAS_t)	Col(4) ln(AA_t)	Col(5) ln(TAX_t)	Col(6) ln(MAS_t)
Adj R-sq	0.985	0.985	0.942	0.984	0.984	0.952
R-sq	0.985	0.985	0.944	0.985	0.985	0.954
Mean VIF	4.07	4.24	3.16	4.25	4.36	3.27
F-statistics	1,201.730	839.804	877.577	836.038	726.310	875.315
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000

Panel B. Two-year/three-year ahead revenue from accounting services

		Full sample 2-Year Ahead			Post SOX 3-Year Ahead	
		ln(AA_t)	ln(TAX_t)	ln(MAS_t)	ln(AA_t)	ln(TAX_t)	ln(MAS_t)
ln(AA_t−2)	β_1	0.454*** (0.006)					
ln(TAX_t−2)	β_2		0.338** (0.032)				
ln(MAS_t−2)	β_3			0.610*** (0.000)			
ln(AA_t−2)*CRISIS	β_4	−0.046** (0.012)					
ln(TAX_t−2)*CRISIS	β_5		−0.030 (0.129)				
ln(MAS_t−2)*CRISIS	β_6			0.046 (0.323)			
ln(AA_t−3)	β_1				0.419*** (0.004)		
ln(TAX_t−3)	β_2					0.309** (0.018)	
ln(MAS_t−3)	β_3						0.538*** (0.000)
ln(AA_t−3)*CRISIS	β_4				−0.053*** (0.003)		
ln(TAX_t−3)*CRISIS	β_5					−0.031 (0.103)	
ln(MAS_t−3)*CRISIS	β_6						0.069 (0.301)
CRISIS	β_7	0.020 (0.723)	0.164* (0.051)	−0.099 (0.557)	0.014 (0.829)	0.157** (0.049)	0.000 (0.999)

$$\ln(AA_t) = \alpha + \beta_1 \ln(AA_{t-1}) + \beta_4 \ln(AA_{t-1})*CRISIS + \beta_7 CRISIS + \beta_8 \ln(REV_t) + \sum_{i=9}^{18} \beta_i Controls + \varepsilon \quad (7)$$

(*continued*)

Table VI.

$$\ln(TAX_t) = \alpha + \beta_2 \ln(TAX_{t-1}) + \beta_5 \ln(TAX_{t-1})*CRISIS + \beta_7 CRISIS + \beta_8 \ln(REV_t) + \sum_{i=9}^{18} \beta_i Controls + \varepsilon \quad (8)$$

$$\ln(MAS_t) = \alpha + \beta_3 \ln(MAS_{t-1}) + \beta_6 \ln(MAS_{t-1})*CRISIS + \beta_7 CRISIS + \beta_8 \ln(REV_t) + \sum_{i=9}^{18} \beta_i Controls + \varepsilon \quad (9)$$

Panel B. Two-year/three-year ahead revenue from accounting services

		Full sample 2-Year Ahead			Post SOX 3-Year Ahead	
	ln(AA_t)	ln(TAX_t)	ln(MAS_t)	ln(AA_t)	ln(TAX_t)	ln(MAS_t)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	602	602	595	602	602	590
Adj R-sq	0.982	0.983	0.927	0.980	0.982	0.908
R-sq	0.983	0.984	0.930	0.981	0.983	0.912
Mean VIF	4.09	4.14	3.17	4.02	4.02	3.13
F-statistics	635.942	814.658	450.380	454.102	874.106	264.367
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000

Notes: Numbers in parentheses are Pr > |t| value, the estimated probability that the regression coefficient is equal to zero; *, **, ***indicate significantly different from zero at the 10%, 5% and 1% levels, respectively

interest are *ln(AA$_{t-1}$)*CRISIS, ln(TAX$_{t-1}$)*CRISIS, and ln(MAS$_{t-1}$)*CRISIS*. Panel A shows the results using one-year ahead revenue. Col(1), Col(2), and Col(3) are the results of the full sample period (1999-2015) after controlling for the firm characteristics. We find that *ln(AA$_{t-1}$), ln(TAX$_{t-1}$), and ln(MAS$_{t-1}$)* have positive and significant relations with *ln(AA$_t$), ln(TAX$_t$), and ln(MAS$_t$)* ($\beta_1 = 0.554$ at significance p-value = 0.004, $\beta_2 = 0.430$ at significance p-value = 0.028, and $\beta_3 = 0.704$ at significance p-value = 0.000). Consistent with Table IV and Table V, revenue from AA, TAX, and MAS are persistent to the subsequent year, while MAS shows the most persistent revenue stream. None of *ln(AA$_{t-1}$)*CRISIS, ln(TAX$_{t-1}$)*CRISIS,* and *ln(MAS$_{t-1}$)*CRISIS* are significant when using the full sample period. Col(4), Col(5), and Col(6) show the results only for the post-SOX period. SOX may have confounding effects on revenue persistence; therefore, we exclude the pre-SOX period which is from 1999 to 2002. The results are slightly different from those using the full-sample period. Col(4) shows that *ln(AA$_{t-1}$)*CRISIS* has a negative coefficient at 5 per cent significance level ($\beta_4 = -0.041$ at significance p-value = 0.018), implying that the financial crisis decreases the revenue persistence of AA services. We discussed that the financial crisis reduces the overall demand for audit services because many client corporations collapsed or were trying to cut costs to survive. The reduced demand, in turn, increased competition in the audit market, and then lowered the revenue persistence of AA services. Thus, our third hypothesis is supported. As shown in Col(5) and (6), after excluding the pre-SOX period, the results are consistent with Col(2) and (3): *ln(TAX$_{t-1}$)*CRISIS and ln(MAS$_{t-1}$)*CRISIS* are not significant.

Panel B of Table VI shows the results using two-year and three-year ahead revenue in the post-SOX period only. The results are consistent with Panel A of Table VI. All of the coefficients for *ln(AA$_{t-2}$), ln(AA$_{t-3}$), ln(TAX$_{t-2}$), ln(TAX$_{t-3}$), ln(MAS$_{t-2}$),* and *ln (MAS$_{t-3}$)* are significantly positive, which implies that revenue from AA, TAX, and MAS are persistent up to three years. MAS has the bigger coefficient than AA and TAX; therefore, it can be argued that MAS is more persistent than AA and TAX. Among the interaction terms, only the coefficients for *ln(AA$_{t-2}$)*CRISIS* and *ln(AA$_{t-3}$) *CRISIS* have significantly negative effects on the subsequent AA revenue in year t ($\beta_4 = -0.046$ at significance p-value = 0.012 for two-year ahead AA revenue and $\beta_4 = -0.053$ at significance p-value = 0.003 for three-year ahead AA revenue).

Hence, Table VI supports our prediction on the negative effect of the financial crisis on revenue persistence of AA.

5. Sensitivity analysis

To examine whether our results are driven by Big 4 accounting firms, we perform a sensitivity analysis. We examine Models (1), (2) and (3) using only non-Big 4 accounting firms. As demonstrated in our descriptive statistics in Table II, Panels B and C, Big 4 accounting firms are different from non-Big 4 accounting firms in terms of size, revenue structure, clientele, and resources. Thus, Big 4 accounting firms may not represent the rest of the sample. After dropping Big 4 accounting firms, our sample decreases from 742 to 694 firm-year observations. We use OLS with robust standard errors clustered by firm and year fixed effects in Table VII. The results are provided in Table VII and are consistent with our main results in Table IV – MAS has more persistent revenue stream than AA and TAX.

6. Conclusion

This paper examines the revenue persistence of the accounting services by identifying which accounting services generate more persistent revenue streams and how SOX and the

$$ln(AA_t) = \alpha + \beta_1 \ln(AA_{t-1}) + \beta_4 \ln(REV_t) + \sum_{i=5}^{14} \beta_i Controls + \varepsilon \quad (1)$$

$$ln(TAX_t) = \alpha + \beta_2 \ln(TAX_{t-1}) + \beta_4 \ln(REV_t) + \sum_{i=5}^{14} \beta_i Controls + \varepsilon \quad (2)$$

$$ln(MAS_t) = \alpha + \beta_3 \ln(MAS_{t-1}) + \beta_4 \ln(REV_t) + \sum_{i=5}^{14} \beta_i Controls + \varepsilon \quad (3)$$

		Col(1) $\ln(AA_t)$	Col(2) $\ln(TAX_t)$	Col(3) $\ln(MAS_t)$
$\ln(AA_{t-1})$	β_1	0.531*** (0.008)		
$\ln(TAX_{t-1})$	β_2		0.395** (0.053)	
$\ln(MAS_{t-1})$	β_3			0.735*** (0.000)
$\ln(REV_t)$	β_4	0.566** (0.013)	0.608*** (0.003)	0.396** (0.014)
MID-TIER	β_5	−0.081 (0.199)	−0.206*** (0.009)	−0.176 (0.111)
LEV_t	β_6	0.002 (0.706)	0.004 (0.480)	−0.002 (0.824)
$OFFICE_t$	β_7	−0.000 (0.835)	0.004*** (0.003)	−0.002 (0.479)
$NCEO_t$	β_8	−0.014 (0.392)	−0.002 (0.905)	0.011 (0.756)
CEO_CHANGE_t	β_9	0.012 (0.448)	−0.020 (0.140)	0.073 (0.108)
$NEAST_t$	β_{10}	0.058 (0.357)	0.001 (0.975)	−0.140* (0.070)
$MWEST_t$	β_{11}	−0.075 (0.235)	−0.061 (0.210)	0.010 (0.902)
$WEST_t$	β_{12}	0.009 (0.924)	0.072 (0.501)	−0.161** (0.033)
$MERGE_t$	β_{13}	0.024 (0.710)	0.027 (0.678)	0.024 (0.878)
Constant	α	−0.661** (0.048)	−0.681** (0.024)	−0.670* (0.090)
N		695	695	695
adj. R-sq		0.970	0.969	0.898
R-sq		0.971	0.970	0.902
Mean VIF		2.46	2.53	2.12
F-Statistics		808.636	825.519	680.049
Prob > F		0.000	0.000	0.000

Notes: Numbers in parentheses are Pr > |t| value, the estimated probability that the regression coefficient is equal to zero; *, **, ***indicate significantly different from zero at the 10%, 5% and 1% levels, respectively

Table VII. Revenue persistence of accounting services for non-Big 4 accounting firms

financial crisis of 2008 affect their revenue persistence. We analyze 742 US accounting firm-year observations from *Top 100 Firms,* published annually by *Accounting Today*, for the period of 1999-2015.

We first examine that revenue persistence varies across the different accounting services and find that, in general, MAS is a more sustainable source of accounting firms' revenue because it is a customized service facing limited competition. Next, we examine how SOX affects the level of revenue persistence of each accounting service. We find that the revenue persistence of MAS is enhanced by the enactment of SOX because SOX leads accounting firms to develop a separate clientele for MAS services. Last, we examine the impact of the financial crisis in 2008 on the revenue persistence of each accounting service and find that revenue from AA services becomes less sustainable in the post-crisis era. The financial crisis in 2008 increases competition in the audit market because of the collapse of many client corporations and the clients' initiative to make cost reductions during financially difficult times.

By identifying MAS as a sustainable source of revenue in post-SOX and the post financial crisis period of 2008, we contribute to understand how professional service firms such as accounting firms create their own playbook to maintain and/or lead their market status with exogenous events (e.g. SOX and the financial crisis). Owing to lack of data for profitability of the overall accounting industry, both practitioners and researchers lack

understanding of how accounting firms create their sustainable source of profit to win their competitors especially after exogenous events such as regulation changes and financial crisis. Within the data limitations, we aim to answer some unanswered questions. Finally, we expect our paper to have implications for the earnings persistence of accounting firms.

Notes

1. Private goods-producing industries include agriculture, forestry, fishing and hunting, mining, construction and manufacturing. (https://www.bea.gov)
2. Based on Lopez *et al.* (2009), we define the sustainable revenue as a revenue that has a high persistence.
3. According to *2017 Accounting Today Top 100 Firms*, 38 accounting firms out of 100 firms report they have 0 per cent of revenue from OTHERS. In addition, 66 accounting firms out of 100 firms have less than 10 per cent of revenue from OTHERS. Therefore, we use AA, MAS, and TAX as the major sources of their revenue.
4. Accounting firms are formed as partnerships; therefore, most of their profit information is not readily available to the public.
5. According to Lowendahl (2005), the professional service firms include law and accounting firms, advertising agencies, architectural practices, management and engineering consulting firms.
6. Associates do not have ownership rights but they cover partners' workload.
7. All Big 4 accounting firms advertise and emphasize on their websites that they are able to provide a wide variety of accounting services in their offices worldwide.
8. The major portion of operating expenses for accounting firms is the cost of personnel. Most accounting firms have similar types of personnel: partners, professionals and other employees (Media 2000, Rosenberg 2013, *Accounting Today* 2000/2016).
9. The accounting industry shares a relatively homogenous cost structure, where the operating expenses are driven by the compensation of professionals (Media 2000, Rosenberg 2013). Depending on the size and scope of accounting services, the proportion of operating expense to revenue may differ (Banker *et al.*, 2005).
10. Lev (1983) and Baginski *et al.* (1999) mention four economic factors which affect earnings persistence - firm size, barriers-to-entry, capital intensity and product-type. For firm size, large firms generate more persistent earnings than small firms because they have financial resources to stabilize growth, which leads to more persistent earnings (Scherer 1973). High barriers to entry increase the earnings persistence by limiting competition by restricting new entries. Capital intensity is another source of barriers to enter, which determines industry competition (Eaton and Lipsey 1981). For the product type, Lev (1983) and Baginski *et al.* (1999) argue that compared to durable goods and services, demand for nondurable goods and services shows a stable pattern over time and thus more persistent growth.
11. *Top 100 Firm* ranks accounting firms based on their revenue. The following information is provided annually for the top 100 ranked firms: city and state of accounting firms' headquarter, name of chief executive, the month of fiscal year-end, revenue (in dollars), number of offices, number of personnel (partners, professionals and total employees) and percentages of revenue from each type of their accounting services (accounting and auditing, tax, management advisory services and others).
12. If accounting firms have any other type of accounting services that cannot be classified into *AA, TAX* and *MAS*, they report as *OTHERS*.
13. We have controlled *REV* for inflation (use 1998 as a base year).

14. Accounting firms with higher leverage means their services rely more on utilizing billable hours of professionals (i.e. template based services) compared to those with lower leverage (Maister 1997).
15. Some companies have reported more than one CEO and we have counted their CEOs based on the names the companies provide as CEOs.
16. For companies that had more than one CEO during our sample periods, and any one of them changed, we code *CEO_CHANGE*=1.
17. We define the pre-SOX period as sample years from 1999 to 2002 and the post-SOX period as sample years from 2003 to 2015.
18. We define the pre-CRISIS period as sample years from 1999 to 2007 and the post-CRISIS period as sample years from 2008 to 2015.
19. We have checked the variable inflation factor (VIF) to ensure multicollinearity issue. We find AA_t, TAX_t, and MAS_t are highly correlated with their lagged variables (AA_{t-1}, TAX_{t-1} and MAS_{t-1}) and with contemporary revenue (REV_t). To mitigate multicollinearity issue, we use a change model and the results are consistent with our main findings.

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