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Audit effort and earnings management ☆

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Abstract

We test the effect of audit effort on earnings management using a unique database of hours worked by auditors on 9,738 audits in Greece between 1994 and 2002. When audit hours are lower, (1) abnormal accruals are more often positive than negative, (2) positive abnormal accruals are larger, and (3) companies are more likely to manage earnings upwards in order to meet or beat the zero earnings benchmark. These results persist after we control for endogeneity between audit hours and earnings management. We conclude that low audit effort increases the extent to which managers are able to report aggressively high earnings.

JEL classification: M49

Keywords: Auditing; Hours; Effort; Earnings management

1. Introduction

Audit quality is defined as the joint probability that an existing material error is detected and reported by an auditor (DeAngelo, 1981). Audit *effort* affects the probability that the auditor *detects* an existing problem, whereas auditor *independence* affects the probability that the auditor *reports* a detected problem. Prior studies primarily investigate whether earnings management is related to factors that could impair auditor independence. Such factors include fees from audit and non-audit services, client importance and audit firm tenure (Frankel et al., 2002; Reynolds and Francis, 2000; Myers et al., 2003). However, there is no

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evidence regarding the effect of audit *effort* on earnings management. In analytical research, hard-working auditors are more likely to detect that earnings are overstated (e.g., Dye, 1993, 1995; Hillegeist, 1999), so theory leads us to predict that audit effort has a negative impact on income-increasing earnings management.

The paucity of evidence on audit effort is mainly attributable to the unavailability of large datasets of audit hours. In Greece, however, audit firms are required to disclose hours to the professional accounting institute, SOEL (SOEL is the translated acronym for the Institute of Certified Auditors-Accountants of Greece), which has provided the data to us for the purpose of academic research. Greece is a good case study, not only because of the availability of data on audit hours, but also because earnings management is rampant there (Leuz et al., 2003). As explained later, earnings management may be widespread in Greece because auditors have low incentives to exert effort.

Auditors jeopardize their reputations (and risk litigation) if their clients are found to have overstated earnings, but there is generally no "penalty" when companies understate earnings (St. Pierre and Anderson, 1984; Kellogg, 1984). Consistent with auditors facing asymmetric loss functions, auditors and clients tend to disagree about accounting choices that are income-increasing rather than income-decreasing and auditors generally require their clients to adjust earnings downwards (DeFond and Jiambalvo, 1993; Kinney and Martin, 1994; Nelson et al., 2002). Thus, we focus on the association between audit effort and *income-increasing* earnings management, although we also report results for income-decreasing earnings management. Another reason for focusing on the direction of earnings management is that unsigned measures of abnormal accruals heighten the threat of correlated omitted variable problems (Hribar and Nichols, 2006).

We measure earnings management by estimating abnormal accruals using the model of Jones (1991). We expect greater audit effort to reduce the extent to which managers report aggressively high earnings. Thus, we predict that (1) abnormal accruals are more likely to be positive when audit hours are lower and (2) the magnitude of positive abnormal accruals is greater when audit hours are lower. We make no prediction about the association between audit hours and the magnitude of negative abnormal accruals. Our tests use audit hours data from 9,738 engagements performed between 1994 and 2002.

Audit hours are endogenous and, a priori, it is unclear in which direction endogeneity might bias the results (Hansen and Watts, 1997). On the one hand, auditors might work harder if they believe that clients are attempting to manage earnings. In this case, endogeneity would induce a spurious *positive* relation between audit hours and earnings management. On the other hand, clients that wish to manage earnings can anticipate that hard-working auditors are more likely to thwart their earnings management attempts and might therefore contract with their auditors to exert less effort. In this case, endogeneity would induce a *negative* relation between audit hours and earnings management. This is consistent with our argument that audit effort reduces earnings management because, if audit effort did not reduce earnings management, then clients that intend to manage earnings would not have incentives to contract for lower audit effort in the first place.

To address the endogeneity issue, we use two-stage instrumental variables (IV) estimation. In the first stage, we estimate a model of audit hours and we use the estimated coefficients to obtain predicted hours. We find that audit hours are strongly related to client size and auditors work significantly more hours in initial audit engagements, consistent with the existence of set-up costs in the first year. We also demonstrate that the Big Five audit firms (Arthur Andersen, Deloitte & Touche, Ernst & Young, KPMG, and Pricewaterhouse Coopers) work more hours than do non-Big Five firms, which corroborates the view that the Big Five supply higher-quality audits (Becker et al., 1998). These findings provide some assurance that audit hours are a reasonable proxy for audit effort.

In the second stage, the predicted hours from the first stage become an independent variable in our earnings management models. While IV estimation is the standard textbook solution to endogeneity, it is only reliable if (1) there is an instrumental variable that is strongly correlated with audit hours and (2) the instrumental variable is uncorrelated with the error term in the earnings management model (Larcker and Rusticus, 2005). Both conditions are met by an hours variable that is lagged by one year. Audit hours are highly persistent over time, making the previous year's hours a powerful predictor of the current year's hours. In addition, our tests fail to reject the null hypothesis that the predicted hours variable is exogenous. That is, lagged hours can be thought of as pre-determined with respect to earnings management in the current year.

Our first main finding is that abnormal accruals are more likely to be positive when audit hours are lower. Our second finding is that the magnitude of income-increasing abnormal accruals is greater when audit hours

are lower. Together, these results suggest that low audit effort is associated with income-increasing earnings management. In contrast, we find weak or insignificant associations between audit hours and income-decreasing earnings management, a finding that is consistent with auditors having asymmetric loss functions.

Since abnormal accruals are simply the residuals from the Jones model, approximately 50% of companies are estimated to have positive abnormal accruals. This frequency likely overstates the proportion of companies that actually manage earnings upwards, even in a country like Greece that has poor accounting quality. Degeorge et al. (1999) argue that managers overstate earnings in order to avoid reporting losses, and they find a significant discontinuity around zero in the earnings distribution. We document that this earnings discontinuity is much more pronounced in Greece than in the US, consistent with earnings management being more widespread in Greece. Therefore, we combine the abnormal accruals variable with an indicator for whether or not the company just meets or beats the zero earnings benchmark.

We identify companies as managing earnings upwards if (1) reported earnings are small and positive, (2) abnormal accruals are positive, and (3) reported earnings would have been negative if abnormal accruals had been zero. Within our sample, 633 (6.5%) companies meet these conditions, so this is a much narrower measure of income-increasing earnings management than are positive abnormal accruals. Results using this alternative measure remain consistent with the abnormal accrual models. Specifically, we find that low audit hours are associated with companies managing earnings upwards in order to avoid reporting losses.

Finally, we test whether the association between audit effort and earnings management is different between Big Five and non-Big Five firms. On the one hand, it could be argued that the impact of additional audit effort on earnings management is greater for Big Five firms because they supply higher-quality audits. On the other hand, we document that Big Five firms work more hours than non-Big Five firms (after controlling for client characteristics) and that there are diminishing returns to audit effort. Diminishing returns imply that the marginal impact of an additional audit hour could be smaller for Big Five firms because they work longer hours.

Our tests reveal a significantly stronger negative relation between audit hours and income-increasing earnings management for Big Five firms. Thus, not only do the Big Five firms work longer hours, but also, the *per unit* impact of an additional audit hour on earnings management is greater for Big Five firms.

Our study makes a unique contribution to the literature by using data on audit engagement hours to examine the impact of audit effort on earnings management. In a related study, Hansen and Watts (1997) examine the strategic interaction between the costs of audit testing and earnings management. Consistent with their game theoretic model, they find that managers are less likely to manage earnings when the costs of audit testing are lower. However, audit hours data are unavailable in their empirical setting and they do not attempt to measure audit effort.

Section 2 provides institutional detail about auditing in Greece and explains the research design. Section 3 describes the sample and provides descriptive statistics. Section 4 reports the main results and Section 5 concludes.

2. Institutional background and research design

2.1. Auditing in Greece

Corporate auditing in Greece began in 1955 with the establishment of a state auditing body, the Body of Sworn-In Accountants (BSA), which enjoyed a legal monopoly over statutory audit engagements. In 1979, the international accounting firms established a rival organization, the Society of Certified Accountants-Auditors (SCAA), which lobbied for the termination of BSA's monopoly. After a political struggle between the two organizations, the government abolished BSA in 1992, a reform that became effective for most companies in fiscal year 1993.

As part of the reform package, the government created a new accounting body, SOEL, to self-regulate the audit profession. After the audit market was liberalized, many of BSA's former employees joined together to form one very large Greek audit firm, SOL SA. At the same time, several smaller Greek audit firms were formed and the Big Five firms and two smaller international firms (Grant Thornton and Moore Stephens) began to supply statutory audit services in Greece.

Every engagement partner is required to report to SOEL the aggregate hours worked on an audit. To trace any engagements with missing hours, SOEL matches the name of each company's auditor (as listed in the Government Gazette) with its own database. SOEL sends reminders to any partner who fails to report hours, and partners are not permitted to retire unless they submit data for all their audit engagements. SOEL also performs reasonableness tests to identify data inaccuracies (e.g., they compare reported hours with the company's size). The requirement for partners to disclose hours is mandated both in Greek law (Article 16 of Presidential Decree 226/1992, Law 2231, Article 18, Paras. 5 & 6) and in guidelines issued by SOEL. There are legal penalties for non-reporting and inaccurate reporting although SOEL have informed us that, to date, it has not been necessary for them to take legal action. Despite that partners are required to disclose audit hours to SOEL the information is not publicly available.

In contrast to the US, annual audits are mandatory in Greece both for public companies and for private companies that exceed two of the following size criteria for two consecutive years: (1) €1.47 million in total assets, (2) €2.93 million in sales, and (3) 50 employees. Moreover, earnings management is widespread in both public and private companies (Burgstahler et al., 2006; Caramanis and Spathis, 2006). In fact, Leuz et al. (2003) rank Greece as having the most earnings management in an international study of 31 countries (Greece is tied for highest with Austria).

Caramanis and Spathis (2006) report that 87.6% of public Greek companies received qualified audit opinions in 2001 and many opinions are qualified because the companies fail to comply with GAAP (see also Baralexis, 2004; Sougiannis et al. 2008).[1] In comparison, Butler et al. (2004) find that only 0.5% of public US companies received qualified audit opinions between 1994 and 1999. Greek audit opinions are qualified due to capitalized expenses, inadequate provisions for taxes, bad debts and depreciation, and other accounting problems (Caramanis and Spathis, 2006). In a survey of auditors in Greece, Baralexis (2004) reports that 68% believe earnings overstatements are more common than earnings understatements while 18% believe that understatements are more common (the remaining 14% express no view). Baralexis (2004) also finds that bank finance is the most important motive for companies to overstate profits, which is unsurprising since the Athens stock market is not well developed.

Audit liability in Greece is capped at five times the salary of the Supreme Court President, for a total cap of €315,000 in 2002, so the litigation threat is small and auditors have little incentive to exert effort. Even in countries that have low litigation risk, however, auditing is in great demand. For example, litigation against auditors was very rare in the US prior to 1966 (Lys and Watts, 1994), yet auditors were presumably providing a useful attestation service and exerting effort. We argue that auditors exert some degree of effort as long as professional standards and regulatory bodies help to monitor auditors' actions. This is certainly the case in Greece, where professional auditing standards are enforced by the Supervisory Council of SOEL, which handled 100 disciplinary cases between 1993 and 2003.

Reputation concerns may also motivate auditors to exert some effort (DeAngelo, 1981). In Greece, audit scandals have featured prominently in both the daily press and specialist publications, and auditors have incentives to avoid being associated with such scandals.[2] To summarize, auditors in Greece have some incentive to exert effort although these incentives are much weaker than in the US, where auditors face high litigation and reputation risk.

2.2. The earnings management models

We measure total accruals using the balance sheet approach rather than the cash flow statement approach of Collins and Hribar (2002), because most Greek companies do not provide cash flow statements. Total accruals ($ACCRUALS_{it}$) are the change in non-cash current assets minus the change in non-debt current liabilities minus depreciation, scaled by lagged total assets. Abnormal accruals (DA_{it}) are the residuals from

[1]The audit opinions in these studies are collected by hand because audit opinion data are not available from public databases in Greece.

[2]In one scandal, an accountant employed by the Bank of Crete misappropriated most of the bank's funds, which he then used to acquire the bank itself, a leading soccer club, two newspapers, a magazine, and a radio station. Several politicians and government officials were associated with the scandal and the negative publicity played a significant role in causing a change of government. The auditor who signed the Bank of Crete's financial statements was expelled from the profession and subsequently received a long prison sentence.

the Jones (1991) model:

$$ACCRUALS_{it} = a_{0jt} + a_{1jt}(1/ASSET_{it-1}) + a_{2jt}\Delta SALES_{it} + a_{3jt}PPE_{it} + \varepsilon_{it}, \quad (1)$$

where $ASSET_{it-1}$ is the lagged total assets, $\Delta SALES_{it}$ the change in sales scaled by lagged assets, and PPE_{it} the net property, plant and equipment scaled by lagged assets. The j subscript denotes the company's industry at the two-digit level. We estimate Eq. (1) for each industry-year that has at least 30 observations. We include an industry-year intercept (α_{0jt}) to reduce the impact of heteroscedasticity and omitted scale effects (Kothari et al., 2005).

Since our main arguments concern income-increasing earnings management, we distinguish between positive and negative abnormal accruals. The first earnings management variable is $Sign\_DA_{it}$, which equals one if abnormal accruals are income-increasing ($DA_{it} > 0$) and zero otherwise. The second variable ($DA_{it}{}^{+}$) captures the magnitude of income-increasing abnormal accruals ($DA_{it}{}^{+}$ equals DA_{it} if $DA_{it} > 0$). The third variable ($DA_{it}{}^{-}$) captures the magnitude of income-decreasing abnormal accruals ($DA_{it}{}^{-}$ equals DA_{it} if $DA_{it} < 0$). We expect that audit effort is negatively associated with $Sign\_DA_{it}$ and $DA_{it}{}^{+}$, but we do not predict the sign of the association between audit effort and $DA_{it}{}^{-}$.

We estimate three earnings management models:

$$Sign\_DA_{it} = \lambda_0 + \lambda_1 LAH_{it} + CONTROLS + u_{it}, \quad (2)$$

$$DA_{it}^{+} = \beta_0 + \beta_1 LAH_{it} + CONTROLS + u_{it}, \quad (3)$$

$$DA_{it}^{-} = \delta_0 + \delta_1 LAH_{it} + CONTROLS + u_{it}, \quad (4)$$

LAH_{it} equals the log of audit hours for company i in year t. We take logs to reduce the skewness in the distribution of audit hours. $CONTROLS$ is a vector of independent variables that affect earnings management as discussed below. When audit hours are lower, we expect positive abnormal accruals more often than negative ($\lambda_1 < 0$), and we expect positive abnormal accruals to be larger ($\beta_1 < 0$). We do not predict the sign of the association between audit hours and the magnitude of negative abnormal accruals (δ_1).

Since $Sign\_DA_{it}$ is a dummy variable, we estimate Eq. (2) using logistic regression. By construction, the $DA_{it}{}^{+}$ ($DA_{it}{}^{-}$) variable is left-truncated (right-truncated) at zero, implying that ordinary least squares (OLS) coefficients would be biased. To avoid this truncation bias, we estimate Eqs. (3) and (4) using truncated regression (Maddala, 1983).

2.3. Endogeneity in audit hours (LAH_{it})

We address the endogeneity issue using IV estimation and we investigate whether LAH_{it} is affected by endogeneity bias using a Hausman test. In the first stage, we estimate a model of audit hours:

$$LAH_{it} = \eta_0 + \eta_1 LAH_{it-1} + CONTROLS + v_{it}, \quad (5)$$

where LAH_{it-1} equals the log of audit hours in the previous year's audit and $CONTROLS$ is a vector of independent variables that affect audit hours.

We obtain the instrumented (predicted) log of audit hours ($ILAH_{it}$) using the coefficient estimates in Eq. (5) and, in the second stage, we replace LAH_{it} with $ILAH_{it}$ in Eqs. (2) to (4):

$$Sign\_DA_{it} = \lambda_0 + \lambda_1 ILAH_{it} + CONTROLS + u_{it}, \quad (2a)$$

$$DA_{it}^{+} = \beta_0 + \beta_1 ILAH_{it} + CONTROLS + u_{it}, \quad (3a)$$

$$DA_{it}^{-} = \delta_0 + \delta_1 ILAH_{it} + CONTROLS + u_{it}. \quad (4a)$$

Auditors often plan the audit hours for year t using their working papers from year $t-1$. Therefore, we expect strong persistence in audit hours such that lagged audit hours (LAH_{it-1}) is a powerful predictor of LAH_{it}. In addition to being a powerful instrument, LAH_{it-1} should be uncorrelated with u_{it} (i.e., LAH_{it-1} should be exogenous) in order for IV estimation to be valid. In a Sargan test, LAH_{it-1} is likely to be a valid instrument if a Hausman test provides no evidence of endogeneity bias for LAH_{it}; that is, LAH_{it-1} may be uncorrelated

with u_{it} if LAH_{it} is uncorrelated with u_{it}. Even if the Hausman test provides evidence of bias, LAH_{it-1} can be a valid instrument if u_{it} is not serially correlated. That is, even if LAH_{it-1} is contemporaneously correlated with u_{it-1}, LAH_{it-1} may be uncorrelated with u_{it} if u_{it-1} is uncorrelated with u_{it}. This is not unlikely since Jones model abnormal accruals have low levels of persistence (Kothari et al., 2005).

In Eq. (5), we do not attempt to model the impact of earnings management on audit hours. To incorporate such a feedback effect, we would need to obtain powerful and exogenous instrumental variables for each of the earnings management variables. Unfortunately, theory does not provide guidance as to how to find good instruments for earnings management.[3] While this limits the scope of our study, it does not affect our inferences regarding the effect of audit hours on earnings management, since we provide evidence that IV estimation is both powerful and valid.

2.4. The control variables

The control variables reflect a number of earlier findings. Because Big Five firms are associated with less earnings management than are non-Big Five firms (Becker et al., 1998; Van Caneghem, 2005), we include a Big Five dummy variable (BIG_{it}). We also include a dummy variable ($INTERNATIONAL_{it}$) for the international non-Big Five firms (Grant Thornton and Moore Stephens). Finally, we include a dummy variable for SOL SA (SOL_{it}), which is the largest Greek audit firm.

O'Keefe et al. (1994) show that client size is the most important determinant of audit hours, so we include the log of assets ($LASSET_{it}$) as a control variable. Since debt finance is relatively important for Greek firms, we control for $LEVERAGE_{it}$ which equals total liabilities minus cash holdings scaled by total assets. Butler et al. (2004) find a positive association between abnormal accruals and liquidity, which we address with the ratio of current assets to current liabilities ($CURRENT_{it}$).

Myers et al. (2003) find a negative relation between abnormal accruals and audit firm tenure. Our $TENURE_{it}$ variable equals the number of consecutive years that the client appoints the same audit firm. Since the market for audit services was not open to non-governmental auditors until 1992-93, the average audit firm tenure is relatively short (four years) and we are able to measure it accurately. We also include an auditor change variable, $SWITCH_{it}$, which equals one if the audit in year t is performed by an incoming audit firm (zero otherwise). If a client changes its auditor, the incoming audit firm likely works more hours because it has lots of start-up costs such as assessing the strength of internal controls.

We include a public company dummy variable ($PUBLIC_{it}$) to control for differences between public and private companies, although it is unclear whether public or private companies are more likely to manage earnings (see Burgstahler et al., 2006). Private companies often have a single controlling shareholder who is in a better position than dispersed shareholders to coordinate activities that expropriate other stakeholders (Ang et al., 2000; Bennedsen and Wolfenzon, 2000). For example, private companies might be more likely than public companies to manage earnings upwards in order to secure access to debt finance (see Graham et al., 2005; Blackwell et al., 1994). Similarly, private companies might manage earnings downwards for tax reasons (Ball and Shivakumar, 2005; Coppens and Peek, 2005), although auditors may not prevent this because their primary incentive is to prevent earnings from being overstated (Kinney and Martin, 1994; Nelson et al., 2002).

Public companies might be less inclined to manage earnings because equity markets demand high-quality earnings and the listing process may screen out companies that are more likely to manage earnings. However, the opposite prediction may hold if equity markets exacerbate managers' incentives to manage earnings (Teoh et al., 1998; Erickson and Wang, 1999; Burgstahler et al., 2006).

The extant evidence is mixed as to whether public or private companies are more likely to manage earnings. Beatty et al. (2002) find that public banks engage in more earnings management than do private banks, whereas Burgstahler et al. (2006) report that private companies are more likely to manage earnings in 12 out of 13 European countries (the exception being Greece).

In addition to the public company dummy variable, we control for the effect of going public. Teoh et al. (1998) find evidence of earnings management around initial public offerings, so we include an IPO_{it} dummy

[3]As shown by Larcker and Rusticus (2005), it is better to use single equation estimation rather than IV estimation if the chosen instruments are weak or invalid.

variable that equals one if company i goes public in year t (zero otherwise). Finally, we include dummy variables for each sample year and for each two-digit industry sector that has at least 100 observations.

3. The sample and descriptive statistics

3.1. The sample

SOEL's database identifies the client's name, the audit firm's name, and the number of audit hours in 28,022 annual audits between 1993 and 2002. In 2,665 audits, financial statement data are unavailable as the audited entities do not publish their accounts publicly (these are mostly public sector organizations such as social security funds, universities and hospitals). We obtain financial statement data for the remaining 25,357 audits from ICAP, which is the largest provider of business information in Greece.[4] We require that each industry-year combination has at least 30 observations because we estimate the Jones model by industry-year.

After imposing the requirement that data are available for all variables, the final sample consists of 9,738 audits between 1994 and 2002 (we lose the year 1993 because we require a lagged audit hours variable). Since the sample is pooled across company-year observations, the annual observations of a given company might not be drawn independently and, to correct this statistical problem, we adjust the coefficients' standard errors by "clustering" on each company (Rogers, 1993; Petersen, 2007).

3.2. Descriptive statistics

Table 1 reports the audit market shares of Big Five firms, the international non-Big Five firms, the largest Greek firm (SOL SA), and the other Greek firms. SOL SA was formed by employees of the state auditing body, which had a monopoly over audits until 1992. SOL SA enjoys a dominant share of the audit market (47.3%) because the former employees of the state auditing body took most of their clients with them to SOL SA in 1992. Nevertheless, the market share of SOL SA has declined throughout the sample period, from 58.1% in 1994 to 41.7% in 2002. At the same time, the combined market share of the Big Five firms has been increasing, from 21.1% in 1994 to 34.5% in 2002. The Big Five market share remained high in 2002 even though Arthur Andersen exited the Greek market shortly after the Enron scandal. All the results continue to hold if we drop the 181 audits performed by Arthur Andersen and if we exclude the auditor changes involving Arthur Andersen in 2001–02 (these constitute only 4.6% of the auditor changes in the sample).

Table 2 reports descriptive statistics and a correlation matrix for the independent variables. We winsorize all the continuous variables at the top 1% and bottom 99% percentiles in order to avoid outlier problems. Mean and median audit hours, AH_{it}, are 233 and 186, respectively, indicating skewness in the audit hours distribution. The mean and median of the log of audit hours (LAH_{it}) are 5.24 and 5.23, respectively, because taking logs causes the distribution to become almost symmetric. Although audit firm changes are relatively rare (6% of the sample) average audit firm tenure is only 4 years because there were no private audit firms prior to 1992 and our sample period ends in 2002. The stock market is not very well developed in Greece and so there are only 678 (7.0%) public company observations in the sample.

The correlation matrix indicates that audit hours are positively associated with client size ($LASSET_{it}$) and audit firm size (BIG_{it}). The other correlations also make sense. For example, larger companies are more likely to be publicly traded, involved in IPOs, and audited by Big Five firms.

4. The multivariate results

4.1. The determinants of audit hours

Table 3 reports the results for three models of audit hours. Consistent with O'Keefe et al. (1994), company size ($LASSET_{it}$) is a very important determinant of audit hours. Audit firm size is also important. The coefficients are positive and statistically significant for the BIG_{it}, $INTERNATIONAL_{it}$, and SOL_{it} variables.

[4]For further information, see www.icap.gr/services/business_info/index_uk.asp.

Table 1
Market shares of the audit firms in Greece (1994–2002)

	Big Five audit firms (%)	International non-Big Five (%)	Largest Greek firm (SOL SA) (%)	Small Greek audit firms (%)
1994-02	30.1	5.0	47.3	17.6
1994	21.1	2.3	58.1	18.5
1995	21.1	3.5	53.9	21.5
1996	23.1	3.0	51.9	22.0
1997	26.7	4.5	52.0	16.8
1998	30.6	5.3	48.1	16.0
1999	29.3	5.4	47.7	17.5
2000	31.2	6.6	46.6	15.6
2001	32.2	5.9	46.3	15.6
2002	34.5	4.2	41.7	19.6

Prior to 1992, audits in Greece were performed by a state auditing body. Following market liberalization, SOL SA was formed by the former employees of the state auditing body. The employees generally took their clients with them, which is why SOL SA has a dominant share of the audit market. Market liberalization also resulted in the formation of 27 smaller Greek audit firms. The Big Five audit firms are Arthur Andersen, Deloitte & Touche, Ernst & Young, KPMG, and PricewaterhouseCoopers. Arthur Andersen ceased supplying audits in 2002 following the Enron scandal. The international non-Big Five audit firms are Grant Thornton and Moore Stephens.
The market share of audit firm k in year t equals $\sum_{i=1}^{I} ASSET_{ikt} / \sum_{k=1}^{K} \sum_{i=1}^{I} ASSET_{ikt}$.
$ASSET_{ikt}$ equals the total assets of company i audited by audit firm k in year t. I equals the total number of companies audited by audit firm k in year t. K equals the total number of audit firms in year t.

Therefore, compared to the small Greek audit firms, hours are significantly higher for the Big Five, the international non-Big Five, and SOL SA.

In untabulated tests, the BIG_{it} coefficients are significantly larger than the $INTERNATIONAL_{it}$ and SOL_{it} coefficients. Therefore, audit hours are significantly higher for Big Five firms than for non-Big Five firms. To assess the economic significance of the BIG_{it} coefficient, we use Model 1 to predict the hours that would be worked by Big Five and non-Big Five firms on each engagement in the sample. We predict that mean engagement hours would be 276 if all audits were performed by Big Five firms compared to 176 if all audits were undertaken by non-Big Five firms. Thus, the BIG_{it} coefficient is economically as well as statistically significant.

In Model 2, we replace BIG_{it} with dummy variables for each of the Big Five firms (AA_{it}, DT_{it}, EY_{it}, $KPMG_{it}$, and PWC_{it}). The five coefficients are all positive and statistically significant, ranging from 0.343 for Arthur Andersen to 0.507 for Ernst & Young. Each Big Five coefficient is significantly larger than the SOL_{it} and $INTERNATIONAL_{it}$ coefficients (0.125 and 0.049, respectively), implying that *each* Big Five firm works more hours than do the non-Big Five firms.

In Models 1 and 2, the $CURRENT_{it}$ variable has significant negative coefficients, which implies that audit hours are higher when clients have lower liquidity. There are significant positive coefficients for $SWITCH_{it}$, indicating that newly appointed auditors work more hours than do retained incumbent auditors. This makes sense given the set-up costs associated with the first year's engagement. However, we do not find evidence of learning-by-doing in the form of lower audit hours as tenure increases beyond the first year. Similarly, O'Keefe et al. (1994) find no evidence of learning-by-doing in their US study of audit hours.

In Model 3, we include the log of the previous year's audit hours (LAH_{it-1}) as an independent variable in order to control for persistence in audit hours. We also add dummy variables for each audit firm that has at least 100 observations in order to control for audit firm heterogeneities. The LAH_{it-1} coefficient is positive and highly significant (t-statistic = 36.24), which implies that there is very strong persistence in audit hours.[5]

[5]In untabulated regressions, we examine whether audit hours are affected by changes in client size. We add to Model 3 either the change in assets or the change in sales and, consistent with our treatment of the other continuous variables, we winsorize the change in assets and change in sales variables in order to avoid outlier problems. The asset growth coefficient is found to be negative and weakly significant ($t = -1.99$) in the hours model whereas the change in sales coefficient is positive and insignificant ($t = 1.48$). Given the mixed signs and the low levels of insignificance, we do not include these variables in the tabulated results.

Table 2
Descriptive statistics and correlation matrix

	Mean	Median	Std. dev.	5% percentile	95% percentile
AH_{it}	233.49	186.00	177.10	50.00	554.00
LAH_{it}	5.24	5.23	0.65	3.91	6.32
$LASSET_{it}$	15.72	15.73	1.35	12.79	17.86
BIG_{it}	0.15	0.00	0.36	0.00	1.00
$INTERNATIONAL_{it}$	0.08	0.00	0.27	0.00	1.00
SOL_{it}	0.58	1.00	0.49	0.00	1.00
$CURRENT_{it}$	2.33	1.21	5.09	0.48	5.86
$LEVERAGE_{it}$	0.48	0.55	0.37	−0.22	0.90
$PUBLIC_{it}$	0.07	0.00	0.25	0.00	1.00
IPO_{it}	0.01	0.00	0.08	0.00	0.00
$SWITCH_{it}$	0.06	0.00	0.24	0.00	1.00
$TENURE_{it}$	4.21	4.00	2.33	1.00	9.00

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. LAH_{it}	1.00									
2. $LASSET_{it}$	0.76*	1.00								
3. BIG_{it}	0.34*	0.22*	1.00							
4. $INTERNATIONAL_{it}$	−0.12*	−0.09*	−0.12*	1.00						
5. SOL_{it}	−0.11*	−0.13*	−0.50*	−0.35*	1.00					
6. $CURRENT_{it}$	−0.26*	−0.25*	−0.04*	0.04*	0.04*	1.00				
7. $LEVERAGE_{it}$	0.29*	0.30*	0.09*	−0.04*	−0.05*	−0.54*	1.00			
8. $PUBLIC_{it}$	0.16*	0.21*	−0.04*	−0.01	−0.01	0.04*	−0.11*	1.00		
9. IPO_{it}	0.04*	0.06*	−0.01	0.00*	−0.01	0.00	−0.02	0.29*	1.00	
10. $SWITCH_{it}$	0.03*	0.01	0.13*	0.01	−0.17*	−0.00	0.01	0.01	0.02	1.00
11. $TENURE_{it}$	0.21*	0.26*	−0.05*	−0.04	0.14*	−0.07*	0.04*	−0.01	−0.01	−0.35*

The continuous variables are winsorized at the top 1% and bottom 99% percentiles. * = Statistically significant at the 1% level (two-tailed).
AH_{it} = Audit hours for company i in year t. LAH_{it} = Log of audit hours for company i in year t. $LASSET_{it}$ = Log of total assets of company i in year t. BIG_{it} = one if the audit is performed by one of the Big Five audit firms; zero otherwise. AA_{it} = one if the audit is performed by Arthur Andersen; zero otherwise. DT_{it} = one if the audit is performed by Deloitte & Touche; zero otherwise. EY_{it} = one if the audit is performed by Ernst & Young; zero otherwise. $KPMG_{it}$ = one if the audit is performed by KPMG; zero otherwise. PWC_{it} = one if the audit is performed by PricewaterhouseCoopers (Price Waterhouse or Coopers & Lybrand prior to the 1998 merger); zero otherwise. $INTERNATIONAL_{it}$ = one if the audit is performed by an international non-Big Five firm (i.e., Grant Thornton or Moore Stephens); zero otherwise. SOL_{it} = one if the audit is performed by the largest Greek audit firm (i.e., SOL SA); zero otherwise. $CURRENT_{it}$ = current assets/current liabilities. $LEVERAGE_{it}$ = (total liabilities − cash)/total assets. $PUBLIC_{it}$ = one if the company is publicly traded on the Athens stock exchange; zero otherwise. IPO_{it} = one in the first year that the company is publicly traded on the Athens stock exchange; zero otherwise. $CHANGE\_OLD_{it}$ = one if the audit is performed by an outgoing audit firm; zero otherwise. $SWITCH_{it}$ = one if the audit is performed by an incoming audit firm; zero otherwise. $TENURE_{it}$ = the number of consecutive years that the company is audited by the same audit firm.

We use the coefficient estimates in Model 3 to obtain the instrumented log of audit hours ($ILAH_{it}$). Since LAH_{it-1} is a strong predictor of LAH_{it}, we can be confident that $ILAH_{it}$ is a powerful instrument. We test whether $ILAH_{it}$ is a valid (i.e., exogenous) instrument when we estimate the earnings management models.

4.2. The univariate association between abnormal accruals and audit hours

Table 4 provides descriptive statistics for abnormal accruals (Panel A) and compares the mean values of audit hours between positive and negative abnormal accruals (Panel B). The means of both hours variables, LAH_{it} and $ILAH_{it}$, are significantly lower when abnormal accruals are income-increasing compared to when abnormal accruals are income-decreasing (t-statistics = −2.55 and −2.53, respectively). Therefore, income-increasing earnings management is associated with lower audit effort.

Table 3
The determinants of audit hours (the dependent variable is the log of audit hours, LAH_{it})

	Model 1		Model 2		Model 3	
	Coefft.	*t*-stat.	Coefft.	*t*-stat.	Coefft.	*t*-stat.
$LASSET_{it}$	0.295	35.17***	0.294	35.39***	0.118	16.70***
BIG_{it}	0.453	16.17***				
AA_{it}			0.343	7.01***	0.102	3.99***
DT_{it}			0.393	7.17***	0.122	4.42***
EY_{it}			0.507	8.10***	0.175	5.97***
$KPMG_{it}$			0.422	7.05***	0.107	4.09***
PWC_{it}			0.498	13.76***	0.166	7.56***
$INTERNATIONAL_{it}$	0.049	1.73*	0.049	1.73*		
SOL_{it}	0.126	6.59***	0.125	6.57***	0.024	1.71*
$CURRENT_{it}$	−0.005	−3.35***	−0.005	−3.35***	−0.002	−3.27***
$LEVERAGE_{it}$	0.030	1.06	0.031	1.09	0.006	0.48
$SWITCH_{it}$	0.108	5.69***	0.106	5.57***	0.036	2.42**
$TENURE_{it}$	0.032	9.98***	0.032	9.98***	0.008	4.22***
$PUBLIC_{it}$	0.017	0.53	0.016	0.51	0.091	4.26***
IPO_{it}	0.029	0.42	0.021	0.45	−0.022	−0.60
LAH_{it-1}					0.681	36.24***
Intercept	0.810	5.98***	0.818	6.08***	−0.094	−1.44
Year dummies?	Yes		Yes		Yes	
Industry dummies?	Yes		Yes		Yes	
Additional audit firm dummies?	No		No		Yes	
# observations	9738		9738		9738	
Adj. R^2	67.7%		67.9%		87.7%	

***Statistically significant at the 1% level (two-tailed).
**Statistically significant at the 5% level (two-tailed).
*Statistically significant at the 10% level (two-tailed).
We include year dummy variables for each sample year and 16 industry dummy variables for each two-digit industry that has at least 100 observations. Model 3 includes 12 audit firm dummy variables (the Big Five firms, the two international Non-Big Five firms, and five Greek firms that have at least 100 observations). The models are estimated using ordinary least squares regression. We adjust the coefficients' standard errors for the effects of non-independence by clustering on each company (Rogers, 1993; Petersen, 2007). LAH_{it} = Log of audit hours for company *i* in year *t*. $LASSET_{it}$ = Log of total assets of company *i* in year *t*. BIG_{it} = one if the audit is performed by one of the Big Five audit firms; zero otherwise. AA_{it} = one if the audit is performed by Arthur Andersen; zero otherwise. DT_{it} = one if the audit is performed by Deloitte & Touche; zero otherwise. EY_{it} = one if the audit is performed by Ernst & Young; zero otherwise. $KPMG_{it}$ = one if the audit is performed by KPMG; zero otherwise. PWC_{it} = one if the audit is performed by PricewaterhouseCoopers (Price Waterhouse or Coopers & Lybrand prior to the 1998 merger); zero otherwise. $INTERNATIONAL_{it}$ = one if the audit is performed by an international non-Big Five firm (i.e., Grant Thornton or Moore Stephens); zero otherwise. SOL_{it} = one if the audit is performed by the largest Greek audit firm, SOL SA; zero otherwise. $CURRENT_{it}$ = current assets/current liabilities. $LEVERAGE_{it}$ = (total liabilities – cash)/total assets. $SWITCH_{it}$ = one if the audit is performed by an incoming audit firm; zero otherwise. $TENURE_{it}$ = the number of consecutive years that the company is audited by the same audit firm. $PUBLIC_{it}$ = one if the company is publicly traded on the Athens stock exchange; zero otherwise. IPO_{it} = one in the first year that the company is publicly traded on the Athens stock exchange; zero otherwise.

Panel C compares the mean values of audit hours between large and small values of positive abnormal accruals. We partition the positive abnormal accruals into large and small groups using the median value of $DA_{it}{}^{+}$. For both hours variables (LAH_{it} and $ILAH_{it}$), we find significant negative associations with the magnitude of positive abnormal accruals (*t*-statistics = −3.93 and −4.16, respectively). Thus, income-increasing abnormal accruals are significantly larger when hours are lower.

Panel D compares the mean values of audit hours between large and small values of negative abnormal accruals (again, we partition using the median value of $DA_{it}{}^{-}$). We find no significant association between hours and the magnitude of negative abnormal accruals (*t*-statistics = −1.37 and −1.52, respectively). Thus, hours are not significantly associated with income-decreasing abnormal accruals, a finding that contrasts with the significant association between hours and income-increasing abnormal accruals. These results are

Table 4
Abnormal accruals and audit hours

Panel A: Descriptive statistics for abnormal accruals

	Obs.	Mean	Median	5% percentile	95% percentile
Abnormal accruals (DA_{it})	9738	−0.005	−0.005	−0.278	0.271
Positive abnormal accruals ($DA_{it} > 0$)	4694	0.120	0.079	0.007	0.373
Negative abnormal accruals ($DA_{it} < 0$)	5044	−0.121	−0.084	−0.371	−0.007

Panel B: Mean values of the log of audit hours (LAH_{it}) and the instrumented log of audit hours ($ILAH_{it}$), after partitioning the sample by the sign of abnormal accruals

	Positive abnormal accruals ($DA_{it} > 0$)	Negative abnormal accruals ($DA_{it} < 0$)	*t*-statistics for the differences in hours
Mean of LAH_{it}	5.223	5.257	−2.55**
Mean of $ILAH_{it}$	5.224	5.256	−2.53**

Panel C: Mean values of the log of audit hours (LAH_{it}) and the instrumented log of audit hours ($ILAH_{it}$), after partitioning the sample by median positive abnormal accruals

	Large positive abnormal accruals ($DA_{it} > 0.074$)	Small positive abnormal accruals ($0 < DA_{it} < 0.074$)	*t*-statistics for the differences in hours
Mean of LAH_{it}	5.186	5.260	−3.93***
Mean of $ILAH_{it}$	5.188	5.261	−4.16***

Panel D: Mean values of the log of audit hours (LAH_{it}) and the instrumented log of audit hours ($ILAH_{it}$), after partitioning the sample by median negative abnormal accruals

	Large negative abnormal accruals ($DA_{it} < -0.088$)	Small negative abnormal accruals ($0 > DA_{it} > -0.088$)	*t*-statistics for the differences in hours
Mean of LAH_{it}	5.244	5.269	−1.37
Mean of $ILAH_{it}$	5.243	5.269	−1.52

***Statistically significant at the 1% level (two-tailed).
**Statistically significant at the 5% level (two-tailed).
DA_{it} = the residual from estimating the cross-sectional Jones model. LAH_{it} = Log of audit hours for company i in year t. $ILAH_{it}$ = Instrumented log of audit hours for company i in year t. We instrument for audit hours using the predicted value of the log of hours from model 3 of Table 3.

consistent with auditors having asymmetric incentives with regard to income-increasing and income-decreasing earnings management.

4.3. The earnings management models

Next, we estimate the earnings management models in Eqs. (2)–(4). To recap, the dependent variables indicate whether abnormal accruals are positive or negative ($Sign\_DA_{it}$) as well as the magnitude of positive abnormal accruals (DA_{it}^{+}) and negative abnormal accruals (DA_{it}^{-}). In each model, the experimental variables are the log of audit hours (LAH_{it}) and the instrumented log of hours ($ILAH_{it}$).

We first use a Hausman test to investigate whether there is any endogeneity bias for the LAH_{it} variable. We find insignificant evidence of an endogeneity bias at the 5% level ($\chi^2 = 3.80$), which has two important implications. First, we should obtain similar results using either single-equation estimation (the LAH_{it} variable) or IV estimation (the $ILAH_{it}$ variable). This is important because Larcker and Rusticus (2005) raise

important concerns about the robustness of IV estimation compared to single-equation modeling.[6] Second, the $ILAH_{it}$ variable is likely to be a valid instrument because the LAH_{it} variable passes the Hausman test. That is, LAH_{it-1} is unlikely to be correlated with u_{it} because LAH_{it} is uncorrelated with u_{it}. Confirming this expectation, we find that the $ILAH_{it}$ variable passes the Sargan test for instrument validity at the 5% level (Sargan statistic = 3.56).[7] Thus, we have good reason to believe that $ILAH_{it}$ is a valid instrument for audit hours.

Table 5 shows that the hours coefficients are significantly negative in the $Sign\_DA_{it}$ models (z-statistics = −3.01 and −3.44, respectively). Therefore, abnormal accruals are more likely to be income-increasing than income-decreasing when audit hours are lower. The hours coefficients are also significantly negative in the $DA_{it}{}^{+}$ models (t-statistics = −4.08 and −4.78, respectively), indicating that income-increasing abnormal accruals are significantly larger when audit hours are lower. The hours coefficients are also negative in the $DA_{it}{}^{-}$ models, but they are relatively small in magnitude and they are only marginally significant (t-statistics = −1.72 and −2.02, respectively). Overall, these multivariate results are consistent with the univariate results reported in Table 4.

To assess the economic magnitude of the association between audit hours and income-increasing abnormal accruals, we examine the effect of a one standard deviation increase in audit hours. The economic magnitudes are calculated using the $ILAH_{it}$ coefficients in Models 2 and 4 of Table 5 with the control variables evaluated at their means. The mean and standard deviation of the log of hours are 5.24 and 0.65, respectively (see Table 2), so we examine the effect of an increase in the log of hours from 4.91 ($= 5.24-(0.65 \div 2)$) to 5.56 ($= 5.24+(0.65 \div 2)$). In unlogged terms, this is equivalent to an increase in audit hours from 136 to 261. The dependent variables in Models 2 and 4 of Table 5 are $Sign\_DA_{it}$ and $DA_{it}{}^{+}$, so we examine how the change in hours affects the predicted probability that abnormal accruals are positive ($Sign\_DA_{it} = 1$) and the predicted magnitude of positive abnormal accruals ($DA_{it}{}^{+}$).

The results are shown in Fig. 1. The predicted probability that abnormal accruals are positive falls from 51.5% to 45.0% as hours increase from 136 to 261. Over the same range, the predicted magnitude of income-increasing abnormal accruals falls from 0.132 to 0.108, a drop of 18.2%. Thus, the negative association between audit hours and income-increasing abnormal accruals is economically significant as well as statistically significant.

The coefficients on the control variables in Table 5 are broadly consistent with extant research. The BIG_{it} coefficients are significantly negative in the $Sign\_DA_{it}$ and $DA_{it}{}^{-}$ models but they are insignificant in the $DA_{it}{}^{+}$ model. These results confirm that Big Five firms are negatively associated with signed abnormal accruals (Becker et al., 1998). The $LASSET_{it}$ coefficients are significantly positive, indicating that large companies are more likely to manage earnings upwards. One explanation is that larger companies have more outside ownership, which increases the agency problem between managers and shareholders. The positive $CURRENT_{it}$ coefficients indicate that signed abnormal accruals are positively associated with liquidity (Butler et al., 2004). Similarly, the $LEVERAGE_{it}$ coefficients are positive, which means that abnormal accruals are more likely to be income-increasing when leverage is high, and the magnitude of income-increasing (income-decreasing) earnings management is positively (negatively) related to leverage. This is consistent with earnings management studies that use leverage as a proxy for closeness to debt constraints.

We find that abnormal accruals are not significantly different during the first audit by an incoming audit firm ($SWITCH_{it}$). However, abnormal accruals are less likely to be income-increasing when audit firm tenure ($TENURE_{it}$) is long, and the magnitude of income-increasing abnormal accruals is negatively related to tenure (see Myers et al., 2003). Consistent with equity market incentives being important (e.g., Teoh et al., 1998), abnormal accruals tend to be income-increasing if companies are publicly quoted ($PUBLIC_{it}$) or they undertake initial public offerings (IPO_{it}).

[6] Larcker and Rusticus (2005) point out that IV estimation is unlikely to be robust when instrumental variables lack power. We expect IV to be robust in our setting because, as revealed in Table 3, the lagged hours variable (LAH_{it-1}) is a very powerful predictor of hours in the current year (LAH_{it}).

[7] The Sargan test requires that the instrumented variable ($ILAH_{it}$) is over-identified. This requirement is met by our test because lagged audit hours (LAH_{it-1}) and the individual audit firm dummy variables are included in the audit effort model (Col. 3 of Table 3) but they are excluded from the earnings management models.

Table 5
Models of abnormal accruals

	Sign of abnormal accruals ($Sign\_DA_{it}$)				Magnitude of positive abnormal accruals (DA_{it}^{+})				Magnitude of negative abnormal accruals (DA_{it}^{-})			
	Coefft.	z-stat.	Coefft.	z-stat.	Coefft.	t-stat.	Coefft.	t-stat.	Coefft.	t-stat.	Coefft.	t-stat.
LAH_{it}	−0.175	−3.01***			−0.025	−4.08***			−0.010	−1.72*		
$ILAH_{it}$			−0.253	−3.44***			−0.036	−4.78***			−0.015	−2.02**
$LASSET_{it}$	0.105	3.81***	0.127	4.15***	0.013	4.15***	0.016	4.73***	0.008	2.61***	0.009	2.85***
BIG_{it}	−0.240	−2.94***	−0.205	−2.45**	−0.002	−0.28	0.003	0.31	−0.041	−5.37***	−0.039	−4.88***
$INTERNATIONAL_{it}$	−0.056	−0.62	−0.052	−0.58	0.001	0.13	0.002	0.17	−0.009	−1.01	−0.008	−0.97
SOL_{it}	0.048	0.82	0.058	0.98	0.005	0.95	0.007	1.17	−0.001	−0.17	−0.000	−0.04
$CURRENT_{it}$	0.040	6.21***	0.039	6.14***	0.004	6.64***	0.004	6.55***	0.004	6.46***	0.004	6.41***
$LEVERAGE_{it}$	0.482	5.52***	0.484	5.55***	0.060	6.20***	0.060	6.26***	0.035	3.51***	0.035	3.52***
$SWITCH_{it}$	0.005	0.05	0.014	0.14	−0.008	−0.85	−0.007	−0.73	−0.006	−0.60	−0.005	−0.54
$TENURE_{it}$	−0.029	−2.56***	−0.027	−2.33**	−0.004	−3.72***	−0.004	−3.37***	−0.000	−0.29	−0.000	−0.15
$PUBLIC_{it}$	0.227	2.21**	0.229	2.22**	0.014	1.48	0.014	1.50	0.019	1.94*	0.019	1.94*
IPO_{it}	0.511	1.83*	0.513	1.84*	0.056	2.23**	0.056	2.22**	0.030	0.92	0.030	0.92
Intercept	−1.264	−3.44***	−1.202	−3.25***	−0.066	−1.92*	−0.113	−2.78***	−0.089	−2.37**	−0.086	−2.25**
Year dummies?	Yes		Yes		Yes		Yes		Yes		Yes	
Industry dummies?	Yes		Yes		Yes		Yes		Yes		Yes	
# observations	9738		9738		4694		4694		5044		5044	
Pseudo R^2	1.52%		1.54%		5.59%		5.65%		5.45%		5.41%	

***Statistically significant at the 1% level (two-tailed).
**Statistically significant at the 5% level (two-tailed).
*Statistically significant at the 10% level (two-tailed).
DA_{it} = the residual from estimating the cross-sectional Jones model. $Sign\_DA_{it}$ = one if $DA_{it} > 0$; zero otherwise. $DA_{it}^{+} = DA_{it}$ if $DA_{it} > 0$. $DA_{it}^{-} = DA_{it}$ if $DA_{it} < 0$. The $Sign\_DA_{it}$ models are estimated using logistic regression. The DA_{it}^{+} and DA_{it}^{-} models are estimated using truncated regression because positive (negative) abnormal accruals are left-truncated (right-truncated) at zero. We adjust the coefficients' standard errors for the effects of non-independence by clustering on each company (Rogers, 1993; Petersen, 2007). We include year dummy variables for each sample year and 16 industry dummy variables for each two-digit industry that has at least 100 observations. LAH_{it} = Log of audit hours for company i in year t. $ILAH_{it}$ = Instrumented log of audit hours for company i in year t. We instrument for audit hours using the predicted value of the log of hours from model 3 of Table 3. $LASSET_{it}$ = Log of assets for company i in year t. BIG_{it} = one if the audit is performed by one of the Big Five audit firms; zero otherwise. $INTERNATIONAL_{it}$ = one if the audit is performed by an international non-Big Five firm (i.e., Grant Thornton or Moore Stephens); zero otherwise. SOL_{it} = one if the audit is performed by the largest Greek audit firm (i.e., SOL SA); zero otherwise. $CURRENT_{it}$ = current assets/current liabilities. $LEVERAGE_{it}$ = (total liabilities − cash)/total assets. $SWITCH_{it}$ = one if the audit is performed by an incoming audit firm; zero otherwise. $TENURE_{it}$ = the number of consecutive years that the company is audited by the same audit firm. $PUBLIC_{it}$ = one if the company is publicly traded on the Athens stock exchange; zero otherwise. IPO_{it} = one in the first year that the company is publicly traded on the Athens stock exchange; zero otherwise.

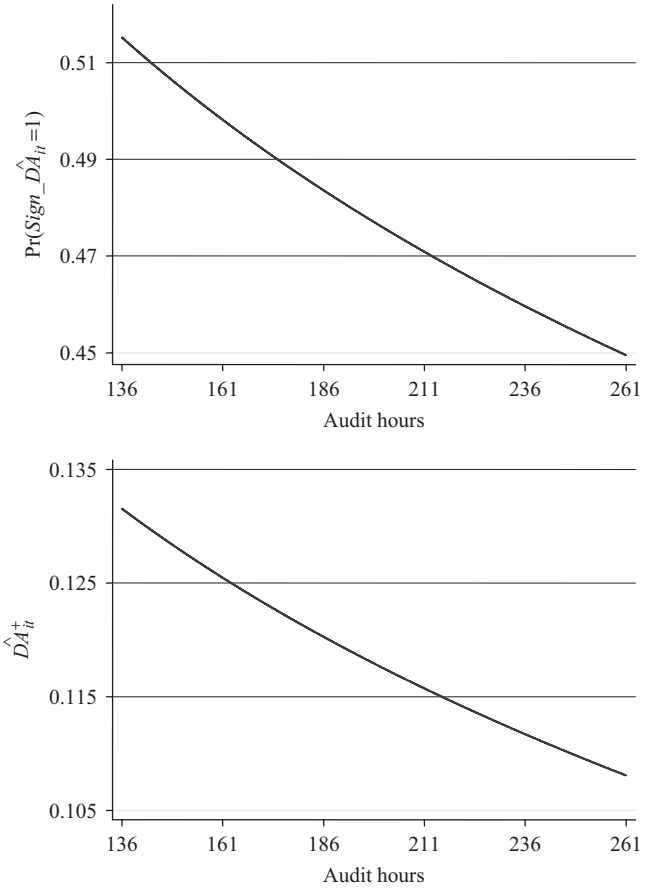

Fig. 1. The associations between audit hours and positive abnormal accruals. The associations are calculated using the $ILAH_{it}$ coefficients in Models 2 and 4 of Table 5, with the control variables evaluated at their means. The vertical axes show the predicted probability that abnormal accruals are positive ($Sign\_DA_{it} = 1$) and the predicted magnitude of positive abnormal accruals ($DA_{it}{}^{+}$). The mean and standard deviation of the log of audit hours are 5.24 and 0.65, respectively (see Table 2). We calculate the effect of a one standard deviation change in the log of audit hours around the mean (i.e., $5.24 \pm (0.65 \div 2)$). This implies that the unlogged values for audit hours range from 136 to 261 on the horizontal axes.

4.4. Income-increasing earnings management to avoid reporting losses

Burgstahler and Dichev (1997) and Degeorge et al. (1999) document that the frequency of small profits is unusually high compared with the earnings distribution as a whole. They suggest that companies manage earnings upwards to report small profits if unmanaged earnings would otherwise be negative.

Degeorge et al. (1999) argue that the incentive to report positive profits is attributable to the psychologically important distinction between positive and negative earnings numbers. However, there are also important economic reasons why firms may wish to avoid reporting losses. In a survey of firm managers, Graham et al. (2005) note that the occurrence of a loss can trip covenants or otherwise affect relationships with creditors and banks. Begley and Freedman (2004) provide archival evidence that profits and losses are not treated equally in debt covenants. They find that typically 50% of net profits are available for paying dividends, while the ability to pay dividends is reduced by 100% of net losses. Begley and Freedman (2004) speculate that such covenant restrictions may explain why companies are reluctant to report losses.

Consistent with losses being penalized more heavily than profits are rewarded, the association between reported earnings and companies' credit ratings has been found to be asymmetric. For example, Ashbaugh-Skaife et al. (2006) document a significant negative association between a loss dummy and credit ratings, even after including a continuous control variable for the return on assets. Moreover, debt covenants are set more

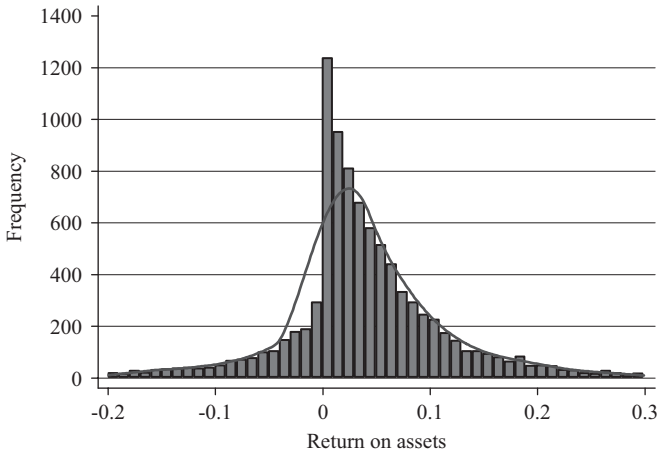

Fig. 2. The distribution of the return on assets (net income divided by total assets). The distribution range is from −20% to +30% and the interval widths are 1%. The curve is fitted using kernel density estimation, where the frequency for each interval is estimated using the adjacent four bins.

tightly in private lending agreements than in public covenants because it is less costly to renegotiate with private lenders such as banks (Smith and Warner, 1979; Dichev and Skinner, 2002). Since the majority of companies in our sample are private, it is likely that they have significant incentives to avoid reporting losses.

Some researchers have challenged the premise that the discontinuity in the earnings distribution is a good indicator of earnings management. Dechow et al. (2003) estimate what the frequency of small profits would be in the absence of a discontinuity in the earnings distribution (i.e., in the absence of earnings management) and they find that the observed frequency of US companies reporting small profits is only 10–15% higher than it would be if companies did not manage earnings. Thus, they conclude that small reported profits capture income-increasing earnings management with significant noise.

Fig. 2 shows the distribution of the return on assets, *ROA*, in Greece. If companies manage earnings upward to avoid reporting losses, we expect a discontinuity in the earnings distribution around zero. Fig. 2 reveals that small positive earnings occur much more frequently than would be expected given the smoothness of the remainder of the earnings distribution. In particular, there are 1,249 *ROA* observations between 0% and +1% compared to only 311 *ROA* observations between 0% and −1%.

Following Dechow et al. (2003), we estimate what the frequency of each earnings interval would be in the absence of a discontinuity in the earnings distribution. In Fig. 2, we fit a curve to the earnings distribution using kernel density estimation, where the frequency of each earnings interval is estimated using the adjacent four intervals (Silverman, 1986). The curve indicates that approximately 620 observations would lie between 0% and +1% in the absence of a discontinuity. Thus, the frequency of Greek companies reporting small profits is approximately *double* what would be expected given the smoothness of the remainder of the earnings distribution. This finding is consistent with earnings management being very common in Greece and, more importantly, it means that the incidence of small reported profits is a relatively powerful indicator of income-increasing earnings management.[8]

In light of Fig. 2, we expect that Greek companies manage reported earnings upwards in order to avoid reporting losses.[9] To reflect this, we create two alternative earnings management variables by combining the abnormal accruals measure with the incidence of small reported profits. The first variable ($SMALL1_{it}$) equals one if *ROA* is in the range [0, +0.01] *and* abnormal accruals are positive *and* the unmanaged *ROA* is negative (zero otherwise). Within the sample of 9,738 audits, there are 633 (6.5%) observations where $SMALL1_{it}$

[8]Recent studies provide evidence that earnings management is responsible for the discontinuity in the US earnings distribution (Jacob and Jorgensen, 2007; Kerstein and Rai, 2007).

[9]We do not use the meet/beat analyst forecast benchmark because there is little analyst following of Greek companies. We do not use the zero earnings change benchmark because we find no discontinuity in the earnings change distribution. Moreover, we find an insignificant multivariate association between the audit effort variables ($ILAH_{it}$ and LAH_{it}) and earnings changes (*t*-statistics = −0.40, −1.58).

equals one. Thus, the $SMALL1_{it}$ variable measures income-increasing earnings management much more narrowly than does the incidence of positive abnormal accruals ($N = 4{,}694$) or the incidence of small positive profits ($N = 1{,}249$). Reassuringly, the 633 observations where $SMALL1_{it}$ equals one is almost exactly equal to the excess number of small positive *ROA* observations based on Fig. 2 (i.e., $629 = 1{,}249-620$).

There are 9,105 ($= 9{,}738-633$) observations where $SMALL1_{it}$ equals zero (i.e., no income-increasing earnings management) and, in some cases, audit effort may not explain the absence of income-increasing earnings management. For example, companies that earn large profits would not need to manage earnings upwards to avoid reporting losses. Also, companies with large losses may be unable to manage earnings upwards sufficiently to report small profits. We therefore create a second variable where observations are dropped if *ROA* is less than -0.01 or greater than +0.01. Specifically, $SMALL2_{it}$ equals one if *ROA* is in the range [0, +0.01] and abnormal accruals are positive and the unmanaged ROA is negative; $SMALL2_{it}$ equals zero if ROA is in the range [−0.01, 0).

Both the $SMALL1_{it}$ and $SMALL2_{it}$ variables have 633 observations equal to one (i.e., income-increasing earnings management). However, there are 9,105 observations where $SMALL1_{it}$ equals zero compared to only 311 observations where $SMALL2_{it}$ equals zero (i.e., no income-increasing earnings management). Compared to $SMALL1_{it}$, the $SMALL2_{it}$ variable has the advantage that the absence of income-increasing earnings management is more likely to be due to high audit effort, although it has the disadvantage of a much smaller sample ($N = 633 + 311$).

Table 6 reports the results of logistic regressions where the dependent variables are $SMALL1_{it}$ and $SMALL2_{it}$ and the independent variables are the same as in Table 5. The audit hours coefficients are significantly negative in both the $SMALL1_{it}$ and $SMALL2_{it}$ models (z-statistics = −3.93, −3.26, −2.32, −3.12). Therefore, companies are less likely to manage earnings upwards to just meet or beat the zero earnings benchmark if audit hours are higher. It is worth noting that the hours coefficients remain significant even in the $SMALL2_{it}$ models where the sample is relatively small. This provides some comfort that our findings are not a statistical artifact of a large sample size.

The coefficients on the control variables are generally consistent with extant research and with the abnormal accruals models reported in Table 5. The BIG_{it} coefficients are negative, indicating that Big Five firms are negatively associated with income-increasing earnings management. The $LASSET_{it}$, $CURRENT_{it}$ and $LEVERAGE_{it}$ coefficients are positive, which is consistent with our previous finding that companies are more likely to manage earnings upwards if they are larger, more liquid and have higher leverage. However, the z-statistics are somewhat lower in the $SMALL2_{it}$ models, reflecting the smaller estimation samples.

The $PUBLIC_{it}$ coefficients are significantly negative in the $SMALL1_{it}$ models whereas they are insignificantly positive in the $SMALL2_{it}$ models. The inconsistent signs suggest that the $PUBLIC_{it}$ variable may capture differences in profitability between public and private companies rather than differences in earnings management.[10]

To assess the economic magnitude of the association between audit hours and the reporting of small positive profits, Fig. 3 illustrates the effect of an increase of one standard deviation in audit hours. The relations are estimated using the $ILAH_{it}$ coefficients in Models 2 and 4 of Table 6, with the control variables evaluated at their means. An increase in audit hours from 136 to 261 is associated with the predicted probability that $SMALL1_{it}$ equals one falling from 9.1% to 4.6%. The same increase in hours is associated with the predicted probability that $SMALL2_{it}$ equals one falling from 77.2% to 55.6%.[11] Therefore, our finding that companies are less likely to report small profits if audit hours are higher is economically significant as well as statistically significant.

[10] $SMALL1_{it}$ is *negatively* correlated with profitability since mean *ROA* in the full sample is +0.02, which lies above the *ROA* interval of [0, +0.01]. In contrast, $SMALL2_{it}$ is *positively* correlated with profitability since $SMALL2_{it}$ equals one for small profits [0, +0.01] and zero for small losses (0, -0.01]. Since the $SMALL1_{it}$ and $SMALL2_{it}$ models yield inconsistent coefficient signs, the $PUBLIC_{it}$ variable likely captures the effects of performance rather than earnings management (the correlation between *ROA* and $PUBLIC_{it}$ is positive (0.09) and significant at less than the 1% level).

[11] The mean value of $SMALL1_{it}$ is 6.5% whereas the mean value of $SMALL2_{it}$ is 67.1% because $SMALL1_{it}$ is defined over the full sample (N = 9,738) whereas $SMALL2_{it}$ is defined over the sub-sample of firms that report either small profits or small losses ($N = 944$).

Table 6
Income-increasing earnings management to report small positive profits

	Dependent variable = $SMALL1_{it}$				Dependent variable = $SMALL2_{itv}$			
	Coefft.	z-stat.	Coefft.	z-stat.	Coefft.	z-stat.	Coefft.	z-stat.
LAH_{it}	−0.542	−3.93***			−0.531	−2.32**		
$ILAH_{it}$			−0.540	−3.26***			−0.930	−3.12***
$LASSET_{it}$	0.415	5.70***	0.413	5.22***	0.401	3.80***	0.513	4.34***
BIG_{it}	−0.478	−2.25**	−0.472	−2.16**	−0.676	−2.33**	−0.494	−1.64
$INTERNATIONAL_{it}$	0.204	0.95	0.202	0.94	−0.244	−0.79	−0.208	−0.67
SOL_{it}	0.171	1.28	0.170	1.27	0.097	0.47	0.142	0.69
$CURRENT_{it}$	0.057	5.92***	0.058	5.99***	0.015	0.75	0.011	0.56
$LEVERAGE_{it}$	1.215	6.59***	1.205	6.48***	0.406	1.06	0.390	1.01
$SWITCH_{it}$	−0.164	−0.87	−0.160	−0.84	−0.003	−0.01	0.100	0.25
$TENURE_{it}$	−0.035	−1.45	−0.035	−1.43	−0.036	−0.91	−0.022	−0.54
$PUBLIC_{it}$	−0.878	−3.08***	−0.905	−3.14***	0.162	0.38	0.300	0.74
IPO_{it}	0.147	0.19	0.182	0.23	−0.653	−0.59	−0.552	−0.51
Intercept	−7.080	−7.83***	−7.051	−7.90***	−2.987	−1.89*	−2.448	−1.52
Year dummies?	Yes		Yes		Yes		Yes	
Industry dummies?	Yes		Yes		Yes		Yes	
# observations	9738		9738		944		944	
Pseudo R^2	6.12%		6.31%		8.24%		8.65%	

***Statistically significant at the 1% level (two-tailed).
**Statistically significant at the 5% level (two-tailed).
*Statistically significant at the 10% level (two-tailed).
The models are estimated using logistic regression. We adjust the coefficients' standard errors for the effects of non-independence by clustering on each company (Rogers, 1993; Petersen, 2007). We include year dummy variables for each sample year and 16 industry dummy variables for each two-digit industry that has at least 100 observations.
$SMALL1_{it}$ = one if the return on assets is in the range [0, 0.01] *and* abnormal accruals are positive *and* the unmanaged return on assets is negative; zero otherwise.
$SMALL2_{it}$ = one if the return on assets is in the range [0, 0.01] *and* abnormal accruals are positive *and* the unmanaged return on assets is negative; zero if the return on assets is in the range (0, −0.01].
LAH_{it} = Log of audit hours for company *i* in year *t*. $ILAH_{it}$ = Instrumented log of audit hours for company *i* in year *t*. We instrument for audit hours using the predicted value of the log of hours from model 3 of Table 3. $LASSET_{it}$ = Log of assets for company *i* in year *t*. BIG_{it} = one if the audit is performed by one of the Big Five audit firms; zero otherwise. $INTERNATIONAL_{it}$ = one if the audit is performed by an international non-Big Five firm (i.e., Grant Thornton or Moore Stephens); zero otherwise. SOL_{it} = one if the audit is performed by the largest Greek audit firm (i.e., SOL SA); zero otherwise. $CURRENT_{it}$ = current assets/current liabilities. $LEVERAGE_{it}$ = (total liabilities−cash)/total assets. $SWITCH_{it}$ = one if the audit is performed by an incoming audit firm; zero otherwise. $TENURE_{it}$ = the number of consecutive years that the company is audited by the same audit firm. $PUBLIC_{it}$ = one if the company is publicly traded on the Athens stock exchange; zero otherwise. IPO_{it} = one in the first year that the company is publicly traded on the Athens stock exchange; zero otherwise.

4.5. The interaction between audit effort and audit firm size

In this section, we investigate whether the impact of an additional hour on income-increasing earnings management is different between Big Five and non-Big Five firms. On the one hand, the incremental effect of audit effort may be larger for Big Five firms due to their higher quality. However, the situation is complicated by the fact that Big Five firms work more hours than non-Big Five firms (see Table 3) and there may be diminishing returns to working more hours.

To illustrate, Fig. 4 plots two curves showing the associations between audit hours and earnings management for Big Five and non-Big Five firms. The broken sections of the curves indicate that it is rare for auditors to work extremely low or high hours; for example there are no audits within our sample in which hours are less than 40. The solid sections indicate the hours that auditors typically work. Since Table 3 shows that the Big Five firms typically work more hours, the solid section of the Big Five curve lies to the right of the non-Big Five solid section.

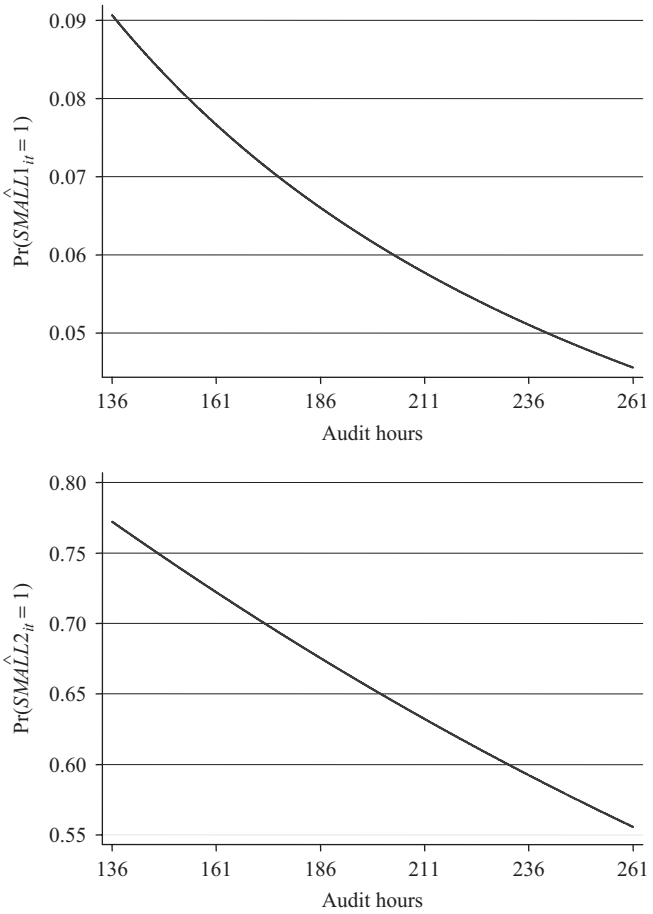

Fig. 3. The associations between audit hours and the reporting of small positive profits. The associations are calculated using the $ILAH_{it}$ coefficients in Models 2 and 4 of Table 6, with the control variables evaluated at their means. The vertical axes show the predicted probability that a firm reports small positive profits ($SMALL1_{it}=1$, $SMALL2_{it}=1$). The mean and standard deviation of the log of audit hours are 5.24 and 0.65, respectively (see Table 2). We calculate the effect of a one standard deviation change in the log of audit hours around the mean (i.e., $5.24 \pm (0.65 \div 2)$). This implies that the unlogged values for audit hours range from 136 to 261 on the horizontal axes.

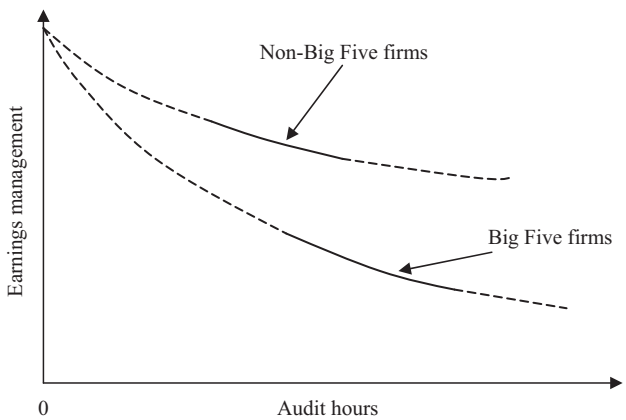

Fig. 4. The association between audit hours and earnings management for Big Five and Non-Big Five audit firms.

Both functions are assumed to be downward sloping because we expect that companies are less likely to manage earnings upwards if auditors work harder. The relations are convex to the origin because the marginal impact of an additional audit hour on earnings management may diminish as hours increase (see also Figs. 1 and 2). In the estimated regressions, this non-linearity is captured using a logarithmic transformation for audit hours.

Crucially, it is unclear whether the negative slopes are expected to be steeper for Big Five or non-Big Five firms along the solid sections of their curves. On the one hand, the marginal effect of an additional hour may be greater for Big Five firms if they supply higher quality audits for any given number of hours. In contrast, the marginal effect of an additional hour may be larger for non-Big Five firms due to the diminishing returns that Big Five firms experience by working more hours.

We investigate this open empirical question by interacting audit hours and audit firm size ($ILAH_{it} * BIG_{it}$). The interaction coefficient may be negative if an additional Big Five hour has a bigger negative impact on income-increasing earnings management than does an additional non-Big Five hour. On the other hand, there may be a positive coefficient for the $ILAH_{it} * BIG_{it}$ variable if the return to working harder diminishes sufficiently quickly.

The results are reported in Table 7. The $ILAH_{it} * BIG_{it}$ coefficients are negative and statistically significant, indicating that greater effort by Big Five firms has a bigger impact on earnings management than does greater effort by non-Big Five firms. The $ILAH_{it}$ coefficients are also negative and statistically significant, which indicates that audit effort by non-Big Five firms also reduces income-increasing earnings management. Overall, these results indicate that the solid sections of both curves are downward-sloping (consistent with Fig. 4) and that the Big Five solid section is steeper. Therefore, it seems that an additional Big Five hour has a bigger negative impact on income-increasing earnings management than does an additional non-Big Five hour (i.e., diminishing returns are not sufficiently strong to give the opposite result).

In untabulated tests we use actual hours (LAH_{it}) rather than instrumented hours ($ILAH_{it}$) in the models of Table 7. The LAH_{it} and $LAH_{it} * BIG_{it}$ coefficients are found to be negative in all four models and they are mostly significant. Specifically, the t- and z-statistics for the LAH_{it} coefficients are −2.15, −3.26, −3.22 and −1.21 in Models (1) to (4). The t- and z-statistics for $LAH_{it} * BIG_{it}$ are −2.12, −1.56, −2.46 and −2.82, respectively. Therefore, the results in Table 7 largely hold whether we measure audit effort using actual hours (LAH_{it}) or instrumented hours ($ILAH_{it}$).

It is worth noting that the BIG_{it} coefficients are positive in Table 7 although they are not all statistically significant. To evaluate the net effect of audit firm size on earnings management, it is necessary to account for *both* the positive coefficients on BIG_{it} and the negative coefficients on the interaction term ($ILAH_{it} * BIG_{it}$). For example, the *BIG* coefficient is 0.952 and the $ILAH_{it} * BIG_{it}$ coefficient is −0.205 in Model 1, which implies that the net effect of audit firm size on earnings management is given by $0.952–0.205 * ILAH_{it}$. Since the mean value of $ILAH_{it}$ is 5.24 (Table 2), the net effect of having a Big Five auditor is negative for the average company ($-0.122 = 0.952–0.205 * 5.24$).[12] Similarly, we verify that the net effects of audit firm size are negative when we use the coefficient estimates for BIG_{it} and $ILAH_{it} * BIG_{it}$ in Models (2), (3) and (4) of Table 7. That the net effects are negative is consistent with the negative coefficients for BIG_{it} in Tables 5 and 6.

4.6. Untabulated sensitivity tests

We have treated the company's choice of audit firm as pre-determined whereas, in reality, the company can choose which audit firm to hire. This raises another endogeneity issue because a company may hire a lower-quality audit firm if it intends to manage earnings. We argue that endogeneity is more likely to be a problem if audit firm tenure is short. For example, suppose that two companies intend to manage earnings in 2001 and both companies are audited by the same low-quality audit firm. Suppose also that company A initially hired its audit firm in 1997 whereas company B initially hired the same audit firm in 2001. We argue that company B is more likely to have hired the low-quality firm because it intends to manage its 2001 earnings. Endogeneity is

[12]We acknowledge that the net effect is estimated to be positive at very low levels of audit hours, for example the net effect is 0.952 when $ILAH_{it}$ equals zero. However, it is difficult to estimate the slope of the curve precisely when audit hours are very low or very high because there are relatively few observations in these regions.

Table 7
The interaction between audit hours and audit firm size

	The dependent variable is:							
	$Sign\_DA_{it}$		DA_{it}^{+}		$SMALL1_{it}$		$SMALL2_{it}$	
	Coefft.	z-stat.	Coefft.	t-stat.	Coefft.	z-stat.	Coefft.	z-stat.
$ILAH_{it}$	−0.213	−2.81***	−0.031	−3.91***	−0.473	−2.77***	−0.678	−2.18**
$ILAH_{it} * BIG_{it}$	−0.205	−1.80*	-0.024	−1.97**	-0.451	−2.02**	−1.745	−3.16***
$LASSET_{it}$	0.128	4.15***	0.016	4.72***	0.413	5.26***	0.522	4.36***
BIG_{it}	0.952	1.46	0.140	1.99**	2.084	1.66*	9.492	2.95***
$INTERNATIONAL_{it}$	−0.051	−0.57	0.002	0.18	0.204	0.95	−0.203	−0.66
SOL_{it}	0.053	0.91	0.006	1.08	0.162	1.21	0.123	0.60
$CURRENT_{it}$	0.040	6.19***	0.004	6.58***	0.059	6.00***	0.015	0.75
$LEVERAGE_{it}$	0.481	5.51***	0.060	6.20***	1.206	6.45***	0.404	1.11
$SWITCH_{it}$	0.004	0.04	−0.008	−0.84	−0.177	−0.93	0.078	0.20
$TENURE_{it}$	−0.028	−2.44**	−0.004	−3.50***	−0.037	−1.53	−0.037	−0.88
$PUBLIC_{it}$	0.223	2.17**	0.013	1.44	−0.908	−3.17***	0.268	0.66
IPO_{it}	0.504	1.80*	0.055	2.16**	0.156	0.20	−0.536	−0.53
Intercept	−1.420	−3.63***	−0.138	−3.23***	−7.408	−8.04***	−3.942	−2.36**
Year dummies?	Yes		Yes		Yes		Yes	
Industry dummies?	Yes		Yes		Yes		Yes	
# observations	9,738		4,694		9,738		944	
Pseudo R^2	1.57%		5.68%		6.18%		9.59%	

***Statistically significant at the 1% level (two-tailed).
**Statistically significant at the 5% level (two-tailed).
*Statistically significant at the 10% level (two-tailed).
DA_{it} = the residual from estimating the cross-sectional Jones model. $Sign\_DA_{it}$ = one if $DA_{it} > 0$; zero otherwise. $DA_{it}^{+} = DA_{it}$ if $DA_{it} > 0$. $SMALL1_{it}$ = one if the return on assets is in the range [0, 0.01] *and* abnormal accruals are positive *and* the unmanaged return on assets is negative; zero otherwise. $SMALL2_{it}$ = one if the return on assets is in the range [0, 0.01] *and* abnormal accruals are positive *and* the unmanaged return on assets is negative; zero if the return on assets is in the range (0, −0.01].
The $Sign\_DA_{it}$ model is estimated using logistic regression. The DA_{it}^{+} model is estimated using truncated regression because positive abnormal accruals are left-truncated at zero. The $SMALL1_{it}$ and $SMALL2_{it}$ models are estimated using logistic regression. We adjust the coefficients' standard errors for the effects of non-independence by clustering on each company (Rogers, 1993; Petersen, 2007). We include year dummy variables for each sample year and 16 industry dummy variables for each two-digit industry that has at least 100 observations. $ILAH_{it}$ = Instrumented log of audit hours for company i in year t. We instrument for audit hours using the predicted value of the log of hours from model 3 of Table 3. $LASSET_{it}$ = Log of assets for company i in year t. BIG_{it} = one if the audit is performed by one of the Big Five audit firms; zero otherwise. $INTERNATIONAL_{it}$ = one if the audit is performed by an international non-Big Five firm (i.e., Grant Thornton or Moore Stephens); zero otherwise. SOL_{it} = one if the audit is performed by the largest Greek audit firm (i.e., SOL SA); zero otherwise. $CURRENT_{it}$ = current assets/current liabilities. $LEVERAGE_{it}$ = (total liabilities − cash)/total assets. $SWITCH_{it}$ = one if the audit is performed by an incoming audit firm; zero otherwise. $TENURE_{it}$ = the number of consecutive years that the company is audited by the same audit firm. $PUBLIC_{it}$ = one if the company is publicly traded on the Athens stock exchange; zero otherwise. IPO_{it} = one in the first year that the company is publicly traded on the Athens stock exchange; zero otherwise.

less likely to be an issue for company A because there is a longer lag between the auditor hiring choice and the earnings management decision. Thus, it is reasonable to treat auditor choice as pre-determined when audit firm tenure is long (Myers et al., 2003).

If the negative associations between audit hours and earnings management are somehow driven by the endogeneity of audit firm choice, we expect the results to disappear (or be much weaker) in a long-tenure sample where audit firm choice is essentially pre-determined. With this in mind, we estimate the earnings management models after partitioning the sample by the median of audit firm tenure (i.e., 4 years).

For the $Sign\_DA_{it}$ model, the $ILAH_{it}$ coefficient is −0.188 (z-statistic = −1.91) in the long-tenure sample and −0.319 (z-statistic = −2.90) in the short-tenure sample. For the DA_{it}^{+} model, the $ILAH_{it}$ coefficient is −0.024 (t-statistic = −2.48) in the long-tenure sample and −0.048 (t-statistic = −4.17) in the short-tenure sample. For the $SMALL1_{it}$ model, the $ILAH_{it}$ coefficient is −0.656 (z-statistic = -3.36) in the long-tenure sample and −0.313 (z-statistic = −1.20) in the short-tenure sample. Finally, for the $SMALL2_{it}$ model, the

$ILAH_{it}$ coefficient is −0.823 (z-statistic = −2.11) in the long-tenure sample and -1.020 (z-statistic = −2.29) in the short-tenure sample. We obtain similar results in the long and short tenure samples if we measure audit effort using LAH_{it} instead of $ILAH_{it}$. Using both LAH_{it} and $ILAH_{it}$, we find that the hours coefficients are not statistically different between long and short tenure in the $Sign\_DA_{it}$, $SMALL1_{it}$ and $SMALL2_{it}$ models. In the DA_{it}^{+} model, the LAH_{it} coefficients are not significantly different between long and short tenure although we do find a significant difference for the $ILAH_{it}$ coefficients (t-statistic = 2.16). Thus, in seven out of eight regressions, the negative associations between audit hours and earnings management are not significantly associated with audit firm tenure. Overall, we conclude that the negative associations between audit hours and earnings management do not appear to be driven by the endogeneity of audit firm choice.

Second, Table 3 shows that client size is a very important determinant of audit hours and we assume a log-linear relation between hours and size ($LASSET_{it}$) when estimating the hours model. If the size effect is misspecified, it could drive a spurious association between audit hours and earnings management, since client size is also a significant variable in the earnings management models. We relax the assumption of a log-linear relation by sorting companies into ten size deciles and constructing a dummy variable for each size decile. We reestimate the audit hours model replacing $LASSET_{it}$ with the ten size dummies and, using the coefficient estimates, we predict an alternative instrument for the log of audit hours. Next, we reestimate the models in Tables 5, 6, and 7 using the alternative instrument for hours. In every model, we continue to find significant negative associations between audit hours and earnings management. Moreover, we continue to find that the hours coefficients are significantly more negative for Big Five firms than for non-Big Five firms.

Third, we examine whether the association between audit effort and earnings management is different between the public and private companies. As the Athens stock market is relatively small, there are only 678 public company observations and, of these, the $SMALL1_{it}$ and $SMALL2_{it}$ variables equal one in only 21 cases. Therefore, there are insufficient public company observations to estimate the small profit models reliably. Instead, we estimate the $Sign\_DA_{it}$ and DA_{it}^{+} models for the public and private company subsamples. In the $Sign\_DA_{it}$ models, the hours coefficients are −0.264 (z-statistic = −1.28) for public companies and −0.321 (z-statistic = −4.14) for private companies. In the DA_{it}^{+} models, the hours coefficients are −0.045 (t-statistic = −2.38) for public companies and −0.041 (t-statistic = −5.26) for private companies. The differences in the hours coefficients between the public and private companies are statistically insignificant.

Fourth, we include the residuals from the audit hours model (Model 3, Table 3) as an additional independent variable in the earnings management models. Since the hours model includes a lagged dependent variable, the residuals capture the unexpected adjustment of audit hours from year $t-1$ to year t. The coefficients for the hours residuals are found to be statistically insignificant in the $Sign\_DA_{it}$, DA_{it}^{+}, DA_{it}^{-} and $SMALL2_{it}$ models but significantly negative in the $SMALL1_{it}$ model. Given these mixed results, we are unable to conclude that earnings management is associated with the unexpected adjustment of audit hours from the previous year.

Finally, we examine whether the results are robust to an alternative measure of loss avoidance. In the case where ROA is small and positive but abnormal accruals are income-decreasing, $SMALL1_{it}$ takes the value of zero; in contrast, these observations are excluded from the $SMALL2_{it}$ model. To determine whether this research design choice affects the results, we construct a third variable ($SMALL3_{it}$) which equals zero if: (1) the return on assets is in the range (0, -0.01], *or* (2) the return on assets is in the range [0, 0.01] and abnormal accruals are negative. Just as with the $SMALL1_{it}$ and $SMALL2_{it}$ variables, $SMALL3_{it}$ is set to one if the ROA is in the range [0, 0.01] and abnormal accruals are positive and the unmanaged return on assets is negative. The $SMALL3_{it}$ variable has 1,534 observations and we re-estimate the models in Table 6 using $SMALL3_{it}$ as the dependent variable. We find that the LAH_{it} and $ILAH_{it}$ coefficients remain negative and statistically significant (z-statistics = −2.44, −1.93) and results for the other variables are similar to those tabulated.

5. Conclusions

In analytical models, audit effort reduces the extent to which managers report aggressively high earnings. However, there is no empirical evidence regarding the impact of audit effort on earnings management, with prior studies focusing instead on the impact of auditor independence. To address this gap in the literature, we measure audit effort using a unique large database of hours worked by Greek audit firms. We measure

earnings management using abnormal accruals and the incidence of small profits. To control for potential endogeneity between audit hours and earnings management, we use instrumental variable estimation in addition to single-equation estimation.

There are three main findings, each of which is robust to controlling for endogeneity in audit hours. First, companies are more likely to report income-increasing abnormal accruals than income-decreasing abnormal accruals, when audit hours are lower. Second, the magnitude of income-increasing abnormal accruals is negatively related to audit hours. Third, companies are more likely to manage earnings upwards to just meet or beat the zero earnings benchmark, when auditors work fewer hours. These results are consistent with managers reporting aggressively high earnings when audit effort is low. Nonetheless, like many previous studies of earnings management, the explanatory power of our abnormal accruals models is low and thus it is important to emphasize that the results should be treated with caution.

We also find weak or insignificant associations between audit hours and the magnitude of negative abnormal accruals. Consistent with prior research, this suggests that auditors have relatively weak incentives to prevent income-decreasing earnings management.

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