

# Determinants and consequences of internal audit functions within colleges and universities

Internal audit  
functions

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## Abstract

**Purpose** – The purpose of this paper is to identify factors associated with the presence and use of internal audit functions (IAFs) at US colleges and universities, as well as their relationship with financial reporting quality and federal grant outcomes.

**Design/methodology/approach** – Using a combination of publicly available and manually collected data, this paper uses a two-stage model to examine both the factors associated with the use of IAFs within US institutions of higher education and the consequences therein.

**Findings** – Results indicate that institutions with larger enrollments and endowments, those that receive public funding and those that have an audit committee are more likely to maintain an IAF. Findings also suggest that the presence of an IAF is negatively associated with reported material weaknesses for major programs at significant levels. Finally, the presence of an IAF is found to have a positive and significant association with federal grants received by the institution, with an even stronger association for IAFs that perform grant-specific procedures.

**Originality/value** – The study's findings provide the first large-sample quantitative insights on IAF work within US colleges and universities. Results should be of interest to college/university leadership as they attempt to improve financial reporting quality and grant outcomes, as well as external stakeholders looking to evaluate whether institutions are acting as good stewards over resources. Additionally, the Institute of Internal Auditors may find the results helpful when promoting the profession.

**Keywords** Internal auditing, Colleges and universities, Financial reporting quality, Grants, Material weaknesses

**Paper type** Research paper

## Introduction

The importance of the internal audit function (IAF) within US publicly-traded companies is well-documented in prior literature (Abdolmohammadi *et al.*, 2006; Cohen *et al.*, 2004; Prawitt *et al.*, 2009; Lin *et al.*, 2011; Ege, 2015). The Institute of Internal Auditors (The IIA, 1999) describes internal auditing as:

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[...] an independent, objective assurance and consulting activity designed to add value and improve an organization's operations. It helps an organization accomplish its objectives by bringing a systematic, disciplined approach to evaluate and improve the effectiveness of risk management, control, and governance processes.

Despite this, little research has examined the role of the IAF outside of publicly-traded companies (Coupland, 1993) in the USA aside from municipal governments (Peterson, 2014; DeSimone, 2020), and to the authors' knowledge very little research has examined the role and impact of IAFs within US colleges and universities. Using a unique set of publicly available and hand-collected data, this study aims to examine both the determinants of use of IAFs in US institutions of higher learning (i.e. colleges and universities) and the IAF's impact on financial reporting quality and federal grant receipts therein.

An empirical examination of the IAF's contributions within US institutions of higher education is important for several reasons. First, these institutions fall under different governance paradigms than publicly traded organizations that are the focus of most prior literature (Christopher, 2012b). Given that IAFs for colleges and universities are likely to be less mature than those in publicly traded firms (van Gils, 2012), a more comprehensive understanding of IAFs in this sector is timely. More importantly, institutions of higher education vary significantly in terms of size, mission, funding sources and scope of operations (Anderson *et al.*, 2010). Therefore, the stakeholders, laws and regulatory requirements are likely different from both publicly traded companies and other nonprofits. One consequence is that internal auditors within US colleges and universities have varying responsibilities that may involve both assurance and/or consultancy over a wide array of topics ranging from financial reporting to grant funding. We use a unique data set that allows for direct evaluation of outcomes that should be impacted by IAFs in higher education.

We use a two-stage model to first examine factors associated with the presence and use of IAFs in these institutions, and second, how IAFs influence internal control material weaknesses (over both financial reporting and federal programs) and federal grant outcomes therein. Using observations from 400 colleges and universities between 2004 and 2017 (based on the largest 250 institutions by either endowment or undergraduate enrollment in 2016), we find that large (based on endowment and enrollment) public institutions and those that have an audit committee (AC) are more likely to maintain an IAF. These findings imply that institutions of higher learning with more resources are likely to use an IAF to provide oversight.

Our results first indicate that the presence of an IAF is negatively associated with reported material weaknesses for major programs at significant levels, but not associated with reported weaknesses in controls over financial reporting. One interpretation of this result is that IAFs focus their efforts on compliance with federal rules over major programs, and that their oversight strengthens the reporting system in a way that mitigates internal control weaknesses. Furthermore, we find that the presence of an IAF has a positive and significant association with federal grants received by the institution, especially when the institution performs grant-oriented procedures. We attribute this result to improved oversight over grant dollars when there is an active IAF, possibly because of greater attention to detail during the grant application process or higher evaluations of stewardship by institutions making granting decisions via fewer internal control issues.

We contribute to the literature on accounting in higher education in at least three ways. First, we are first to examine the IAF's role in higher education on a quantitative macro level. Our findings provide an important benchmark for college/university leadership looking to determine how their approach to internal audit compares with peer institutions. Second, by documenting associations between IAF existence and financial reporting outcomes, we illustrate how internal audit can facilitate the sharing of high-quality

information with stakeholders. Third, our findings regarding grant funding highlight that the benefits of IAFs in higher education extend beyond financial reporting, reinforcing the notion that these IAFs perform a wide variety of value-added services. This is important because internal audit helps increase levels of governance transparency (Archambeault *et al.*, 2008) and improve grant processes, which should be useful amidst high levels of competition for grant dollars (Howard and Laird, 2013).

We organize the remainder of this paper as follows. We first present a brief background on accounting and internal audit for institutions of higher learning, followed by our hypotheses. Next, is a description of our research design, followed by our results. The last section provides a summary and concluding remarks.

## Background and hypotheses

### *Background*

Internal auditors within US colleges and universities perform a wide variety of procedures, which can involve both assurance and/or consultancy work. This includes but is not limited to financial, risk management, advisory, compliance (assets, grants, purchasing and academics) and information technology work. Some colleges/universities have large system-wide or individual campus IAFs, some maintain one person IAFs, while others outsource IAF activities to vendors (e.g. Proviti [1]) or co-source them through consortiums (e.g. The Boston Consortium [2]).

In performing financial assurance work internal auditors within colleges/universities assist with accounting standard compliance and report findings to leadership. This is done through assessment of policies and procedures and by providing ideas to improve internal controls and financial systems and reporting. In summary these IAFs:

Review internal controls, processes, and systems to identify systemic weaknesses and propose improvements and Internal auditors assess the adequacy of corporate governance and the control environment; the effectiveness of processes to identify, assess, and manage risks; the assurance provided by control policies, procedures, and activities; and the completeness and accuracy of information and communication systems and practices (The IIA, 2012).

Regarding grants, the federal government historically has been the largest sponsor of research activities at US institutions of higher education, contributing around \$39bn or 54% of the money spent on research by these institutions in 2016 (NSF, 2017) [3]. With federally funded research grants, the principal investigator (researcher) is responsible for conducting and completing the technical (research) portion of the project, while the college/university is responsible for the project adhering to the regulations and policies of the federal funding source. Additionally, cost accounting principles and audit requirements for higher education federal award grantees are established by the US Office of Management and Budget (OMB) and are detailed in The Uniform Administrative Requirements (OMB, 2014a). The proposal and award policies are often long and detailed, such as the National Science Foundation's (NSF) 198 page *Proposal and Award Policies and Procedures Guide*, which covers proposal preparation and submission guidelines, as well as the award, administration and monitoring of grants (NSF, 2019). Additionally, the NSF's Office of the Inspector General (NSF-OIG) periodically conducts audits of grantee internal controls related to grants, and in its 2016 semi-annual report to Congress noted a total of more than \$5.5m in questioned costs over 13 audits during 2011-2015. The NSF-OIG also stated:

[. . .] at 32 of the 42 awardees with findings, auditors reported 65 material weaknesses and/or significant deficiencies in internal control over compliance, representing more than 80 % of

findings identified during the period, calling into question the awardees' ability to provide effective stewardship over federal funds (NSF-OIG, 2016).

Recent stories in the press highlight the importance of audits related to federal grants, and the costs of non-compliance. During a 2010 visit to Duke University, an NSF-OIG auditor stated "scientific excellence is no longer enough [. . .] financial and administrative excellence are now required" (Mock, 2002). In 2015, the University of Florida was ordered to pay the US \$19.875m to settle allegations that it improperly charged salary and administrative costs to hundreds of federal grants from the US Department of Health and Human Services from 2005-2010 (US DOJ, 2015). Internal auditors help their institutions with grant compliance by creating and/or auditing procedures and internal controls that cover these administrative aspects of externally sponsored projects for both pre- and post-award activities, and as such, can contribute to the success of obtaining and retaining grants.

#### *Literature review*

Colleges and universities in the USA may be state or privately supported. Stakeholders that provide funding to these institutions include state governments, taxpayers, private donors, tuition payers, students and potential employers of graduates. Both public and private institutions of higher education routinely obtain federal grants for research (Montondon and Fischer, 1999). As discussed previously, these federal grants often comprise a large portion of funding for research conducted within higher education institutions, and has roughly doubled to almost \$40bn since 2000 (NSF, 2017) [4].

Gordon *et al.* (2002) examine the factors associated with service efforts and accomplishments (SEA) reporting disclosure levels [5] for both public and private institutions of higher learning without considering internal audit, and find that disclosure levels are significantly higher for large institutions (based on assets). Gordon and Fischer (2008) find higher levels of SEA reporting for larger institutions, those with greater debt levels and those providing more advanced degrees. Furthermore, Behn *et al.* (2010) suggest that greater levels of transparency for entities of higher education compared to other nonprofit organizations is because of familiarity with scrutiny by stakeholders.

Research regarding internal audit in higher education is limited, especially in the USA. Montondon and Fischer (1999) examine the work of IAFs in US institutions of higher education and find that they focus efforts on compliance and financial audits, but do not perform financial or program audits of academic subunits. Additionally, Anderson *et al.* (2010) propose a model to effectively size IAFs in US colleges and universities, although this research does not empirically examine the impact of IAF work. However, we expect that IAFs within the USA to provide benefits to colleges/universities at least as much as their international counterparts. This is because prior research indicates that IAF development is more advanced in Anglo-Saxon countries primarily because of the longer IAF history therein (Sarens and Abdolmohammadi, 2011).

Outside the USA, some studies have examined the use and work of IAFs within institutions of higher education. Lundquist (1997) suggests that internal auditors can make positive contributions within total quality management in higher education in Sweden. Zakaria *et al.* (2006) find that IAFs are more prevalent and have a broader scope within public institutions of higher education than their private counterparts. Arena (2013) examines internal audit in Italian universities and finds a varying degree of IAF usage therein, as well as a wide range of processes audited by IAFs. Using a case study approach, Mihret and Yimsaw (2007) suggest that the IAF within an Ethiopian institution of higher education is not highly effective. Sari *et al.* (2017), using survey data from universities in Indonesia, find that IAFs do not effectively improve internal control systems because they lack the organizational influence to do so.

Blackmore (2004) suggests that internal academic audit inspection and quality control processes in the UK are close to the ISO 9000 guidelines for auditing quality management systems but also sometimes fall short in the areas of quality assurance and total quality management. Using survey data from a sample of Australian university vice-chancellors, Christopher (2012a) finds that IAFs are viewed as an important part of corporate governance by monitoring controls effectively, but some may lack the skills necessary to monitor management and conduct both operational and performance audits of educational institutions. Christopher (2012b) develops a model of the factors that influence corporate governance mechanisms, including internal auditing, in Australian public universities. Christopher (2015) finds that IAFs in public Australian universities operate under flexible structural and functional arrangements (sufficient organizational support, IAF activities and relationship with management) that allow them to enhance governance in their respective institutions. Finally, Ntim *et al.* (2017) examine whether internal governance structures influence voluntary disclosures in UK higher education institutions, but only considers IAF resources and no other IAF-related variables. Thus, our research fills a gap by examining the effectiveness of IAFs in institutions of higher education, specifically in the USA, as there exists variability internationally therein. Additionally, we take a more quantitative macro approach to examine IAFs within institutions of higher education than most prior studies, which focus on case studies or contain more limited samples.

#### *Hypotheses*

Recently, public universities have increasingly followed market-based public administration and corporate managerialism (Christopher, 2012a; Kezar and Eckel, 2004; Parker, 2011). This includes the shift to a more centralized and structured approach to governance (Kezar, 2005), which closely resembles that of the private sector. To assist higher education administration and trustees in ensuring effective governance, the framework under the corporate and new public management structure provides for a number of control mechanisms including an independent IAF. Within colleges and universities, IAFs assist administrators by creating, updating, reviewing and reporting on internal controls related to governance and providing feedback therein (Christopher, 2012a). This includes controls related to both the financial reporting and the grant processes.

The Single Audit Act of 1984 (United States Congress, 1984) and Single Audit Act Amendments of 1996 (United States Congress, 1996) require local governments, non-profit organizations or institutions of higher education receiving certain levels of federal funding to undergo a single audit (previously called A-133 audit) [6]. Single audits ensure compliance with rules regarding the use of federal funds and whether appropriate internal controls are in place therein per the US OMB (OMB, 2014a). The objectives of single audits are to evaluate whether entities that receive significant federal funding comply with laws, regulations and the provisions of contract and grant agreements and maintain internal control to provide reasonable assurance of compliance (OMB, 2003). Institutions that spend \$750,000 or more in federal funds must undergo a financial statement audit (OMB, 2014a). This audit includes external auditor assessment of whether internal controls over financial reporting are designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements per Government Auditing Standards issued by the Comptroller General of the USA. When internal controls are deemed inadequate enough to create a reasonable possibility of a material misstatement, material weaknesses [7] are noted in audit reports for both single audits and financial statement audits (U.S. GAO, 2011).

Prior research suggests a positive relationship between the use of the IAF and financial reporting quality in publicly-traded companies (Prawitt *et al.*, 2009; Lin *et al.*, 2011; Ege, 2015) [8]. In the non-profit setting, using a sample of US municipalities, Peterson (2014) finds no relationship between the presence of an IAF in municipalities and audit reportable conditions. DeSimone (2020) finds a significant positive relationship between the presence of an IAF and reported financial statement internal control issues (significant deficiencies) in a sample of US municipalities with populations over 100,000. DeSimone (2020) also indicates a significant negative association between the presence of an IAF and financial statement restatements. The author posits that these results indicate that IAFs in the public sector are able to identify and ensure proper reporting of these issues and prevent related financial statement errors, but lack the resources to implement the controls to completely mitigate them. Thus, IAFs demonstrate the ability to help improve financial reporting quality through transparency, even when they lack appropriate resources for complete mitigation therein.

If IAFs improve an institution's governance structure in a way that strengthens internal controls, one consequence should be an inverse association between IAFs and internal control weaknesses. However, IAFs in higher education may not be as mature as publicly-traded companies, as they are often younger and have less funding (Gordon and Fischer, 1996; Montondou and Fischer, 1999; The IIA, 2009). Additionally, universities/colleges are generally not required to follow the provisions of Section 404 of Sarbanes-Oxley (United States Congress, 2002) [9]. Thus, one consequence could be a positive relationship between IAF existence and internal control weaknesses. This is because IAFs may help improve the transparency of financial reporting by helping to properly disclose internal control weaknesses, but may not have the appropriate time or resources for remediation or their parent institution may fail to act on IAF recommendations.

The NSF-OIG has noted this scenario in numerous audit reports of grantee institutions. For example, in an audit of Cornell University's effort certification system (used to validate salaries and wages charged NSF grants), the NSF-OIG found that 19% of reviewed salaries were inadequately certified. This was despite the fact that Cornell's IAF identified the same weakness two years prior to the NSF-OIG audit (NSF-OIG, 2009a). The NSF-OIG also reported in 2009:

Georgia Tech has not developed adequate oversight processes for the review of prospective workload changes and cost transfers even though the issue of inadequate cost transfer justifications has been identified with respect to the area of cost transfers since 2004 by Georgia Tech's own internal audit function (NSF-OIG, 2009)

Additionally, some prior research (Lopez and Peters, 2010) finds that large Certified Public Accountant firms are more likely to issue control exceptions than are governmental and local Certified Public Accountant firms. The authors point to the abundance of literature suggesting that public firms provide higher quality audits than governmental auditors, and that audit firm size is positively associated with audit quality. Therefore, given the mixed results of prior literature and resulting expectations therein, we state our first hypothesis in the null as follows:

*H1.* The presence of an IAF will be independent of internal control material weaknesses.

Next, the benefits of IAFs to institutions of higher education are not limited to financial reporting, as they also may be an integral participant in the grant process of their respective institutions. The Uniform Administrative Requirements (OMB, 2014a) detail the overarching accounting principles and audit requirements, while also providing the basis for determining

applicable costs for federal award grantees. These requirements can be daunting on their own, plus each grant sponsor also has specific requirements. For example, pre-grant policies and procedures for the submission of proposals may require the use of specific application forms or electronic web-based systems. This may also include detailed instructions regarding page limitations on narrative sections, biographical sketches/CVs, budgets, budget justifications. Applications that do not conform to these requirements may jeopardize the proposal's success.

The researcher is responsible and accountable for the sponsored project and the college/university provides the infrastructure (generally administered through a sponsored research department) in which the investigator conducts the project. Thus, the institution provides guidance and support with regard to the development and administration of externally funded sponsored projects, which includes but is not limited to the definition of roles and responsibilities regarding administration and compliance and to answer questions about institutional policies and procedures, as well as federal and other regulations. Pre-award, the institution helps faculty locate and apply for external funding (searches, proposal and budget development, reading and interpreting regulations and compliance guidelines and proposal submissions). Post-award the institution may help with award negotiation, compliance with federal rules and regulations, assisting with technical report completion and any modifications.

Internal auditors within colleges/universities are in a unique position to assist with advanced and value-added activities (Bou-Raad, 2000; Nagy and Cenker, 2002; The IIA, 2013), such as grants. First, they have an innate knowledge of the institution's purpose, employees and its environment. Second, internal auditors are trained to assess policies and procedures, provide ways to improve operations and make recommendations to enhance the efficiency and effectiveness of institutional operations. Finally, they regularly communicate findings and suggestions for improvements to relevant decision-makers, and assist with implementation therein (Gramling *et al.*, 2004; Nagy and Cenker, 2002; The IIA, 2013).

Specific to the grant process, IAFs perform grant compliance auditing for their institutions. This includes validation that expenses charged to a grant are allocable, allowable and reasonable and verification that specific compliance standards are upheld (export controls, hazardous materials, human subject management, IRB protocol, etc.). This "grant compliance auditing" provides an assessment of compliance with federal and university guidelines to determine problem areas. Additionally, IAFs examine the controls and processes in place that handle a large number/scope of grants to verify that these processes will meet compliance/legal requirements. This includes collaboration with research administrators around controls in place (first layer of defense) to strengthen the overall control environment. Additionally, IAFs perform university wide controls/processing auditing, which involves controls that reside in pre/post-award central offices (second layer of defense) to ensure they are operating appropriately. These controls generally cover three main areas, namely, management responsibility (application timing, composition, budgeting, financial reporting), reporting requirements (research progress, personnel, time and effort) and risk assessment (personnel, time and effort, costs, policies and procedures, compliance) (Evans and Roy, 2012). Finally, some IAFs use sophisticated data analysis tools to ensure conformance with compliance and legal regulations (primarily for expenses) [10].

In 2006, the University of Florida internal audit department discovered a weakness within the accounting system under which researchers confirm the allocation of salaries charged to research grants (Magoc, 2015). However, the university failed to begin to remedy this weakness until 2007, and ultimately had to settle litigation and pay back \$19.8m in research grants to the US Department of Health and Human Services (Magoc, 2015; US DOJ, 2015). Despite this example, many audit reports published by the NSF-OIG find that grantee institutions with IAFs generally have well-established grant management systems, with

some exceptions (NSF-OIG, 2006;2008; 2009a; 2009b) [11]. Also, many institutions publicly disclose the results of their IAF's audits of grants ( UTEP, 2016; University of Washington Department of Audits, 2007; Minnesota State Colleges and Universities Office of Internal Auditing, 2016) (internal control weakness). Thus, we expect that IAFs are able to apply both their institutional and compliance knowledge to help create processes and controls that streamline and make the grant process more efficient and effective and/or that IAF oversight control provides assurance to funders, which leads to more positive granting decisions. Thus, we present our second hypothesis:

*H2.* The presence of an IAF will be associated with higher amounts of federal grant funding.

## Research design and results

### *Data and summary statistics*

We begin our analysis based on the 1,570 institutions of higher education that awarded bachelor's degrees in the USA using data from the Integrated Post-secondary Education Data System (IPEDS) provided by the National Center for Education Statistics (NCES). To facilitate both data availability and comparability, we focus on the largest 250 institutions in terms of either undergraduate enrollment or endowment value in 2016. This restriction resulted in 400 unique institutions that are the focus of our analysis between 2004 and 2017 [12]. We hand collect information on IAFs and ACs for sample institutions from websites and by contacting institutions via e-mail and/or phone when information is not available online. Most institutional characteristics such as endowment value and enrollment also come from IPEDS, while the highest degree awarded details are from the Carnegie classification of institutions of higher education. Finally, we merge in details from audit analytics to identify internal control weaknesses and select financial information. Table 1 outlines our sample selection procedures, which result in 3,433 institution-years for the internal control model and 4,952 for the federal grants model.

### *Determinants of internal audit functions*

Given that maintaining an IAF is voluntary for non-profit organizations such as institutions of higher education, there is the risk that selection bias influences any results. Therefore, we begin our analysis with a model designed to assess the likelihood an institution maintains

Colleges/Universities	Internal control sample	Federal grants sample
Top 250 colleges and universities by endowment or enrollment	400	400
Potential observations from 2004-2017 (400 × 14)	5,600	5,600
Less those with missing IPEDS records	(30)	(30)
Less those with missing federal audit clearinghouse details	(1,914)	–
Less those with missing federal grant details	–	(46)
Less those with missing debt or endowment details	(111)	(180)
Less those with missing determinants model observations	(112)	(392)
Final sample	3,433	4,952

**Table 1.**  
Sample selection



an IAF as part of a Heckman (1979) two-stage procedure. We use the following probit specification:

$$\begin{aligned}
 IAF_{i,j} = & \alpha_0 + \alpha_1 Endowment_{i,j} + \alpha_2 Total\ enrollment_{i,j} \\
 & + \alpha_3 Graduate\ percentage_{i,j} + \alpha_4 Public_i + \alpha_5 College_i \\
 & + \alpha_6 Doctoral_i + \alpha_7 Masters_i + \alpha_8 Land\ grant_i + \alpha_9 Religious_i \\
 & + \alpha_{10} Urban_i + \alpha_{11} Hospital_i + \alpha_{12} Audit\ committee_i \\
 & + \sum \delta_j YearFE_{i,j} + \sum \phi_j StateFE_i + \varepsilon_{i,j}
 \end{aligned} \tag{1}$$

Where *IAF* is an indicator variable equal to 1 (0 otherwise) for institutions with an *IAF* in place [13]. The control variables for all models are derived from the internal audit and education streams of literature streams and are presented in the Appendix. *Endowment* represents the total logged endowment of the institution while *Total enrollment* represents the total logged number of undergraduate students enrolled. These are used as proxies for institution size, as prior research finds that the presence of an IAF is often a resource allocation decision (Abdolmohammadi *et al.*, 2006; Anderson *et al.*, 2012; Christopher, 2012a, 2012b). *Graduate percentage* is the fraction of total enrollment that are graduate students and is a proxy for research intensity (Dundar and Lewis, 1998).

Private colleges and universities are not subject to the electoral control, which holds the government accountable, while public institutions have a unique relationship to state government through funding and their relationship with the state auditor (Gordon *et al.*, 2002). Prior research finds that a larger internal audit department budget for private universities despite employing fewer people than the public universities (Montondon and Fischer, 1999) and that public colleges and universities disclose financial information to a greater extent than private ones (Gordon *et al.*, 2002). Public versus private is also used as a control variable in higher education research that examines research grant funding and productivity (Dundar and Lewis, 1998; Payne, 2001; Ali *et al.*, 2010). Thus, *Public* indicates if an institution is public (coded as 1) or private (coded as 0). *College* denotes whether an institution is organized into a single college encompassing all students (coded as 1) or a university (coded as 0) where operations are organized into separate colleges.

We use several additional measures to control for factors associated with research intensity. *Doctoral* and *Masters* are indicator variables equal to 1 (0 otherwise) to indicate the highest degree awarded at a given institution. *Land grant* identifies whether an institution is designated to receive the benefits of the Morrill Acts of 1862 and 1890, while *Hospital* is an indicator denoting whether the institution maintains an independent hospital (1 yes, 0 no).

*Religious* is an indicator equal to 1 for institutions with a religious affiliation, and *Urban* is an indicator equal to 1 (0 otherwise) for institutions with an urban locale code as defined by the NCES. *Audit committee* is an indicator equal to 1 (0 otherwise) to denote institutions that maintain an active AC, which is a separate source of governance. Finally, *YearFE* represents fiscal year fixed effects while *StateFE* represents the state where the institution resides.

#### Consequences of internal audit functions

We propose the following specification to test for associations between *IAFs* in higher education and internal control material weaknesses.

$$\begin{aligned}
ICW_{i,j} = & \alpha_0 + \alpha_1 IAF_{i,j} + \alpha_2 IAF \text{ type}_i + \alpha_3 Endowment_{i,j} + \alpha_4 Total \ enrollment_{i,j} \\
& + \alpha_5 Graduate \ percentage_{i,j} + \alpha_6 Public_i + \alpha_7 Doctoral_i \\
& + \alpha_8 Hospital_i + \alpha_9 Audit \ committee_{i,j} + \alpha_{10} Debt \ Ratio_{i,j} \\
& + \alpha_{11} Deficit_{i,j} + \alpha_{12} Big4 \ auditor_{i,j} + \alpha_{13} Low \ risk \ audit_{i,j} \\
& + \alpha_{14} Lambda_{i,j} + \sum \delta_j YearFE_j + \varepsilon_{i,j}
\end{aligned} \tag{2}$$

Where internal control weakness (*ICW*) represents either a material weakness over:

- the financial statements in general or
- major programs (Petrovits *et al.*, 2011).

*IAF type* considers the nature of internal audit procedures and is coded as 1 if the *IAF* performs specific financial reporting (*IAF financial work*) or grant-oriented (*IAF grant work*) procedures (0 otherwise) [14]. *Debt ratio* represents the ratio of debt to total assets, and captures the extent of reliance on leverage. *Big4 auditor* indicates if the institution uses a Big 4 auditor (1) or not (0), and is a proxy for audit quality. *Low risk audit* denotes whether the year's audit is characterized by the external auditor as low risk, implying that the auditors expect few exceptions to arise during fieldwork (Petrovits *et al.*, 2011). *Lambda* is the inverse Mills from the first stage of our Heckman (1979) two-stage procedure based on equation (1). All other variables are defined previously.

We propose the following specification to test for associations between IAFs in higher education and federal grant funding.

$$\begin{aligned}
Federal \ Grants_{i,j} = & \alpha_0 + \alpha_1 IAF_{i,j} + \alpha_2 IAF \ textype_i + \alpha_3 Endowment_{i,j} \\
& + \alpha_4 Total \ enrollment_{i,j} + \alpha_5 Graduate \ percentage_{i,j} \\
& + \alpha_6 Public_i + \alpha_7 Doctoral_i + \alpha_8 Hospital_i \\
& + \alpha_9 Audit \ committee_{i,j} + \alpha_{10} Debt \ Ratio_{i,j} + \alpha_{11} Deficit_{i,j} \\
& + \alpha_{12} Lambda_{i,j} + \sum \delta_j YearFE_j + \sum \phi_j StateFE_i + \varepsilon_{i,j}
\end{aligned} \tag{3}$$

Where *Federal Grants* represents the logged total dollar amount of federal grant money received by the college/university. All other variables are as defined previously. Our controls include all variables considered in the higher education literature regarding research productivity (Dundar and Lewis, 1998; Payne, 2001; Ali *et al.*, 2010). These studies use various proxies to control for institution size, graduate student percentage, public/private, research productivity and the presence of a medical school. Note that all continuous variables are winsorized at the 1% and 99% levels.

## Results

Table 2 provides summary statistics for the institutions in our sample. Panel A is for the entire sample, which highlights that 67% of institution-years have an IAF, and that 45% and 37% of institution-years involve an IAF that performs specific financial reporting and grant work, respectively. Internal control material weaknesses over both financial statements and major programs are relatively infrequent, occurring in approximately 3%-4% of observations and average federal grant funding is approximately \$85m. The average endowment value is over \$1.1bn and total enrollment is approximately 15,500 students. A minority of institutions are

Variable	Mean	P25	Median	P75	SD		
<i>Panel A: full sample (n = 3,433)</i>							
IAF	0.67	0.00	1.00	1.00	0.47		
IAF financial work	0.45	0.00	0.00	1.00	0.50		
IAF grant work	0.37	0.00	0.00	1.00	0.48		
MW	0.03	0.00	0.00	0.00	0.16		
MW program	0.04	0.00	0.00	0.00	0.20		
Federal grants ('000 s)	84,964	2,982	23,576	72,952	164,111		
Endowment ('000 s)	1,148,228	109,656	33,182	817,324	3,159,642		
Total enrollment	15,558	3,508	13,631	23,063	12,762		
Graduate percentage	0.22	0.09	0.21	0.31	0.16		
Public	0.41	0.00	0.00	1.00	0.49		
College	0.23	0.00	0.00	0.00	0.42		
Doctoral	0.51	0.00	1.00	1.00	0.50		
Masters	0.22	0.00	0.00	0.00	0.41		
Land grant	0.07	0.00	0.00	0.00	0.26		
Religious	0.19	0.00	0.00	0.00	0.39		
Urban	0.63	0.00	1.00	1.00	0.48		
Hospital	0.10	0.00	0.00	0.00	0.30		
Audit committee	0.76	1.00	1.00	1.00	0.43		
Debt ratio	0.36	0.22	0.31	0.43	0.22		
Deficit	0.23	0.00	0.00	1.00	0.42		
Big4 auditor	0.63	0.00	1.00	1.00	0.48		
Low risk audit	0.83	1.00	1.00	1.00	0.38		
<i>Panel B: Sorted by IAF (n = 3,433)</i>							
Variable	IAF = 1			IAF = 0			Test of Mean Diff
	Mean	Median	SD	Mean	Median	SD	
MW	0.03	0.00	0.16	0.03	0.00	0.17	
MW program	0.04	0.00	0.19	0.04	0.00	0.20	
Federal grants ('000 s)	117,595	40,834	188,652	17,059	2,491	58,709	***
Endowment ('000 s)	1,453,781	333,799	3,793,383	541,638	330,648	828,714	***
Total enrollment	19,451	17,574	12,844	7,830	3,272	8,303	***
Graduate percentage	0.26	0.23	0.16	0.14	0.08	0.15	***
Public	0.50	1.00	0.50	0.21	0.00	0.41	***
College	0.11	0.00	0.31	0.46	1.00	0.50	***
Doctoral	0.65	1.00	0.48	0.23	0.00	0.42	***
Masters	0.21	0.00	0.41	0.22	0.00	0.42	
Land grant	0.10	0.00	0.30	0.03	0.00	0.16	***
Religious	0.15	0.00	0.36	0.27	0.00	0.45	***
Urban	0.70	1.00	0.46	0.48	0.00	0.50	***
Hospital	0.13	0.00	0.34	0.04	0.00	0.19	***
Audit committee	0.85	1.00	0.36	0.58	1.00	0.49	***
Debt ratio	0.40	0.35	0.23	0.28	0.25	0.17	***
Deficit	0.24	0.00	0.43	0.21	0.00	0.41	*
Big4 auditor	0.66	1.00	0.47	0.57	0.00	0.50	***
Low risk audit	0.82	1.00	0.39	0.85	1.00	0.35	***

**Notes:** This table provides descriptive statistics for all variables included in the study. Panel A is for the entire sample, while Panel B divides the sample into two subsamples based on institutions with and without IAFs. \*, \*\*, \*\*\* indicate significance at  $p < 0.10, 0.05$  and  $0.01$  in tests of mean differences between the two subsamples. Variable descriptions are as stated in the [Appendix](#), except for *federal grants*, *endowment* and *total enrollment*, which are reported at raw values

**Table 2.**  
Summary statistics

**Table 3.**  
Pairwise correlations

Variable	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]
[1] IAF	1.00															
[2] IAF financial work	0.66*	1.00														
[3] IAF grant work	0.55*	0.67*	1.00													
[4] MW	0.00	0.01	-0.04*	1.00												
[5] MW program	0.00	0.05*	0.00	0.17*	1.00											
[6] Federal grants	0.23*	0.31*	0.29*	0.00	-0.02	1.00										
[7] Endowment	0.08*	0.08*	0.16*	-0.03*	-0.05*	0.53*	1.00									
[8] Total enrollment	0.37*	0.41*	0.39*	0.01	0.08*	0.44*	0.07*	1.00								
[9] Graduate percentage	0.24*	0.28*	0.19*	-0.01	0.02	0.46*	0.32*	0.18*	1.00							
[10] Public	0.31*	0.38*	0.30*	0.01	0.11*	0.05*	-0.24*	0.55*	-0.04*	1.00						
[11] College	-0.37*	-0.38*	-0.31*	0.02	-0.07*	-0.24*	-0.04*	-0.48*	-0.43*	-0.44*	1.00					
[12] Doctoral	0.34*	0.38*	0.35*	0.02	0.07*	0.41*	0.18*	0.56*	0.42*	0.21*	-0.46*	1.00				
[13] Masters	-0.03*	-0.06*	-0.06*	-0.05*	-0.03	-0.24*	-0.16*	-0.09*	-0.17*	0.20*	-0.13*	-0.61*	1.00			
[14] Land grant	0.13*	0.15*	0.17*	0.00	0.06*	0.21*	-0.02	0.35*	0.00	0.28*	-0.17*	0.32*	-0.19*	1.00		
[15] Religious	-0.17*	-0.17*	-0.14*	-0.02	-0.04*	-0.15*	-0.01	-0.25*	0.07*	-0.45*	0.10*	-0.05*	-0.02	-0.15*	1.00	
[16] Urban	0.16*	0.16*	0.11*	-0.05*	0.03	0.19*	0.03*	0.23*	0.25*	0.06*	-0.25*	0.19*	-0.01	0.00	0.02	1.00
[17] Hospital	0.12*	0.17*	0.13*	0.07*	0.09*	0.39*	0.13*	0.16*	0.32*	0.04*	-0.15*	0.18*	-0.17*	0.02	-0.04*	0.13*
[18] Audit committee	0.29*	0.27*	0.20*	-0.03	0.00	0.11*	0.08*	0.09*	0.08*	0.02	-0.03*	0.04*	-0.02	-0.02	-0.07*	0.07*
[19] Debt ratio	0.20*	0.11*	0.08*	0.01	0.02	-0.02	-0.14*	0.25*	0.05*	0.36*	-0.26*	0.07*	0.25*	0.02	-0.16*	0.09*
[20] Deficit	0.00	-0.05*	-0.04*	0.05*	-0.03	-0.05*	-0.01	-0.11*	-0.04*	-0.09*	0.09*	-0.10*	0.05*	-0.07*	0.03*	-0.03*
[21] Big4 auditor	0.11*	0.07*	0.19*	-0.11*	-0.01	0.18*	0.18*	0.03*	0.23*	-0.23*	-0.11*	0.10*	-0.05*	0.00	0.05*	0.26*
[22] Low risk audit	-0.05*	-0.08*	-0.03*	-0.14*	-0.24*	0.05*	0.08*	-0.11*	0.01	-0.14*	0.06*	-0.03	-0.02	-0.04*	0.03	-0.03
[17] Hospital			[17]		[18]		[19]		[20]		[21]		[22]			
[17] Hospital			1.00													
[18] Audit committee			0.03*		1.00											
[19] Debt ratio			0.03		0.09*		1.00									
[20] Deficit			-0.02		0.06*		0.20*			1.00						
[21] Big4 auditor			0.12*		0.09*		0.03			0.00			1.00			
[22] Low risk audit			-0.05*		0.00		0.02			-0.01			0.09*			1.00

**Notes:** This table provides pairwise correlations for the variables in our study. \*denotes significance at the 5% level. Variable descriptions are included in the Appendix

Endowment	0.23* (1.92)
Total enrollment	0.67** (2.43)
Graduate percentage	1.18 (1.09)
Public	1.58*** (2.99)
College	-0.11 (-0.23)
Doctoral	0.74 (1.17)
Masters	0.19 (0.37)
Land grant	-0.09 (-0.17)
Religious	-0.36 (-0.73)
Urban	0.13 (0.50)
Hospital	0.66 (1.22)
Audit committee	1.48*** (4.52)
Constant	4.07 (1.19)
Observations	5,093
Pseudo $R^2$	0.40

**Notes:** \*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$  based on two-tailed tests. Robust z-statistics in parentheses, with standard errors clustered on institution following procedures outlined by Rogers (1993). Year and state fixed effects are included but not reported. This table presents results from a logit specification of a determinants model of IAF existence based on [equation \(1\)](#). The dependent variable is an indicator variable equal to one (0 otherwise) for institutions of higher learning that maintain a distinct IAF. Variable descriptions are in the [Appendix](#)

**Table 4.**  
Determinants of  
internal audit  
functions in higher  
education

public (41%), 51% offer doctoral degrees and 23% are colleges (as opposed to universities). 76% of the sample has a formal AC and 83% of audits are designated as low risk.

[Table 2](#), Panel B is partitioned based on the existence of an IAF, and highlights that the two subsamples are statistically different across most elements included in our analysis. [Table 3](#) provides pairwise correlations and provides univariate evidence that IAFs are associated with higher grant funding. While several independent variables are moderately correlated (primarily among the different measures of size), an examination of variance inflation factors highlights no values above 5, which limits the impact of multi-collinearity on our results described below ([Kennedy, 2003](#)).

We summarize the results of our determinants model in [Table 4](#). The findings suggest that institutions with larger endowments and higher total enrollments are more likely to maintain an IAF (*Endowment* = 0.23; *z*-statistic = 1.92; *Total enrollment* = 0.67; *z*-statistic = 2.43), possibly because they have more financial resources at stake. Furthermore, institutions that are publicly funded (*Public* = 1.58; *z*-statistic = 2.99) and that maintain an AC (*Audit committee* = 1.48; *z*-statistic = 4.52) are also more likely to maintain IAFs. One interpretation of these results is that accountability to the public and increased complexity and/or reliance on external grant funding prompt additional governance mechanisms.

We present our results for tests of *H1* regarding internal control material weaknesses in [Table 5](#). The results presented in Columns 1 through 3 suggest no statistical association between the presence of IAFs and material weaknesses over financial statements. However, the results in Column 4 imply that institutions that maintain IAFs are *less* likely to disclose an internal control material weakness over major programs (*IAF* = -0.77; *z*-statistic = -2.30), which prompts us to reject the null hypothesis that IAFs and internal control material weaknesses are independent. One possible interpretation of this result is that IAFs serve to strengthen oversight over major programs in a way that reduces the likelihood of internal control problems.

**Table 5.**  
the Relation between  
internal audit  
functions and  
material weaknesses  
in higher education

Variable	MW financial statements			MW major programs		
	[1]	[2]	[3]	[4]	[5]	[6]
IAF	0.12 (0.40)		0.11 (0.32)	-0.77** (-2.30)		-1.08*** (-2.66)
IAF financial work		0.10 (0.32)	0.02 (0.07)		-0.19 (-0.45)	0.41 (0.94)
Endowment	0.09 (0.59)	0.05 (0.36)	0.09 (0.59)	-0.10 (-0.99)	-0.13 (-1.14)	-0.10 (-0.91)
Total enrollment	-0.32 (-1.36)	-0.42* (-1.84)	-0.32 (-1.37)	-0.18 (-0.79)	-0.20 (-0.94)	-0.17 (-0.76)
Graduate percentage	1.00 (1.14)	0.77 (0.83)	0.99 (1.13)	1.18 (1.16)	1.35 (1.40)	1.04 (0.98)
Public	0.74 (1.50)	0.63 (1.28)	0.74 (1.50)	1.59*** (3.50)	1.58*** (3.39)	1.54*** (3.24)
Doctoral	0.57 (1.58)	0.45 (1.23)	0.57 (1.57)	0.49 (1.30)	0.55 (1.41)	0.48 (1.28)
Hospital	0.61 (1.17)	0.67 (1.18)	0.60 (1.11)	0.56 (1.29)	0.62 (1.33)	0.54 (1.24)
Audit committee	0.00 (0.02)	-0.19 (-0.60)	-0.00 (-0.00)	0.39 (0.85)	0.44 (1.11)	0.35 (0.72)
Debt ratio	0.50 (0.66)	0.41 (0.54)	0.51 (0.66)	-1.06 (-1.30)	-1.10 (-1.34)	-1.02 (-1.20)
Deficit	0.69** (2.40)	0.69** (2.43)	0.69** (2.40)	-0.55 (-1.57)	-0.59* (-1.69)	-0.55 (-1.56)
Big4 auditor	-1.26*** (-5.29)	-1.24*** (-5.18)	-1.26*** (-5.28)	0.28 (0.91)	0.34 (1.02)	0.27 (0.89)
Low risk audit	-1.23*** (-4.24)	-1.20*** (-4.13)	-1.23*** (-4.23)	-1.77*** (-7.29)	-1.79*** (-7.59)	-1.76*** (-7.40)
Lambda	0.66** (2.46)	0.15 (0.76)	0.66** (2.45)	-0.09 (-0.19)	0.15 (1.27)	-0.09 (-0.19)
Constant	-3.78 (-0.96)	-1.63 (-0.43)	-3.76 (-0.97)	-1.09 (-0.35)	-1.12 (-0.38)	-1.20 (-0.39)
Observations	3,433	3,433	3,433	3,433	3,433	3,433
Pseudo R <sup>2</sup>	0.13	0.12	0.13	0.20	0.20	0.20

**Notes:** \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$  based on two-tailed tests. Robust z-statistics in parentheses, with standard errors clustered on institution following procedures outlined by Rogers (1993). Year fixed effects are included but not reported. This table presents results from logit specifications of internal control material weaknesses based on equation (2). The dependent variable in columns [1] through [3] is an indicator variable equal to one (0 otherwise) for audit years with material weaknesses related to the financial statements, and an indicator variable equal to one (0 otherwise) for audit years with material weaknesses related to major programs in Columns [4] through [6]. Variable descriptions are in the Appendix

The results in Columns 2 and 5 suggest that the presence of an IAF that is involved in financial work has no effect on material weaknesses over financial statements or major programs. The results in Columns 3 and 6 include both the presence of an IAF and if that IAF is involved in financial work. These results in Column 3 indicate no statistical significance in the combined model between our independent variables for material weaknesses over financial statements. The results in Column 6 remain significant for the presence of an IAF. These findings imply no incremental impact on material weaknesses (financial statements or major programs) from IAFs specifically identifying financial work, which supports the conclusion that merely the presence of an IAF is sufficient to elicit the improvement in oversight over major programs.

In terms of control variables, *Low risk audit* is associated with fewer material weaknesses over both financial statements and major programs in all models. *Deficit* is positively associated with material weaknesses over financial reporting in all models, and negatively associated with material weaknesses over major programs in one model. *Big4 auditor* is negatively associated with material weaknesses over financial controls in all models, which is consistent with prior corporate literature (Rice and Weber, 2012). Finally, *Public* is significantly associated with more material weaknesses over major programs in all models, possibly because of the increased complexity of operations.

We present our results for tests of *H2* regarding federal grant funding in Table 6. The findings in Column 1 suggest that institutions maintaining IAFs receive higher levels of federal grants ( $IAF = 0.28$ ;  $t$ -statistic = 2.54) after controlling for other factors influencing funding decisions, consistent with our predictions. As IAFs are often asked to meet with some larger grant providers to opine on the control environment, we take this finding as evidence suggesting that granting agencies view the presence of an IAF as a positive factor when making funding decisions, possibly because of higher levels of compliance with proposal

Variable	[1]	[2]	[3]	[4]	[5]
IAF	0.28** (2.54)		0.19 (1.62)	0.33** (2.57)	0.26** (2.56)
IAF grant work		0.25** (2.52)	0.18* (1.71)		
Endowment	0.35*** (11.39)	0.34*** (11.42)	0.34*** (11.44)	0.39*** (9.12)	0.30*** (9.45)
Total enrollment	0.75*** (7.47)	0.73*** (7.16)	0.73*** (7.21)	0.71*** (4.95)	0.81*** (9.32)
Graduate percentage	2.68*** (5.92)	2.70*** (5.96)	2.68*** (5.95)	2.63*** (4.47)	2.49*** (5.52)
Public	1.13*** (5.93)	1.12*** (5.76)	1.11*** (5.79)	1.20*** (4.50)	0.92*** (5.01)
Doctoral	0.20 (1.43)	0.18 (1.23)	0.18 (1.24)	0.32* (1.72)	0.014 (0.11)
Hospital	0.70*** (4.91)	0.70*** (4.81)	0.70*** (4.86)	0.66*** (3.65)	0.76*** (5.19)
Audit committee	-0.07 (-0.68)	-0.10 (-0.89)	-0.10 (-0.94)	-0.10 (-0.58)	-0.17 (-1.62)
Debt ratio	0.21 (0.96)	0.26 (1.18)	0.24 (1.09)	0.38 (1.32)	-0.05 (-0.19)
Deficit	0.12*** (2.86)	0.12*** (2.87)	0.12*** (2.76)	0.09* (1.92)	0.15*** (2.79)
MW program <sub>t-1</sub>				-0.32*** (-2.96)	
Patent activity					19.77*** (3.82)
Lambda	-0.39* (-1.75)	-0.48** (-2.14)	-0.42* (-1.88)	-0.32 (-1.06)	-0.54** (-2.21)
Constant	1.98** (2.03)	2.50** (2.53)	2.32** (2.38)	0.72 (0.53)	2.52** (2.57)
Observations	4,952	4,952	4,952	3,409	2,654
Pseudo R <sup>2</sup>	0.82	0.82	0.82	0.81	0.84

**Notes:** \*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; and \* $p < 0.1$  based on two-tailed tests. Robust  $z$ -statistics in parentheses, with standard errors clustered on institution following procedures outlined by Rogers (1993). Year and state fixed effects are included but not reported. This table presents results from OLS specifications of logged federal grants based on equation (3). The dependent variable is the log of federal grants received by a given institution. Variable descriptions are in the Appendix

**Table 6.** the Relation between internal audit functions and federal grants in higher education

guidelines. Column 2 presents results when we consider if the IAF does work specific to grants (*IAF grant work* = 0.25; *t*-statistic = 2.52), and implies that procedures tailored to grants influences outcomes. Column 3 presents findings from our combined model where we include both the presence of an IAF and if the IAF performs grant work. *IAF grant work* remains significant (*IAF grant work* = 0.18; *t*-statistic = 1.71), although only at the 10% level.

The results in Table 6, Column 4 include lagged material weaknesses over programs, and highlight a negative association with grant funding (*MW Program<sub>t-1</sub>* = 0.32; *t*-statistic = -2.96). One possible interpretation of this finding is that granting agencies use internal control results when making funding decisions, and suggests that the IAF effect on grants could be because of higher evaluations of stewardship. Finally, we use data from the USA Patent and Trademark Office from 2004 to 2012 to create a patent-based measure of research productivity [15]. Specifically, we use the ratio of patents awarded to the university divided by the number of instructional faculty. Our results with the inclusion of this variable in Column 5 suggests a positive association with grant funding (*Patent activity* = 19.77; *t*-statistic = 3.82), but no impact the coefficient on *IAF*.

While we understand that we cannot definitively state the direction of relationships between IAFs and grant activity, discussions with chief audit executives (CAEs) and these results further illustrate the important role IAFs play in the grant processes, and support the conclusion that IAFs facilitate structures that ensure grant applications cover all necessary administrative bases and/or granting agencies gain increased comfort awarding monies to entities that have internal audit oversight. For other variables, *Endowment size*, *Total enrollment*, *Graduate percentage*, *Public*, *Hospital* and *Deficit*, are all associated with greater levels of grant funding in all models, likely because of an emphasis on research activity.

We also performed a set of additional untabulated tests to evaluate the robustness of our results. First, we performed our internal control weakness analyzes based on equation (2) using an indicator only denoting significant deficiencies and an internal control index capturing severity (Lopez and Peters, 2010) as the dependent variable [16]. Findings on *IAF* were similar in terms of internal controls over both financial reporting and major programs to those presented in Table 5, although the negative coefficient on *IAF* in the major programs specification were only significant at the 10% level. Furthermore, we also included state fixed effects in analyzes based on equation (2) and noted similar results to those in Table 5. Finally, we re-performed our federal grants test based on equation (3) using federal grants per undergraduate student to further control for institution size, and noted very similar results to those presented in Table 6.

### Summary and conclusions

Using a unique hand-collected data set we examine the correlates and consequences of IAFs at US institutions of higher education. Our findings suggest that IAFs are more likely at institutions with more students and large endowments, those that are public and those that maintain an AC. This may suggest that complex institutions that have more resources and rely on public funding use IAFs as an important governance mechanism to provide oversight over resources. Furthermore, we find that the presence of IAFs within US institution of higher education is associated with significantly fewer internal control material weaknesses over major programs. Finally, we find that both the presence of IAFs and IAFs involved within the grant process are associated with greater levels of federal grant funding. We interpret these findings to imply that IAFs are associated with improved processes related to federal funding, which should translate into greater levels of compliance with grant regulations and provide comfort to granting agencies about stewardship over resources.



Future research opportunities are available due to the limitations of the current study. First, this study focuses only on a subsample of the largest US colleges and universities, and thus, our results may not be generalizable to the entire population of US colleges and universities. Future research may consider other types of institutions of higher learning, alternate types of organizations, such as not-for-profit organizations and state governments or examine similar organizations in other countries. Second, results indicate correlation and not causality and there may be omitted variables in our models. Future studies using the case study approach and/or experiments may be useful to further investigate the impact of IAFs within colleges and universities. Finally, our study does not consider the effect of IAF quality on our hypothesized dependent variables. One potential avenue for future research involves the examination of IAF quality and its effects on financial reporting quality and grants.

Limitations aside, we interpret our results to suggest that IAFs are increasingly important within US institutions of higher education. First, our results indicate that IAFs serve to improve financial reporting systems, both by promoting transparency and by improving internal controls over and above what ACs can do without IAFs. Second, IAFs help provide confidence to granting agencies making allocation decisions, either directly through grant work or indirectly by improving internal controls within their institutions. These findings should be of use to college/university administrators looking to improve financial reporting transparency and effectively compete for research dollars, by illustrating the incremental benefits that IAFs add to what ACs and external auditors contribute. We also help the profession (The IIA) promote their constituency in the public sector and higher educational settings. Finally, we inform external stakeholders looking to assess higher education institutional performance.

## Notes

1. See [www.protiviti.com/US-en/internal-audit-and-financial-advisory](http://www.protiviti.com/US-en/internal-audit-and-financial-advisory)
2. See [www.boston-consortium.org/shared\\_resources/internal\\_audit.asp](http://www.boston-consortium.org/shared_resources/internal_audit.asp)
3. There are many federal funding agencies that fund research, education, training, travel and other areas of scholarship. Some examples include: The National Institutes of Health, The National Science Foundation, The Department of Defense, The Department of Education, The National Endowment for the Arts and the National Endowment for the Humanities. See [www.grants.gov](http://www.grants.gov) for a more comprehensive list.
4. To the authors' knowledge, no regulation exists that requires the existence of an IAF within institutions of higher education that receive federal grant monies.
5. The authors use an index of the extent of SEA reporting with 14 total categories including enrollment statistics, persistence and graduation outcomes, graduation statistics, quality of educational experience indicators, efficiency or comparative financial data/ratios, diversity measures, student satisfaction or graduating senior survey, selectivity. measures, student outcome measures, quality of faculty indicators, faculty/staff morale and salary studies, nationally recognized exam performance, alumni/employer survey results and "other." Tuition cost and financial aid, endowment performance and various financial ratios were among the categories listed under "other indicators."
6. The threshold has increased over time from an initial cutoff of \$300,000 to \$750,000 (OMB 2014a).
7. Per the GAO (2011): "a deficiency in internal control exists when the design or operation of a control does not allow management or employees, in the normal course of performing their assigned functions, to prevent or detect and correct, misstatements on a timely basis. A material weakness is a deficiency or a combination of deficiencies, in internal control, such that there is a

reasonable possibility that a material misstatement of the entity's financial statements will not be prevented or detected and corrected on a timely basis. A significant deficiency is a deficiency or a combination of deficiencies, in internal control that is less severe than a material weakness, yet important enough to merit attention by those charged with governance."

8. Prawitt *et al.* (2009) find a positive relationship between IAF quality and financial reporting quality (abnormal accruals and the likelihood of just beating or meeting analyst forecast) in publicly traded firms. Lin *et al.* (2011) find a negative relationship between IAF quality disclosed material weaknesses. Ege (2015) finds a negative association between a composite measure of IAF quality (internal auditor competence, independence/objectivity, IAF financial work and size) and management misconduct (financial reporting fraud, bribery and misleading disclosure practices).
9. Section 404(b) of the Sarbanes-Oxley act (SOX) requires that the management of public companies assess the effectiveness of the internal controls over financial reporting and that registered public accounting firm that issues the audit report therein attest to, and report on, the assessment made by the management of the issuer (U.S. Congress, 2002). As SOX was enacted, management for these companies have relied largely on internal auditors to ensure proper controls are in place to comply with this regulation. Therefore, IAFs in publicly traded companies are likely more mature and advanced than their counterparts in colleges/universities.
10. The information in this paragraph is largely based on conversations the researchers had with CAEs of a large private college/university, a public statewide university system and a small private college/university.
11. Additional reports can be found on the NSF-OIG website <https://www.nsf.gov/oig/>
12. We begin our analysis is 2004 due to coding/availability issues in the IPEDS data.
13. We do consider situations where an institution created an IAF during our sample period. Thus, an institution may have some years during our sample period where it does not maintain an IAF, and others where it does maintain an IAF. For reference, 66 institutions created an IAF during our sample period.
14. Based on conversations with a few CAEs of colleges/universities in the northeast, there is no reason to believe that IAF financial and grant work substantially differs between in-house and outsourced IAFs. Additionally, only eight institutions in our sample indicated they had outsourced their IAF, thus there were not enough cases to complete an analysis therein.
15. We do not include this in our primary model because are only available through 2012 from [https://www.uspto.gov/web/offices/ac/ido/oeip/taf/univ/org\\_gr/all\\_univ\\_ag.htm](https://www.uspto.gov/web/offices/ac/ido/oeip/taf/univ/org_gr/all_univ_ag.htm). The average number of patents is just under 8, although there is significant variation with a standard deviation of about 25.
16. More specifically, we use a value of 2 for material weaknesses, 1 for significant deficiencies and 0 for no internal control weaknesses in an ordered logit specification.

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#### Further reading

Sawan, N. (2013), "The role of internal audit function in the public sector context in Saudi Arabia", *African Journal of Business Management*, Vol. 7 No. 6, pp. 443-454.

Variable	Definition	Source
<i>MW</i>	Indicator variable equal to 1 (0 otherwise) for audit years with a material weakness related to the financial statements	Audit analytics
<i>MW program</i>	Indicator variable equal to 1 (0 otherwise) for audit years with a material weakness related to major programs	
<i>Federal grants</i>	Amount of federal grants received by the institution	IPEDS public (F1A)/private (F2) institutions finance table
<i>IAF</i>	Indicator variable equal to 1 (0 otherwise) for institutions that maintain a distinct internal audit function (IAF)	Manually collected from institution website and/or e-mail or phone correspondence with institution
<i>IAF financial work</i>	Indicator variable equal to 1 (0 otherwise) for institutions where the IAF conducts financial work	
<i>IAF grant work</i>	Indicator variable equal to 1 (0 otherwise) for institutions where the IAF conducts grant work	
<i>Audit committee</i>	Indicator variable equal to 1 (0 otherwise) for institutions that maintain an audit committee (AC)	
<i>Endowment</i>	Year-end value of institution's endowment	IPEDS public (F1A)/private (F2) institutions finance table
<i>Total enrollment</i>	12-month total enrollment	IPEDS 12-month enrollment (EFFY) table
<i>Graduate percentage</i>	Fraction of 12-month total enrollment that are graduate students	
<i>Public</i>	Indicator variable equal to 1 (0 otherwise) for institutions that are publicly administered	IPEDS public (F1A) institutions finance table
<i>College</i>	Indicator variable equal to 1 (0 otherwise) for institutions that are classified as colleges (i.e. units are not organized into separate colleges)	Manually collected
<i>Doctoral</i>	Indicator variable equal to 1 (0 otherwise) for institutions where the highest degree awarded is a doctorate	Carnegie classification of institutions of higher education
<i>Masters</i>	Indicator variable equal to 1 (0 otherwise) for institutions where the highest degree awarded is a masters	
<i>Land grant</i>	Indicator variable equal to 1 (0 otherwise) for land grant institutions	IPEDS institutional characteristics – directory information (HD) table
<i>Urban</i>	Indicator variable equal to 1 (0 otherwise) for institutions with a city (11, 12 or 13) locale code	
<i>Hospital</i>	Indicator variable equal to 1 (0 otherwise) for institutions that maintain a hospital	
<i>Religious</i>	Indicator variable equal to 1 (0 otherwise) for institutions with a religious affiliation	IPEDS institutional characteristics – educational offerings, organization, services and athletic associations (IC) table

Table A1. Variable definitions  
(continued)

Table A1.

Variable	Definition	Source
<i>Debt ratio</i>	The ratio of debt to total assets	IPEDS public (F1A)/private (F2) institutions finance table
<i>Deficit</i>	Indicator variable equal to 1 (0 otherwise) for institutions with a change in net assets less than 0	IPEDS public (F1A)/private (F2) institutions finance table
<i>Big4 auditor</i>	Indicator variable equal to 1 (0 otherwise) for institutions that use a Big 4 auditor	Audit analytics
<i>Low risk audit</i>	Indicator variable equal to 1 (0 otherwise) for audit years that are designated as low risk	
<i>Patent activity</i>	Number of patents received by institution divided by number of instructional faculty	US patent and trademark office

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