Honors Thesis

Analyzing Internal Audit Effectiveness within U.S College and Universities: Using Nearest Neighbor Matching (NN)

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Abstract

Purpose – The purpose of this paper is to examine/determine what *specific* characteristics of internal audit functions (IAFs) within U.S. colleges and universities are more influential than others with regards to defined outcome variables of an *effective* IAF.

Design/methodology/approach – Using a combination of publicly-available and hand-collected data, this paper uses the T- Nearest Neighbor algorithm to pair schools together by examining a predefined set of *institution characteristics* (excluding characteristics of the IAF) which are most similar among these schools creating a matching propensity. This matching propensity strengthens results regarding the determinants of effective IAF characteristics within U.S. institutions of higher education.

Findings – The existence of an IAF Charter, IAF size, and Chief Audit Executive (CAE) experience are all positively correlated with greater amounts of federal grants obtained and retained within U.S colleges and universities. The existence of an IAF Charter is correlated with fewer Reportable Conditions. The size of an IAF is also correlated with fewer Material Weaknesses.

Originality/value – To the authors knowledge, this will be the first study to implement the t-NN algorithm in determining what specific variables determine IAF effectiveness. This study contributes to the existing literature on IAF quality in public sector organizations (specifically in U.S. institutions of higher learning; i.e., colleges and universities), while also encouraging future research of the effects of an IAF on specific industries that may enhance IA's value proposition. Findings should be of use to college/university administrators looking to improve financial reporting transparency and effectively compete for research/federal grant dollars. In addition, the results should be of interest to public sector organizations and college/university leadership as they attempt to improve, understand, or implement an *effective* IAF.

Keywords – Internal audit effectiveness, internal auditing, colleges and universities, financial reporting quality, material weaknesses, grants, nearest neighbor matching.

1 Introduction

Many businesses and organizations employ *internal auditors* that form an internal audit function (IAF) within an organization, which can play a pivotal role in improving an organization's operations. The Institute of Internal Auditors describes internal auditing as *"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"* [1]. Internal audit effectiveness has been a topic of literature for many years. Developing and maintaining relevance for internal audit and assurance functions in general is a continual challenge. Prior literature has shown that an IAF *can* add value to any organization whether in publicly traded companies or public sector organizations. However, there is still uncertainty with regards to what specific IAF attributes most influence IAF effectiveness, which motivates this study.

2 Prior Literature

Before examining IAFs within U.S Colleges and Universities, it is important to understand how an IAF can add value to an organization. IAF effectiveness is very important to external auditors, as they consider the quality of the IAF and the extent to which they are able to rely on the work performed by the IAF [2]. IAF contribution is a significant determinant of the external audit fee (i.e, the greater the contribution of IAF to the financial statements audit, the lower the audit fee [3]). The value that an external auditor places on an IAF is dictated by how much reliance can be placed on the work performed by the IAF. Thus, a more effective and

[1] The IIA, 1999
[2] Cohen, J., Krishnamoorthy, G., and Wright., A. (2004),
[3] Felix et al. (2001, p.530)

reliable IAF will play a pivotal role in improving an organization's operations through facilitating the activities during the external audit. The added value of IAF's within U.S. publicly-traded companies is well-documented in prior literature [4]. A key aspect of a financial audit is identified material weaknesses. A study performed in 2011 investigates associations between material weakness disclosures and various IAF attributes and activities using survey data collected by the IIA. This study finds that material weakness disclosures are positively related with both IAF grading of audit engagements and external-internal auditor coordination.[5] Thus, it is generally understood that an IAF can improve an organization's financial statements and facilitate external audits in publicly traded companies.

Internal auditors within U.S. colleges and universities have varying responsibilities and may perform 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 [6] or co-source them through consortiums [7].

There are a few studies conducted outside of the United States that have examined IAF's within institutions of higher learning. A study performed in 1997 suggests that internal auditors can make positive contributions within total quality management in higher education in Sweden. [8] Another study performed in 2006 finds that IAFs are more prevalent and have a broader scope

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[4] Abdolmohammadi *et al*., 2006, Cohen *et al*., 2006, Prawitt *et al*., 2009; Lin *et al*., 2011; Ege, 2015
[5] Lin, Pizzini, Vargus, and Bardhan, 2011
[6] See https://www.protiviti.com/US-en/internal-audit-and-financial-advisory.
[7] See http://www.boston-consortium.org/shared_resources/internal_audit.asp.

[8] Lundquist, R. (1997).

within public institutions of higher education than their private counterparts.[9] My research fills a gap by examining the effectiveness of IAFs in institutions of higher education, specifically in the U.S, since there is a lot of variability that exists with analyzing insitutitions internationally.

Using a unique set of publicly available and hand-collected data, Desimone and Rich (2020) examines both the determinants of use of IAFs in U.S. institutions of higher learning (i.e. colleges and universities) and the IAF's impact on financial reporting quality and federal grant receipts therein[10]. Results of the study indicate that institutions with larger enrollments and endowments, those that receive public funding, those with a hospital, 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. A material weakness is a deficiency, or a combination of deficiencies, in internal control over financial reporting, such that there is a reasonable possibility that a material misstatement of the company's annual or interim financial statements will not be prevented or detected on a timely basis. A reportable condition, similar to a material weakness, is a significant deficiency in the *design or operation* of the entity's internal control that could adversely affect an entity's ability to fulfill future obligations with customers and/or the satisfaction of liabilities. Finally, the presence of an IAF has a positive and significant association with federal grants received by the institution. As it has already been shown that an IAF plays a role in reported material weakness for major programs and has a positive association with federal grants, we will be using these three outcome variables in our study as determinants of an *effective* IAF. It is generally understood that an IAF *can* add value to any organization whether in publicly traded companies

[9] Zakari *et al*. (2006
[10] DeSimone, S. M. (2018)

or public sector organizations. This study analyzes what *specific* characteristics of an IAF most influence IAF quality (as defined by certain outcome variables) in U.S institutions of higher learning.

3 Background

Prior research suggests that effective IAFs can improve an organization's relative operations in both publicly traded and public sector organizations. Prior IAF research is limited as data is difficult to obtain. The Institute of Internal Auditors (IIA) frequently conducts surveys of its members. Due to privacy and security concerns, the IIA's data is anonymous, which makes detailed analysis therein difficult to interpret. For example, instead of the IIA disclosing the exact revenue figure of the surveyed organizations, they give a broad range instead. Because of this "range", it is impossible for researchers to link the outcome of the IAF of these organizations (ie. audit reportable conditions and restatements) to the actual organization itself. Due to these data limitations, there are very few studies in IAF literature that examine and determine what *specific* variables of an IAF influence outcome variables. It is very difficult to gather data on specific variables and constituents of an IAF of publicly traded U.S companies. Because this data is not publicly available, "matching" the characteristics of the IAF with the respective firm/company is nearly impossible. One way to avoid this data limitation is to focus on the public sector where data can be linked to specific institutions (specifically, U.S Colleges and Universities). The importance of an IAF in the public sector is often overlooked. The benefits of an IAF in the public sector extends beyond financial reporting, specifically through grant funding. Internal

audit helps increase levels of governance transparency[11] and improves grant processes, which should be useful amidst high levels of competition for grant dollars in institutions [12].

Despite the documented importance of the IAF, little research exists regarding the role of the IAF in public sector organizations, specifically U.S. colleges and universities. Internal auditors within U.S. colleges and universities have varying responsibilities such as; risk management, advisory, finances,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 [13] or co-source them through consortiums [14] .

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 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)."*

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

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[11] Archambeault *et al*., 2008
[12] Howard and Laird, 2013
[13] See https://www.protiviti.com/US-en/internal-audit-and-financial-advisory.
[14] See http://www.boston-consortium.org/shared_resources/internal_audit.asp.

federal funding source. Internal auditors add value to their respective institution through grant compliance by creating and/or auditing procedures and internal controls that cover the 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 [15].

4 Hypotheses

Prior literature generally shows that detailed and comprehensive documentation of what is expected of people within an organization is beneficial. Prior research finds organizational benefits from documentation related to corporate governance, formal strategy, and control environment [16]. Documentation facilitates corporate governance and the control environment of an organization by listing the actions, policies and procedures that reflect the overall attitudes of management and employees. [17] Most organizations may have multiple forms of documentation/oversight to guide management and set expectations for employees. Specifically for IAF's, organizations implement IAF charters. An IAF charter is a document that lists the purpose and mission of an IAF. For example, Columbia University's IAF charter's purpose and mission is to, "provide independent, objective assurance and auditing, investigative services to add value, improve internal controls, and strengthen the University's operations." Secondly, the charter lists the professional standards that the IAF is in line to adhere to, "The Office of Internal Audit's responsibilities will be performed in accordance with the Institute of Internal Auditors International Standards for the Professional Practice of Internal Auditing and Code of Ethics." In

[15] Desimone and Rich, 2020
[16] Rittenberg and Miller, 2005; Wagner and Dittmar, 2006
[17] Ibid.

addition, the charter lists the authority, independence, responsibility, and scope of the IAF activities. The IAF charter is signed by the CAE, Audit Committee, Board, and CEO and acts as an official covenant of the IAF's overall purpose. Having an ***IAF charter*** improves system organization, responsibility designation, motivates employees, and provides a strategic detailed approach to carrying out grant compliance objectives. Thus it is believed that a well organized and clearly descriptive IAF charter will play a role in an IAF being *effective* in its scope to carry out its objectives and add value to an organization, which leads to this studies first hypothesis:

Hypothesis 1*: The existence of an* ***IAF charter*** *will be associated with higher amounts of federal grant funding and will more likely lead to a disclosure of an internal control material weakness over major programs and reportable conditions over major programs:*

The Institute of Internal Auditors (IIA) requires that CAE's must develop and maintain a quality assessment and improvement program for their IAFs. For example, CAE's perform activities such as external assessments that evaluate the effectiveness and efficiency of the IAF as well as identify opportunities for improvement. [18] The quality/external assessments provide organizations with a high level monitoring tool of the IAF. The organization then considers these processes and procedures that IAF's use as well as characteristics of internal auditors and IAF's. [19] Pforsich et al. (2006 and 2008) emphasize the importance of the Chief Audit Executive (CAE) when establishing an IAF. The CAE plans, organizes, staffs, and directs the IAF of an organization. Their findings (a case study done) summarized the steps that an organization took

[18] The IIA 2012a
[19] DeSimone, 2015

when first implementing an IAF. Findings suggest that the CAE is a pivotal variable when first developing an IAF. [20] The qualifications and competencies of the IAF staff all matter, however, the overall working environment starts with the CAE. The CAE oversees the IAF activities surrounding the institution through grant compliance by creating and/or auditing procedures and internal controls that cover the administrative aspects of externally sponsored projects for both pre and post-award activities. The capability of the IA activity is directly related to the actions taken by the chief audit executive (CAE) to establish the processes and practices needed to achieve and maintain internal audit capabilities and the measures taken by the organization's management to establish a supportive environment for internal auditing.[21] This leads to this studies second hypothesis:

Hypothesis 2*: The* ***years of experience of the Chief Audit Executive (CAE)*** *within the IAF will be associated with higher amounts of federal grant funding and will more likely lead to a disclosure of an internal control material weakness over major programs:*

The typical work that an IAF performs within colleges and universities includes monitoring of internal controls that cover the administrative aspects of externally sponsored projects for both pre and post-award activities, contributing to the success of obtaining and retaining grants. IAF employees focus on more value-added activities, specifically, responding to queries in the process of acquiring federal grants, which leads to this study's third hypothesis:

[20] Prorsich et.al. 2006 and 2008
[21] The IIA, 2010

Hypothesis 3: *The* ***size of an IAF*** *is associated with higher amounts of* ***federal grant funding.***

U.S institutions with more members in its IAF will have significantly more federal grant funding.

4 Model and Methods

Using a unique set of publicly available and hand collected data from U.S colleges and universities and implementing a "T-Nearest Neighbor algorithm" (tNN), this study isolates and analyzes the impact of IAF characteristics in U.S colleges and universities. This novel approach emphasizes and sheds light on what specific factors, processes, and variables are more important than others when implementing and developing an *effective* IAF. The interest for internal audit in public sector organizations is rising in response to calls from users of public goods and donor agencies for improved accountability, transparency and increased consumer choice [22]. The t-NN algorithm uses a set of data which are separated into different classes to predict a classification of a new sample point. t-NN is a unique algorithm since its technique is *non-parametric*, meaning it doesn't make any assumptions about the data it receives. The t-NN algorithm is based on *feature similarity:* How closely out-of-sample features resemble our testing set determines how we classify a given data point. Firstly, all of the universities and colleges in the sample ***will have an IAF.*** Additionally, the t-NN algorithm pairs schools together by examining a predefined set of *external characteristics* (excluding characteristics of the IAF) which are most similar among these schools creating a "matching propensity". Binary external characteristics are used as an exact match in the propensity scoring for more accurate matching on specified variables. This allows for pairs of similar schools along many dimensions, the only difference being the

[22] Goodwin, 2004; Diamond, 2002, Ayagre 2001

characteristics of their IAF's. This thens allows the isolation of the effect of those IAF characteristics on the IAF's effectiveness.

T-effects nnmatch estimates treatment effects from observational data by nearest-neighbor matching. t-NN imputes the missing potential outcome for each subject by using an average of the outcomes of similar subjects that receive the other treatment level. Similarity between subjects is based on a weighted function of the covariates for each observation[23]. My study calculates the Average Treatment Effects (ATE) which estimates the treatments effects of [**Characteristics of IAF**] on [**IAF Effectiveness Outcome Variables**], while subjects are matched defined by covariates of [**External Matching Variables**]. The variables used in the model are discussed in greater detail below:

1) <u>External Matching Variables</u>

As all of the colleges and universities have an IAF, the main focus is to "match" these institutions based on predefined set of external characteristics not including the IAF. This introduces a unique "matching propensity" which will ultimately strengthen any findings regarding the characteristics of the IAF based on prior research[24]. The external characteristics included in the NN algorithm as variables are as follows:

1. ***Public or Private:***
    - Whether the institution is public or private
2. ***University or College***
    - Whether the institution is a university or college
3. ***Endowment***
    - Represents the total logged endowment of the institution
4. ***Enrollment Undergrad***
    - Represents the total logged number of undergraduate students enrolled
5. ***Enrollment Grad***

[23] Abadie, A., D. M. Drukker, J. L. Herr, and G. W. Imbens. 2004
[24] DeSimone, 2012

- Represents the total logged number of graduate students enrolled.

6. ***System IAF***
   - Whether the college or university is organized in a state system structure

As the model includes indicators and categorical variables, matches are restricted to only those subjects who are in the same category. The **ematch** () option of the t-NN allows for the exact match of external variables that have a binary outcome such as (Public = 1, Private = 0). In our model, we are **exactly matching** public and private institutions.

2) IAF Characteristic Variables

Evidence from prior studies shows that a high-quality IAF may have various benefits for firms, for instance, by improving internal controls, constraining earnings manipulation and fraud, reducing audit costs, and enhancing audit efficiency [25]. Also, in 2018, DeSimone found a significant positive relationship between the presence of an IAF and reported financial statements internal control issues in a sample of U.S municipalities with populations over 100,000 [26] DeSimone results also indicated a significant negative association between the presence of an IAF and financial statements restatements. A restatement is an act of revising one or more of a company's previous financial statements to correct an error. Restatements are necessary when it is determined that a previous financial statement contained a "material" inaccuracy. Thus, it is generally understood that IAF's demonstrate the ability to improve the quality of financial reporting.

The characteristics of the IAF that I will use in hypothesis testing to determine which variables are more effective than others:

[25] Felix et al. 2001, Prawitt et al. 2009, Lin et al. 2011

[26] DeSimone 2018

1. ***IAF Size***
    - The number of employee/staff members that comprise the IAF
2. ***IAF Charter***
    - Whether the IAF has a charter or not
3. ***CAE Years of Experience***
    - Experience years of CAE

3) <u>Outcome "IAF Effectiveness" Variables</u>

Next, the measure of IAF effectiveness is defined. OIA (Other Independent Audits) Audit Analytics Data Dictionary is used to measure *"IAF effectiveness"* outcome variables. All organizations that receive $500,000 or more in federal funding are required to have an audit by an independent accountant. Desimone (2020) suggests that the presence of an IAF is negatively correlated with reported material weakness for major programs and has a positive correlation with federal grants. DeSimone's study also found that the presence of an IAF has a positive and significant association with federal grants received by the institution.[27] These outcome variables will be used as determinants of an *effective* IAF.

1) ***Reportable Condition MP***
    - Indicates whether any significant deficiency was found in internal control over major programs
2) ***Material Weakness MP:***
    - Indicates whether the significant deficiency (if found) in internal control over major programs (mp) was a "material weakness"
2) ***Federal Grants:***
    - Federal operating grants and contracts + federal non-operating grants (NCES)

5 <u>Data 2008-2016</u>

Data for this research is corporate governance and internal audit function (IAF) characteristics for the 400 largest U.S. universities and colleges (by endowment and enrollment).

[27] Desimone and Rich, 2020

This is combined with financial reporting internal control outcomes (from Audit Analytics) as well as grant data (from the National Center for Education Research). Data collection for college universities included the examinations of IAF information websites, IAF charters, and inquired IAF departments to collect information with regards to the number/ qualifications of IA employees, CAE experience/qualification, work performed, audit strategy etc.

6 Variable Definitions + Data Sources

Variable	Definition	Source
IAF	Indicator variable equal to 1 (0 otherwise) for institutions that maintain a distinct internal audit function (IAF).	Hand-collected from institution website and/or e-mail or phone correspondence with institution.
System IAF	Indicator variable equal to 1 (0 otherwise) for institutions that are organized in a state system structure	
IAF Size	Indicator variable equal to 1 (0 otherwise) for institutions with an IAF > 12	
IAF Charter	Indicator variable equal to 1 (0 otherwise) for institutions with an IAF charter	
CAE Years of Experience	Indicator variable equal to 1 (0 otherwise) if CAE year of experience > 24	
IAF financial work	Indicator variable equal to 1 (0 otherwise) for institutions where the IAF conducts financial work.	

IAF grant work	Indicator variable equal to 1 (0 otherwise) for institutions where the IAF conducts grant work.	
Endowment	Year-end value of institution's endowment	IPEDS Public (F1A) / Private (F2) Institutions Finance Table, https://nces.ed.gov/ipeds/
Enrollment Undergrad	Represents the total logged number of undergraduate students enrolled	IPEDS 12-Month Enrollment (EFFY) Table
Enrollment Grad	Represents the total logged number of undergraduate students enrolled	IPEDS 12-Month Enrollment (EFFY) Table
Public	Indicator variable equal to 1 (0 otherwise) for institutions that are publicly administered.	IPEDS Public (F1A) Institutions Finance Table, https://nces.ed.gov/ipeds/
College	Indicator variable equal to 1 (0 otherwise) for institutions that are classified as colleges.	Author judgement: Universities offer both undergraduate and graduate degrees, colleges offer only undergraduate or associate's degrees.
Going Concern	Indicator variable equal to 1 (0 otherwise) for institutions that identified a going concern	Audit Analytics,https://www.auditanalytics.com
Reportable Condition	Indicator variable equal to 1 (0 otherwise) for institutions that identified a reportable condition.	
Reportable Condition MP	Indicator variable equal to 1 (0 otherwise) for institutions that identified a reportable condition MP.	
Type of Report MP	Indicator variable equal to 1 (0 otherwise) for institutions that release an unqualified opinion.	
MW	Indicator variable equal to 1 (0 otherwise) for audit years with a material weakness related to the financial statements.	
MW program	Indicator variable equal to 1 (0 otherwise) for audit years with a material weakness related to major programs.	
Federal grants	Amount of federal grants received by the institution	IPEDS Public (F1A) / Private (F2) Institutions Finance Table
Federal Funds	Log of Total Federal Expenditures	IPEDS Public (F1A) / Private (F2) Institutions Finance Table
Total Federal Expenditures	Total federal funds spent	IPEDS Public (F1A) / Private (F2) Institutions Finance Table
Current Year Findings	Indicator variable equal to 1 (0 otherwise) for institutions that identified a current year finding	IPEDS Public (F1A) / Private (F2) Institutions Finance Table

External Matching Variables of Universities and Colleges Data

- ➔ For the external variables of the colleges and universities (ei. Enrollment, Endowment, Grants) we use the IPEDS Public (F1A) / Private (F2) Institutions Finance Table and hand collected publicly available data.

IAF Characteristic Variables Data

- ➔ For the specific characteristics of the IAF of the colleges and universities, this study uses a unique set of hand collected data through IAF websites, charters, public information, and manually inquiring IAF departments requesting relevant information to be used for data collection.

Outcome "IAF Effectiveness" Variables

- ➔ For the outcome variables, we use the OIA Data Audit Analytics which is a single audit data set that covers all organizations that have filed Form SF-SAC (2000 and forward) with the Office of Management and Budget according to Circular A-133. All organizations that receive $500,000 or more in federal funding are required to have an audit by an independent accountant. In addition, the data has been matched to data fields extracted from IRS Form 990. Data points include funding agency, income, assets and total federal expenditures. The data base also includes contact information for both the institution and auditor of record. DeSimone and Rich (2020) suggest that the presence of an IAF is negatively associated with reported material weaknesses for major programs at significant levels. Also, the presence of an IAF is found to have a positive and significant association with federal grants received by the institution. We will be using these outcome variables in our study as determinants of an *effective* IAF.

7 Findings

1) *The existence of an **IAF charter** is associated with higher amounts of **federal grant funding**. U.S institutions with an **IAF charter** present have significantly higher amounts of **federal grant funding** when compared to schools without an IAF charter.*

➔ An ***IAF charter*** lists the purpose, missions, authority, responsibility, and scope of the IAF activities for the respective institution. Results indicate that when institutions take the time to create and implement a well organized and clearly descriptive ***IAF charter***, the IAF is more effective in carrying out its objectives by adding value to an organization through federal grant funding**.** 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. 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, contributing to the success of obtaining and retaining grants. Having an ***IAF charter*** improves system organization, responsibility designation, motivates employees, and provides a strategic detailed approach to carrying out grant compliance objectives. A charter highlights the specific goals and responsibilities of each respective employee, which facilitates organization and efficiency. Employees and management can always refer to the charter to understand the scope and objectives of the IAF. An IAF charter also improves the control environment,

which are the actions, policies and procedures that reflect the overall attitudes and ethical values of management and employees within the IAF.

2) *The **size of an IAF** is associated with higher amounts of **federal grant funding.** U.S institutions with more members in its IAF have significantly more federal grant funding.*

➔ An IAF composed of at least 12 employees is associated with higher amounts of **federal grant funding**. U.S institutions with more members in its IAF have significantly more federal grant funding. The main explanation for this correlation is that when an IAF has more employees, the function is able to focus on more value-added activities, specifically, responding to queries in the process of acquiring federal grants. The increased number of employees may also allow for more efficient work, timely answered queries, and overall more complete and effective governance over the grant process. In addition, the more employees allows for more monitoring of internal controls that cover these administrative aspects of externally sponsored projects for both pre and post-award activities, contributing to the success of obtaining and retaining grants.

3) *The **experience of the CAE** is associated with higher amounts of **federal grant funding.** When the **experience of the CAE** is greater than 24 years ,the institution has significantly more federal grant funding.*

➔ IAF's are composed of a chief audit executive (CAE) who oversees the work performed by the IAF. Results indicate that when CAE's have experience greater than 24 years, the

institutions receive higher amounts of **federal grant funding**. CAE's play a very important role in the IAF of these institutions. The CAE, oversees the IAF activities surrounding the institution through grant compliance by creating and/or auditing procedures and internal controls that cover the administrative aspects of externally sponsored projects for both pre and post-award activities. More experience CAEs likely possess more knowledge of grant compliance and how to implement and maintain related effective internal controls therein. Strong internal controls related to the administrative aspects of externally sponsored projects lead to success of obtaining and retaining more federal grants. This is because the granting agency will likely be more comfortable with these internal controls than those designed and implemented by an IAF led by a less experienced CAE. When the IAF has meetings with grant agencies, or is replying to queries, the more experienced the CAE, the more capable he or she will be in providing sound information. With an experienced CAE, the grant process within the institutions is thus likely to be both more effective and efficient.

4) *The **size of an IAF** is associated with fewer **Material Weaknesses over Major Programs and** fewer **Reportable Conditions over Major Programs.***

➔ An IAF composed of at least 12 employees is associated with *fewer **Material Weaknesses over Major Programs.*** With more internal auditors, the IAF is able to implement better internal controls. The U.S institutions with more members in its IAF result in fewer material weaknesses over internal controls. One interpretation of this result is that since employees comprise the IAF, the larger sized IAF's with more

employees are able to detect and remediate Material Weaknesses over Major Programs. A ***Reportable Condition*** *i*s a matter coming to the auditor's attention relating to significant deficiencies in the design or operation of the entity's internal control that could adversely affect an institution's ability to fulfill future objectives. One interpretation of this result is that since employees comprise the IAF, the larger sized IAF's with more employees are able to remediate ***Reportable Conditions*** *over internal controls.* This is simply because the IAF is able to perform more tests of internal control throughout the year and have additional employees monitoring internal controls specifically attempting to remediate deficiencies. Thus this is a resource allocation phenomenon.

5) *The existence of an* ***IAF charter*** *is associated with fewer* ***Reportable Conditions over Major Programs.***

➔ Having an ***IAF charter*** improves system organization, responsibility designation, motivates employees, and provides strategic detailed approach to carrying out objectives. IAF's with charters highlight the specific goals and responsibilities of each respective employee, which leads to fewer reportable conditions over internal controls. One interpretation of this result is that since the IAF charter improves system organization, responsibility designation, motivates employees, and provides strategic detailed approach to carrying out objectives, the IAF is able to remediate deficiencies surrounding internal controls in a timely manner.

8 Conclusion

Internal audit effectiveness has been a topic of literature for many years. Due to data limitations, there is still little known about what specific aspects of an IAF are more effective than others with regards to adding value and impacting firms/organizations. The purpose of this study is to derive a new research approach to analyzing IAF's in the public sector. Using a unique set of publicly available and hand collected data allows for the isolation of characteristics of an IAF within U.S colleges and universities. This study contributes to the existing literature on what constitutes an effective IAF in public sector organizations (specifically in U.S. institutions of higher learning i.e. colleges and universities), while also encouraging future research of the effects of an IAF on specific industries that may enhance IA's value proposition. Results have indicated that certain characteristics such as 1) the presence of an IAF charter 2) the size of the IAF and 3) the experience of the CAE, are more influential than others with regards to IAF effectiveness. The existence of an IAF charter, the size of IAF, and the experience of CAE are all positively correlated with greater amounts of federal grants obtained and retained. The presence of an IAF charter and the size of the IAF are also correlated with fewer Reportable Conditions over Major Programs. Finally, the size of the IAF is correlated with fewer Material Weaknesses over Major Programs. Findings should be of use to college/university administrators looking to improve financial reporting transparency and effectively compete for research dollars. In addition, the results should be of interest to public sector organizations and college/university leadership as they attempt to improve, understand, or implement an *effective* IAF.

9 Summary Statistics

The data for this project includes 941 US Colleges and Universities. Prior literature has already shown that an IAF is effective within U.S Institutions of higher learning. This study is taking a step further by analyzing what specific characteristics of an IAF are more effective than others. Some important statistics to note are, all of the 941 schools surveyed have an IAF. 62% of the institutions surveyed were public, while 96% of the institutions were universities. On average, a CAE of an IAF would have about 24 years of experience and 69% of the schools had an IAF Charter. The average endowment for the institutions surveyed was $1,300,000 while the average federal grants received from these institutions was $162,00,000.

Variable	Obs	Mean	Std. Dev.	Min	Max
Year	941	2012	2.58	2008	2016
Public	941	0.62	0.49	-	-
University	941	0.96	0.19	-	-
CAEExperience	941	24 years	10 years	2 years	40 years
Endowment	941	1,300,000,000	2,590,000,000	4,153,798	22,300,000,000
Federal Grants	941	162,000,000	221,000,000	468,257	1,420,000,000
Total Enrollment	941	22,917	12,081	1,604	64,930
Enrollment Undergrad	941	16,763	9,716	256	48,487
Enrollment Grad	941	6,144	3,878	75	20,268
Total Federal Expenditures	941	969,000,000	1,390,000,000	8,556,357	5,780,000,000
System IAF	941	0.34	0.48	-	1.00
IAF Charter	941	0.69	0.46	-	1.00
ln Endowment	941	19.58	1.81	15.24	23.83

10 Results Statistics

1) The effects of the existence of an IAF charter on Federal Grant Funding

Coef.	.116
P- value	0.041
Z- statistic	2.04

2) The effects of the size of an IAF on Federal Grant Funding

Coef.	.790
P-value	0.000
Z- statistic	14.66

3) The effects of the size of an IAF on Material Weaknesses

Coef.	-.054
P-Value	.001
Z- statistic	-3.22

4) The effects of the existence of an IAF Charter on Reportable conditions

Coef.	-.070
P-Value	.058
Z- statistic	01.90

5) The effects of the CAE experience on Federal Grant Funding

Coef.	.439
P-Value	.000
Z- statistic	7.31

11 Regression Results

1) *The existence of an **IAF charter** is associated with higher amounts of **federal grant funding**. U.S institutions with an **IAF charter** present have significantly higher amounts of **federal grant funding** when compared to schools without an IAF charter.*

```
. **Fed Grants NN Specifications (Charter)
. teffects nnmatch (ln_fed_grant univ system_iaf ln_endowment ln_enroll_ug ln_enroll_grad year) (charter), ematch(public) nneighbor(1)

Treatment-effects estimation                   Number of obs      =        941
Estimator      : nearest-neighbor matching     Matches: requested =          1
Outcome model  : matching                                  min =          1
Distance metric: Mahalanobis                               max =          1
```

ln_fed_grant	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
charter (1 vs 0)	.1156731	.0565867	2.04	0.041	.0047651	.2265811

*2) The **size of an IAF** is associated with higher amounts of **federal grant funding.** U.S institutions with more members in its IAF have significantly more federal grant funding.*

```
. **Fed Grants NN Specifications (IAFSize)
. teffects nnmatch (ln_fed_grant univ system_iaf ln_endowment ln_enroll_ug ln_enroll_grad year) (IAFSize_d), ematch(public) nneighbor(1)

Treatment-effects estimation                   Number of obs      =        941
Estimator      : nearest-neighbor matching     Matches: requested =          1
Outcome model  : matching                                  min =          1
Distance metric: Mahalanobis                               max =          1
```

ln_fed_grant	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
IAFSize_d (1 vs 0)	.7900638	.053878	14.66	0.000	.6844648	.8956627

*3) The **size of an IAF** is associated with fewer **Material Weaknesses over Major Programs***

```
. **MWMP NN Specifications (IAFSize)
. teffects nnmatch (MWMP univ system_iaf ln_endowment ln_enroll_ug ln_enroll_grad year) (IAFSize_d), ematch(public) nneighbor(1)

Treatment-effects estimation                   Number of obs      =        941
Estimator      : nearest-neighbor matching     Matches: requested =          1
Outcome model  : matching                                  min =          1
Distance metric: Mahalanobis                               max =          1
```

MWMP	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
IAFSize_d (1 vs 0)	-.0541977	.0168554	-3.22	0.001	-.0872336	-.0211617

*4) The existence of an **IAF charter** is associated with fewer **Reportable Conditions over Major Programs (RCMP).***

```
. **RCMP NN Specifications (Charter)
. teffects nnmatch (RCMP univ system_iaf ln_endowment ln_enroll_ug ln_enroll_grad year) (charter), ematch(public) nneighbor(1)

Treatment-effects estimation                   Number of obs      =        941
Estimator      : nearest-neighbor matching     Matches: requested =          1
Outcome model  : matching                                  min =          1
Distance metric: Mahalanobis                               max =          1
```

RCMP	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
charter (1 vs 0)	-.0701382	.0369666	-1.90	0.058	-.1425914	.0023151

5) *The **experience of the CAE** is associated with higher amounts of **federal grant funding.** When the **experience of the CAE** is greater than 24 years ,the institution has significantly more federal grant funding.*

```
. **Fed Grants NN Specifications (CAEExp)
. teffects nnmatch (ln_fed_grant univ system_iaf ln_endowment ln_enroll_ug ln_enroll_grad year) (CAEExp), ematch(public) nneighbor(1)

Treatment-effects estimation                   Number of obs      =        941
Estimator      : nearest-neighbor matching     Matches: requested =          1
Outcome model  : matching                                  min =          1
Distance metric: Mahalanobis                               max =          1
```

ln_fed_grant	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
CAEExp (1 vs 0)	.438716	.0600077	7.31	0.000	.321103	.5563289

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