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The Level of Accounting Standardization in Historical and Occupational Contexts

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The Level of Accounting Standardization in Historical and Occupational Contexts

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Abstract

The Level of Accounting Standardization in Historical and Occupational Contexts

By Paul E. Madsen

Many of the costs and benefits of standardizing accounting, which reduces the discretion of accountants and managers, are impossible to quantify. As a consequence, arriving at an efficient level of standardization in accounting is impossible using traditional cost/benefit analysis. In this paper, I study the level of accounting standardization in two contexts. First, taking a historical perspective, I show that the output of accounting standard-setters has increased fourfold over the last 50 years. I then examine how the increased standard-setter output was received by the accounting profession. Using data collected from editions of a well known accounting reference manual, the *Accountants' Handbook*, published between 1923 and 2007, I find a negative temporal association between increasing standardization and proxies for the quality of the accounting discourse, consistent with the predictions in Baxter (1962). I then examine the level of accounting standardization in the context of a large sample of occupations in the United States. I develop and estimate a model of standardization in occupations. Using this model, I estimate a benchmark of the "expected" level of standardization in accounting occupations given their characteristics. I find that the accounting occupation most involved with financial reporting is far more standardized than the model predicts, consistent with "standards overload."

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1. Introduction

Accounting standards constrain the choices available to accountants and managers. But what level of standardization is efficient? [1] The answer is elusive. It is well known that allowing accountants and managers accounting choices can have costs and benefits. But the difficulty or impossibility of measuring the costs and benefits of standardization is a significant impediment to identifying an efficient level of standardization (FASB, 1991; Watts and Zimmerman, 1986). Some of the costs and benefits have been thoroughly examined in the accounting literature. For example, large bodies of literature examine the hypothesis that managers use their accounting discretion opportunistically to expropriate wealth from shareholders and the competing hypothesis that they use it to convey their private information to the market. There is evidence to support both hypotheses (Fields et al., 2001; Kothari, 2001; Dechow et al., 2009). But many of the other potential costs and benefits of standardization have not been measured. As a result, it is still the case that "no one knows the optimal amount of standardization" in accounting (Easterbrooke and Fischel, 1991, pg. 304).[2]

The disagreement about the optimal level of accounting standardization is observable in several parts of the accounting literature. There is a literature on "standards overload" which claims that financial reporting is excessively standardized (McGill and Arnstein, 1972; Seidler, 1990; Hepp and McRae, 1982; AICPA, 2005). In reply, standard-setters argue that they write detailed standards, with complexity-increasing features like implementation guidance and applicability exceptions, because their constituents demand

[1] There is no well accepted definition for the term "standard." In this paper, I define standards as "formalized and codified decision rules that join professional knowledge to action" (Baer, 1986). This is a broad definition that encompasses decision making tools like laws, rules, or routines.

[2] The term "efficiency" as I use it here refers to what Douglas North calls "adaptive efficiency" (North, 1990). See section 2 for more discussion of this issue.

them (Beresford and Van Riper, 1992; FASB, 2002). Ultimately, debates about the efficient level of standardization are unresolvable without a common benchmark.

In this paper, I examine the level of accounting standardization in two ways. First, I study the level of accounting standardization historically by examining how changes in the influence of accounting standard-setters have corresponded with changes in the properties of the accounting discourse between 1923 and 2007. In this analysis, I quantify the influence of various parties on accounting discourse. I find that the influence of standard-setters increased slowly during the tenures of the CAP and APB, then accelerated following the creation and empowerment of the FASB in the 1970s. This increase in standard-setter influence coincides with a reduction in the participation of a number of other groups in the dialogue about accounting, consistent with Baxter's (1962) prediction that an authoritative standard-setter could crowd out other dialogue participants. If standard-setters have reduced the quality of the professional accounting discourse, it is likely to have some significant undesirable effects such as reduced value-increasing innovation and poorer quality education.

I then examine the level of standardization in accounting in a modern context, the cross-section of occupations in the United States.[3] I begin by developing and testing an empirical model of the level of standardization in occupations. The model provides a meaningful benchmark of the "expected" level of standardization in accounting occupations. I construct the model using theory from economics, sociology, and accounting and estimate it using data from the U.S. Department of Labor's O*NET database. O*NET is a collection of survey data gathered from workers in more than 800 occupations concerning the background, skills, and tasks that are necessary for performing their jobs. Occupational features that are

[3] In accounting, standards arise through top down processes from the work of a standard-setting board. But standards can also arise from the ground up, in the form of evolved conventions (Littleton, 1953). Whether produced through top-down or bottom-up processes, standards are common across the economy (Jamal and Sunder, 2007).

empirically associated with standardization are job difficulty, the importance of innovation in the job, legal risks, and the extent of professionalization. The model explains almost half of the cross-sectional variation in the level of standardization in my sample.

Using my empirical model of standardization in occupations, I find that the accounting occupations most involved with financial reporting (accountants and especially auditors) are more standardized than the model predicts, consistent with excessive standardization. In contrast, bookkeeping, the accounting occupation with the least interaction with standard-setters, is less standardized than predicted. This suggests that excessive standardization is associated with the reporting function of accounting but not the more mechanical recording function of bookkeeping.

Analyzing the standardization of accounting by comparing accounting occupations with other occupations is a new approach to identifying an efficient level of standardization in accounting. The traditional approach is cost/benefit analysis, which the FASB performs for each new standard. It is well recognized that the cost/benefit approach has serious weaknesses when applied to accounting standards because of the difficulty or impossibility of quantifying many of the costs and benefits of accounting standards (FASB, 1991; Watts and Zimmerman, 1986; Dye and Sunder, 2001). The advantage of my approach is that it relies on observing the level of standardization that has been arrived at through a competitive process repeated for each of hundreds of occupations. This competitive process likely disciplines occupations, rewarding those that use standards to improve their competitive position effectively, and punishing mistakes. This observed level of standardization can then be modeled as a function of an occupation's observable characteristics. Because it relies on a different set of information and methods, my approach provides a "second opinion" about the level of accounting standardization to complement the traditional cost/benefit approach.

My results must be interpreted with some caution because they depend on the descriptive validity of the model of occupational standardization that I develop and on the quality of the data I use to estimate the model. As with all empirical models, important variables may be omitted. While I search broadly to identify variables that likely explain standardization, it is possible that future research will discover important relations not captured in my model. Also, the data come from worker surveys and as such they reflect the opinions of workers about their own jobs, which likely have some biases. The evidence in the paper of predictable associations among variables, the high explanatory power of the model, and the robustness of the results to a number of alternative specifications suggests that the biases do not render the data uninformative.

The remainder of the paper is organized as follows. In section 2, I develop my hypotheses. In section 3, I present evidence on the extent of standardization in accounting occupations and the output of accounting standard-setters over time. Section 4 presents my analysis of historical changes in the level of accounting standardization. Section 5 presents my model of the level of standardization in occupations. Section 6 concludes.

2. Hypothesis Development

Accounting scholars and practitioners have asserted that excessive standardization threatens the intellectual development of the accounting profession. The mechanism linking accounting standardization and intellectual development that has been most frequently discussed is education (West (2003, chapter 3) reviews criticisms of accounting education). In general, the claim is that as standards have proliferated, accounting educators teach rules over reason and reward memorization rather than intellectual sophistication. Besides providing inadequate preparation, such a shift in accounting education could make it difficult to attract bright students (Sunder, 2006).

Standards could influence accounting discourse through their influence on education, but other mechanisms have been proposed as well. Baxter (1962) argues that even a benevolent standard-setter may discourage debate, "whether from fear, or powerful preconceptions, or belief that others can do the job better," and as a result, "ideas are not put to a stern test" (pg. 421). Consistent with this argument is historical evidence that the largest accounting firms were active participants in accounting debates of the 1940s, 1950s, and 1960s, but that their participation declined and disappeared during the 1970s and 1980s (Zeff, 1986). One explanation Zeff (1986) proposes is that when the FASB took over standard-setting, the large firms came to believe that they could better influence standards through comment letters than public debates in the accounting literature.

There is a broad literature that discusses the intellectual value of diverse networks of interacting individuals (Gilsing, 2005; Brown and Duguid, 1991; Fang et al., 2007). Such networks enable knowledge sharing (Freidson, 2001), and, more importantly, novel synthesis of knowledge that could not occur without interaction (Podonly and Page, 1998). In this paper, I use the properties of the professional network contributing to the accounting dialogue to characterize the intellectual climate in the profession. All else equal, the more diverse and large the network, the more knowledge it is likely to contain, spread, and synthesize. This leads to my first hypothesis:

> H_1: The level of standard-setter influence is associated with reduced size and diversity of the network of participants in the professional accounting dialogue.

For standard-setters, balancing the costs and benefits of standardization is difficult because little is known about what would constitute an efficient level of standardization in accounting. The problem faced by standard-setters is not like a classic optimization problem

because many of the assumptions common in neoclassical economics are violated. The term "efficiency" as I use it here refers to what Douglas North calls "adaptive efficiency" (North, 1990). This conception of efficiency differs from standard neoclassical allocative efficiency, which occurs when goods are allocated to exploit all potential Pareto improvements assuming no market frictions or externalities and perfect information. In contrast, adaptive efficiency assumes the presence of market frictions, externalities, and substantial uncertainty. In such a world, "'profit maximization' is meaningless as a guide to specifiable action" (Alchian, 1950) and adaptation to unpredictably changing circumstances becomes more important than allocation for economic success (Kling, 2007). Adaptively efficient solutions are those that have evolved over time in response to selection pressures and market feedback to successfully compete in an unstable environment against other known alternatives. In other words, an adaptively efficient solution is the known solution that best enhances the survival prospects of its users.[4]

The levels of standardization observable in a cross-section of occupations are potentially valuable for estimating a meaningful benchmark level of standardization in accounting occupations. This is due, in large part, to the fact that occupations and the workers in them face competition with other occupations for work. There are hundreds of occupations in the United States, each performing distinct sets of tasks that overlap on the margins with the tasks performed by other occupations. The domains within which a given occupation operates have been called its "jurisdictions." Occupations compete over jurisdictions, each seeking to expand the number and size of the jurisdictions it controls (Abbott, 1988).[5]

[4] I also use the term "expected" level of standardization to refer to the adaptively efficient level of standardization.

[5] For example, in the United States in the early 20th century, accountants and engineers fought for control of what is now called "cost accounting." The accountants won (Abbott, 1988).

Standards are one tool that occupations can develop to improve their competitive positions.[6] All else equal, occupations that use standards effectively will have greater success than those that do not and will expand at the expense of occupations that use standards ineffectively.[7] Assuming that these competitive forces punish extreme deviations from efficient standardization in an average occupation, comparisons of standardization in accounting occupations to standardization in the population are likely to be informative about the adaptive level of standardization in accounting occupations. This background leads to my second hypothesis (stated in alternative form):

> H_2: The levels of standardization in accounting occupations are consistent with those in other occupations after controlling for characteristics likely to influence the expected level of standardization.

Adaptively efficient solutions are not arrived at inevitably. Barriers to achieving adaptive efficiency include institutional structures that reward unproductive more than productive work, imperfect knowledge about how a given course of action will turn out, and entrenched organizations that benefit from the existing institutional structure and resist change (North, 1990; 2005). For this reason, my analysis does not assume that all occupations are in equilibrium. My approach can be compared to a typical stock market

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[6] There is a literature on organizational learning that explores the tradeoff firms make between exploiting existing knowledge and exploring to discover knowledge (March, 1991). There is evidence that the way firms make this tradeoff influences their competitive success. Firms that are "ambidextrous" or that locate themselves near the middle of the continuum between exploitation and explorations strategies enjoy greater sales growth (He and Wong, 2004) and Tobin's Q (Uotila et al., 2007). Standards are tools for exploiting existing knowledge but have been shown to limit innovation (Benner and Tushman, 2002; Cole and Matsumiya, 2007; Raisch and Birkinshaw, 2008).

[7] Examples of occupations that have failed to remain competitive and have disappeared are serjeants-at-law of the English courts and railway surgeons. Examples of occupations that have successfully expanded by taking jurisdictions away from existing occupations are the surgeons and apothecaries that emerged in England to serve the medical needs of the poor (Abbott, 1988).

anomaly study which assumes that stock prices on average are efficient but then seeks to identify exceptions.

3. The Extent of Accounting Standardization in Form and Implementation

It is fairly straightforward to gather data to show that accounting has become standardized. Figure 1 shows a three-year moving average of the number of words in new accounting standards issued each year since 1953. This is a rough measure of the output of standard-setters. The chart begins with ASR 43 which was a large standard (42,000 words) because it summarized the previous 42 ASRs. The data show that the output of standard-setters has increased significantly with time. The CAP's output from 1953 to 1959 averaged about 8,100 words a year, the APB's output from 1962 to 1973 averaged about 13,500 words a year, and the FASB's output from 1974 to 2008 averaged about 60,800 words a year, an increase over the APB of more than four times.

Figure 2 is a scatter plot of occupations arranged according to the importance and complexity of their standards. The data come from the O*NET 12.0 database which was released in 2007. On the x- and y-axes are measures of the "importance" of standards and the "level" or complexity of standards used to perform an occupation's work. The data come from a questionnaire that asks workers how important and how complex (what "level") it is in their current job to "evaluate information to determine if it complies with standards." Appendix 1 shows summary descriptions of the O*NET questions that produced these variables.[8] Each point in the figure represents an occupation. The points representing three accounting occupations (bookkeepers, accountants, and auditors) are highlighted and labeled. Several other points are also labeled to put the accounting points in context. The figure shows that standards are more important and complex for accountants and auditors than for an

[8] Detailed variable definitions are available in appendix 2 of the "additional information" file which can be downloaded from http://sites.google.com/site/excessivestandardsaddinfo/.

average occupation, but less important and complex for bookkeepers than an average occupation.

The inferences that can be drawn from Figures 1 and 2 are limited. Figure 1 shows that standard-setter output has increased, but it says nothing about the nature of the output or its influence. Standard-setters have argued that measures of output are not informative about the burden of standards because longer standards are not necessarily more complex than shorter ones. They point out that "a lot more than the standard itself is included" in a standard, much of which is "intended to help constituents understand and implement the standards" (Beresford and Van Riper, 1992). In addition, information about the quantity of output of a standard-setter tells us little about how the output is received by the profession. It is possible that the impact of standard-setters is not solely dependent on the quantity of output but on some other characteristic. A more direct measure of the influence of standards is needed to capture the influence of standard-setters on the profession.

Figure 2 is similarly limited. It shows that standards are more important and more complex for accountants and auditors than for workers in other occupations. However, it is limited because it does not control for the characteristics of occupations. Occupations differ along many dimensions. For example, it is likely that a different degree of standardization is appropriate for anesthesiologists than for graphic artists because of differences in the types of work they perform. As a result, the data in figure 2, while useful for illustrating differences in standardization between occupations, do not show whether the level of standardization is greater than expected in light of underlying occupational characteristics.

4. Standard-Setters and Accounting Dialogue

In this section I examine the level of accounting standardization in terms of its influence on professional dialogue. I test the claim that standard-setting is associated with a decline in the intellectual vitality of the accounting profession. This analysis goes a step

beyond that presented in figure 1 because it shows how the increasing output of standard-setters was received by the profession and how it influenced the development of the profession. I take the size and diversity of the network discussing accounting issues as a measure of the intellectual health of the profession. I examine new data characterizing the accounting dialogue to test H_1, that increased accounting standard-setting has been associated with a decline in the number and diversity of participants in the accounting dialogue.

4.1 Data: The Accountants' Handbook

I hand collected data from eight editions of the *Accountants' Handbook,* which were published in 1923 (1st), 1932 (2nd), 1943 (3rd), 1956 (4th), 1970 (5th), 1981 (6th) , 1991 (7th), and 2007 (11th).[9] The *Handbook* is a useful data source with which to test H_1, because of its longevity, comprehensiveness, and consistency. Its goal has always been "to provide in a single reference source an answer to all reasonable questions on accounting and financial reporting that might be asked by accountants, auditors, executives, bankers, lawyers, financial analysts, and other users and preparers of accounting information" (Carmichael et al., 1991). A review of the second edition says that the first was "one of the most popular and successful works ever published in the field of accounting" (Graham, 1932, pg. 205). By the 1960s, it was recognized as "the standard reference work" (Zeff, 1963). Table 1 shows the year of publication, the names of the editor(s), the number of contributors, the qualifications of the contributors, and the number of pages for each edition I examine.[10]

[9] Editions of the *Handbook* were published with increasing frequency after 1980, as the preface to the 6th edition explains, due to the "explosion in scope and complexity of accounting principles and practices" that occurred between 1970 and 1981. In addition, some changes were made in the 6th edition. The *Handbook* was split into two volumes, the number of sections increased to 45 from the 28 in the 5th edition, the contributors were more likely to be specialist practitioners and less likely to be academics, and, because it became "almost impossible for anyone to be a general expert in accounting," sections were for the first time signed by their individual authors (Seidler and Carmichael, 1981, pg. v). I selected the editions from which to gather data in order to get about 1 book a decade and to include the most recent edition.

[10] I argue that the *Handbook* is an excellent source of data with which to construct proxy measures of the participation of various parties in the accounting dialogue but it has some limitations. Each edition is overseen by an editor or team of editors whose idiosyncrasies could influence the results. However, the

I use citations from the *Handbooks* as proxy measures of the participation of various groups in the professional accounting dialogue. Citations have been used in many fields to study how their ideas evolve (White, 2004). There has been work in the past few decades on creating a theory of citation from a field called scientometrics, which is the science of quantifying and analyzing science (Leydesdorff, 1999; Springer, 2008). This literature finds that citations are primarily used to persuade the reader, but are also frequently used to give credit to the cited party (Brooks, 1985 and 1986; Leydensdorff, 1999; Wouters, 1999; White, 2004). This is consistent with what I observed in the *Handbooks* where citations were frequently used to illustrate two sides of an ongoing debate, to explain proper accounting treatment, to provide support for or explain opposition to an advocated accounting practice, to provide examples of hypothetical or real accounting cases, or to provide accepted definitions of terms.

I hand collect citations from the chapters on three topics: financial statements: form and content, production costs, and intangible assets. These topics were chosen because I could develop *ex ante* expectations about their sensitivity to standard-setters, which should help me rule out alternative explanations for changes in citations over time. Discussions of financial statements can be expected to be highly sensitive to standard-setters because the Securities Acts, from which standard-setters derive their authority, are considered disclosure regulations, and financial statements are a primary vehicle for disclosure. Production cost accounting, which is a management accounting topic, is largely independent of standard-setters and so can be thought of as a control for changes in accounting that were not due to standard-setters. I examine discussions of intangible assets because they can be expected to be sensitive to standard-setters, but to a lesser extent than financial statements and because

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reader should note that the choice of editors is endogenous. The book's publishers had incentives to choose editors that would appeal to the largest possible audience at the time the books were published. These incentives reduce the chances that the *Handbook* editors had opinions that were extremely idiosyncratic.

they have been a contentious topic throughout my sample period (Yang, 1927; Hand and Lev (eds.), 2003). I expect discussions of intangible assets to quickly reflect changes in the network of participants in accounting dialogue because they have been a consistent source of controversy over my sample period.

To collect the data, I randomly sampled 10 pages each from the chapters discussing financial statements: form and content, intangible assets, and production costs, in each book and recorded all of the citations in them. I excluded pages that contained large figures or tables so that all sampled pages were at least three quarters text. In most cases the citations were unambiguous and the process was straightforward.[11]

After collecting individual citations, I classify them into six groups of similar citations. In this paragraph and in the tables, I arrange the groups roughly according to the extent of explicit coordination in them. I label the group with the least explicit coordination "norms." This group includes citations to general acceptance, orthodox accounting, accounting practice in general, business in general, business associations, and case law. The second, labeled "experts," encompasses citations to journals, books, specific experts, research, writers, and authorities. The third, "profession," is made up of citations to the American Institute of Certified Public Accountants (AICPA), American Accounting Association (AAA), and the National Association of Cost Accountants (NACA). The forth, "regulation," includes citations to the Interstate Commerce Commission (ICC), Securities and

[11] A research assistant without knowledge of this paper's hypotheses recoded about 10% of the pages that I coded. Excluding norms citations, our data matched in 82% of cases. The norms citations did not match as well. Only 41% of norms citations matched. This was mostly because the independent coder recorded more norms citations than I did. To be more specific, the independent coder was more likely to count a statement that something "usually," or "seldom," or "commonly" occurred as a citation to norms. This raises concerns about the quality of the norms citation data. In untabulated supplementary tests, I exclude all norms citations and find that the results remain essentially the same.

Exchange Commission (SEC), public utilities commissions, and the U.S. Treasury. And the final category, "standards," encompasses citations to the CAP, the APB, and the FASB.[12]

4.2 Results

Table 2 presents descriptive data on the number of citations per page and the proportion of citations to each of my citation groups. I consider the number and diversity of participants in the dialogue to be a function of both the number of citations per page (citation density), and the distribution of citations among contributor groups. The groups in each panel are arranged according to the extent of explicit coordination in them. As a result of this arrangement, when citations are concentrated in the top of the table, the dialogue has more participants and is more diverse than when they are concentrated in the bottom of the table.

Panels A and B of table 2 both show a dramatic change in the distribution of citations after the 1970 edition. In panel A (financial statements), the proportion of citations to standard-setters jumps dramatically, from 14% to 40%, between the 1970 and 1981 editions. Similarly, in panel B (intangible assets), citations to standard-setters increase from 5% in 1970 to 42% in 1981 and climb to 69% in 2007. There is no similar jump in panel C (cost accounting) where standards are only cited in the 1970 edition and only make up 2% of all citations in that edition.

The contrast of panels A and B with panel C with regard to accounting experts is also interesting. Citations to experts increased in all panels between 1923 and 1932, the pre-standard-setter period. But, citations to experts decline monotonically in all periods in which there is a standard-setter in the financial accounting sections (panel A and B), while they continue to increase over time in the cost accounting sections (panel C). The only exception

[12] For a detailed description of the data collection and categorization process see appendix 4 in the "additional information" document at http://sites.google.com/site/excessivestandardsaddinfo/. Examples of each citation type are available in appendix 5 of the "additional information" document.

is in the intangible assets section where they increase between 1932 and 1943, the first period in which standard-setters had any influence.

Table 3 displays a statistical analysis of the citation data. In table 3, the sample period is divided into three time frames. The first covers the 1923 and 1932 editions of the *Handbook* and is called the *pre-standard-setters* period. The second covers the 1943, 1956, and 1970 editions and is called the *CAP and APB* period. The third covers the 1981, 1991, and 2007 editions and is called the *FASB* period. Each panel displays data for the cost accounting section separate from the data for financial accounting sections. Panel A displays the references to standard-setters as a percentage of total references. In panel A, the unit of analysis is an individual citation and the statistical tests are tests for differences in proportion.[13] Panel A shows that the large increases in the proportion of citations to standards in the financial accounting sections that are apparent in table 2 are statistically significant and that there are no statistically significant changes over time in the cost accounting sections. This is evidence that the relative influence of standard-setters increased significantly over time in financial accounting.

Panels B and C of table 3 show changes in the citations per page to standard-setters and non-standard-setter groups. This analysis is informative about the absolute influence of standard-setters and other groups. The unit of analysis is a page from the *Handbooks*. The statistical tests are t-tests and assume unequal variances. Similar to panel A, panels B and C show no statistically significant changes in the citations per page from the cost accounting sections over time.[14] However, there are significant changes for financial accounting. Panel B shows that the citations per page to standards increased monotonically and that the increases

[13] These are similar to t-tests but are adjusted to account for the mean-variance relationship with binary variables (Stata Press, 2001).

[14] When I exclude all norms citations from the analysis, I find a statistically significant increase in citations to non-standard-setters between the pre-standard-setter period and the CAP and APB period. This is the only result that changes when I exclude norms citations.

were statistically significant. This is consistent with expectations and with the observations from table 2.

If standard-setters crowded other groups out of the dialogue, I expect that the absolute number of citations to non-standard-setter groups fell concurrent with the increase in citations to standard-setters. Panel C of table 3 shows that the citations per page to non-standard-setters increased between the pre-standard-setters period and the CAP and APB period. This is inconsistent with standard-setters crowding other groups out of the dialogue. However, the citations per page to non-standards groups fell significantly between the CAP and APB period and the FASB period, consistent with standard-setters crowding out other groups. Together, the result suggests that standard-setters do not inevitably crowd out other dialogue participants but that crowding out may have occurred during the FASB's tenure. This is consistent with the evidence in Zeff (1986) that large auditing firms ended their advocacy writing in professional publications when the FASB came to power.

The pattern of emerging standard-setter dominance that is observable in the citation data is also apparent in the evolution of the *Handbooks'* discussions of specific issues. For example, the discussions of the purposes of financial statements in the "Financial Statements: Form and Content" chapter show how the discussion evolved from norms-based, to academic, to standards-based. The first edition says, without citing a source, that the chief purposes for which enterprises issue financial statements are "1. To meet the requirements of management. 2. To meet the requirements of investors. 3. To meet the requirements of governmental regulations." (Saliers, 1923, pg. 320). In the third and forth editions, the discussion of the purpose of financial statements moves to a new section on "single purpose financial statements" and cites a number of academic sources who were engaged in a debate about whether firms should issue many sets of single-purpose financial statements targeted to

specific user groups in place of a single general purpose set of financial statements (Paton, 1943, pg. 13; Wixon, 1956, pg. 2.8-9).

In the fourth and fifth editions there is for the first time an extensive discussion of the reporting requirements of the SEC and the recommendations of the AIA (AICPA), the AAA, and the requirements for public utilities with respect to financial reporting. Finally, the sixth, seventh, and eleventh editions cite APB and FASB statements as "the most comprehensive and authoritative coverage" of the subject (Seidler and Carmichael, 1981, pg. 4.3; Carmichael et al., 1991, pg. 4.2; Carmichael et al., 2007, pg. 10.2). These changes are consistent with the quantitative data. The discussion of financial statement users evolves from one based on the experience of the *Handbook* authors, to one based on an academic debate, to one based on the pronouncements of standard-setters.

The results in this section show that there is a temporal association between the level of standardization, defined as the influence of standard-setters on the professional dialogue, and the size and diversity of the network participating in the dialogue about financial accounting. The influence of standard-setters on accounting dialogue increased drastically after the empowerment of the FASB in the 1970s. As standard-setters receive more citations in the *Handbooks*, other larger and more diverse groups receive fewer citations. This association is not present in the dialogue about management accounting. The evidence is consistent with Baxter's (1962) prediction that standardization would reduce the quality of accounting discourse.

5. The Level of Standardization in Accounting Occupations

In this section, I look at the level of accounting standardization in another way. While section 4 examined the influence of standard-setters over time, this section examines the modern outcome of that historical process in the context of the cross-section of occupations.

Figure 2 shows that accountants and auditors believe their standards are more important and more complex than workers in an average occupation. The significance of this fact is difficult to determine, however, because accounting and auditing differ from other occupations along a number of dimensions. In this section, I develop a model of standardization in occupations and use the O*NET 12.0 database maintained by the U.S. Department of Labor to estimate it. By comparing the model's estimates of standardization with the actual extent of standardization in accounting occupations, I test the hypothesis that the level of standardization in accounting occupations is consistent with other occupations after controlling for their essential occupational characteristics.

5.1 Theory of Standards

To develop my model, I characterize the observed level of standardization in a given occupation as the result of a discovery process in which workers in an occupation seek to promote their self-interest.[15] From this perspective, standards are a competitive tool employed by occupations and the workers that make them up to increase their share of the market for their services and expand the number of markets in which they compete. To the extent that standards can improve an occupation's competitive position, workers will demand them and occupations that use standards effectively will have greater opportunities to expand their jurisdictions. Standards can be supplied in many ways but are often supplied by professional bodies, government agencies, or firms. The relevant outcome of interest in the competition between occupations is not an idealized utility or wealth maximizing optimum, but efficiency relative to the known alternatives. Occupations need only be more efficient than their competition in a given jurisdiction of work to survive.

Prior research has identified several reasons that work may be standardized. Standards can record and disseminate expert knowledge and increase uniformity. By

[15] One implication of this perspective is that I explicitly do not model a social welfare function.

recording expert knowledge, standards potentially: reduce litigation risk by providing a strong basis for justifying decisions (Baer, 1987; Healy, 2003; Healy and Palepu, 2001; Watts, 2003), increase the value of professional designations by helping members of the profession perform their job competently (Larson, 1977), and help their users avoid the costs of becoming an expert or experimenting by trial-and-error (Brunsson and Jacobsson, 2000). By increasing uniformity, standards potentially help users take advantage of "network externalities" or situations in which the value of a product or service increases with the number of users (as with, for example, telephones or standardized weights and measures) (Katz and Shapiro, 1985; Farrel et al., 1992; Healy, 2003; Dye and Sunder, 2001; Jamal et al., 2003). More uniformity may also increase the value of professional designations by increasing the predictability of professional output (Larson, 1977).[16]

Several factors limit the usefulness of standards. Standards may displace expert judgment with the possible consequence of reducing the quality of professional debates and education (Baxter, 1962 and 1979; Jamal et al., 2005; Sunder, 2006). Standards can also be difficult to change once they are in place, a condition called "excess inertia," which can trap users in an inferior or obsolete standard (Farrel and Saloner, 1985). If standards are set by a centralized standard-setter, as they are in accounting, there is a risk that the process could be captured by political interests (Stigler, 1971). There is evidence that users react strategically to standards, giving rise to unintended consequences of standardization (Sivakumar and Waymire, 2003). Without perfect foresight, a standard-setter's solutions to one problem may cause other more serious problems (Dye and Sunder, 2001). Finally, standards are intended to

[16] Standards that are made mandatory and enforced have been proposed as solutions to "market failures." When combined with enforcement, standards have been proposed as solutions to the public goods problem (Beaver, 1998; Gonedes, 1976; Healy and Palepu, 2001; Healy, 2003) and as tools to protect the public from negligent harm or purposeful exploitation (Occupational Safety and Health Act, 1970; Securities and Exchange Commission, 2008; Healy and Palepu, 2001; Healy, 2003). However, I do not model this function of standards because these market failures are of greatest concern when taking a social welfare perspective, a perspective I do not take here.

increase uniformity which is the source of several of their benefits. But an unavoidable consequence of increased uniformity is a reduction in all forms of variation, from experimentation to favorable accidents, which have been shown to be important inputs to innovation (Benner and Tushman, 2002; Cole and Matsumiya, 2007). In other words, increased uniformity can increase efficiency in the short-term but can reduce an occupation's adaptability, which can threaten its long-term relevance (Benner and Tushman, 2002).

To summarize, the theory suggests that standardization involves tradeoffs. The gains from uniformity are balanced by the costs of rigidity. The relative usefulness of standardization is therefore likely to depend upon the relative magnitudes of those gains and losses for a group, given its characteristics. In the next sections, I describe the data and how I link the theory of standards to occupational variables that are likely to be associated with the usefulness of standards to occupations.

5.2 Data

Most of the data on occupations in this paper come from a database created by the U.S. Department of Labor called O*NET 12.0, which was released in September of 2007.[17] I also use data on state licensing requirements from Career One Stop, a website sponsored by the Department of Labor, data on occupations' sizes and average incomes from the Occupational Employment Statistics (OES), which are also furnished by the Department of Labor, and data on occupation ages from the General Social Survey (GSS).

The data in O*NET are collected using surveys that are administered in two stages. The first stage identifies a random sample of businesses that are expected to employ people in the targeted occupation. The second stage selects a random sample of workers in each selected business to complete a survey instrument. Once identified, workers complete one of seven questionnaires that aim to describe a dimension of the occupation's characteristics. The

[17] See http://www.onetcenter.org/dataCollection.html.

questionnaires ask workers to rate how important an item is for performing their current jobs, what level (of complexity) of an item is needed to perform their current jobs, and how frequently their jobs require them to perform certain activities. Appendix 1 provides summary descriptions of each variable I use in this paper.[18]

The occupations surveyed are classified according to the Department of Labor's Standard Occupational Classification (SOC) system, which was developed to help government agencies produce comparable data on occupations.[19] O*NET 12.0 contains limited data on 801 occupations, 777 of which meet my data requirements. I study three accounting occupations from O*NET. These are bookkeeping, accounting, and auditing clerks (SOC code 43-3031.00); accountants (SOC code 13-2011.01); and auditors (SOC code 13-2011.02).[20] O*NET's descriptions of these occupations explain that: bookkeeping clerks are primarily responsible for the routine recording of accounting data; accountants analyze operations, prepare accounting records and financial statements, prepare budgets, and may manage other accountants; and auditors prepare, analyze, and verify financial statements and collect and analyze data to assess controls and identify fraud or violations of laws, regulations, or management policies.[21]

5.3 Linking the Theory of Standards to Empirical Observable Occupational Traits

The dependent variable in the occupation analysis in this section is the extent of standardization in an occupation. The extent of standardization is likely to be increasing in both the number and complexity of written standards. Therefore, my measure of *standardization* comes from O*NET questions about the importance and "level" (of

[18] For detailed variable definitions see appendix 2 of the "additional information" document at http://sites.google.com/site/excessivestandardsaddinfo/.
[19] See http://www.bls.gov/soc/.
[20] O*NET does not update the data for each occupation with each update of the database. The data for bookkeepers and auditors was collected in July of 2004 and for accountants in March of 2003.
[21] Complete descriptions of the three O*NET accounting occupations I examine in this paper are available in appendix 3 of the "additional information" document which is available for download from http://sites.google.com/site/excessivestandardsaddinfo/.

complexity) of "evaluating information to determine compliance with standards" required in a job. These are also the variables on the axes of figure 2. The proxy for this construct measures the influence that standards have on the actual work of people in the occupation. In other words, if standards exist, but are ignored, the extent of standardization in the occupation is low.

I estimate *standardization* using factor analysis to identify unobserved "latent" factors that can explain the shared variance in the importance and "level" of standardization O*NET variables.[22] Table 5 shows the factor analysis results for *standardization* and all others estimated using factor analysis. Panel A of table 5 shows the factors produced by the factor analysis, their eigenvalues, and the amount of the variance in the input variables they explain. I retain one factor for *standardization* because only one has an eigenvalue greater than 1. By construction, *standardization* explains all of the shared variance in the "importance" and "level" of standardization variables. Panel B of table 5 shows the variable loadings. These describe the association between each input variable and the retained factor. The loadings for the input variables in the *standardization* factor analysis are both 0.95.

In section 3, I presented data showing high levels of standardization for accountants and auditors relative to other occupations. However, occupations differ and interpreting comparisons of them that do not control for these differences is difficult. To produce more meaningful comparisons of the level of standardization in accounting occupations with other

[22] I use factor analysis to produce a number of the variables is use in my tests. An alternative approach would be to use principal component analysis (PCA) to aggregate the information in several variables to create a smaller number of "principal components." PCA is often used to reduce the dimensionality of a dataset by reducing multiple variables to fewer "principal components" that explain the largest possible proportion of the total variance in the input variables (Johnson and Wichern, 2007). Principal component analysis differs from factor analysis in that it identifies unobserved components which explain the maximum proportion of the *total* variance of the input variables. In contrast, factor analysis identifies latent factors which explain the maximum proportion of the *shared* variance of the input variables. The O*NET data I use was not collected with the intent of performing the analyses I perform in this paper. As a consequence, O*NET variables likely measure my constructs with error. By using factor analysis, I reduce the role that this error plays in my tests. As a robustness check, I perform all of my tests using variables produced with PCA. The results are almost identical.

occupations, I develop a multivariate model of standardization in occupations. I identify occupational characteristics that are likely to be associated with the value of standards to an occupation. These characteristics include the difficulty of the occupation's work, litigation risk, professionalization, and the importance of innovation.

The theory of standards predicts that their benefits come from their ability to record and disseminate expert knowledge and to increase uniformity. A benefit of recording and disseminating expert knowledge is that it allows a non-expert to perform a difficult or complex task without acquiring the training and experience of an expert (Brunsson and Jacobsson, 2000). The implication is that standards would be particularly valuable for difficult or complex tasks. This could cause employers or clients as well as non-expert workers to demand standards. However, it is also possible that for many complex and difficult tasks, expert knowledge cannot easily be standardized. This is possible if expert knowledge is tacit, if the unique skill of an expert is the ability to react quickly to a complex array of possibilities, or if the situation is strategic.[23] This has the opposite implication; for difficult or complex tasks, expert judgment is invaluable and expert performance cannot be replicated by a non-expert using a standard (Baxter, 1979). If this is the case, standards for complex tasks would be of little value.

The first independent variable is, therefore, the difficulty and complexity of the occupation's work (*difficulty)*. I make no prediction about the sign of the coefficient because there are reasons to expect either a positive or negative association of task difficulty with

[23] For example, it would be very difficult to write a standard for how to win a chess game. Such a standard might be a large book containing thousands of pages of board configurations and rules for how to react to them. A player following a standard would be predictable, a disadvantage in a strategic game like chess. In addition, a novice would have difficulty applying the standard because identifying the part of the standard that applies to their particular situation would require that they quickly recognize board configurations. A novice would likely have trouble doing this because it is one of the abilities that distinguish chess experts from novices (Gobet and Charness, 2006).

standardization.[24] To construct this variable, I aggregate seven O*NET variables again using factor analysis. The input variables are from questions about the complexity of information dealt with, the complexity of the analysis of information, the complexity of decision making processes, and the amount of preparation required to perform the job. Table 4 shows the input variables for all factor analyses in this paper. Summary definitions of all variables are in appendix 1.[25] Table 5 panel A shows that only one factor has an eigenvalue greater than one and that it explains 90% of the shared variance of the input variables. I retain only this factor. Panel B shows that the input variables most strongly associated with the *difficulty/complexity* factor are *analyze info* and *complex problem solving*.

Another benefit of recording expert knowledge in a standard is that it can be used to justify decisions. Accountants have theorized that one benefit of financial reporting and auditing standards is that they reduce litigation risk for auditors (Healy, 2003; Healy and Palepu, 2001; Watts, 2003; Bratton, 2007). This is because auditors can justify their actions by arguing in court that they followed best-practices, as defined in auditing or financial accounting standards, and therefore behaved responsibly. This argument can be extended to any occupation that places property or people at risk. There is potentially less risk of losing lawsuits if workers follow precisely defined and well accepted standards than if they use judgment and depart from a standard. If the potential litigation costs are large enough, workers or firms will demand standards to protect against these losses. Thus, the second independent variable is litigation risk.

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[24] My prediction is that difficulty/complexity causes standardization but the causality could also go in the opposite direction. It may be that standards make tasks more difficult/complex than they would be without standards. I empirically examine this potential endogeneity in section 4.5. Statistical correction for endogeneity has a small impact on the results.

[25] Detailed variable definitions are available in appendix 2 of the "additional information" document at http://sites.google.com/site/excessivestandardsaddinfo/.

I construct two litigation risk proxies using factor analysis, one capturing the risk of financial damage (*legal risk financial*), the second capturing the risk of physical harm (*legal risk physical*). I construct the proxy for *legal risk financial* from variables measuring the impact of workers' decisions on other people or on their employer, the potential consequences of an error they could commit, and their level of responsibility for work outcomes. I retain only the first factor because it has an eigenvalue greater than one. Table 5 panel A shows that this factor explains 97% of the shared variance in the input variables. Panel B shows that *impact decisions co.* is most strongly associated with *legal risk financial.*

The proxy for *legal risk physical* is constructed using O*NET measures of the extent of responsibility for other people's health and safety, the need for knowledge of public health and safety, and a measure I create by taking the maximum value from several O*NET measures of exposure to occupational hazards (*physharm)*. I retain only the first factor which has an eigenvalue greater than one and explains 93% of the shared variance in the input variables. Table 5 panel B shows that *responsible for others' safety* is most strongly associated with *legal risk physical*.

A number of the features of professions that distinguish them from other occupations may increase their demand for standards. Legitimacy in the eyes of the public or the government is a critical requirement for jurisdictional control, and, for professions, demonstrating professional knowledge can be a means of increasing legitimacy (Abbott, 1988). Thus, the benefits of public displays of professional knowledge could create occupational demand for standards. Indeed, accounting historians have argued that early accounting standardization efforts in the U.K. were an attempt to increase professional legitimacy in response to jurisdictional conflicts with lawyers and legitimacy damaging public crises (Lee, 1995). In addition, because there is an "asymmetry of expertise" between professions and the parties with which they contract, there may be demand in professions for

mechanisms to control the quality and consistency of professional work (Abbott, 1988; Freidson, 2001).

One way that professions can coordinate the actions of their members is by creating standards and enforcing them through fines or the threat of expulsion from the profession. Thus, the next variable I expect to influence standardization is professionalization. The variable *professionalization* is constructed from O*NET variables measuring occupational attributes that Freidson (2001) and Abbott (1988) suggest make professions unique. These are the importance of integrity and independence, the extent of freedom, and a measure of the prevalence of state licenses for the occupation, which I construct from the Career One Stop website. I again retain the only factor with an eigenvalue greater than one. Table 5 panel A shows that this factor explains 82% of the shared variation in the input variables. Panel B shows that the input variable most strongly related to *professionalization* is *integrity*.

While there are benefits to increasing uniformity, there are costs as well. The economic environment is constantly changing and occupations need to adapt to the changes in order to stay competitive (Abbott, 1988; North, 2005). Competition is an effective mechanism for identifying useful innovations, but it can only work if there are a variety of competing ideas (Hayek, 1968; Alchian, 1950; Baxter, 1962). Standards can inhibit innovation because they reduce variation both by reducing “favorable” accidents and by increasing the costs of experimentation (Benner and Tushman, 2002; Cole and Matsumiya, 2007). If standards are enforced, experimentation is discouraged because experimentation outside the bounds of the standards is prohibited and there is a risk of being caught and punished. Even if standards are not enforced, there may be costs to ignoring them like social sanctions for failing to support a norm (Rutherford, 1998). Standards are also likely to increase the litigation risk of experimentation. Just as standards protect those that follow

them from litigation costs, they may expose those that fail to follow them to increased litigation costs (Baxter, 1962).

Standardization can therefore be a costly commitment. For occupations that face high levels of environmental instability, standardization is unattractive because it reduces their ability to adapt and compete against other occupations. Workers in these occupations are, therefore, likely to resist standardization. Thus, the final variable I expect to influence standardization is the importance of innovation.[26] My proxy for the importance of innovation, which I label *innovation*, is a single variable taken from an O*NET question asking workers how important innovation is in their job.

In my regressions, I control for occupation size. The proxy I use is the log of the number of full time workers, which I collect from the OES database.[27]

A possibly important omitted variable is the importance of network externalities. I omit it from my model because a variable measuring it is not available. An occupation's size is likely related to the importance of network externalities because the size of the externality increases with the number of people in the network. However, size is not a good proxy for network externalities because it is likely a function of many variables other than the importance of network externalities.

Table 6 shows descriptive statistics for the variables used in the factor analyses, the factors themselves, and all other variables used in this section. It also shows the values and percentiles for the three accounting occupations in O*NET. Auditors' work is extremely

[26] My prediction is that the importance of innovation causes occupations to demand less standardization but the causality could be reversed. It may be that standards cause innovation as people try to avoid the restrictions imposed by the standard. I empirically examine this potential endogeneity in section 4.5. Statistical corrections for endogeneity have a small influence on the results.

[27] The O*NET database divides some six-digit SOC codes into smaller sub-occupations. Of the 801 occupations in O*NET, 33 are not present in OES, while 50 others are subdivided. 35 occupations are divided into 2 subgroups, 9 into 3 subgroups, 4 into 4 subgroups, and 2 into 5 subgroups. When occupations are subdivided in O*NET, I assume that workers are equally distributed in each O*NET subgroup.

standardized and they are subject to high financial litigation risk. Table 3 shows that auditors' value for *standardization* is in the 99th percentile and for *legal risk financial* is in the 76th percentile. Accountants' standardization value is also high (75th percentile) but bookkeepers' value is low (19th percentile). This suggests that high standardization is not a phenomenon that is general to all accounting tasks. The characteristic of accounting occupations that appears to be correlated with the level of standardization is their involvement with financial reporting. O*NET's occupation definitions indicate that bookkeepers are primarily responsible for record keeping duties, accountants are responsible both for data analysis and financial reporting duties, and auditors are primarily focused on financial reporting.

5.4 Model and Results

I model standardization as a function of the difficulty/complexity of an occupation's work, the litigation risk posed because of the potential for damage to property and people, the degree of professionalization of the occupation, the importance of innovation, and a control for occupation size. Table 7 shows univariate correlations between these variables. Consistent with predictions, *standardization* is positively correlated with *difficulty*, *legal risk financial*, *legal risk physical*, and *professionalization*. *Standardization* is positively correlated with *innovation* in my univariate analysis against predictions. It is negatively correlated with size.

Results of the multivariate analysis are in Table 8. Table 8 shows results of an OLS estimation of the model and two instrumental variables estimations (IV). The first IV estimation treats *difficulty* as endogenous and uses the occupation's age and a variable measuring the importance of soft sciences to the occupation as exogenous instruments for *difficulty* for use in the first stage of the IV estimation. The second IV estimation treats both *difficulty* and *innovation* as endogenous and uses the occupation's age, the soft sciences measure, and an O*NET variable measuring the level of competitiveness in an occupation as

instruments.[28] The Hansen J statistics are both statistically insignificant which is evidence that the instruments in both IV models are uncorrelated with the estimated error terms. The F-statistics for the partial R^2 of the instruments in the first stage regression are all greater than 14 which is above the rule of thumb values suggested in Baum (2006) and Larcker and Rusticus (2010), which is evidence that the instruments are not weak. Finally, Hausman tests fail to reject the null hypothesis that differences in the coefficient estimates of the OLS model and the 2SLS models are not systematic. Assuming that at least one of my instruments is exogenous, this is evidence that *difficulty* and *innovation* are not endogenous. As a result, the discussion that follows focuses on the OLS results.

I cluster errors by two-digit SOC code (22 groups) to correct for possible correlation of error terms among similar occupations. The variables that were produced by factor analysis are approximately standard normally distributed. To make its coefficient comparable with the others, I also standardize *innovation*. The model explains 46% of the variation in standardization across the sample.[29, 30]

I expect to find a relationship between *standardization* and *difficulty/complexity* but do not predict whether it will be positive or negative. Table 8 shows that it is positive and statistically significant, which is consistent with the argument that, on average, standards are

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[28] Choosing proper instruments, ones which are likely to be correlated with the endogenous variable but uncorrelated with the true (unobserved) error term, is complicated here because of the lack of similar prior research. The source of the potential endogeneity is this paper is reverse causality, with *standardization* possibly causing variation in *difficulty* and *innovation*. It is difficult to imagine how *standardization* causes variation in an occupation's age, its use of soft sciences knowledge, or its level of competitiveness. I, therefore, expect that the instruments are more exogenous than *difficulty* and *innovation*.

[29] O*NET includes a variable called "recommend suppress" which is a dummy variable intended to flag low precision estimates. The variable description in O*NET says, "an estimate is considered to have low precision if any of the following are true: (1) the sample size is less than 10; (2) the variance is 0 and the sample size is less than 15; (3) the relative standard error (RSE) is greater than .5. (The RSE of a mean estimate is the ratio of the estimate's standard error to the estimate itself)." When I exclude the 43 occupations for which any of my regression variables is flagged "recommend suppress," the results remain the same.

[30] The independent variables I use in the Table 5 regression are fairly highly correlated and multicolinearity is a potential problem. I compute variance inflation factors (VIFs) and find that the highest is 2.09, well below the "rule of thumb" cutoff of 10 (Baum, 2006).

valuable for difficult tasks because they allow non-experts to perform them more like an expert. I find that standardization is positively and significantly associated with the risk of damage to property, the risk of damage to people, and *professionalization.* The coefficient on *innovation* is negative and highly statistically significant. This supports the proposition that standards are costly in unstable environments and that innovative occupations anticipate this and resist standardization. The coefficient on *Size* is positive but is not significantly different from zero.

The errors from this regression model show the size of the gap between the actual level of standardization and the model's estimated standardization for a given occupation. I examine these gaps for auditors, accountants, and bookkeepers in table 9. Auditors have the largest gap of the three which is in the 95th percentile of the sample, followed by accountants in the 64th percentile, and bookkeepers in the 38th.[31, 32]

The evidence in this section shows that the model I develop can explain about half of the variation in standardization across my sample. The model does a poor job of explaining standardization in auditing, which has a very large positive error. The model performs better for accountants, with a moderate positive error, and bookkeepers, with a moderate negative error. The results suggest that the model performs well for occupations involved with the

[31] It is possible that this result is driven by an overreaction by accountants and auditors to the Sarbanes-Oxley Act of 2001 (SOX). My data come from the O*NET 12.0 database, which contains data collected from 2000 to 2007. To examine the impact of SOX, I use the O*NET 4.0 database, which contains only data collected before 2001. The data show that the results cannot be explained by SOX. The values for standardization were also high prior to 2001. In O*NET 4.0, auditors had the 22nd and 3rd highest assessments of the importance and level of standards respectively. This compares with O*NET 12.0, which I use in this study, in which auditors had the 12th and 6th highest values for these variables.

[32] There are two occupation groups (two-digit SOC codes) that are over-represented in the extreme positive error sample (top 97%). One is "business and financial operations occupations" (SOC code 13) and the other is "office and administrative support occupations" (SOC code 43). Accountants and auditors fall in the first group and bookkeepers fall in the second. This suggests that business occupations may share some characteristic that makes them more standardized than other occupations and that this characteristic is not in the model. A candidate for this variable is the amount of strategic interaction with other people. If this is higher for business occupations than for other occupations, it could explain some of their larger errors. See the robustness checks in section 5.5 for more discussion of this issue. The other business occupation group, management occupations (SOC code 11), is not over-represented in the extreme positive error sample.

recording function of accounting, which is controlled by individual firms, but not the reporting function of accounting, which is governed by the FASB.

5.5 Robustness Checks

I conduct a number of analyses to test the robustness of my findings. The results are summarized in table 10.

The data in my sample come from the survey responses of workers. These workers provide the data I use to construct both the dependent variable and many of the independent variables in the regression model. This gives rise to the risk that my model is capturing associations that exist in the minds of the survey respondents but not in objective reality. To correct for this possibility, I re-estimate my main regression with the values for *Standardization* replaced with values constructed from an earlier version of O*NET (version 4.0). Versions of O*NET prior to version 5.0 were not constructed using data collected from worker surveys. Rather, they were constructed using data collected from "occupational analysts" employed by the O*NET project.[33] The disadvantages of using the occupational analyst data are that it is older than the worker survey data (the analyst data was collected in the late 1990s), and that the occupational analysts have less occupation specific knowledge than workers. The advantages are that the analysts did not select into the occupations they analyze, easing concerns about selection bias that could exist with workers, and that they did not provide the data used to construct the independent variables.

The result of substituting the occupational analyst values for *standardization* for the workers values for *standardization* are in column 1 of table 10. They show that the coefficients on some of the variables become less statistically significant or insignificant and

[33] The ratings of occupational analysts have been used for many O*NET projects. The minimum requirements to serve as an occupational analyst were two years of work experience, two years of graduate education in I/O or vocational psychology, human resources, or industrial relations, specific courses on job analysis, and O*NET training. For a more detailed description of the analyst qualifications and training, see http://www.onetcenter.org/reports/AnalystProc.html.

the R^2 falls to 36%. The size of the error terms for the accounting occupations falls as well. The error for auditors moves down to the 84th percentile, accountants to the 31st percentile, and bookkeepers to the 10th percentile. While some of the results are not robust to this alternative specification, the large positive error for auditors is robust.

Because workers in different jobs are likely to have different characteristics, there may be noise in the data they provide. To be specific, it is possible that a variable like *difficulty* will be understood differently by surgeons than it is by lifeguards. It is therefore potentially problematic to assume that the cardinal values in O*NET can be compared. One method for relaxing this assumption is to transform the raw variables into ranks. This requires the somewhat weaker assumption that the ordinal rank of the variables can be compared. This approach is likely to be more robust to perceptual differences between workers in the various occupations. I transform all O*NET variables into ranks and re-estimate my main regression. The results are in column 2 of table 10. The results are very similar to those in table 8. Auditors' error is in the 87th percentile, accountants in the 76th, and bookkeepers in the 12th percentile.

One method for identifying important omitted variables is to examine the occupations with the largest regression residuals looking for common characteristics that are omitted from the regressions that could explain the inaccurate regression estimates for these occupations. This type of analysis must be considered preliminary because it is guided by the data rather than theory. As a result, there is a risk of identifying idiosyncratic patterns and falsely labeling them causative factors, a mistake known as "overfitting" the data. However, such exploratory analyses can provide directions for future research.

Table 11 panel A shows the occupations with the 45 largest positive regression residuals from the model in table 8 model 1. A common feature of many of these occupations is that their work is regulated by government agencies. If government regulation is important

for predicting an occupation's demand for standards, this could explain some of the large residual for auditors.

One possible explanation for such a result is that the threat of greater governmental involvement in regulating an occupation can motivate greater self-regulation (Phillippe, 1963; Anthony, 1963). Another is that regulatory rule makers tend to overproduce rules (Sunder, 1988). Finally, if regulators are working to maximize a social welfare function, they may consider factors that are not important from the perspective of workers in the occupation. A prominent example is the public goods problem. Some have argued that financial reports are subject to the public goods problem and so information about the financial status of corporations is underproduced from a social welfare perspective (Healy, 2003). O*NET contains a variable called "knowledge of law and government" which I label *KnowlLawGov* which could capture the importance of regulation, or the threat of regulation, to an occupation. I re-estimate the regression my main regression with *KnowlLawGov* added. The results are displayed in table 10 column 3. They show that the coefficient on *KnowlLawGov* is positive and significant. With this variable included, auditors still have very large regression errors (98^{th} percentile).

An alternative method for studying the relationship between government involvement in an occupation and its standardization uses licensing requirements. Licensing requirements generally require that a person meet some minimum qualifications before practicing an occupation. These can include work experience, education requirements, and qualification exams. There are two contrasting interpretations of licensing requirements. Some interpret them as anti-competitive barriers to entry (Abbott, 1988), while others view them as part of an institutional mix that encourages professional knowledge sharing and development (Freidson, 2001). If licensing requirements are used as an anti-competitive barrier to entry, licensed occupations could be insulated from the competitive pressures that discipline

standard-setters in the marketplace for occupations' services. Licensing requirements are included in the model through their influence on the *professionalization* variable. However, it is possible that licensed occupations react differently to the non-*professionalization* variables in my model. If this is the case, re-estimating the model including only licensed occupations could reduce the size of the error for auditors and accountings, which are both licensed occupations.

Table 10 column 4 shows the results of re-estimating my main regression on a sample restricted to only licensed occupations. The model predicts the level of standardization in accounting very well but the large positive error for auditing remains.

Another common feature in the positive error occupations in table 11 is that many of them provide inspection services. Auditors essentially provide inspection services for financial statements which involves strategic interaction with other people. It is possible that standardization is more valuable for workers facing strategic opponents in inspection relationships. If my variables do not adequately capture this aspect of auditors' work, my regression results are likely biased. To examine this possibility, I create a dummy variable labeled *inspection* which is equal to 1 for occupations with the word "inspect" or "audit" in their job title and zero for all other occupations. There are 12 inspection occupations in my sample. I re-estimate the main regression including the *inspection* dummy variable. The results are in table 10 column 4. The coefficient in *inspection* is positive and statistically significant indicating that inspection occupations use a higher level of standards than others. The inclusion of the *inspection* dummy reduces auditors' error to the 63rd percentile.[34]

[34] Each O*NET occupation has a primary job title and several alternative job titles. In untabulated analysis, I define *inspection* as equal to 1 for occupations with the words "inspect" or "audit" in their primary or alternative job titles and zero otherwise. When defined this way, there are 95 inspection occupations in O*NET. When *inspection* is defined this way and included in the regression, auditors' error is in the 91st percentile.

In conclusion, the large positive regression residual for auditors is robust to a number of alternative regression specifications that incorporate potential explanations for the result. The moderately positive residual for accountants is less robust. Exploratory analysis of the data suggests that the nature of auditors' work, namely their inspection role, could explain their large regression error to some extent.

6. Conclusions

Increasing standardization was surely one of the most important developments in accounting during the 20th century (Baxter, 1953 & 1979; Jamal and Sunder 2007). In this paper, I study the level of accounting standardization through history and across occupations. I present data that show that the influence of standard-setters in financial reporting discourse has increased over time while at the same time the influence of professional accountants, business organizations, and accounting experts has declined. This was particularly true during the FASB's tenure. The findings are consistent with a "crowding out" effect where standard-setters reduce the breadth of the professional dialogue about financial accounting topics. Accounting experts appear to be particularly vulnerable to this effect.

The decline in the size and diversity of the network engaged in discussions about financial reporting, where standard-setters have significant influence, is not observed in the network discussing management accounting, where firms are the primary influence. The isolation of this effect to financial accounting topics suggests that standard-setters exert important indirect influences over the accounting profession.

I then examine accounting standards in the context of occupations in the United States. I model standardization in occupations as a function of their characteristics and estimate a benchmark level of standardization. I find a very large positive deviation from the benchmark for auditors, the accounting occupation most involved with financial reporting. The model's predicted levels of standardization for accountants and bookkeepers are more

accurate, suggesting that excessive standardization is not caused by forces common to all accounting occupations. Thus, formal standard-setting bodies like the FASB, IASB, and PCAOB, which largely influence financial accounting but not routine bookkeeping, likely are a major force in producing greater than expected standardization for auditors.

The model is also informative about the occupational features that influence the costs and benefits of standards in occupations. I find a positive and significant association between standardization and task difficulty, litigation risk, and professionalization. This is consistent with theory suggesting that standards are useful for simplifying complex tasks, reducing litigation risk, and enhancing professional legitimacy. I find a negative and significant association between standardization and the importance of innovation. This is consistent with the theory that occupations operating in unstable environments resist standardization because it limits their ability to innovate. These findings can potentially help explain past changes in the extent of standardization in accounting. For example, increases in litigation risk faced by accounting professionals over time (Basu, 1997) could have increased their demand for standards.

Cost/benefit analyses of accounting standards are difficult to perform because many of their costs and benefits are unobservable. An alternative approach is to examine accounting standardization in the context of other occupations. This enables the analyst to see whether accounting standard-setters have made the cost/benefit tradeoff involved with standardization in the same way as standard-setters in other occupations. The results suggest that they have not. Rather, they have tended to produce more standardization than standard-setters in other occupations.

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Figure 1

Words in New Accounting Standards: Accounting Research Bulletins (CAP), Accounting Principles Board Opinions (APB), and Statements of Financial Accounting Standards (FASB)

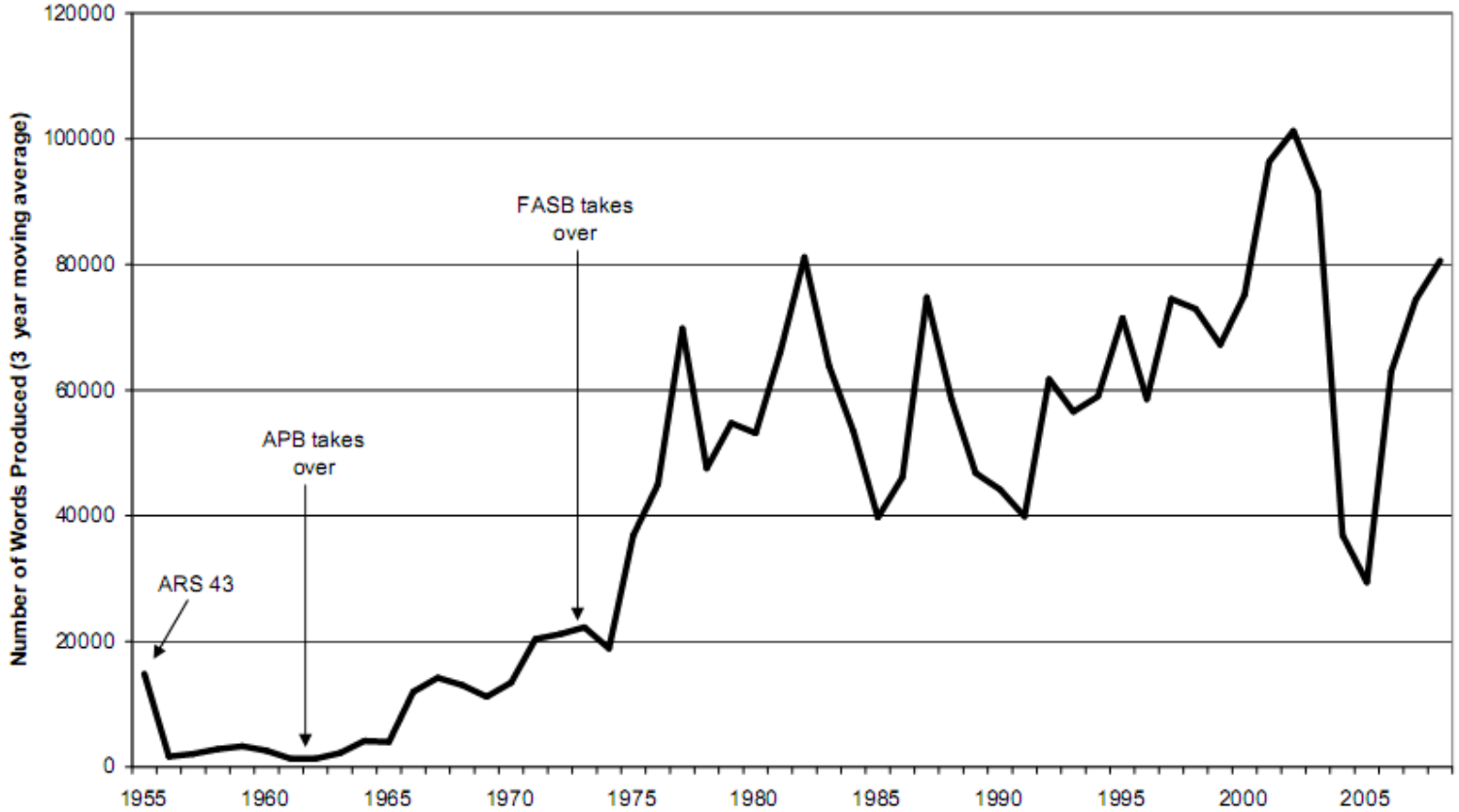
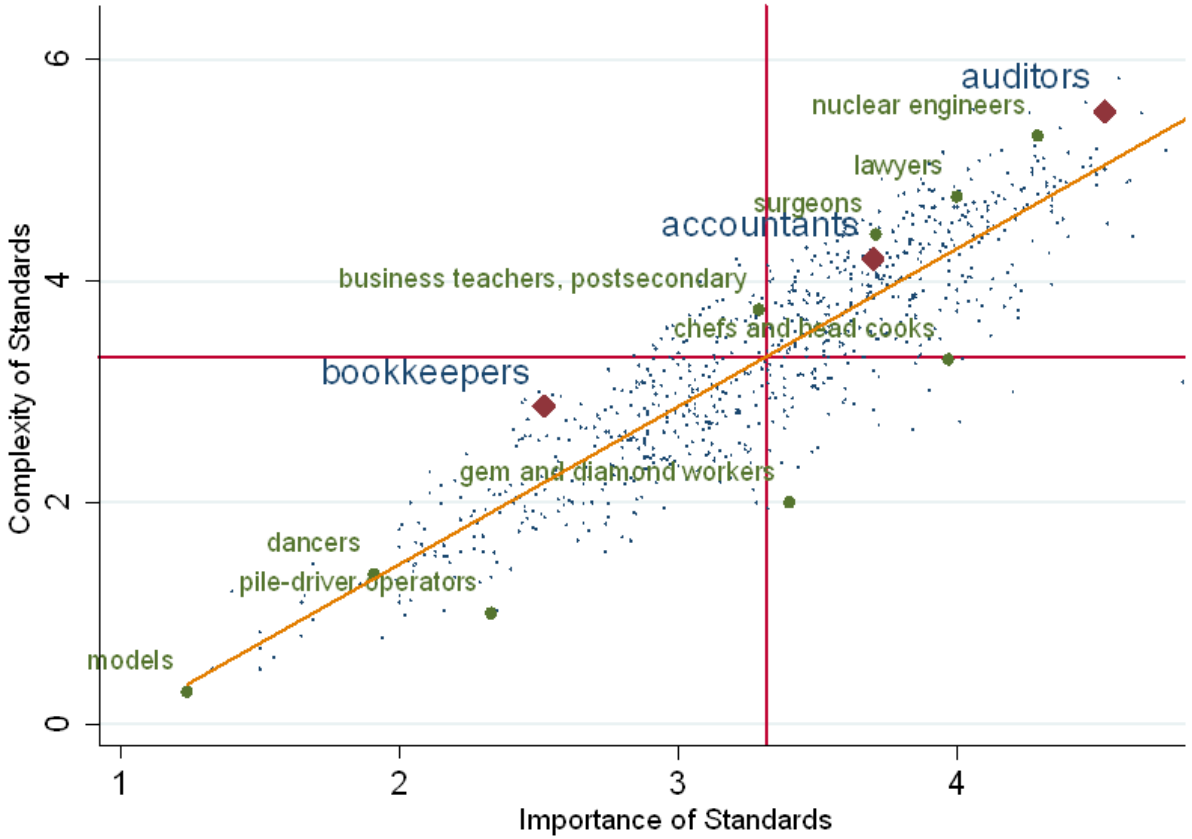


Figure 2
Degree of Standardization in Occupations



The data in this figure come from the O*NET database. Each dot represents on occupation. Occupations are arranged according to the importance of standards and the level (complexity) of standards needed to perform the job. A horizontal line marks the mean value for the level of standards and a vertical line marks the mean value for the importance of standards.

Table 1
Descriptive Information about the Accountants' Handbooks

Edition	Year	Editor	Number of Contributors	% Ph.D.	% CPA or CA	Total Pages
1	1923	Earl. A. Saliers	19	11%	42%	1675
2	1932	W. A. Paton	77	31%*	-*	1742
3	1943	W. A. Paton	89	39%*	-*	1505
4	1956	Rufus Wixon Walter G. Kell	30	67%	80%	1541°
5	1970	Rufus Wixon Walter G. Kell Norton M. Bedford	50	72%	74%	1523°
6	1981	Lee J. Seidler D. R. Carmichael	57	30%	75%	2068
7	1991	D. R. Carmichael Steven B. Lilien Martin Mellman	56	21%	82%	1378
11	2007	D. R. Carmichael O. Ray Whittington Lynford Graham	69	20%	87%	1799

* The 2nd and 3rd editions do not list contributors' degrees and designations. I counted the number of contributors described as "Professor" or "Dean" as contributors with Ph.D.s. I was unable to count the number of CPAs for these editions.

Table 2

Citations in the Accountants' Handbook

Panel A: Financial Statements: Form and Content

	Citations per page									*Proportion of citations per year*								
Categories	**1923**	**1932**	**1943**	**1956***	**1970***	**1981**	**1991***	**2007***	**Ave.**	**1923**	**1932**	**1943**	**1956**	**1970**	**1981**	**1991**	**2007**	**All**
Norms	1.00	1.30	1.70	2.96	3.34	2.60	1.25	0.58	1.84	45%	37%	40%	35%	46%	46%	41%	19%	39%
Expert	1.00	1.80	1.30	0.81	0.37				0.66	45%	51%	31%	9%	5%				14%
Profession			0.40	2.25	1.11	0.20		0.49	0.56			10%	26%	15%	4%		17%	12%
Regulation	0.20	0.40	0.60	1.89	1.39	0.60	0.17	0.16	0.68	9%	11%	14%	22%	19%	11%	5%	6%	14%
Standards			0.20	0.63	1.02	2.30	1.67	1.73	0.94			5%	7%	14%	40%	54%	58%	20%
Grand Total	**2.2**	**3.5**	**4.2**	**8.5**	**7.2**	**5.7**	**3.1**	**3.0**	**4.7**									

Panel B: Intangible Assets

	Citations per page									*Proportion of citations per year*								
Categories	**1923**	**1932**	**1943**	**1956***	**1970***	**1981**	**1991***	**2007***	**Ave.**	**1923**	**1932**	**1943**	**1956**	**1970**	**1981**	**1991**	**2007**	**All**
Norms	2.10	1.80	1.20	1.71	1.39	0.90	1.17	0.74	1.38	54%	49%	30%	35%	34%	24%	20%	14%	31%
Experts	0.40	1.10	1.90	1.80	1.39	0.90	0.17		0.96	10%	30%	48%	37%	34%	24%	3%		22%
Profession			0.10	0.09	0.09	0.10	0.17	0.41	0.12			3%	2%	2%	3%	3%	8%	3%
Regulation	1.40	0.80	0.80	1.17	1.02	0.30	1.34	0.49	0.91	36%	22%	20%	24%	25%	8%	23%	9%	21%
Standards				0.09	0.19	1.60	3.00	3.70	1.07				2%	5%	42%	51%	69%	24%
Grand Total	**3.9**	**3.7**	**4.0**	**4.9**	**4.1**	**3.8**	**5.8**	**5.4**	**4.4**									

Panel C: Production Costs

	Citations per page									*Proportion of citations per year*								
Categories	**1923**	**1932**	**1943**	**1956***	**1970***	**1981**	**1991***	**2007***	**Ave.**	**1923**	**1932**	**1943**	**1956**	**1970**	**1981**	**1991**	**2007**	**All**
Norms	1.60	0.80	0.60	0.63	1.67	0.90			1.03	84%	44%	46%	25%	38%	36%			43%
Experts	0.30	0.80	0.70	1.89	1.58	1.20			1.08	16%	44%	54%	75%	36%	48%			45%
Profession		0.20			0.74	0.20			0.19		11%			17%	8%			8%
Regulation					0.28	0.20			0.08					6%	8%			3%
Standards					0.09				0.02					2%				1%
Grand Total	**1.9**	**1.8**	**1.3**	**2.5**	**4.4**	**2.5**			**2.39**									

* The number of words per page differs by small amounts in the different editions of the *Handbooks*. To make the citations per page numbers comparable between editions, I estimate the number of words per page in each edition and standardize them. I take the 1923, 1932, and 1943 editions as a baseline and test for statistical differences in words per page between each edition and the words per page in the first three editions. The 1956, 1970, 1991, and 2007 have more words per page than the others. I standardize the raw numbers by multiplying them by a deflator equal to the baseline words per page divided by the words per page for a given edition.

Table 3
Statistical Analysis of Citations from the Accountants' Handbook

Accounting Topic	Time Period	N	Value	Expected sign of change	Change
Panel A: References to Standard-Setters as a Percentage of Total References					
Cost Accounting	Pre-standard-setters	37	0.00%		
	CAP and APB	88	1.14%	?	1.14%
	FASB	25	0.00%	?	-1.14%
Financial Accounting	Pre-standard-setters	133	0.00%		
	CAP and APB	353	6.52%	+	6.52%***
	FASB	303	53.10%	+	46.62%***
Panel B: Number of References Per Page to Standard-Setters					
Cost Accounting	Pre-standard-setters	20	0.000		
	CAP and APB	30	0.031	?	0.031
	FASB	10	0.000	?	-0.031
Financial Accounting	Pre-standard-setters	40	0.000		
	CAP and APB	60	0.354	+	0.354***
	FASB	60	2.334	+	1.980***
Panel C: Number of References Per Page to Non-Standard-Setter Sources					
Cost Accounting	Pre-standard-setters	20	1.850		
	CAP and APB	30	2.692	?	0.842
	FASB	10	2.500	?	-0.192
Financial Accounting	Pre-standard-setters	40	3.325		
	CAP and APB	60	5.127	-	1.802†††
	FASB	60	2.123	-	-3.005***

The data are citations from eight editions of *the Accountants Handbook*. In panel A, the unit of analysis is the citation and the statistical tests are tests of differences in proportion (using the prtest command in Stata). In panels B and C, the unit of analysis is the page and the statistical tests are t-tests. *** indicates statistical significance at the p = .001 level. ††† signifies statistical significance at the p = .001 level but in the direction opposite of predictions.

Table 4

Occupational Characteristics Used in Principal Component Analyses to Create the Standardization, Difficulty/Complexity, Legal Risk Financial, Legal Risk Physical, and Professionalization Components

Component Variable	**Observations**	**O*NET Variable I.D.**
Standardization		
Standards (importance)	801	4.A.2.a.3 – IM
Standards (level)	801	4.A.2.a.3 – LV
Difficulty		
Analyzing data or information (level)	801	4.A.2.a.4 – LV
Complex Problem Solving (level)	801	2.B.2.i – LV
Interpreting the meaning of information for others (level)	801	4.A.4.a.1 – LV
Provide consultation and advice to others (level)	801	4.A.4.b.6 – LV
Making decisions and solving problems (level)	801	4.A.2.b.1 – LV
Job zone	801	N/A
Judgment and decision making (level)	801	2.B.4.e – LV
Legal Risk Financial		
Impact of decisions on co-workers or company results	780	4.C.3.a.2.s
Consequence of Error	801	4.C.3.a.1
Responsible for outcomes and results	801	4.C.1.c.2
Legal Risk Physical		
Responsible for others' health and safety	801	4.C.1.c.1
Physical Harm	801	Multiple
Knowledge of public safety and security	801	2.C.8.a – IM
Professionalization		
Integrity	780	1.C.5.c
Independence	780	1.C.6
Freedom to make decisions	780	4.C.3.a.4
State Licenses	801	N/A

Data come from then O*NET database. *Observations* is the number of non-missing values in the database. *O*NET variable I.D.* is the variable code in the O*NET database (if applicable). Summary variable descriptions are in appendix 1. Detailed variable definitions are available in appendix 2 of the "additional information" document available for download at http://sites.google.com/site/excessivestandardsaddinfo/.

Table 5
Results of Factor Analysis to Create Proxies for Standardization, Difficulty, Financial Legal Risk, Physical Legal Risk, and Professionalization

Panel A: Factors and Eigenvalues

Regression variable	Factor	Eigenvalue	Proportion explained	Cumulative explained
Standardization	1	1.79	1.00	1.00
	2	0.00	0.00	1.00
Difficulty	1	5.17	0.90	0.90
	2	0.35	0.06	0.96
	3	0.15	0.03	0.99
	4	0.06	0.01	1.00
	5	0.01	0.00	1.00
	6	0.01	0.00	1.00
	7	0.00	0.00	1.00
Legal Risk Financial	1	1.23	0.97	0.97
	2	0.04	0.03	1.00
	3	0.00	0.00	1.00
Legal Risk Physical	1	1.72	0.93	0.93
	2	0.12	0.07	1.00
	3	0.00	0.00	1.00
Professionalization	1	1.67	0.82	0.82
	2	0.25	0.12	0.95
	3	0.10	0.05	1.00
	4	0.00	0.00	1.00

The variables used to estimate the factors are listed in Table 1. For *standardization* they are the importance and complexity of standards. For *difficulty* they are the complexity of information analyzed, the complexity of problems solved, the complexity of interpreting information for others, the complexity of consultation and advice provided to others, the complexity of decision making and problem solving, the amount of training necessary, and the complexity of judgment and decision making required to perform the job. For *legal risk financial* the input variables are the impact of decisions on co-workers or company results, the consequences of errors, and the responsibility for outcomes and results. For *legal risk physical* the input variables are the extent of responsibility of others' health and safety, a variable measuring the hazards faced by workers (*physharm*), and the extent of knowledge of public health and safety required to perform the job. The input variables for *professionalization* are the importance of integrity, the amount of independence, the freedom to make decisions, and the need for a state license to perform the job. Summary variable descriptions are in appendix 1. Detailed variable definitions are available in appendix 2 of the "additional information" document available for download at http://sites.google.com/site/excessivestandardsaddinfo/. I use the iterated principal factors estimation method. I retain factors with eigenvalues greater than 1 to estimate the proxy values. "Proportion explained" is the proportion of the shared variance in the input variables that is explained by a given factor.

Table 5 (continued)

Panel B: Variable Loadings on Factors

	Standardization	Difficulty	Legal Risk Financial	Legal Risk Physical	Professionalization
Standards (importance)	0.95				
Standards (level)	0.95				
Analyzing data or information (level)		0.89			
Complex problem solving (level)		0.87			
Interpreting the meaning of information for others (level)		0.87			
Provide consultation and advice to others (level)		0.85			
Making decisions and solving problems (level)		0.84			
Job zone		0.82			
Judgment and decision making (level)		0.82			
Impact of decisions on co-workers or company results			0.77		
Consequence of error			0.57		
Responsible for outcomes and results			0.55		
Responsible for others' health and safety				0.99	
Physical harm				0.66	
Knowledge of public safety and security				0.57	
Integrity					0.78
Independence					0.75
Freedom to make decisions					0.57
State licensing					0.39

Summary variable descriptions are in appendix 1. Detailed variable definitions are available in appendix 2 of the "additional information" document available for download at http://sites.google.com/site/excessivestandardsaddinfo/.

Table 6

Descriptive Statistics, Values and Rakings for Auditors, Accountants, and Accounting Clerks for All Variables

						Auditors		Accountants		Bookkeepers	
	Mean	Med.	Min.	Max.	N	Val.	%-ile	Val.	%-ile	Val.	%-ile
Standardization	0.00	0.06	-3.03	2.70	801	1.99	99%	0.72	75%	-0.82	19%
Standards (importance)	3.32	3.37	1.24	4.99	801	4.53	99%	3.70	69%	2.52	13%
Standards (level)	3.32	3.35	0.29	6.29	801	5.53	99%	4.20	78%	2.87	35%
Difficulty	0.00	-0.04	-2.58	2.33	801	1.10	84%	1.07	84%	-0.71	25%
Analyzing data or information (level)	3.25	3.14	0.00	6.66	801	5.56	96%	4.97	89%	3.19	50%
Complex Problem Solving (level)	3.60	3.71	0.52	6.11	801	4.36	73%	4.25	70%	2.77	24%
Interpreting the meaning of info. for others (level)	2.94	2.85	0.00	5.94	801	3.70	75%	3.94	81%	1.75	13%
Provide consultation and advice to others (level)	2.86	2.76	0.00	6.59	801	4.31	84%	4.32	84%	1.68	20%
Making decisions and solving problems (level)	4.06	4.15	0.50	6.58	801	4.93	79%	4.59	66%	3.01	16%
Job zone	3.00	3.00	1.00	5.00	801	4.00	86%	4.00	86%	3.00	68%
Judgment and decision making (level)	3.70	3.79	0.70	6.54	801	4.43	74%	5.35	95%	2.75	21%
Legal Risk Financial	0.00	0.00	-3.02	2.23	780	0.65	76%	-1.06	11%	-0.54	26%
Impact of decisions on co-workers or firm results	3.82	3.86	1.91	4.98	780	4.16	71%	3.42	23%	3.76	43%
Consequence of Error	2.94	2.90	1.30	4.83	801	3.86	88%	1.84	4%	2.09	11%
Responsible for outcomes and results	3.15	3.17	1.10	4.85	801	3.10	47%	2.49	18%	2.70	27%
Legal Risk Physical	0.00	0.07	-2.37	2.13	801	-0.47	33%	-1.40	10%	-1.77	4%
Responsible for others' health and safety	3.07	3.14	1.00	4.94	801	2.68	34%	1.85	11%	1.51	4%
Physical Harm	3.54	3.55	1.23	5.00	801	3.07	35%	1.49	0%	2.50	17%
Knowledge of public safety and security	2.61	2.55	1.00	4.79	801	1.25	2%	2.27	35%	1.65	9%
Professionalization	0.00	0.09	-2.68	1.84	780	0.65	73%	0.94	84%	0.39	64%
Integrity	4.23	4.31	2.67	5.00	780	4.55	69%	4.80	90%	4.51	66%
Independence	3.92	3.95	2.24	4.93	780	4.06	61%	4.05	59%	4.20	74%
Freedom to make decisions	4.18	4.25	2.17	5.00	780	4.02	33%	4.11	39%	4.05	35%
State Licenses	0.78	0.00	0.00	5.00	801	5.00	99%	5.00	99%	0.00	68%
Importance of Innovation	0.00	0.00	-2.92	2.58	780	-0.13	45%	-0.09	47%	-0.42	32%
Occupation Size	10.71	10.70	5.70	15.29	789	13.21	94%	13.21	94%	14.43	99%
Occupation Age	2.88	0.00	0.00	15.00	801	15.00	99%	15.00	99%	15.00	99%
Soft Science	3.11	2.98	1.00	5.00	801	2.96	49%	3.58	74%	2.10	10%
Level of Competition	2.98	2.94	1.41	4.84	780	3.46	80%	2.33	13%	2.95	51%
Error	0.00	0.02	-2.57	1.72	777	1.09	95%	0.26	64%	-0.20	38%

Summary variable descriptions are in appendix 1. Detailed variable definitions are available in appendix 2 of the "additional information" document available for download at http://sites.google.com/site/excessivestandardsaddinfo/.

Table 7

Spearman (Top) and Pearson (Bottom) Correlations Between Variables in Standardization Regression

	Standardization	Difficulty	Legal Risk Occupation Financial	Legal Risk Physical	Profess.	Innovation	Size
Standardization		0.59	0.44	0.18	0.34	0.18	-0.13
		0.00	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Difficulty	0.61		0.36	-0.11	0.60	0.58	-0.27
	0.00		*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Legal Risk Financial	0.45	0.37		0.48	0.25	0.15	-0.14
	0.00	*0.00*		*0.00*	*0.00*	*0.00*	*0.00*
Legal Risk Physical	0.22	-0.06	0.49		-0.18	-0.15	-0.04
	0.00	*0.11*	*0.00*		*0.00*	*0.00*	*0.29*
Professionalization	0.34	0.59	0.28	-0.17		0.61	-0.09
	0.00	*0.00*	*0.00*	*0.00*		*0.00*	*0.01*
Innovation	0.18	0.57	0.15	-0.15	0.61		-0.16
	0.00	*0.00*	*0.00*	*0.00*	*0.00*		*0.00*
Occupation Size	-0.06	-0.21	-0.13	0.02	-0.09	-0.18	
	0.07	*0.00*	*0.00*	*0.58*	*0.01*	*0.00*	

The sample comes from the O*NET database maintained by the U.S. Department of Labor. The unit of analysis is the occupation. *Standardization* is a measure of the level of standardization in each occupation. *Difficulty* is a measure of the difficulty or complexity of an occupation's work. *Legal risk financial* is a measure of the extent to which the work of the occupation puts people at risk of financial loss. *Legal risk physical* is a measure of the extent to which the work of the occupation puts people at risk of physical injury. *Professionalization* is a measure of the extent to which an occupation has become professionalized. *Innovation* is a measure of the importance of innovation to the work of the occupation. *Size* is the log of the number of workers in the occupation. Italicized rows are p-values.

Table 8
Multivariate Model of Standards in Occupations

Model 1 is the following equation estimated using OLS:

$$\text{Standardization}_i = \alpha + \beta_1\text{Difficulty}_i + \beta_2\text{Legal Risk Financial}_i + \beta_3\text{Legal Risk Physical}_i + \beta_4\text{Professionalization}_i + \beta_5\text{Innovation}_i + \beta_6\text{Size}_i + \varepsilon_i$$

Model 2 treats *difficulty* as endogenous. It is estimated using 2SLS with *age* and *soft science* as instruments. Model 3 treats both *difficulty* and *innovation* as endogenous. It is estimated using 2SLS with *age, soft science,* and *level of competition* as instruments.

	Predicted Sign.	Model 1	Model 2 (p-values in parentheses)	Model 3
Constant		-0.321	-0.312	-0.430
		(0.270)	*(0.228)*	*(0.391)*
Difficulty	?	0.643	0.636	1.387
		(0.000)	*(0.000)*	*(0.005)*
Legal Risk Financial	+	0.155	0.157	-0.121
		(0.020)	*(0.015)*	*(0.304)*
Legal Risk Physical	+	0.183	0.182	0.270
		(0.000)	*(0.000)*	*(0.006)*
Professionalization	+	0.105	0.108	0.536
		(0.080)	*(0.116)*	*(0.014)*
Innovation	-	-0.217	-0.215	-1.373
		(0.001)	*(0.000)*	*(0.027)*
Size	+	0.030	0.029	0.037
		(0.131)	*(0.115)*	*(0.193)*
R^2		0.46		
Observations		777	777	777
Partial R^2 of instrumental variables from first stage regression				
Difficulty			0.12	0.18
(F-value)			(53.23)	(14.93)
Innovation				0.09
(F-value)				(18.73)
P-value of Hansen J test of overidentifying restrictions			0.52	0.31
P-value of Hausman test			1.00	0.31

The sample comes from the O*NET database maintained by the U.S. Department of Labor. The unit of analysis is the occupation. The dependent variable is *standardization* which is a measure of the level of standardization in each occupation. *Difficulty* is a measure of the difficulty or complexity of an occupation's work. *Legal risk financial* is a measure of the extent to which the work of the occupation puts people at risk of financial loss. *Legal risk physical* is a measure of the extent to which the work of the occupation puts people at risk of physical injury. *Professionalization* is a measure of the extent to which an occupation has become professionalized. *Innovation* is a measure of the importance of innovation to the work of the occupation. *Size* is the log of the number of workers in the occupation. Errors are clustered by two-digit SOC code. P-values (in parentheses) are one-tailed for all variables except *difficulty* for which I could not make a directional prediction.

Table 9

Regression Errors for Accounting Occupations in Table 5 Model 1 Regression

		Auditors		Accountants		Bookkeepers	
	Coefficients	Values	Predicted	Values	Predicted	Values	Predicted
Constant	-0.32		-0.32		-0.32		-0.32
Difficulty	0.64	1.10	0.71	1.07	0.69	-0.71	-0.46
Legal Risk Financial	0.15	0.65	0.10	-1.06	-0.16	-0.54	-0.08
Legal Risk Physical	0.18	-0.47	-0.09	-1.40	-0.26	-1.77	-0.32
Professionalization	0.11	0.65	0.07	0.94	0.10	0.39	0.04
Innovation	-0.22	-0.13	0.03	-0.09	0.02	-0.42	0.09
Occupation Size	0.03	13.21	0.39	13.21	0.39	14.43	0.43
Standardization Predicted			0.89		0.46		-0.62
Standardization Actual			1.99		0.72		-0.82
Error			1.09		0.26		-0.20
Percentile			95%		64%		38%

The sample comes from the O*NET database maintained by the U.S. Department of Labor. The unit of analysis is the occupation. The dependent variable is *standardization* which is a measure of the level of standardization in each occupation. *Difficulty* is a measure of the difficulty or complexity of an occupation's work. *Legal risk financial* is a measure of the extent to which the work of the occupation puts people at risk of financial loss. *Legal risk physical* is a measure of the extent to which the work of the occupation puts people at risk of physical injury. *Professionalization* is a measure of the extent to which an occupation has become professionalized. *Innovation* is a measure of the importance of innovation to the work of the occupation. *Size* is the log of the number of workers in the occupation. The "coefficients" column lists the regression coefficients from Table 5, model 1. The "values" column lists the actual values for the occupation. The "predicted" column is the product of the "values" and the "coefficients" columns. "Standardization predicted" is the regression prediction while "standardization actual" is the observed value for standardization. "Error" is the difference between the predicted level of standardization and the actual level of standardization (a.k.a. the regression error). "Percentile" shows where the occupation's error falls within the distribution of regression errors from the whole sample.

Table 10
Robustness Tests

	Predicted Sign.	1	2	3	4	5
			(p-values in parentheses)			
Constant		-1.178	141.317	-1.080	-0.008	-0.331
		(0.000)	*(0.076)*	*(0.001)*	*(0.983)*	*(0.221)*
Difficulty	?	0.547	0.668	0.562	0.748	0.632
		(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
Legal Risk Financial	+	0.116	0.130	0.114	-0.035	0.152
		(0.069)	*(0.028)*	*(0.036)*	*(0.333)*	*(0.018)*
Legal Risk Physical	+	-0.159	0.179	0.175	0.209	0.185
		(0.030)	*(0.000)*	*(0.001)*	*(0.002)*	*(0.001)*
Professionalization	+	0.106	0.097	-0.012	0.089	0.098
		(0.128)	*(0.090)*	*(0.430)*	*(0.188)*	*(0.093)*
Innovation	-	-0.111	-0.245	-0.180	-0.145	-0.201
		(0.043)	*(0.000)*	*(0.001)*	*(0.055)*	*(0.002)*
Size	+	0.117	-6.750	0.031	0.004	0.030
		(0.000)	*(0.158)*	*(0.119)*	*(0.408)*	*(0.114)*
Law and Government	+			0.315		
				(0.000)		
Inspection	+					0.870
						(0.000)
R^2		38%	47%	50%	50%	47%
Observations		645	777	777	249	777
Auditors' Error		0.78	-166*	1.09	1.17	0.26
Auditors' Error Percentile		85%	93%	95%	96%	63%
Accountants' Error		-0.45	-69*	0.01	0.03	0.29
Accountants' Error Percentile		31%	77%	50%	50%	65%
Bookkeepers' Error		-1.25	92*	0.02	N/A	-1.05
Bookkeepers' Error Percentile		9%	18%	50%	N/A	7%

The sample comes from the O*NET database maintained by the U.S. Department of Labor. The unit of analysis is the occupation. The dependent variable is *standardization* which is a measure of the level of standardization in each occupation. *Difficulty* is a measure of the difficulty or complexity of an occupation's work. *Legal risk financial* is a measure of the extent to which the work of the occupation puts people at risk of financial loss. *Legal risk physical* is a measure of the extent to which the work of the occupation puts people at risk of physical injury. *Professionalization* is a measure of the extent to which an occupation has become professionalized. *Innovation* is a measure of the importance of innovation to the work of the occupation. *Size* is the log of the number of workers in the occupation. *Law and government* is an O*NET question about the importance of knowledge of law and government in a job. *Inspection* is a dummy variable equal to 1 for the 16 occupations in O*NET that inspect the work of others and 0 for all others. Errors are clustered by two-digit SOC code. P-values (in parentheses) are one-tailed for all variables except *difficulty* for which I could not make a directional prediction. Column 1 uses O*NET 4.0 values for *standardization* in place of the O*NET 12.0 values used in model 1. Column 2 is model 1 with all variables except size transformed into ranks. Column 3 is model 1 with the variable *knowledge of law and government* added. Column 4 is model 1 estimated for only the subsample of occupations in O*NET with non-zero values for *state license.* Column 5 is model 1 with the variable *inspection* added.

* In model 2, negative errors result when the model predicts less standardization than is observed. This is because the dependent variable is a rank on *standardization* with higher values of standardization yielding lower ranks (the occupation with the highest level of standardization is ranked 1st).

Table 11
Occupations with the Largest Regression Errors

Panel A: Occupations with Large Positive Errors

Rank	Job Title	Error
1	tax examiners, collectors, and revenue agents	1.72
2	interviewers, except eligibility and loan	1.68
3	medical records and health information technicians	1.65
4	insurance claims clerks	1.65
5	equal opportunity representatives and officers	1.59
6	financial examiners	1.58
7	manufactured building and mobile home installers	1.55
8	traffic technicians	1.55
9	roof bolters, mining	1.51
10	packaging and filling machine operators and tenders	1.50
11	court clerks	1.47
12	brokerage clerks	1.43
13	transportation attendants, except flight attendants and baggage porters	1.43
14	coin, vending, and amusement machine servicers and repairers	1.41
15	tellers	1.41
16	locomotive engineers	1.40
17	environmental compliance inspectors	1.40
18	architectural drafters	1.38
19	airfield operations specialists	1.35
20	construction and building inspectors	1.33
21	licensing examiners and inspectors	1.32
22	human resources assistants, except payroll and timekeeping	1.31
23	civil drafters	1.30
24	aviation inspectors	1.29
25	railroad brake, signal, and switch operators	1.20
26	shuttle car operators	1.20
27	gaming supervisors	1.19
28	slot key persons	1.18
29	fish and game wardens	1.17
30	police identification and records officers	1.16
31	administrative law judges, adjudicators, and hearing officers	1.15
32	upholsterers	1.13
33	fiberglass laminators and fabricators	1.13
34	special education teachers, middle school	1.12
35	technical writers	1.11
36	insurance policy processing clerks	1.11
37	electromechanical equipment assemblers	1.10
38	mechanical drafters	1.10
39	fire-prevention and protection engineers	1.10
40	**auditors**	**1.09**
41	insurance underwriters	1.09
42	environmental engineers	1.09
43	pest control workers	1.09
44	electrical and electronic equipment assemblers	1.08
45	gaming managers	1.08

This table lists the O*NET occupation titles for the occupations with the 50 largest positive regression errors from the regression in table ? column 1.

Table 11 (continued)

Panel B: Occupations with Large Negative Errors

Rank	Job Title	Error
777	historians	-2.57
776	agricultural equipment operators	-2.52
775	computer systems analysts	-2.04
774	pipe fitters and steamfitters	-2.04
773	public relations specialists	-2.02
772	mathematicians	-1.80
771	veterinarians	-1.72
770	choreographers	-1.68
769	cooks, short order	-1.67
768	travel guides	-1.66
767	operations research analysts	-1.66
766	market research analysts	-1.55
765	merchandise displayers and window trimmers	-1.55
764	atmospheric, earth, marine, and space sciences teachers, postsecondary	-1.54
763	public relations managers	-1.54
762	lifeguards, ski patrol, and other recreational protective service workers	-1.46
761	first-line supervisors/managers of non-retail sales workers	-1.44
760	riggers	-1.40
759	sociologists	-1.40
758	family and general practitioners	-1.38
757	sales managers	-1.37
756	locker room, coatroom, and dressing room attendants	-1.36
755	coroners	-1.36
754	music directors	-1.32
753	mobile heavy equipment mechanics, except engines	-1.31
752	anthropologists	-1.29
751	astronomers	-1.28
750	forestry and conservation science teachers, postsecondary	-1.28
749	order clerks	-1.27
748	advertising sales agents	-1.26
747	hoist and winch operators	-1.26
746	travel agents	-1.24
745	furniture finishers	-1.22
744	chemistry teachers, postsecondary	-1.21
743	survey researchers	-1.21
742	wholesale and retail buyers, except farm products	-1.20
741	art directors	-1.20
740	chief executives	-1.19
739	parking lot attendants	-1.17
738	personal and home care aides	-1.16
737	physics teachers, postsecondary	-1.16
736	diagnostic medical sonographers	-1.15
735	veterinary assistants and laboratory animal caretakers	-1.15
734	retail salespersons	-1.14
733	bicycle repairers	-1.13

This table lists the O*NET occupation titles for the occupations with the 50 largest negative regression errors from the regression in table ? column 1.

Appendix 1: Summary Variable Definitions

Name	Description	Source
Standards (importance)	Survey responses to the question, "how important is evaluating information to determine compliance with standards to the performance of your current job?"	O*NET
Standards (level)	Survey responses to the question, "what level of evaluating information to determine compliance with standards is needed to perform your current job?"	O*NET
Analyze Data or Information (level)	Survey responses to the question, "What level of analyzing data or information is needed to perform your current job."	O*NET
Complex Problem Solving (level)	Survey responses to the question, "what level of complex problem solving is needed to perform your current job?"	O*NET
Interpreting the Meaning of Information for Others (importance)	Survey responses to the question, "how important is providing consultation and advice to others to the performance of your current job?"	O*NET
Providing Consultation and Advice to Others (importance)	Survey responses to the question, "how important is providing consultation and advice to others to the performance of your current job?"	O*NET
Make Decisions Solve Problems (level)	Survey responses to the question, "what level of making decisions and solving problems is needed to perform your current job?"	O*NET
Judgment and Decision Making (level)	Survey responses to the question, "what level of judgment and decision making is needed to perform your current job?"	O*NET
Job Zone	A ranking by O*NET's "occupational analysts" of the amount of preparation needed to perform a job.	O*NET
Impact of Decisions on Co-Workers or Company Results	Survey responses to the question, "in your current job, what results do your decisions usually have on other people or the image or reputation or financial resources of your employer?"	O*NET
Consequence of Error	Survey responses to the question, "how serious a mistake can you make on your current job (one you can't easily correct)?"	O*NET
Responsible for Outcomes and Results	Survey responses to the question, "how responsible are you for work outcomes and results of other workers on your current job?"	O*NET
Responsible for Others' Health and Safety	Survey responses to the question, "how responsible are you for the health and safety of other workers on your current job?"	O*NET
Knowledge of Public Safety and Security (importance)	Survey responses to the question, "how important is public safety and security knowledge to the performance of your current job?"	O*NET

Appendix 1: Summary Variable Definitions (continued)

Name	Description	Source
PhysHarm	O*NET surveys ask workers several questions of the form "in your current job, how often are you exposed to (hazard)?" where hazards include very hot or very cold temperatures, extremely bright or inadequate lighting conditions, sounds and noise levels that are distracting and uncomfortable, whole body vibration, hazardous equipment, hazardous conditions, high places, diseases or infection, radiation, and contaminants. PhysHarm is equal to the maximum value across these questions.	O*NET
Integrity	Survey responses to the question, "how important is integrity to the performance of your current job?"	O*NET
Independence	Survey responses to the question, "how important is independence to the performance of your current job?"	O*NET
Freedom to Make Decisions	Survey responses to the question, "in your current job, how much freedom do you have to make decisions without supervision?"	O*NET
State Licenses	State licensing requirements are available from the Career One Stop Licensed Occupations website. To create this variable, I randomly selected five states from a list of all 50 states. The selected states were Arkansas, Kentucky, Texas, Arizona, and Rhode Island. StateLic is equal to the number of these states that require a license for the six-digit SOC code of an occupation. The value of *State License* is therefore integer values between 0 and 5.	Career One Stop Licensed Occupations
Importance of Innovation	Survey responses to the question, "how important is innovation to the performance of your current job?"	O*NET
Occupation Size	*Occupation Size* is an estimate of the total number of workers in an occupation based on a semi-annual survey of 200,000 businesses. The O*NET database divides some six-digit SOC codes into smaller sub-occupations. When this is the case, I assume that workers in the six-digit SOC code are equally distributed across the sub-occupations. For example, if a six-digit SOC occupation has 60 workers in the OES but is divided into three occupations in O*NET, I assume that the O*NET occupations each have 20 workers.	OES

Appendix 1: Summary Variable Definitions (continued)

Name	Description	Source
Age	GSS provides data on occupations as early as 1850. GSS occupations are classified according to the Census Bureau's occupation classification system. *Age* is equal to the number of decades prior to the year 2000 that an occupation is present in the GSS. I convert occupations from historical census classifications to the 2000 census occupational classification system using GSS conversions. I then convert from the 2000 census classification to SOC using a conversion table available from the Census Bureau. *Age* is an integer value between 0 and 15. The O*NET database divides some six-digit SOC codes into smaller units. When this is the case, all subdivisions of a six-digit SOC code take on the value of their source six-digit SOC code.	GSS
Soft Science	Workers responded to the question "How important is knowledge of _____ to the performance of *your current job*?" for therapy and counseling, sociology and anthropology, psychology, philosophy and theology, law and government, history and archeology, art, and education and training. SoftSci is equal to the maximum value across these questions.	O*NET
Level of Competition	Survey responses to the question, "how competitive is your current job?"	O*NET

O*NET is a collection of survey data maintained by the U.S. Department of Labor about the skills, knowledge, work context, work activities, and work styles of occupations. Career One Stop is a website that contains data on state licensing requirements maintained by the U.S. Department of Labor. The Occupational Employment Statistics (OES) is a database of the size and incomes of workers in occupations also maintained by the U.S. Department of Labor. The General Social Survey (GSS) is a database of survey responses from the National Opinion Research Center covering a wide variety of topics related to societal change in the United States. Full variable definitions are available in the "additional information" document which can be downloaded from http://sites.google.com/site/excessivestandardsaddinfo/.