Online Appendix: Occupational Licensing and Accountant Quality: Evidence from the 150-Hour Rule

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This supporting online appendix provides additional descriptions, analysis, and robustness for the main paper. The tables and figures referenced in the online appendix are described in the paper's main text.

1 150-Hour Rule Jurisdiction Adoption List

Jurisdiction	Effective Date	Adoption Rank	Jurisdiction	Effective Date	Adoption Rank
Florida	8/1/83	1	**West Virginia**	2/15/00	27
Tennessee	4/14/93	2	**Guam**	6/1/00	28
Utah	7/1/94	3	**Idaho**	7/1/00	29
Alabama	1/1/95	4	**New Jersey**	7/1/00	30
Mississippi	2/1/95	5	**Washington**	7/1/00	31
Louisiana	12/31/96	6	**Hawaii**	12/31/00	32
Kansas	6/30/97	7	**Alaska**	1/1/01	33
Montana	7/1/97	8	**Illinois**	1/1/01	34
South Carolina	7/1/97	9	**Iowa**	1/1/01	35
Texas	8/31/97	10	**Nevada**	1/1/01	36
Arkansas	1/1/98	11	**North Carolina**	1/1/01	37
Georgia	1/1/98	12	**Wisconsin**	1/1/01	38
Nebraska	1/1/98	13	**Massachusetts**	7/1/02	39
South Dakota	1/1/98	14	**Maine**	5/1/03	40
Missouri	6/30/99	15	**Michigan**	7/1/03	41
Maryland	7/1/99	16	**Oklahoma**	7/1/03	42
Rhode Island	7/1/99	17	**Arizona**	6/30/04	43
Connecticut	1/1/00	18	**New Mexico**	7/1/04	44
Indiana	1/1/00	19	**Minnesota**	6/1/06	45
Kentucky	1/1/00	20	**Virginia**	7/1/06	46
North Dakota	1/1/00	21	**New York**	8/1/09	47
Ohio	1/1/00	22	**Pennsylvania**	1/1/11	48
Oregon	1/1/00	23	**Delaware**	8/1/12	49
Puerto Rico	1/1/00	24	**California**	1/1/14	50
Wyoming	1/1/00	25	**New Hampshire**	7/1/14	51
District of Colombia	1/2/00	26	**Vermont**	7/1/14	52
			Colorado	7/1/15	53

This table reports the year in which the Rule became effective (Effective Date) in each jurisdiction. Additionally, the order of adoption is reported in the Adoption Rank column.

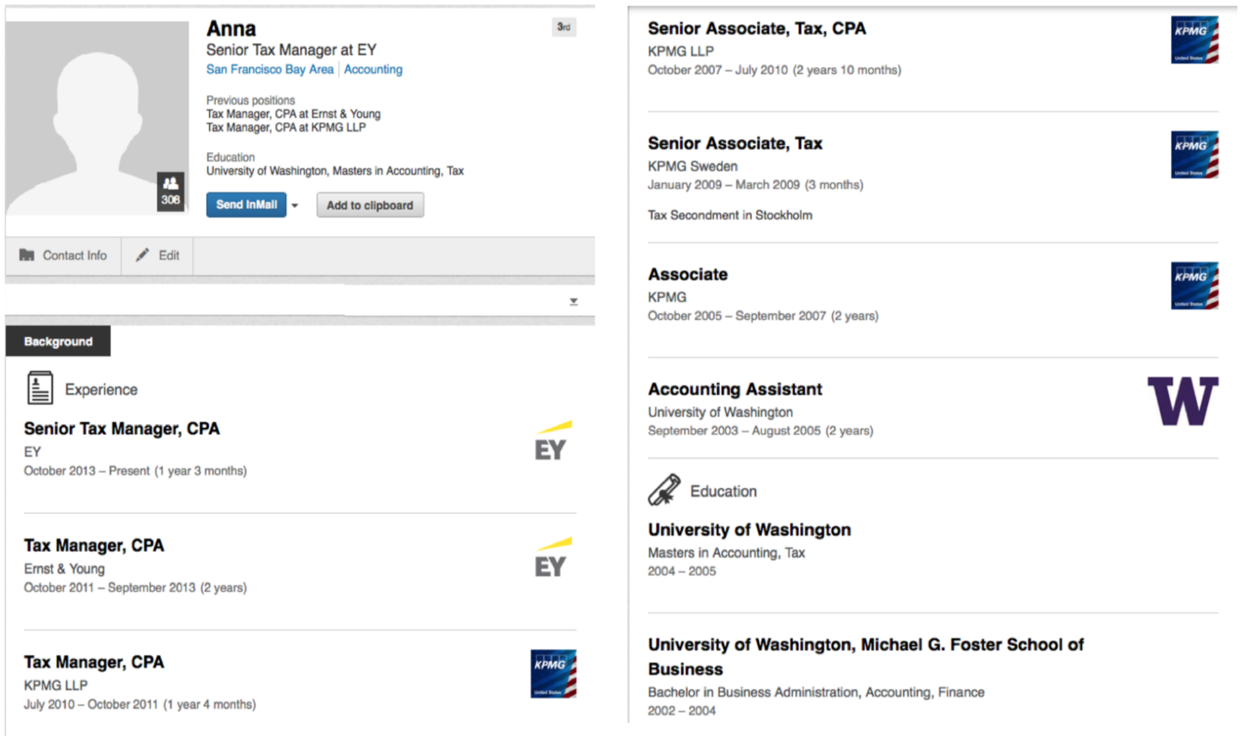
2 Professional Networking Sample States' Descriptives

State	Effective Date	Initial Profiles	Clean Profiles	16-yr. Avg. Num of Accountants	Rank of State	16-yr. Avg. % Contribution of State to U.S. GDP	Rank of State
Florida	8/1/83	2,500	2,264	61,523	4	5.13%	4
Texas	8/31/97	2,500	2,278	77,239	3	7.99%	2
Georgia	1/1/98	2,500	2,285	26,824	12	2.88%	10
Connecticut	1/1/00	2,500	2,292	15,836	23	1.57%	23
Pennsylvania	1/1/00	2,500	2,313	43,044	6	3.93%	6
Illinois	1/1/01	2,500	2,288	46,916	5	4.61%	5
Massachusetts	7/1/02	2,500	2,303	29,146	11	2.63%	13
Michigan	7/1/03	2,500	2,288	30,426	10	2.95%	9
New York	8/1/09	2,500	2,412	86,478	2	7.77%	3
California	1/1/14	2,500	2,338	114,859	1	13.13%	1
Colorado	7/1/15	2,500	2,292	22,872	13	1.74%	21

This appendix provides the adoption dates of the 150-Hour Rule for the eleven selected states. Additionally, descriptive data is provided with regard to the average number of accountants in the state, the state's rank in terms of accountants, the state's 16-year average contribution to national Gross Domestic Product as well as the rank of each state in each of the categories.

3 Example of Data Processing of the Resume

This online appendix displays how the raw profile pages of the professional networking website are converted into machine-readable data. Below is a fictitious example of a raw resume.



The profile contains a section of an individual's career experience as well as an educational section. These sections are parsed to generate two datasets like the ones below. The experience section is processed by giving each job position a unique job id and then extracting the firm name, the position title as well as start and end dates. The educational information is then processed by assigning each degree a unique degree id and then extracting the university name, degree, and start and end dates.

3 (Continued)

Processed (Machine Readable) Data

Job_ID	**Firm**	**Title**	**Start**	**End**
1	KPMG	Associate	Oct-05	Sep-07
2	KPMG Sweden	Senior Associate, Tax	Jan-09	Mar-09
3	KPMG LLP	Senior Associate, Tax, CPA	Oct-07	Jul-10
4	KPMG LLP	Tax Manager, CPA	Jul-10	Oct-11
5	Ernst & Young	Tax Manager, CPA	Oct-11	Sep-13
6	EY	Senior Tax Manager, CPA	Oct-13	.

Degree_ID	**University**	**Degree**	**Start**	**End**
1	University of Washington	Bachelor in Business Administration, Accounting, Finance	2002	2004
2	University of Washington, Michael G. Foster School of Business	Masters in Accounting, Tax	2004	2005

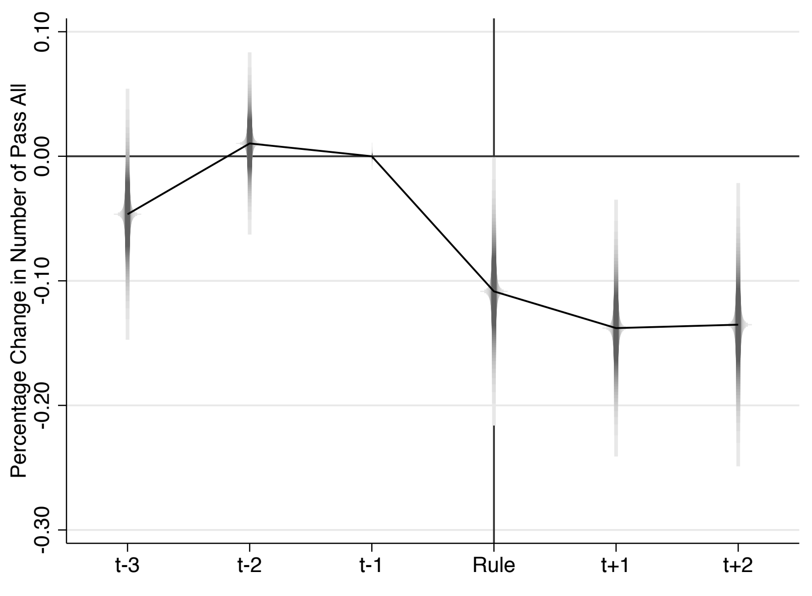
The graduation (in 2004) from her undergraduate degree allows me to define her age at graduation as 22. In the case of matching this individual, I would do it on the year they entered the labor market: 2005.

4 Sample Selection and Screens

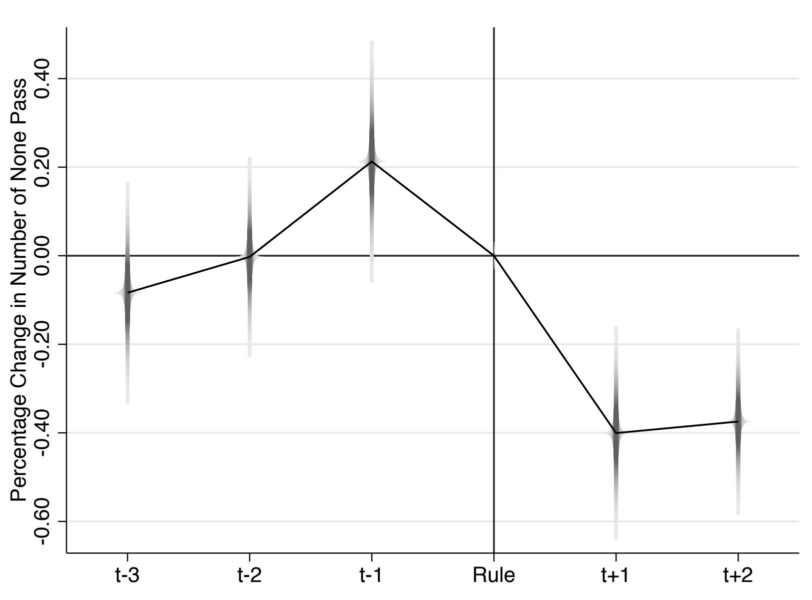
	Initial Sample Downloaded Resumes				Sample with Clean Work Experience				Reports Education			
State	**Non-Rule**	**Rule**	**Total**	**%**	**Non-Rule**	**Rule**	**Total**	**%**	**Non-Rule**	**Rule**	**Total**	**%**
CALIFORNIA	2079	260	2339	9.23%	1506	44	1550	8.81%	1454	44	1498	8.77%
COLORADO	2116	177	2293	9.04%	1655	26	1681	9.56%	1615	26	1641	9.60%
CONNECTICUT	1073	1214	2287	9.02%	858	708	1566	8.90%	833	694	1527	8.94%
FLORIDA	220	2045	2265	8.93%	193	1375	1568	8.91%	183	1318	1501	8.79%
GEORGIA	975	1310	2285	9.01%	811	798	1609	9.15%	791	776	1567	9.17%
ILLINOIS	1161	1128	2289	9.03%	962	633	1595	9.07%	936	624	1560	9.13%
MASSACHUSETTS	1174	1129	2303	9.08%	985	613	1598	9.08%	953	600	1553	9.09%
MICHIGAN	1201	1087	2288	9.02%	987	621	1608	9.14%	948	612	1560	9.13%
NEW YORK	1646	766	2412	9.51%	1348	279	1627	9.25%	1299	274	1573	9.21%
PENNSYLVANIA	1060	1253	2313	9.12%	904	643	1547	8.79%	872	627	1499	8.77%
TEXAS	924	1354	2278	8.99%	804	839	1643	9.34%	783	823	1606	9.40%
Total	13629	11723	25352	100	11013	6579	17592	100	10667	6418	17085	100

This appendix reports the sampling procedure for the sample of CPA resume. It displays how the sample is reduced given the requirements for each individual to report their work experience and educational histories.

5 Trends in the Supply of CPAs



(a) Number of Pass All Over Event Time



(b) Number of Pass None Over Event Time

The figure above graphs the trend of the supply of CPAs over the event-time relative to the Rule. The sample consists of observations at university level from test sittings from the years 1984 to 2004. Figure (a) graphs the trend of high type candidates taking the CPA exam over the event-time relative to the Rule. High type candidates are the first-time test takers who passed all four sections of the exam in a sitting by each university. Figure (b) graphs the trend of low type candidates taking the CPA exam over the event-time relative to the Rule. Low type candidates are the first-time test takers who fail all four sections of the exam in a sitting by each university. The estimates are obtained by regressing the log number of test takers on the event-time indicators by type, with university, year and university-year fixed effects.

6 Labor Market Outcomes and Audit Quality

To complement the theoretical motivation for using labor market outcomes as proxies for individuals' quality, in this appendix I empirically correlate the two labor market measures with several proxies of audit quality. To the extent that they capture the quality of individuals, the labor market proxies should correlate positively with audit quality, as higher quality audit employees should translate into better audits.

I proxy for audit quality using three prominent measures from the auditing literature: Big N audits, (2) absolute discretionary working capital accruals, and (3) the likelihood of an accounting restatement (DeFond and Zhang (2014)). As the audit quality measures are linked to firms, I perform my analysis by aggregating the measures to the state level and comparing them to state level measures of my individual labor market proxies.

The sample to generate the audit quality measures is obtained from the intersection of Compustat industrial and research files and Audit Analytics between the years 1995 and 2015. The sample is restricted to firms with complete data on assets, earnings, cash flow from operations, changes in accounts receivable, and changes in inventory. I further require auditor information to construct BigN audits. The state-level measures are constructed by assigning firms to the state in which the audit firm signing the annual report is located. The use of state-level measures is necessitated as the resume data does not allow for specific identification to firms.

The first measure of audit quality BigN [1] Audits is calculated as the average state percentage of public firm audits conducted by the BigN. The literature views BigN as higher quality and thus to the extent that BigN audits encompass the majority of audits in the state the more than measures of employee quality should be higher. The second audit quality measure is the average Absolute Discretionary accruals, that is calculated as the 20-year average level of absolute discretionary accruals in the state. Thus, to the extent that the labor proxies capture high ability CPAs, we should see lower levels of absolute discretionary accruals. Finally, I use restatements as the third measure of audit quality. I measure restatements as sample period average percentage of firms in the state that have disclosed a material misstatement. If the labor market proxies capture individual quality, then we should expect lower restatements in states with higher quality labor market measures.

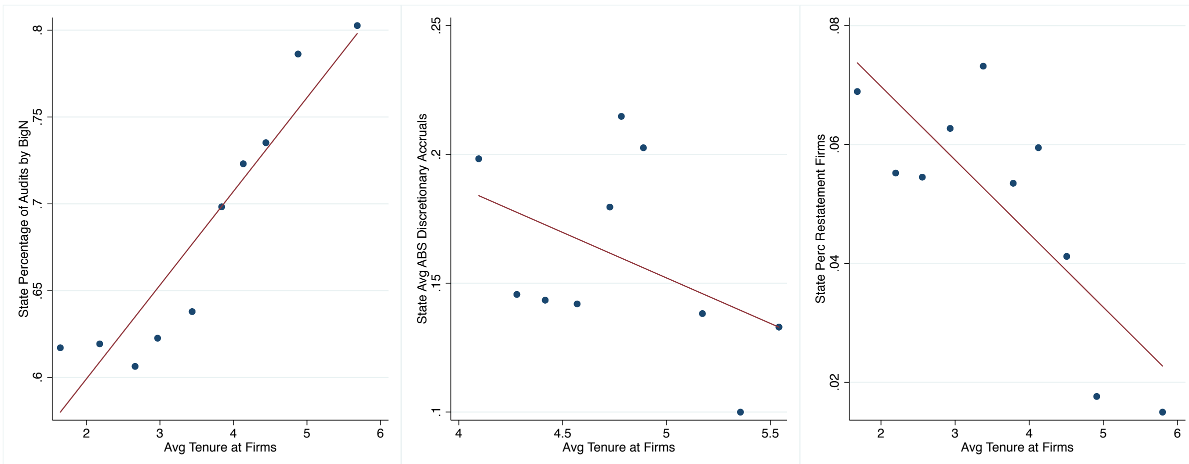
In Appendix Figure 6, I plot the labor market measures, the average tenure at the firm (Panel A) and the average time to promotion (Panel B), against the three audit quality proxies. Panel A shows that states where the average duration of employment at the firms is higher are also the states with a higher proportion of Big N audits, lower levels of absolute discretionary accruals, and lower restatement likelihood. This pattern is consistent with longer tenure at the firms, and thus, lower turnover, leading to better coordination among individuals in conducting audits leading to higher audit quality. In contrast, time to promotion has a negative association with the audit quality measures (i.e., longer times to promotion relate to lower audit quality values). Thus, states with shorter average times to promotion have a higher percentage of Big N audits, lower average levels of absolute discretionary accruals, and a lower percentage of restatements by firms in the state. These

[1] I use BigN as the sample period includes years in which Arthur Anderson was also present thus it captures audits by the Big5 as well as the Big4 after the demise of Arthur Anderson.

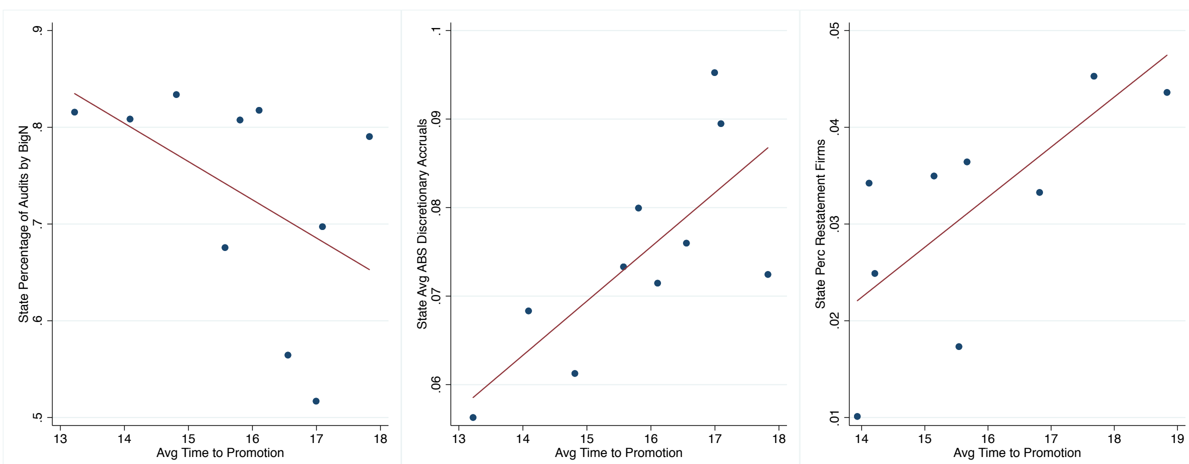
patterns are consistent with shorter times to promotion signaling higher ability individuals and thus better audits. The overall positive association between the labor-market and audit-quality measures suggests that the labor market measures capture some attributes of individual CPA quality and audit quality.

Figure 6: Labor Market Outcomes and Audit Quality

Panel A: Tenure at Firms



Panel B: Time to Promotion



The figure above graphs the relation between the labor market outcome measures and several proxies of audit quality. The labor market measures Tenure at the Firm (Panel A) and Time to Promotion (Panel B) are averaged over the years 1995-2015 of the sample at the state level. The audit quality measures (BigN Audit, Absolute Discretionary Accruals, and Restatements) are constructed using data from Compustat and Audit Analytics. The sample includes firms with financial data to generate discretionary accruals and information on the auditor signing the annual report. The audit quality measures are aggregated up to the state level based on the firm's auditor state; these state-level measures are then averaged over the 20 years of the sample. Thus BigN Audits is the percentage of firms in the state audited by a BigN auditor; average absolute discretionary accruals are the weighted average absolute discretionary accruals of firms in the state averaged over the sample years, and percent restatements is the average percent of firms in the state restating over the sample years.

7 Seniority Classification Scheme

Panel A: List of Titles included in Each Seniority Level

Level-1:Low Seniority	%	Level-2:Low Seniority	%	Level-3:Low Seniority	%
Accountant	10.1	Manager	23.1	Controller	12.8
Associate	5.9	Director	10.5	Vice President	7
Auditor	5	Consultant	6.2	CFO	6.3
Staff	5	Senior Manager	4.1	President	5.7
Accounting Assistant	5	Supervisor	2.1	Partner	2
Staff Accountant	3.6	Treasurer	1.2	Owner	1.7
Tax Associate	1	Principle	1.1	CEO	0.7
Staff Auditor	0.8	Investment Banker	0.3	CAO	0.3
Tax Accountant	0.7	Revenue Agent	0.1	Managing Partner	0.3
Bookkeeper	0.7			Chairman	0.3
Accounting Clerk	0.2			Chief Operation Officer	0.3
				Chief Risk Officier	0.2
				Managing Member	0.1

Panel B: Descriptives

Full Sample					
		Obs	Mean	Median	Std. Deviation
Low Seniority	**Time to Promotion**	7380	4.022	1.000	7.51
	Job Order	7381	2.452	2.000	2.02
Medium Seniority	**Time to Promotion**	45812	9.115	6.417	10.01
	Job Order	45846	3.838	3.000	2.62
High Seniority	**Time to Promotion**	22771	14.888	12.667	13.37
	Job Order	22790	4.756	4.000	2.82

This appendix provides examples of job titles that have been classified as belonging to one of the three seniority groups. High seniority positions contain jobs titles that make reference to top-level corporate officers in corporations or partners in public accounting firms. The medium seniority group contains job titles that refer to middle-management positions as well as senior positions at firms. Finally, the low seniority group contains job titles of entry-level positions at the firm. Panel A provides examples of titles that have been classified into each of the seniority levels. Panel B provides descriptive statistics on the average rank order position of titles in individuals careers as well as the average time spent in each level (for the high seniority it is the time individuals take to get to these positions).

8 Career Outcomes Descriptive Sample Statistics

Panel A: Average Tenure per Position for Matched Sample Based on Age and Gender

	Full Sample		Rule		Non-Rule		Diff in Means
	Obs.	Mean	Obs.	Mean	Obs.	Mean	Rule-Non
1st Position Tenure	15209	4.52	6292	3.74	8917	3.46	0.285
2nd Position Tenure	14686	3.76	5988	2.89	8698	2.86	0.032
3rd Position Tenure	13190	3.43	5194	2.63	7996	2.52	0.110
4th Position Tenure	10935	3.12	4032	2.39	6903	2.29	0.094
5th Position Tenure	8356	2.85	2790	2.15	5566	2.14	0.007

Panel B: Matched Sample – Promotion Times

	Full Sample		Rule		Non-Rule		Diff in Means
	Obs.	Mean	Obs.	Mean	Obs.	Mean	Rule-Non
Low Seniority	2653	5.55	1531	4.41	1122	4.68	-0.276
Medium Seniority	9708	7.54	4099	5.77	5609	5.38	0.397
High Seniority	6676	9.80	1863	8.58	4813	8.37	0.212

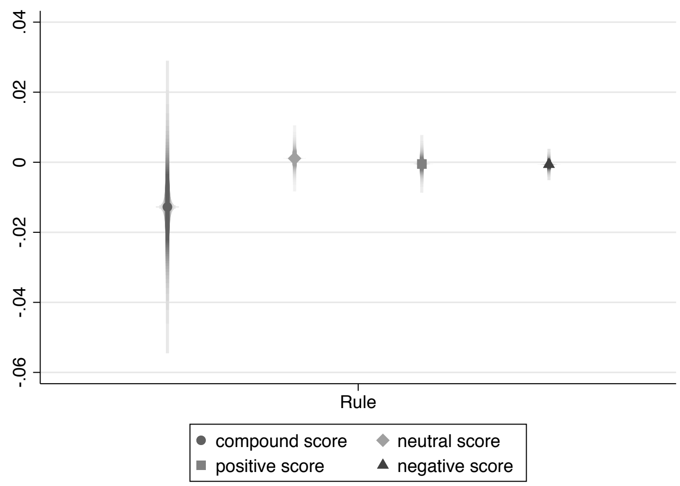
This appendix examines the difference between rule and non-rule individuals along the lines of tenure and time to promotion. It uses a matched sample of Rule individuals matched to non-Rule individuals based on year of graduation and gender from the networking website. Panel A reports the average and median tenures at the first five positions for individuals in the sample for Rule and non-Rule individuals. The last column reports the differences in means between the Rule and the non-Rule groups. Panel B provides the average for time to promotion for low, medium, and high seniority positions for the full sample and the Rule and non-Rule sub-samples. The difference in means between the Rule and non-Rule samples are reported in the final column. The significance of the difference in means in both panels is evaluated parametrically using a student t-test. CEM weights are used for the subsamples of Rule and non-Rule group and student t-test. Significance levels are indicated by: * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$.

9 CPA Sample: Writing Length and Complexity Descriptives

	Full Sample				Non-Rule				Rule			
	Count	Mean	Median	Std. Dev	Count	Mean	Median	Std. Dev	Count	Mean	Median	Std. Dev
Job Has Description	44086	0.81	1.00	0.39	31083	0.84	1.00	0.37	13003	0.74	1.00	0.44
Individual Has Majority Description	8340	0.57	1.00	0.49	5260	0.61	1.00	0.49	3080	0.51	1.00	0.50
Words Per Sentence	24132	35.44	24.00	32.44	17759	34.07	23.00	31.50	6373	39.25	27.00	34.64
Number of Sentence	24132	2.87	2.00	2.51	17759	2.97	2.00	2.56	6373	2.59	2.00	2.35
Num Words	24132	76.27	58.00	58.13	17759	76.94	58.00	59.16	6373	74.39	58.00	55.15
Fog	24132	24.89	21.17	13.21	17759	24.40	20.69	12.82	6373	26.24	22.22	14.14
Flesch	24132	13.63	7.52	16.27	17759	13.92	8.21	16.20	6373	12.84	4.48	16.43

This table reports the descriptive statistics on the writing length and complexity of job descriptions for the sample of CPAs drawn from the professional networking website. Words Per Sentence is the number of words in each sentences in an individual's job description. Number of sentences is the number of sentences in each job description. Fog is the Fog index that measures how easy or difficult a text is to read. Flesch is the Flesch reading ease measure. Compound score is the weighted score for the tone of the job description. Job Has Description is an indicator for a job having descriptions. Individual Has Majority Description is an indicator that equals to one if an individual's majority of jobs have descriptions.

10 The Rule's Effect on the Tone of Writing



The figure above graphs the Rule's effect on the tone of writing. The sample consists of job descriptions in the profile for the sample of CPAs from the networking website. The estimates are obtained by regressing the tone score on the Rule, Male, Total Jobs, Big N First, with state and cohort fixed effects. Standard errors are clustered by individuals.

11 Variable Definitions

Variable	Definition
	Supply Test
Number of Candidate	The number of candidates
Passed All	The number of first-time test takers who passed all four sections of the exam in a sitting
Passed None	The number of first-time test takers who fail all four sections of the exam in a sitting
Rule	An indicator variable set to one in state years in which the Rule is in effect and zero otherwise
Year before Adoption	An indicator variable equal to one in the year before the Rule is implemented and zero otherwise
May Sitting	An indicator variable set to one if the sitting is in May and zero otherwise
	Career Outcome
Number of Jobs	A count of the number of jobs that the individuals have held in their career, as reported in their profile
Big N	An indicator variable set to one if the individual has worked at an international accounting firm such as Deloitte, PWC, E&Y, KPMG, or Arthur Andersen
Years per Job	The length of time spent at each position for each individual
Tax	An indicator variable set to one if the individual has worked in the area of tax as designated by his position or firm
Years Graduated	The year in which the individual received his degree before entering the labor market
Number of Degrees	The total number of degrees above the high school degree that the individual reports
Master's Degree	An indicator variable set to one if the individual reports any postgraduate degree
Non-Accounting Master's	An indicator variable set to one if the individual reports a non-accounting-specific master's such as an MBA
Accounting Master's	An indicator variable set to one if the individual reports an accounting specific master's such as MACC or MST
Number of Positions	A count of the number of positions that the individuals have held in their career, as reported in their profile
Log Avg Tenure	Logarithm of an individual's average tenure at the various firms they have worked in
Log Firms	Logarithm of the number of unique firms an individual has worked in during their career
Num Firms	The number of unique firms an individual has worked in during their career
Exit Pub ACC	An indicator variable set to one if an individual leaves public accounting.
Time to Exit Pub ACC	The number of years till an individual exits public accounting

	Career Outcome (Continued)
Higher Seniority Post ACC	An indicator set to one if an individual gets a higher seniority position after exiting public accounting
Master's Degree	An indicator for an individual having a master's degree
Masters $\times$ Rule	An indicator variable that is one for Rule CPAs who have a master's degree
Level-2 Seniority Promotions	The number of year to promotion to level-two seniority
Level-3 Seniority Promotions	The number of years to promotion to level-three seniority positions
Seniority at the Last Public Accounting Position	The level of seniority at the last public accounting position before exiting public accounting
Post Public Accounting Seniority	The level of seniority at the new position after exiting public accounting
	Writing
Log Words Per Sentence	The log number of words in each sentence of an individual's job description
Log Num of Sentences	The log number of sentences in an individual's job description
Fog	Fog is the Fog Index calculated as (words per sentence + percent of complex words) * 0.4
Flesch	The Flesch reading ease score the ease of readability in a document. It is calculated as 206.835 - (1.015 * words per sentence) - (84.6 * syllables per word). The higher the Flesch Reading Ease, the easier is the text