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Article

How does human capital in the public sector affect tax uncertainty?

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Abstract: This paper provides new evidence on human resources management within the public sector. We explore the impact and mechanisms of the education and skills of tax inspectors on tax uncertainty using data from A-share-listed companies from 2009 to 2016. Our findings show that tax uncertainty is negatively correlated with the increase in human capital in the tax inspection bureau. That is, tax inspectors with higher levels of education and those who are certified tax agents help reduce tax uncertainty. Further analysis demonstrates that the impact of tax inspectors on tax uncertainty is most pronounced within large-scale and long-established firms.

Keywords: human capital; tax uncertainty; corporate governance; tax inspectors

1. Introduction

Human resources management has long been a significant issue in the field of economics. Prior literature, however, focuses on human resources management in firms. It is unclear how human resources management within the public sector works. Public officials serve as the linchpins in the execution of governmental functions and the delivery of public services. Their competencies and efficiency profoundly impact the quality of governance, transparency, and public trust in institutions (Rogger et al., 2023). Given the importance of public officials in government governance, the public sector is increasingly prioritizing the enhancement of human capital among its officials, aiming to improve the quality and effectiveness of government administration. Competent public servants ensure the effective implementation of policies, uphold the rule of law, and safeguard the interests of citizens. Conversely, deficiencies in human capital, such as inadequate skills, can lead to governance failures and the erosion of public confidence in government institutions. In this paper, we exploit a relatively special setting—the tax inspection bureau in China—to provide new evidence on the governance effect of human capital within the public sector.

The tax inspection bureau in China presents an opportunity for us to examine the impact of the education and skills of tax inspectors on tax uncertainty. The government places significant emphasis on recognizing and harnessing the governance role of human capital within the public sector. It underscores the importance of public officials acquiring the requisite skills and competencies to navigate the complexities of governance in a rapidly evolving landscape. One area that has received particular attention is the tax authorities, given their critical role in revenue generation and fiscal management. As a frontline agency tasked with serving taxpayers and upholding tax compliance, the tax authorities operate within a dynamic environment characterized by evolving regulations and diverse stakeholder needs. Consequently, there is a heightened emphasis on enhancing the professional skills and expertise of tax officials.

Tax bureaus are placing greater focus on recruiting individuals with higher education levels, providing them with training, and offering incentives for them to pursue professional certifications, such as certified tax agent credentials. Moreover, these certifications are increasingly tied to salary increments and career advancements within the bureaus.

Tax uncertainty, a pervasive concern in the realm of corporate tax strategy, has garnered increasing attention in recent years. Prior literature has studied the relationship between tax uncertainty and corporate tax avoidance and explored the impact of tax uncertainty (Guenther et al., 2018; Hanlon et al., 2017; Jacob et al., 2022). At its essence, tax uncertainty refers to the ambiguity and unpredictability surrounding various aspects of tax laws, regulations, interpretations, and enforcement practices, which may affect corporate activities. Firms always hold more cash and delay large capital investments in the face of tax uncertainty (Hanlon et al., 2017; Jacob et al., 2022). The enforcement capabilities of tax inspectors in the tax inspection bureau play a pivotal role in shaping tax uncertainty. On one hand, when tax inspectors possess the necessary expertise and proficiency in tax laws and regulations, they are better equipped to identify potential instances of non-compliance and enforce tax obligations rigorously. If this is the case, tax inspectors can effectively dissuade enterprises from engaging in tax avoidance. We adopt a broad definition of tax avoidance as the entire continuum of all the tax-planning activities to reduce firms' explicit tax burden. "Tax avoidance" is used as a neutral term in this paper) practices that reduce the likelihood of tax uncertainty stemming from ambiguous tax positions or contentious tax practices (Guenther et al., 2019). On the other hand, elevating the professional skills of tax inspectors can enhance the quality of tax services provided. Timely and accurate tax inspection, clear and transparent communication of tax obligations, and efficient resolution of tax inquiries and disputes contribute to a more predictable tax environment for businesses. Conversely, inadequately trained or inexperienced tax inspectors may struggle to navigate the complexities of tax laws and regulations effectively. This can result in inconsistent application of tax rules, erroneous tax assessments, and delayed resolution of tax disputes, all of which contribute to heightened tax uncertainty.

Using the data from Chinese listed firms from 2008 to 2016, we examine how tax inspectors affect tax uncertainty. Our findings revealed that for every one percentage point increase in the ratio of personnel with graduate degrees or higher in the tax inspection bureau, firms experienced a significant reduction in tax uncertainty of approximately 1.52 percentage points. A mere 1 percentage point increase in the proportion of staff holding CAT credentials corresponded to a 1.58 percentage point decrease in tax uncertainty for enterprises. Further analysis demonstrates that the impact of tax inspectors on tax uncertainty is most pronounced within large-scale and long-established firms. Their complex organizational structures and extensive resources often afford them opportunities to exploit loopholes in tax regulations, leading to increased tax uncertainty. However, the introduction of highly skilled tax personnel disrupts this trend by mitigating the inclination towards tax avoidance. In addition, the enhancement of human capital within the tax inspection bureau contributes to a more standardized tax audit process. This standardization reduces

uncertainty surrounding firms' tax obligations, fostering a more predictable tax environment.

We make two contributions. First, we advance the tax literature on the governance effects of tax inspectors on corporate activities. By shedding light on the phenomenon of "certificate craze" (the "certificate craze" in China refers to a phenomenon where there has been a surge in the pursuit of professional certifications) within Chinese tax authorities, our findings enhance our understanding of tax governance, particularly from the micro-perspective of law enforcement officials. Secondly, we extend the literature on tax uncertainty. While previous studies have examined the impact of tax policy and corporate tax avoidance on tax uncertainty, little attention has been given to the role of tax law enforcement personnel. Our findings bridge this gap by demonstrating the significance of tax agency staff in influencing tax uncertainty.

2. Research design

Data and methodology

We include all Chinese A-share firms from 2009 to 2016 as our samples. We obtain the firms and their financial data from the Chinese Stock Market and Accounting Research (CSMAR) database and the WIND database. Then, we delete firms that belong to the financial industry and have missing variables. The sample includes 13,459 firms in the A-share market during the sample period.

There are two main measurement methods for assessing tax uncertainty in the previous literature: Uncertain Tax Positions (UTP) reserve (Guenther et al., 2019) and the coefficient of variation of annual Effective Tax Rates (ETRs) (McGuire et al., 2019) over a period. Because the data sample of Chinese listed companies does not disclose Uncertain Tax Positions (UTP) reserves, this paper uses the latter to construct a tax uncertainty index. We measure the tax uncertainty of a firm's tax strategy using the coefficient of variation of annual cash ETRs over a five-year period, which measures the variability in the outcomes of a firm's tax avoidance strategy over time. Consistent with prior research, we define the cash ETR as cash taxes paid divided by pre-tax book income (adjusted for special items) (Dyreng et al., 2008, 2010). We measure the coefficient of variation for annual cash ETRs over a five-year period, which includes the current year's cash ETR and the cash ETRs for the four previous years (i.e., over the period t to $t-4$). The coefficient of variation for cash ETRs (Uncertain) is determined by dividing the standard deviation of annual cash ETRs by the absolute value of the mean of annual cash ETRs over the same five-year period.

$$\text{Uncertain}_{it} = \frac{\sqrt{\sum_{t=1}^{N}(\text{Cash ETR}_{it} - \text{Avg. Cash ETR}_{i})^2]/N}}{abs(\frac{1}{N}(\sum_{t=1}^{N}\text{Cash ETR}_{it}))}$$

We define a company's tax uncertainty as lower when it demonstrates a low coefficient of variation for annual cash ETRs (i.e., a low value of uncertainty) over a five-year period. In our robustness checks, we also employ alternative measures of tax uncertainty, i.e., the coefficient of variation for the annual GAAP effective tax rate for the five-year period.

To construct human capital within tax inspection bureau measures, we obtain data on tax inspectors from the China Taxation Auditing Yearbook, which provides information related to tax administration and enforcement activities carried out by the tax inspection department across various regions of China. It also provides information on tax inspectors, including their academic backgrounds and professional qualifications. We measure human capital within the provincial tax inspection bureau using two ratios: the proportion of personnel with graduate degrees or higher (Graduate) and the proportion of certified tax agents (CTA) among the total workforce in the tax inspection bureau.

Additionally, we carefully consider various firm-specific characteristics that might influence tax uncertainty. These include firm size (the natural logarithm of total assets), leverage (total debt divided by total assets), asset tangibility (fixed assets divided by total assets), and Big4 (=1 if the audit firm is either Deloitte, EY, KPMG, or PwC). We further include an extensive set of area-specific characteristics as control variables. We control for secondshare (GDP share of secondary industry), tertiaryshare (GDP share of tertiary industry), and budget deficit (ratio of general budget expenditure to general budget revenue minus 1) for each province. We summarize all continuous variables at the 1% and 99% levels.

Essentially, we estimate the following regression analysis:

$$\text{Uncertain}_{it} = \alpha + \beta_1(\text{human capital})_{pt} + \text{Controls} + \text{Year Dummies} + \text{firm Dummies} + \varepsilon_{it} \quad (1)$$

The subscripts *i*, *p* and *t* represent firm, province and year, respectively. We include fixed effects for year and firm to control the time and firm factors affecting tax uncertainty.

We execute a range of empirical strategies to enhance robustness. Specifically, we conduct a regression analysis incorporating industry and province-specific fixed effects.

3. Results and discussions

3.1. Summary statistics

Table 1 shows the descriptive statistics of the variables. The mean and standard deviation of uncertain are 71.6% and 51.1%, respectively, suggesting that tax uncertainty, on average, is large with considerable variation.

We present the baseline results of Equation (1) in **Table 2**. Besides the full model, we also include simplified models without control variables and without area-specific characteristic control variables. In addition, we include industry-year and province-year fixed effects, and, following Petersen (2009), we cluster standard errors at the firm levels. For the first five models (columns 1–5), the independent variable is graduate, while in subsequent models (columns 6–10), it is CTA. Notably, in column 3 of **Table 2**, the coefficient of graduate is negative and statistically significant at the 1 percent level, indicating that tax inspectors with graduate degrees or higher in the tax inspection bureau reduce firm tax uncertainty. Similarly, in column 8, the coefficient of CTA is also negative and statistically significant at the 1 percent level. This implies that as the proportion of tax inspectors with certifications increases, tax uncertainty is reduced. We find that, on average, for each additional percentage point

increase in the ratio of personnel with graduate degrees or higher in the tax inspection bureau, firms experience a significant reduction in tax uncertainty, by approximately 1.52%. Similarly, a mere 1% increase in the proportion of staff holding CAT credentials corresponds to a 1.58% decrease in tax uncertainty for enterprises. Turning to the firm-level control variables, we find that Leverage and Assettangibility are positively and significantly associated with tax uncertainty, while Firmsize is negatively and significantly related to tax uncertainty. The results also indicate that the coefficients on Big4, Secondshare, Tertiaryshare and Budgetdeficit are all insignificant.

Table 1. Summary statistics.

Var name	Mean	SD	1th	Median	99th
Uncertain	0.716	0.511	0.017	0.613	2.449
Graduate	0.046	0.025	0.004	0.039	0.121
CTA	0.064	0.037	0.011	0.050	0.167
Firmsize	21.939	1.234	18.861	21.758	25.966
Leverage	0.421	0.209	0.028	0.418	0.863
Assettangibility	0.221	0.166	0.002	0.185	0.765
Big4	0.060	0.238	0.000	0.000	1.000
Secondshare	0.446	0.092	0.178	0.474	0.620
Tertiaryshare	0.481	0.117	0.298	0.453	0.816
Budgetdeficit	0.634	0.624	0.066	0.252	3.349

Table 2. The effect of tax inspectors on tax uncertainty.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Uncertain	**Uncertain**	**Uncertain**	**Uncertain**	**Uncertain**	**Uncertain**	**Uncertain**	**Uncertain**	**Uncertain**	**Uncertain**
Graduate	−1.5405***	−1.5295***	−1.5223***	−1.3929***	−1.3608***					
	(0.4995)	(0.4894)	(0.5018)	(0.5129)	(0.4944)					
CTA						−1.4791***	−1.5219***	−1.5819***	−1.5265***	−1.3053**
						(0.5114)	(0.5029)	(0.5062)	(0.5364)	(0.5066)
Firmsize		−0.0640***	−0.0629***	−0.0565***	−0.0714***		−0.0663***	−0.0644***	−0.0580***	−0.0725***
		(0.0180)	(0.0179)	(0.0176)	(0.0170)		(0.0182)	(0.0181)	(0.0176)	(0.0171)
Leverage		0.4121***	0.4114***	0.3942***	0.3814***		0.4131***	0.4108***	0.3967***	0.3817***
		(0.0559)	(0.0561)	(0.0528)	(0.0549)		(0.0558)	(0.0561)	(0.0530)	(0.0550)
Assettangibility		0.4197***	0.4200***	0.4654***	0.3995***		0.4184***	0.4197***	0.4656***	0.3993***
		(0.0583)	(0.0584)	(0.0567)	(0.0574)		(0.0584)	(0.0585)	(0.0568)	(0.0575)
Big4		0.0075	0.0070	0.0154	0.0231		0.0089	0.0073	0.0156	0.0230
		(0.0504)	(0.0503)	(0.0510)	(0.0505)		(0.0506)	(0.0504)	(0.0509)	(0.0506)
Secondshare			−0.8075	−0.6007	−0.8510			−0.9754	−0.7130	−0.9848
			(0.8430)	(0.8551)	(0.8342)			(0.8416)	(0.8586)	(0.8329)
Tertiaryshare			−0.8059	−0.4385	−0.6969			−0.8023	−0.3338	−0.6852
			(0.8203)	(0.8293)	(0.8104)			(0.8204)	(0.8308)	(0.8111)
Budgetdeficit			−0.0235	0.0218	−0.0206			−0.0151	0.0298	−0.0121
			(0.0459)	(0.0394)	(0.0431)			(0.0451)	(0.0385)	(0.0423)

Table 2. (*Continued*).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Uncertain	**Uncertain**	**Uncertain**	**Uncertain**	**Uncertain**	**Uncertain**	**Uncertain**	**Uncertain**	**Uncertain**	**Uncertain**
Constant	0.7858***	1.9239***	2.6604***	2.2143**	2.8212***	0.8101***	2.0002***	2.7940***	2.2731**	2.9165***
	(0.0228)	(0.3888)	(0.8868)	(0.8850)	(0.8615)	(0.0327)	(0.3966)	(0.8918)	(0.8930)	(0.8648)
Observations	13459	13459	13459	13442	13455	13459	13459	13459	13442	13455
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province-industry FE	No	No	No	Yes	No	No	No	No	Yes	No
Industry-year FE	No	No	No	No	Yes	No	No	No	No	Yes
r2_a	0.7377	0.7458	0.7459	0.7545	0.7536	0.7377	0.7459	0.7460	0.7546	0.7537

3.2. Robustness checks

We define Guncertain as the coefficient of variation for the annual GAAP effective tax rate for the five-year period. In **Table 3**, we examine the robustness of our main evidence using alternative measures of tax uncertainty. The results in columns 1 and 2 of **Table 3** show that the coefficients of Guncertain and CTA continue to be negative and significant at the 5% level. Hence, the baseline findings in **Table 2** are robust to alternative metrics of tax uncertainty.

Table 3. The effect of tax inspectors on tax uncertainty using alternative measures.

	(1)	(2)
	Guncertain	**Guncertain**
Graduate	−1.1187**	
	(0.5222)	
CTA		−1.0469**
		(0.4927)
Firmsize	−0.0541***	−0.0551***
	(0.0182)	(0.0183)
Leverage	0.4411***	0.4407***
	(0.0556)	(0.0556)
Assettangibility	0.4244***	0.4241***
	(0.0579)	(0.0579)
Big4	0.0199	0.0199
	(0.0482)	(0.0484)
Secondshare	−0.3548	−0.4656
	(0.7310)	(0.7293)
Tertiaryshare	−0.3271	−0.3192
	(0.7147)	(0.7146)
Budgetdeficit	−0.0087	−0.0013
	(0.0447)	(0.0438)

Table 3. (*Continued*).

	(1)	(2)
	Guncertain	**Guncertain**
Constant	1.8504**	1.9295**
	(0.8043)	(0.8072)
Observations	13459	13459
Firm FE	Yes	Yes
Year FE	Yes	Yes
Adj. R^2	0.7461	0.7461

3.3. Heterogeneous analysis

We argue that the reduction of corporate tax avoidance due to the growth of human capital in the tax inspection bureau reduces tax uncertainty. The enhancement of human capital in the Tax Inspection Bureau has optimized and standardized the tax process and intensified the governance effect on tax uncertainty. If the logic is valid, we expect the impact of human capital on tax uncertainty to be more significant in companies with tax avoidance tendencies and complex businesses.

To examine this logic, we divide enterprises into large enterprises and small enterprises according to the median of their total assets (large = 1 if the firm is large). The results are reported in **Table 4**. The coefficients on Large are significantly negative. This suggests that in large enterprises, the effect of human capital in the tax inspection bureau on tax uncertainty is more pronounced. We also classify companies into old companies and new companies based on the median age of establishment (Old = 1 if the firm is old). The coefficients on Old × Graduate and Old × CTA are negative and significant. This indicates that for firms that have been established for a longer period of time, human capital in the tax inspection bureau results in a greater reduction in tax uncertainty. Overall, the findings in **Table 4** support the logic of the testable hypothesis.

Table 4. Heterogeneous analysis.

	(1)	(2)	(3)	(4)
	Uncertain	**Uncertain**	**Uncertain**	**Uncertain**
Graduate	−0.1375		0.4790	
	(0.5703)		(0.6465)	
CTA		−0.6483		0.1856
		(0.5378)		(0.5995)
Large × Graduate	−2.1975***			
	(0.5240)			
Large × CTA		−1.3569***		
		(0.3669)		
Old × Graduate			−3.7545***	
			(0.7612)	
Old × CTA				−2.9445***
				(0.6755)

Table 4. (*Continued*).

	(1)	(2)	(3)	(4)
	Uncertain	**Uncertain**	**Uncertain**	**Uncertain**
Large	0.1302***	0.1225***		
	(0.0298)	(0.0298)		
Old			0.0909**	0.1091**
			(0.0454)	(0.0554)
Firmsize	−0.0720***	−0.0749***	−0.0651***	−0.0645***
	(0.0192)	(0.0192)	(0.0180)	(0.0182)
leverage	0.4097***	0.4124***	0.3946***	0.3974***
	(0.0559)	(0.0556)	(0.0561)	(0.0560)
Assettangibility	0.4155***	0.4177***	0.4131***	0.4109***
	(0.0580)	(0.0581)	(0.0581)	(0.0584)
Big4	0.0122	0.0115	0.0152	0.0179
	(0.0507)	(0.0506)	(0.0496)	(0.0499)
Secondshare	−0.9608	−1.0729	−0.9519	−1.0535
	(0.8453)	(0.8396)	(0.8387)	(0.8409)
Tertiaryshare	−0.9433	−0.8741	−0.8534	−0.7886
	(0.8261)	(0.8198)	(0.8136)	(0.8184)
Budgetdeficit	−0.0289	−0.0173	−0.0281	−0.0151
	(0.0467)	(0.0455)	(0.0462)	(0.0447)
Constant	2.9229***	3.0253***	2.7563***	2.7535***
	(0.9056)	(0.9038)	(0.8824)	(0.8912)
Observations	13459	13459	13458	13458
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adj. R^2	0.7471	0.7469	0.7480	0.7475

4. Conclusions

In the past few decades, there has been a notable trend within Chinese tax authorities towards certification, with a growing number of tax officers actively pursuing professional skills certificates. This pursuit is incentivized by the tax authorities through bonuses offered to certified professionals. Based on this ideal context, we investigate the governance effects of human capital in the public sector. Our findings show that tax uncertainty is negatively correlated with the increase in human capital in the tax inspection bureau. Having more professional and proficient tax officers in the tax inspection bureau reduces firms' tax aggressiveness, subsequently diminishing tax uncertainty. Moreover, these skilled officers optimize and standardize the tax process, further lowering tax uncertainty. Through heterogeneity analysis, we have validated this logic. Our research refutes doubts about the phenomenon of tax authorities' "certificate craze". Far from being a frivolous pursuit, our findings demonstrate that such efforts yield tangible benefits, not only in terms of tax governance but also in mitigating tax uncertainty for enterprises. As we

navigate the complexities of modern taxation systems, the importance of investing in human capital within the public sector cannot be overstated, and our research serves as a testament to its enduring value.

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