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THE DARK SIDE OF STRENGTHENING TAX ENFORCEMENT

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Abstract. Using the staggered adoption of China's province-level Tax Administration Information System (TAIS) as an exogenous shock, we show that firms compromise employee workplace safety in response to strengthened tax enforcement driven by advances in tax collection technology. This effect is more pronounced in firms with significant prior tax avoidance, those under greater earnings pressure, and those where employees have limited bargaining power. Further analyses reveal that firms reduce employee workplace safety by cutting safety-related investments and increasing employee workloads. Collectively, our study highlights an unintended consequence of intensified tax enforcement on workplace safety.

Keywords: tax collection technology, tax enforcement, tax burden, workplace safety, employee welfare, developing countries.

JEL Classification: G38, H22, H23, J28.

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1. Introduction

Paying corporate taxes is not only a social responsibility but also a substantial expenditure for a firm. Previous studies suggest that an excessive tax burden has adverse impacts on a firm in terms of shareholder wealth (Dharmapala et al., 2011), financial constraints (Dharmapala et al., 2011), investment efficiency (Amberger et al., 2021), and corporate innovation (Mukherjee et al., 2017). To ameliorate these adverse impacts, firms engage in tax avoidance or shift the tax burden to others. For instance, they may transfer taxable income to subsidiaries in low-tax jurisdictions (Klassen & Shackelford, 1998) or relocate their establishments to regions with lower tax rates (Suárez Serrato & Zidar, 2016). Some firms may even resort to illegal tax evasion (Fisman & Wei, 2004). However, the literature assumes that shareholders bear the tax burden exclusively, without exploring the possibility of shifting the tax burden from shareholders onto (ordinary) employees.

The purpose of our study is to examine the impact of excessive tax burden on a firm's decision to shift tax burden onto employees through the lens of tax enforcement effectiveness and employee workplace safety. Conceptually, while shareholders, managers, and employees are crucial stakeholders of a firm, employees are in the most disadvantaged position in terms of their bargaining power. Therefore, a firm has incentives to shift its tax burden by lowering employee welfare and benefits. This argument echoes studies by Ljungqvist and

Smolyansky (2018), Suárez Serrato and Zidar (2016), and Fuest et al. (2018), who document that when governments raise corporate income tax rates, firms may shift the tax burden onto employees by reducing wages. While wages represent an explicit indicator of employee welfare, employee benefits also include implicit benefits in terms of employee workplace safety. Bradley et al. (2023) show that corporate income tax rate increases across states in the US lead to more employee injuries. However, there is little evidence on whether tax enforcement effectiveness impacts the distribution of the tax burden between firms (shareholders) and labor (employees).

Our study is motivated by the fact that the tax collection effectiveness in emerging markets is substantially lower than their counterparts in developed markets (Besley & Persson, 2014), leading to severe losses in government revenue (Besley & Persson, 2013)[1]. Therefore, in emerging markets, tax enforcement effectiveness is more critical than tax rate changes in affecting corporate tax burden (Basri et al., 2021)[2]. Moreover, studies examining tax rate changes often focus on a single specific tax. For instance, Bradley et al. (2023) consider how corporate income tax rate increases impact employee workplace safety but do not examine the potential influences from other taxes. Whereas our study explores the impact of advancements in tax collection technological infrastructure aiming at all taxes, not just corporate income tax, on employee workplace safety, providing a more comprehensive scope.

We conduct our analysis using a sample of Chinese firms for two reasons. First, China began adopting the province-level Tax Administration Information System (TAIS) in stages since 2013[3]. The TAIS applies novel technologies (e.g., big data and cloud computing) to enhance tax enforcement, significantly reducing corporate tax avoidance and elevating the effective tax rate for all the taxes paid by firms. As a result of the TAIS, shareholders may experience a substantial decline in wealth. The exogenous shock enables us to identify the increase in tax enforcement effectiveness, allowing for analysis with minimal endogeneity concerns. Second, labor rights protection in China is weak (Fan et al., 2020; Fisman & Wang, 2015). Weak labor protections create opportunities for shareholders to strategically respond to the TAIS by shifting the tax cost to employees.

On the one hand, the TAIS reduces corporate tax avoidance, effectively increasing the corporate general tax burden. For the benefit of shareholders, firms may strategically respond to offset the increased tax cost by reducing employee workplace safety investments or increasing employee workloads, resulting in a heightened risk of employee injuries. On the other hand, firms may bear the tax burden without shifting it to employees post-TAIS. Given that workplace injury incidents can tarnish a firm's reputation, increase regulatory oversight,

[1] On average, developing countries collect much less tax revenue (10%–15% of GDP) than developed countries (30%–40% of GDP) International Growth Centre (n.d.).

[2] The fiscal system in the U.S. is decentralized, under which state governments possess autonomy to set tax codes, change tax rates, and collect taxes. Many countries, especially developing countries, like China and Indonesia, pursue fiscal centralization, under which subnational local governments have no legislative rights to set tax rates and tax bases, except for the rights to enforce taxes (Jia et al., 2020). Tax information is central to tax enforcement effectiveness (Pomeranz, 2015). However, the technology for acquiring and processing tax information in developing countries is inadequate, leading to poor tax collection efficiency (Okunogbe & Pouliquen, 2022). Therefore, we contend that examining the effect of intensified tax enforcement, introduced by improvements in information technology, on employee welfare is of greater importance in emerging markets.

[3] TAIS represents the third stage of the China Tax Administration Information System, which is a nationally unified information system implemented since 2013. We detail TAIS in Section 2.2.1.

and incur penalties, firms may maintain employee workplace safety investments post-TAIS to prevent such incidents. Furthermore, since workplace safety investments are tax-deductible, firms may increase safety investments post-TAIS, mitigating the risk of employee injuries. Therefore, we exploit the implementation of TAIS as a quasi-natural experiment, adopting a staggered difference-in-differences (DID) approach to examine the impact of intensified tax enforcement on employee workplace safety.

Using data from Chinese listed firms in industries with severe workplace safety hazards from 2010 to 2017, we find that the TAIS significantly raises the likelihood of safety incidents in firms. In terms of economic significance, post-TAIS raises the probability of employee workplace safety incidents by 5.54% relative to pre-TAIS. The result indicates that employees bear a portion of the tax burden due to a compromised workplace safety. To reveal the underlying incentives, we examine cross-section implications for our results. The impact of tax burden on workplace safety is more salient in firms with ex ante substantial tax avoidance, in firms with significant short-term performance pressures, or among firms with weaker employee rights protections. Further investigations reveal that the TAIS prompts firms to significantly reduce safety-related investments, hire fewer employees (primarily production workers), and increase employee work intensity. Additionally, we find that the implementation of TAIS has no discernible impact on executive compensation, cash dividends, or fixed asset investments. Therefore, firms have neither mitigated heightened tax enforcement by reducing benefits to shareholders and executives, nor have they curtailed their expansions. Consequently, increased tax enforcement has the unintended effect of worsening workplace safety.

This study contributes to the literature in three ways. First, we contribute to the literature on the distribution of the tax burden between firms and labor. Prior studies mainly investigate whether, and to what extent, the tax burden is shifted from owners to workers through channels such as reduced wages, layoffs, and workplace safety following tax rate increases (Fuest et al., 2018; Ljungqvist & Smolyansky, 2018; Suárez Serrato & Zidar, 2016; Bradley et al., 2023), but they underexplore the impact of tax enforcement effectiveness on employee workplace safety. However, different from developed markets, the impact of taxation on corporate activity in emerging markets primarily arises from insufficient tax enforcement rather than tax rate increases (Basri et al., 2021). Unlike increases in tax rates, intensified tax enforcement from improved information technology explicitly aims to combat tax avoidance and evasion. By investigating the impact of tax enforcement on employee workplace safety, this paper complements the literature on the tax burden distribution between firms and labor from the perspective of tax enforcement and shows that tax burden increase leads to worsened employee workplace safety in both emerging and developed markets.

Second, our paper contributes to the burgeoning literature on the determinants of employee workplace safety. Recent studies suggest that the short-term performance pressure from capital market (Caskey & Ozel, 2017; Cohn et al., 2021; Qian et al., 2023), import competition pressure in product market (McManus & Schaur, 2016), as well as media and analysts monitoring (Bradley et al., 2022; Liang et al., 2023) have important implications for employee workplace safety. Additionally, Fisman and Wang (2015) and Jia and Nie (2017) investigate Chinese firms' safety performance from the institutional perspective, asserting that collusion between firms and governments is a critical driver of worker fatalities. We take a novel

perspective by exploring the effect of tax enforcement effectiveness on employee workplace safety after the government adopted a new technological-based tax collection system, revealing that enhanced tax enforcement prompts firms to shift the increased tax burden onto employees, thereby compromising employee workplace safety.

Third, this study extends the literature on the economic consequences of tax enforcement. The literature on tax enforcement mainly examines the impact of tax enforcement on tax evasion and fiscal revenue but often neglects other unintended consequences (Gupta & Lynch, 2016; Hoopes et al., 2012; Kubick et al., 2017). This study finds that improved tax enforcement adversely affects employee workplace safety, thereby complementing the literature on tax enforcement externalities from the perspective of employee workplace safety. This study implies that tax regulation as a public policy requires enhanced cross-departmental coordination and governance. Tax enforcement policies should synergize with labor rights protection policies to serve the public good.

2. Related literature and hypothesis development

2.1. Related literature

2.1.1. The distribution of tax burden

Tax burden has welfare implications for corporate stakeholders. The distribution of tax burden among corporate stakeholders has been a topic of debate. Early work by Harberger (1962) suggests that the entire tax burden falls on shareholders under stringent assumptions – such as perfect labor mobility and immobile capital. When these assumptions are relaxed, Mutti and Grubert (1985) demonstrate that stakeholders beyond shareholders also bear part of the tax burden. This implies that firms engage in a trade-off by allocating the tax burden among various stakeholders. Recent empirical findings show that corporate income tax rates are negatively correlated with labor wages and even employment, indicating that employees bear a proportion of corporate tax burden (Fuest et al., 2018; Ljungqvist & Smolyansky, 2018; Suárez Serrato & Zidar, 2016). Furtherly, using detailed administrative data encompassing owners, firms, and employees, Risch (2024) shows that for every $1 increase in business income tax liability, approximately 11 to 18 cents are transferred to worker earnings. Importantly, this burden is disproportionately borne by higher-income employees within the firm, suggesting that employees bear a portion of the shifted tax burden.

Beyond direct changes in tax rates, another crucial dimension of taxation is tax enforcement. Under a given tax rate, the amount of tax collected depends heavily on the rigor of enforcement. However, compared to the extensive literature on tax rates, studying the relationship between tax enforcement and employee outcomes remains limited. Existing studies primarily focus on the direct effects of tax enforcement on firms. They explore its influence on tax avoidance behaviors (Gupta & Lynch, 2016; Hoopes et al., 2012; Kubick et al., 2017), and more aggressive practices such as tax evasion and tunneling (Mironov, 2013). Additionally, tax enforcement has been linked to corporate governance changes, which can affect financing costs, such as the cost of debt (Guedhami & Pittman, 2008) and the cost of equity (El Ghoul et al., 2011). Other studies examine its impact on firm performance (Belnap et al., 2024; Mironov, 2013).

Two recent studies touch on the relationship between tax enforcement and employees. Specifically, Gallemore and Jacob (2024) find that stronger enforcement is negatively associated with both employment and wage growth. Conversely, using Internal Revenue Service (IRS) audit data, Belnap et al. (2024) show that tax enforcement does not significantly affect employee wages or employment. However, both studies primarily investigate how tax enforcement influences firms' operational outcomes, treating employee-related outcomes as secondary considerations. While prior studies linking tax rates or enforcement to employee outcomes emphasize wages or employment, workplace safety remains relatively underexplored.

2.1.2. Workplace safety

Research on workplace safety has gained increasing attention, starting with Cohn and Wardlaw (2016). They show that a company's financial capacity significantly influences employee safety. Ensuring workplace safety requires substantial investment in physical assets, training programs, and the enforcement of safety policies. These investments typically result in the long term returns and are not easily quantifiable in financial statements, making them vulnerable to short-termism, particularly under performance pressure. For instance, McManus and Schaur (2016) find that import competition exacerbates performance pressure, reducing workplace safety investments. Similarly, Caskey and Ozel (2017) show that firms narrowly meeting or beating analyst earnings forecasts experience higher injury rates. Qian et al. (2023) find that short-selling pressure leads firms to cut workplace safety investments to meet short-term goals. Conversely, alleviating short-termism via long-term stakeholder prioritization or private equity buyouts can improve workplace safety (Cohn et al., 2021; Qian et al., 2023).

External factors also influence workplace safety. Liang et al. (2023) find that publicly listed firms outperform private ones in ensuring safety due to greater media scrutiny and regulatory oversight. In China, political connections have been shown to insulate firms from safety audits, reducing workplace safety investments (Fisman & Wang, 2015; Jia & Nie, 2017). These findings suggest that beyond a company's financial situation, managerial discretion also shapes workplace safety outcomes.

The relationship between taxation and employee workplace safety remains underexplored, and its mechanisms are not fully understood. A recent related study by Bradley et al. (2023) investigates this issue in the context of the U.S., focusing on tax rates. They document that increases in state corporate income tax rates adversely affect employee workplace safety, suggesting that firms shift the tax burden onto employees. However, these existing studies overlooked the importance of tax collection technological infrastructure on employee welfare. For an emerging market, the tax collection technological infrastructure is backward, and corporate tax evasion is rampant. Compared to the level of tax rates, the impact of tax collection technology on a company's tax burden is more significant (Basri et al., 2021). Given the growing trend toward technology adoption in tax administration, investigating the consequences of using new technologies in taxation is very important (Bellon et al., 2022). As Acemoglu (2021) pointed out, whether technological advancements always lead to welfare improvements is still an open question. Based on the aforementioned literature, our study explores a distinct yet understudied dimension: tax collection technological infrastructure.

Leveraging data from China and the exogenous shock of TAIS backed with advanced technologies, we examine how enhanced tax enforcement impacts employee workplace safety. Together with Bradley et al. (2023), our study complements the growing literature of taxation and employee welfare[4].

2.2. Hypothesis development

2.2.1. The TAIS background

The implementation of the TAIS in China marks a significant technological advancement in tax enforcement infrastructure. Specifically, the TAIS establishes a unified technological platform for managing tax-related information. Through the platform, tax authorities process centralized tax data at both the national and provincial levels. Compared to previous tax enforcement policies, the TAIS offers several advantages. First, the TAIS leverages cutting-edge technologies, such as big data and cloud computing, enabling the national tax authority to collect and analyze tax-related information, thereby making tax collection more accurate, expeditious, and efficient[5]. Second, the TAIS facilitates the sharing of tax-related information among various tax authorities and other relevant government departments, including those responsible for commerce, social security, and banking. This fosters the cross-verification of tax related information, mitigates regional and interdepartmental disparities, and effectively combats corruption throughout the tax collection process. Third, the TAIS encompasses a broader spectrum of tax types compared to earlier tax enforcement policies[6].

In summary, the introduction of the TAIS improves tax authorities' ability to identify and process tax-related information. Moreover, digitalized information processing increases transparency and reduces the discretion held by tax inspectors, thereby curbing rent-seeking in tax collection. Consequently, the TAIS boosts government tax collection efficiency, facilitates the effective detection of corporate tax avoidance, increases in the tax burden on firms and reduces corporate after-tax earnings.

2.2.2. TAIS, tax burden, and employee workplace safety

Regarding the apportionment of the corporate tax burden between capital (shareholders) and labor (employees), studies suggest that firms tend to protect the interests of shareholders, and thereby shift the tax burden to employees (Ljungqvist & Smolyansky, 2018; Suárez Serrato & Zidar, 2016). Our analysis indicates that the implementation of the TAIS increases corporate tax burden by curbing their tax avoidance, thereby reducing the earnings available to shareholders. We hypothesize that firms strategically curtail investments in employee workplace safety to counteract the possible erosion of shareable earnings for three reasons.

[4] Our research contributes to this discussion by examining how improvements in tax infrastructure, supported by advanced technology, impact employee workplace safety through strengthened tax enforcement.

[5] China initiated the first stage of the China Tax Administration Information System (CTAIS-1) in 1994, with main objective of establishing a specialized VAT invoice cross-verification system. However, due to the underdevelopment of information technology at that time, CTAIS-1 heavily relied on manual collection of tax-related information. This reliance in increased costs and errors, leading to the suspension of CTAIS-1 in 1996.

[6] While CTAIS-1 and CTAIS-2 primarily focused on the collection and management of VAT, TAIS extends its coverage to include corporate income tax, individual income tax, social security contributions, and other taxes and fees.

First, in the absence of specific legal provisions, managers have significant discretion in making decisions regarding employee workplace safety investments. Devoid of detailed specifications, the Safety Production Law and Labor Law in China only provide guidelines and advocacy norms regarding regulations on resources allocations for corporate safety equipment, maintenance, and employee workplace safety trainings[7]. The loose safety regulations allow managers considerable discretion in determining the quantity, quality, and maintenance of employee workplace safety facilities. For instance, in pursuit of cost reduction, managers may opt for cost-effective safety production equipment, albeit with lower quality. Additionally, managers can cut back investments in employee workplace safety training. The implementation of the TAIS increases the tax burden on firms, and makes managers exploit their discretion to reduce investments in employee workplace safety, thereby shifting the increased tax burden to employees as a means to maximize shareholder wealth.

Second, the current laws on labor protection in China are relatively weak. Specifically, Chinese labor protection laws focus on employee wages, employment terms, and dismissal procedures, but lack detailed provisions concerning employee safety investments and post-accident penalties. Moreover, the employment system in Chinese companies contains vague regulations regarding formal and temporary workers. Companies often assign high-risk positions to temporary workers[8]. Even in cases of safety incidents, temporary workers often resort to private negotiations with the firm rather than pursuing formal legal means for resolution. Overall, employees are in a relatively disadvantaged position in China, making them more likely to become targets for cost-shifting by companies following the TAIS.

Third, reducing employee workplace safety investments is challenging to detect compared to other forms of cost-cutting. Unlike reductions in expenses, curtailing employee workplace safety investments is less likely to generate conspicuous short-term impacts on a firm's operational performance. When contrasted with investments that have long-term implications, such as research and development, the effectiveness of employee workplace safety investments is difficult to monitor[9]. As a result, compared to other short-term or long-term expenditures, firms tend to favor cost-saving by reducing workplace safety investments. Compared to the consequences of cutting salaries or implementing layoffs – such as strong opposition from employees, significant dismissal-related legal and economic costs, and even governmental scrutiny – cutting workplace safety investment is less conspicuous (Abowd & Ashenfelter, 1981; Unsal & Brodmann, 2020). Hence, instead of resorting to salary cuts or layoffs post-TAIS, managers are more inclined to reduce workplace safety investments to preserve the interests of major shareholders.

[7] For example, the Ministry Emergency Management of the People's Republic of China and the Ministry of Finance of the People's Republic of China have formulated the *Measures for the Extraction and Utilization Management of Enterprise Safety Production Costs* in accordance with the Safety Production Law. However, this *Measure* only stipulates standards for safety expenses extraction for different industries, while lacking specific provisions for the utilization of these expenses.

[8] For example, Allmed Medical, has attracted media and regulators' attention for the "employee poisoning" incident and has been found to have a large share of workers are temporary workers in the workshop where the poisoning accident occurred.

[9] Similar to PPE and R&D, companies are mandated to disclose safety production-related expenditures in their annual reports (specifically, under the Special Reserve for Safety Production, as per the *Measures for the Extraction and Management of Enterprise Safety Production Costs*, 2012, 2019, 2022). Nevertheless, companies typically refrain from providing further illustrations regarding the utilization of safety production-related reserves.

To conclude, the adoption of the TAIS, marked by digital tax collection technologies has fortified tax enforcement capabilities, resulting in increased tax avoidance costs for firms and a possible subsequent reduction in their post-tax earnings. Given the discretion of managers regarding employee workplace safety investments, the disadvantaged position of Chinese employees, and the covert nature of reducing investments in employee workplace safety, managers are inclined towards reducing such investments. The consequence is compromised employee workplace safety, resulting in an increase in workplace accidents. Thus, we propose the following Hypothesis:

H1a: *Ceteris paribus, the implementation of the TAIS decreases employee workplace safety.*

However, there are countervailing forces that prevent firms from reducing safety investments. First, firms may maintain employee workplace safety investments after the implementation of TAIS to avoid workplace incidents, as such accidents can damage a firm's reputation, incur penalties, and attract greater regulatory oversight. Furthermore, the TAIS increases the effective tax rates, which might prompt firms to increase tax-deductible expenses. According to Chinese tax laws and accounting regulations, expenses related to safety equipment procurement are eligible for value-added tax deductions, and costs associated with employee workplace safety can be deducted from pre-tax income[10]. Consequently, after the implementation of TAIS, the incentive for pre-tax deductions may encourage firms to increase their investments in employee workplace safety, leading to a competing Hypothesis:

H1b: *Ceteris paribus, the implementation of the TAIS increases employee workplace safety.*

3. Research design

3.1. Data and sample

We manually collect workplace casualty data from firms' announcements, corporate social responsibility reports, the official websites of the Ministry of Emergency Management of the People's Republic of China [MEMPRC] (n.d.) and the Ministry of Housing and Urban-Rural Development of China (n.d.). The TAIS implementation data is manually collected from the official websites of local tax authorities. We obtain corporate income tax rates and local tax enforcement capability data from the Wind Financial Terminal (Wind) and the *China Tax Audit Yearbook* (Editorial Committee of China Tax Audit Yearbook, 2011, 2012, 2013). Firm-level financial data are collected from the China Stock Market and Accounting Research (CSMAR) database.

We construct our sample following Fisman and Wang (2015). Our initial sample consists of all publicly listed Chinese firms on the Shanghai and Shenzhen Stock Exchanges operating in the following industries: chemical materials and chemical manufacturing (C26), pharmaceutical manufacturing (C27), ferrous metal smelting and rolling processing (C31), non-ferrous

[10] For example, *The Announcement of the State Administration of Taxation on the Pre-tax Deduction of Maintenance Fees for Coal Mining Enterprises and Safety Production Expenses for High-Risk Industry Enterprises* (Announcement No. 26, 2011) stipulates that, starting in 2011, the actual incurred maintenance expenses for coal mining enterprises and safety-related expenses for high-risk industry enterprises, considered as revenue expenses, can be directly deducted before taxation. However, expenses classified as capital expenditures should be included in the relevant asset costs and subject to depreciation or amortization.

metal smelting and rolling processing (C32), coal mining and processing (B06), non-ferrous metal mining (B09), electricity and heat production and supply (D44), and construction (E48). These industries represent the primary regulatory focus of the Ministry of Emergency Management of the People's Republic of China (n.d.), highlighting the critical importance of workplace safety issues. Moreover, focusing on these industries facilitates the collection of reliable employee workplace casualty data (Fisman & Wang, 2015; Liu et al., 2022).

We begin our sample in 2010 because workplace accident data became more standardized after that year[11]. We end our sample in 2017 to avoid potential confounding effects introduced by the 2018 merger of tax collection bureaus in China[12]. We exclude "ST" firms and firms controlled by the central government from our sample. "ST" firms are excluded due to operational abnormalities, while central government-controlled firms are excluded because they are subject to strict regulatory oversight and exhibit limited incentives for tax avoidance (Chen et al., 2022b; Liu et al., 2022; Tang et al., 2017)[13,14]. We require firms to have at least one observation before and after the implementation of TAIS. Additionally, we exclude observations with missing values for variables used in our empirical analysis. Our final sample consists of 3,231 firm-year observations from 529 distinct firms, spanning the period from 2010 to 2017. Appendix Table A1 provides a detailed tabulation of the sample construction.

Table 1 presents the distribution of our sample. Panel A displays the distribution of the sample across the years, while Panel B provides the distribution across industries. The observations are evenly distributed across the years, with an increase in firm-year observations related to workplace accidents over time. This trend aligns with findings in the existing literature (Liu et al., 2021). Furthermore, the Table 1 highlights significant cross-industry variation in the number of firm-year observations with workplace accidents.

[11] The disclosure of workplace accident data became standardized after the issuance of the *Notice on Further Strengthening and Improving the Reporting of Workplace Accidents Information* [2010] No. 24 by the State Administration of Workplace Safety (SAWS). The quality and timeliness of workplace safety data improved significantly from this point onward. Additionally, starting the sample in 2010 provides a sufficient time window leading up to 2013, when the first regions implemented the TAIS. This timeline facilitates a meaningful comparison of firm responses before and after the introduction of the TAIS.

[12] In 2018, the State Tax Bureau (STB) and Local Tax Bureaus (LTBs) were consolidated into a unified system, altering the tax collection incentives of both groups. Although the 2018 reform enhanced tax enforcement, it was driven by institutional changes in the tax collection framework (Liu et al., 2022). This motivation differs fundamentally from the TAIS, which focuses on improving tax enforcement through advancements in tax collection technology, reflecting infrastructure-driven rather than institution-driven changes. Moreover, including the 2018 reform in the analysis could introduce confounding effects that bias the estimation of the TAIS's impact on workplace safety (Karpoff & Wittry, 2018). To ensure clean identification, we end our sample period before the 2018 reform.

[13] "ST" stands for "Special Treatment", a designation used in the Chinese stock market to identify listed companies with abnormal financial or operational conditions. We exclude "ST" firms because (1) these firms are often in financial distress, with nearly no taxable income, and thus TAIS which targets the improvement of tax enforcement, is less likely to influence these firms' tax behavior; (2) "ST" firms operate under intensified scrutiny from regulators and investors due to their designation. The increased scrutiny may alter their incentives to respond to TAIS in ambiguous ways, potentially biasing the estimation of TAIS effects. Excluding "ST" firms is also consistent with prior literature (Chen et al., 2022b; Liu et al., 2022). Although not tabulated, our results remain robust when "ST" firms are included in the sample.

[14] Tang et al. (2017) show the conflicts between central and local governments resulting from the 2002 tax-sharing reform have increased tax avoidance by firms controlled by local governments. In contrast, the tax avoidance incentives for central government-controlled firms subject to tax sharing are much weaker, and non-tax-sharing central government-controlled firms have little incentive to avoid taxes.

Table 1. Sample distribution

Panel A: Distribution by year					
	Full sample		Samples with workplace accidents		
	Obs.	% of Obs.	Obs.	% of Obs.	% of full sample
2010	295	9.13	17	7.02	5.76
2011	350	10.83	34	14.05	9.71
2012	415	12.84	27	11.16	6.51
2013	437	13.53	29	11.98	6.64
2014	428	13.25	33	13.64	7.71
2015	432	13.37	31	12.81	7.18
2016	441	13.65	35	14.46	7.94
2017	433	13.40	36	14.88	8.31
Total	3,231	100.00	242	100.00	7.49

Panel B: Distribution by industry					
	Full sample		Samples with workplace accidents		
	Obs.	% of Obs.	Obs.	% of Obs.	% of full sample
Manufacturing of chemical materials and chemicals (C26)	1,009	31.23	83	34.30	8.23
Medicine manufacturing (C27)	945	29.25	21	8.68	2.22
Construction (E48)	231	7.15	15	6.20	6.49
Non-ferrous metal smelting and rolling processing (C32)	322	9.97	19	7.85	5.90
Non-ferrous metal mining (B09)	132	4.09	25	10.33	18.94
Coal mining and selection (B06)	160	4.95	35	14.46	21.88
Production and supply of electricity and heat (D44)	274	8.48	14	5.79	5.11
Ferrous metal smelting and rolling processing (C31)	158	4.89	30	12.40	18.99
Total	3,231	100.00	242	100.00	7.49

Note: This table presents the sample distribution. Panel A shows the distribution by year. Panel B shows the distribution across industries. The first column of Panel A and Panel B shows the distribution of full samples, and the second column is the distribution of samples with one or more workplace accidents (*WorkAccident* = 1).

3.2. Variables

3.2.1. The adoption of Tax Administration Information System (TAIS)

We utilize the staggered adoption of TAIS as a quasi-natural experiment to investigate whether and how technology-driven tax enforcement affects employee workplace safety. We first identify the years in which each province or region implemented TAIS. This information is manually collected from the official websites of local tax authorities. Table 2 provides an overview of the TAIS implementation timeline across regions. The implementation timing

varies significantly among regions. For instance, Chongqing, Shandong Province (excluding Qingdao City), and Shanxi Province adopted TAIS in 2013, while Liaoning Province, Jiangxi Province, and Fujian Province implemented it in 2016. By the end of our sample period, all provinces had implemented TAIS.

Table 2. The initiation timeline of TAIS

Implementation year	2013	2014	2015	2016
Regions	Chongqing, Shanxi, Shandong (except Qingdao)	Neimenggu, Henan, Guangdong (except Shenzhen)	Ningxia, Hebei, Guizhou, Guangxi, Yunnan, Hunan, Qinghai, Hainan, Tibet, Gansu, Anhui, Sichuan, Xinjiang, Jilin	Liaoning, Jiangxi, Fujian, Beijing, Tianjin, Heilongjiang, Shaanxi, Hubei, Shanghai, Jiangsu, Zhejiang, Qingdao, Shenzhen

To determine if a firm is affected by TAIS adoption, we construct an indicator variable *GTP*. For firms headquartered in regions prior to the implementation of TAIS, *GTP* is assigned a value of zero. For the period following the implementation of TAIS, *GTP* takes a value of one.

3.2.2. Employee workplace safety

Our workplace (un)safety proxy is the workplace casualties (Fisman & Wang, 2015; Liu et al., 2021). To gather data on workplace casualties, we utilize multiple sources, including firms' disclosures, official Chinese government websites, and media coverage. Initially, we collect information on workplace accidents from public firms' announcements and their Corporate Social Responsibility reports. We also access the website of MEMPRC (n.d.) to obtain relevant data. For the construction industry, we supplement our data through the website of the Ministry of Housing and Urban-Rural Development of China (n.d.). All workplace accident data we collect are matched with the names of our sample firms. To ensure data accuracy, we cross-verify the workplace safety data using news articles retrieved from the Baidu search engine. Specifically, for each listed firm, we search for keywords such as "firm name," "accident," "fatality," or "injury" and review the corresponding news articles to extract the date and number of employee casualties.

Our primary measure of workplace (un)safety is the workplace accident indicator (*WorkAccident*). *WorkAccident* is set to one if a firm has at least one workplace accident record in a given year and zero if otherwise. In our robustness checks, we also consider an alternative measure based on the number of employee casualties from workplace accidents. This alternative proxy (*CasualtyNum*) is defined as the natural logarithm of one plus the number of employee casualties at the firm in a given year.

3.2.3. Control variables

To isolate the effect of TAIS implementation on employee workplace safety, we control for various firm characteristics. Specifically, we control for firm size (*Size*), leverage ratio (*Lev*), return on assets (*ROA*), cash flow capacity (*CF*) and firms' sales growth (*Growth*). Following Cohn and Wardlaw (2016), we include the ratio of tangible asset to total assets (*Tangible*),

ratio of capital expenditure to total assets (*Capex*), and the ratio of current year sales to total assets (*Turnover*) to account for investments in fixed assets on workplace safety. Fisman and Wang (2015) report higher workplace casualty rate for political connected firms, and thus we include whether a firm has political connections (*Connected*) as well as whether a firm is government-controlled (*SOE*). Additionally, we control for analyst coverage (*Analyst*), given the findings of analyst coverage on work-related injury rates (Bradley et al., 2022). Also included are the duality of the board chair and the manager (*Dual*), and board size (*Boardsize*) to account for the effect of corporate governance (Liu et al., 2022). Finally, we control for GDP growth rate (*GDP*), and unemployment rate (*Unemp*) in each province. Detailed variable definitions are provided in Appendix Table A2.

3.3. Research model

Following Imbens and Wooldridge (2009) and Atanassov (2013), we estimate staggered DID with a two-way fixed effects design to examine the effect of TAIS on employee workplace safety, as Eq. (1) below[15]:

$$WorkAccident_{i,t} = \alpha + \beta GTP_{i,t} + \gamma X_{i,t} + Firm_i + Industry_j + Year_t + \epsilon_{i,t}, \quad (1)$$

where $WorkAccident_{i,t}$ is the workplace accident indicator, which equals 1 if firm i experiences at least one workplace accident in year t, and 0 otherwise. $GTP_{i,t}$ captures the adoption of TAIS, assigned as 1 for firms headquartered in regions where TAIS has been implemented during year t, and 0 otherwise. β captures the effect of TAIS implementation on workplace safety. $X_{i,t}$ represents a set of control variables as described in Section 3.2. We estimate Eq. (1) with firm, industry, and year fixed effects. $\epsilon_{i,t}$ is the error term.

4. Empirical results

4.1. Descriptive statistics

We present the descriptive statistics of our main variables in Table 3. On average, approximately 7.5% of firm-years in our sample experience workplace accidents. The standard deviation of the workplace accident dummy is 26.4%, indicating significant variation in workplace accidents across firms. The statistics of our control variables align with previous studies (Chen et al., 2022a).

[15] The staggered DID method is particularly suitable for capturing the effect of staggered implementation of TAIS across regions. This approach enables us to identify the average treatment effect on the treated (ATT) of TAIS on employee workplace safety by comparing the differences between the treated and control groups before and after the implementation of TAIS. In this setup, the treated group comprises firms headquartered in regions where TAIS has been implemented, while the control group consists of firms headquartered in regions where TAIS has not yet been adopted. In addition, we follow Yost (2023) and employ a linear probability model rather than a logit regression to address computational issues associated with the inclusion of firm fixed effects in nonlinear models such as logit or probit. These challenges include functional non-concavity in maximum likelihood estimation and the automatic exclusion of a substantial portion of the sample due to perfect prediction.

Table 3. Summary statistics

Variables	N	Mean	SD	Min	Median	Max
WorkAccident	3,231	0.075	0.263	0.000	0.000	1.000
CasualtyNum	3,231	0.103	0.421	0.000	0.000	2.485
GTP	3,231	0.391	0.488	0.000	0.000	1.000
Size	3,231	22.250	1.234	19.760	22.090	25.380
Lev	3,231	0.445	0.224	0.044	0.447	0.908
Roa	3,231	0.041	0.055	-0.154	0.0360	0.211
Tangible	3,231	0.282	0.167	0.013	0.263	0.731
Growth	3,231	0.196	0.409	–0.453	0.125	2.636
CF	3,231	0.047	0.068	–0.174	0.047	0.229
Capex	3,231	0.060	0.049	0.001	0.046	0.243
Turnover	3,231	0.642	0.402	0.092	0.548	2.304
SOE	3,231	0.433	0.496	0.000	0.000	1.000
Connected	3,231	0.780	0.415	0.000	1.000	1.000
Analyst	3,231	1.587	1.086	0.000	1.609	3.584
Dual	3,231	0.231	0.422	0.000	0.000	1.000
Boardsize	3,231	2.282	0.180	1.792	2.303	2.773
GDP	3,231	10.140	0.789	7.209	10.200	11.400
Unemp	3,231	3.232	0.633	1.300	3.300	4.300

Note: The table reports descriptive statistics for our main variables in the analysis. The sample consists of Chinese A-share-listed firms in industries with high workplace safety hazard over the period of 2010–2017. All variables are defined in Appendix Table A2.

4.2. Baseline results

Our primary hypothesis is that the implementation of TAIS enhances corporate tax enforcement, prompting firms to shift the tax burden to employees, thereby increasing the incidence of workplace accidents. In Appendix Table A3, we show the implementation of TAIS makes corporate tax collection stricter, leading to a significant reduction in corporate tax avoidance. To test our hypotheses, we conduct our baseline regression analysis using Model 1 and report the results in Table 4. Column (1) includes firm, year, and industry fixed effects, but without any control variables. Column (2) adds firm and regional control variables on the basis of Column (1). The results show that the coefficient estimates of *GTP* are positive and statistically significant at the 1% level in both columns, suggesting that the firms are more likely to have employee workplace accidents after the implementation of TAIS. In terms of economic magnitude, the coefficient estimate suggests that the post-TAIS increases the probability of employee workplace accidents to 5.54% of the pre-TAIS. The coefficients of control variables generally align in signs with prior literature (Bradley et al., 2022; Caskey & Ozel, 2017; Cohn & Wardlaw, 2016). Overall, our regression results indicate that employees are more susceptible to workplace safety-related accidents following the implementation of TAIS.

Table 4. The effect of TAIS on employee workplace safety

Variables	(1)	(2)
	WorkAccident	*WorkAccident*
GTP	0.0529***	0.0554***
	(2.8301)	(2.9389)
Size		0.0084
		(0.4282)
Lev		–0.0121
		(–0.2188)
Roa		–0.1777
		(–1.1169)
Tangible		–0.0237
		(–0.3826)
Growth		0.0081
		(0.5372)
CF		–0.0059
		(–0.0549)
Capex		0.0160
		(0.1196)
Turnover		0.0579
		(1.3128)
SOE		0.0440
		(1.2084)
Connected		–0.0463**
		(–2.1904)
Analyst		0.0160***
		(3.0244)
Dual		0.0010
		(0.0398)
Boardsize		–0.0769
		(–1.3148)
GDP		–0.0674
		(–1.0663)
Unemp		–0.0236
		(–0.9345)
Constant	0.0541***	0.7740
	(7.4134)	(1.0774)
Firm/Year/Industry FE	Yes	Yes
N/R-squared	3,208/0.10	3,208/0.10

Note: Following Yost (2023), the table presents results from estimating a linear probability model. We report robust standard errors clustered at the province level[16], and t-statistics are in parentheses. *, **, and *** represent significance at the 0.1, 0.05, and 0.01 levels, respectively.

[16] Our results remain qualitatively unchanged when standard errors are clustered at the firm level or industry level.

4.3. Robustness tests

In this Section, we perform a battery of tests to verify the robustness of our baseline results. Specifically, they include placebo test, parallel trend analysis, stacked DID and other robustness tests.

4.3.1. Placebo test

If a random factor negatively impacted workplace safety and happened to correlate with GTP implementation in specific provinces, the observed relationship between GTP and workplace safety might be spurious. To address this concern, we conducted a placebo test. Specifically, during the sample period, we randomly assign a starting year for TAIS to each region. Subsequently, we employ this assigned starting pseudo-year to set the *GTP_placebo* variable for a staggered DID regression analysis. We conduct this regression analysis 500 times and then plot the distribution of the *GTP_placebo* coefficients derived from these 500 iterations in Figure 1. If the observed relationship between *GTP_placebo* and workplace safety were driven by random factors, we would expect the *GTP_placebo* coefficients to be similar in magnitude, direction, and significance to those of the variable GTP in Table 4. However, Figure 1 shows that the *GTP_placebo* coefficients are centered around zero and are smaller than the coefficients for GTP in Table 4, which suggests that the relationship between GTP and workplace safety is unlikely to be driven by random factors.

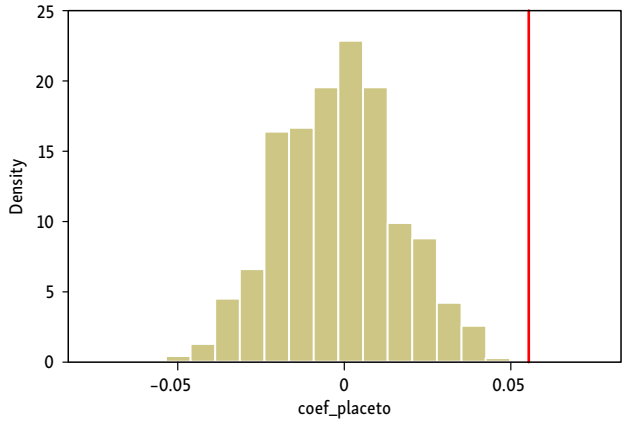

Figure 1. Coefficient Estimates of *GTP_placebo*

4.3.2. Parallel trend analysis

A fundamental requirement for the validity of DID estimation is the adherence to the parallel trend assumption. The parallel trend assumption posits that, conditional on the covariates included in the regression model, treatment and control firms exhibit parallel movements in their workplace safety in the absence of the treatment shock. To assess the possible impact of pre-trends, we follow Bertrand and Mullainathan (2003) and replace *GTP* in Eq. (1) with six indicators. Specifically, GTP_Pre_j (GTP_Post_j) takes a value of one for treated firms in the j^{th} year relative to the year of TAIS implementation and zero otherwise, except for GTP_Post_{3+}, which indicates more than three years after the recognition of TAIS. We use *GTP_Adoption*,

a dummy variable, to indicate the year in which TAIS was implemented in the province where a given firm is located. We then re-estimate Eq. (1) with *GTP* being replaced by six indicators.

Table 5 presents the regression results. The coefficient estimates of GTP_Pre_2, and GTP_Pre_1 are both statistically insignificant, indicating no evidence of pre-existing trend. The result implies that no other factors significantly affect the differences in workplace safety between the treated and control groups prior to the TAIS implementation. Moreover, the coefficient estimates from *GTP_Adoption* to GTP_Post_{3+} remain positive and significant. This indicates that the differential in the probability of workplace accidents becomes evident only after the implementation of TAIS. The increasing coefficient estimates suggest that the recognition of TAIS has a long-lasting and non-trivial effect on the likelihood of employee workplace accidents. Overall, the finding suggests that treatment and control firms follow parallel trends in workplace safety for the two years prior to TAIS enablement, and the trend diverge after TAIS launching.

Table 5. Parallel trend analysis

Variable	*WorkAccident*
GTP_Pre2	0.0063
	(0.2692)
GTP_Pre1	0.0201
	(0.6346)
GTP_Adoption	0.0794**
	(2.2653)
GTP_Post1	0.1016**
	(2.1047)
GTP_Post2	0.1084*
	(1.7776)
GTP_Post3+	0.1363*
	(1.9970)
Constant	0.6852
	(0.9404)
Controls	Yes
Firm/Year/Industry FE	Yes
N/R-squared	3,208/0.10

Note: The table presents results of parallel trend analysis. We report robust standard errors clustered at the province level, and t-statistics are in parentheses. *, **, and *** represent significance at the 0.1, 0.05, and 0.01 levels, respectively.

4.3.3. Stacked DID

A two-way fixed effects staggered DID approach may yield biased estimates due to potential time-varying effects and heterogeneity in treatment effects (Baker et al., 2022). To address this concern, we adopt the stacked DID approach as suggested by Callaway and Sant'Anna (2021) and Baker et al. (2022) to get robust estimation. Specifically, when a province adopts TAIS in year t, we extract observations for all firms within that province from three years before

to one year after the adoption. These observations are then combined with data from firms in other provinces that had not yet adopted TAIS by year t and would not adopt it in the following year. This forms the year-t cohort ([t – 3, t + 1]), which includes firms that adopted TAIS in year t and those that did not. We use the stacked data to re-estimate Eq. (1) with cohort-firm and cohort-year fixed effects. The results presented in Column (1) of Table 6 show that the stacked DID estimates remain significantly negative, consistent in magnitude and direction with our main regression results.

4.3.4. Other robustness tests

In addition, we perform a battery of additional tests to verify the robustness of our baseline results against model specifications and different variable definitions. Specifically, In Column (2) of Table 6, we use logit regressions and include province, industry and year fixed effects. In Column (3), we exclude observations in year 2016 and 2017. In Column (4), we use the natural logarithm of one plus the number of employee causalities at the firm in a given year (*CasualtyNum*) as our dependent variable. Overall, the regression results obtained from the above regression align with our main results, suggesting that the implementation of TAIS increases work accidents.

Table 6. Robustness tests

Variables	(1)	(2)	(3)	(4)
	WorkAccident	*WorkAccident*	*WorkAccident*	*CasualtyNum*
GTP	0.0621**	0.7424***	0.0649**	0.0566*
	(2.4291)	(2.7158)	(2.6571)	(1.8366)
Constant	–0.3411	–17.9167***	0.6557	1.3592
	(–0.2871)	(–4.2097)	(0.7352)	(1.2650)
Controls	Yes	Yes	Yes	Yes
Firm FE	No	No	Yes	Yes
Year FE	No	Yes	Yes	Yes
Industry FE	No	Yes	Yes	Yes
Province FE	No	Yes	No	No
Firm × Event FE	Yes	No	No	No
Year × Event FE	Yes	No	No	No
Industry × Event FE	Yes	No	No	No
N/Pseudo/R-squared	4,884/0.14	3,227/0.18	2,317/0.12	3,208/0.11

Note: The standard errors are clustered at the province level. *, **, and *** represent significance at the 0.1, 0.05, and 0.01 levels, respectively.

4.4. Mechanism tests

4.4.1. Tax enforcement intensity across firms pre-TAIS

The implementation of TAIS strengthens the tax supervision efficiency and makes firms' tax avoidance activities more challenging. Consequently, for firms that extensively employed tax avoidance activities before the enactment of TAIS, their tax avoidance will be more suscep-

tible to detection following the implementation of TAIS. If the negative impact of TAIS on workplace safety indeed arises from stricter tax enforcement following its implementation, we would expect this negative effect to be more pronounced among firms with higher level of tax avoidance prior to TAIS. To examine this heterogeneity, we create a binary variable, *HighTaxAvoid*, which is assigned a value of one if a firm's level of tax avoidance exceeds the sample median prior to the TAIS, and zero if otherwise. We then generate an interaction term between *HighTaxAvoid* and *GTP* and integrate both this interaction term and *HighTaxAvoid* into Eq. (1). We expect the interaction term (*Moderator* × *GTP*) to be positively significant. The result presented in Column (1) of Table 7 Panel A is consistent with our expectation and indicates that the impact of TAIS on employee workplace safety is more pronounced among firms that have higher tax avoidance level before the implementation of TAIS. The result shows TAIS implementation increases workplace unsafety by strengthening tax enforcement.

In regions with weaker tax enforcement, firms are more likely to engage in tax avoidance due to lower costs (Allingham & Sandmo, 1972). After the implementation of TAIS, firms in regions with originally lower levels of tax enforcement should experience a significant enhancement in tax regulation compliance. If the effect of TAIS on workplace safety indeed comes from strengthened tax enforcement, we would expect that its impact to be more pronounced among regions with lower level of tax enforcement and weaker tax supervision prior to TAIS implementation. This is because firms in such regions experience a greater increase in tax enforcement due to TAIS. To account for the heterogeneities, we construct two dummy variables, *LowTE* and *LowSuper*, which indicate the tax enforcement and tax supervision levels in the location of a firm's headquarters, respectively. *LowTE* is an indicator variable that takes the value of one if a firm is headquartered in a region with less stringent tax enforcement before the implementation of TAIS, and zero otherwise. We measure the intensity of tax enforcement for each region pre-TAIS by utilizing the ratio of actual tax revenue to expected tax revenue. *LowSuper* is an indicator variable that takes the value of one if a firm is headquartered in a region with less stringent tax supervision before the implementation of TAIS, and zero otherwise. We capture the level of tax supervision using the ratio of problematic invoices inspected by the local tax bureau. A higher ratio of problematic invoices suggests a higher level of tax supervision. We incorporate the variables, interact with *GTP* and again re-estimate Eq. (1), respectively. We separately present the results in Columns (2) and (3) of Table 7 Panel A. The coefficients of the interaction term *Moderator* × *GTP* are both positive and significant at 5% level, implying that the effect of TAIS on employee workplace safety is stronger among firms in regions with less stringent tax enforcement or weaker tax supervision. These results provide further evidence that the effect of TAIS on employee workplace safety comes from the intensified tax enforcement.

Previous research documents that firms associated with local governments or tax authorities are more likely to engage in tax avoidance (Lin et al., 2018; Tang, 2023). TAIS, by emphasizing inter-departmental collaboration and cross-verification of tax-related data, weakens the connections between firms and local tax authorities, thereby enhancing tax enforcement. If the negative impact of TAIS on workplace safety results from the strengthened tax enforcement following its implementation, we would expect the effect of TAIS on workplace safety to be more pronounced among firms that had closer ties with government or tax

authorities prior to TAIS, as such firms are more significantly affected by the TAIS induced changes. To assess the strength of the relationship between firms and local tax authorities, we follow Tang (2023) and employ abnormal entertainment and travel expenses (*ETC*) to proxy for the amount firms spend to establish relations with local governments. We construct a dummy variable *HighAbETC*, which takes the value of one if a firm's *ETC* is higher than the sample median before the implementation of TAIS, and zero otherwise. We include *HighAbETC* along with its interaction with *GTP* in our model and re-estimate Eq. (1). The results are presented in Column (4) of Table 7 Panel A. The coefficient estimates of the interaction term *Moderator*×*GTP* is positive and significant at the 5% confidence interval. These findings suggest that the impact of TAIS on employee workplace safety is more significant among firms with closer ties to governments or tax authorities. This finding also suggests that the impact of TAIS on employee workplace safety stems from the heightened tax enforcement following its implementation.

4.4.2. Short-term earnings pressure

The implementation of TAIS strengthens tax enforcement, which reduces firms' expected post-tax earnings. To avoid potential losses, shareholders may pressure managers to protect their interests. In China, where managers' interests align with majority shareholders, this pressure may lead managers to look for ways to mitigate the TAIS impact on post-tax earnings by compromising employee welfare. Our hypothesis suggests that the effect of TAIS on workplace safety is more pronounced when managers face greater earnings pressure from shareholders. To proxy for pressure from shareholders, we utilize three variables. First, we create an indicator variable *Suspect*, which takes a value of one for firms that meet or beat analysts' consensus forecasts by a margin of two cents or less. Firms that narrowly meet or exceed analysts' forecasts can represent those under significant shareholder pressure. Their management strives to prevent shareholder losses, as failing to meet these forecasts could result in a sharp decline in the firm's market value, harming shareholder interests (Bartov et al., 2002). Second, we construct an indicator variable *Pressure*, which equals one for firms whose return on equity (*ROE*) slightly surpasses zero but remains below 2%, and zero otherwise. This variable is also an ex-post measure, identifying firms with managers who work to avoid pressure from shareholder losses by keeping ROEs slightly above zero. Our third measure, *HighSubsidy*, is an indicator variable that equals one if the amount of government subsidies received by a firm surpasses the industry median and zero otherwise. Firms receiving higher subsidies might experience reduced earnings pressure due to the additional financial support from the government.

We interact the variables *Suspect* and *Pressure* with *GTP* and include both variable and interaction terms to re-estimate Eq. (1), respectively. The results are presented from columns (1) to (3) in the Panel B of Table 7. The results show that the interaction terms *Suspect* × *GTP* and *Pressure* × *GTP* are both significantly positive and the interaction *HighSubsidy* × *GTP* exhibits negative significance, indicating a stronger effect of TAIS implementation on employee workplace accidents in firms experiencing greater shareholder pressures. This suggests that when managers face the pressure from reduction in post-tax earnings due to enhanced tax enforcement under TAIS, they prioritize shareholder interests over employee welfare.

Table 7. Mechanism tests

Panel A. Tax avoidance before TAIS

	Dependent variable = WorkAccident			
	(1)	(2)	(3)	(4)
Moderator =	*HighTaxAvoid*	*LowTE*	*LowSuper*	*HighAbETC*
GTP	0.0467*	0.0314	0.0253	0.0327
	(1.9435)	(1.3795)	(1.2514)	(1.4395)
Moderator × GTP	0.0378**	0.0401**	0.0516**	0.0535**
	(2.6297)	(2.0616)	(2.2542)	(2.1198)
Constant	0.1654	0.8206	0.3486	1.1395
	(0.2353)	(1.0012)	(0.5130)	(1.5339)
Controls	Yes	Yes	Yes	Yes
Firm/Year/Industry FE	Yes	Yes	Yes	Yes
N/R-squared	2,737/0.10	3,208/0.10	3,208/0.10	2,622/0.10

Panel B. Short-term earnings pressure

	Dependent variable = WorkAccident		
	(1)	(2)	(3)
Moderator =	*Suspect*	*Pressure*	*HighSubsidy*
GTP	0.0656***	0.0457**	0.0723***
	(3.1451)	(2.7298)	(3.3442)
Moderator×GTP	0.0909**	0.0630*	–0.0357**
	(2.1048)	(1.7135)	(–2.0722)
Constant	0.3826	0.6654	0.6564
	(0.3893)	(0.9290)	(0.9431)
Controls	Yes	Yes	Yes
Firm/Year/Industry FE	Yes	Yes	Yes
N/R-squared	2,192/0.11	3,208/0.10	3,208/0.10

Panel C. Employee bargaining power

	Dependent variable = WorkAccident	
	(1)	(2)
Moderator =	*HighIntensity*	*HighProtect*
GTP	0.0350*	0.0731***
	(2.0259)	(2.8288)
Moderator × GTP	0.0398*	–0.0412*
	(1.9844)	(–1.9435)
Constant	0.6579	0.5252
	(0.9118)	(0.7764)
Controls	Yes	Yes
Firm/Year/Industry FE	Yes	Yes
N/R-squared	3,208/0.10	3,208/0.10

Note: The table reports the results of mechanism tests. Panel A shows the heterogeneous effect of TAIS on workplace safety conditional on different tax enforcement intensity across firms pre-TAIS. Panel B shows the heterogeneous effect of TAIS on workplace safety conditional on firms' earnings pressure. Panel C shows the heterogeneous effect of TAIS conditional on employee bargaining power. We report robust standard errors clustered at the province level, and *t*-statistics are in parentheses. *, **, and *** represent significance at the 0.1, 0.05, and 0.01 levels, respectively.

4.4.3. Employee bargaining power

Managers have discretion over employee safety and weigh the costs and benefits of their decisions. Lowering workplace safety may incur costs such as compensation for workplace accidents and legal liabilities. When these costs are low, managers are more likely to reduce safety measures. Employee bargaining power could affect these potential costs and consequently managerial decisions. For example, in companies or regions with low employee bargaining power, even if workers suffer from workplace accidents, they are less likely to receive adequate compensation or successfully sue due to difficulties such as long timelines and challenges in providing evidence. As a result, managers in such firms are more likely to take actions harming employee safety. Our Hypothesis suggests that the effect of TAIS on workplace safety will be more pronounced in firms with lower employee bargaining power. To approximate employee bargaining power, we utilize firms' labor intensity and regions' labor protection index. First, we create a binary variable, *HighIntensity*, to identify firms with high labor intensity. *HighIntensity* takes the value of one if a firm's labor intensity in a given year exceeds the sample median, and zero otherwise[17]. Second, we use a binary variable *HighProtect* to determine if firms are located in regions with robust labor rights protection. *HighProtect* is set to one if a firm is headquartered in a province with a favorable labor rights protection environment and zero otherwise. A favorable labor rights protection environment indicates a higher employee bargaining power. We then interact *HighIntensity* and *HighProtect* with *GTP* and separately include both indicator variables and interaction terms in Eq. (1). The results are presented in Panel C of Table 7, where both interaction terms are statistically significant at 10% level. These results suggest that the impact of TAIS on employee workplace accidents is more pronounced among firms with higher labor intensity but less significant for firms located in provinces with stronger labor rights protection. These findings highlight the role of employee bargaining power in the effect of TAIS on employee workplace accidents.

4.5. Further analyses

In previous Sections, we show that TAIS implementation increases workplace accidents, with stronger effects in firms with higher tax avoidance, greater shareholder pressure, and weaker employee bargaining power. These findings indicate how the strengthening of tax enforcement after TAIS influences workplace safety. In this Section, we further investigate how TAIS increases workplace accidents by firms' safety investments, employee workload and alternative ways, to explore how managers prioritize shareholder interests over employee welfare.

4.5.1. Workplace safety investments

Employee safety investments are closely linked to workplace safety. The reduction in workplace safety is often due to a decrease in a company's safety investments. After the implementation of TAIS, companies may reduce these safety investments to maintain post-tax profits, as such cuts can go unnoticed by regulators and employees. The direct consequence of reducing safety investments is an increase in workplace accidents. In other words, the im-

[17] High labor intensity indicates lower employee bargaining power, as companies can easily find replacements for the same work. This aligns with Dyreng et al. (2022), who suggest that when labor supply elasticity is low, changes in labor supply have less impact on wages, making it more likely for tax costs to shift to employees.

plementation of TAIS may increase safety accidents by reducing company safety investments. We investigate this potential mechanism by examining changes in safety-related investments after TAIS.

We employ three variables to proxy safety investment: total safety investments (*SafetyExp*), safety investments per employee (*SafetyExp/Emp*), and abnormal discretionary per employee (*AbDiscExp*). Specifically, *SafetyExp* is calculated as the natural logarithm of one plus the total safety expenditure, while *SafetyExp/Emp* is the total safety expenditure scaled by the total number of employees. The two indicators can directly measure safety investments. Caskey and Ozel (2017) construct an indirect variable to proxy safety investment based on abnormal selling, general, and administrative expenses[18]. Following Caskey and Ozel (2017), We construct the variable *AbDiscExp* to proxy safety investment. We use *SafetyExp*, *SafetyExp/Emp*, and *AbDiscExp* as the dependent variables and re-estimate Eq. (1). Panel A of Table 8 presents the results. We find that the coefficient estimates of the variable *GTP* are significantly negative across all columns. The results suggest that post-TAIS, affected firms reduce their investments in workplace safety. The reduction in safety investments may lead to more workplace accidents, further validating our main finding that TAIS implementation increases firm workplace accidents.

4.5.2. Employee workload

Increased workloads can lead to employee injuries, as managers under earnings pressure prioritize productivity over workplace safety (Caskey & Ozel, 2017). Previous studies also show that higher corporate tax rates reduce employment and wages (Fuest et al., 2018; Ljungqvist & Smolyansky, 2018; Suárez Serrato & Zidar, 2016). They imply that after TAIS adoption, affected firms may cut costs by laying off workers to maintain post-tax profits. However, total workloads may not decrease proportionally, so remaining employees may be required to work longer hours or accelerate their tasks, leading to more workplace accidents.

We utilize two variables, *EmployeeNum* and *ProworkerNum*, to examine the effect of TAIS implementation on employee injuries through reduced workforces and increased workloads. *EmployeeNum* is defined as the natural logarithm of one plus the total number of employees, while *ProworkerNum* is calculated as the natural logarithm of one plus the total number of manufacturing workers. We also follow Caskey and Ozel (2017) and employ revenue per employee to capture employee workloads (*RevperEmp*). *RevperEmp* is calculated as the natural logarithm of total revenue scaled by the number of employees. We then use the three variables as the dependent variables and re-run the Eq. (1). Panel B of Table 8 presents the results examining the effect of TAIS implementation on the employment and employee workloads. The coefficient estimates of *GTP* in columns (1) and (2) are significantly negative. In column (3), the coefficient estimate of *GTP* is significantly positive. The results reveal a decline in the number of employees and an increase in the workloads of the remaining workers. Combined with the results from workplace safety investments, these findings shed light on the mechanism through which TAIS implementation affects employee workplace safety.

[18] Safety expenditures, such as workplace safety training and the maintenance cost, usually fall within selling, general, and administrative expenses (Cohn & Wardlaw, 2016). To gauge safety expenditures, Caskey and Ozel (2017) developed a measure – abnormal discretionary SG&A expenses per employee (*AbDiscExp*). Detailed definition of *AbDiscExp* is provided in Appendix Table A2.

Table 8. Further analysis

Panel A. Employee workplace safety investments

Variable	*SafetyExp*	*SafetyExp/Emp*	*AbDiscExp*
	(1)	(2)	(3)
GTP	–0.2972*	–0.1539*	–0.9744*
	(–1.7745)	(–1.8784)	(–1.9586)
Constant	–7.5191	1.1025	–18.6850
	(–0.7080)	(0.2002)	(–0.3650)
Controls	Yes	Yes	Yes
Firm/Year/Industry FE	Yes	Yes	Yes
N/R-squared	1,237/0.80	1,237/0.83	3,181/0.58

Panel B. Employment and workloads

Variable	*EmployeeNum*	*ProworkerNum*	*RevperEmp*
	(1)	(2)	(3)
GTP	–0.0499**	–0.0516**	0.0450*
	(–2.2662)	(–2.1451)	(1.7074)
Constant	–4.1490***	–4.1324***	–4.2110
	(–2.9326)	(–2.8646)	(–1.6913)
Controls	Yes	Yes	Yes
Firm/Year/Industry FE	Yes	Yes	Yes
N/R-squared	2,490/0.95	2,466/0.95	3,206/0.86

Note: This table reports the results of further analyses. Panel A shows the association between TAIS and safety investments. Panel B shows the effect of TAIS on employment and workloads. We report robust standard errors clustered at the province level, and *t*-statistics are in parentheses. *, **, and *** represent significance at the 0.1, 0.05, and 0.01 levels, respectively.

4.5.3. Alternative ways

Next, we examine whether companies, in addition to shifting the tax burden to employees, also deal with increased tax costs in other alternative ways. There are various ways for companies to respond to increased tax costs. Firms can reduce capital investments, lower executive salaries, and decrease dividends, rather than necessarily reducing employee safety investments and increasing the workload of workers.

To test the Hypothesis, we construct three variables, *Fassets*, *Lnpay*, and *DPS* to capture firms' fixed asset investments, executive compensation, and dividend payments. *Fassets* is measured as the natural logarithm of the amount of fixed assets. *Lnpay* is calculated as the natural logarithm of the average cash compensation of the top three executives. *DPS* is dividend per share. Table 9 presents the regression results. The results show that the coefficient estimates of *GTP* are statistically insignificant for all three variables. This indicates that the implementation of TAIS does not systematically affect the fixed asset investments, executive compensation, and dividend payout policies of affected firms. In other words, firms do not

significantly slow down their expansion or weaken the interests of executives and shareholders in response to TAIS implementation. Moreover, when considered alongside our previous findings, the results in Table 9 provide evidence for our conjecture that firms strategically pass on the tax burden to employees after the implementation of TAIS.

Table 9. The effect of TAIS on other expenditures

Variable	*Fassets*	*Lnpay*	*DPS*
	(1)	(2)	(3)
GTP	–0.0099	0.0009	0.0051
	(–0.5283)	(0.0387)	(0.4800)
Constant	7.5270***	8.9855***	–0.6277***
	(7.6236)	(11.1438)	(–3.2645)
Controls	Yes	Yes	Yes
Firm/Year/Industry FE	Yes	Yes	Yes
N/R-squared	3,026/0.96	3,204/0.82	2,828/0.55

Note: This table reports the OLS results of other impacts of TAIS. We report robust standard errors clustered at the province level, and t-statistics are in parentheses. *, **, and *** represent significance at the 0.1, 0.05, and 0.01 levels, respectively.

5. Conclusions and implications

The effects of taxation on social welfare – including its impact on society, firms, and individuals – have long been subject to extensive debate. These effects are largely contingent on the level of tax enforcement. Recent technological advancements, such as the widespread adoption of big data and cloud computing, particularly in tax collection, have significantly enhanced tax enforcement capabilities. On one hand, these advancements have increased government tax revenues. On the other hand, the ways in which firms respond to an increased tax burden under heightened tax enforcement raise important questions about who ultimately bears the cost of taxation and whether advanced technologies introduce potential societal costs. These issues warrant further exploration.

In this paper, we contribute to this broader debate by examining the impact of tax enforcement on employee workplace safety within the context of China. Using the staggered implementation of province-level TAIS as an exogenous shock, we investigate how heightened tax enforcement affects workplace safety. TAIS is a tax collection infrastructure supported by cutting-edge technologies that have improved tax enforcement levels in China. Our staggered DID analysis reveals that the implementation of TAIS significantly reduces employee workplace safety, leading to an increase in workplace accidents and casualties. A series of robustness tests confirm the validity of these findings.

We then investigate three potential mechanisms through which TAIS implementation affects workplace safety. Our mechanism tests indicate that the impact of TAIS on workplace safety is more pronounced in firms that engaged in significant tax avoidance, in regions with lower pre-TAIS tax enforcement, in firms experiencing higher performance pressure, and in regions where employee bargaining power is weaker. These results suggest that, following

the implementation of TAIS, managers facing an increased tax burden strategically reduce workplace safety as a way to shift part of the tax burden onto employees.

Our further analysis sheds light on how TAIS implementation leads to changes in workplace safety. Our results reveal that TAIS implementation prompts managers to reduce workplace safety-related expenditures and increase existing employees' workloads through layoffs, both of which contribute to the decline in workplace safety. We also examine the broader outcomes of TAIS implementation and find that shareholder dividends, executive compensation, and firm size remain unchanged. Collectively, these findings suggest that TAIS implementation enables managers to shift the tax burden onto relatively disadvantaged employees, thereby preserving the interests of shareholders and themselves.

Our findings also carry significant implications for policymakers. While improving tax enforcement to deter tax evasion is crucial for tax authorities, governments should also consider the varying tax burdens that companies can bear, as well as the need for complementary policies. When corporate tax rates are high and enforcement is stringent, firms may have greater incentives to shift the tax burden onto other stakeholders, potentially undermining overall welfare and equality. Therefore, when designing policies to strengthen tax enforcement and reduce tax avoidance or combat tax evasion, policymakers might consider simultaneously adjusting tax rates moderately to reduce the legitimate tax burden on firms. Additionally, tax-related policies should be integrated with protective measures for vulnerable groups to minimize the risk of these groups such as employees – becoming unintended targets of tax burden shifting.

Moreover, policymakers could explore the application of new technologies to protect disadvantaged groups. The positive impact of technology often depends on how and where it is applied. If advanced technologies can enhance tax enforcement by more accurately identifying firms likely to engage in tax evasion, policymakers might also leverage these technologies to pinpoint employees who are more vulnerable to bearing shifted tax burdens after enforcement intensifies. By providing targeted support to these individuals, policymakers can mitigate the adverse effects on vulnerable groups during policy implementation.

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Author contributions

Xinyi Peng developed the empirical analysis, collected and analyzed the data, drafted and revised the manuscript, and edited the final manuscript. Jian Huang interpreted the results, drafted and revised the manuscript, and edited the final manuscript. Zhi Jin conceptualized the study, developed the empirical analysis, drafted and revised the manuscript, and reviewed and edited the final manuscript. Kam C. Chan reviewed and edited the final manuscript.

Disclosure statement

The authors have no relevant financial or non-financial interests to disclose.

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APPENDIX

Table A1. Sample selection

Description	Change in no. of obs	No. of obs remaining
Firms listed on Shanghai Stock Exchange and Shenzhen Stock Exchange in industries with high workplace safety hazard from 2010 to 2017		4,590
(1) Exclude samples with missing data required for variables in the multivariate analyses	508	4,082
(2) Exclude samples under special treatment	145	3,937
(3) Exclude firms listed in the year or after the year when TAIS is implemented in firms' located province	103	3,834
(4) Exclude central government-controlled firms	603	3,231

Note: This table presents the sample selection procedures.

Table A2. Variable definitions

Variable	Definition
Variables in the baseline analysis	
WorkAccident	A dummy variable that equals 1 if the firm has one or more employee workplace accidents in a given year, and 0 otherwise.
CasualtyNum	Natural logarithm of one plus the number of casualties due to workplace accidents in a given year.
GTP	A dummy variable that equals 1 in the current and subsequent years when TAIS is implemented in the region where the firm is located, and 0 otherwise.
Size	Natural logarithm of total assets at the end of year.
Lev	Total liabilities divided by total assets at the end of year.
Roa	Net profit divided by total assets at the end of year.
Tangible	Net value of fixed assets divided by total assets at the end of year.
Growth	Changes in sales revenue divided by lagged sales revenue.

Continue of Table A2

Variable	Definition
CF	Ratio of net operating cash flow to total assets.
Capex	Capital expenditures divided by total assets at the end of year.
Turnover	Total sales divided by total assets at the end of year.
SOE	A dummy variable that equals 1 if a firm is state-owned, and 0 otherwise.
Dual	A dummy variable that equals 1 if a firm's CEO and board chairperson is the same person in a given year, and 0 otherwise.
Connected	A dummy variable that equals 1 if there is any top manager had served as a government official in a given year, and zero otherwise.
Analyst	Natural logarithm of one plus the number of analyst teams that issue firms' forecast earnings annually.
Boardsize	Natural logarithm of one plus the number of board members at the end of year.
GDP	Natural logarithm of gross domestic product at the end of year.
Uuemp	The number of unemployment divided by the total population at the province level.
Additional variables in Table 7	
HighTaxAvoid	A dummy variable that equals 1 if a firm's average tax avoidance degree before the implementation of TAIS is above the sample median and 0 otherwise. Following Chen et al. (2010), we use the book-tax difference (BTD) to characterize firms' tax avoidance degree.
LowTE	A dummy variable that equals 1 if a firm is headquartered in a region with less rigorous tax enforcement before the implementation of TAIS and 0 otherwise. We use the ratio of actual tax revenue divided by expected tax revenue to characterize the tax enforcement intensity of each region pre-TAIS. Following Mertens (2003), the expected tax revenue for each region is estimated using the following model: $T_{i,t} / Y_{i,t} = \alpha + \beta_1 GDP_{i,t} + \beta_2 IND\_1_{i,t} + \beta_3 IND\_2_{i,t} + \epsilon_{i,t}$, where T_{it} is the tax revenue of region i in year t, Y_{it} is the gross domestic product of region i in year t, GDP_{it} is natural logarithm of per capita GDP in that region, and IND_1_{it} and IND_2_{it} represent the proportions of the primary and secondary industries in the gross domestic product, respectively.
LowSuper	An indicator variable that equals one if a firm is headquartered in a region with less stringent tax supervision before the implementation of TAIS and zero otherwise. We capture tax supervision using the ratio of problematic invoices inspected by local tax bureau to the total number of invoices.
HighAbETC	An indicator variable that equals one if a firm spends more to build relations with local governments before the implementation of TAIS and zero otherwise. Following Tang (2023), we use the abnormal ETC to capture the amount firms spend to build relations with local governments. We regress the following model by year and industry, and use the residual to proxy for the abnormal ETC. $ETC_{i,t} = \beta_0 + \beta_1 Size_{i,t} + \beta_2 Growth_{i,t} + \beta_3 Roa_{i,t} + \beta_4 Lev_{i,t} + \beta_5 Age_{i,t} + \beta_6 Soe_{i,t} + \beta_7 Firsh_{i,t} + \beta_8 Lnpay_{i,t} + \epsilon_{i,t}$, where $ETC_{i,t}$ is the ratio of ETC recoded in administration expense accounts to revenue of firm i in year t. We use ETC recorded in administration expense accounts, rather than the total ETC, as these expenses are mainly used for building non-sales-related networks (Tang, 2023). The data are collected from the footnotes of administration expense accounts.
HighIntensity	A dummy variable that equals 1 if a firm's labor intensity in a year is above the sample median and 0 otherwise.
HighProtect	A dummy variable that equals 1 if a firm is headquartered in a province with a better labor rights protection environment and 0 otherwise. We utilize the number of labor dispute cases accepted per 10,000 people in each province to characterize the local labor rights protection environment.

End of Table A2

Variable	Definition
Suspect	A dummy variable that equals 1 for firms that meet or beat the latest consensus of analysts' forecasts by two cents or less. We follow Caskey and Ozel (2017) to compute analyst forecast as the average of each analyst team's latest forecast issued within [–180, –4] days of actual earnings announcement date.
Pressure	A dummy variable that equals 1 if a firm's Roe just exceeds zero thresholds and below 0.02, and 0 otherwise.
HighSubsidy	A dummy variable that equals 1 if the aggregate amount of government subsidy a firm receives is higher than the median value in the industry and 0 otherwise.
Additional variables in Table 8	
SafetyExp	Natural logarithm of one plus the safety expenditure at the end of year.
SafetyExp/Emp	Natural logarithm of one plus safety expenditure at the end of year scale the number of employees at the beginning of year.
AbDiscExp	Abnormal discretionary expenses per employee, which is computed as the residual from the following model estimated for each industry and year with at least 15 observations: $SGA_{i,t} / Emp_{i,t-1} = \alpha + \beta_1 1 / Emp_{i,t-1} + \beta_2 Sale_{i,t-1} / Emp_{i,t-1} + \epsilon_{i,t}$. Where *SGA* is the total selling, general, and administrative expenditures, *Sale* is the total revenue, and *Emp* is the number of employees.
RevperEmp	Total revenue divided by the number of employees.
EmployeeNum	Natural logarithm of one plus the total number of employees in year $t + 1$.
ProworkerNum	Natural logarithm of one plus the total number of manufacturing workers in year $t + 1$.
Additional variables in Table 9	
Lnpay	Executive cash compensation, computed as natural logarithm of the average cash compensation of a firm's top three highest-paid executives.
DPS	Dividend per share.
Fassets	Natural logarithm of the aggregate amount of fixed assets.
Additional variables in Appendix	
ETR	Effective income tax rate, measured as the ratio of income tax payable minus deferred income tax scaled by total earnings.
Rate_Diff	The difference between statutory income tax rate and effective income tax rate.

Table A3. The impact of TAIS on tax aggressiveness

Variable	*ETR*	*Rate_Diff*
	(1)	(2)
GTP	0.0162*	–0.0169**
	(1.8321)	(–2.0968)
Constant	–0.4666	0.3506
	(–1.2916)	(1.0554)
Controls	Yes	Yes
Firm/Year/Industry FE	Yes	Yes
N/R-Squared	2,755/0.40	2,755/0.37

Note: The table presents results of the impact of TAIS on effective income tax rate and degree of tax avoidance. The dependent variable in column (1) is effective income tax rate, *ETR*, measured as the ratio of income tax payable minus deferred income tax over total earnings. The dependent variable in column (2) is tax avoidance, *Rate_Diff*, measured as the difference between statutory income tax rate and effective income tax rate. The control variables are the same as in Eq. (1). Following Chen et al. (2010), we truncate *ETR* to the range [0, 1], and we also delete variables with negative pre-tax earnings. We report robust standard errors clustered at the province level, and *t*-statistics are in parentheses. *, **, and *** represent significance at the 0.1, 0.05, and 0.01 levels, respectively.