

Evading by Any Means? VAT Enforcement and Payroll Tax Evasion in China^{*}

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ABSTRACT

We study how the enforcement of value-added tax (VAT) affects Chinese firms' evasion of payroll tax, which is collected by weakly empowered agencies. Using the central government's 2005 repeal of the agricultural tax to measure fiscal squeeze and subsequent enforcement effort of VAT collection, our instrumental variable estimation finds that the VAT enforcement leads to a significant increase in the payroll tax evasion. Examining firm heterogeneity and real responses suggests that increased payroll tax evasion mainly stems from cost optimization by small and cash-constrained private firms. Our paper echoes a growing literature to highlight the importance of understanding compliance spillover across taxes.

1. Introduction

Tax evasion by individuals and firms is pervasive in developing countries (Besley and Persson, 2014). Recent literature attests to the effectiveness of various policy interventions, such as auditing (Best, Brockmeyer, Kleven, Spinnewijn, and Waseem, 2015; Bø, Slemrod, and Thoresen, 2015; Kleven, Knudsen, Kreiner, Pedersen, and Saez, 2011; Slemrod, Blumenthal, and Christian, 2001), third-party reporting (Kopczuk and Slemrod, 2006; Pomeranz, 2015), public disclosure (Luttmer and Singhal, 2014), and incentive schemes for tax agencies (Khan, Khwaja, and Olken, 2015, 2019; Chen, 2017) in reducing tax evasion. However, the effects of those policies may be compromised if increasing enforcement for one tax aggravates evasion in other areas. For example, when tax authorities enhanced monitoring technology over gross revenue, firms may switch to informal sector or inflate the reported volumes of input costs that are not subject to monitoring technology (Carrillo, Pomeranz, and Singhal, 2017; Slemrod, 2019; Waseem, 2018).

Motivated by the multidimensional nature of tax evasion, this paper studies how enforcement of the value-added tax (VAT), the tax levied on the value-added of commodities during the production process, gives rise to payroll tax evasion by manufacturing firms in China. We focus on VAT as an essential dimension in tax enforcement for three reasons. First, VAT has been the most important source of government revenue since the central government in China implemented the tax-sharing reform in 1994 (Shen and Zou, 2015). Second, there is enormous variation in VAT collection capability at the local level. Local administrations differ considerably in their abilities of managing economic policies and raising VAT revenue thanks to a regionally decentralized system in China (Jin, Qian, and Weingast, 2005; Xu, 2011; Zhang and Zou, 1998). Third, VAT collection is a fundamental public finance issue around the world (Almunia and Lopez-Rodriguez, 2018; Das-Gupta, Lahiri, and Mookherjee, 1995; Pomeranz, 2015; Tran-Nam, Evans, Walpole, and Ritchie, 2000). This feature warrants the external validity of our research for better understanding the constraints of fiscal capacity.

Meanwhile, the payroll tax (social security contribution) occupies an important place in public revenue (Adam, Phillips, and Roantree, 2019). Unlike VAT, payroll tax revenues are collected by weakly empowered social security

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offices.¹ The payroll tax revenues accrue separately to social security funds and cannot be used for other purposes. The separation of revenue collection and spending between the VAT and the payroll tax renders a coordination problem. Consequently, when the enforcement of VAT becomes more stringent, cash-constrained firms evade payroll taxes to save total costs and maintain their survival in the market.

We utilize the central government's 2005 repeal of the agricultural tax to identify the impacts of VAT enforcement. Before 2005, the agricultural tax was collected by county administrations. The repeal of the agricultural tax created a revenue shortage for counties and resulted in varying incentives to enhance the collection of other taxes, most notably VAT, depending on the loss from forsaking the agricultural tax (Chen, 2017). Meanwhile, due to the separation between social security fund and local administrations' budget, the repeal of the agricultural tax did not directly affect the enforcement of payroll tax. Taking advantage of this feature, we calculate county-specific revenue shocks based on counties' preexisting revenues of the agricultural tax, and use the revenue loss as an instrumental variable to estimate the effect of VAT enforcement on payroll tax evasion.

Our empirical investigations employing comprehensive panel data of manufacturing firms attest to a pronounced pattern of evasion substitution between the VAT and the payroll tax. In the baseline estimation using all private firms whose sales are above 500 million yuan (about 720 thousand US dollars) in China, a one percentage point increase in the effective VAT rate led to a 3.25 percentage points decrease in the effective payroll tax rate paid by the firms. The results survive a set of robustness checks that account for various confounding factors, firm dynamics, and alternative measures of VAT rates and revenue losses.

We complement the baseline results with several investigations of the potential mechanisms. First, firms responded to VAT enforcement by reducing employment, liquid assets, and debt; however, the pattern of payroll tax evasion is unlikely to be driven by these real responses. Second, firms evade the payroll tax more when they are financially constrained and when they face fiercer market competition. Third, we conduct a placebo test using state-owned enterprises (SOEs), which are less susceptible to cash constraint and profit losses thanks to the soft budget (Kornai, Maskin, and Roland, 2003). We do not find a similar pattern of payroll tax evasion. Altogether, these results attest to our prior that the negative enforcement spillover effect is driven by the business stress and cash strain.

Our paper speaks to a growing literature concerning the compliance substitution or spillover across different policies and across different regulatory agencies (Rinke and Traxler, 2011). The literature has explored evasion substitution between different margins of the same tax (Asatryan and Peichl, 2017; Carrillo et al., 2017; Slemrod, Collins, Hoopes, Reck, and Sebastiani, 2017), between different periods of time for the same tax (Advani, Elming, and Shaw, 2017; Kleven et al., 2011), or substitution among different subsidiaries within the firm (Boning, Guyton, Hodge, Slemrod, and Troiano, 2018).

A notable recent contribution to this literature is López-Luzuriaga and Scartascini (2019), who propose an analytical framework for understanding the mechanisms of compliance spillover across different types of taxation. They argue that changing enforcement effort or severity of punishment for noncompliance in one type of tax may induce taxpayers to update their belief about enforcement of other taxes. In turn, whether compliance spillover across taxes is positive or negative depends on the correlation of detection probabilities for different types of tax evasions. Whereas López-Luzuriaga and Scartascini (2019) report a positive compliance spillover from property tax to sales tax, our paper suggests that spillover could be negative in some circumstances. A substitution of tax evasion tends to arise when tax agencies are fragmented and cash-strained firms economize their cost through evading tax collected by the weakly empowered agencies.²

In addition, our study relates broadly to the literature examining fiscal capacity in developing countries (Besley and Persson, 2014; Best et al., 2015; Gordon and Li, 2009; Jensen, 2019). Our findings have a policy implication that the enhancement of state capability in one policy domain may unintentionally impose social costs in other areas. This logic extends to the phenomenon of displaced illegal activities, where strengthened enforcement in some areas aggravates institutional loopholes in other areas, such as import duty enforcement (Yang, 2008), crime deterrence (Amodio, 2017; Gonzalez-Navarro, 2013), and pollution regulation (Gibson, 2019; Fullerton and Karney, 2018; Hansman, Hjort, and León, 2018).

Our paper also relates to the literature examining the interplay between decentralization and state capacity (Bard-

¹In the recent years, some provinces adopted policy reforms to allow local tax administration to aid social security offices in collecting the payroll tax. However, the management of social security funds still reside in social security offices. See Section 2 for details.

²By weakly empowered agencies, we mean a slackness in tax enforcement. Analytically, this can be understood as a relatively flat slope of detection probability function or mild punishment, and thus, a relatively small marginal cost of noncompliance when increasing payroll tax evasion. Consequently, strengthening enforcement of VAT may induce more payroll tax evasion.

han, 2016). Cai and Treisman (2004) propose a model of decentralization, in which weak enforcement of tax policies emerges from interregional competition for investments. Mast (2020) attributes 30 percent of tax exemptions received by firms in the state of New York to interregional competition. Burgess, Hansen, Olken, Potapov, and Sieber (2012) document that intensive interregional competition for revenues aggravates deforestation in Indonesia. Our paper suggests that a negative externality may arise not only from spatial interaction, but also from inter-departmental spillovers. As a result, increasing enforcement of one policy may compromise the performance of weakly empowered branches. The findings in this paper lend support to the argument for increasing policy coordination within bureaucratic systems (Weyland, 1998).

The remainder of the paper is organized as follows. Section 2 introduces the background of China's fragmented tax systems. Section 3 describes the data. Section 4 introduces the empirical strategy. Section 5 provides the baseline results and robustness checks. Section 6 explores potential mechanisms of payroll tax evasion and real responses of firms to VAT enforcement. Section 7 concludes.

2. A Tale of Three Taxes

2.1. Social Security Tax in China

In China, employers and employees share the responsibilities of contributing to two kinds of social security funds: pension (basic old-age insurance, BOAI) and public health insurance.³ The statutory social security contribution rates require that employers deposit 20% for pension and 6%-10% for health insurance worth of employees' wages. Aside from employers' contribution, employees are required to make a 10% contribution out of their own wages to the social security system. Although the statutory rates were reduced in 2019 as part of the fiscal stimulus package, social security contributions remain a significant share of firms' cost.⁴

Two features of the social security system render social security payments a tax paid by firms rather than savings on behalf of employees. First, China's social security system is regionally fragmented (Fang and Feng, 2018). Local social security bureaus have substantial power over managing pension funds and distributing social security benefits. Moreover, employees are unable to carry their entitled benefits when they move to another city due to the lack of a nationally unified pension system.

Second, the pension system adopts a mixture of pay-as-you-go system and personal account. Whereas the contribution by employees is deposited into their personal accounts, the contribution by employers goes to the pay-as-you-go system without a guarantee for future pension benefits. In reality, local social security offices may divert funds in personal accounts to support the pay-as-you-go system. As a result, the saving in personal accounts is only used for calculating pension payment after retiring. This operation makes the personal account essentially an accounting tool rather than an investment. Thus, the pension is functionally equivalent to a pay-as-you-go system. According to a report by the Ministry of Human Resources and Social in 2016, the deficit in personal accounts was as large as 90% of the total pension fund. These institutional frictions undermine the incentives of compliance to social security payments (Giles, Wang, and Park, 2013; Giles, Meng, Xue, and Zhao, 2018).

The administrative system for payroll tax collection is weakly empowered and fragmented. Local social security offices were responsible for payroll tax collection before the 1990s. In 1998, the pension funds around the country faced a severe challenge of payment deficit due to surging laid off workers after the massive privatization of state-owned enterprises (?). To sustain the social security system, the Ministry of Finance recommended local tax administrations to help collect payroll taxes and delegated the decision to provincial governments.⁵ However, this reform did not significantly enhance the revenue collecting capability as desired. Most provinces adopting this reform only authorized local tax administrations to collect the revenue, and left the job of calculating and monitoring payroll tax payments to social security offices. In addition, in many regions local treasury bureau also takes part in policy implementations related to the social security system. As a result, local tax administrations did not have access to the payroll information of firms, neither did they have a strong incentive to enhance payroll tax collection, which ultimately accrues separately to social security funds (Liu, 2011). Presumably due to the coordination problem between payroll tax offices and local

³There are other kinds of small social insurance program for employees, including unemployment insurance, injury insurance, and maternity insurance. Since the contributions to these programs are much less than those to basic old-age insurance and health insurance, here we only focus on the latter two programs.

⁴<https://tinyurl.com/rj769oz>. See Fang and Feng (2018) for a detailed introduction to China's social security system.

⁵In China, the State Tax Administration and local tax administrations had been two separate agencies. The STA was responsible for collecting VAT, income tax, and consumption tax. LTAs' jobs include collecting property tax, road tax, and sales tax from the service industry. The STA and LTAs were integrated in the administrative reform by the State Council in 2018.

tax administrations, only 18 provinces (out of 31) delegated revenue collection to local tax administrations as of 2008. Empirical evidence on the effectiveness of this reform is limited and inconclusive (Peng, Liu, and Lin, 2015; Tang and Feng, 2019).

Overall, local governments are weakly incentivized to collect payroll tax. The payroll tax deters employers' incentives to expand investment and employment, which are the primary focus of local governments.⁶ At the same time, stringent regulations on the usage of social security funds prohibit local governments from diverting social security funds for other purposes (Meng, 2012). Lacking personnel assistance from local governments, social security offices fall short of regulatory teeth to detect tax evasion and impose punishment on employers.

In turn, evasion on the payroll tax is prevalent. Employers resort to various mechanisms of payroll tax evasion, including underreporting wages, postponing social security payments, and hiring temporary workers (Nyland, Smyth, and Zhu, 2006). Some enterprise surveys reported that 70% of firms paid less than the statutory rate in 2019.⁷ According to a 2018 report by *Caixin*, an influential Chinese business magazine,

*If all companies are required to fully meet their social insurance payment obligations, the average costs for businesses will increase by 30% ... To reduce costs, it is common for employers to find ways to avoid making the full contributions, for example by dividing compensation into basic wages and bonuses, paying taxes only on basic wages, or by hiring more temporary workers to skirt social security obligations.*⁸

2.2. VAT Collection

In contrast to the payroll tax, the VAT was collected by the State Tax Administration with the assistance by local governments. VAT evasion used to be a ubiquitous phenomenon in China due to limited fiscal capability. The means of evasion include cash transaction, falsified accounts and transaction, and using fake invoices for input investments to deduct from value added. Fan, Liu, Qian, and Wen (2018) find that the nationwide adoption of the electric invoice system in 2001 provided a large regulatory overhaul for revenue-collecting capabilities, attesting to severe preexisting slackness in VAT enforcement. Indeed, the average comparable VAT payment rate in our sample, which covers all above-scale industrial firms in 2001-2007 before the adoption of the electric invoice system, is only 12%. This rate remained considerably lower than the statutory rate of 17%.

Local governments play a pivotal role in shaping the effectiveness of VAT collection. Although the State Tax Administration is vertically managed (senior officials of STA's local branches are appointed by STA instead of local executives), they have limited resources and capacity to detect evasion and impose punishment for non-compliance. Moreover, local governments have relatively strong incentives to help VAT enforcement because they obtain a fixed share of the VAT revenue.⁹ Consequently, the intensity of VAT largely hinges on the incentive of local governments to facilitate VAT collection.

2.3. Agricultural Tax

Before 2005, peasants in China paid agricultural taxes equivalent to approximately 15% of the value of total yields. Revenues from agricultural taxes mainly accrued to county governments. Over 2000-2004, agricultural taxes accounted for more than 17% of the tax revenue of county governments. Figure 1 demonstrates the distribution of the period-average ratio of agricultural taxes in tax revenue, suggesting large regional variation in dependence on agricultural taxes.

The central government formally repealed the agricultural tax on the first day of 2006. Before 2006 several rounds of small-scale experimentations of repeal were implemented. Effectively, local administrations had mostly followed the instruction by the central government and stopped collecting agricultural taxes during 2005. From local administrations' perspective, the repeal of agricultural tax posed an exogenous shock applied to all regions across the country. Figure 2 shows a dramatic increase in the average share of VAT revenue in county administrations' budget after 2005. This pattern is consistent with the premise of "fiscal squeeze" (Chen, 2017), which maintains that county governments faced severe revenue shortage after the repeal of the agricultural tax and had to increase VAT enforcement.

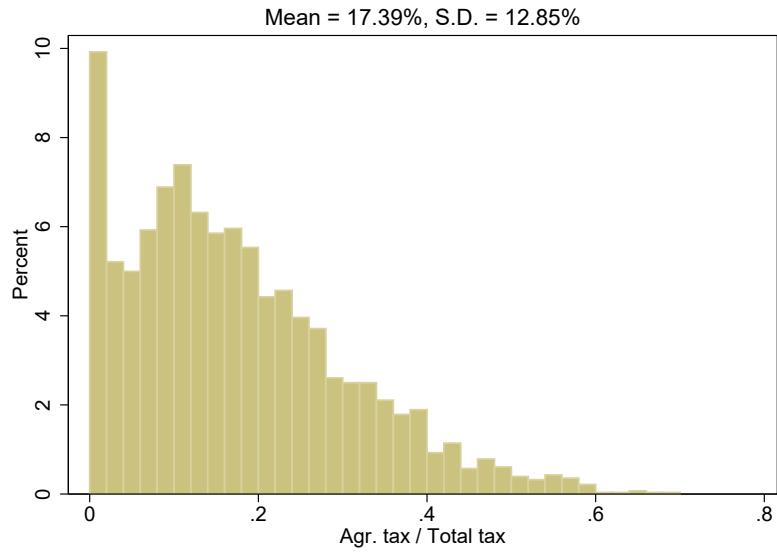
⁶Persson and Zhuravskaya (2016) find that Chinese provincial party secretaries who had spent a higher share on health care and education and a lower share on growth-enhancing infrastructure investments in the public expenditure were less likely to be promoted.

⁷<https://tinyurl.com/yx5rtq2k>.

⁸<http://weekly.caixin.com/2018-08-24/101318354.html>.

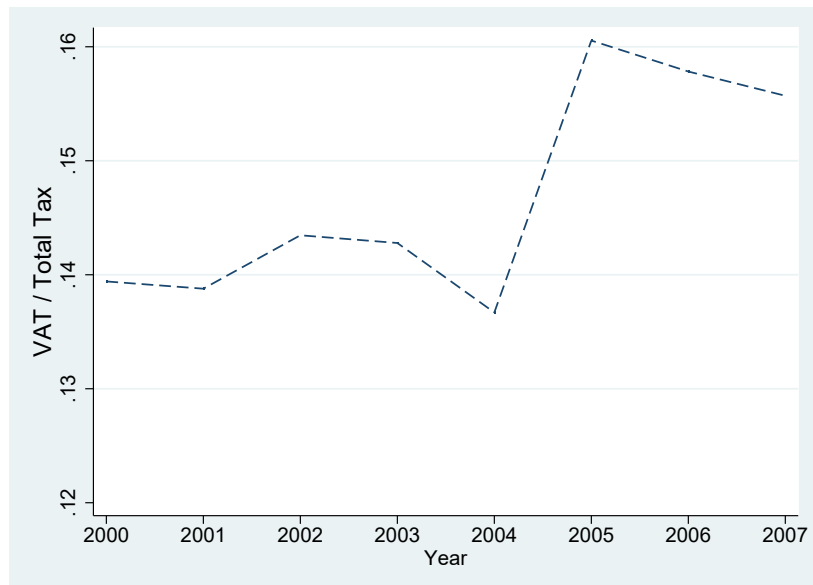
⁹Local governments obtain 25% of VAT revenues after the tax-sharing reform in 1994.

Figure 1: Distribution of Agricultural Tax Share



Note: This graph plots the distribution of the share of agricultural tax in total tax revenue, by county, in 2000-2004. Source: *Sub-Provincial Public Finance Statistics*, published by the Ministry of Finance.

Figure 2: VAT-to-Total Tax Ratio



Notes: The figure plots the ratio of VAT revenue to total tax revenue at the national level, by year. Source: *Sub-Provincial Public Finance Statistics*, published by the Ministry of Finance.

3. Data

3.1. Data Description

The firm-level data we use are from the *Annual Survey of Industrial Firms*, conducted by the National Bureau of Statistics of China. The data provide comprehensive information about key performance and finance indicators for all manufacturing firms with annual sales greater than RMB 5 million yuan (approximately 720 thousand US dollars). The National Bureau of Statistics of China implements a stringent policy of data confidentiality and prohibits using the survey for tax auditing. This approach ensures firms' incentive to report truthfully of their tax payments. We focus on firms' payments of the VAT and payroll tax. We also utilize a set of firm characteristics, including industry, county location, ownership structure, total sales, profits, and total wages.

We examine the 2001-2007 period for two reasons. First, the payroll tax data are unavailable before 2001. Second, the composition of fiscal revenue for county governments changed considerably after 2008 due to the Chinese government's stimulus package (Bai, Hsieh, and Song, 2016; Han and Kung, 2015). We focus on the sample of private firms for most of the analyses but explore the pattern of SOEs for a comparison. Following Cai and Liu (2009), we drop outliers to obtain a consistently reliable sample.

We obtain fiscal information at the county level from the *Sub-Provincial Public Finance Statistics* published by the Ministry of Finance in China. We use agricultural tax, budget revenue, and fiscal transfer to compute revenue losses due to the repeal of agricultural tax in 2005. Counties' level of development is likely to affect their capability and incentive for tax enforcement. To address confounding factors on tax collection, we control for a set of county-level variables such as GDP per capita and social security subsidy. In addition, the regional variation in payroll tax enforcement may be shaped by the share of retirees in the county's population. We include the elderly population ratio from the 2010 Population Census data as a proxy for the ratio of retirees.

3.2. Measurement of the Main Variables

Effective payroll tax rate. We focus on two major items of social security contributions. The first is basic old-age insurance, and the second is health insurance. These two contributions consist of an overwhelming part of the social security payments by employers in China.¹⁰ We measure the effective payroll tax rate as the ratio between a firm's total payment on these two items and the total wage.

Effective VAT rate. In principle, the tax base of VAT is the total value-added. However, in China a large share of input, including fixed asset investments and services, was not deductible from VAT payment in 2001-2007¹¹. We thus compute the effective VAT rate as the ratio of a firm's payable VAT to their total sales. We also follows the standard definition to measure the effective VAT rate as the ratio of VAT payment to total value added for a robustness check. The sample mean of VAT-sales ratio is 6.6%, and that of the VAT-value-added ratio is 12%, suggesting prevailing incompleteness of VAT enforcement compared with the statutory VAT rate, 17%.

Agricultural tax loss. The repeal of agricultural tax at the national level in 2005 incurred varying revenue losses for county governments. To relieve the revenue shortage for counties, the central and provincial governments adopted a formula-based transfer program targeting counties affected by the repeal of the agricultural tax. Overall, however, those transfers were limited, and counties were unable to recover the full revenue loss (Hou, 2011). Following Chen (2017), we measure each county's revenue loss induced by the repeal of agricultural tax as the following:

$$\text{Agr.Tax Loss}_c = \frac{\text{Agr.Tax}_{c,2000-2004} + \text{Transfer}_{c,2000-2004}}{\text{Tax.Rev}_{c,2000-2004}} - \frac{\text{Transfer}_{c,2005-2007}}{\text{Tax.Rev}_{c,2005-2007}} \quad (1)$$

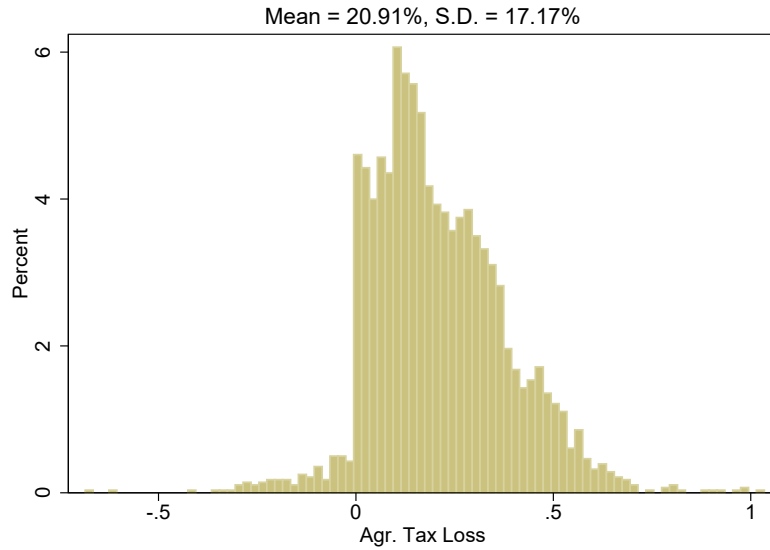
In equation (1), $\text{Agr.Tax}_{c,2000-2004}$ is the period average of revenues from agricultural taxes in county c in the 2000-2004 period. $\text{Transfer}_{c,2000-2004}$ and $\text{Transfer}_{c,2005-2007}$ are the averages of formula-based transfers associated with the losses due to the repeal of the agricultural tax. $\text{Tax.Rev}_{c,2000-2004}$ and $\text{Tax.Rev}_{c,2005-2007}$ measure counties' tax revenue, including VAT (shared with the central government), corporate income tax, business tax, and other tax revenues, but they do not include other off-budget revenues, such as land sales revenues¹².

¹⁰The Annual Survey of Industrial Firms only reports the sum of basic old-age insurance and health insurance for each firm.

¹¹Capital expenditure was not deductible until 2009. Input in the service sector was not deductible until 2016.

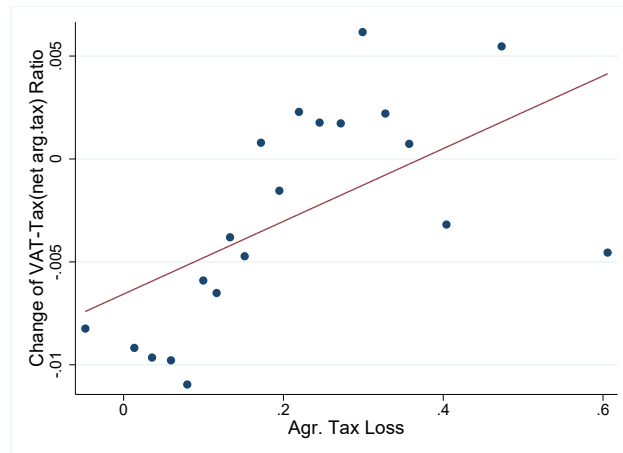
¹²We compute the correlation between the revenue loss measure and county-level fiscal revenue growth from 2005-2007 and find a non-significant coefficient, suggesting that the increase of VAT-to-revenue ratio is not driven by spurious trends that come with growth.

Figure 3: Distribution of Agricultural Tax Losses



Notes: This graph plots the distribution of $Agr.Tax Loss_c$, by county. The revenue loss is calculated based on equation (1). Source: Authors' calculation based on *Sub-Provincial Public Finance Statistics*, published by the Ministry of Finance.

Figure 4: Agricultural Tax Losses and VAT Ratios



Notes: This figure presents the binned scatterplot of before-and-after changes in VAT-to-revenue ratios against the revenue losses due to the repeal of agricultural tax. Source: *Sub-Provincial Public Finance Statistics*, published by the Ministry of Finance.

Figure 3 plots the distribution of $Agr.Tax Loss_c$ across 2,161 counties in the sample. Most of the counties incurred a loss following the reform. The average loss is about 20.9%. The ratio can be as high as 80% in extreme cases. The regional variation in revenue loss may stem from various reasons, such as the share of the agriculture sector, number of firms, social ties between heads of county governments and their superiors, and other idiosyncratic factors. These predetermined features shaping revenue dependence on agriculture are not directly related to the finance of the social

Table 1
Summary Statistics

Variable	Observations	Mean	S.D.	Median	Min	Max
Effective payroll tax rate	793,940	6.597	10.68	0.876	0	51.41
Payroll tax payment	793,940	399.8	6,453	9	0	1,518,000
log (payroll tax payment)	793,940	2.497	2.647	2.303	0	14.23
Effective VAT rate	793,940	3.633	2.997	3.07	0	14.48
VAT payment	793,940	2,968	59,665	480	0	22,700,000
log (VAT payment)	793,940	5.94	2.161	6.176	0	16.94
Corporate income tax/ sales	793,940	0.821	1.718	0.163	0	209.3
Corporate income tax payment	793,940	923.2	25,183	26	0	12,400,000
Wages	793,940	3,393	31,187	990	1	5,853,000
Employees	793,940	224.5	1,054	92	10	156,965
Sales	793,940	75,275	797,788	17,920	500	195,000,000
Export-sales ratio	793,940	0.104	0.302	0	0	61.79
Input-output ratio	793,940	0.736	0.13	0.75	0	0.999
Profit rate	793,940	0.105	0.275	0.039	-21.16	36.49
Capital intensity	793,940	1.157	3.519	0.669	0.003	1,320
Agricultural tax loss	793,940	0.158	0.117	0.128	-0.606	1.026

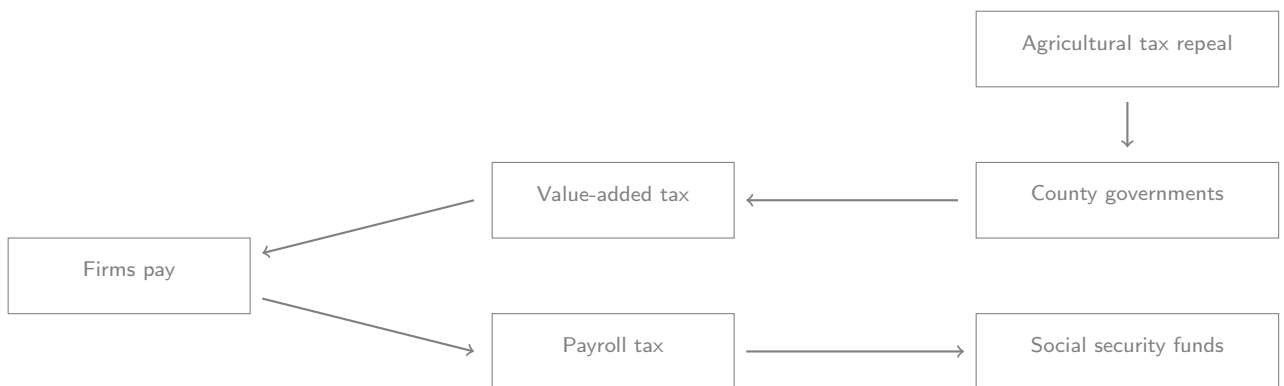
Note: This table provides descriptive statistics for private industrial firms in 2001-2007. The effective payroll tax rate is defined as social security contribution/sum of wages. The effective VAT rate is defined as VAT / sales \times 100. Capital intensity is defined as total assets/sales volume. The profit rate is defined as profits/total assets. The exports-sales ratio is defined as exports/sales \times 100. The input-output ratio is defined as intermediate inputs/total value of products and services \times 100. Agricultural tax loss is computed at the county level as net tax revenue loss due to the repeal of agricultural tax according to equation (1) in section 3.2.

security system.

Figure 4 shows that the revenue losses due to the repeal of agricultural tax are positively associated with the increases of VAT-to-revenue ratio after 2005 at the county level. Consistent with the intuition of fiscal squeeze, revenue losses for county governments are correlated with a higher degree of VAT intensity.

Table 1 provides a summary of statistics for the key variables used in the empirical analyses.

Figure 5: Illustration of the Identification Strategy



4. Empirical Strategy

Estimating the effect of VAT enforcement on firms' compliance with payroll tax payment by ordinary least squares may be biased due to unobservable contextual factors shaping VAT and payroll tax compliance at the same time. Improvements in monitoring technology, tax collection personnel, economic booms, and other firm-level unobservable

factors may contribute to a co-movement of revenues collected by different departments. To deal with the concern about endogeneity, we adopt an instrumental variable approach, exploiting largely exogenous regional variations in revenue losses due to the repeal of agricultural tax.

3.2 graphically presents the identification strategy. Firms pay payroll taxes on top of VAT. Importantly, the revenues from firms' VAT and payroll tax collection accrue to different accounts. While a portion of VAT revenues are used to finance county governments, payroll tax payments are separately saved in social security funds. After the repeal of agricultural tax in 2005, county administrations facing more severe revenue losses are forced to exert greater effort on VAT, but not social security payments.¹³ In turn, VAT enforcement pose more severe challenges for firms to maintain profits and survive. Thus, firms respond by evading their payroll tax duties.

Our identification assumption requires that regional variations in revenue losses were not directly affected by the efficacy of payroll tax collection. This is a reasonable assumption because the social security system is separately managed and subject to stringent regulations. Diverting pension funds to ease local fiscal pressure is strictly prohibited.¹⁴

We follow a two-step approach of the instrumental variable estimation. The first step exploits cross-county and over-time variation in agricultural tax revenue losses after 2005. Specifically, we employ a difference-in-difference approach to estimate the effect of fiscal squeeze on the effective VAT ratio.

$$\text{VAT rate}_{ict} = \alpha \text{Agr.Tax Loss}_c \times \text{Post}_t + \gamma X_{it} + \delta_i + \lambda_t + \epsilon_{ict} \quad (2)$$

In equation (2), VAT rate_{ict} is the effective VAT rate for firm i located in county c in year t . Agr.Tax Loss_c is the revenue loss defined by equation (1). Post_t is a dummy indicating the years after 2005, when the repeal of the agricultural tax was implemented across the board. X_{it} is a vector of variables for firm characteristics, including the logarithm of employees, sales, capital-intensity, profit rate, input-output ratio, and export-sales ratio. In all the regressions, we control for firm fixed effects (δ_i) and year fixed effects (λ_t). We cluster the standard errors at the county level. α is the main parameter of interest in the first-stage estimation. The parallel-trend assumption associated with equation (2) requires that there is no systematic difference in the trends of the VAT enforcement among counties exposed to different Agr.Tax Loss_c before the treatment. We test this assumption in Section 5.1.

$$\text{Payroll rate}_{ict} = \beta \widehat{\text{VAT rate}}_{ict} + \gamma X_{it} + \eta_i + \mu_t + \sigma_{ict} \quad (3)$$

The second-stage as specified by Equation (3) estimates the effective payroll tax rate as a function of VAT rate_{ict} as predicted by equation (2). In equation (3), $\text{Payroll rate}_{ict}$ is firm i 's effective payroll tax payment rate. β is the main parameter of interest. η_i and μ_t stand for firm and year fixed effects. σ_{ict} is a term of random disturbance at the firm-year level. As in the estimation for equation (2), we cluster the standard errors of estimates at the county level. In section 5.2, we also provide reduced-form estimates for the effective payroll tax rate using $\text{Agr.Tax Loss}_c \times \text{Post}_t$ as an explanatory variable.

5. Results

5.1. Fiscal Squeeze

Column (1) in Table 2 presents the first-stage estimates according to Equation (2), without firm-level controls. The estimated coefficient for the interaction term is 0.552 and statistically significant at the 1% level. In column (2), we include additional firm-level control variables, such as logged employees and value-added, capital intensity, profit rate, export-sales ratio, and input-output ratio. The estimated coefficient is 0.872 and significant. Given the average revenue loss of 20.9% in the sample, the repeal of agricultural tax promotes the effective VAT rate by 0.18 percentage point, or 5% increase from the pre-2005 level. These estimates attest to a sizable effect of fiscal squeeze due to the repeal of the agricultural tax.

¹³There are other kinds of tax revenue from firms in addition to VAT, for example, corporate income tax. Since corporate income tax is collected based on profit, while VAT is computed based on value added, we only consider the VAT burden in most of our specifications. In a robustness check, we aggregate all taxes except the payroll tax as an alternative measure of the tax burden.

¹⁴In 2006, the National Audit Office (NAO) conducted an audit for RMB 220 billion yuan social security fund used in the fiscal year of 2005, which accounted for 46.5% of the total amount in 2005. The NAO reported that violation funds were RMB 7.1 billion yuan, which accounts for 3.2% of the total audited fund. Considering that local government spent RMB 2,586.6 billion yuan in 2005, the scale of violation in the usage of social

Table 2
Agricultural Tax Repeal and VAT Enforcement

Dependent variable: Mean of D.V.	Effective VAT rate 3.633	
	(1)	(2)
Agr. Tax Loss \times Post	0.552*** (0.199)	0.872*** (0.198)
ln (Sales)		-0.510*** (0.024)
ln (Employees)		0.386*** (0.021)
Export-Sales Ratio		-0.007 (0.032)
Input-Output Ratio		0.228*** (0.088)
Profit Rate		0.544*** (0.073)
Capital Intensity		-0.001 (0.003)
Firm FE	Y	Y
Year FE	Y	Y
Observations	708,374	708,374
R-squared	0.712	0.716

Note: Robust standard errors clustered at the county level are reported in parentheses. Firm-level controls include logged employees and value-added, capital intensity, profit rate, export-sales ratio, and input-output ratio. ***, **, and * denote significance at the 1%, 5%, and 10% level.

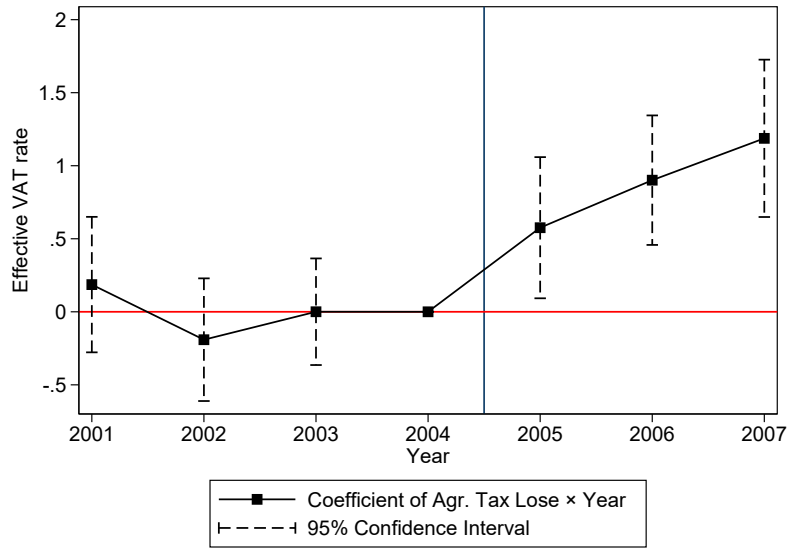
Figure 6 demonstrates the estimates for the dynamic effects of the repeal of the agricultural tax. We generalize the difference-in-difference estimations in Equation (2) by interacting Agr. Tax Loss_c with a set of year dummies. Using 2004 as the reference point, the results show that counties that are exposed to heavier revenue losses do not behave differently on VAT collection before 2004, and are associated with a significant rise in the effective VAT rates after 2005. Thus, the findings presented by Figure 6 do not support the premise that the repeal of the agricultural tax was motivated by any considerations related to VAT collection.

5.2. VAT Enforcement and Payroll Tax Compliance

Table 3 presents several estimates for the relationship between VAT enforcement and payroll tax compliance. First, column (1) reports OLS estimates. The coefficient for the effective VAT rate is positive but small (0.062), suggesting potential omitted variable bias in the estimates due to contextual factors. In columns (2) and (3), we conduct a reduced-form estimation for the effective payroll tax rate, using $\text{Agr. Tax Loss}_c \times \text{Post}_t$ as an explanatory variable. Consistent with the proposed argument about indirect impacts of fiscal pressures on payroll tax compliance, the coefficients of the interaction terms are negative and statistically significant. The results are similar with and without firm-level controls.

Columns (4) and (5), respectively, present the two-stage least squares estimates with and without firm-level controls. The coefficients for the effective VAT rate are negative and significant. The Cragg-Donald statistics obtained for the first-stage estimations reject the hypothesis of weak instruments by a large margin. According to column (5), a one percentage point increase in the effective VAT rate leads to a reduction of the effective payroll tax rate by 3.251

security fund was relatively small. Moreover, most cases of violation involved investment restrictions (for example, investing the social security fund in hotel and parking lots for higher returns) rather than diverting the fund to support administrative expenditure. The audit report can be found in http://www.gov.cn/zwggk/2006-11/24/content_452459.htm.

Figure 6: Dynamic Effects on the Effective VAT Rate

Note: Robust standard errors are clustered at the county level. The points connected by the solid line indicate the estimated coefficients of the Agr. Tax Loss interacted with the year dummies. The dashed lines indicate the 95% confidence intervals. The blue vertical line marks the timing of the repeal of the agricultural tax. Year 2004 is omitted as the reference year.

percentage points. The estimate translates to an elasticity of roughly 1.8 fixing the effective payroll tax and VAT rates at the sample means. In a back-of-the-envelope calculation, increasing the VAT payment by RMB 1 yuan is associated with a RMB 0.15 yuan decrease in the social security contribution.¹⁵ Putting the results in Table 2 and Table 3 together, the repeal of the agricultural tax is associated with an increase in VAT revenue by RMB 186 billion yuan per year and a decrease in the payroll tax revenue by $186 \times 0.147 = 27.3$ billion yuan per year in 2005-2007.¹⁶ This finding is consistent with previous researches showing that firms deal with tax enforcement by misreporting their revenues and costs (Carrillo et al., 2017; Slemrod et al., 2017), and it provides an additional channel of tax evasion substitution between different types of liability margins.

5.3. Robustness

Table 4 provides several robustness checks, using alternative specifications and measures to estimate effective payroll tax rates and accounting for confounding factors.

County-specific features affecting payroll tax collection. First, payroll tax enforcement may be sensitive to local socioeconomic conditions that shape fiscal pressures of social security offices. We deal with this issue by including two control variables reflecting the demand and supply sides of social security funds. The first control variable is the population share of individuals over age 65, which captures the demand for pension funds. The second control variable is the ratio of social security subsidy in counties' budgets. We also control for the level of per capita GDP, which may be

¹⁵The calculation is as follows: average wages (3,393) × 3.251/average sales (75,275) = 0.147.

¹⁶The calculation takes three steps. First, we calculate the increase in the effective VAT rate associated with the repeal of the agricultural tax. Note that the average intensity of agricultural tax loss (weighted by the number of firms at the county level), as specified by Equation (1), is 0.158. The estimated coefficient for the marginal effect of the agricultural loss on the effective VAT loss obtained in the Column (2) of Table 2 is 0.872. So the increase in the effective VAT rate associated with the repeal of the agricultural tax is $0.158 \times 0.872 = 0.138$ percentage point. Second, we estimate the increased amount of VAT paid by individual firms. Note that the mean of annual sales in the 2005-2007 sample is RMB 888.9 million yuan. So the increase in VAT per firm is roughly $0.138\% \times 888.9 \approx 1.227$ million yuan. Third, we calculate the total increase of VAT paid by the above-scale industrial firms. The 2005-2007 sample has on average 151,849 firms every year. So the overall VAT revenue increase is $1.227 \text{ million} \times 151,849 \approx 186.3$ billion yuan. The total evasion of the payroll tax revenue associated with the repeal of the agricultural tax is $186.3 \times 0.147 \approx 27.4$ billion yuan.

Table 3
Effects of Tax Enforcement on Payroll Tax Evasion

Dependent variable: Mean of D.V.	Effective payroll tax rate 6.597				
	OLS (1)	Reduced form (2)	Reduced form (3)	2SLS (4)	2SLS (5)
Effective VAT Rate	0.062*** (0.020)			-4.657** (2.378)	-3.251** (1.317)
Agr. Tax Loss × Post		-2.572*** (0.934)	-2.835*** (0.931)		
ln (Sales)			0.375*** (0.077)		-1.282* (0.677)
ln (Employees)			-0.949*** (0.090)		0.306 (0.526)
Export-Sales Ratio			-0.075 (0.076)		-0.099 (0.143)
Input-Output Ratio			0.571** (0.262)		1.314*** (0.485)
Profit Rate			0.063 (0.166)		1.831** (0.840)
Capital Intensity			-0.005 (0.010)		-0.007 (0.015)
Firm FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
1st stage Cragg-Donald Wald F				132.86	332.001
Observations	708,374	708,374	708,374	708,374	708,374

Note: Robust standard errors in parentheses are clustered at the county level. Firm-level controls include logged sales and number of employees, capital intensity, profit rate, export-sales ratio, and input-output ratio. The means of the effective payroll tax rate and VAT rate are 6.597 and 3.633, respectively. ***, **, * denote significance at the 1%, 5%, 10% level.

correlated with local fiscal capability and the abundance of social security funds. The estimated coefficient presented by column (1) in Table 4 is close to the one by column (5) in Table 3, and is significant at the 5% level.

Province-specific trends. Second, we include a set of province-specific time trends to alleviate the concern that our estimates may be driven by a co-movement of revenue collection activities among different government branches pertaining to the same political jurisdiction. The estimate reported in column (2) of Table 4 has similar magnitude (-3.264) and is statistically significant.

Accounting for firm entries and exits. Third, there may be a concern that firms' entries and attrition were driven by increasing VAT collection efforts. The estimates may be biased if firms complying with tax duties incurred larger losses and were forced to exit the market, and non-complying firms managed to survive. To deal with this concern, we estimate equation (3) using only firms that are present throughout the 2001-2007 period. The estimated coefficient is -2.652 and the significance level remains the same (column (3)).

Alternative measure of the effective VAT rate. Fourth, we use total value-added as the denominator for the effective VAT ratio. Column (4) reports a statistically significant coefficient. The elasticity of payroll tax rate with regard to the value-added based VAT rate is 2.53, or, 0.19 yuan in payroll tax evasion associated with an increase in the VAT payment of one yuan.¹⁷ This is pretty close to the baseline results in Table 3.

Other tax margins. In addition to revenues from VAT, county administrations obtain revenues from several other

¹⁷The point estimate in column (4) of Table 4 is -1.337, and the average VAT to value added ratio is 12.50. So the elasticity is $(1.337/6.597)/(1/12.50) = 2.53$.

Table 4
Robustness Checks

Dependent variable:	Effective payroll tax rate						
Mean of D.V.	6.597						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Effective VAT rate	-3.179** (1.495)	-3.264** (1.329)	-2.652** (1.194)			-3.269** (1.321)	-3.452** (1.488)
Social security subsidy	0.175 (0.453)						
Aging pop. ratio × Post	0.073 (0.127)						
ln GDP per capita	-0.051 (0.250)						
VAT/value added				-1.337** (0.579)			
Effective total tax rate					-2.616** (1.151)		
Firm FE	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y
Firm-level Controls	Y	Y	Y	Y	Y	Y	Y
Province-specific trends		Y					
Balanced panel			Y				
Control for NRCMS						Y	
Control for personal account							Y
Cragg-Donald Wald F	248.946	327.905	114.777	157.799	165.479	331.443	275.500
Observations	695,571	708,374	125,841	708,374	708,284	708,374	708,374

Notes: Robust standard errors in parentheses are clustered at the county level. Firm-level controls include logged sales and the number of employees, capital intensity, profit rate, export-sales ratio, and input-output ratio. The mean of the effective payroll tax rate is 6.597. Column (4) presents the results using the ratio of VAT to value added as an alternative VAT rate (mean value: 12.50). In column (5), we replace the VAT rate with the effective total tax rate (including VAT, corporate income tax, business tax, consumption tax, and other tax, divided by sales). The average total tax rate is 5.47. ***, **, * denote significance at the 1%, 5%, 10% level.

types of taxation, such as corporate income tax and sales tax. The logic of induced payroll tax evasion should apply to the total volume of tax revenue. Column (5) in Table 4 adopts the total tax payments of each firm (except payroll tax) as a measure of the intensity of tax enforcement.¹⁸ The result is similar, with an elasticity of approximately 2.17.¹⁹

Other Reforms. The repeal of the agricultural tax in 2005 is overlapped by two other reforms affecting the social security system. The first reform was the setup of the New Rural Co-operative Medical System (NRCMS) in 2003-2006, which provides a wide coverage of health insurance for the rural population. The funding responsibilities are shared between the central government, local government, and individuals. It is possible that the establishment of NRCMS enhances the capacity of local social security offices and thus confounds the collection of the payroll tax. This venue of influence may actually work against our hypothesis of evasion substitution. The second reform was the introduction of fully funded personal accounts of pension fund. That reform may increase the willingness of compliance to social security contribution. Nevertheless, to address the concern that the estimates may be confounded by other reforms related to the social security system, we include two dummy variables, *NRCMS* and *Personal Account*. *NRCMS*, which is manually collected from the websites of local governments, varies at the county-year level. *Personal Account* varies at the province-year level and is obtained from ?. Columns (6) and (7) of Table 4 report estimates that

¹⁸More precisely, the effective tax rate used in column (5) is obtained through dividing the sum of VAT, corporate income tax, and business tax by the total sales.

¹⁹The point estimate of the coefficient according to column (5) is -2.616. Note that the average payroll tax rate is 6.597, and the average total tax rate is 5.47. So the elasticity is $\frac{(2.616/6.597)}{1/5.47} \approx 2.17$.

Table 5
Real Responses to VAT Enforcement

Dependent variable:	Employee	Fixed asset	Liquid asset	Debt	Wage per labor	Wage bill
	(1)	(2)	(3)	(4)	(5)	(6)
Effective VAT rate	-0.230*** (0.075)	-0.092 (0.065)	-0.289*** (0.100)	-0.505*** (0.151)	0.260*** (0.083)	0.03 (0.072)
Firm FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Firm-level Controls	Y	Y	Y	Y	Y	Y
Cragg-Donald Wald F	279.054	276.058	278.457	255.34	279.054	279.054
Observations	708,374	705,589	708,132	703,139	708,374	708,374

Notes: Robust standard errors in parentheses are clustered at the county level. Firm-level controls include logged sales, capital intensity, profit rate, export-sales ratio, and input-output ratio. All dependent variables are in logarithm. ***, **, * denote significance at the 1%, 5%, 10% level.

are significant and similar to the baseline.

Alternative instrumental variables. In calculating agricultural tax losses, we take local tax revenues and subsidies as given. A concern is that revenues and subsidies may have been shaped by bargaining between the central and local governments before the repeal of agricultural tax in 2005. In this case, the bargaining power of local governments may be correlated with the capability of payroll tax enforcement by social security offices. To address this concern, we extrapolate the tax revenues of county governments over 2005–2007 based on the growth trajectory of tax revenues over 2000–2004 period, and use the simulated values Tax^{sim} to substitute for the actual value $TaxRevenue_{c,2005-2007}$ in estimating equation (2). By a similar token, we use $Transfer^{sim}$, the simulated transfer, to substitute $Transfer_{c,2005-2007}$. We then use Tax^{sim} and $Transfer^{sim}$ to construct an instrumental variable of revenue loss as in equation (1). Table A.1 in the appendix reports the estimates using alternative instrumental variables. As evident from Table A1, the results are quite similar compared with the baseline.

6. Mechanisms

In this section, we test for potential mechanisms and alternative explanations related to the phenomenon of tax evasion substitution. First, we investigate real responses of firms to determine whether the results are driven by firms' adjustment in investment and employment decisions. Second, we test whether financial constraint consists an important channel of payroll tax evasion. Third, we conduct a reduced form placebo test using only state-owned enterprises, which are less susceptible to financial constraint, to examine further the channel of payroll tax evasion. Fourth, we provide suggestive tests with regard to an alternative explanation that increasing payroll tax evasion stems from firms' strategic collusion with local governments.

6.1. Real Responses of Firms

Previous literature suggest that firms adjust investment decisions in response to tax enforcement (Slemrod, 2001). It is plausible that firms' adjustments of their investment plans led to substantial decreases in the effective payroll tax rate. Employers may choose to promote profits through streamlining the number of employees, or they may turn to service purchases for non-essential work. Such adaptations help firms shoulder the responsibilities of social security tax payments and increase the deductions from the VAT. We conduct similar two-stage estimations as in equation (2) and (3) to investigate the effects of VAT enforcement on a set of firm-level management indicators, including the number of employees, fixed assets, liquid assets, total debt, total wage bill, and the level of wages per employee.

The results presented in Table 5 suggest that firms respond to increasing VAT burdens by decreasing the number of employees (column (1)), reducing liquid assets (column (3)), and borrowing less (column (4)). By contrast, the intensity of VAT does not affect existing firms' size of fixed assets (column (2)). We also investigate the gross effects of VAT enforcement on the payroll. Column (5) shows that increasing the VAT burden is associated with higher wages per employee. Column (6) suggests that the total wage bill does not change along with increasing tax burden. These results are likely to be driven by firms firing low-skill workers. It is noteworthy that in China, firms pay a higher rate

Table 6
Heterogeneity in Financial Constraints

Dependent variable:	Effective payroll tax rate			
	(1)	(2)	(3)	(4)
Sampled by	Cash flow/fixed assets		Credit marketization index	
	High	Low	High	low
Mean of D.V.	6.750	7.946	6.547	6.646
Effective VAT Rate	-3.117* (1.699)	-8.400** (3.832)	0.265 (2.601)	-6.182** (2.749)
Firm FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Firm-level Controls	Y	Y	Y	Y
Cragg-Donald Wald F	81.205	27.907	115.06	123.966
Observations	145,720	144,645	357,216	351,155

Notes: This table displays the effects of tax enforcement on payroll tax evasion for financially constrained and unconstrained firms. We divide the firms in 2004 by various measures of financial constraint and split the sample into above the median of each of those variables and below. Robust standard errors in parentheses are clustered at the county level. The credit marketization index is from Wang, Fan, and Yu (2017), which evaluates the extent to which credit resources flow into the non-state sector in different regions. Firm-level controls include logged sales and the number of employees, capital intensity, profit rate, export-sales ratio, and input-output ratio. ***, **, * denote significance at the 1%, 5%, 10% level.

of social security contribution for higher-wage employees than for low-wage employees.²⁰ The effective payroll tax rate should have increased due to the firing of low-skill workers if firms did not shy away further from social security contribution. However, column (6) suggests that firms did not reduce the total wage bill. Taken together, the results presented in Table 5 support the cost-driven motives of payroll tax evasion in response to increased VAT enforcement.

6.2. Heterogeneity in Financial Constraints and Profitability

We then conduct a set of tests of the effects of firm heterogeneity in financial constraints and competitiveness to further assess potential mechanisms of payroll tax evasion. Stringent VAT enforcement not only imposes extra cost on firms, but also entails firms having less cash in hand. Column (3) in Table 5 supports such a cash flow shock. This constraint poses a more severe threat to market survival where firms are credit constrained. We follow the idea of Saez, Schoefer, and Seim (2019) and Hadlock and Pierce (2010) to adopt the cash flow-to-asset ratio as a proxy for the credit constraints faced by firms.²¹ In addition, we employ a credit marketization index developed by Wang et al. (2017), which is based on the share of banking credits flowing into non-state sectors in different cities.

The results reported in Table 6 are consistent with the credit constraint explanation as the motive for payroll tax evasion. The coefficients associated with VAT intensity and the effective payroll tax rate are more negative for firms with less cash in hand, a relatively small scale of sales, and in regions with more severe financial repression. In comparison, the coefficients for larger and more cash abundant firms are smaller, and the coefficient for firms located in credit abundant regions becomes insignificant.

In addition to the heterogeneity of financial constraints, we explore whether the effects vary with firms' profit margin and market power. A plausible conjecture following the logic of financial constraints is that firms with higher profit margins and market power are less financially pressured. To that end, we divide the sample into high- and low-profitability groups depending on profit-to-assets and profit-to-value added ratios. Using a similar approach, we group firms according to their market share and the industry-specific Herfindahl-Hirschman index. The results presented by Tables A3 and A4 in the appendix demonstrate that firms evade their payroll tax duties more strongly when the firms are less profitable and control a smaller market share.

We further explore firm heterogeneity and labor intensity according to the wages-to-sales and employees-to-sales ratios. The results presented in Table A5 of the appendix suggest that stronger patterns of payroll tax evasion in response

²⁰According to the sample we investigate, the mean of the effective payroll tax rate is 6.851% for firms whose average wages are above the sample median, and 5.786% for firms whose average wages are below the median. The difference is statistically significant. Table A2 in the appendix reports these statistics.

²¹We use the variables in 2004 to alleviate the endogeneity problem.

Table 7
State-Owned Enterprises

Dependent variable:	Effective VAT rate		Effective payroll tax rate	
Mean of D.V.	4.85		15.90	
	(1)	(2)	(3)	(4)
Agr. Tax Loss \times Post	-0.708 (0.760)	-0.624 (0.821)	-1.494 (3.973)	-1.045 (3.995)
Firm FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Firm-level controls	Y	Y	Y	Y
Province-specific trends	N	Y	N	Y
Observations	7,192	7,192	7,192	7,192
R-squared	0.79	0.798	0.627	0.629

Notes: Robust standard errors in parentheses are clustered at the county level. Firm-level controls include logged sales and the number of employees, capital intensity, profit rate, export-sales ratio, and input-output ratio. ***, **, * denote significance at the 1%, 5%, 10% level.

to VAT enforcement are present among firms with a larger share of labor cost. These results spell out a picture that smaller and more marginal entities in the market struggle to survive by evading making payroll tax payments.

6.3. Does Tax Evasion Matter for State-Owned Enterprises?

We have obtained the baseline results using only the information of privately owned firms. We expect that payroll tax evasion is less significant for SOEs than private firms. The first reason is that SOEs face a soft budget constraint and thus are less sensitive to profit loss (Kornai et al., 2003). The second reason is that taxpayers tend to have lower tax evasion when they are politically connected with the administration, as illustrated by research based on U.S. personal income taxes (Cullen, Turner, and Washington, 2018). In the Chinese context, SOEs tend to follow the party line. Instead of being purely driven by profit maximization, SOEs share various policy burdens, such as maintaining employment, and they also bear a large political cost of evading taxation (Lin, Cai, and Li, 1998). Based on this logic, we conduct a placebo test using the sample of SOEs.²²

Table 7 presents the reduced-form estimates using the SOE sample. Contrary to the case of private firms, the coefficients of $\text{Agr. Tax Loss}_c \times \text{Post}_t$ are negative and statistically insignificant, failing to support the existence of a similar fiscal squeeze effect for SOEs (columns (1) and (2)). We attribute this discrepancy to the high compliance rate on VAT among SOEs. In columns (3) and (4), the reduced-form estimates for the effective payroll tax rate are insignificant, with a considerably smaller magnitude compared with the results obtained for private firms. The results on SOEs provide tentative support for attributing payroll tax evasion to profit-driven motives.

7. Conclusion

This paper studies how VAT enforcement by local administrations affects firms' payroll tax evasion in China. Using the repeal of agricultural tax in 2005 as a natural experiment, we capture varying VAT enforcement efforts by county administrations and adopt an instrumental variable approach to study the effects of VAT intensity. The estimations document a sizable increase in payroll tax evasion among private industrial firms in the face of increased VAT enforcement. Firms respond to increasing VAT enforcement by cutting low-skill labor force, liquid asset, and debts. Moreover, the effect is more pronounced among firms that are more financially constrained, less profitable, and those with a larger labor share in total cost. These results suggest that increasing evasion of the payroll tax is more likely to stem from cost optimization motives by cash constrained firms.

These empirical results attest to the importance of taking into account the compliance spillover between different taxes and between different agencies when assessing the impacts of tax policies. From the perspective of taxpayers, increasing tax enforcement may pose a critical challenge of survival for small and financially constrained firms and induce them to cut labor force and evade payroll tax payment. From the perspective of government, strengthening

²²In our sample, SOEs' VAT rate is much higher than that of private-owned enterprises in both VAT compliance measurements. The ratio of VAT over total sales for SOEs (4.85%) is 33.5% higher than that for private firms (3.63%). If we measure VAT compliance by the ratio of VAT to value added, the ratio for SOEs (15.41%) is 23.2% higher than that for the privately owned firms (12.51%).

enforcement in one policy may lead to an unintended increase of informality along other dimensions. This problem is more severe when the bureaucratic system is fragmented and short of coordination. The findings in our paper suggest a useful perspective for understanding the underperformance in less salient policy areas such as the environment, public health, and social security.

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Appendix Not for Publication

Table A1
Alternative Measurements of Agricultural Revenue Loss

Dependent variable:	Effective payroll tax rate		
	Tax ^{sim}	Transfer ^{sim}	Transfer ^{sim} + Tax ^{sim}
	(1)	(2)	(3)
Effective VAT Rate	-3.873** (1.708)	-3.154** (1.281)	-3.672** (1.608)
Firm FE	Y	Y	Y
Year FE	Y	Y	Y
Firm-level controls	Y	Y	Y
Cragg-Donald Wald F	232.727	337.21	248.649
Observations	708,374	708,374	708,374

Note: Robust standard errors in parentheses are clustered at the county level. Firm-level controls include logged sales and the number of employees, capital intensity, profit rate, export-sales ratio, and input-output ratio. ***, **, * denote significance at the 1%, 5%, 10% level.

Table A2
Comparison of Payroll Tax Compliance between Wage Levels

Years	Effective payroll tax rate	
	2001-2004	2004
Firms with high average wage	6.851	7.267
Firms with low average wage	5.786	5.091
F-test for difference	27.053	35.995
p-value for F-test	0.000	0.000

Table A3
Heterogeneity in Profitability

Dependent variable: Sampled by	Effective payroll tax rate			
	Profits/assets		Profits/value-added	
	High	Low	High	Low
Mean of D.V.	5.817 (1)	7.959 (2)	6.308 (3)	7.46 (4)
Effective VAT Rate	-1.993** (0.996)	-6.406* (3.375)	-1.604* (0.936)	-6.134** (3.056)
Firm FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Firm-level Controls	Y	Y	Y	Y
Cragg-Donald Wald F	384.834	34.156	340.5	50.451
Observations	260,124	250,143	262,201	248,066

Notes: This table displays the effects of tax enforcement on payroll tax evasion for firms with different levels of profitability. We divide the firms by the profits/assets ratio and profit/value-added ratio in 2004, and split the sample into above the median and below. This division drops all firms for which there is no observation for 2004. Robust standard errors in parentheses are clustered at the county level. ***, **, * denote significance at the 1%, 5%, 10% level.

Table A4
Heterogeneity in Market Competition

Dependent variable: Sampled by	Effective payroll tax rate			
	Firm market share		Industry Herfindahl Index	
	High	Low	High	Low
Mean of D.V.	7.575	6.066	7.636	6.149
	(1)	(2)	(3)	(4)
Effective VAT Rate	-1.216 (1.049)	-5.280** (2.217)	-2.375** (1.145)	-3.651** (1.719)
Firm FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Firm-level Controls	Y	Y	Y	Y
Cragg-Donald Wald F	221.44	101.635	167.235	143.232
Observations	273,580	236,687	247,083	263,184

Notes: This table displays the effects of tax enforcement on payroll tax evasion for firms facing more and less market competition. We divide the firms by firm market share and the Herfindahl index in 2004, and split the sample into above the median and below. This division drops all firms for which there is no observation in 2004. Robust standard errors in parentheses are clustered at the county level. Firm market share is computed by the share of sales in a 4-digit industry. The Herfindahl index is the sum of squares of the market shares (by sales) of all firms in a 4-digit industry. A lower value of the index implies a higher degree of competition and lower market power. ***, **, * denote significance at the 1%, 5%, 10% level.

Table A5
Heterogeneity in Labor Intensity

Dependent variable: Sampled by	Effective payroll tax rate			
	Wage/sales		Labor/sales	
	High	Low	High	Low
Mean of D.V.	7.477	2.268	6.823	6.916
	(1)	(2)	(3)	(4)
Effective VAT Rate	-4.197*** (1.435)	-2.275 (1.754)	-3.883*** (1.253)	-1.346 (1.384)
Firm FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Firm-level Controls	Y	Y	Y	Y
Cragg-Donald Wald F	122.936	150.115	161.664	204.954
Observations	253,983	256,284	253,443	256,824

Notes: This table displays the effects of tax enforcement on payroll tax evasion for firms with different levels of labor intensity. We divide the firms by wage/sales ratio and labor/sales ratio in 2004, and split the sample into above the median and below. This division drops all firms for which there is no observation in 2004. Robust standard errors in parentheses are clustered at the county level. ***, **, * denote significance at the 1%, 5%, 10% level.

Table A6
Accounting for Local Leaders' Characteristics

Dependent variable:	Effective payroll tax rate		
	(1)	(2)	(3)
Effective VAT Rate	-3.558** (1.543)	-3.668** (1.554)	-3.962** (1.746)
Effective VAT Rate × mayor (home-originated)	-0.487 (4.619)		
Effective VAT Rate × mayor (age>57)		1.132 (1.336)	
Effective VAT Rate × mayor (tenure>3)			-1.94 (3.083)
Mayor (home-originated)	2.926 (17.599)		
Mayor (age>57)		-2.45 (4.771)	
Mayor (tenure>3)			7.052 (11.045)
Firm FE	Y	Y	Y
Year FE	Y	Y	Y
Firm-level Controls	Y	Y	Y
Cragg-Donald Wald F	69.386	135.289	58.488
Observations	634,825	628,270	635,323

Notes: Robust standard errors in parentheses are clustered at the county level. Firm-level controls include logged sales and the number of employees, capital intensity, profit rate, export-sales ratio, and input-output ratio. Mayor (home-originated) is defined by whether the mayor serves in the same city as her hometown. Mayor (age>57) is a dummy variable that equals 1 if the mayor's age is above 57 when he has no promotion opportunity, and 0 otherwise. Mayor (tenure>3) is a dummy that takes the value 1 if the mayor has been in the current position for more than 3 years, suggesting higher likelihood to establish strong local connections. ***, **, * denote significance at the 1%, 5%, 10% level.