Does Tax Enforcement Mitigate Firm Misoptimization? Evidence from China *

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Abstract

We develop a model in which firms face cognitive costs when making precise decisions. The model predicts that stricter tax enforcement incentivizes firms to pay greater attention in production and commit fewer optimization errors. Leveraging China's 2002 corporate income tax reform as a natural experiment, and using a regression discontinuity design (RDD), we find that stricter tax enforcement reduces firm misoptimization, leading to more efficient resource allocation. Despite the increased tax burden, profitability growth—measured by per worker operating profit growth—improves post-reform, suggesting that efficiency gains offset the financial costs. Robustness checks confirm the validity of these findings, highlighting the broader economic implications of tax enforcement on firm performance.

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1 Introduction

Does stricter tax enforcement reduce firms' profitability? At first glance, the answer may seem yes: tougher taxation reduces after-tax earnings and can weaken incentives to boost profits. Yet this view overlooks an important possibility — firms often fail to operate at their optimal level because of pervasive informational frictions and managerial inattention. In such contexts, stronger tax enforcement may serve as a disciplining device, compelling firms to acquire and process information more carefully, thereby improving their decision-making and efficiency.

Prior research emphasizes the role of firms' internal capabilities, such as information-processing capacity and managerial quality (Sims, 2003; Bloom et al., 2013), and external conditions like market structure and economic fluctuations (Benhabib et al., 2019; Flynn and Sastry, 2024), in shaping misoptimization. By contrast, much less is known about the role of government institutions. Tax administration, as a central institutional interface between firms and the state, provides audit-based feedback, imposes penalties for noncompliance, and creates incentives to strengthen internal information systems.

This institutional perspective builds on evidence that stronger tax enforcement can enhance corporate governance (Desai and Dharmapala, 2006; Desai et al., 2006). We extend the discussion by asking whether stricter tax administration also improves managerial decision-making and, ultimately, profitability. Framing misoptimization through this lens highlights an underexplored channel through which external governance can raise firm efficiency and, more broadly, illustrates the non-revenue benefits of tax enforcement.

We begin by developing a theoretical model that demonstrates how stronger tax enforcement can reduce misoptimization by compelling firms to allocate more attention to production decisions. We then empirically test this prediction using China's 2002 corporate income tax reform as a quasi-natural experiment that exogenously increased tax enforcement intensity. Exploiting a regression discontinuity design (RDD), we find that stricter tax enforcement not only reduces firm misoptimization but also boosts profitability. Despite facing higher tax burdens, firms under stronger enforcement see faster growth in operating profit per worker, showing that the efficiency gains outweigh the costs of compliance.

Our model is built upon Flynn and Sastry (2024), in which firms are subject to behavioral biases and limited cognitive capacity. We incorporate two features drawn from existing empirical evidence into the model. First, tax enforcement requires firms and third parties — such as consumers, suppliers, banks, and employees — to disclose tax-related information to the authorities (Gordon and Li, 2009; Kleven et al., 2011; Kleven, 2014; Pomeranz, 2015; Slemrod, 2019). As a by-product, firms gain broader and more accurate information, which reduces their costs of attention and lowers the likelihood of operational errors. Second, tax administration in China and other developing economies often involves discretionary or negotiable enforcement (Chen, 2017; Jensen and Weigel, 2025; Overbeck and Lungu, 2025). In such settings, tighter enforcement functions as a hard budget constraint, imposing stricter financial discipline and pressuring firms to allocate resources more efficiently (Kornai, 1979; Cull and Xu, 2005). Taken together, these mechanisms suggest that stronger tax enforcement not only raises firms' tax liabilities but also compels them to reduce misoptimization under the stricter tax discipline.

In our empirical analysis, we implement a regression discontinuity design (RDD) by leveraging the institutional cutoff introduced by China's 2002 corporate income tax reform, which reassigned tax collection authority for newly established firms from local tax bureaus (LTBs) to the more stringent State Taxation Bureau (STB). Specifically, firms registered on or after January 1, 2002, were placed under STB enforcement, while those registered before that date remained under LTB oversight. This sharp administrative threshold generates a natural discontinuity in tax enforcement intensity that is unrelated to firms' endogenous characteristics. Because the reform was announced only days before implementation and firm registration involves a lengthy approval process, we argue that firms could not systematically manipulate their registration timing. This institutional feature allows us to treat the registration date as a quasi-random assignment mechanism, enabling credible identification of the causal effect of tax enforcement on firm misoptimization and growth.

We begin our empirical analysis by testing whether stricter tax enforcement reduces firm misoptimization. We find that firms subject to STB enforcement exhibit significantly lower levels of misoptimization—measured as residual variance in labor input conditional on productivity and other controls—relative to those under LTB oversight. This result is robust to alternative specifications, including versions that control for firm-level effective tax rate (ETR), and holds across multiple bandwidths around the cutoff. Moreover, we show that the decline in misoptimization is driven primarily by firms facing higher effective tax burdens, consistent with our model's prediction that increased production costs incentivize firms to allocate more cognitive effort toward optimizing decisions.

Next, we examine how the reform affected profitability growth, using the growth rate of per capita operating profit as our outcome variable. Despite the increase in effective tax pressure, we find that firms exposed to stricter tax enforcement grow faster than their counterparts just below the cutoff. This positive effect is statistically significant and most pronounced in narrower bandwidths, with post-reform firms exhibiting profitability growth gains of around 3 to 5 percentage points. To understand the mechanism, we split the sample based on ex post misoptimization levels and find that the growth effect is concentrated among firms that exhibit greater reductions in misoptimization. This suggests that enhanced attention and internal efficiency, induced by tax enforcement, drive better performance outcomes—even in the face of higher tax burdens.

Finally, we conduct a series of robustness checks to validate our findings. A placebo test using a false cutoff at January 1, 2001, shows no discontinuity in misoptimization or growth, ruling out spurious time trends. Similarly, when we restrict the sample to central state-owned and foreign firms—who were already under STB oversight and unaffected by the reform—we find no significant treatment effect, confirming that our results are not driven by broader macroeconomic or institutional changes. We also confirm that our findings hold when adjusting the misoptimization measure for financial frictions and higher-order productivity effects. In addition, our findings are robust to controlling for the effective corporate income tax rate, which rules out the concern that the estimates merely capture profit misreporting due to tax evasion. Taken together, the empirical evidence supports the theoretical claim that stricter tax enforcement reduces firm misoptimization and improves performance by altering firms' attention allocation and decision quality.

Our findings suggest that tax enforcement is more than a revenue-collection tool: it can also improve firm efficiency by encouraging managers to allocate attention more carefully and make more optimal production decisions. In this sense, well-designed enforcement policies can function as a disciplining mechanism, particularly in settings with weak oversight or high managerial discretion.

It is important to emphasize that our argument is not a call for higher tax burdens to raise social efficiency. Its implications are most relevant where tax systems are poorly designed or weakly enforced. In such environments, firms often rely on evasion or bribery, generating both fiscal losses and allocative inefficiencies. Strengthening enforcement in these cases offers dual benefits: enhancing compliance while also fostering more attentive and efficient decision-making within firms.

Related Literature

Our model examines how the intensity of tax enforcement affects firms' attention allocation and production misoptimization. The framework builds on Flynn and Sastry (2024), which incorporates cognitive frictions into a business-cycle setting and generates counter-cyclical attention and pro-cyclical errors. The idea that managers' limited attention and decision-making capacity lead to optimization mistakes dates back to the seminal work of Mintrom (2015). Our model shares similarities with models where firms produce under behavioral inattention (Caplin and Dean, 2013; Gabaix, 2014, 2019) or behavioral bias (Angeletos and La'o, 2010; Benhabib et al., 2015); see also the experimental and empirical evidence by Goecke et al. (2013) and Benchimol et al. (2025). More broadly, our model relates to the literature on firm production under information frictions and its economic implications (Sims, 2003; Woodford, 2003; Van Nieuwerburgh and Veldkamp, 2006; Maćkowiak and Wiederholt, 2009; Kohlhas and Walther, 2021).

Our paper is also closely connected to the literature on how information frictions contribute to resource misallocation and efficiency losses. Following the seminal contributions of Hsieh and Klenow (2009) and Restuccia and Rogerson (2008), subsequent work has studied how information frictions and idiosyncratic uncertainty shape firms' choices, thereby influencing resource misallocation and aggregate efficiency (Midrigan and Xu, 2014; Moll, 2014; Benhabib et al., 2016; David et al., 2016; David and Venkateswaran, 2019).

Empirically, our paper relates to the literature documenting that firms often fail to maximize profits. For instance, Dube et al. (2025) provide evidence of misoptimization in wage setting. This result is consistent with a growing body of work showing various dimensions in which firms deviate from profit maximization (Romer, 2006; Hortaçsu and Puller, 2008; Cho and Rust, 2010; DellaVigna and Gentzkow, 2019; Zwick, 2021). Bloom and Van Reenen (2007) and Goldfarb and Xiao (2011) attribute such misoptimization to poor management practices.

Our work contributes to the literature on taxation and misallocation. For instance, Chen (2017) show that dispersion in the effective VAT rate generates a 7.9% TFP loss in China, while Bachas et al. (2019) find that size-dependent taxation leads to a 1–2% TFP loss. Our paper is also related to empirical studies on tax remittance and enforcement regimes (Onji, 2009; Best et al., 2015; Khan et al., 2016; Boning et al., 2020; Bergeron et al., 2024). For a comprehensive review, see Slemrod and Wilson (2009). In addition, our empirical analysis leverages China's Reform of the Income Tax Revenue Sharing System. Prior studies (Xie and Fan, 2015; Tang et al., 2017; Xing et al., 2024) show that the reform standardized and tightened tax collection. Related work by Chen (2017) and Li et al. (2021) investigates the incentives shaping tax enforcement in China. Our paper complements this literature by introducing a novel mechanism: stricter tax enforcement induces firms to devote greater attention to production decisions, thereby reducing optimization errors and enhancing operational efficiency.

The remainder of this paper is structured as follows. Section 2 discusses the theoretical framework and the research hypotheses. Section 3 presents the empirical identification strategy, and Section 4 delivers empirical results and robustness checks to validate the findings. Finally, Section 5 concludes with a discussion of the implications of the results and directions for future research.

2 Model and Hypotheses

In this section, based on the framework of Flynn and Sastry (2024), we develop a model of firms' attention allocation and mistake-making. We abstract from aggregate shocks to focus exclusively on idiosyncratic uncertainty. Our analysis centers on intermediate goods firms, which provides a sufficient foundation for our theoretical exploration.

2.1 Firms

Firm i is an intermediate goods producer that produces goods x_{it} at time t. Its demand function is given by:

$$p_{it} = x_{it}^{-\frac{1}{\epsilon}} X \tag{1}$$

where p_{it} is the price of firm i's good, and X is an exogenous constant. This demand function can be derived from the profit-maximization problem of a representative final goods producer.

Firm i's profit at time t is

$$\pi_{it} = [p_{it} - q_t(\theta_{it}, \tau)]\, x_{it} \tag{2}$$

where $q_t(\theta_{it}, \tau)$ is firm i's production cost. The production cost decreases with firm-specific productivity θ_{it} and increases with the tax rate τ.[1]

2.2 Modeling Attention via Costly Control

We consider a setting in which firms operate under imperfect information regarding their own productivity.[2] Due to cognitive constraints, firms cannot perfectly align their production decisions with actual productivity. To capture this, following Flynn and Sastry (2024), we model firms as choosing stochastic decision rules—mappings from states to distributions over production levels—while incurring cognitive costs associated with processing information and optimizing these decisions.

Decision State and Choice Variable. Firm i's choice variable is a stochastic choice rule ϕ: $\Theta \to \Delta(\mathcal{X})$, where $\mathcal{X}$ denotes the feasible set of production levels. That is, given the decision state θ_{it}, the firm selects a probability density function $\phi(\cdot|\theta_{it})$ over possible production quantities. The firm commits to delivering the realized quantity $x_{it} \in \mathcal{X}$ to the market. Equivalently, this can be interpreted as committing to input combinations—such as hiring L_{it} units of labor and using m_{it} units of materials—to produce output via the production function $\theta_{it} L_{it}^{\alpha} m_{it}^{1-\alpha}$.

Costly Control of Firm Attention. We model the cognitive cost of attention using a cost functional $c(\cdot)$, which quantifies the difficulty of implementing a given stochastic

[1] Under a standard Cobb-Douglas production function, marginal cost q_t is decreasing in θ_{it} and increasing in input prices (e.g., wages and capital costs).

[2] There is a substantial literature in economics emphasizing that firms face limited attention and possess imperfect information about their productivity. This information friction has been shown to influence a range of important economic outcomes, including resource misallocation, financial crises, and business cycles. See, for example, Sims (2003), Van Nieuwerburgh and Veldkamp (2006), Hsieh and Klenow (2009), Midrigan and Xu (2014), Benhabib et al. (2016), and David et al. (2016).

choice rule.The key idea is that greater precision in decision-making entails higher cognitive costs. To capture this trade-off in a tractable way, we define the cost functional as the negative expected entropy of the action distribution, scaled by a firm-specific parameter $\lambda_i > 0$:

$$c(\phi, \lambda_i, \theta_{it}, f) = \lambda_i \int_{\Theta} \int_{\mathcal{X}} \phi(x|\theta_{it}) log(\phi(x|\theta_{it}))dx f(\theta_{it})d\theta_{it} \tag{3}$$

where $f(\theta_{it})$ represents the probability density function of the firm's productivity state θ_{it}. It is worth noting that a smaller λ_i implies a lower cost of attention, or equivalently, a lower cost of achieving greater precision in decision making. Thus, we refer to λ_i as the attention cost parameter. This formulation reflects the notion that cognitive constraints make it costly to implement highly precise actions, resulting in inevitable decision errors.

2.3 Equilibrium and Implications

We assume firms are risk-neutral and maximize expected profits net of cognitive costs:

$$\max_{\phi \in \Phi} \left\{ \int_{\Theta} \int_{\mathcal{X}} \pi(x, \theta_{it}, \tau)\phi(x|\theta_{it})dx \ f(\theta_{it})d\theta_{it} - c(\phi, \lambda_i, \theta_{it}, f) \right\} \tag{4}$$

where $\pi(x, \theta_{it}, \tau)$ denotes the profit from choosing output level x given productivity θ_{it} and tax rate τ. Firms optimally choose a stochastic production plan $\phi(x|\theta_{it})$ for each realized productivity θ_{it}.

This framework allows firms to endogenously determine how the distribution of their production choices—e.g., its mean and variance—responds to idiosyncratic productivity shocks. However, precise planning entails cognitive costs that are increasing in the informational precision of the chosen production distribution—formally captured by its entropy. Consequently, the firm's optimal strategy balances the expected gains from more accurate production decisions against the rising cognitive burden required to implement them across states.

Following Flynn and Sastry (2024), we simplify the firm's objective using a linear-quadratic approximation to facilitate tractable equilibrium analysis. Let the firm's ex post optimal production level be defined as $x^*(\theta_{it}, \tau) \equiv arg\max_{x \in \mathcal{X}} \pi(x, \theta_{it}, \tau)$, and denote the corresponding optimal profit as as $\bar{\pi}(\theta_{it}, \tau)$. Let $\pi_{xx}(\theta_{it}, \tau)$ represent the second derivative of the profit function with respect to x, evaluated at $(x^*(\theta_{it}, \tau), \theta_{it}, \tau)$. Using these definitions, we approximate the firm's profit function to second order:

$$\tilde{\pi}(x, \theta_{it}, \tau) = \bar{\pi}(\theta_{it}, \tau) + \frac{1}{2}\pi_{xx}(\theta_{it}, \tau)(x - x^*(\theta_{it}, \tau))^2 \tag{5}$$

The first-order term vanishes by the envelope theorem, as marginal deviations from $x^*(\theta_{it}, \tau)$ incur no first-order loss.

Now we characterize firms' production and attention choices in partial equilibrium.

Proposition 1. *The random production of a type-λ_i firm, conditional on realized productivity θ_{it}, can be written as*

$$x_i = x^*(\theta_{it}, \tau) + \sqrt{\frac{\lambda_i}{|\pi_{xx}(\theta_{it}, \tau)|}} \cdot v_i \tag{6}$$

where $x^*(\theta_{it}, \tau)$ is the unconstrained optimal output, $\pi_{xx}(\theta_{it}, \tau)$ is the magnitude of curvature for the firms' profit function, and v_i is a standard Normal random variable.

Proposition 1 corresponds to the result in Flynn and Sastry (2024). According to Proposition 1, given productivity θ_{it} and tax rate τ, firms' output x_{it} is a random variable following Normal distribution, where

$$x_{it} \in N\left(x^*(\theta_{it}, \tau), \frac{\lambda_i}{|\pi_{xx}(\theta_{it}, \tau)|}\right) \tag{7}$$

Specifically, we have

$$x^*(\theta_{it}, \tau) = \left(1 - \frac{1}{\epsilon}\right)^{\epsilon} X^{\epsilon}[q(\theta_{it}, \tau)]^{-\epsilon}. \tag{8}$$

$$|\pi_{xx}(\theta_{it}, \tau)| = (\epsilon - 1)^{-\epsilon} e^{\epsilon - 1} X^{-\epsilon}[q(\theta_{it}, \tau)]^{1+\epsilon} \tag{9}$$

Corollary 1 follows from equation (9).

Corollary 1. *A firm's misoptimization, measured by $\frac{\lambda_i}{|\pi_{xx}(\theta_{it}, \tau)|}$, increases with attention cost parameter λ_i and decreases with its production cost $q(\theta_{it}, \tau)$.*

Corollary 1 formalizes how a firm's misoptimization depends on two factors: the attention cost λ_i and the production cost $q(\theta_{it}, \tau)$. A higher λ_i makes it more costly for the firm to devote cognitive resources to decision-making, leading to less effort allocated to optimizing production and, consequently, greater misoptimization. Conversely, higher production costs $q(\theta_{it}, \tau)$ reduce profits and increase the stakes of mistakes. When production errors are costly, the firm has a stronger incentive to allocate attention and optimize more carefully.

2.4 Effect of Tax Enforcement on Firm Misoptimization.

We now examine how stricter tax enforcement affects firm misoptimization, with a particular focus on newly established firms—the primary subjects of our empirical analysis. Specifically, enhanced enforcement influences firms through two channels.

On the one hand, firms acquire more informative records under stricter tax enforcement. Compliance with standardized documentation and operational processes generates more formalized internal records. In addition, formalized and standardized documentation and processes may mitigate internal moral hazard, as agents within the firm find it harder to shirk responsibilities, thereby reducing information asymmetry. These effects are likely to be particularly pronounced for newly established firms, which are the focus of our empirical analysis. As a result, firms gain better information about their operations. With access to these detailed records, making precise production plans becomes less costly, effectively reducing the attention cost parameter λ_i.

On the other hand, firms' operating costs increase. Compliance with stricter enforcement entails following additional procedures and providing more documentation, which can be costly. Moreover, tighter enforcement reduces opportunities for tax evasion, raising the effective tax rate. Together, these factors increase firms' operation costs $q(\theta_{it}, \tau)$.

When stricter tax enforcement lowers the attention cost λ_i or raises production costs $q(\theta_{it}, \tau)$, Corollary 1 implies that firms will allocate greater cognitive attention to optimizing their decisions, thereby reducing the likelihood of misoptimization. This reasoning yields the following testable hypothesis:

Hypothesis: Stricter tax enforcement reduces firms' misoptimization in production.

3 Identification Strategy

3.1 Institutional Background

Since 1990s, the central government in China has increasing relied on local governments to implement a wide range of policy objectives, from stimulating economic development to delivering public services. Despite the high share of expenditures borne by local governments, the revenue system has undergone progressive centralization, especially following the 1994 tax-sharing reform.

This 1994 reform marked a critical institutional turning point, establishing a dual-track tax administration system comprising the State Taxation Bureau (STB) and the Local Taxation Bureau (LTB). Its primary goal was to enhance the central government's fiscal capacity and improve tax collection efficiency. Under this framework, taxes were categorized into central (e.g., customs duties), local (e.g., corporate income tax for domestic firms), and shared taxes (e.g., value-added tax). The STB was tasked with collecting central and shared taxes and operated independently of local governments. In contrast, the LTB, responsible mainly for local taxes, remained under the direct control of local authorities, with local governments retaining influence over its organization, personnel appointments, and enforcement practices.

This bifurcated system led to notable differences in enforcement behavior. The STB is generally recognized for its standardized procedures and stringent enforcement, driven by centralized oversight and performance evaluations based on revenue targets and tax compliance metrics. Conversely, the LTB, as an arm of local governments, is often more attuned to local political and economic objectives, such as investment promotion, employment stability, and short-term economic growth. This alignment has led to more discretionary and accommodative enforcement practices, including reduced audit frequency, selective enforcement, and informal arrangements with firms (Wilson and Janeba, 2005).

A significant institutional change occurred at the end of 2001, when the State Council issued the *Notice on the Reform Plan for Income Tax Revenue Sharing (Guo Fa [2001] No. 37)*. This tax collection reform transferred the authority to collect corporate income taxes for newly registered enterprises from the LTB to the STB. Specifically, firms established on or after January 1, 2002, were placed under the jurisdiction of the STB, while those registered before this cutoff remained under the LTB's administration. Central state-owned enterprises and foreign-invested enterprises, already under STB oversight, were unaffected by this reform. This policy shift created a clear and exogenous institutional discontinuity, serving as a quasi-natural experiment to study the effects of tax enforcement regimes.

The reform's design enables researchers to isolate the impact of tax enforcement intensity on firm behavior. The fundamental distinction lies in the contrasting incentive of the two bureaus. The LTB's subordination to local governments often encourages lax enforcement to support local economic goals, providing room for tax avoidance and facilitating informal rent-seeking arrangements. Empirical studies document that LTB-administered firms are more likely to engage in tax evasion and bribery, particularly in jurisdictions where government intervention is pervasive and institutional constraints are weak (Tang et al., 2017; Cai et al., 2018; Cao et al., 2021). These informal relationships enables firms to enjoy lower effective tax burdens and greater fiscal favoritism, such as tax refunds and subsidies, in exchange for rent-seeking payments.

In contrast, STB-administered firms operate under stricter enforcement regimes since tax officials are incentivized to adhere to standardized procedures and meet revenue collection benchmarks, resulting in more frequent audits and higher expected penalties for non-compliance. Consequently, firms under STB oversight face greater effective tax pressure, not because of differences in statutory tax rates, but due to diminished opportunities for evasion and collusion (Keen and Marchand, 1997; Wilson and Janeba, 2005; Xie and Fan, 2015).

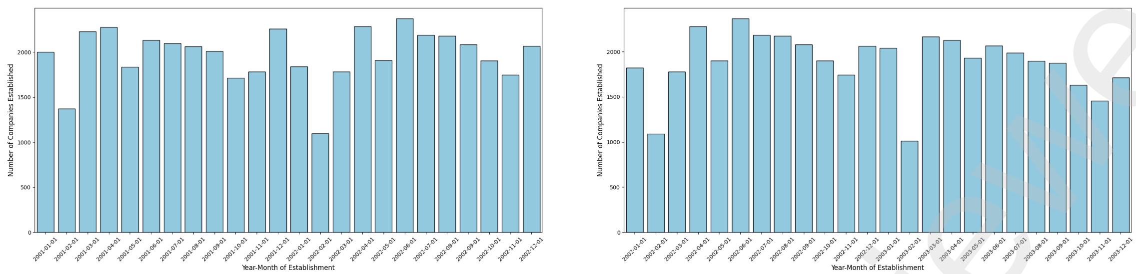
3.2 Econometric Specification

To draw causal inferences about the impact of tax enforcement on corporate misoptimization, we exploit the 2002 tax collection reform in China as a quasi-natural experiment. Specifically, we implement a regression discontinuity (RD) design centered around the exogenous shift in tax administration from LTB to the STB for firms registered after January 1, 2002.

The reform, announced at the end of December 2001, was implemented immediately, leaving firms with virtually no time to adjust their registration timing strategically. Since Establishing a new firm in China typically involves a lengthy administrative process, such extremely short interval between policy announcement and implementation makes firms unlikely to anticipate the policy and adjust their registration dates accordingly. Therefore, this design satisfies the key identifying assumption in the RD framework that firms cannot manipulate their assignment around the cutoff.

To empirically verify the plausibility of this assumption, we examine the density of firm registrations around the cutoff. Figure 1 plots the number of newly registered firms by month for 2002 and 2003. The distribution appears smooth around the cutoff date, suggesting no evidence of manipulation.[3]

[3] Because of the Spring Festival—a major national holiday—typically leads to administrative slowdowns and delays in firm registration, firm registrations in February are typically the lowest.



Panel (A): Firms Registered in 2002 Panel (B): Firms Registered in 2003

Fig. 1. Number of Monthly Firm Registration in 2002 and 2003

Based on this exogenous cutoff, we first estimate the impact of tax enforcement stringency on firm behaviors using the following specification:

$$y_{i,t} = \beta_0 + \beta_1 \mathrm{STB}_i + \gamma X_{i,t} + \alpha_s + \alpha_p + \alpha_t + \varepsilon_{i,t}, \tag{10}$$

where $y_{i,t}$ denotes the dependent variables of interest, including firm-level measures of misoptimization and profitability growth. STB_i is a dummy variable indicating whether the firm was established after the tax policy reform and under more strict tax administration by the STB. The vector $X_{i,t}$ includes firm size (number of employees), Herfindahl index, an export dummy, return on asset and debt ratio.[4] In Addition, industry (α_s), region (α_p), and year (α_t) fixed effects are incorporated to control for unobservable heterogeneity across industries, provinces, and time. Standard errors are clustered at the industry level.

The motivation behind this specification is grounded in prior literature. It is well-documented that the STB enforces tax laws more rigorously than the LTB, which, due to its subordination to local governments, is often more lenient and aligned with local economic goals (Keen and Marchand, 1997; Wilson and Janeba, 2005; Xie and Fan, 2015). Empirical studies have shown that the 2002 tax collection reform increased the effective tax burden on newly established firms (Li et al., 2018), enhanced administrative transparency,

[4]When $y_{i,t}$ denotes profitability growth, we exclude the firm size and return on asset from $X_{i,t}$ to avoid potential collinearity.

and significantly reduced corporate tax avoidance (Fan and Tian, 2013; Tian and Fan, 2016).

Building on these findings, we hypothesize that the heightened enforcement pressure faced by STB-administered firms led to higher marginal production costs, tighter financing conditions, and reduced policy discretion. In this more constrained environment, firms were incentivized to optimize internal operations more efficiently to maintain profitability. Thus, the reform provides a compelling setting to examine how tax enforcement regimes shape firm behavior, particularly in terms of resource allocation and misoptimization.

3.3 Data and Sample Selection

We use the panel data from the Chinese Industrial Enterprise Database, an extensively used dataset for economic research in China (Cai and Liu, 2009; Brandt et al., 2012; Lu and Yu, 2015; Liu and Qiu, 2016; Li et al., 2024). Before cleansing the data with the given sample selection procedure, we winsorize observations at the top and bottom 0.5% of the distribution to prevent outliers contaminating the results. Then, we impose the following sampling procedures.

Following Brandt et al. (2012), we merge annual cross-sectional data from 2002 to 2006 by identifying the unique enterprises using a combination of identifiers, including enterprise code, name, legal representative, address, telephone number, and other relevant information. We manually corrected firms with obvious errors, such as inconsistent capitalization of codes, mismatches between codes and names, and name changes. We exclude central state-owned and foreign-funded enterprises, which were subject to taxation by the National Tax Administration and thus unaffected by the 2002 tax reform. We exclude firms with operating income under 5 million yuan, sales revenue under 1 million yuan, total assets under 1 million yuan, employees less than 30, and establishment prior to 1949. We also exclude firms with negative profits, income tax, total assets, and total assets less than net fixed or current assets, or accumulated depreciation below current depreciation.

Firm-level Misoptimization Build on Flynn and Sastry (2024), misoptimizations can be measured as residual variation in firms' choices conditional on productivity, factor prices, and demand. To avoid the potential misspecification due to these factors, we estimate the following specification to obtain the residual variations:

$$\log L_{it} = \eta_i + \chi_{j(i),t} + \beta \log \theta_{it} + m_{it}, \tag{11}$$

where θ_{it} is the firm-level total factor productivity, L_{it} is the firms' labour input, η_i and $\chi_{j(i),t}$ are the firm and industry-by-time fixed effects, with $j(i)$ denoting the industry of the firm i. β is an unrestricted coefficient. The residual m_{it} follows an AR(1) process:

$$m_{it} = \rho m_{i,t-1} + \left(\sqrt{1-\rho^2}\right) u_{it}, \tag{12}$$

where $\rho \in (0,1)$ represents the persistence of misoptimization, and u_{it} is a zero-mean innovation term with variance $\tilde{\sigma}^2$. If $\tilde{\sigma}^2$ is sufficiently persistent, it approximates the variance of m_{it}.

We adopt the method of Olley and Pakes (1996) (hereafter, the OP method) to estimate the firm-level total factor productivity (TFP) θ_{it}. To do so, we first estimate firm-level investment ($I_{i,t}$) following Lu and Lian (2012) and Wang (2017):

$$I_{i,t} = F_{i,t} - \hat{F}_{i,t-1} + D_{i,t}, \tag{13}$$

where $F_{i,t}$ is the fixed asset, $\hat{F}_{i,t-1}$ is the estimated value of fixed asset at time $t-1$ based on geometric interpolation (Wang, 2017). $D_{i,t}$ is the depreciation of firm i at time t. We report the distribution of our estimated firm-level productivity in Appendix Figure B.1, consistent with Lu and Lian (2012).

After obtaining estimates of productivity θ_{it}. We follow Flynn and Sastry (2024) to obtain a measure of the firm-level misoptimization. Specifically, we first estimate Equation (11) via ordinary least squares (OLS) and obtain a preliminary estimated residual $\hat{m}^0_{it}$. We next back out the persistence $\hat{\rho} = 0.03$ from estimating Equation (12) using $\hat{m}_{it}^0$. Finally, we estimate the *quasi-differenced* labor demand equation via OLS:

$$\log L_{it} - \hat{\rho} \log L_{i,t-1} = \eta_i + \chi_{j(i),t} + \beta_0 \log \hat{\theta}_{it} + \beta_1 \log \hat{\theta}_{i,t-1} + \nu_{it}, \tag{14}$$

where the residual term is defined as $\nu_{it} \equiv m_{it} - \hat{\rho} m_{i,t-1}$. Equation (12) implies $\nu_{it} = \sqrt{1-\rho^2}\, u_{it}$ when $\hat{\rho} = \rho$, therefore, we obtain a benchmark measure of the firm-level misoptimization $\hat{u}_{it}$, denoted as:

$$\hat{u}_{it} = \frac{\hat{\nu}_{it}}{\sqrt{1-\hat{\rho}^2}}. \tag{15}$$

In addition, to reconcile the potential increase in firm tax burden, we extend specification (14) by incorporating heterogeneity of tax rate and estimate the following:

$$\log L_{it} - \hat{\rho} \log L_{i,t-1} = \eta_i + \chi_{j(i),t} + \beta_0 \log \hat{\theta}_{it} + \beta_1 \log \hat{\theta}_{i,t-1} + \beta_2 \mathrm{Tax}_{it} + \nu_{it}, \tag{16}$$

where Tax_{it} is defined as the ratio of corporate income tax payment to total profit. Analogously, we obtain an alternative measure of misoptimization which is orthogonal to potential tax hikes:

$$\tilde{u}_{it} = \frac{\hat{\nu}_{it}^{(\mathrm{tax})}}{\sqrt{1-\hat{\rho}^2}}, \tag{17}$$

where $\hat{\nu}_{it}^{(\mathrm{tax})}$ denotes the residual obtained from Equation (16).

Table 1 presents the descriptive statistics for these variables. The mean and median values of misoptimization ($\hat{u}^2$) are 0.044 and 0.0076, respectively. After adding the influence of effective tax rate, as shown in $\tilde{u}^2$, these values remain relatively stable. Overall, the standard deviation of firm misoptimization is relatively large (0.1064), indicating substantial variation in the degree of optimization across firms. This also suggests that many enterprises have considerable room for improvement in optimization practices.

Profitability growth is proxied by the growth rate of per worker operating profit, exhibits an upward trend with mean value 0.2425. This suggest that the profit growth of most companies was increasing during the period from 2002 to 2006. The mean value of STB is 0.4753, which suggests that the number of firms established around January 1, 2002, is relatively random. The effective tax rate (Tax) is 18.23% on average. The standard deviation of Tax is 0.1854, which indicates that the effective tax rate for certain firm is sufficiently low (close to 0), suggesting a potential large variation across firms. The rest of the firm-level variables are constructed following Cai and Liu (2009), Li et al. (2018), and Xing et al. (2024). Table B.1 provides definitions of all variables used in the subsequent analyses.

Table 1
Descriptive Statistics

Variable	Obs.	Mean	Std.	P5	Median	P95
$\hat{u}^2$	42,432	0.0440	0.1064	0.0000	0.0076	0.2090
$\tilde{u}^2$	42,432	0.0439	0.1065	0.0000	0.0076	0.2095
Profitability Growth	33,731	0.2425	1.2073	-1.6691	0.1841	2.3270
STB	42,432	0.4753	0.4994	0.0000	0.0000	1.0000
Tax Rate	41,937	0.1823	0.1854	0.0000	0.1714	0.4314
Size	42,432	4.8262	0.8479	3.6636	4.7005	6.3969
Return on Asset	42,432	0.0887	0.1566	-0.0312	0.0404	0.3805
Leverage	42,432	0.0391	0.1033	0.0000	0.0000	0.2677
HHI index	42,432	0.0174	0.0269	0.0011	0.0073	0.0681
$\mathbb{I}$(Export)	42,432	0.2509	0.4335	0.0000	0.0000	1.0000
TFP	42,432	3.4865	0.8626	2.1488	3.4511	4.9447

Note: This table presents the descriptive statistics of key variables for full sample.

4 Empirical Results

In this section, we present fourth pieces of evidence that are important to understand the empirical relationships between tax enforcement and firm behaviors. Section 4.1 first examines whether firms established after January 1, 2002, exhibit a decline in misoptimization, consistent with their exposure to stricter tax enforcement. Then, we assess whether this reduction can be attributed to increased effective tax rates by estimating the heterogeneous effect of tax burden on misoptimization. Section 4.2 evaluates changes in profitability growth around the policy implementation to explore its broader economic impact. In addition, we investigate the heterogeneous impact of misoptimization on profitability growth, testing whether reductions in misoptimization are associated with improved firm performance. Section 4.3 conducts a series of robustness checks, including altering the policy cutoff date to January 1, 2001 and restricting the sample to foreign and centrally administered firms, to ensure the validity of our findings.

4.1 Effects of Tax Enforcement on Misoptimization

We estimate specification (10) to examine whether firms established after January 1, 2002, exhibit a reduction in misoptimization. The results are reported in Table 2, Columns (1) - (3) correspond to the estimates of benchmark measures of misoptimization constructed by Equation (14). We observe a statistically significant decline in misoptimization among firms constructed after January 1, 2002. The coefficients on the post-reform indicator are consistently negative across different time intervals, with the largest effect observed at the 6-month interval (–0.0043), followed by the 8-month and 4-month intervals. These findings suggest that the reform, which centralized corporate income tax collection under the State Taxation Bureau, contributed to a reduction in firms' misoptimization behaviors.

Table 2
The Effect of Tax Enforcement on Misoptimization

Dependent Variable	$\hat{u}^2$			$\tilde{u}^2$		
	(1)	(2)	(3)	(4)	(5)	(6)
Time Window [Months]	[4]	[6]	[8]	[4]	[6]	[8]
STB	-0.0039*	-0.0043***	-0.0030***	-0.0041*	-0.0043***	-0.0028***
	(-1.9651)	(-3.3146)	(-3.1406)	(-2.0416)	(-3.1336)	(-2.8448)
Firm-level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13,206	20,807	28,232	13,364	21,113	28,739
Adj. R^2	0.0208	0.0226	0.0210	0.0178	0.0198	0.0188

Notes: This table presents coefficient estimates from estimating Equation (10). The dependent variables are two measures of a firm's misoptimization, where $\hat{u}^2$ is estimated from Equation (15) following Flynn and Sastry (2024) and $\tilde{u}^2$ is estimated from Equation (17) orthogonalizing tax effects. The firm-level controls and fixed effects are indicated in the table. t-statistics are reported in parentheses and the standard errors are clustered by industry. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. For brevity, other control variables' coefficients are omitted here but are reported in Table B.2.

A plausible interpretation is that the enhanced enforcement capacity of the central tax authority limited opportunities for tax avoidance, increased the effective tax burden, and induced firms to allocate resources more judiciously. Faced with reduced discretion and higher compliance costs, firms were likely compelled to optimize their production and investment decisions to maintain operational efficiency under the new institutional constraints.

Moreover, Columns (4) through (6) replicate the analysis using an alternative measure of misoptimization that explicitly incorporates firm-level effective tax rates. The results remain robust, with consistently negative and significant coefficients ranging from –0.0043 to –0.0028. This further corroborates the hypothesis that the observed decline in misoptimization is primarily driven by the increased tax pressure resulting from the reform, rather than by firm heterogeneity or unobserved confounding factors.

Ljungqvist et al. (2017), Becker et al. (2020) and Kubick et al. (2024) provide evidence that firms tend to exhibit more risk-averse behavior when confronted with higher tax burdens. Building on this literature, we posit that heightened tax pressure may incentivize firms to engage in more cautious and disciplined decision-making, thereby mitigating resource misallocation and improving the overall efficiency of factor allocation.

Heterogeneity Analysis of Tax Burdens. The results reported in Table 3 provide further evidence on the relationship between tax burden and firm-level misoptimization. In particular, we group these enterprises subject to STB taxation into the high-tax group and the low-tax group based on the median of the effective tax rate they face. Specifically, the estimates show that within the high-tax group, firms overseen by the STB experienced a statistically significant decline in misoptimization relative to those under LTB enforcement. The coefficients are consistently negative and significant at conventional levels across all time windows, with the largest effect observed at the 6-month window (–0.0059), followed by the 8-month window (–0.0049). These results suggest that the increased tax burden, coupled with stricter enforcement by the STB, effectively reduced firms' misallocation behaviors. In contrast, no statistically significant differences are observed within the low-tax group, where the estimated effects of STB enforcement are smaller in magnitude and not statistically significant across any time window. This asymmetry reinforces the interpretation that it is the rise in effective tax pressure drives the observed reduction in misoptimization which is consistent with the hypothesis that increased tax burdens induced more disciplined behavior among affected firms. In the post-reform period, stricter tax enforcement combined with higher compliance costs may have limited firms' ability to engage in evasive practices or discretionary misallocation of resources. Consequently, firms in the high-tax group exhibited greater incentives to streamline their production decisions, reduce inefficiencies, and improve the overall alignment between inputs and outputs. Taken together, these results suggest that the 2002 reform, by reshaping firms' fiscal environment, contributed meaningfully to the observed decline in misoptimization.

Table 3
Heterogeneity Analysis of Tax Burden

Dependent Variable	$\hat{u}^2$			$\tilde{u}^2$		
	(1)	(2)	(3)	(4)	(5)	(6)
Time Window [Months]	[4]	[6]	[8]	[4]	[6]	[8]
			High Tax Group			
STB	-0.0049**	-0.0059***	-0.0049***	-0.0051**	-0.0058***	-0.0049***
	(-2.1325)	(-3.7649)	(-3.7390)	(-2.2645)	(-3.3102)	(-3.1975)
Observations	10,117	15,897	21,468	10,283	16,223	22,007
Adj. R^2	0.0253	0.0264	0.0258	0.0213	0.0225	0.0224
			Low Tax Group			
STB	-0.0029	-0.0027	-0.0010	-0.0033	-0.0030	-0.0010
	(-1.2122)	(-1.4515)	(-0.7145)	(-1.3681)	(-1.5711)	(-0.7704)
Observations	10,059	15,777	21,307	10,282	16,213	21,996
Adj. R^2	0.0192	0.0209	0.0186	0.0161	0.0181	0.0165

Notes: This table presents coefficient estimates by splitting the sample into high and low tax group. The dependent variables are two measures of a firm's misoptimization, where $\hat{u}^2$ is estimated from Equation (15) following Flynn and Sastry (2024) and $\tilde{u}^2$ is estimated from Equation (17) orthogonalizing tax effects. t-statistics are reported in parentheses and the standard errors are clustered by industry. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. All regressions in columns 1-6 include year fixed effect, industry fixed effect, and region fixed effect, as well as the same control variables as in the baseline regression reported in Table 2.

4.2 Effect of Tax Enforcement on Profitability Growth

Corporate tax burdens are typically viewed as a constraint on profitability growth, as resources that could otherwise support expansion, innovation, or productivity improvements are diverted to tax obligations (Atanassov and Liu, 2014). Higher effective tax rates increase firms' marginal costs, reduce the availability of internal funds for reinvestment, and may dampen incentives to pursue long-term growth opportunities (Mukherjee et al., 2017). Additionally, elevated tax pressure can prompt firms to rely more heavily on external financing—particularly debt—as a means of easing the liquidity constraints imposed by taxation (Faulkender and Smith, 2016). However, increased leverage can expose firms to greater financial risk and limit strategic flexibility, ultimately undermining their growth prospects and long-term sustainability (Lang et al., 1996).

Table 4
Effect of Tax Enforcement on Profitability Growth

Dependent Variable	Profitability Growth		
	(1)	(2)	(3)
Time Window [Months]	[4]	[6]	[8]
STB	0.0515**	0.0294*	0.0301**
	(2.5770)	(1.8998)	(2.3783)
Firm-level Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
Observations	10,592	16,622	22,543
Adj. R^2	0.0141	0.0132	0.0140

Notes: This table presents coefficient estimates from estimating Equation (10). The dependent variable is profitability growth, which is measured by the growth rate of operating profit per worker. The firm-level controls and fixed effects are indicated in the table. t-statistics are reported in parentheses and the standard errors are clustered by industry. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively

Contrary to these theoretical predictions, the empirical results reported in Table 4 reveal a positive and statistically significant relationship between the post-reform tax enforcement regime and profitability growth. Firms established shortly after the 2002 tax collection reform experienced significantly faster growth compared to those registered just prior to the policy shift. The most pronounced effect is observed within the 4-month bandwidth, where the estimated coefficient is 0.0515—implying a 5.15 percentage point increase in growth. Although the magnitude of the effect moderates over longer bandwidths, which declines to 2.94 and 3.01 percentage points at the 6- and 8-month intervals, respectively. The estimates remain statistically significant.

This counterintuitive finding raises important questions regarding the mechanisms through which tax enforcement influences firm dynamics. One plausible explanation is that, heightened enforcement pressure may have incentivized firms to improve internal efficiency. The need to comply with stricter tax regulations may have led to better financial reporting, more disciplined management practices, and more strategic resource allocation. In this sense, the reform served as a disciplining mechanism, pushing firms toward more sustainable and productivity-enhancing growth paths.

Taken together, these findings suggest that the relationship between tax policy and profitability growth is not necessarily unidirectional. The positive growth response observed in our setting underscores the importance of considering not just the magnitude of the tax burden, but also the level of firm-level misoptimization. We explore this underlying mechanism in the following part.

Heterogeneity Analysis of Misoptimization. Because the across-time change of misoptimization is not directly observable, we employ a classification strategy based on firms' relative positions within the distribution of estimated misoptimization. Specifically, we classify a firm into *High Misoptimization Group* if its estimated misoptimization is above median in the post-reform period, and into *Low Misoptimization Group*, otherwise.

Specifically, we assume that firms falling into the *Low Misoptimization Group* are more likely to experience a substantial decline in misoptimization. These firms are therefore presumed to have responded to increased tax pressure by adopting more prudent decision-making behaviors and improved resource allocation efficiency. If these efficiency gains translate into better performance, then we would expect the *Low Misoptimization Group* to demonstrate stronger subsequent growth compared to their counterparts.

Table 5 reports the heterogeneity analysis, which split the firms into high and low misoptimization group and estimates the effects of tax enforcement on profitability growth. Across all time windows, the estimated coefficients for the low misoptimization group are consistently positive and statistically significant, ranging from 0.0486 to 0.0648. These estimates are larger than the average treatment effects documented in Table 4, implying that the overall post-reform growth acceleration is concentrated among firms that effectively curtailed misoptimization.

This heterogeneity pattern further support for the mechanism proposed in the preceding analysis: the 2002 tax collection reform raised the cost of inefficient behavior by imposing stricter enforcement and higher effective tax burdens. In doing so, it created strong incentives for firms to improve internal efficiency. Those that adapted by reallocating resources more effectively realized superior growth outcomes. In contrast, firms that failed to adjust their decision-making remained operationally inefficient and saw little benefit from the institutional shift, despite facing the same external tax conditions.

Table 5
Heterogeneity Analysis of Misoptimization

Dependent Variable	Profitability Growth		
	(1)	(2)	(3)
Time Window [Months]	[4]	[6]	[8]
High Misoptimization Group			
STB	0.0317	0.0051	0.0057
Observations	8261	12,931	17,499
Adj. R^2	0.0112	0.0112	0.0123
Low Misoptimization Group			
STB	0.0648**	0.0486**	0.0584***
	(2.5464)	(2.6774)	(3.8712)
Observations	8273	12,942	17,511
Adj. R^2	0.0134	0.0133	0.0135

Notes: This table presents coefficient estimates by splitting the sample into high and low misoptimization groups. The dependent variable is profitability growth, which is measured by the growth rate of operating profit per worker. t-statistics are reported in parentheses and the standard errors are clustered by industry. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. All regressions in columns 1-6 include year fixed effect, industry fixed effect, and region fixed effect, as well as the same control variables as in the baseline regression reported in Table 4.

4.3 Robustness Check

Appendix B.2 contain four sets of robustness checks to validate our main findings.

First, we reconstruct firm-level misoptimization measures by accounting for potential confounding factors. To capture the impact of financial frictions, we augment the policy function (Equation (14)) by including leverage (total debt over total assets) and its interaction with TFP. In addition, we allow for non-linear effects of TFP in the policy function to reflect decreasing returns to scale and the asymmetric hiring and firing frictions documented by Ilut et al. (2018). Table B.3 confirms that our results are robust to these alternative specifications in the construction of firm-level misoptimization.

Second, it is possible that our baseline results are simply a mechanical correlation, or simply because newly established firms have smaller misoptimization compared to older firms. If this is the case, then we may find significant "jumps" in misoptimization in any year as a cutoff. To rule out this possibility, we conducted a placebo test by changing the regression discontinuity cutoff to January 1, 2001. This falsification exercise helps ensure that the observed effects are not driven by general time trends or unrelated policy changes occurring around the original cutoff. If the original findings were due to confounding temporal effects, we would expect to observe similar patterns around the placebo cutoff. However, as shown in Tables B.4 to B.7, the key coefficients are statistically insignificant and economically small under the placebo specification, which validates our identification strategy.

Third, we examine whether our results are driven by firms that were actually affected by the tax collection reform. To do so, we restrict our sample to central state-owned and foreign firms, which were already under the jurisdiction of the State Administration of Taxation prior to the 2002 tax collection reform and therefore not subject to the shift in tax enforcement authority. As a result, the reform is not expected to affect these firms. Tables B.9 to B.11 show that there are no significant impacts on these firms, supporting the claim that our baseline results are indeed driven by the change in tax enforcement and not by broader macroeconomic or institutional trends.

Finally, stricter enforcement may reduce firms' ability to underreport profits for tax evasion, leading to higher reported earnings. To address this concern, we re-estimate the baseline specifications with the effective corporate income tax rate included as a control variable to account for this channel (see Tables B.12 and B.13). The coefficient on STB remains essentially unchanged (0.0543 with *Tax Rate* in Table B.12 vs. 0.0515 without *Tax Rate* in Table 4), indicating that our findings are not sensitive to controlling for firms' effective tax rate. A similar pattern holds when comparing Tables 5 and B.13, where the sample is split into two groups. Meanwhile, the *Tax Rate* itself is strongly and positively associated with profitability growth (coefficient$\approx$3.9, significant at 1% level). These results are consistent with the hypothesis that the reduced evasion is one channel through which the tax enforcement affects the reported profit. Taken together, our findings rule out the concern that the profitability growth merely reflects the profit misreporting and highlight that the efficiency gains through the reduced misoptimization remain a robust channel.

5 Conclusion

This study examines the impact of tax enforcement on firm behavior. Grounded in a theoretical framework inspired by the costly control model, we conceptualize firms as operating under imperfect information, where optimizing production requires cognitive effort and managerial attention. We argue that heightened tax pressure compels firms to allocate more attention to decision-making, thereby reducing inefficiencies.

To examine our theoretical hypothesis, we leverage China's 2002 corporate income tax reform as a quasi-natural experiment. Using a regression discontinuity design (RDD), we provide robust empirical evidence that stricter tax enforcement reduces firm-level misoptimization and enhances profitability growth, despite the increased tax burden. This counterintuitive result appears to stem from efficiency gains that outweigh the financial constraints imposed by higher taxation. Notably, firms that achieved lower misoptimization were more likely to experience enhanced growth, underscoring the importance of managerial efficiency in driving firm performance. To ensure the robustness of our conclusions, we conduct several sensitivity analyses. These include alternative constructions of the misoptimization metric, a placebo test with a shifted RDD cutoff, and subsample tests using central and foreign-owned enterprises that were unaffected by the reform. Across all tests, the results remain consistent, bolstering the credibility of our identification strategy and empirical conclusions.

The policy implications of this study extend beyond the context of China. Our findings reveal a dual role for taxation: while it imposes financial burdens, it also incentivizes firms to reduce inefficiencies and improve operational performance. Policymakers should recognize this potential and design tax enforcement strategies that not only ensure compliance but also foster more efficient firm behavior.

We emphasize that our findings should not be construed as advocating for higher corporate effective tax rates to improve social welfare. Instead, our results have particular relevance for economies with inadequately designed or insufficiently enforced tax systems. Under such institutional conditions, firms frequently engage in tax avoidance through illicit means or corrupt practices, generating both revenue shortfalls and resource misallocation. Implementing robust tax enforcement mechanisms in these settings can yield complementary advantages: enhancing fiscal compliance while simultaneously incentivizing firms to adopt more deliberate and efficient operational strategies.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used GPT4.0 developed by OpenAI in order to improve readability and language. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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Online Appendix

This online appendix presents the details of theoretical proofs and empirical robustness checks.

Appendix A Proof

Proof of Proposition 1. The proof here follows the proof of Proposition 1 in Flynn and Sastry (2024). Consider a firm of type λ_i, with a payoff $\pi : \Theta \times \mathcal{X} \to \mathbb{R}$ and prior density $f \in \Delta(\Theta)$. The firm's stochastic choice problem can be written as

$$\max_{\phi} \int_{\mathcal{X}} \int_{\Theta} \pi(x, \theta_{it}) \phi(x \mid \theta_{it}) \, dx \, f(\theta_{it}) \, d\theta - \lambda_i \int_{\mathcal{X}} \int_{\Theta} \phi(x \mid \theta_{it}) \log \phi(x \mid \theta_{it}) \, dx \, f(\theta_{it}) \, d\theta \tag{A.1}$$

We can formulate this problem as constrained optimization for choosing $\phi(x \mid \theta_{it})$ pointwise, with constraints embodying non-negativity and the restriction that conditional distributions integrate to one. We can then write a Lagrangian for this problem, giving these constraints multipliers $\kappa(x, \theta_{it})$ and $\gamma(\theta_{it})$, respectively:

$$\begin{aligned} L(\{\phi(x \mid \theta_{it}), \kappa(x, \theta_{it})\}, \{\gamma(\theta_{it})\}) = & \int_{\Theta} \int_{\mathcal{X}} \pi(x, \theta_{it}) \phi(x \mid \theta_{it}) \, dx \, f(\theta_{it}) \, d\theta \\ & - \lambda_i \int_{\Theta} \int_{\mathcal{X}} \phi(x \mid \theta_{it}) \log \phi(x \mid \theta_{it}) \, dx \, f(\theta_{it}) \, d\theta \\ & + \int_{\Theta} \int_{\mathcal{X}} \kappa(x, \theta_{it}) \phi(x \mid \theta_{it}) \, dx \, f(\theta_{it}) \, d\theta \\ & + \int_{\Theta} \gamma(\theta_{it}) \left(\int_{\mathcal{X}} \phi(x \mid \theta_{it}) \, dx - 1 \right) f(\theta_{it}) \, d\theta \end{aligned} \tag{A.2}$$

The Lagrangian is concave in the collection $\{\phi(x \mid \theta_{it})\}$, since the expected utility term and the two constraint terms are linear in these variables, and the control-cost term is convex in these variables. Taking the first-order condition of the Lagrangian with respect to $\phi(x \mid \theta_{it})$ yields the necessary first-order condition

$$\pi(x, \theta_{it}) - \lambda_i (\log \phi(x \mid \theta_{it}) + 1) + \kappa(x, \theta_{it}) + \gamma(\theta_{it}) = 0 \tag{A.3}$$

Rearranging this expression and applying the normalization that the density integrates to one, we get the solution

$$\phi(x \mid \theta_{it}) = \frac{\exp\left(\lambda_i^{-1}\pi(x, \theta_{it})\right)}{\int_{\mathcal{X}} \exp\left(\lambda_i^{-1}\pi(x', \theta_{it})\right) dx'} \tag{A.4}$$

This solution is invariant to the prior distribution $f(\theta_{it})$, and hence can be indexed solely by the ex post realized state θ_{it}. To solve our firm's problem, we replace π with $\tilde{\pi}(x, \theta_{it}, \tau)$ in equation (5). Performing this substitution and ignoring the normalizing constant, we get

$$\phi(x \mid \theta_{it}) \propto \exp\left(-\frac{(x - x^*(\theta_{it}, \tau))^2}{2\lambda_i \left|\pi_{xx}(\theta_{it}, \tau)\right|^{-1}}\right) \tag{A.5}$$

Taking $\mathcal{X} = \mathbb{R}$, it is then immediate that $\phi(x \mid \theta_{it})$ is a Gaussian random variable with mean $x^*(\theta_{it}, \tau)$ and variance $\lambda_i \left|\pi_{xx}(\theta_{it}, \tau)\right|^{-1}$. Thus:

$$x_i = x^*(\theta_{it}, \tau) + \sqrt{\frac{\lambda_i}{\left|\pi_{xx}(\theta_{it}, \tau)\right|}} \cdot v_i, \quad v_i \sim \mathcal{N}(0, 1) \tag{A.6}$$

□

Proof of Corollary 1. The proof of Corollary 1 follows the discussion in the main text. □

Appendix B Empirical appendix

Appendix B.1 Density estimate of TFP and variable definition

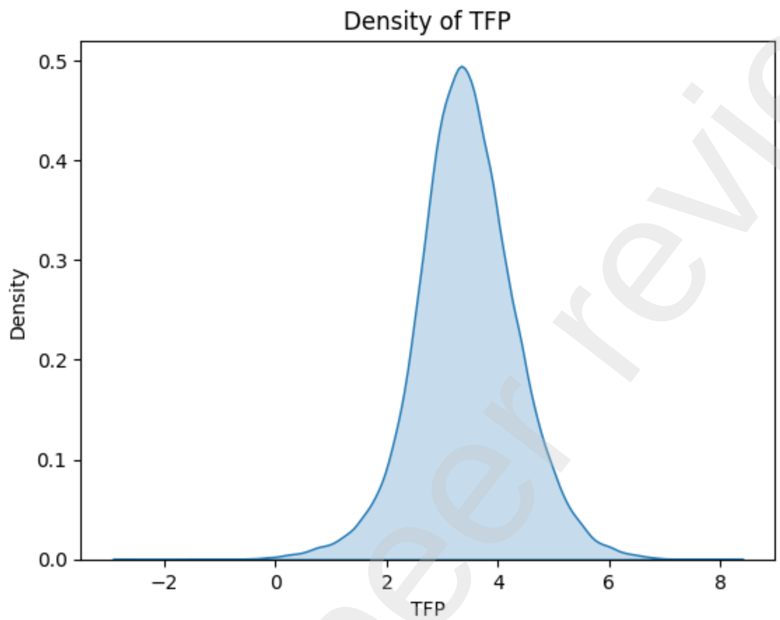

Fig. B.1. Density estimate in TFP of industrial enterprises

Notes: This figure shows the estimate of the density of the total factor productivity (TFP) calculated by the OP method for industrial enterprises.

Table B.1
Variable Definition

Variable	Description
$\hat{u}^2$	Measured as residual variation in firms' choices conditional on productivity, factor prices, and demand
$\tilde{u}^2$	Measured as residual variation in firms' choices conditional on productivity, factor prices, demand and effective tax rates
Tax Rate	Indicator of the firm's effective tax rates, calculated as the ratio of corporate income tax to total profit
Profitability Growth	The growth rate of operating profit per worker, calculated as the change of total profit over the number of workers in its logarithm: $\ln\left(\frac{\text{Total Profit}_{i,t}}{\text{Number of Workers}_{i,t}}\right) - \ln\left(\frac{\text{Total Profit}_{i,t-1}}{\text{Number of Workers}_{i,t-1}}\right)$
STB	A dummy variable for policy shocks, which equals 1 if the company was established after January 1, 2002, and 0 otherwise
Return on Asset	Return on Asset (ROA) of the company
Size	The logarithm of the number of employees in a company.
Leverage	The company's asset-liability ratio, calculated as total liabilities divided by total assets.
$\mathbb{I}(Export)$	A dummy variable for company exports, which equals 1 if the company engages in export trade and 0 otherwise.
HHI	Herfindahl Index, measure the market concentration of different industry

Table B.2
The Effect of Tax Enforcement on Misoptimization

Dependent Variable	$\hat{u}^2$			$\tilde{u}^2$		
	(1)	(2)	(3)	(4)	(5)	(6)
Time Window [Months]	[4]	[6]	[8]	[4]	[6]	[8]
STB	-0.0039*	-0.0043***	-0.0030***	-0.0041*	-0.0043***	-0.0028***
	(-1.9651)	(-3.3146)	(-3.1406)	(-2.0416)	(-3.1336)	(-2.8448)
Size	0.00072	0.00132	0.00160	0.00112	0.00199	0.00248*
	(0.5647)	(0.9948)	(1.1868)	(0.8456)	(1.4147)	(1.8268)
Pro	0.0012	-0.00088	-0.00052	0.00316	-0.00008	0.00056
	(0.1541)	(-0.1602)	(-0.1501)	(0.4173)	(-0.0160)	(0.1665)
Lev	0.00047	0.00594	-0.00071	0.00565	0.01084	0.00138
	(0.0434)	(0.5642)	(-0.0731)	(0.5695)	(1.0923)	(0.1636)
HHI	0.03315	-0.00333	-0.00559	0.04248	-0.00819	-0.01723
	(0.6332)	(-0.0906)	(-0.2148)	(1.0010)	(-0.2305)	(-0.6413)
EX	-0.00229	0.00089	-0.00077	-0.00300	-0.00012	-0.00185
	(-0.8170)	(0.3345)	(-0.3340)	(-0.9486)	(-0.0419)	(-0.7846)
Firm-level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13,206	20,807	28,232	13,364	21,113	28,739
Adj. R^2	0.0208	0.0226	0.0210	0.0178	0.0198	0.0188

Notes: This table presents all the coefficients of the control variables in Table 2. The firm-level controls and fixed effects are indicated in the table. t-statistics are reported in parentheses and the standard errors are clustered by industry. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Appendix B.2 Robustness check

Table B.3
Effect on Misoptimization - Financial Friction and High Order

Dependent variable	Financial Friction ($\hat{u}^2$)			High Order ($\hat{u}^2$)		
Time Window [Months]	[4]	[6]	[8]	[4]	[6]	[8]
STB	-0.0039*	-0.0043***	-0.0030***	-0.0038*	-0.0042***	-0.0030***
	(-1.9729)	(-3.3107)	(-3.1343)	(-1.9570)	(-3.2208)	(-3.0270)
Firm-level FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Ind FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13,206	20,807	28,232	13,206	20,807	28,232
Adj. R2	0.02083	0.02265	0.02102	0.02069	0.02275	0.02110

Notes: This table presents coefficient estimates from estimating Equation (10). The dependent variables are firm's misoptimizaiton after adding the impact of financial frictions and non-linear effects of TFP. t-statistics are reported in parentheses and the standard errors are clustered by industry. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. All regressions in columns 1-6 include year fixed effect, industry fixed effect, and region fixed effect, as well as the same control variables as in the baseline regression reported in Table 2.

Table B.4
Effect on Misoptimization (Change Sample)

Dependent variable	$\hat{u}^2$			$\tilde{u}^2$		
Time Window [Months]	[4]	[6]	[8]	[4]	[6]	[8]
STB	0.0026	-0.0013	-0.0025	0.0053	-0.0010	-0.0024
	(0.7848)	(-0.3999)	(-0.8131)	(1.0462)	(-0.3121)	(-0.7531)
Firm-level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Ind FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5560	3736	5008	2390	3741	5025
Adj. R^2	0.0489	0.0257	0.0379	0.0232	0.0231	0.0338

Notes: This table presents the results of our research sample replacement with foreign enterprises and central enterprises that are not subject to policy changes. The dependent variables are two measures of a firm's misoptimization, where $\hat{u}^2$ is estimated from Equation (15) following Flynn and Sastry (2024) and $\tilde{u}^2$ is estimated from Equation (17) orthogonalizing tax effects. t-statistics are reported in parentheses and the standard errors are clustered by industry. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. All regressions in columns 1-6 include year fixed effect, industry fixed effect, and region fixed effect, as well as the same control variables as in the baseline regression reported in Table 2.

Table B.5

Heterogeneity Analysis of Tax Burden (Change Sample)

Dependent Variable	$\hat{u}^2$			$\tilde{u}^2$		
Time Window [Months]	[4]	[6]	[8]	[4]	[6]	[8]
			High Tax Group			
STB	0.0008	-0.0053	-0.0050	0.0014	-0.0052	-0.0054*
	(0.1835)	(-1.6778)	(-1.6262)	(0.3429)	(-1.6246)	(-1.7755)
Observations	1877	2933	3897	1874	2938	3915
Adj. R^2	0.0828	0.0611	0.0654	0.0795	0.0586	0.0600
			Low Tax Group			
STB	0.0034	-0.0001	-0.0022	0.0039	0.0003	-0.0019
	(0.5106)	(-0.0106)	(-0.5794)	(0.5785)	(0.0609)	(-0.4549)
Observations	1894	2964	3964	1895	2974	3991
Adj. R^2	0.0535	0.0449	0.0547	0.0507	0.0427	0.0501

Notes: This table presents the results of our research sample replacement with foreign enterprises and central enterprises that are not subject to policy changes. Same as Table 3, we split the sample into high and low tax group. The dependent variables are two measures of a firm's misoptimization, where $\hat{u}^2$ is estimated from Equation (15) following Flynn and Sastry (2024) and $\tilde{u}^2$ is estimated from Equation (17) orthogonalizing tax effects. t-statistics are reported in parentheses and the standard errors are clustered by industry. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. All regressions in columns 1-6 include year fixed effect, industry fixed effect, and region fixed effect, as well as the same control variables as in the baseline regression reported in Table 2.

Table B.6
Effect on Profitability Growth (Change Sample)

Dependent variable	Profitability Growth		
Time Window [Months]	[4]	[6]	[8]
STB	-0.0627*	0.0082	0.0178
	(-1.7798)	(0.3150)	(0.9521)
Firm-level Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Ind FE	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
Observations	3672	5776	7730
Adj. R^2	0.0129	0.0118	0.0092

Notes: This table presents the results of our research sample replacement with foreign enterprises and central enterprises that are not subject to policy changes. The dependent variable is profitability growth, which is measured by the growth rate of operating profit per worker. t-statistics are reported in parentheses and the standard errors are clustered by industry. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. All regressions in columns 1-6 include year fixed effect, industry fixed effect, and region fixed effect, as well as the same control variables as in the baseline regression reported in Table 4.

Table B.7
Effect on Profitability Growth – Median Misallocation Group (Change Sample)

Dependent Variable	Profitability Growth		
Time Window [Months]	[4]	[6]	[8]
High Misoptimization Group			
STB	-0.0628	-0.0098	0.0165
	(-1.3989)	(-0.2716)	(0.7096)
Observations	2909	4547	6045
Adj. R^2	0.0174	0.0123	0.0079
Low Misoptimization Group			
STB	-0.0679	-0.0015	-0.0098
	(-1.2436)	(-0.0409)	(-0.3244)
Observations	2905	4538	6038
Adj. R^2	0.0083	0.0101	0.0099

Notes: This table presents the results of our research sample replacement with foreign enterprises and central enterprises that are not subject to policy changes. Same as Table 5, we split the sample into high and low tax group. The dependent variable is profitability growth, which is measured by the growth rate of operating profit per worker. t-statistics are reported in parentheses and the standard errors are clustered by industry. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. All regressions in columns 1-6 include year fixed effect, industry fixed effect, and region fixed effect, as well as the same control variables as in the baseline regression reported in Table 4.

Table B.8
Falsification Test on Misoptimization (Moving reform backward by one year)

Dependent variable	$\hat{u}^2$			$\tilde{u}^2$		
Time Window [Months]	[4]	[6]	[8]	[4]	[6]	[8]
STB	0.0041*	0.0027	0.0025	0.0040*	0.0026	0.0024
	(1.6935)	(1.3901)	(1.3977)	(1.6224)	(1.3618)	(1.3241)
Firm-level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Ind FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13740	20702	28043	13503	20365	27591
Adj. R^2	0.0256	0.0211	0.0218	0.0266	0.0219	0.0226

Notes: This table presents the results after moving the reform backwards by one year. The dependent variables are two measures of a firm's misoptimization, where $\hat{u}^2$ is estimated from Equation (15) following Flynn and Sastry (2024) and $\tilde{u}^2$ is estimated from Equation (17) orthogonalizing tax effects. t-statistics are reported in parentheses and the standard errors are clustered by industry. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. All regressions in columns 1-6 include year fixed effect, industry fixed effect, and region fixed effect, as well as the same control variables as in the baseline regression reported in Table 2.

Table B.9
Falsification Test on Misoptimization Heterogeneity (Moving reform backward by one year)

Dependent Variable	$\hat{u}^2$			$\tilde{u}^2$		
Time Window [Months]	[4]	[6]	[8]	[4]	[6]	[8]
			High Tax Group			
STB	-0.0010	-0.0009	-0.0018	-0.0010	-0.0008	-0.0016
	(-0.6754)	(-0.6185)	(-1.0153)	(-0.7106)	(-0.5270)	(-0.8720)
Observations	11,258	17,074	23,196	11,035	16,755	22,767
Adj. R^2	0.0293	0.0237	0.0233	0.0307	0.0250	0.0245
			Low Tax Group			
STB	0.0013	-0.0003	-0.0004	0.0015	-0.0004	-0.0002
	(0.3606)	(-0.1157)	(-0.1722)	(0.4064)	(-0.1479)	(-0.1095)
Observations	11,246	17,059	23,170	11,030	16,754	22,765
Adj. R^2	0.0225	0.0187	0.0198	0.0238	0.0197	0.0208

Notes: This table presents the results after moving the reform backwards by one year. Same as Table 3, we split the sample into high and low tax group. The dependent variables are two measures of a firm's misoptimization, where $\hat{u}^2$ is estimated from Equation (15) following Flynn and Sastry (2024) and $\tilde{u}^2$ is estimated from Equation (17) orthogonalizing tax effects. t-statistics are reported in parentheses and the standard errors are clustered by industry. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. All regressions in columns 1-6 include year fixed effect, industry fixed effect, and region fixed effect, as well as the same control variables as in the baseline regression reported in Table 2.

Table B.10
Falsification Test on Firm Profitability Growth (Moving reform backward by one year)

Dependent variable	Firm Profitability Growth		
Time Window [Months]	[4]	[6]	[8]
STB	-0.0093	0.0102	0.0150
	(-0.5747)	(0.9198)	(1.5524)
Firm-level Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Ind FE	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
Observations	11,597	17,570	23,775
Adj. R^2	0.0119	0.0137	0.0137

Notes: This table presents the results after moving the reform backwards by one year. The dependent variable is profitability growth, which is measured by the growth rate of operating profit per worker. t-statistics are reported in parentheses and the standard errors are clustered by industry. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. All regressions in columns 1-6 include year fixed effect, industry fixed effect, and region fixed effect, as well as the same control variables as in the baseline regression reported in Table 4.

Table B.11
Falsification Test on Firm Profitability Growth Heterogeneity (Moving reform backward by one year)

Dependent Variable	Firm Growth		
Time Window [Months]	[4]	[6]	[8]
High Misoptimization Group			
STB	-0.0297	0.0003	0.0094
	(-1.6065)	(0.0225)	(0.6923)
Observations	8120	12382	16877
Adj. R^2	0.0124	0.0149	0.0147
Low Misoptimization Group			
STB	0.0210	0.0243	0.0259*
	(0.9667)	(1.6070)	(1.7189)
Observations	8223	12568	17062
Adj. R^2	0.0123	0.0145	0.0150

Notes: This table presents the results after moving the reform backwards by one year. Same as Table 5, we split the sample into high and low tax group. The dependent variable is profitability growth, which is measured by the growth rate of operating profit per worker. t-statistics are reported in parentheses and the standard errors are clustered by industry. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. All regressions in columns 1-6 include year fixed effect, industry fixed effect, and region fixed effect, as well as the same control variables as in the baseline regression reported in Table 4.

Table B.12
Effect of Tax Enforcement on Profitability Growth (Effective tax rate as control variable)

Dependent variable	Firm Profitability Growth		
Time Window [Months]	[4]	[6]	[8]
STB	0.0543**	0.0336**	0.0320**
	(2.6709)	(2.2193)	(2.5232)
Tax Rate	3.9157***	3.7178***	3.7628***
	(9.7702)	(13.3170)	(16.7228)
Firm-level Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Ind FE	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
Observations	10,592	16,622	22,543
Adj. R^2	0.02519	0.02365	0.02466

Notes: The dependent variable is profitability growth, measured by the growth rate of operating profit per worker. t-statistics are reported in parentheses and standard errors are clustered by industry. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. All regressions include year, industry, and region fixed effects, plus baseline controls.

Table B.13
Heterogeneity Analysis of Misoptimization (Effective tax rate as control variable)

Dependent Variable	Profitability Growth		
	(1)	(2)	(3)
Time Window [Months]	[4]	[6]	[8]
High Misoptimization Group			
STB	0.0133	-0.0054	-0.0107
	(0.6630)	(-0.2514)	(-0.5941)
Tax Rate	3.9192***	3.7231***	3.7732***
	(9.7286)	(13.3094)	(16.8551)
Observations	10,592	16,622	22,543
Adj. R^2	0.02519	0.02365	0.02466
Low Misoptimization Group			
STB	0.0538**	0.0464**	0.0527***
	(2.2452)	(2.4593)	(3.1735)
Tax Rate	3.9157***	3.7178***	3.7628***
	(9.7702)	(13.3170)	(16.7228)
Observations	10,592	16,622	22,543
Adj. R^2	0.02519	0.02365	0.02466

Note: This table presents coefficient estimates by splitting the sample into high and low misoptimization groups. The dependent variable is profitability growth, measured by the growth rate of operating profit per worker. t-statistics are reported in parentheses and standard errors are clustered by industry. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. All regressions include year, industry, and region fixed effects, plus baseline controls.