China Economic Review 83 (2024) 102078

Contents lists available at ScienceDirect

China Economic Review

journal homepage: www.elsevier.com/locate/chieco

Do firms benefit from public information services: Evidence from a tax hotline program in China☆

Wenjing Gao [a,*], Jie Mao [b], Xinzheng Shi [c]

[a] School of Economics, Hangzhou Normal University, Hangzhou, China
[b] School of International Trade and Economics, University of International Business and Economics, Beijing, China
[c] School of Economics and Management, Tsinghua University, Beijing, China

ARTICLE INFO

JEL classifications:
D83
H26
H32

Keywords:
Information friction
Tax hotline
Effective corporate income tax rate

ABSTRACT

We investigate the effect of a public information service program in taxation on firms' effective corporate income tax rate (ECITR), taking advantage of a tax hotline program that lowers the cost of access to tax information. Using Chinese firm-level administrative data and exploiting a stacked difference-indifferences model, we find that firms experienced decreases in ECITR after the hotline adoption, and this effect is more pronounced for smaller firms and younger firms. This effect is driven by the hotline helping existing policies transmit more efficiently, and firms claim more tax credits. Furthermore, the tax windfall brought by the hotline has real impacts on firms by increasing their cash flow, investment, and returns on assets.

1. Introduction

Preferential policies are widely used to boost firms' growth in developing countries (for example, Chaurey (2017), Hasan, Jiang, and Rafols (2021) for India; Lu, Wang, and Zhu (2019), Liu and Mao (2019), Zhang, Chen, and He (2018) for China). However, those policies usually go through reforms frequently and feature complex characteristics such as nonlinear thresholds with kinks or notches (Chen, Liu, Serrato, & Xu, 2021; Li, Liu, & Sun, 2021), resulting in information frictions (Zwick, 2021). Although the existence and inefficiency of information friction have been well documented for individuals in the literature (Alm, Cherry, Jones, & McKee, 2010; Blaufus et al., 2015; Hoopes, Reck, & Slemrod, 2015), there are surprisingly few empirical analyses that directly study the causal effect of reduced information friction on behaviors of firms. This paper explores whether firms benefit from public information services in the context of taxation by examining how variations in access to taxation information affect firms' tax burden, taking advantage of a tax hotline program in China.

Two features make the taxation setting suitable for studying the effect of public information services. First, tax-based incentives have proliferated worldwide as fiscal instruments in recent decades (Felix & Hines, 2013; Saez, Schoefer, & Seim, 2019). Second,

☆ We thank seminar participants in the China Summer Institute of Public Economics 2018, Central University of Finance and Economics, and participants of the Camphor Conference 2019 for their helpful comments. Wenjing Gao acknowledges financial support from the National Natural Science Foundation of China (Project 72103179) and the Zhejiang Province Natural Science Foundation (Project LQ22G030016). Jie Mao acknowledges financial support from the Chinese National Funding of Social Sciences (Project 18ZDA097). Xinzheng Shi acknowledges financial support from the Chinese National Funding of Social Sciences (Project 21&ZD076) and Tsinghua University Initiative Scientific Research Program (Project 2021THZWJC14).

* Corresponding author.
E-mail address: gaowenjing18@icloud.com (W. Gao).

https://doi.org/10.1016/j.chieco.2023.102078
Received 24 May 2023; Received in revised form 18 September 2023; Accepted 15 November 2023
Available online 20 November 2023

taxpayers do not perfectly optimize their behaviors in response to tax incentives (Bastani, Giebe, & Miao, 2020), since they are either not fully informed (Hoopes et al., 2015) or have misperceptions (Blaufus & Milde, 2021). The provision of public information services can potentially benefit firms.

Firms face information friction in taking up various tax credit programs in China. For example, the Chinese government offered eligible small firms a reduced corporate income tax rate of 10% in contrast to the statutory tax rate of 25%.[1] However, <10% eligible firms take up this program in the early stages of the policy, and the take-up rate increases to only about 25% in the later stages of the policy. This means that firms leave more than RMB 720 million (about US$115.2 million) on the table.[2]

To alleviate information friction, a tax hotline, 12,366, was adopted by local governments from 2002 to 2014.[3] The hotline is free and is a major information source for taxpayers since it is responsive, interactive, and professional. Taxpayers can call the hotline to ask different questions, such as the criteria of tax laws and application procedures of tax policies. These questions are answered by well-trained professional operators. Compared with the Internet, the hotline has several advantages. On the one hand, the hotline acts like a consultant that provides customized information services. On the other hand, making calls is far more accessible and more efficient than searching the Internet, especially for the less-educated (Blaufus et al., 2015), and those without tax assistance (Ballard & Gupta, 2018). The hotline has been extensively used. For example, the hotline center we surveyed receives >70 calls per operator per day. The hotline significantly reduces the cost of obtaining tax-related information, potentially benefiting firms.

To explore the impact of the hotline on firms, we manually collect the timings of hotline adoptions for each prefecture from newspaper.[4] The hotline effect is estimated by exploiting a stacked difference-in-differences (stacked DD) strategy (Cengiz, Dube, Lindner, & Zipperer, 2019; Deshpande & Li, 2019) to deal with the challenge of heterogeneous treatment effects in the standard two-way fixed effect DD model.[5] We focus on the impact of hotline adoptions on corporate income tax (CIT), the second-largest tax payment in China.[6] Compared with the largest tax payment, the value-added tax (VAT), which is calculated based on transaction paper trails (Pomeranz, 2015), CIT is calculated based on profit and requires lots of information to apply for credits. Thus, variation in information may result in differences in firms' effective corporate income tax rates (ECITR).

We find that the adoption of the hotline significantly reduces firms' ECITR. Quantitatively, firms in a prefecture with the hotline would experience an average of 0.561 percentage points decrease in ECITR, compared with prefectures not yet adopting the hotline. Heterogenous analysis shows that firms facing larger information friction, benefit more from the hotline adoptions. Specifically, firms that are more capital intensive and younger firms experience a larger decrease in ECITR.

We then conduct several robustness checks to ensure the validity of our empirical strategy: (1) we provide evidence that the ECITR of firms in prefectures with different hotline adoption timings evolved similarly before the hotline adoption; (2) we show that other confounding events, including another hotline adopted by state tax bureaus, the InnoCom program, the business tax to value-added tax reform, the golden tax project, and the tax administration reform, do not drive our results; (3) we conduct a placebo test to investigate the impact of the hotline on business tax borne by firms, which is free from information friction since it's transparent and straightforward, and we find no significant effect; (4) we show that the adoption of hotlines in other prefectures does not affect the estimation of the hotline effect. These robustness tests give us further confidence in our main findings.

We further examine the channels through which the hotline reduces firms' ECITR. We first find that the hotline and tax policies complement each other. Exploiting a preferential tax policy for small firms, we find that tax policies exhibit a statistically significant impact on a firm's ECITR when there is a hotline. We then find that the hotline helps firms claim more tax credits but such an effect mainly concentrates on firms already claiming tax credits (i.e., intensive margin).

We then investigate whether the tax windfall brought by the hotline has real impacts on firms, and we find that the hotline increases firms' cash flow, investment, and return on assets (ROA). We finally conduct a cost and benefit analysis. A dollar investment in the hotline would reduce 8 dollars of the tax burden borne by firms.

Our paper contributes to the literature in three aspects. First, our paper belongs to a fast-growing literature that investigates the role of information in shaping responses to policy incentives. This strand of literature mainly focuses on individuals. Information friction exists at the individual level in both developed countries such as the U.S. (Chetty, Friedman, & Saez, 2013; Hoopes et al., 2015) and France (Aghion, Akcigit, Lequien, & Stantcheva, 2017), and also in developing countries such as China (Giles, Meng, Xue, & Zhao, 2021) and Ecuador (Bohne & Nimczik, 2018). Individuals prefer simplified tax regimes (Aghion, Akcigit, Gravoueille, Lequien, &

[1] The 2008 Corporate Income Tax Law awarded small firms a preferential statutory tax rate 20%, which was 5 percentage points lower than the standard rate. From 2010 to 2011, small firms with taxable income of less than RMB 30,000 yuan were eligible for a 10% tax rate. The coverage of the policy expanded to small firms with taxable income of less than RMB 60,000 yuan in 2012 and 2013, to small firms with taxable income of less than RMB 100,000 yuan in 2014, and finally to small firms with taxable income of less than RMB 300,000 yuan in 2015. For firms in manufacturing industries, small firms are those with less than RMB 300,000 yuan CIT payable, fewer than 100 employees, and less than RMB 30 million in assets. In other industries, small firms are those with less than RMB 300,000 yuan CIT payable, fewer than 80 employees, and less than RMB 10 million in assets.

[2] This number is calculated as the difference between the CIT that firms actually paid and the CIT that firms should pay under the preferential tax rate using the National Tax Survey Dataset (NTSD), see a detailed introduction of this data set in section 3.

[3] There were two types of tax bureaus from 1994 to 2018, state tax bureaus (STB) and local tax bureaus (LTB). LTBs and STBs were unified into one tax bureau in 2018. In our paper, we focus on the hotline adopted by LTBs.

[4] Prefectures are administrative units below provinces and above counties. There are four cities directly under the Central Government, namely, Beijing, Tianjin, Shanghai, and Chongqing. To simplify notations, we do not distinguish them from other prefectures throughout this paper.

[5] See Baker, Larcker, and Wang (2022); Roth et al. (2022) for reviews on this strand of literature.

[6] According to the Finance Yearbook of China (2020), CIT constitutes about 24% of total tax revenues in 2019.

Stantcheva, 2023). However, empirical evidence of information friction at the firm level is scant (Blaufus, Chirvi, Huber, Maiterth, & Sureth-Sloane, 2020). An exception is the research by Zwick (2021), who highlights firms' imperfect response to a complex tax policy for U.S. firms. Our paper focuses on how reduced tax information friction affects firms' ECITR in China, complementing the literature by providing evidence at the firm level from the largest developing country.

Second, our paper contributes to the literature by showing that providing public information services is an effective approach to reduce friction and enhance policy transmission. Previous research studied how the design of the tax system affects policy transmission, such as the form of taxation (Atkinson & Stiglitz, 1976; Pomeranz, 2015), the choice of tax base (Best, Brockmeyer, Kleven, Spinnewijn, & Waseem, 2015), and the detailed tax schedule (Saez, 2001). Another factor affecting policy transmission is tax enforcement (Jia, Ding, & Liu, 2020; Pomeranz, 2015). Taxation services started to attract researchers' attention recently. Laboratory evidence suggests that providing tax services can increase the compliance behavior of individual taxpayers (Alm et al., 2010; Koumpias & Martinez-Vazquez, 2019; Vossler & Gilpatric, 2018). Craig and Slemrod (2022) build a theoretical model and point out that the government faces a tradeoff in providing tax knowledge and raising revenue. However, empirical studies on the effect of providing taxation services in the real world are rare. We explore a unique taxation hotline program in China to study the role of public information services on firms. Our results complement the existing literature on policy transmission by showing that providing public information services can facilitate firms to claim tax credits.

Third, our paper also contributes to the literature studying the role of public goods and services. Most of the existing literature emphasizes the role of physical public goods. For example, one of the areas that attracted much attention is the impact of transportation infrastructure, which is a way to reduce spatial frictions (Behrens, Mion, Murata, & Suedekum, 2017). How transportation infrastructure affects commuting (Lu, Shi, Sivadasan, & Xu, 2021), suburbanization (Baum-Snow, 2007), innovation (Agrawal, Galasso, & Oettl, 2017) and economic growth (Donaldson & Hornbeck, 2016) is well-answered in the literature. However, the role of public services is far less discussed. Our paper complements this strand of literature by exploring the role of public services in reducing taxpayers' tax burden.

The remaining part of this paper is organized as follows. Section 2 describes the institutional background. Section 3 introduces the data used in our paper and how the stacked sample is constructed. Section 4 presents the empirical strategy. Section 5 reports our main results, heterogeneous analysis, and robustness checks. We explore the underlying channels in section 6. Section 7 investigates the real impacts of the hotline on firms and conducts a cost and benefit analysis. Section 8 concludes the paper.

2. Corporate income tax and the hotline program

2.1. Tax legislation in China

Unlike the U.S. and many other countries, the taxation legislative power in China is concentrated in the central government. It is the central government that enacts and amends laws, administrative rules, and regulations. Take the tax laws in CIT as an example. The current *Corporate Income Tax Law* (CITL) was enacted by the National People's Congress (NPC), the supreme organ of the State power, on March 16, 2007. It became effective on January 1, 2008.[7] On December 6, 2007, the State Council, the supreme organ of the State administration, issued *the Regulation on the Implementation of the Corporate Income Tax Law*, providing explanations for items in the CITL and implementation guidance for the CITL.[8] Ministries of the State Council have the power to issue preferential policies. For example, the State Taxation Administration (STA) and the Ministry of Finance issued preferential policies for small firms.

Local governments are responsible for the implementation of tax policies. They focus on practical issues, such as how to file a tax return, and what's the procedure for tax claims. Tax bureaus under the management of local governments are local tax bureaus (LTB). Fig. 1 summarizes the tax legislative structure in China.

Two features of the legislation system may result in information friction. On the one hand, firms need to comply with both the tax laws of the central government and the implementation procedures of the local governments to apply for tax credits. Information on tax laws and regulations is easy to obtain through the Internet. However, region-specific procedures are not unified and difficult to obtain. On the other hand, in a transitional economy like China, tax laws are frequently modified and some of them are complex. This may hamper firms' effective use of tax policies. According to the policy database of the STA, there have been 487 regulations on CIT from 1994 to 2019 at the central level.[9] The number of regulations at the local level may be doubled or even tripled, one consequence of which could be that firms cannot take full advantages of the policies.

Before the LTB's hotline was adopted, taxpayers had no convenient and reliable ways to obtain information on the implementation rules. The difficulty of acquiring and processing information may invalidate the impact of tax policies as fiscal instruments. An efficient information channel is badly needed. The tax hotline filled this gap, which is introduced in section 2.2.

2.2. The tax hotline program

The tax hotline, 12,366, was gradually adopted by prefecture-level LTBs from 2002 to 2014. The hotline is free and aims to improve

[7] An English version of this document can be found at http://www.lawinfochina.com/Display.aspx?lib=law&Cgid=89382.
[8] An English version of this document can be found at http://www.lawinfochina.com/display.aspx?lib=law&id=6546&CGid=.
[9] Since there is no English version available on this database, the Chinese version can be found at http://www.chinatax.gov.cn/chinatax/n810341/n810825/index.html?title=.

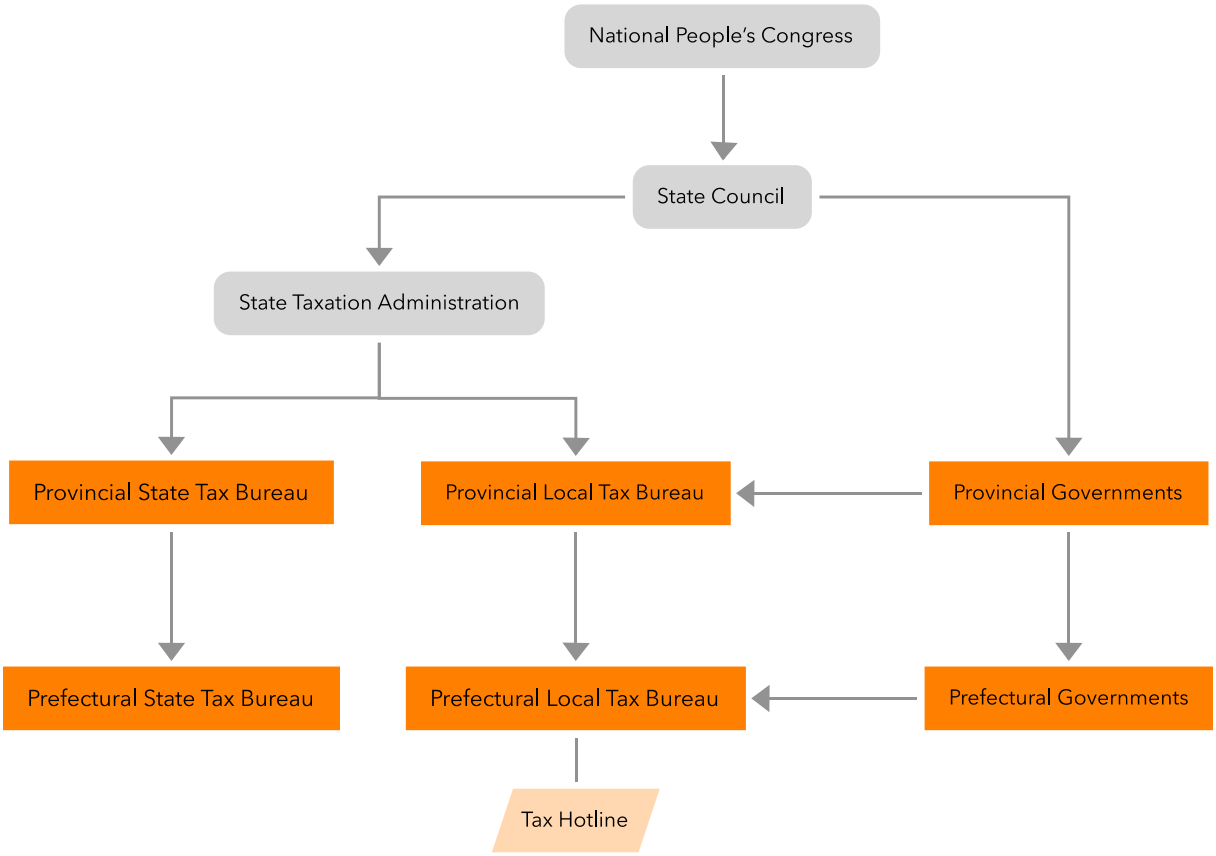


Fig. 1. Tax Legislation System in China.
Notes: The figure shows the tax legislation system in China during the period from 1994 to 2018. The rounded rectangular blocks denote government entities at the central level. The rectangle blocks indicate organizations of local governments. The tax hotline is shown in the parallelogram, which was adopted by prefectural local tax bureaus. Arrows between blocks denote management relationships. For example, the prefectural local tax bureau is managed by the provincial local tax bureau and the prefectural government. The tax legislative power is concentrated in the central government in China. The *Corporate Income Tax Law* was enacted by the National People's Congress, and the *Regulation on the Implementation of the Corporate Income Tax Law* was issued by the State Council. Ministries of the State Council, like the State Taxation Administration, have the power to issue preferential tax policies. Local governments, like the prefectural governments, are responsible for the implementation of tax policies. They can make practical rules on tax filings and claim procedures.

the service quality of local governments. According to our manually collected timings of hotline adoptions (see section 3.1 for a detailed introduction of the hotline timing data), the hotline was firstly adopted in Beijing and Guangzhou in 2002. Inner Mongolia Autonomous Region was the last to adopt the hotline in 2014.

The prefecture-level hotline is the one that provides the consulting service. However, the procedure of receiving and distributing calls is slightly different across prefectures. For prefectures that adopted the hotline on their own, the prefecture directly receives and answers calls. In our sample, most prefectures fall in this category. There are also some provinces adopting the hotline in all prefectures at the same time, like Shannxi province. For those hotlines, the province center is only responsible for distributing the calls, it is the prefecture tax bureau that provides service. So we focus on the hotline at the prefecture level.

The hotline is a major information source for taxpayers. To investigate how the hotline works, we spent two weeks in a hotline center in a prefecture.[10] We briefly discuss the hotline hereafter and provide a detailed description in Appendix A.

Three features of the hotline make it a perfect setting to study the impact of reduced information friction. First, the hotline is extensively used. It received about 5 million calls in 2018 alone. On average, each of the 100 operators in the hotline center we surveyed has a basic workload of 70 calls per day. In terms of content, CIT is always a hot topic. The number of calls on CIT in this center in a single week in 2018 was 19,987. Among those calls, implementation rules on preferential tax policies are frequently asked. Approximately 37.56% of them are about tax filing, and the other 25.21% ask about application procedures for preferential tax policies. Some hot questions are: "What are the requirements to enjoy the preferential tax rate for small firms"; "What files do we need

[10] We stayed in this hotline center from August 12, 2019, to August 23, 2019. Most of the figures we mentioned in this section are provided by this hotline center.

to prepare to enjoy preferential tax policies".[11]

Second, the hotline provides customized information specific to a caller.[12] Although tax policies are easier to get from the Internet, taxpayers need to comply with implementation rules to claim a tax credit. The hotline acts like a consultant that provides customized information services. Moreover, for taxpayers, making calls is far more accessible and more efficient than searching the Internet, especially for the less-educated (Blaufus et al., 2015), and those without tax assistance (Ballard & Gupta, 2018).

Third, the hotline operators are specialized in taxation services. To get the job, operators must pass the civil service exam, one of the most competitive exams in China, with hundreds or thousands of applicants competing for one position. Operators are trained for approximately 2 to 3 months before they work without the supervision of an expert. They need to learn the structure of the Chinese tax system, laws, and regulations for each tax; they also need to learn communication skills. What's more, there is frequent on-the-job training that updates them about current changes in the tax system. The hotline operators are therefore capable of providing accurate and immediate services.

The hotline significantly reduces the cost of obtaining tax-related information, potentially benefiting firms, particularly firms facing larger information frictions. Thus, we use the timing of hotline adoption in each prefecture to measure access to taxation public information.

3. Data

3.1. Hotline adoption time

We manually collected the timings of hotline adoptions for prefectures from newspapers. For example, Xiamen, a prefecture in Fujian province, adopted the hotline in 2005, which was reported by Xiamen Daily. Dalian, a prefecture in Liaoning province, adopted the hotline in 2009, which was reported by China Taxation News. At last, we got data on 116 LTBs among all the 330 prefectures in China. The adoption time ranges from 2002 to 2014.

For prefectures without publicly available adoption timings, we cannot distinguish whether they did not adopt the hotline or they adopted the hotline but did not publish the timing. So we restrict our sample to prefectures with data on the timing of hotline adoption. For the sake of our empirical strategy (see section 3.4), we focus on the hotline effect for 37 prefectures that adopted the hotline from 2009 to 2012.

We use the timing of the hotline to measure access to public taxation information. The underlying assumption for this measurement is the tax hotline only serves local firms. This is a reasonable assumption since firms pay taxes locally and they need to comply with regulations in their own prefecture, taxation information in other prefectures is unlikely to be useful. In fact, we tried to call the hotline in other prefectures from where we are located, and the standard procedure the operator did was to transfer the call back to the home prefecture.

3.2. Firm data

The firm data is from the National Tax Survey Dataset (NTSD) from 2008 to 2013. The NTSD was jointly collected by the STA and the Ministry of Finance of China. It is collected to monitor firms for tax bureaus, which ensures the accuracy of the data (Liu & Mao, 2019). The data is at the plant level. Plant-level data allow us to identify the hotline effect even when access to information services differs across plants within the same firm.[13]

We choose 2008 as the starting year to avoid the potential confounding effects of the 2008 Corporate Income Tax Law, which took effect on January 1, 2008.[14] We choose 2013 as the ending year since it's the last year that we know how the data was sampled.

Compared with the extensively used firm dataset from the Annual Survey of Industrial Firms (for example Brandt, Biesebroeck, and Zhang (2012); Hsieh and Klenow (2009)), our dataset has several advantages. It covers firms in all industries, not only firms in manufacturing industries. It includes firms of all sizes, not only firms with sales above some threshold. Besides, it includes rich variables ranging from firms' financial indicators to detailed tax-related information (Cao & Mao, 2021). For example, variables related to CIT include taxable income, tax credits, tax deductions, and inter-period tax adjustments, among others. These variables allow us to explore the underlying channels for the hotline to affect firms.

The variable of the most interest in our paper is ECITR, defined as the ratio of CIT to taxable income. In some studies, the ECITR is normalized by their pre-tax profits (Cai & Liu, 2009; Dyreng, Hanlon, & Maydew, 2008). Given that GAAP accounting (accounting as

[11] See Appendix Table A1 for a list of frequently asked questions.

[12] The main function of the hotline is to provide information. The hotline sometimes receives calls to file complaints. However, those calls are only recorded and then transferred to other related departments. The operators are not responsible for the handling of complaints. In contrast, the operators must follow the whole process of the information consulting calls, even when they cannot give immediate replies, they must call taxpayers back when the requested information is available.

[13] A firm refers to a plant-level firm hereafter.

[14] Before 2008, the statutory CIT rate for domestic firms was 33%, whereas foreign-invested firms (FIFs) were eligible for many preferential tax treatments and enjoyed a preferential rate ranging from 15% to 24%. The ECITR was approximately 15% for FIFs and 25% for domestic firms. The 2008 Corporate Income Tax Law, which took effect on January 1, 2008, unified the tax rate for domestic firms and FIFs to 25% (see Chen et al. (2021b) for a detailed introduction of the structure of business taxation in China).

per "Generally Accepted Accounting Principles") is different from tax accounting (accounting that applies the principles and method used to prepare a tax return), pre-tax profits can be very different from taxable income. For example, the wage is a cost and can be subtracted from output to calculate profits under GAAP. In contrast, only a fraction of the wage bill can be deducted under the tax accounting principles. Therefore, using taxable income as the denominator when calculating firms' ECITR is more appropriate.

Other key variables we use include the number of employees, the total value of assets, investment, and profits. The monetary values of the firm-level variables are deflated to the 2008 level.

Since the hotline is available to all firms in the prefecture, we use all firms instead of restricting the sample to firms administrated by LTBs. We drop firms wholly-owned by an individual and partnership firms since they are not corporate income taxpayers in the baseline analysis.[15]

The NTSD systematically undersampled small firms. For example, for value-added taxpayers in the manufacturing industry, the data includes all firms with sales larger than RMB 400 million. However, for firms with sales of less than RMB 3 million, the sampling ratio is 1 to 500. Table C1 lists the sampling weight for firms in different industries. We include the sampling weight in the empirical model to adjust for the imbalance.

3.3. Prefecture data

The prefecture-level data is from China City Statistical Yearbooks. Prefecture characteristics are used to explore the potential determinants of the timing of hotline adoption (see Appendix B). We collect data from 2000 to 2014, which is consistent with the hotline adoption time. The prefecture-level variables include the GDP per capita, the GDP share of secondary industry and tertiary industry, the employment share of secondary industry and tertiary industry, population density, the ratio of FDI to GDP, CIT, budget revenue, and budget expense.

In the baseline model, we only use prefecture characteristics in 2000, the year before any prefectures had adopted a hotline.

3.4. Sample construction

The hotline effect is estimated using a stacked DD model (Cengiz et al., 2019; Deshpande & Li, 2019) to deal with the challenge of heterogeneous treatment effects in the standard two-way fixed effect DD model.[16] The estimation is based on a stacked dataset that treats prefectures adopting the hotline in the same year as in one event.

The dataset is constructed as follows. We first create separate datasets for each hotline adoption. In order to have pre-hotline and post-hotline data for each hotline adoption, we need to focus on hotline adoptions after 2009. For prefectures that adopted the hotline before 2008, we do not have pre-hotline periods for this prefecture since our firm-level NTSD started in 2008. So, we drop prefectures adopting the hotline before 2008.

In each dataset, prefectures with the hotline are treated prefectures, while prefectures that adopt the hotline more than one year later are control prefectures. Event times are specified relative to the hotline adoption. Since we do not have never-adopting prefectures, we use the pre-treatment data of the not-yet-adopting prefectures to construct the clean control group. The last treated prefectures are those adopting the hotline in 2014, so the requirement of a clean control in each stack leaves us with a sample from 2008 to 2013.

We have four separate datasets for prefectures adopting the hotline in 2009, 2010, 2011, and 2012. For the first dataset (the 2009 adoption event), the treated prefectures are prefectures adopting the hotline in 2009, and control prefectures are prefectures adopting the hotline in 2011, 2012, and 2014. This dataset includes all periods in the treated prefecture (2008 to 2013) and pre-hotline periods in the control prefectures (2008 to 2010 for prefectures adopting the hotline in 2011, 2008 to 2011 for prefectures adopting the hotline in 2012, and 2008 to 2013 for prefectures adopting the hotline in 2014). Thus, the event time ranges from one year before the hotline adoption and four years after the hotline adoption in the first dataset. The remaining three datasets are constructed similarly.

We then append all the datasets into one dataset. This is the sample we use for the empirical analysis. The event time ranges from four years before the hotline adoption and four years after the hotline adoption. There are 142,853 firm-year observations with 28,775 unique firms from 2008 to 2013 in the stacked sample.

3.5. Summary statistics

We plot the distribution of the hotline adoption years in Fig. 2. From this figure, we can see that one prefecture adopted the hotline in 2009, ten prefectures adopted the hotline in 2010, twelve prefectures adopted the hotline in 2011 and 2012, respectively, and there are two prefectures that adopted the hotline in 2014.

Table 1 reports the summary statistics for the original sample and the stacked sample. Overall, there are no systematic differences between the two samples. We introduce the statistics based on the stacked sample hereafter. Panel A focuses on the hotline adoption time.[17] The mean value for the hotline adoption timing is 2011. 61.3% firms are in treated prefectures, and 63.0% firms are in the post-

[15] According to the Corporate Income Tax Law, firms wholly-owned by an individual and partnership firms pay individual income tax based on their distributed profits.

[16] See Baker et al. (2022); Roth et al. (2022) for reviews on this strand of literature.

[17] The hotline refers to the LTB's hotline hereafter.

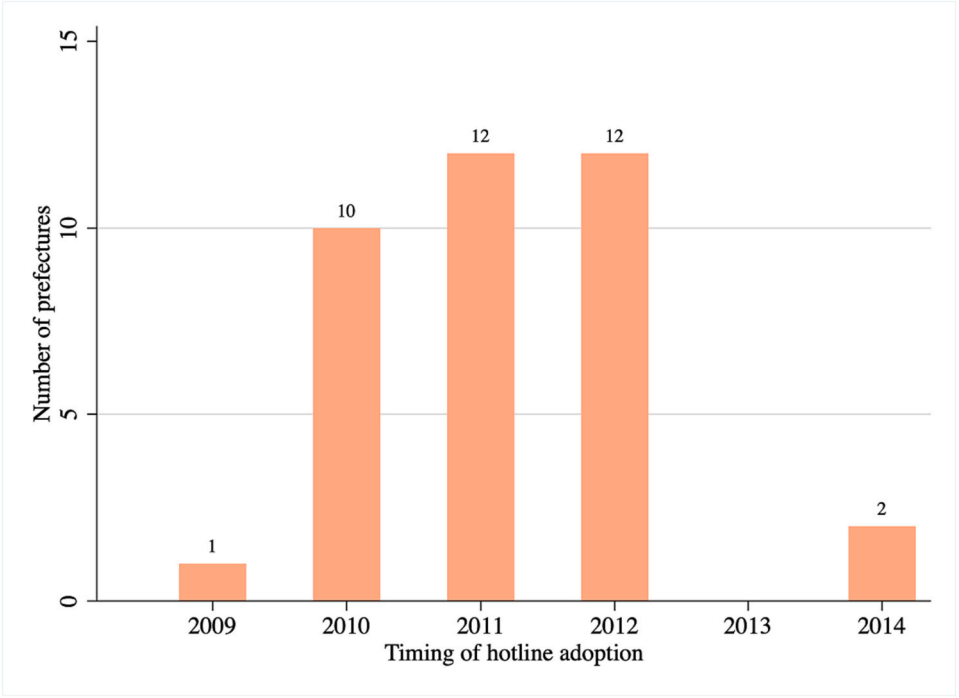


Fig. 2. Distribution of the hotline adoption timings.
Notes: The figure plots the distribution of the hotline adoption timings, where the horizontal axis is the calendar year, and the vertical axis is the number of prefectures adopting the hotline each year. The hotline adoption time was manually collected from newspapers. See section 2.2 for a brief introduction of the hotline and appendix A for a detailed introduction.

hotline periods.

Panel B in Table 1 reports the summary statistics for firm-level variables. On average, the ECITR for firms is 23.975%. Firms, on average, are 8 years old and have 100 employees. The mean value of the logarithm of assets is 12.436. The mean value of tax credits is 1.199% of the taxable income. 14.5% firms enjoy positive credits.

Panel C in Table 1 reports the summary statistics for prefecture variables measured in 2000, in which none of the hotlines had been adopted. The mean value of the logarithm of GDP per capita is 8.902, with a standard deviation of 0.697. On average, the secondary industry accounts for 45.640% of GDP, and the tertiary industry accounts for about 37.843%. Budget revenue, on average, accounts for 4.4% of GDP, and the prefecture's CIT accounts for 0.7% of GDP. The average ratio of budget expense to budget revenue is 1.381.

4. Empirical strategy

We combine two variations to identify the effect of adopting hotlines: a time variation from before to after hotline adoption within a prefecture and a cross-sectional variation among prefectures with different hotline adoption years. We exploit a stacked DD model to avoid bias in the traditional DD model when the treatment effect is heterogeneous (Cengiz et al., 2019; Deshpande & Li, 2019; Roth, Anna, Bilinski, & Poe, 2022). The sample we use is the constructed stacked sample which only includes treated prefectures and their clean controls as introduced in section 3.4. The stacked DD model is specified as follows:

$$ECITR_{ipst} = \alpha_i + \delta Hotline_{ps} \times Post_t^s + \sum_{\tau} D_t^{\tau} + \mu_t + \gamma_{ps} + W_{p,2000} \times \mu_t + \epsilon_{ipst} \tag{1}$$

where $ECITR_{ipst}$ is the *ECITR* for firm i in prefecture p for hotline adoption event s in year t. $Hotline_{ps}$ is an indicator equal to 1 if prefecture p is a treated prefecture for hotline adoption s. $Post_t^s$ is a dummy variable with one denoting that year t is after hotline adoption s. D_t^{τ} is a dummy variable with one representing year t being $|\tau|$ years before ($\tau < 0$) or after ($\tau > 0$) the hotline adoption year (denoted as relative period dummy). Inclusion of $\sum_{\tau} D_t^{\tau}$ controls for any common shocks in each period from before to after the hotline adoption. By doing so, we do not need to include $Post_t^s$ separately since it is absorbed by $\sum_{\tau} D_t^{\tau}$. Since we use a stacked sample and the same year might have different values of D_t^{τ}, we therefore can still control yearfixed effects μ_t to absorb the same shock happening to all prefectures in the same year. α_i is firm fixed effects that control for firm-level time-invariant characteristics. γ_{ps} is prefecture-event fixed effects that control for any time-invariant prefecture-level characteristics in each dataset related to hotline adoption event s. We do not include $Hotline_{ps}$ separately in this model since it is absorbed by γ_{ps}.

Table 1
Summary statistics.

	(1)	(2)	(3)	(4)
	Original sample		Stacked sample	
	Mean	SD	Mean	SD
Panel A. Hotline Adoption Time				
Hotline adoption timing	2010	1.105	2011	1.275
Hotline dummy	/	/	0.613	0.487
Post dummy	/	/	0.630	0.483
Hotline × Post	/	/	0.364	0.481
Panel B. Firm Variables (2008–2013)				
ECITR(%)	23.836	3.715	23.975	3.514
Business tax rate (%)	4.283	1.014	4.228	1.006
Age	9	7	8	7
Number of employmees	102	117	100	115
ln(Total value of assets)	12.503	1.739	12.436	1.699
Tax credit/Taxable income	1.309	3.453	1.199	3.290
$1(\text{Credit}_{>} 0)$	0.152	0.359	0.145	0.352
Cash flow / Assets	3.302	9.565	3.072	8.906
ln(Investment)	4.893	1.620	4.784	1.537
ROA	4.598	6.137	4.713	6.383
Panel C. Prefecture Characteristics (2000)				
ln(GDP per Capita)	9.044	0.751	8.902	0.697
GDP Share of Secondary Industry (%)	46.749	7.743	45.640	8.847
GDP Share of Tertiary Industry (%)	38.886	6.456	37.843	6.191
Population Density (1000 per $\frac{2}{km}$)	0.443	0.250	0.372	0.237
The Ratio of FDI to GDP	0.057	0.064	0.043	0.055
The Ratio of CIT to GDP	0.007	0.005	0.006	0.004
The Ratio of Budget Revenue to GDP	0.044	0.028	0.039	0.027
The Ratio of Budget Expense to Budget Revenue	1.368	0.247	1.381	0.255
ln(Budget Revenue per Capita)	5.611	1.636	5.322	1.588
ln(Budget Expense per Capita)	5.899	1.577	5.625	1.533

Notes: This table presents summary statistics for the analysis sample. The timings of the tax hotline, 12,366, were collected manually from newspapers. The firm variables are calculated using administrative data from the National Tax Survey Database (2008–2013). The prefecture characteristics are taken from China City Statistical Yearbook (2000). Columns (1) and (2) report the summary statistics for the original NTSD sample. Columns (3) and (4) report the summary statistics for the stacked sample, which is constructed following the method proposed by Deshpande and Li (2019) and Cengiz et al. (2019). The stacked sample contains treated prefectures and their clean control prefectures. Estimates based on this sample is free from the threat of heterogeneous treatment effects in the standard two-way fixed effects model. There are 91,624 firm-year observations with 28,775 unique firms in the original data. There are 142,853 firm-year observations with 28,775 unique firms in the stacked sample. All the empirical analyses hereafter are based on the stacked sample.

One might be concerned that prefectures did not adopt hotlines randomly, such that there are systematic differences between prefectures adopting the hotline earlier and those adopting the hotline later. To address this concern, we explore possible determinants of the timings of hotline adoption.[18] Our exercise shows that the logarithm of GDP per capita, the GDP share of secondary industry, the GDP share of tertiary industry, population density, the ratio of FDI to GDP, and the ratio of corporate income tax to GDP are significantly related to the timing of hotline adoption. We denote them as W_p. We then conduct a balance test in table B2. We see that prefectures adopting the hotline earlier are significantly different from those adopting the hotline later in different dimensions (proxied by the ratio of budget revenue to GDP, the ratio of budget expense to budget revenue, budget revenue per capita, and budget expense per capita) without conditional on W_p. However, the significant difference disappears while we condition on W_p. We therefore include the interaction of these variables in 2000 value, denoted as $W_{p,2000}$, with year fixed effects μ_t in the regression. Doing so allows the effects of $W_{p,2000}$ to vary over time.

ϵ_{ipst} is the error term with the mean equal to zero. We calculate standard errors by clustering over prefectures to account for the possibility of correlation among firms within the same prefecture (Bertrand, Duflo, & Mullainathan, 2004). While estimating regression functions in our paper, we use the sample weight to address the issue that the NTSD systematically undersampled small firms.

Coefficient δ is of our main interest. Ideally, if we can observe who calls LTB hotlines, we can get an estimate of the average treatment effect on the treated (ATT). However, this information is unavailable to us. Since not all firms in the treated prefectures call the hotline; thus, δ represents the intent-to-treat effect (ITT) of the hotline.

The underlying identification assumption is that the trend of firms' ECITR in prefectures adopting the hotline earlier and

[18] We first run a Cox hazard proportional model, which is specified as $h(t) = h_0(t)exp(\gamma W_t)$. The hazard of the hotline adoption is a product of a baseline hazard function that depends on time, $h_0(t)$, and the relative risk of a prefecture $exp(\gamma W_t)$. W_t is a set of time-varying prefecture characteristics from the China City Statistical Yearbook from 2000 to 2014. We also report results estimated by OLS in appendix B.

prefectures adopting the hotline later would have remained the same in the absence of hotline adoption. To address this issue, we can estimate the following equation:

$$ECITR_{ipst} = \alpha_i + \sum_{\tau} \delta_{\tau} Hotline_{ps} D_t^{\tau} \times Post_t^s + \sum_{\tau} D_t^{\tau} + \mu_t + \gamma_{ps} + W_{p,2000} \times \mu_t + \epsilon_{ipst} \quad (2)$$

where we replace $Post_t^s$ in eq. 1 with a set of dummies D_t^{τ}. If the coefficient δ_{τ} is not significant when $\tau < 0$ (i.e., before the hotline adoption), it provides evidence supporting the identification assumption.

Another concern is that there may be confounding events that may be correlated with hotline adoption and affect firms' ECITR. We address this concern in section 5.3.1. We also test whether the hotline effect is driven by spatial spillover effect in section 5.3.4.

5. Results

5.1. The impact of hotline on ECITR

We present estimation results of eq. 1 (column (1)) and eq. 2 (column (2)) in Table 2. In both columns, we control for the event year fixed effects, firm fixed effects, year fixed effects, prefecture-event fixed effects, and the interaction of prefecture-level variables in 2000 and year fixed effects.

We see from column (1) that the coefficient of the interaction of the treated prefecture dummy and the post dummy is −0.561 and statistically significant at the 1% level. It means that compared with firms in prefectures not adopting hotlines yet, the ECITR of firms in prefectures with the hotline is, on average, 0.561 percentage points lower.

In column (2), we replace the post dummy with a set of relative period dummies. Those coefficients of the interaction terms are also plotted in Fig. 3. Three features stand out. First, before the hotline adoption, although the coefficients of the interaction terms are negative, they are not statistically significant. It provides evidence that the ECITR of firms evolves similarly for prefectures adopting the hotline and not adopting the hotline yet. Second, after the hotline is adopted, the coefficients of the interactions remain negative but become statistically significant. The magnitude of the coefficients also becomes much larger than those before the hotline adoption. Third, during our sample period, the effect of the hotline becomes larger over time.

5.2. The heterogeneous impact of hotline on ECITR

5.2.1. Tax complexity

The existing literature has shown that individual taxpayers are not able to react optimally to incentives that feature highly complex, nonlinear schedules with kinks, thresholds, and exemptions (Abeler & Jäger, 2015). If this is also the case for firms, we should anticipate the hotline has a stronger effect on firms facing more complex policies. However, measuring complexity is a challenge. We exploit the heterogeneous impact of the hotline on firms in industries with different capital intensities to stress this issue.

One source of complexity is rooted in how firms deal with capital. The firm's profit and the tax burden are affected by the structure of asset types (Gravelle, 1982) and the depreciation strategy (Cui, Hicks, & Xing, 2022; Maffini, Xing, & Devereux, 2019; Zwick & Mahon, 2017). For example, for an asset with a regular asset life of five years, the difference in present value between the regular depreciation and accelerated depreciation regimes is $5.86 on a $100 investment, which means the resulting CIT difference is $1.46 under a 25% tax rate[19] (Cui et al., 2022). The hotline can help firms understand different depreciation strategies and use preferential depreciation policies. Firms that are more capital-intensive may benefit more from the public information service.

To test whether the hotline effect varies for firms in industries with different capital intensities, we calculate the capital-to-labor ratio for each of the 4-digit industries (Arai, 2003). We then divide the sample into two subgroups, one with a capital intensity above the median level, and another with a capital intensity below the median level. We estimate eqs. 1 and 2 on each subsample, respectively.

Columns (1) and (2) in Table 3 show the estimation results of eq. 1 for firms with higher capital intensity and lower capital intensity. We can see that the effect of the hotline adoption is negative for both firms with high capital intensity and low capital intensity. However, the magnitude is much larger for firms with high capital intensity. We test the significance of their difference in the bottom two rows in Table 3. The result shows that the hotline effect on firms with high capital intensity significantly differs from that on firms with low capital intensity.

Fig. 4a plots the dynamic effects of the hotline on firms with different levels of capital intensity estimated from eq. 2. We see similar results. That is, the hotline barely affects firms with low capital intensity but significantly affects firms with high capital intensity. Moreover, we can see that the effect remains persistent for firms with high capital intensity even four years after the hotline adoption. These results suggest that firms facing more complex tax schemes benefit more from the hotline.

5.2.2. Firm age

Firms of different ages also face different levels of information friction. Although young firms are an important source of job

[19] Under the accelerated depreciation regime, the asset can be depreciated in 3 years instead of 5 years. The risk-adjusted discount rate is assumed to be 7% as used by (Zwick & Mahon, 2017) and (Maffini et al., 2019).

Table 2
Impact of hotline adoptions on firms' ECITR.

Dep var. *ECITR (%)*	(1)	(2)
Hotline × *Post*	0.561***	
	(0.155)	
Hotline ×*1(D = −4)*		−0.172
		(0.188)
Hotline ×*1(D = −3)*		−0.018
		(0.192)
Hotline ×*1(D = −2)*		−0.051
		(0.110)
Hotline ×*1(D = 0)*		−0.538***
		(0.153)
Hotline ×*1(D = 1)*		−0.803***
		(0.286)
Hotline ×*1(D = 2)*		−1.024*
		(0.558)
Hotline ×*1(D = 3)*		−1.040*
		(0.573)
Hotline ×*1(D = 4)*		−1.856**
		(0.699)
Firm FE	Yes	Yes
Year FE	Yes	Yes
Stack-Prefecture FE	Yes	Yes
Event FE	Yes	Yes
$W_{p.2000}$ × Year FE	Yes	Yes
Observations	142,583	142,583

Notes: This table reports estimates of the effect of the hotline adoptions on the firms' ECITR. Specifically, the table lists estimates of δ from eq. 1 and δ_t coefficients from eq. 2. $W_{p.2000}$ includes the logarithm of GDP per capita, GDP share of secondary industry and tertiary industry, population density, the ratio of FDI to GDP, and the ratio of CIT to GDP at the 2000 value. The standard errors are clustered at the prefecture level. *, **, and *** denote statistical significance at 10%, 5%, and 1%, respectively.

creation and growth (Adelino, Ma, & Robinson, 2017), they are more volatile than their older counterparts (Haltiwanger, Jarmin, & Miranda, 2013). How firms of different ages respond to the reduced information friction is unknown in the existing literature. We explore the heterogeneous effect of the hotline on firm age in this section.

We categorize firms into two groups based on their ages: young firms with ages below 5 years, and old firms with ages above 5 years (Ouimet & Zarutskie, 2014). We estimate eqs. 1 and 2 on each of the subsamples, respectively.

Columns (3) and (4) in Table 3 show the estimation results of eq. 1 for young and old firms, respectively. We can see that the coefficients of the interaction term in both columns are significantly negative; however, the magnitude is larger for young firms than for old firms. As shown by the bottom two rows in Table 3, their difference is statistically significant at the 10% level.

Fig. 4b plots the dynamic effects of the hotline on firms of different ages estimated from eq. 2. We can see that the hotline only has a short-run effect on old firms within the first two years after the hotline adoption, but it has a persistent effect on young firms. Young firms experienced a 0.867 percentage points reduction in ECITR in the year of hotline adoption, and this reduction raised to 5.665 percentage points four years after the hotline adoption, suggesting that young firms benefit more from the hotline.

5.3. Robustness checks

5.3.1. Confounding events

An important concern with our findings is that the prefecture's hotline adoption could be correlated with other events, which might also affect firms' ECITR. We undertook a detailed survey of all policies from 2008 to 2013. We found three tax reforms that could raise concerns: a hotline adopted by the STB during the same period, the tax administration reform in 2009, and the business tax to VAT reform starting in 2012.

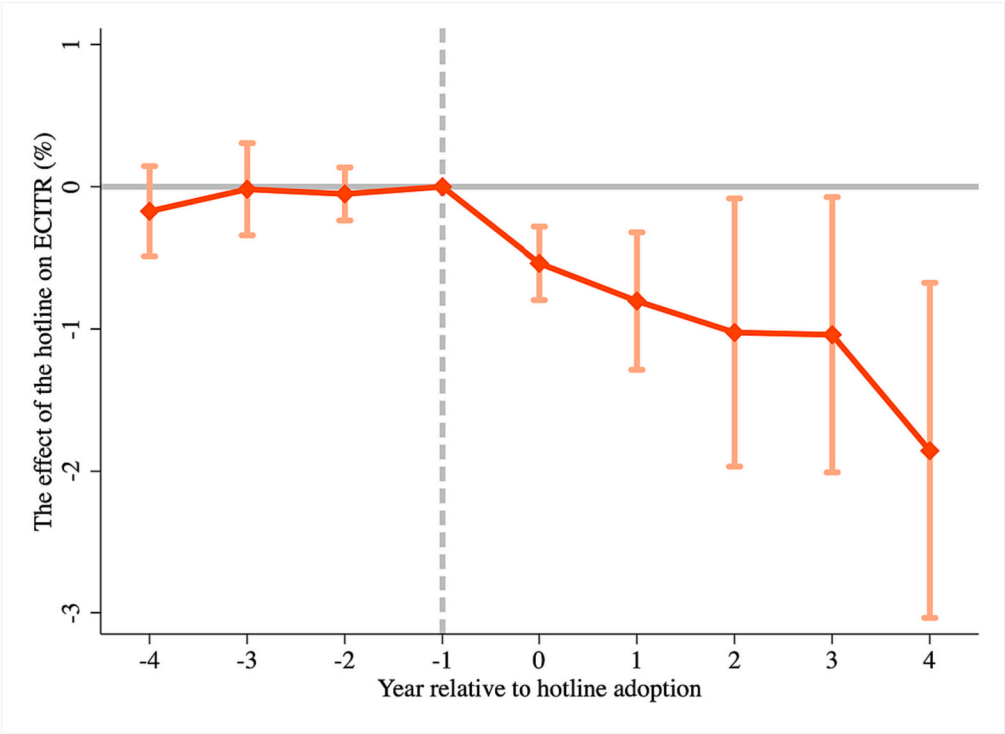


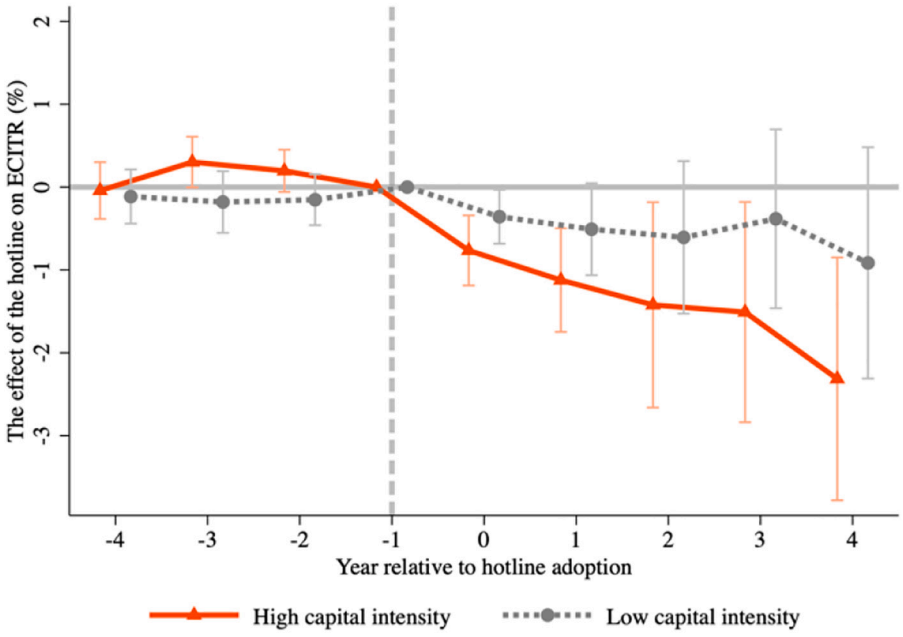
Fig. 3. Effect of hotline adoptions on firms' ECITR.
Notes: The figure plots estimates of the effect of hotline adoptions on firms' ECITR. Specifically, the figure plots estimates of δ_t coefficients from eq. 2, which is a regression of firms' ECITR on the interaction terms of the treated prefecture dummy and event indicators, firm fixed effects, event indicators, stack-prefecture fixed effects, and prefectural initial characteristics interacted with year dummies. The dependent variable, ECITR, is defined as the corporate income tax ratio to taxable income. We show the 90% confidence interval based on standard errors clustered at the prefecture level.

Table 3
Heterogeneous impact of hotline adoptions.

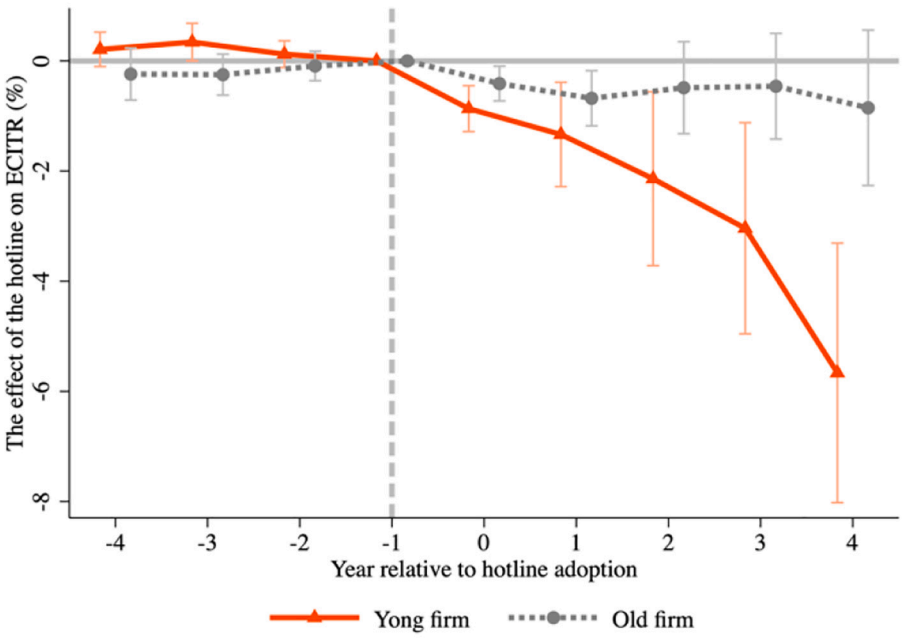
	(1)	(2)	(3)	(4)
	By capital intensity		By age	
Dep var. *ECITR (%)*	High capital intensity	Low capital intensity	Young firms	Old firms
Hotline × *Post*	−0.851***	−0.349*	−0.776***	−0.456**
	(0.222)	(0.185)	(0.250)	(0.195)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Stack-Prefecture FE	Yes	Yes	Yes	Yes
Event FE	Yes	Yes	Yes	Yes
$W_{p.2000}$ × Year FE	Yes	Yes	Yes	Yes
Observations	70,654	68,716	52,856	85,875
	Test of the significance of coefficient difference			
Coefficient difference	−0.502***		−0.321***	
Empirical *p*-value	0.010		0.010	

Notes: This table reports estimates of the effect of the hotline adoptions on subsamples. Specifically, the table lists estimates of δ from eq. 1, which is a regression controlling firm fixed effects, event indicators, stack-prefecture fixed effects, and prefectural initial characteristics interacted with year dummies. Columns (1)–(2) are based on firms with different industry-level capital intensity, where high capital intensity firms are those in an industry with above-median capital-to-labor ratio, and low capital intensity firms are those in an industry with below-median capital-to-labor ratio. Columns (3)–(4) are the effect of the hotline on firms of different ages, where young firms are those below five years old, and old firms are those above five years old. $W_{p.2000}$ includes the logarithm of GDP per capita, GDP share of secondary industry and tertiary industry, population density, the ratio of FDI to GDP, and the ratio of CIT to GDP at the 2000 value. The standard errors are clustered at the prefecture level. *, **, and *** denote statistical significance at 10%, 5%, and 1%, respectively.

(a) By capital intensity



(b) By age



(caption on next page)

Fig. 4. Effect of hotline adoptions on firms' ECITR by subgroups.
Notes: The figure plots estimates of the effect of hotline adoptions on firms' ECITR. Specifically, the figure plots estimates of δ_t coefficients from eq. 2, which is a regression of firms' ECITR on the interaction terms of the treated prefecture dummy and event indicators, firm fixed effects, event indicators, stack-prefecture fixed effects, and prefectural initial characteristics interacted with year dummies. The dependent variable, ECITR, is defined as the corporate income tax ratio to taxable income. Panel (a) plots the effect of the hotline on firms with different industry-level capital intensities. The solid orange line shows the results for firms with high capital intensity (those in an industry with above-median capital-to-labor ratio), and the gray dashed line shows the results for firms with low capital intensity (those in an industry with below-median capital-to-labor ratio. Panel (b) plots the effect of the hotline on firms of different ages. The solid orange line shows the results for young firms (with ages below five years), and the gray dashed line shows the results for old firms (with ages above five years). We show the 90% confidence interval based on standard errors clustered at the prefecture level.

Table 4
Robustness Checks.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline result	Confounding events					Industry -Event FE	Placebo test
		STB's hotline	InnoCom program	Tax administration reform	B2V reform	Golden tax reform		
Hotline × *Post*	0.561***	−0.609***	−0.561***	−0.597***	−0.563***	−0.562***	−0.553***	0.038
	(0.155)	(0.144)	(0.158)	(0.144)	(0.155)	(0.155)	(0.169)	(0.045)
STB		−0.152						
		(0.245)						
B2V reform				0.570*				
				(0.307)				
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Event FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stack-Prefecture FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$W_{p,2000}$ × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry × Event FE	\	\	\	\	\	\	Yes	\
Observations	142,583	142,583	142,853	121,613	142,853	142,853	142,838	30,748

Notes: This table reports the results of robustness checks. The dependent variable from columns (1) to (7) is the firms' ECITR, defined as the corporate income tax ratio to taxable income. The dependent variable in column (8) is the firms' BTR, defined as the ratio of business tax to its tax base. Column (1) reports the estimate for the baseline model as a comparison. Columns (2) to (6) report the results after controlling for confounding events. Column (2) controls whether a prefecture's STB adopts a hotline. Column (3) controls the impact of the InnoCom program. Column (4) controls the impact of the tax administration reform using data after 2009. Column (5) controls for the effect of the business tax to vat reform (B2V reform). Column (6) deals with the golden tax project. Column (7) includes the industry-event year fixed effects in the model. We conduct a placebo test using the BTR as the dependent variable in column (8). $W_{p,2000}$ includes the logarithm of GDP per capita, GDP share of secondary industry and tertiary industry, population density, the ratio of FDI to GDP, and the ratio of CIT to GDP at the 2000 value. The standard errors are clustered at the prefecture level. *, **, and *** denote statistical significance at 10%, 5%, and 1%, respectively.

STBs' hotline. Apart from LTBs, STBs also gradually adopted a tax hotline from 2001 to 2011. Since STBs are vertically managed, and their decisions on hotline adoptions are independent of LTBs', their hotline should not affect our baseline results. Nevertheless, we manually collect the data for each prefecture in our sample on whether they have an STB hotline to control for the effect of this confounding event. Column (2) of Table 4 reports the result, while column (1) reports the estimate for the pre-post version of the hotline effect (eq. 1) for comparison. We can see that the coefficient of the interaction term of the treated prefecture dummy and the post dummy is still significantly negative, and its magnitude is similar to that in the baseline model. In contrast, the coefficient of STB's hotline adoption is not significant, and the magnitude is much smaller.[20] The results suggest that the effect of the hotline is not driven by the adoption of STB's hotline.

China's InnoCom program. The corporate income tax law provides corporate income tax rate cuts for high-tech firms, known as the InnoCom program (Chen, Liu, et al., 2021). If prefectures adopting the hotline earlier also had stronger incentives to promote the

[20] Two reasons may result in the difference in the impact of LTB's hotline and STB's hotline. First, LTBs were more likely to be influenced by local governments compared with STBs. In China, local governments are involved in fierce tax competition to attract investment and promote economic growth (Liu & Martinez-Vazquez, 2014). This has two consequences. On the one hand, given that the tax legislation in China is highly centralized, it is the central government that stipulates tax policies and tax-sharing rules. One instrument local governments have autonomy over is the quality of their tax services. So, LTBs' hotline may have better service quality. On the other hand, local governments may introduce some regional preferential tax policies, for example, in the form of tax repayment or exemption. That information was only accessible through the LTBs' hotline. Second, firms administrated by STBs are relatively larger and suffer less from information friction.

growth of high-tech firms, then our estimates could be upward biased. During our sample period, high-tech firms are those with R&D intensity (R&D investment over revenue) over a given threshold, specifically, 3% for firms with sales above RMB 200 million, 4% for firms with sales between RMB 50 million to 200 million, and 6% for firms with sales below RMB 50 million. We thus include an indicator for firms' high-tech-firm status to separate the effect of the InnoCom program from the hotline. The result is shown in column (3) of Table 4. The magnitude of the hotline effect is identical to the baseline results, suggesting that the hotline effect is not driven by the InnoCom program.

Tax administration reform. Tax administration and enforcement can affect a firm's effective tax rate directly (Besley & Persson, 2014). Had the administration reform also affected the hotline adoption, our estimates may be biased. The administration of CIT changed in 2009. Firms subject to VAT (most of them are in the manufacturing industries) pay CIT to STB, while firms subject to business tax (most of them are in the service industries) pay CIT to LTB. To investigate whether our main results are driven by the tax administration reform, we re-estimate the baseline model using the post-reform sample from 2009 to 2013. Column (4) of Table 4 reports the result. The hotline effect is similar to that in the baseline model (column (1)). This suggests that the effect of the hotline is not driven by the tax administration reform.

Business tax to VAT reform. Another important tax reform during our sample period is the one replacing business tax with VAT (B2V Reform). The B2V Reform was piloted in 2012 and completed in 2016.[21] Although this reform is not directly targeted at CIT, it may affect a firm's tax-reporting behavior and the ECITR. To the extent that prefectures with the hotline were more affected by this reform, our estimates could be biased. To address this concern, we include an additional dummy variable indicating whether a firm is affected by the B2V Reform in the baseline regression. The variable equals one if one firm is in the pilot region and sector and zero otherwise.[22] As shown in column (5) of Table 4, the inclusion of this variable does not change the estimation results of the hotline, suggesting that our main results are not driven by this reform.

The Golden Tax Project. The third phase of the Golden Tax Project (GTP III) was aimed to facilitate the monitoring and administration of tax authorities with the help of modern computation technology. This reform is found to improve tax enforcement (Li, Wang, & Wu, 2020) and therefore tends to increase firms' ECITR. If prefectures adopting hotlines happened to be those affected by the GTP III, then our estimates will be downward biased. The reform was implemented progressively from 2013 to 2016. Since our data is from 2008 to 2013, the relevant year is the first year of the reform. In 2013, the pilot provinces implementing the modern technology included Chongqing, Shanxi, and Shandong (Wu, 2021). In order to test the robustness of our results to this reform, we add to the regression an indicator for the GTP III, which equals 1 if the province is a pilot in that year and 0 otherwise. The result is shown in column (6) of Table 4. We find that the hotline effect is not affected.

5.3.2. Controlling for industry-event fixed effects

A key feature of Chinese CIT policy is that it is categorized by industry rather than by ownership after the 2008 Corporate Income Tax Law (Li et al., 2021). The CIT rate differs substantially across industries. More than half of CIT is paid by manufacturing industries (Chen, He, Liu, Serrato, & Xu, 2021). Therefore, our estimates could also be biased if prefectures with different industry structures have different hotline adoption timings. We conduct another robustness test by including the industry-event fixed effects, which can absorb any time-varying economic or regulatory shocks at the industry level. Column (7) of Table 4 reports the regression result. The effect of the hotline remains similar to the baseline result. These results show that time-varying shocks at the industry level do not drive our main results.

5.3.3. Placebo test

We conduct a placebo test of the hotline effect on firms' effective business tax rate (BTR). The reduced information friction after the hotline adoption is expected not to affect the business tax firms pay because business tax is based on a simple rule (i.e., gross receipts), and few preferential policies are applied. Indeed, only 1.93% of firms in our sample reported enjoying preferential business tax policies, whereas the percentage for CIT is 26.55%. Column (8) of Table 4 reports the regression result. As expected, the coefficient on the interaction of the hotline adoption dummy and the post dummy is insignificant, providing additional evidence supporting our main results.

5.3.4. Spatial spillover effect

One may concern that our main result is driven by the spatial spillover effect. Had firms in prefectures not adopting hotlines called hotlines in other prefectures, the hotline effect we estimated would be downward biased. It is unlikely the case because of two reasons. First, firms pay taxes locally and need to comply with regulations in their own prefecture, the incentives to call hotlines in other prefectures are very low. Second, the hotline only serves local firms. We actually tried to call the hotline in other prefectures from where we are located, and the standard procedure the operators did was to suggest you consult your local tax bureau. So the adoption of hotlines from other regions won't affect local firms.

Nevertheless, to test if there exists any spatial spillover effect, we conduct two analyses. First, given that there are taxation reforms

[21] The Pilot Plan for Converting Business Tax to Value Added Tax (Decree No. 110 of the Minister of Finance and State Administration of Taxation, November 16, 2011). See an English version at http://www.lawinfochina.com/display.aspx?lib=law&id=9152&CGid=.

[22] The B2V reform was first implemented in Shanghai in the transportation sector (excluding railway transportation) and six modern services sectors in 2012. The reform was gradually extended to other pilot regions and service sectors. It was fully implemented in all service sectors nationwide in 2016. See Dai and Zhao (2021) for a detailed introduction.

Table 5
Spatial spillover effect.

Dep var. *ECITR (%)*	(1)	(2)	(3)
Hotline × *Post*	−0.562***	−0.665**	−0.562***
	(0.155)	(0.253)	(0.155)
Hotline Nearest × *Post Nearest*			0.260
			(0.177)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Stack-Prefecture FE	Yes	Yes	Yes
Event FE	Yes	Yes	Yes
$W_{p.2000}$ × Year FE	Yes	Yes	Yes
Observations	142,811	142,811	142,811

Notes: This table reports the results of the existence of the spatial spillover effect. The dependent variable is the firms' ECITR, defined as the corporate income tax ratio to taxable income. Column (1) reports the estimate for the baseline model as a comparison. Column (2) reports the results after controlling for province-event year FE. Column (3) reports the results after controlling for the effect of the hotline adoption from the nearest two prefectures. $W_{p.2000}$ includes the logarithm of GDP per capita, GDP share of secondary industry and tertiary industry, population density, the ratio of FDI to GDP, and the ratio of CIT to GDP at the 2000 value. The standard errors are clustered at the prefecture level. *, **, and *** denote statistical significance at 10%, 5%, and 1%, respectively.

taking place at the provincial level, we include the province-event year fixed effects to control for any within-province spatial spillover effects. For example, the B2V Reform and the GTP III mentioned above were gradually implemented with some provinces as the pilot region. Tax policies within the same province are closer than tax policies across different provinces at a given time. The result is reported in column (2) of Table 5, while column (1) reports the estimate for the hotline effect using the sample for comparison. The coefficient on the interaction of the hotline adoption dummy and the post dummy is still significantly negative, suggesting that controlling for the within-province spillover effect does not affect the hotline effect.

Second, we estimate whether the hotline adopted by the nearest prefectures has any effect on the local prefecture. We include an interaction of the hotline adoption dummy in the nearest prefectures (*Hotline Nearest*) and the corresponding post dummy (*Post Nearest*) to absorb any spillover effects from neighboring prefectures. Specifically, we calculate the road distance between each pair of prefectures using BaiduMap API. We select the closest two prefectures to see whether either of the two neighboring prefectures adopted a hotline.[23] If the answer is true, the variable *Hotline Nearest* equals 1, and the variable *Post Nearest* equals 1 in years after the neighboring prefecture adopting a hotline. The result is reported in column (3) of Table 5. We find that only the hotline in its own prefecture has a significant effect on firms' ECITR, the adoption of hotlines in the neighboring prefectures won't affect local firms.

6. Channels

6.1. Complementarity between tax information and tax policy

The hotline aims to reduce tax information friction, which may enhance the effect of preferential tax policies. If the hotline is effective in alleviating information friction, its impact should be larger when there are preferential tax policies.

We investigate whether the hotline complements a specific preferential tax policy targeted to small firms during this period (Chen, He, et al., 2021). The 2008 Corporate Income Tax Law awarded small firms a preferential rate of 20%.[24] From 2010 to 2011, small firms with taxable income of less than RMB 30,000 were eligible for a 10% tax rate (the 1*st* stage).[25] The coverage of the policy was expanded to small firms with taxable income less than RMB 60,000 in 2012 and 2013 (the 2*nd* stage).[26] We create two dummies to denote the eligibility of small firms credits (SFC). 1(*Eligible for Stage 1 SFC*) is defined as the product of the dummy for small firms with taxable income less than RMB 30,000 and the dummy for post-2010 periods. 1(*Eligible for Stage 2 SFC*) is defined as the product of the dummy for small firms with taxable income in the interval of RMB 30,000 and RMB 60,000 and the dummy for post-2012 periods. We then add cross-terms of the *Hotline* × *Post* with these two variables to test whether the policy effect varies with the access to the hotline.

The result is reported in column (3) of Table 6. We can see that the coefficients of the triple interaction of the treated prefecture dummy, the post dummy, and the dummies for the eligibility of the preferential tax policy are negative and statistically significant at the 1% level. They are equal to −1.127 for the 1*st* SFC and − 2.033 for the 2*nd* SFC. It suggests that firms eligible for SFC, on average,

[23] Since we don't have the timing of hotline adoption for all prefectures, to avoid the missing values of the neighboring prefectures, we select two closest prefectures instead of one.

[24] Small firms are industrial firms with taxable income of less than RMB 300,000, a total number of employees of <100, and total assets of less than RMB 30 million. In other sectors, small firms are those with taxable income of less than RMB 30 million, a total number of employees of <80, and total assets of less than RMB 10 million.

[25] An English version of this policy can be found at http://www.lawinfochina.com/display.aspx?lib=law&id=11036&CGid=&EncodingName=gb2312.

[26] An English version of this policy can be found at http://www.lawinfochina.com/Display.aspx?lib=law&Cgid=163,585.

Table 6
Impact of the hotline on policy transmission.

Dep var. ECITR (%)	(1)	(2)
Hotline × *Post*	0.561***	−0.202
	(0.155)	(0.157)
Hotline × *Post* × *1(Eligible for Stage 1 SFC)*		−1.127***
		(0.382)
Hotline × *Post* × *1(Eligible for Stage 2 SFC)*		−2.033***
		(0.365)
1(Eligible for Stage 1 SFC)		0.535***
		(0.178)
1(Eligible for Stage 2 SFC)		0.942***
		(0.188)
Firm FE	Yes	Yes
Year FE	Yes	Yes
Stack-Prefecture FE	Yes	Yes
Event FE	Yes	Yes
$W_{p,2000}$ × Year FE	Yes	Yes
Observations	142,583	142,583

Notes: This table presents the effect of the hotline on policy transmission using a policy example of the small firm credit (SFC). Column (1) reports the estimate for the pre-post version of the hotline effect (eq. 1) for comparison. Column (2) focuses on the preferential tax policy for small firms, which decreases their legislative tax rate. From 2010 to 2011, small firms with taxable income of <30,000 RMB were eligible for a 10% tax rate (the 1*st* Stage SFC). The policy's coverage expanded to small firms with taxable income of <60,000 RMB in 2012 and 2013 (the 2*nd* Stage SFC). 1(*Eligible for Stage 1 SFC*) is defined as the product of the dummy for small firms with taxable income of <30,000 RMB and the dummy for post-2010 periods. 1(*Eligible for Stage 1 SFC*) is defined as the product of the dummy for small firms with taxable income in the interval of 30,000 RMB and 60,000 RMB and the dummy for post-2012 periods. $W_{p,2000}$ includes the logarithm of GDP per capita, GDP share of secondary industry and tertiary industry, population density, the ratio of FDI to GDP, and the ratio of CIT to GDP at the 2000 value. The standard errors are clustered at the prefecture level. *, **, and *** denote statistical significance at 10%, 5%, and 1%, respectively.

have lower ECITR in prefectures with the tax hotline. The reduction in tax rates is 1.127 percentage points for the first stage SFC and 2.033 percentage points for the second stage SFC. This evidence indicates that the hotline and preferential tax policies complement each other.

As a summary, the above findings suggest that one channel through which the hotline can reduce ECITR is to enhance the effects of preferential tax policies.

6.2. The impact of hotline on tax credits

Another channel for the hotline to affect firms' ECITR is to reduce the costs of gaining access to tax information and help firms

Table 7
Impact of the hotline on tax credits.

	(1)	(2)	(3)
	Credit ratio	1(Credit ratio > 0)	Credit ratio if credit>0
Hotline × *Post*	0.373***	0.010	1.214***
	(0.115)	(0.012)	(0.324)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Stack-Prefecture FE	Yes	Yes	Yes
Event FE	Yes	Yes	Yes
$W_{p,2000}$ × Year FE	Yes	Yes	Yes
Observations	114,726	114,726	114,726

Notes: This table reports the estimates of the effect of hotline adoptions on firms' tax credits. Specifically, the table presents estimates of δ from eq. 1, which is a regression on firm fixed effects, event indicators, stack-prefecture fixed effects, and prefectural initial characteristics interacted with year dummies. The dependent variable in column (1) is the ratio of tax credits to taxable income (%). Column (2) shows the results of the effect of the hotline on whether a firm enjoys positive tax credits (i.e., extensive margin), while column (3) presents the results of the effect of the hotline on the amount of tax credits given that the firm's tax credit is positive (i.e., intensive margin). $W_{p,2000}$ includes the logarithm of GDP per capita, GDP share of secondary industry and tertiary industry, population density, the ratio of FDI to GDP, and the ratio of CIT to GDP at the 2000 value. The standard errors are clustered at the prefecture level. *, **, and *** denote statistical significance at 10%, 5%, and 1%, respectively.

obtain more tax credits. We investigate this channel in this section.

We first estimate the hotline effect on tax credits obtained by firms, which is measured by firms' tax credits as a percentage of the taxable income. The value is zero for firms getting no tax credits. We first estimate the overall effect of the hotline on firms' tax credits. We then further explore the impact of the hotline in two margins: the extensive margin and the intensive margin. The extensive margin response is estimated using a dummy variable *1(Credit > 0)* as the dependent variable, which indicates whether the firm has any positive tax credits or not. The intensive margin response focuses on firms having positive tax credits and estimates the effect of the hotline on the amount of tax credits.

Column (1) of Table 7 shows the results. The coefficient of the interaction is 0.373 and statistically significant at the 1% level. It suggests that firms in prefectures with the hotline obtained more tax credits. We then show the results of the extensive margin in column (2) of Table 7 where the dependent variable is a dummy variable, *1(Credit > 0)*, which equals 1 if a firm claims a positive amount of credits and 0 if otherwise. We find that the coefficient of the interaction term is 0.010 and insignificant. However, as we can see from column (3), the hotline has a significant positive effect on the amount of tax credits obtained by firms that had obtained tax credits. Results from columns (2) and (3) in Table 7 show that the hotline effect on tax credits is more pronounced along the intensive margin instead of the extensive margin.

Fig. 5a, b, and c present the estimation results from eq. 2. We can see the hotline has a significant impact on tax credits, and the effect is mainly induced by the intensive margin response. These figures support results shown in Table 7.

7. Discussion

7.1. The impact of hotline on firm's outcome

Cash flow (Edwards, Schwab, & Shevlin, 2016; Foley, Hartzell, Titman, & Twite, 2007), investment (Liu & Mao, 2019; Ohrn, 2018; Zwick & Mahon, 2017), and return to assets (ROA) (Chen, Firth, & Xu, 2009) are important indicators which both researchers and policymakers care about. Unlike policy shocks with preferential treatments for certain inputs, the hotline promotes the implementation of existing preferential policies. It's important to test whether the hotline has a real impact on firms apart from ECITR. Therefore, we investigate how the hotline affects firms' cash flow, investment, and ROA in this section.

The amount of cash a firm holds is affected by tax costs (Foley et al., 2007). Since the hotline increases the tax credits, we expect firms in prefectures with the hotline have more cash within the firm. We use the ratio of cash flow from operating activities to total assets as the dependent variable and estimate the hotline effect on a firm's cash holding. Column (1) of Table 8 reports the result. The hotline significantly increases a firm's cash flows. Firms in prefectures adopting the hotline earlier have 1.3% more cash compared to those in prefectures adopting the hotline later.

Investment is responsive to tax rates (Liu & Mao, 2019; Ohrn, 2018; Zwick & Mahon, 2017), we use the logarithm of the difference between assets at the end of the year and assets at the beginning of the year to measure investment. We expect firms to conduct more investment in prefectures adopting the hotline earlier. Column (2) of Table 8 reports the result. The hotline increases the investment of firms by 12%.

We then turn to the impact of the hotline on firms' performance in column (3) of Table 8. We use the gross ROA to measure firms' profitability. We find that firms in prefectures adopting the hotline earlier are more profitable than firms in prefectures adopting the hotline later.

Overall, we find that the hotline not only decreases firms' ECITR, it also brings a tax windfall for firms, which has a real impact on them. The hotline helps increase firms' cash flow, investment, and ROA.

7.2. Cost and benefit analysis

We find that the hotline can benefit firms by reducing their tax burden. The hotline also involves costs. To provide a more comprehensive understanding of the hotline, we conduct a cost and benefit analysis in this section.

We use the amount of taxes saved due to the hotline to measure benefits. On average, the hotline lowers firms' ECITR by 0.561 percentage points. Given that the corporate income tax was RMB 3.532 trillion in 2018 in China, and the average ECITR is 23.975% in our sample, firms would pay RMB 3.615 trillion ($3.532 \times (23.975\% + 0.561\%)/23.975\% = 3.615$ trillion) corporate income tax had there been no hotline. In other words, the hotline saved RMB 83 billion (3.615–3.532 trillion = 83 billion) a year for the firm sector.

Since we do not have data on the hotline's operating cost, we roughly estimate its cost in the following ways. First, we estimate the number of operators in each prefecture. The hotline center we surveyed had 100 operators who served 1,544,925 firms in 2018. Suppose the operators-to-firms ratio is fixed, we can estimate the number of operators in each prefecture based on the number of firms in each prefecture. The latter information can be obtained from the China National Business Registration Dataset.[27] To avoid extremely small values of the number of operators, we assume there are at least 10 operators in each prefecture. Second, we calculate the labor cost of operators by assuming that they earn a wage equal to the average wage in each prefecture.[28] Hence, the labor cost of the hotline

[27] This dataset is from the State Administration of Industry and Commerce. It includes all firms registered in China. The variables include registration date, locations, industry, and other registration information. We aggregate firm-level data to the prefecture-level in order to get the number of firms in each prefecture.

[28] The average wage data is from China Statistical Yearbook.

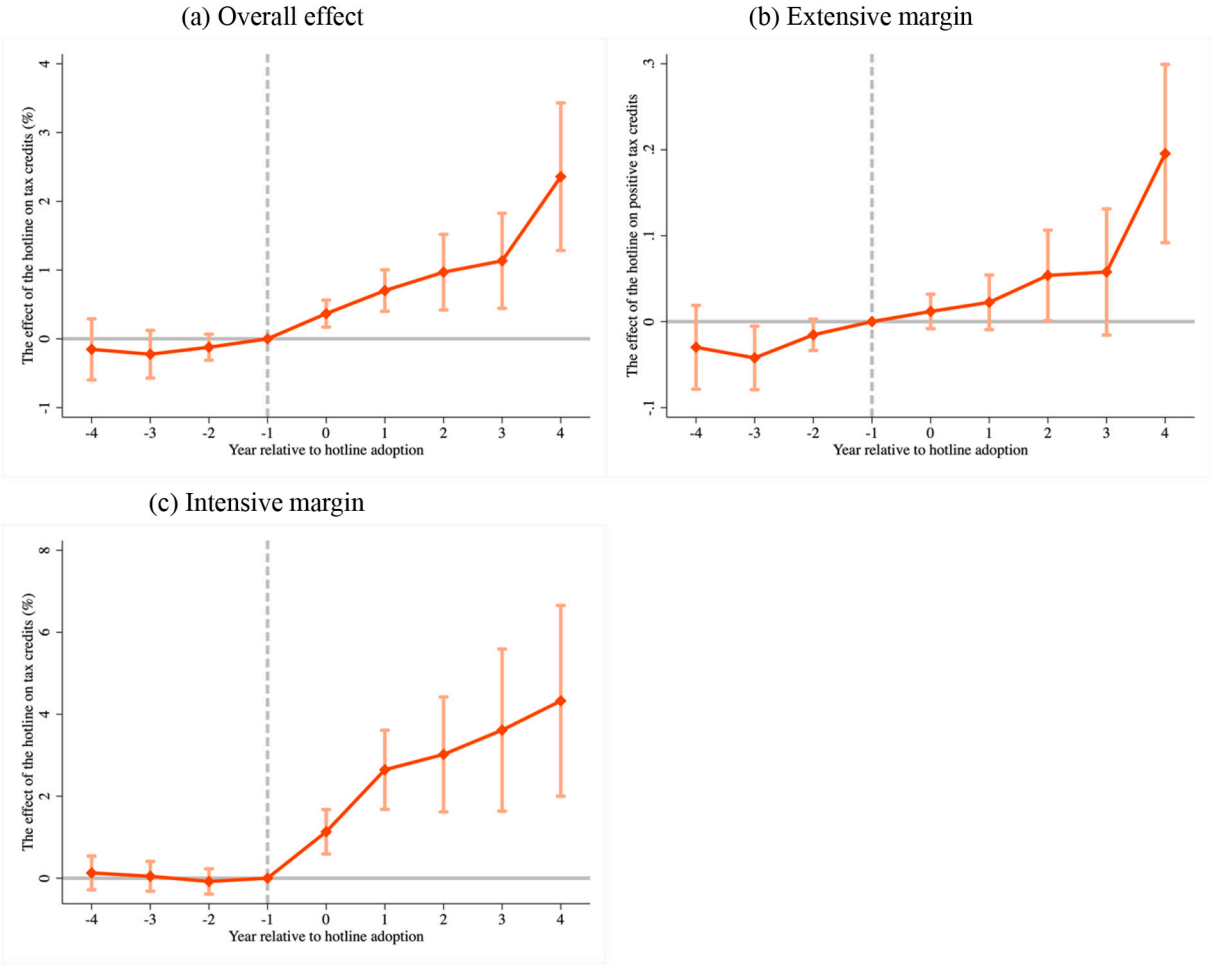


Fig. 5. Channels of the hotline.
Notes: The figure plots estimates of the effect of hotline adoptions on firms' tax credits. Specifically, the figure plots estimates of δ_t coefficients from eq. 2, which is a regression of firms' tax credits on the interaction terms of the treated prefecture dummy and event indicators, firm fixed effects, event indicators, stack-prefecture fixed effects, and prefectural initial characteristics interacted with year dummies. The dependent variable in panel (a) is the ratio of tax credits to taxable income. Panel (b) plots the results of the effect of the hotline on whether a firm enjoys positive tax credits (i.e., extensive margin), while panel (c) plots the results of the effect of the hotline on the amount of tax credits given that the firm's tax credit is positive (i.e., intensive margin). We show the 90% confidence interval based on standard errors clustered at the prefecture level.

equals the sum of the product of the number of operators and the average wage in all prefectures. The labor cost of the hotline is RMB 0.332 billion per year. Third, since the labor cost is only part of the total cost, we then estimate the total cost of the hotline. According to our sample, a firm's total cost is about 31 times the labor cost. Assuming this ratio also applies to the hotline, the total cost of the hotline is about RMB 10.292 billion (0.332 billion $\times$ 31 $=$ 10.292 billion) per year.

This analysis suggests that for every RMB 1 yuan invested in the hotline, RMB 8 yuan would be reduced in corporate income tax. However, two caveats need to be borne in mind. First, we may underestimate the benefit. In the previous analysis, we only consider the hotline's effect on firms' corporate income tax. If we take the positive effect of the hotline on firms' performance into account, the estimated benefit would be larger. Second, this analysis is only suggestive since we do not have accurate data on the cost side. The result we get here relies on the assumptions mentioned above.

8. Conclusion

Alleviating the frictions firms face in developing countries is crucial for growth. Although many papers based on laboratory evidence have proven that providing information assistance is effective in helping economic agents respond to tax incentives, surprisingly few micro-econometric analyses directly study the causal effects of reduced information friction in the real world. We explore whether firms benefit from reduced taxation information friction, taking advantage of a tax hotline program in China.

We use a stacked DD model to identify the hotline effect. We find a significant negative effect of the hotline on firms' ECITR, indicating that information frictions exist at the firm level. Quantitatively, after the adoption of the hotline, firms in a prefecture would

Table 8
Impact of the hotline on firms' outcomes.

	(1)	(2)	(3)
	Cash flow	ln(Investment)	ROA
Hotline × *Post*	0.013***	0.120**	0.003*
	(0.004)	(0.059)	(0.002)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Stack-Prefecture FE	Yes	Yes	Yes
Event FE	Yes	Yes	Yes
$W_{p,2000}$ × Year FE	Yes	Yes	Yes
Observations	120,369	92,644	126,443

Notes: This table reports the estimates of the effect of hotline adoptions on firms' cash flow, investment, and return to assets (ROA). Specifically, the table presents estimates of δ from eq. 1, which is a regression of firms' tax credits on firm fixed effects, stack-prefecture fixed effects, event indicators, and prefectural initial characteristics interacted with year dummies. The dependent variable is the ratio of cash flow from operating activities to total assets in column (1), the logarithm of the difference between assets at the end of the year and assets at the beginning of the year in column (2), and gross ROA in column (3). $W_{p,2000}$ includes the logarithm of GDP per capita, GDP share of secondary industry and tertiary industry, population density, the ratio of FDI to GDP, and the ratio of CIT to GDP at the 2000 value. The standard errors are clustered at the prefecture level. *, **, and *** denote statistical significance at 10%, 5%, and 1%, respectively.

experience an average of 0.561 percentage points decrease (roughly 2.34% of the average ECITR) in ECITR than their counterparts in prefectures not yet adopting the hotline. Firms facing larger information frictions, such as firms that are more capital-intensive and young firms, benefit more from the hotline adoption. Further analysis shows that the hotline and tax policies complement each other. The hotline reduces firms' tax burden by helping them obtain more tax credits.

Our results indicate that tax policy transmission for firms is not fully effective. Instead of issuing more tax credits, providing interactive information services can help increase policy efficiencies, reduce firms' tax burden, and achieve fiscal objectives.

Data availability

The authors do not have permission to share data.

Appendix A. More backgroud for the tax hotlin

The tax hotline, 12,366, was gradually adopted by local governments from 2002 to 2014. The hotline is aimed at improving the service quality of tax bureaus. We manually collected the hotline adoption timing from newspapers. We spent two weeks (from August 12, 2019, to August 23, 2019) in a hotline center to investigate the hotline working system. Some frequently asked questions were listed in table A1.

Training. The quality of the hotline is largely determined by whether operators have the ability and incentive to provide information service. The center offers many training opportunities to guarantee the qualification of operators. To obtain the job, operators must first pass the civil service exam, one of China's most competitive exams, with hundreds or thousands of applicants competing for one position. Operators must train for approximately 2–3 months before receiving calls independently. Table B1 provides an example of the training scheme. Generally, in the first month, operators learn general knowledge about the Chinese tax system, such as the functions of tax bureaus and the history of the tax system. In the next month, they are trained on other specific topics, which include (1) detailed laws, regulations, and administrations of different tax categories; (2) workflow, platform, and protocol of the hotline service; and (3) soft skills for communication. After finishing the training, each operator does on-the-job practice under the supervision of a senior operator. This stage lasts for approximately two weeks. Apart from the orientation, a huge amount of on-the-job training is provided when necessary, especially when new tax policies are issued.

Evaluation. The evaluation process of operators is designed sophisticatedly. The total score of operators' performance is 100, 40 points of which are determined by the number of calls one receives, another 40 points weigh on the quality of calls, and the grade of the monthly exam determines the remaining 20 points. The number of calls and the grade of the monthly exam are straightforward to measure. How to measure the quality of calls is more complicated. Given that all calls are recorded, the quality of calls is evaluated by reviewing a sample of randomly selected recordings (approximately 10 out of 1400 calls for each operator each month). The most important part of the quality is whether the operator can understand the question and give the right answer, which accounts for 60% of the quality score. If the operator provides a wrong answer, they must call back and explain to the caller. Service manner contributes 20% of the quality score. For example, one indicator of service manner is that only the taxpayer can end the call, which ensures all callers' questions are listened to and solved. Accurately summarizing the content of each call accounts for another 10%. An additional 10% score was designed to encourage adequately performing operators. Those who can generally reply clearly and efficiently can gain additional scores. Operators' measured performance is linked with their career development, and those with excellent performance are rewarded with honorable titles (e.g., "Star Operator"), further training, and promotion opportunities.

Appendix Table A1
Frequently Asked Questions of Tax Hotline on Corporate Income Tax.

Questions frequently asked on the Hotline	Frequency
Questions about the filing of Annual Income Tax Return Form	5806
Do we need to file related forms on preferential tax policies to tax bureaus?	4259
When should we do the annual income tax settlement?	1171
Do we need to file related forms about capital loss deduction to tax bureaus?	668
How is the taxable income calculated? Which costs can be deducted, and which income should be counted?	531
Can we deduct employees' education fees at a rate of 8%?	364
What are the requirements for small firms to enjoy the preferential tax rate?	341
Can high-tech firms pay income tax at a rate of 15% in the year when the qualification ended?	75
What is the deduction limit of production-related commissions?	33

Note: This table lists hot questions received on the tax hotline from May 7, 2018, to May 11, 2018. 19,987 calls were recorded, and we present the top 10 frequently asked questions. Questions 1, 3, and 5 were related to the implementation rule; questions 2, 7, 8, and 9 were about preferential tax policies; and questions 6 and 10 were about the calculation of taxable income.

Appendix B. Determinants of hotline adoption time

This section explores the possible determinants of the prefecture's hotline adoption time. We manually collect the hotline adoption timings from historical newspapers. The adoption time ranges from 2002 to 2014.

We study determinants that influence the likelihood of a prefecture adopting the hotline in a specific year, given that it has not adopted the hotline yet. Using data from China City Statistical Yearbook from 2000 to 2014, we run a Cox proportional hazards (Cox PH) model of the form:

$$h(t) = h_0(t)exp(\gamma W_t)$$

where the hazard of hotline adoption is the product of a baseline hazard function that depends on time only $h_0(t)$, and the relative risk of a prefecture $exp(\gamma W_t)$. W_t is a set of time-varying prefecture characteristics, including the logarithm of GDP per capita, the GDP share of secondary industry and tertiary industry, population density, the ratio of FDI to GDP, and the ratio of CIT to GDP. The model is estimated by using the partial-likelihood estimation method.

Table B1 reports the results. The LTB's hotline timing result is reported in Column (1), and the STB's hotline timing result is reported in Column (3). Column (1) shows that the coefficients of the logarithm of GDP per capita and population density are significantly positive, whereas those of GDP shares in secondary and tertiary industries are significantly negative. By contrast, the coefficients of GDP share of FDI and the ratio of CIT to GDP are insignificant. Column (3) shows that none of the coefficients of prefecture-level variables are significant.

We also report the results from OLS estimation in Columns (2) and (4). For LTB's hotline timing, apart from population density, all other coefficients are significant. Those variables are insignificant for STB's hotline timing. For STB's hotline timing, all coefficients except for that on GDP share of secondary industry and population density are significant.

To rule out the potential endogeneity of hotline timing, we include all the significant variables in the hazard model at the 2000 value, in which none of the hotlines had been adopted, in our empirical model. To test whether prefectures are balanced conditional on the selected variables, we report a balance check in table B2. The treatment group is prefectures that adopt the hotline earlier, whereas the control group is prefectures that adopt the hotline later. We find that the ratio of budget revenue to GDP, the ratio of budget expense to budget revenue, budget revenue per capita, and budget expense per capita are all balanced conditional on the selected variables.

Appendix Table B1
Hotline adoption timing and prefecture characteristics.

	Cox PH	OLS
	(1)	(2)
Logarithm of GDP per capita	0.446**	0.187***
	(0.207)	(0.023)
GDP share of secondary industry	−2.761**	−0.542***
	(1.455)	(0.150)
GDP share of tertiary industry	−3.324*	−0.669***
	(1.765)	(0.181)
Population density	0.711***	0.036
	(0.239)	(0.032)
FDI/GDP	0.357	−1.054***
	(3.815)	(0.414)
Corporate Income Tax/GDP	−0.224	−0.069***
	(0.271)	(0.024)
Observations	1233	1233

Notes: This table reports how prefecture characteristics affect hotline timing. The sample in columns (1) and (2) contains 170 prefectures that adopted LTB's hotline after 2002; the sample in columns (3) and (4) contains 174 prefectures that adopted STB's hotline after 2001. In columns (1) and (3), we report the results from a hazard model where the dependent variable is an indicator of the hotline adoption year. The OLS estimation results are reported in columns (2) and (4) as a comparison. Standard errors are clustered at the prefecture level. *, **, and *** denote statistical significance at 10%, 5%, and 1%, respectively.

Appendix Table B2
Balance table.

	Treat Group	Control Group	Unconditional Diff.	Conditional Diff.
	(1)	(2)	(3)	(4)
The Ratio of Budget Revenue to GDP (%)	5.018	5.121	−0.103	0.545
	(1.843)	(1.518)	(0.266)	(0.405)
The Ratio of Budget Expense to Budget Revenue (%)	1.381	1.678	−0.297***	−0.212
	(0.411)	(0.794)	(0.101)	(0.267)
ln(Budget Revenue per Capita)	5.588	5.190	0.398**	−0.095
	(0.866)	(1.081)	(0.155)	(0.179)
ln(Budget Expense per Capita)	5.300	4.711	0.589***	0.050
	(1.011)	(1.195)	(0.176)	(0.172)
Observations	80	81	161	161

Notes: This table reports a balance check of hotline timings. We focus on prefecture fiscal indicators in 2000 when none of the hotlines was adopted. Column (1) reports the mean and standard deviation (in brackets) of the treatment group, and column (2) reports those statistics for the control group. The treatment group is prefectures adopting the hotline earlier, whereas the control group is prefectures adopting the hotline later. Column (3) reports the unconditional difference between the treatment group and the control group. In Column (4), we report the difference between the treatment group and control group conditional on the six selection variables from the hazard model: ln(GDP per capita), the GDP share of secondary industry, the GDP share of tertiary industry, population density, the ratio of FDI to GDP, and the ratio of CIT to GDP. *, **, and *** denote statistical significance at 10%, 5%, and 1%, respectively.

Appendix C. Additional tables

Appendix Table C1
The Sample Rate for NTSD.

	Tax Payers	Sales	Sample Rate
Manufacturing industry	VAT payers	> 400,000,000 RMB	1:1
Manufacturing industry	VAT payers	100,000,000 to 400,000,000 RMB	1:10
Manufacturing industry	VAT payers	20,000,000 to 100,000,000 RMB	1:50
Manufacturing industry	VAT payers	10,000,000 to 20,000,000 RMB	1:100
Manufacturing industry	VAT payers	3,000,000 to 10,000,000 RMB	1:200
Manufacturing industry	VAT payers	< 3,000,000 RMB	1:500
Manufacturing industry	VAT payers	> 400,000,000 RMB	1:1
Wholesale industry	VAT payers	> 400,000,000 RMB	1:1
Wholesale industry	VAT payers	100,000,000 to 400,000,000 RMB	1:10
Wholesale industry	VAT payers	50,000,000 to 100,000,000 RMB	1:50
Wholesale industry	VAT payers	10,000,000 to 50,000,000 RMB	1:100
Wholesale industry	VAT payers	5,000,000 to 10,000,000 RMB	1:200
Wholesale industry	VAT payers	< 5,000,000 RMB	1:500
Construction industry	BT payers	> 800,000,000 RMB	1:1
Construction industry	BT payers	100,000,000 to 800,000,000 RMB	1:10
Construction industry	BT payers	60,000,000 to 100,000,000 RMB	1:50
Construction industry	BT payers	10,000,000 to 60,000,000 RMB	1:100
Construction industry	BT payers	3,000,000 to 10,000,000 RMB	1:300
Construction industry	BT payers	< 3,000,000 RMB	1:500
Other industries	All payers	> 500,000,000 RMB	1:1
Other industries	VAT payers	100,000,000 to 500,000,000 RMB	1:10
Other industries	BT payers	100,000,000 to 500,000,000 RMB	1:5
Other industries	All payers	10,000,000 to 100,000,000 RMB	1:50
Other industries	All payers	10,000,000 to 10,000,000 RMB	1:100
Other industries	VAT payers	100,000 to 10,000,000 RMB	1:200
Other industries	BT payers	100,000 to 10,000,000 RMB	1:300
Other industries	All payers	< 100,000 RMB	1:500

Note: This table lists the sampling rate for NTSD before 2013. Value-added tax is levied on the production and sale of goods. VAT payers are those who pay value-added taxes. Business tax is levied on the provision of services. BT payers are those who pay business taxes.

References

Abeler, J., & Jäger, S. (2015). Complex Tax Incentives. *American Economic Journal: Economic Policy, 7*(3), 1–28.

Adelino, M., Ma, S., & Robinson, D. (2017). Firm Age, Investment Opportunities, and Job creation: Firm Age, Investment Opportunities, and Job creation. *The Journal of Finance, 72*(3), 999–1038.

Aghion, P., Akcigit, U., Gravoueille, M., Lequien, M., & Stantcheva, S. (2023). *Tax Simplicity or Simplicity of Evasion? Evidence from Self-Employment taxes in France*. Working Paper.

Aghion, P., Akcigit, U., Lequien, M., & Stantcheva, S. (2017). *Tax Simplicity and Heterogeneous Learning*.

Agrawal, A., Galasso, A., & Oettl, A. (2017). Roads and Innovation. *The Review of Economics and Statistics, 99*(3), 417–434.

Alm, J., Cherry, T., Jones, M., & McKee, M. (2010). Taxpayer Information Assistance Services and Tax Compliance Behavior. *Journal of Economic Psychology, 31*(4), 577–586.

Arai, M. (2003). Wages, profits, and Capital Intensity: Evidence from Matched Worker-firm Data. *Journal of Labor Economics, 21*(3), 593–618.

Atkinson, A. B., & Stiglitz, J. E. (1976). The Design of Tax Structure: Direct versus indirect Taxation. *Journal of Public Economics, 6*(1–2), 55–75.

Baker, A. C., Larcker, D. F., & Wang, C. C. (2022). How much should we Trust Staggered Difference-in-differences estimates? *Journal of Financial Economics, 144*(2), 370–395.

Ballard, C. L., & Gupta, S. (2018). Perceptions and Realities of Average Tax rates in the Federal Income Tax: Evidence from Michigan. *National Tax Journal, 71*(2), 263–294.

Bastani, S., Giebe, T., & Miao, C. (2020). Ethnicity and Tax Filing Behavior. *Journal of Urban Economics, 116*, Article 103215.

Baum-Snow, N. (2007). Did highways Cause Suburbanization? *The Quarterly Journal of Economics, 122*(2), 775–805.

Behrens, K., Mion, G., Murata, Y., & Suedekum, J. (2017). Spatial Frictions. *Journal of Urban Economics, 97*, 40–70.

Bertrand, M., Duflo, E., & Mullainathan, S. (2004). How much should we Trust Differences-in-differences estimates? *The Quarterly Journal of Economics, 119*(1), 249–275.

Besley, T., & Persson, T. (2014). Why do developing Countries Tax so Little? *Journal of Economic Perspectives, 28*(4), 99–120.

Best, C. M., Brockmeyer, A., Kleven, K. J., Spinnewijn, S., & Waseem, M. (2015). Production versus Revenue Efficiency with Limited Tax Capacity: Theory and evidence from Pakistan. *Journal of Political Economy, 123*(6), 1311–1355.

Blaufus, K., Bob, J., Hundsdoerfer, J., Sielaff, C., Kiesewetter, D., & Weimann, J. (2015). Perception of Income Tax rates: Evidence from Germany. *European Journal of Law and Economics, 40*(3), 457–478.

Blaufus, K., Chirvi, M., Huber, H.-P., Maiterth, R., & Sureth-Sloane, C. (2020). Tax Misperception and its Effects on Decision making – Literature Review and Behavioral Taxpayer Response Model. *The European Accounting Review*, 1–34.

Blaufus, K., & Milde, M. (2021). Tax Misperceptions and the effect of Informational Tax Nudges on Retirement Savings. *Management Science, 67*(8), 5011–5031.

Bohne, A., & Nimczik, J. S. (2018). *Information Frictions and Learning Dynamics: Evidence from Tax Avoidance in Ecuador*.

Brandt, L., Biesebroeck, J. V., & Zhang, Y. (2012). Creative Accounting or Creative Destruction? Firm-level Productivity Growth in Chinese Manufacturing. *Journal of Development Economics, 97*(2), 339–351.

Cai, H., & Liu, Q. (2009). Competition and Corporate Tax Avoidance: Evidence from Chinese Industrial Firms. *The Economic Journal, 119*(537), 764–795.

Cao, J., & Mao, J. (2021). Firm Performance and Economic Development: Evidence from a Unique Dataset of China. *Economics of Transition and Institutional Change*, 1–18.

Cengiz, D., Dube, A., Lindner, A., & Zipperer, B. (2019). The effect of Minimum Wages on Low-wage Jobs. *The Quarterly Journal of Economics, 134*(3), 1405–1454.

Chaurey, R. (2017). Location-based Tax Incentives: Evidence from India. *Journal of Public Economics, 156*, 101–120.

Chen, G., Firth, M., & Xu, L. (2009). Does the Type of Ownership Control Matter? Evidence from China's Listed Companies. *Journal of Banking & Finance, 33*(1), 171–181.

Chen, Z., He, Y., Liu, Z., Serrato, J. C. S., & Xu, D. Y. (2021). The Structure of Business Taxation in China. *Tax Policy and the Economy, 35*, 131–177.

Chen, Z., Liu, Z., Serrato, J. C. S., & Xu, D. Y. (2021). Notching R&D Investment with Corporate Income Tax Cuts in China. *American Economic Review, 111*(7), 2065–2100.

Chetty, R., Friedman, J. N., & Saez, E. (2013). Using differences in Knowledge across Neighborhoods to Uncover the Impacts of the EITC on earnings. *The American Economic Review, 103*(7), 2683–2721.

Craig, A. C., & Slemrod, J. (2022). *Tax Knowledge and Tax Manipulation: A Unifying Model. Technical Report w30151*. National Bureau of Economic Research.

Cui, W., Hicks, J., & Xing, J. (2022). Cash on the Table? Imperfect Take-up of Tax Incentives and firm Investment Behavior. *Journal of Public Economics, 208*, Article 104632.

Dai, X., & Zhao, Z. (2021). Behavioural Additionality of China's Business-taxto-VAT Reform on Firms' Internal and External R&D Investment. *Applied Economics, 53*(31), 3590–3603.

Deshpande, M., & Li, Y. (2019). Who is Screened out? Application costs and the Targeting of Disability Programs. *American Economic Journal: Economic Policy, 11*(4), 213–248.

Donaldson, D., & Hornbeck, R. (2016). Railroads and American Economic Growth: A "Market Access" Approach. *The Quarterly Journal of Economics, 131*(2), 799–858.

Dyreng, S. D., Hanlon, M., & Maydew, E. L. (2008). Long-Run Corporate Tax Avoidance. *The Accounting Review, 83*(1), 61–82.

Edwards, A., Schwab, C., & Shevlin, T. (2016). Financial Constraints and Cash Tax Savings. *The Accounting Review, 91*(3), 63–85.

Felix, R. A., & Hines, J. R. (2013). Who Offers Tax-based Business Development Incentives? *Journal of Urban Economics, 75*, 80–91.

Foley, C. F., Hartzell, J. C., Titman, S., & Twite, G. (2007). Why do firms hold so much Cash? A Tax-based Explanation. *Journal of Financial Economics, 86*, 579–607.

Giles, J., Meng, X., Xue, S., & Zhao, G. (2021). Can Information Influence the Social Insurance Participation Decision of China's Rural Migrants? *Journal of Development Economics, 150*, Article 102645.

Gravelle, J. G. (1982). Effects of the 1981 Depreciation Revisions on the Taxation of Income from Business Capital. *National Tax Journal, 35*(1), 1–20.

Haltiwanger, J., Jarmin, R. S., & Miranda, J. (2013). Who creates Jobs? Small versus large versus Young. *Review of Economics and Statistics, 95*(2), 347–361.

Hasan, R., Jiang, Y., & Rafols, R. M. (2021). Place-based Preferential Tax Policy and Industrial Development: Evidence from India's program on Industrially Backward Districts. *Journal of Development Economics, 150*, Article 102621.

Hoopes, J. L., Reck, D. H., & Slemrod, J. (2015). Taxpayer Search for Information: Implications for Rational attention. *American Economic Journal: Economic Policy, 7*(3), 177–208.

Hsieh, C.-T., & Klenow, P. J. (2009). Misallocation and Manufacturing TFP in China and India. *The Quarterly Journal of Economics, 124*(4), 1403–1448.

Jia, J., Ding, S., & Liu, Y. (2020). Decentralization, Incentives, and Local Tax Enforcement. *Journal of Urban Economics, 115*, Article 103225.

Koumpias, A. M., & Martinez-Vazquez, J. (2019). The Impact of Media Campaigns on Tax Filing: Quasi-experimental evidence from Pakistan. *Journal of Asian Economics, 63*(63), 33–43.

Li, B., Liu, C., & Sun, S. T. (2021). Do Corporate Income Tax Cuts Decrease Labor Share? Regression Discontinuity evidence from China. *Journal of Development Economics, 150*, Article 102624.

Li, J., Wang, X., & Wu, Y. (2020). Can Government Improve Tax Compliance by adopting Advanced Information Technology? Evidence from the Golden Tax Project III in China. *Economic Modelling, 93*, 384–397.

Liu, Y., & Mao, J. (2019). How do Tax Incentives Affect Investment and Productivity? Firm-Level evidence from China. *American Economic Journal: Economic Policy, 11*(3), 261–291.

Liu, Y., & Martinez-Vazquez, J. (2014). Interjurisdictional Tax Competition in China. *Journal of Regional Science, 54*(4), 606–628.

Lu, Y., Shi, X., Sivadasan, J., & Xu, Z. (2021). How does Improvement in Commuting Affect Employees? Evidence from a Natural Experiment. *The Review of Economics and Statistics*, 1–47.

Lu, Y., Wang, J., & Zhu, L. (2019). Place-based policies, creation and Agglomeration Economies: Evidence from China's Economic Zone Program. *American Economic Journal: Economic Policy, 11*(3), 325–360.
Maffini, G., Xing, J., & Devereux, M. P. (2019). The Impact of Investment Incentives: Evidence from UK Corporation Tax returns. *American Economic Journal: Economic Policy, 11*(3), 361–389.
Ohrn, E. (2018). The effect of Corporate Taxation on Investment and Financial Policy: Evidence from the DPAD. *American Economic Journal: Economic Policy, 10*(2), 272–301.
Ouimet, P., & Zarutskie, R. (2014). Who Works for Startups? The Relation between firm Age, Employee Age, and growth. *Journal of Financial Economics, 112*(3), 386–407.
Pomeranz, D. (2015). No Taxation without Information: Deterrence and self Enforcement in the Value added Tax. *American Economic Review, 105*(8), 2539–2569.
Roth, J., Anna, P. H. C. S., Bilinski, A., & Poe, J. (2022). What's Trending in Difference-in-differences? A Synthesis of the recent Econometrics Literature. In *Working Paper* (pp. 1–54).
Saez, E. (2001). Using Elasticities to Derive Optimal Income Tax rates. *The Review of Economic Studies, 68*(68), 205–229.
Saez, E., Schoefer, B., & Seim, D. (2019). Payroll taxes, firm Behavior, and Rent sharing: Evidence from a Young Workers' Tax Cut in Sweden. *American Economic Review, 109*(5), 1717–1763.
Vossler, C. A., & Gilpatric, S. M. (2018). Endogenous Audits, uncertainty, and Taxpayer Assistance Services: Theory and experiments. *Journal of Public Economics, 165*, 217–229.
Wu, F. (2021). Tax Enforcement and firm Investment Efficiency: Evidence from Staggered Implementation of Tax Administration Information System. Available at SSRN 3869665.
Zhang, L., Chen, Y., & He, Z. (2018). The effect of Investment Tax Incentives: Evidence from China's Value-added Tax Reform. *International Tax and Public Finance, 25*(4), 913–945.
Zwick, E. (2021). The costs of Corporate Tax Complexity. *American Economic Journal: Economic Policy, 13*(2), 467–500.
Zwick, E., & Mahon, J. (2017). Tax Policy and Heterogeneous Investment Behavior. *American Economic Review, 107*(1), 217–248.