The Effect of Tax-Collection Mechanism and Management on Enterprise Technological Innovation: Evidence from China

Yuan Jiang 1,2,†, Jianwen Qin 1,† and Hayat Khan 3,*

1 School of Economics, Guangxi University, Nanning 530004, China; jiangyuanyuan722@gxufe.edu.cn (Y.J.); jianwqin@163.com (J.Q.)
2 School of Finance and Public Administration, Guangxi University of Finance and Economics, Nanning 530007, China
3 China Center for Special Economic Zone Research, Shenzhen University, Shenzhen 518000, China
* Correspondence: khiljhayat@szu.edu.cn
† These authors contributed equally to this work and shared first authorship.

Abstract: Tax collection and management is an important cornerstone to safeguard a country’s financial strength, and it is also a key task to realize the modernization of a country’s tax governance. This study examines the effect of tax-collection mechanism and management on technological innovation in China from 2007 to 2020. By using a fixed effect model, the findings indicate that a higher intensity of regional compulsory tax collection and management rises the level of technological innovation of enterprises. Strengthening tax collection and management is more conducive to raising the level of technological innovation of midwestern enterprises, non-high-tech enterprises and enterprises in a poor market environment. The concrete impact mechanism shows that tax collection and management improve the level of enterprises and technology innovation by using a tax credit-rating system and enhancing enterprises’ information transparency; the application of the Golden Three system has been more conducive to strengthening tax collection and management to enhance the level of enterprises’ technological innovation. The findings of this study have policy implications for China regarding rising innovation through tax collection.

Keywords: tax collection and management; tax credit; intermediary effect; technological innovation

1. Introduction

As the driving force of a country’s economic growth, enterprise technological innovation is the key to enhancing a country’s competitive strength and realizing enterprises’ sustainable development. Knowledge of intelligence and application skills offers long-term sustainable development (Jan Porvaznik et al.) [1]. Tax collection and administration is an important cornerstone to ensure national financial resources, and also a key task to realizing the modernization of tax governance in China. It generally exists in the work links of tax identification, tax declaration, tax audit and evaluation, tax punishment and so on. In the process of tax collection by the state from enterprises, tax collection and administration is connected with “government” and “people”, which is bound to have an impact on enterprises’ technological-innovation activities.

China has always attached great importance to tax collection and administration. As early as 1994, in order to adapt to the reform of the tax-distribution system, reduce the cost of tax collection and administration and reduce the loss of national tax money, the country started the Golden Tax project (the key project is referred to as “Golden Tax Phase III”). In 2016, Golden Tax Phase III was launched nationwide, which opened the road to tax development by science and technology, continued to expand the application of big data in taxation, and inserted “golden wings” for the modernization of taxation (Wang Jun, 2021) [2]. By the end of 2020, with the completion of the third phase of golden tax construction, China has basically built a modern tax-collection and management system.
However, to better adapt to the development of the digital economy, to play a fundamental role in security tax, the development of economy and high-quality service, in March 2021, the Chinese government focused “on further deepening the reform of tax collection and administration of opinions” (hereinafter referred to as “opinions”), and began “synthetic” tax collection and management reform. This aims to build a smart tax system with a high integration function, high security performance and high application efficiency, and use big-data tax regulation to better serve the development of enterprises, as well as the technological innovation of enterprises. At the same time, the state began to implement the tax-credit evaluation system in October 2014. As a supplement to compulsory tax collection and management, tax credits have become an important asset for taxpayers to participate in market competition, which is conducive to enterprises carrying out technological innovation and obtaining more social resources.

Therefore, in the context of further deepening the reform of tax collection and management and accelerating the development of enterprise technological innovation, what is the impact of tax collection and management on the technological innovation of enterprises? What impact will the strengthening of big-data tax collection and management and tax-credit evaluation have on the relationship between traditional mandatory tax collection and management and enterprise technological innovation? These are the two key issues studied in this paper, which are of great significance for accelerating the establishment of a smart tax system, improving the tax-credit evaluation system, and improving the level of technological innovation of enterprises.

In the existing literature on the impact of tax collection on enterprises, scholars have mainly carried out relevant studies for different samples of countries and regions from the aspects of the fairness and efficiency of tax-policy implementation and the influence of policy implementation, etc. For example, Vladimira et al. [3] studied the tolls of social policy and dealt with the social function of tax collection, tax imposing, and taxation justice, pointing out that the social aspects of the social system of taxes in the Slovak Republic indicate that tax collection should be certain for the citizens in the state and attention should be given to minimum wage and tax policy under legal conditions in the Slovak Republic. Tomas Peracek et al. [4] found that a simple company’s law on shares requires changes; there is an absence of shareholder liability for a company’s liabilities, allowing shareholders to behave indifferently to owners. Pshdar Abdalla Hamza et al. [5] analyzed the impact of information technology on efficient tax management in Kurdistan, the information technology that is online, including tax filing, online tax registration and online tax remittances, has a positive effect on efficient tax management in Kurdistan. Some scholars also studied the topic of enterprise innovation, such as Zuzana Hajduova [6], who argued that there is a statistically positive and significant association between the performance of revenues of enterprises that have introduced innovations, with there being a two-year lag from the R&D expenditure of enterprises in Slovakia. Anel kireyeva et al. [7] examined the innovation potential determinants of enterprises in Kazakhstan. The results show that the age of the company, type, sector, exporter status and activity have a positive effect on the innovation tendency of companies. They further found, as a part of the study, that competitors in the marketplace and regions of activity of enterprises predominately negatively affect the prospects of introducing innovation.

In existing studies, Chinese scholars focus on the tax burden of tax collection and management on enterprises [8–10], tax compliance [11,12], financial reporting quality [13–16], financing activities [17,18] and also on the impact of resource supply, and less attention is paid to studies on the consequences of tax collection and management on enterprise resource supply and use, that is, how the tax-collection-and-management service market influences subjects such as enterprise performance, technological innovation and green transformation. Meanwhile, the existing literature on the influence mechanism of tax collection and management on enterprise innovation mainly focuses on the effect of tax collection and management on taxation and governance effects [18,19], competition effects and resource effects [20], and Golden Tax Phase III policy effects [21]. However, little
literature has studied the influence mechanism and effect of big-data tax collection and flexible tax collection on enterprise technological innovation on the basis of traditional compulsory tax collection and management.

In view of this, based on the data of A-share listed companies in China from 2007 to 2020, this paper empirically tests the effect and mechanism of tax collection and management on enterprise technological innovation by using the fixed effect model. This paper shows that the higher the intensity of regional compulsory tax collection and management, the higher the level of enterprise technology innovation. Strengthening tax collection and administration is more conducive to improving the technological innovation level of enterprises in central and western regions, non-high-tech enterprises and enterprises in poor market environments. The specific influence mechanism is that tax collection and management enhance the level of enterprise technological innovation through the supplementary application of a tax payment credit evaluation system. The application of the Golden Tax Phase III system is more conducive to strengthening tax collection and management to enhance the level of enterprise technology innovation.

The possible contributions of this paper are as follows: First of all, in contrast to existing studies, this paper systematically analyzes the effect of traditional compulsory regional tax collection on enterprise technological innovation from the dual perspectives of information technology and flexible tax collection, and expands the micro-evidence of the impact of regional tax collection on enterprise technological innovation. Second, heterogeneity research not only considered the different areas, the industrial enterprise technology innovation affected by differences in tax collection and administration, but also considered the market competition environment, investment and financing environment and the protection of intellectual property rights system caused by the institutional environment factors, such as for the accurate direction for the reform of tax collection and administration and service enterprise innovation to provide enlightenment, for reference. Finally, from the perspective of the mediating effect of tax credits and the moderating Golden Tax Phase III effect, this paper investigates the influence mechanism of tax collection and management on enterprise technological innovation, and preliminarily answers the key question of how to expand the reform of tax collection and management to better improve the level of enterprise technological innovation.

The research of this paper enriches the research perspective and literature results on the impact of tax collection and management on enterprise technological innovation, and can provide inspiration and reference for China to further expand the reform of tax collection and management, accelerate the establishment of a smart tax system, and improve the tax-credit evaluation system.

The rest of the paper is structured as follows: Section 2 lays out the review and puts forward the research hypothesis; Section 3 is composed of the methodology, models and variables used in the analysis; Section 4 presents results and discussion; while Section 5 conclude the paper.

2. Literature Review

2.1. Tax Collection and Administration and Enterprise Technological Innovation

Enterprise technological innovation refers to the innovation of production technology, mainly including the research and development of new technologies and new processes, or the use of existing technologies and processes to develop new products and complete the commercialization process. There are two different viewpoints on the impact of tax collection and management on enterprise innovation in the existing literature: one holds that tax collection and management is not conducive to enterprise technological innovation.

According to the tax avoidance motivation theory, the strengthening of tax collection and management will increase internal cash outflow of enterprises; additionally enterprises often face external financing problems [22,23], so enterprises are motivated to adopt tax avoidance methods to save internal funds and maintain daily operations under the pressure
of taxation [24–26], and there is simply no extra money for technological innovation to pursue long-term growth [27,28].

However, the other view is that tax collection can promote the technological innovation of enterprises. Based on information asymmetry theory and principal-agent theory, consider the tax department as a special “external shareholder” of the company; strengthening tax collection and administration can regulate the behavior of corporate tax, decrease the cost of two kinds of agent [19], curb management’s proprietary gains [29], improve the enterprise’ target the consistency of the principal and agent, and realize the “governance effect” that “constrains” enterprise behavior [30]. Therefore, enterprises can save more innovation resources, improve enterprises financing environment, and promote enterprise technological innovation.

It can be seen that tax collection and management have positive and negative effects on enterprise technological innovation. Then, what is the main effect of tax collection on enterprise technological innovation?

This paper agrees with Zhu Honglan et al. [20] that, compared with the “resource reduction” effect of tax collection and administration on enterprise innovation, tax collection and administration play a major role in the “resource increase” effect of enterprise innovation. That is, tax collection and administration can promote enterprise technological innovation. The main reason is because national tax follows the principles of efficiently and fairly and reasonably burden for taxpayers; this way of participating in enterprise profit allocation does not affect enterprises’ normal operation. However, the occupation or plunder of enterprise resources by shareholders or managers may lead to the exhaustion of enterprise resources, so enterprises’ normal operation cannot be guaranteed.

Therefore, the “resource increase” effect of tax collection and management on enterprise technological innovation will be greater, which can improve the level of enterprise innovation. Based on the above analysis, this paper proposes Hypothesis 1:

Hypothesis 1 (H1). The greater the intensity of tax collection and management, the higher the level of enterprise technological innovation.

2.2. Tax Collection and Administration, Tax Credits and Enterprise Technological Innovation

It can be seen from the above analysis that compulsory tax collection and management can improve the technological innovation level of enterprises. However, traditional compulsory collection and management has some problems, such as poor legitimacy (referring to whether the regulatory policy is consciously recognized and obeyed), low effectiveness and poor responsiveness [31]. Therefore, compulsory tax collection and administration should include flexible supervision and strengthen taxpayers’ integrity and self-discipline, which is the development direction of government governance and the governing concept.

In 2014, the Chain State Administration of Taxation implemented the tax credit-rating system and began to practice the flexible tax collection and administration mode [32], conduct tax-credit evaluation based on enterprise tax declaration, tax assessment and tax inspection. This flexible tax collection and administration reflects legality, transparency, responsibility, response and effectiveness [31], encouraging some companies that prefer incentives to pay taxes voluntarily. As an important asset and implicit institutional arrangement that constrains enterprises to participate in market competition [33], tax payment credits will affect enterprises’ technological innovation through governance and financing mechanisms:

First, in the process of the tax credit rating, the tax authority will check books, vouchers and other financial information, carry out tax audits and tax investigations, such as enterprises-related transactions and transfer pricing behavior. These can, to some extent, inhibit managers’ self-interested behavior of encroaching on enterprise resources, save enterprises’ innovation resources, and promote their technological innovation.

Secondly, the implementation of enterprise tax credit evaluation can improve the transparency of enterprise information, and A-level tax credit enterprises can also obtain joint
incentives such as fiscal capital projects and bank credit financing, thus improving the availability of external financing and helping to improve the level of enterprise technological innovation [34].

Therefore, as a supplementary taxation tool for compulsory tax collection and management, strengthening tax credit evaluation can “save or increase resources” for enterprises innovation, thus promoting enterprise technological innovation. Based on the above analysis, this paper proposes Hypothesis 2:

**Hypothesis 2 (H2).** Tax collection and administration can enhance the level of enterprise technological innovation by strengthening tax credit management.

### 2.3. Tax Collection and Administration, Golden Tax Phase III and Enterprise Technological Innovation

In recent years, studies on tax collection and administration have mainly focused on the role of information in tax collection and administration [35–37]. Using big-data technology to improve the modernization level of national governance has become the strategic goal of Chinese government governance in the era of digital economy [38].

As an information system for tax collection and administration, Golden Tax Phase III (Golden Tax Phase III, the abbreviation of golden Tax Project Phase III construction, is an information engineering project constructed by the Chinese state to realize information tax administration. Currently, it has mainly undergone phase III construction and started phase V construction from the end of 2020. In 2013, “Golden Tax Phase III” was first launched in Chongqing, Shandong and Shanxi; in 2014, the optimized version of “Golden Tax Phase III” was launched in Guangdong, Inner Mongolia and Henan provinces; in 2015, it was launched in 14 provinces and autonomous regions including Hainan, Jilin and Xizang; in 2016, “Golden Tax Phase III” was launched in 16 provinces and autonomous regions including Beijing, Shanghai, Zhejiang and Jiangsu, realizing full coverage.) utilizes big data, cloud computing and other information technologies to greatly improve the supervision ability of enterprises’ tax-related information [8]. To be specific, through a unified platform, Golden Tax Phase III has achieved coverage of various tax categories, links and departments, improving the sharing of tax-related information. In addition, at the same time, Golden Tax Phase III, with the aid of an external information system to collect information by a third party, assesses correlation output invoices; increases the commodity classification coding of invoices; compares the tax burden rate and profit rate of the same industry etc. to achieve multi-dimensional tax supervision.

It can be said that the Golden Tax Phase III online operation has reduced the tax evasion and tax collection costs of enterprises, and improved the efficiency of tax collection and administration [39]. It further standardizes enterprise management, saves innovative resources for enterprises and promotes technological innovation.

Xu [21] also found that Golden Tax Phase III big data at the front desk will directly affect enterprises’ tax burden, while tax collection and administration-system backstage functions such as tax auditing and accounting ratio will affect the enterprises production and transmission of information, reduce enterprises’ managers self-interest, improve the quality of enterprises’ information, and promote the enterprises’ business activities, including technological innovation.

It can be seen that, after the online operation of Golden Tax Phase III, tax collection and management can play a role in improving the level of enterprise technological innovation through the advantages of big-data tax information governance. Based on the above analysis, this paper proposes Hypothesis 3:

**Hypothesis 3 (H3).** The launch of Golden Tax Phase III application helps promote tax collection and management to improve the level of enterprise technological innovation.
3. Methodology

3.1. Model of the Study

Since the unobservable factors that affect the technological innovation of enterprises cannot be fully controlled, such as corporate vision, institutional culture, innovation opportunities and so on, this paper refers to the practice of Lan et al. [20] to test the impact of tax collection and management on the technological innovation of enterprises, which can make the test conclusion more reliable. Thus, the benchmark regression model (1) is constructed:

\[
\frac{\text{Patent}_{it+3}}{\text{Patent}_{it+4}} = \beta_0 + \beta_1 \text{TE}_{jt} + \beta_2 \text{Control}_{it} + u_i + v_t + \epsilon_{it}
\] (1)

In the above equation, Patent is the explained variable, and the total number of patent applications is used to describe the technological innovation level of the enterprise. Considering the long R&D cycle of the enterprise and the time-lag issue of patent-output results, the patent-lag three and four periods are, respectively, used as the explained variable; the explanatory variable TE represents the intensity of regional tax collection and administration, and Control represents the control variable, which mainly controls the related variables that affect the technological innovation of enterprises. The subscript \(i\) represents the company, \(j\) represents the province, and \(t\) represents the year, and \(\epsilon\) is a random disturbance term that controls both the time fixed effect and the company fixed effect.

3.2. Data Sources

The patent application data and patent citation data in this article come from the China Research Data Service Platform (CNRDS), the company’s financial data comes from the Cathay Pacific Database (CSMAR) from 2015–2020 and the A-level tax-credit data is collected manually from the Credit China website. The institutional environment data comes from the Wind database (WIND), and the marketization index data from 2017 to 2020 was fitted and supplemented, excluding insolvency, ST and *ST samples, missing data on main variables and three-year financial information for samples with discontinuous data; 1% and 99% winsorizing variables were performed on continuous variables; and 17,889 unbalanced panel data of 1753 companies from 2007 to 2020 were used as research samples.

3.3. Variable Definition

3.3.1. Dependent Variable

Enterprise technology innovation (Patent) is the dependent variable used in the model. Enterprise technological innovation mainly refers to the output and achievements of technological innovation. Considering the long cycle of enterprise technology innovation, R&D and output of innovation results, this paper refers to the practice of Tian and Meng, and Tian [40,41], who use the natural logarithm of the total number of enterprise patent applications plus 1, and lags three periods (f3pata) and lags four periods (f4pata), to measure the technological innovation of enterprises, and use the natural logarithm of the total number of enterprise invention patent applications plus 1 and lag four periods (f4ainv) to replace the technological innovation of enterprises for robustness test.

3.3.2. Independent Variable

Tax collection and management (TE) is the independent variable. In this paper, the ratio of the actual tax revenue to the expected tax revenue in each region is used to describe the regional tax-collection and management intensity [19,20,42] and the model (2) is used to estimate the expected tax revenue in each region.

\[
\frac{T_{it}}{GDP_{it}} = \phi_0 + \phi_1 \times \text{IND1}_{it} / GDP_{it} + \phi_2 \times \text{IND2}_{it} / GDP_{it} + \phi_3 \times \text{OPEN}_{it} / GDP_{it} + \epsilon_{it}
\] (2)

Among them, it is the tax revenue of each province in that year divided by the GDP of that year, \(\text{IND1}\) is the output value of the primary industry of each province in that year;
IND2 is the output value of the secondary industry of each province in that year; OPEN represents the degree of regional openness, which is equal to the total import and export value of each province in that year (by operating location of the unit). The data of each variable was substituted into model (1) to obtain the estimated coefficient after regression, which was used to estimate the expected tax revenue, and is represented by tax collection and administration (TE) as the ratio of the actual tax revenue to the expected tax revenue of each province, namely,

\[ TE_{it} = \frac{T_{it}}{GDP_{it}} / \left( \frac{T_{it}}{GDP_{it,est}} \right) \]

(3)

3.3.3. Mediating Variable

Tax credit (a) was used a mediating variable. According to the “Enterprise Credit Evaluation System”, the State Administration of Taxation has started to carry out tax-credit evaluation of enterprises since October 2014, and classified the tax-credit rating of enterprises into five levels, ABMCD, and, from 2015, the tax-credit rating of A-level taxpayers has been classified. Enterprise information is published on the website of the State Administration of Taxation. This paper defines the 2015–2020 A-level tax credit enterprises (A) as 1, and other tax credit enterprises as 0.

3.3.4. Moderating Variable

Net effect of Gold Tax Phase III (tp) is used as a moderating variable. As Gold Tax Phase III has achieved a major change in the “tax management by ticket” model of tax collection and management, it has had a great impact on the law enforcement of the tax department and the lawful tax payment of enterprises. Therefore, in order to examine the impact of the application of Gold Tax Phase III on tax collection and management and enterprise technological innovation, this paper refers to the practice of Fan and Li [12]. As a quasi-natural experiment, the double-difference method is used to define net effect of Gold Tax Phase III variable (tp).

Specifically, the defined \( tp = \text{treat} \times \text{post} \) represents the dummy variable of the experimental group affected by the “Gold Tax Phase III” policy and the cross term before and after the event, that is, whether the enterprise is located in a region where the “Gold Tax Phase III” has been piloted and the cross term of the two dummy variables before and after the implementation. Among them, treat is the grouping variable of the “Gold Tax Phase III” pilot enterprises, that is, the processing group is the 20 time-saving treatments in the “Gold Tax Phase III” pilot in the region where the enterprise is located. The value of treat is 1, otherwise it is 0; variables, considering the lag of “Gold Tax Phase III” system’s operation and commissioning, staffing, data migration, etc., these are the enterprises in Chongqing area in 2013 and later; Shanxi- and Shandong-area enterprises in 2014 and later; and Guangdong-, Henan- and Inner Mongolia-area enterprises in 2014 and later. In 2015 and later, enterprises in 14 provinces and regions including Hainan, Jilin, and Tibet will be used as the “Gold Tax Phase III” pilot time in 2016 and later, and the corresponding post value will be 1, otherwise, it will be 0. Since the “Gold Tax Phase III” has been fully rolled out since 2016, the “Gold Tax Phase III” impact time is only set to 2017.

3.3.5. Control Variables

Referring to the practice of existing scholars [20,28,34,43–47] and considering the impact of other variables on enterprise technological innovation, the following control variables were added to the benchmark regression model (2): asset–liability ratio (lev), return on assets (roa), enterprise size (size), enterprise age (age), operating income growth rate (gsales), shareholding ratio of major shareholders (top1), equity incentives (bstock), salary incentives (bsalary), monetary funds (cash), two jobs in one (dual), the ratio of directors (outr), the size of the board of directors (bsize), the nature of the enterprise (soe), R&D investment (rdsale), government subsidies (subsidy), tax incentives (tc), economic growth rate (gdp) and institutional environment (mar). The variables’ definitions are detailed in Table 1.
Table 1. Variable definition and descriptive statistical analysis table.

| Variable Nature | Variable Name | Symbols | Variable Calculation Formula and Description | N  | Mean  | Std. Dev. | Min  | P50  | Max  |
|-----------------|---------------|---------|---------------------------------------------|----|-------|-----------|------|------|------|
| Dependent variable | Technology innovation | F3PATA | Add 1 to the natural logarithm of the total number of patents filed by enterprises with a lag of three periods. | 17,889 | 1.570 | 1.630 | 0 | 1.390 | 6.310 |
|                  |               | F4PATA | Add 1 to the natural logarithm of the total number of patents filed by enterprises with a lag of four periods. | 11,627 | 1.680 | 1.680 | 0 | 1.390 | 6.370 |
| Independent variable | Tax collection and management | TE | Provincial actual tax revenue divided by provincial expected tax revenue. | 17,889 | 1 | 0.240 | 0.650 | 0.970 | 1.660 |
| Intervening variable | Tax credit | A | A is defined as 1 when the enterprises' annual tax credit is grade A; otherwise, it is 0. | 17,889 | 0.340 | 0.470 | 0 | 0 | 1 |
| Moderating variable | Net effect of Gold Tax Phase III | TP | tp = 1 for enterprises in areas where Gold Tax Phase III is launched; and 0 for enterprises in other areas. | 17,889 | 0.240 | 0.430 | 0 | 0 | 1 |
| Control variable | Debt-to-assets ratio | LEV | Total liabilities divided by total assets. | 17,889 | 0.410 | 0.200 | 0.050 | 0.410 | 0.860 |
|                  | Return on assets | ROA | Current net profit divided by average total assets. | 17,889 | 0.0500 | 0.0600 | −0.210 | 0.0400 | 0.220 |
|                  | Enterprise scale | SIZE | The natural log of total assets. | 17,889 | 22.13 | 1.230 | 19.89 | 21.98 | 25.97 |
|                  | Enterprise age | AGE | Year of observation minus year of establishment. | 17,889 | 15.98 | 5.670 | 3.580 | 16 | 31.42 |
|                  | Revenue growth rate | GSALES | Change in current year's operating income divided by previous year's operating income. | 17,889 | 0.230 | 0.410 | −0.510 | 0.150 | 2.350 |
|                  | Shareholding ratio of major shareholders | TOPI | The shareholding ratio of the largest shareholder. | 17,889 | 34.50 | 14.72 | 8.350 | 32.79 | 72.88 |
|                  | Stock ownership incentive | BSTOCK | Shareholding ratio of directors and managing directors. | 17,889 | 15.88 | 23.57 | 0 | 0.120 | 103.7 |
|                  | Salary incentive | BSALARY | The natural logarithm of the total annual salary of directors, supervisors and senior executives. | 17,889 | 15.24 | 0.740 | 13.42 | 15.21 | 17.27 |
|                  | Monetary capital | CASH | Monetary capital divided by total assets at year end. | 17,889 | 0.200 | 0.140 | 0.0200 | 0.150 | 0.720 |
|                  | CEO duality | DUAL | If the chairman and general manager hold concurrent positions, the value is 1; otherwise, the value is 0. | 17,889 | 0.280 | 0.450 | 0 | 0 | 2 |
|                  | Ratio of independent directors | OUTR | The number of independent directors divided by the number of directors. | 17,889 | 0.370 | 0.0500 | 0.330 | 0.330 | 0.570 |
|                  | Board size | BSIZE | Total number of directors. | 17,889 | 8.660 | 1.680 | 5 | 9 | 15 |
|                  | Enterprise property | SOE | State-owned enterprises are defined as 1; otherwise, 0. | 17,889 | 0.320 | 0.470 | 0 | 0 | 1 |
|                  | Research input | RDSALE | State-owned enterprises are defined as 1; otherwise, 0. | 17,889 | 0.0400 | 0.0400 | −0.0300 | 0.0300 | 0.260 |
|                  | Governmental subsidy | SUBSIDY | Government subsidies divided by total assets. | 17,889 | 0.0100 | 0.0100 | 0 | 0 | 0.0400 |
|                  | Tax preference | TC | \(\ln[\text{total profit} \times (\text{Nominal Tax Rate} − \text{Effective Tax Rate})]\). The nominal tax rate is the tax rate published in the financial statements. The effective tax rate is income tax expense divided by total profit before tax. | 17,889 | 12.85 | 7.150 | 0 | 16.15 | 20.43 |
|                  | Economic growth rate | GDP | Percentage of annual GDP growth | 17,889 | 0.0800 | 0.0100 | 0.0700 | 0.0700 | 0.140 |
|                  | Institutional environment | MAR | Provincial marketization index | 17,889 | 8.280 | 1.780 | 3.450 | 8.640 | 11.27 |
4. Results and Discussions

4.1. Descriptive Statistical Analysis of Main Variables

The descriptive statistics of each variable in this paper are shown in Table 1. In the research sample, the average value of the total number of enterprise patent applications lag three (f3patg) and four (f4patg) are 1.57 and 1.68, respectively, indicating that the overall level of technological innovation of Chinese enterprises is not high enough. The mean value of tax collection and administration (TE) is exactly 1, and the standard deviation is only 0.24, indicating that the intensity of tax collection and administration in this country is relatively reasonable, and it can basically ensure that the actual tax revenue collected by each region is equal to the expected. The average value of the category variable tax credit (a) is 0.34, indicating that the proportion of A-level tax credit enterprises is 34%. The mean value of the net effect of Gold Tax Phase III (tp) is 0.24, indicating that about 24% of the sample companies are affected by the Gold Tax Phase III policy. The descriptive statistics of other control variables were basically in-line with expectations.

4.2. Analysis of Benchmark Regression Results

In this paper, robust standard errors were used to eliminate the regression results obtained after intra-group autocorrelation. The results show (see Table 2) that strengthening the regional tax collection and management system can improve the technological innovation of enterprises; that is, for every 1% increase in the regional tax collection and management intensity, the number of patent applications in the third and fourth phases of the lag of enterprises will increase by 0.2915 and 0.3734 units, respectively, indicating that strengthening tax collection and management improves the level of technological innovation of enterprises, and thus confirms Hypothesis H1. This conclusion is basically consistent with the existing research conclusions [20,43,48]. However, the research results of this paper also show that the promotion effect of regional compulsory tax collection on local enterprises’ technological innovation is not an “immediate effect”, but there is a certain lag. This suggests that the government, if it wants to encourage enterprise innovation by strengthening tax collection and administration, should formulate a reasonable tax-collection and administration plan as soon as possible, give play to the external governance role of tax collection and administration, save or increase resources for enterprise technological innovation, and accelerate the development of enterprise technological innovation.

Table 2. The impact of tax collection on corporate technological innovation.

| Variable | National Regions | Eastern Region | Central Region | Western Area |
|----------|------------------|----------------|---------------|-------------|
| TE       | (1)              | (2)            | (3)           | (4)         |
|          | (5)              | (6)            | (7)           | (8)         |
| f3pata   | 0.2915 *         | 0.3734 **      | 0.1940        | 0.2762      |
| f4pata   | 0.8508           | 1.4352 **      | 0.8758 **     | 0.8584 **   |
| Constant | 0.7489           | −40.2641       | 15.4788       | −15.3531 ** |
|          | (1.8833)         | (2.3729)       | (0.9179)      | (1.2837)    |
|          | (0.0443)         | (−1.4627)      | (−2.1148)     | (−1.4296)   |
| Control variable | Yes | Yes | Yes | Yes |
| Individual firm effect | Yes | Yes | Yes | Yes |
| Annual time effect | Yes | Yes | Yes | Yes |
| Observations | 17,889 | 11,627 | 13,065 | 8392 |
| R-squared | 0.1195 | 0.0752 | 0.1198 | 0.0771 |

Note: robust t-statistics are in brackets; *, ** represent 10%, and 5% significance levels, respectively.

4.3. Heterogeneity Tests

4.3.1. Regional Heterogeneity Test

In order to test the effect of tax collection and management on the regional heterogeneity of enterprise technological innovation, referring to the practice of Duan [49], this paper divides the sample enterprises into eastern, central and western regions for group regres-
sion. The results in Table 2 show that the positive impact of tax collection and management in the eastern region on the technological innovation of enterprises is not significant, while the strengthening of tax collection and management in the central and western regions can significantly improve the level of technological innovation of enterprises. The main reason is that the economic development level in the eastern region is higher, and the tax collection and administration efforts are lower than those in the western region. Therefore, a lower tax collection and administration intensity does not have an obvious effect on the technological innovation of enterprises. Strong innovation vitality has a large demand for innovation resources. Taxation will occupy the cash flow of enterprises, cause financing constraints and weaken the role of taxation and management in promoting technological innovation of enterprises.

Among the three regions, the central region has the lowest tax-collection and management intensity, but it can improve the technological innovation level of enterprises to a greater extent, while the western region has made the greatest efforts in tax collection and management, but its role in promoting technological innovation of enterprises is not as good as the central region. There, the economic development and innovation vitality are better than those in the western region. There may also be flexible tax-credit ratings and non-mandatory tax-law enforcement methods such as first-time offenders not incurring a penalty. As supplementary tools for mandatory tax collection and management, these tax-collection and management methods can also improve the level of technological innovation of enterprises to a certain extent, which shows the importance of flexible tax collection and management and non-mandatory law enforcement.

4.3.2. Industrial Technology Heterogeneity Test

In order to examine the impact of tax collection and administration on the technological innovation of technological enterprises in different industries, this paper divides the sample enterprises into high-tech enterprises and non-high-tech enterprises for group regression. The results in Table 3 show that the positive impact of tax collection and administration on the technological innovation of high-tech enterprises is not significant, but it significantly improves the technological innovation level of non-high-tech enterprises. The main reason is that, in order to encourage the technological transformation and development of enterprises, China allows high-tech enterprises to enjoy certain tax incentives, but enterprises need to carry out tax identification before enjoying tax incentives in accordance with the “Administrative Measures for the identification of High-tech Enterprises”, and the tax authorities will then certify the identified enterprises. When the high-tech enterprises levy taxes, the external governance effect of tax collection and management will be offset, to a certain extent. In addition, such enterprises have strong innovation willingness and inertia, so the impact of external governance factors on the improvement of their technological innovation level is not obvious. In non-high-tech enterprises, on the one hand, strengthening tax collection and administration can alleviate information asymmetry between the two sides and break the information barrier between departments [50,51]; it is beneficial to increase the interaction between tax authorities and enterprises, and push incentives for national science and technology innovation industries in a timely way. On the other hand, strengthening tax collection and administration can also reduce the behavior of enterprise managers’ self-interest and shareholders’ hollowing out enterprise innovation resources, and improve the level of enterprise technological innovation by exerting an external governance role.
Table 3. Heterogeneity test of industrial technology and market environment.

|           | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|-----------|-----|-----|-----|-----|-----|-----|-----|-----|
| Variable  |     |     |     |     |     |     |     |     |
| High-Tech Enterprise | $f_3$pata | $f_4$pata | $f_3$pata | $f_4$pata | $f_3$pata | $f_4$pata | $f_3$pata | $f_4$pata |
| Non-High-Tech Enterprises | 0.2561 | 0.2442 | 0.3020 | * | 0.3840 | ** | 0.3395 | 0.4223 | 0.5994 | ** | 0.6487 | *** |
| A Better Institutional Environment | (0.8417) | (0.7771) | (1.6748) | (2.1192) | (1.1486) | (1.2331) | (2.4644) | (2.6675) |
| Poor Institutional Environment | -1.4344 | 1.8282 | 2.6779 | -123.9599 | 31.9889 | -1.9324 | -5.9104 | -126.1233 |
| Control variable | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Individual firm effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Annual time effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 6090 | 3888 | 11,799 | 7739 | 10,114 | 6305 | 7775 | 5322 |
| R-squared | 0.1559 | 0.1005 | 0.1019 | 0.0696 | 0.1287 | 0.0764 | 0.1153 | 0.0837 |

Note: robust t-statistics are in brackets; *, **, *** represent 10%, 5%, and 1% significance levels, respectively.

4.3.3. Heterogeneity Test of Market Environment

As an external macro-governance factor, changes in institutional environment can affect the behavior and activities of all the micro-enterprises within its jurisdiction. For this reason, this paper refers to Wang et al. [52] to measure the institutional environment with the marketization index, and divides the good institutional environment (greater than the median) and the poor institutional environment according to the median size for sub-sample regression. The results in Table 3 show that under a better institutional environment, the positive impact of tax collection and management on corporate technological innovation is not significant. A possible reason for this is that strengthening tax collection and management for enterprises in a good institutional environment will be more strictly standardized. Tax authorities will levy more taxes on enterprises with better business performance, stronger tax-paying capacity and more standardized internal management, so as to squeeze the innovation resources of such enterprises (they also have better innovation conditions) and reduce their willingness to innovate; here, the “resource reduction” effect of tax collection and administration on enterprise technology innovation is obvious, which is not good for enterprise technology innovation. However, in a poor institutional environment, tax collection and administration have a significant effect on improving the level of technological innovation of enterprises, indicating that tax collection and administration, as an external governance method, can make up for the deficiencies of other institutional environments (these environments include administrative approval, investment and financing, intellectual property protection and so on) and improve the level of enterprise technological innovation; here, the “resource increase” effect of tax collection and administration on enterprise technology innovation is obvious, which is good for enterprise technology innovation. This conclusion is consistent with the policies of the state in recent years, to accelerate the promotion of the technological innovation of enterprises, strengthen the construction of the intellectual-property protection system, optimize the tax business environment, and use tax-credit management to make up for the lack of compulsory tax collection and management.

4.4. Endogeneity Test

Generally speaking, endogeneity problems mainly come from measurement errors, omitted variables and bidirectional causality [53]. Model endogeneity will cause explanatory variables to be related to perturbation terms, resulting in the biased estimation of model results.
In this paper, the independent variable tax collection and management is a macro index, while the dependent variable enterprise technology innovation index is a micro index; therefore, it is less likely for enterprise technological innovation to have an impact on macro tax collection and management; that is to say, the bidirectional causality problem of the benchmark regression model is difficult to establish. However, endogeneity problems caused by omitted variables and measurement errors are inevitable. Therefore, this paper adopts the following two methods to conduct endogeneity tests:

(1) In order to alleviate endogeneity problems caused by measurement errors, the practice of Melecky and Podpiera [54] was referred to; independent and control variables were used for regression with a lag of one stage.

(2) In order to control the missing variables that may change over time at the industry level, referring to the practice of Qin Jianwen et al. [55], the industry fixed effect and its cross term with the annual fixed effect were added to the regression on the basis of benchmark regression.

The results show that (see Table 4), after the above endogeneity test, the basic conclusion that strengthening tax collection and management promotes enterprise technological innovation remains unchanged.

Table 4. Endogeneity test results.

| Variable | Independent and Control Variables Lag by One Stage | Add Industry Fixed Effect and Its Cross Term with Annual Fixed Effect |
|----------|---------------------------------------------------|-------------------------------------------------------------|
|          | f3pata f4pata                                      | f3pata f4pata                                               |
| LTE      | 0.3484 ** 0.3785 *                                 | 0.2711 * 0.3453 **                                         |
|          | (2.1848) (1.8469)                                  | (1.7403) (2.1770)                                          |
| TE       | −11.8036 −33.9166                                  | 4.9413 −102.5081                                           |
|          | (−0.6899) (−1.3832)                                | (0.2823) (−1.6365)                                         |
| Control variable | No No Yes Yes | No No Yes Yes |
| Control variables lag by one stage | Yes Yes Yes Yes | No No Yes Yes |
| Individual firm effect | Yes Yes Yes Yes | Yes Yes Yes Yes |
| Annual time effect | Yes Yes Yes Yes | Yes Yes Yes Yes |
| Industry effect | No No Yes Yes | Yes Yes Yes Yes |
| Industry × Annual time effect | No No Yes Yes | Yes Yes Yes Yes |
| Observations | 16,000 9807 | 17,889 11,627 |
| R-squared | 0.1308 0.0867 | 0.1398 0.0939 |

Note: robust t-statistics are in brackets; *, ** represent 10%, and 5% significance levels, respectively.

4.5. Robustness Test

In order to ensure the stability of the benchmark regression results, the following robustness tests were carried out:

(1) Substitution-dependent variable. The lagging four term (F4AINV) of the total number of enterprise invention patent applications was used to replace the quantity and quality of enterprise technological innovation.

(2) The sample subinterval was used for estimation. The 2008 global financial crisis had a great impact on various business activities of enterprises, which easily causes abnormal changes in enterprise technological innovation. Therefore, this paper only adopts the sample data of enterprises from 2012 to 2020, after eliminating the sample data of three consecutive years after the financial crisis for regression.

(3) Removing interference from the policy of replacing business tax with value-added tax. Since October 2014, China has taken the lead in implementing the pilot policy of replacing business tax with value-added tax in Shanghai, Beijing, Jiangsu, Anhui, Fujian, Guangdong, Tianjin, Hubei and Zhejiang provinces. In order to eliminate the
influence of this policy on enterprise technological innovation, the enterprise samples in the pilot cities and provinces were removed and returned.

(4) The control group was proportioned by the PSM method. In order to eliminate the influence of differences in enterprise characteristics, referring to the practices of existing scholars [56–58], the whole sample was divided into a control group and treatment group according to whether analyst values are greater than the mean (analyst = the number of analyst tracking plus 1 as the natural logarithm, if analyst is greater than the mean and the value is 1, it is regarded as the treatment group; otherwise, it is regarded as the control group if analyst is 0). Then the PSM method was used to match calipers with 0.001 radius [59].

After the above treatment, the research conclusion of the benchmark regression remains unchanged after the regression was conducted again according to the benchmark model (see Table 5).

Table 5. Robustness test results.

| Variable      | Substitution Variable | Sample Subinterval Estimation | Remove VAT Policy Interference | PSM Method Proportioning Control Group |
|---------------|-----------------------|------------------------------|-------------------------------|---------------------------------------|
| TE            | 0.3095 **             | 0.3296 *                     | 0.7969 ***                   | 0.6557 **                            |
| Constant      | −25.9241              | 13.4701 *                    | −5.8602                      | 1.1648                               |
|               | (2.2281)              | (1.9509)                     | (3.1007)                     | (2.4693)                             |
| Control variable | Yes                   | Yes                          | Yes                          | Yes                                  |
| Individual firm effect | Yes             | Yes                          | Yes                          | Yes                                  |
| Annual time effect | Yes               | Yes                          | Yes                          | Yes                                  |
| Observations  | 11,627                | 14,016                       | 7754                         | 5698                                 |
| R-squared     | 0.0391                | 0.1615                       | 0.1218                       | 0.1209                               |

Note: robust t-statistics are in brackets; *, **, *** represent 10%, 5%, and 1% significance levels, respectively.

5. The Influence Mechanism of Tax Collection and Management and Technological Innovation of Enterprises

5.1. Model Design of Influence Mechanisms

5.1.1. The Mediating-Effect Model of Tax Credit

According to the research Hypothesis 2 outlined above, referring to the methods of Baron and Kenny [60] and Wen et al. [61] to test the mediation effect, this paper constructs the following model to test the mediation effect of tax collection and administration.

\[
\frac{\text{Patent}_{it+3}}{\text{Patent}_{it+4}} = a_0 + a_1 \text{TE}_{it} + a_2 \text{Control}_{it} + u_i + v_t + \epsilon_{it}
\]

\[
A_{it} = b_0 + b_1 \text{TE}_{it} + b_2 \text{Control}_{it} + u_i + v_t + \epsilon_{it}
\]

\[
\frac{\text{Patent}_{it+3}}{\text{Patent}_{it+4}} = c_0 + c_1 \text{TE}_{it} + c_2 A_{it} + c_3 \text{Control}_{it} + u_i + v_t + \epsilon_{it}
\]

Among them, A is an intermediary variable, which is the tax credit (a) of the A-level enterprise. When the sample enterprise’s tax credit is A-level, \( a = 1 \); otherwise, it is 0. The definitions of other variables are exactly the same as in model (2). The mediation effect test process is as follows (referring to the practice of Wen and Ye [62]): Firstly, when the coefficients \( a_1, b_1 \) and \( c_2 \) are all significant, it means that there is a conduction effect; when the coefficient \( a_1 \) is significant, but only one of \( b_1 \) and \( c_2 \) is significant, the Sobel test is required. Secondly, if there is a conduction effect or through Sobel’s significance test, if \( a_1 \) is significant, there is a mediating effect, otherwise there is no mediating effect. Thirdly, when there is a mediating effect if \( c_1 \) is not significant, it is a complete mediating effect; when \( c_1 \) is significant, if \( b_1 \times c_2 \) and \( c_1 \) have the same sign, it is a partial mediating effect; if \( b_1 \times c_2 \) and \( c_1 \) have different signs, there is a masking effect.
5.1.2. The Moderating Effect Model of the Three Phases of the Golden Tax

According to the research hypothesis put forward above, this paper uses the Golden Tax Phase III Policy Effect \((tp)\) as a moderating variable to test the moderating effect of the Golden Tax Phase III project’s on-line operation in the relationship between tax collection and management and enterprise technological innovation.

\[
\frac{\text{Patent}_{it+3}}{\text{Patent}_{it+4}} = a_0 + a_1 \text{TE}_{it} + a_2 \text{TE}_{it} \times tp_{it} + a_3 \text{tp}_{it} + a_4 \text{Control}_{it} + u_t + v_t + \epsilon_{it} \tag{7}
\]

Among them, \(tp\) is an adjustment variable, which represents the three-phase policy effect of the golden tax, and is a dummy variable. \(tp = 1\) (experimental group) when the sample is an enterprise in the area where the “Golden Three” pilot phase was launched, and \(tp = 0\) (control group) when it is an enterprise in other regions. The coefficient of the \(\text{TE} \times tp\) multiplication term in model (7) is the moderating effect of the three-phase golden tax policy effect in the relationship between tax collection and management and enterprise technological innovation (in order to solve the multicollinearity problem of explanatory variables, moderator variables and their interaction terms, this paper’s explanatory and moderator variables are centered). According to the research hypothesis, the online operation of Golden Tax Phase III can improve the efficiency of tax collection and management, which, in turn, can help strengthen tax collection and management and improve the level of technological innovation of enterprises, that is, the \(\text{TE} \times tp\) coefficient of the transportation term may be significantly positive. The definitions of other variables are exactly the same as in model (2).

5.2. Analysis of Influence Mechanism

First of all, the impact mechanism of tax collection and administration on the technological innovation of enterprises is shown in Table 6. Results of mediation effect are: \(\text{TE}\) in column (3) is significantly (5%) negative for coefficient \(b_1\), indicating that the greater the tax collection and management effort, the less conducive it is for enterprises to obtain A-level tax credit. Tax-credit rating can be used as a supplementary tool for mandatory tax collection and management. In columns (4) and (5), the coefficient \(c_2\) of a to \(f_3\text{pata}\) and \(f_4\text{pata}\) is not significant, so the Sobel test is required. After the Sobel test, the results are significant, indicating that there is a conduction relationship between tax collection and management, tax credit and enterprise technological innovation, and \(b_1c_2\) and \(c_1\) have the same number and the coefficients of \(\text{TE}\) on \(f_3\text{pata}\) and \(f_4\text{pata}\) are all significant, indicating that mandatory tax collection and management can supplement tax credit. At the same time, since the coefficients of \(\text{TE}\) on \(f_3\text{pata}\) and \(f_4\text{pata}\) in (4) and (5) are both significant, a partial mediation effect is reflected, indicating that Hypothesis H2 cannot be rejected statistically. This verifies the conclusion of other scholars that flexible tax collection and mandatory tax collection have a “complementary effect” [31,34]. This conclusion suggests that the government can promote enterprise innovation by using a “rigid and flexible” collection and management mode, but for some enterprises that prefer incentive measures, the “good” management mode is more conducive to encouraging enterprise innovation. In addition, Li Lin et al. [63] found, in their study, that the comprehensive application of the policy tools of “joint punishment + joint incentive” in the tax-payment credit rating system can achieve the “double dividend” of improving enterprises’ tax compliance and business performance (including enterprise innovation performance). These conclusions can provide useful reference for the government to improve the tax-credit rating system to serve enterprise innovation.

Secondly, the results of the moderating effect (see Table 6): the coefficients of the \(\text{TE} \times tp\) multiplication term in columns (6) and (7) are all significantly positive, indicating that the online operation of Golden Tax Phase III has improved the efficiency of tax collection and management, which is helpful to strengthen tax collection and management and improve the level of technological innovation of enterprises; that is, hypothesis H3 cannot be rejected statistically. However, it is intuitively believed that the standardized management of Golden Tax Phase III will increase the tax burden of enterprises, which
will be detrimental to enterprise innovation. For this problem, Fan and Li [12] found that Golden Tax Phase III improved the corporate tax compliance, promoted national tax “should be fully collected”, and Golden Tax Phase III also improved the enterprises’ preferential proportion, enterprises’ preferential tax “should be fully enjoyed”, and, under the action of both, Golden Tax Phase III does not improve the corporate tax burden. Therefore, it will not inhibit the technological innovation of enterprises. Therefore, it is reasonable for this paper to draw a research conclusion about Golden Tax Phase III’s positive regulation effect of tax collection and management and enterprise technological innovation.

Table 6. Analysis of the impact mechanism of the intermediary effect of tax credit and the three-phase adjustment effect of Golden Tax Phase III.

| Variable        | (1)   | (2)   | (3)   | (4)   | (5)   | (6)   | (7)   |
|-----------------|-------|-------|-------|-------|-------|-------|-------|
| TE/c_TE         | 0.2915* | 3.0734** | -0.1249** | 0.2910* | 3.0721** | 0.3652** | 0.4455*** |
| a               | -0.0048 | -0.0136 | -0.0029 | -0.03658 |       |       |       |
| c_tp            | 0.0203 | 0.0240 |       |       |       |       |       |
| c_TE#c_tp      | 0.5314*** | 0.3871* |       |       |       |       |       |
| Constant        | 0.7489 | -40.2641 | -1.4056 | 0.7422 | -40.2123 | 2.1522 | -38.9067 |
| R-squared       |       |       |       |       |       | 0.0959 |       |

Note: robust t-statistics are in brackets; *, **, *** represent 10%, 5%, and 1% significance levels, respectively.

In addition, as the degree of information asymmetry between different enterprises and tax authorities is different, does the positive moderating effect of Golden Tax Phase III differ among different enterprises? So sample enterprises were grouped in the following two ways for heterogeneity test: (1) sample enterprises were divided into high-tech enterprises (indh = 1) and non-high-tech enterprises (indh = 0); (2) sample enterprises were divided into more transparent information enterprises (analyst = 1) and less transparent information enterprises (analyst = 0). Table 7 reports the regression results of these two groups. The results show that the positive moderating effect of Golden Tax Phase III on the promotion of enterprise technological innovation by tax collection is significant in non-high-tech enterprises and enterprises with more opaque information, but not in high-tech enterprises and more transparent information enterprises (see Table 6). The reason is that in non-high-tech enterprises and less transparent information enterprises, the information asymmetry between tax authorities and enterprises is more serious, which can give full play to the advantages of the big-data tax-information governance of Golden Tax Phase III, and has a more obvious positive moderating effect on the impact of tax collection on enterprise technological innovation. This will reveal the government, in order to better supervise non-high-tech enterprises and less transparent information enterprises, upgrade and improve the golden tax engineering system, strengthen the monitoring of such enterprises by using big-data tax collection and management, and help improve such enterprise technological innovation.
Table 7. Analysis on the effect mechanism of moderating effect of Golden Tax Phase III in different types of enterprises.

|                      | C. The Moderating Effect of Golden Tax Phase III on Enterprises with Different Industrial Properties | D. The Moderating Effect of Golden Tax Phase III on Enterprises with Different Information Transparency |
|----------------------|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
|                      | High-Tech Enterprise (indh = 1)                                                                     | Non-High-Tech Enterprises (indh = 0)                                                                  |
|                      | (1)                                                | (2)                                                                                                  | (3)                                                | (4)                                                                 | (5)                                                | (6)                                                                 | (7)                                                | (8)                                                                 |
| Variable             | f3pata                                              | f4pata                                                | f3pata                                              | f4pata                                                | f3pata                                              | f4pata                                                | f3pata                                              | f4pata                                                |
| c_TE                 | 0.2626                                              | 0.6118                                                | 0.3994 **                                           | 0.4667 **                                            | 0.3042                                              | 0.3813 *                                              | 0.4929 **                                           | 0.5482 **                                            |
|                      | (0.8566)                                            | (1.6691)                                              | (2.1337)                                            | (2.4850)                                              | (1.4665)                                            | (1.7767)                                              | (2.1112)                                            | (1.9995)                                              |
| c_tp                 | 0.0389                                              | 0.2082                                                | 0.0111                                              | −0.0054                                              | 0.0020                                              | 0.0307                                                | 0.0224                                              | −0.0471                                              |
|                      | (0.4643)                                            | (0.6263)                                              | (0.2018)                                            | (−0.0985)                                             | (0.0337)                                            | (0.5482)                                              | (0.3176)                                            | (−0.5028)                                             |
| c_TE#c_tp            | 0.1476                                              | 0.0354                                                | 0.6403 ***                                          | 0.4692 *                                              | 0.1585                                              | 0.1432                                                | 1.0085 ***                                          | 0.8726 **                                            |
|                      | (0.3912)                                            | (0.0547)                                              | (2.7970)                                            | (1.8463)                                              | (0.6299)                                            | (0.5483)                                              | (3.8476)                                            | (2.0457)                                              |
| Constant             | 0.0696                                              | 2.6681                                                | 5.8302                                              | −119.3126                                             | −32.0246                                             | −211.9059 **                                          | 15.0574                                             | −24.2409                                              |
|                      | (0.0012)                                            | (0.0692)                                              | (0.1428)                                            | (−1.5150)                                             | (−0.4509)                                            | (−10.3533)                                            | (0.6390)                                            | (−1.1065)                                             |
| Control variable     | Yes                                                 | Yes                                                   | Yes                                                  | Yes                                                   | Yes                                                 | Yes                                                   | Yes                                                 | Yes                                                   |
| Individual firm effect| Yes                                                 | Yes                                                   | Yes                                                  | Yes                                                   | Yes                                                 | Yes                                                   | Yes                                                 | Yes                                                   |
| Annual time effect   | Yes                                                 | Yes                                                   | Yes                                                  | Yes                                                   | Yes                                                 | Yes                                                   | Yes                                                 | Yes                                                   |
| Observations         | 6090                                                | 129                                                   | 11,799                                              | 7739                                                  | 12,424                                              | 8616                                                   | 5405                                                | 3011                                                  |
| R-squared            | 0.1560                                              | 0.2989                                                | 0.1041                                              | 0.0704                                                | 0.1068                                              | 0.0870                                                | 0.1263                                              | 0.0734                                                |

Note: robust t-statistics are in brackets; *, **, *** represent 10%, 5%, and 1% significance levels, respectively.

6. Conclusions

In order to encourage enterprise innovation, various countries will implement tax preferential policies, such as the US implementation of R&D tax credits and the small-business credit-guarantee policy; while Japan has specially formulated preferential tax policies, patent protection systems and low-interest loans for small- and medium-sized enterprises for key national industries such as energy conservation and environmental protection. Korea allows technology-intensive companies to draw technology-development reserves for technology training, technology development and innovation, and so on. At the same time, in order to implement tax policies and increase taxpayers’ sense of gain, national governments continue to improve the efficiency of tax collection and administration, reduce the cost of tax collection and administration, strengthen tax payment credit management and enhance taxpayers’ compliance. For example, the United States established the earliest IRS electronic service system, the use of “data mining” technology to develop collection software, management of the national tax, improvement in the efficiency of tax collection and management, and ensuring national information security; Japan has established the SKS system to manage corporate-tax payment credits: this system has high sharing degree and timely data maintenance, can form a credit-information exchange platform through a membership system, obtain tax-credit ratings, implement a different-color declaration system, share information among tax, banking and customs departments and will strictly punish dishonest taxpayers; South Korea has established the Taxpayer Integrity Management System (TIMS), which regularly compares and verifies invoice information with third-party information, conducts tax-credit evaluation, and focuses on monitoring high-risk taxpayers and preventing tax risks.

This study examines the effect of tax-collection mechanisms and management on technological innovation in China from 2007 to 2020. By using a fixed effect model, the findings indicate that the higher the intensity of regional compulsory tax collection and management, the higher the level of the technological innovation of enterprises. Strengthening tax collection and management is more conducive to raising the level of technological innovation of midwestern enterprises, non-high-tech enterprises and enterprises in a poor market environment. The concrete-impact mechanism shows that tax collection and management improves the level of enterprises and technology innovation by using a tax-credit rating system and enhancing enterprises’ information transparency; the application of the golden
three system has been more conducive to strengthening tax collection and management to enhance the level of enterprises’ technological innovation.

Compared with developed countries, there are still some problems in tax collection and administration in China, such as the low technical level of the application system, the lack of a functioning intelligent tax platform and insufficient application of a tax-credit incentive policy. This paper expands the research perspective of the influence mechanism of tax collection and management on enterprise technological innovation, provides empirical evidence for the government to strengthen tax-credit management and build a smart tax system to serve the enterprises technological innovation and it is helpful to further understanding the positive significance of expanding the reform of tax collection and administration in China, and it can also provide a reference for other emerging countries to use tax policy to encourage enterprise innovation.

Based on the study results, this paper puts forward the following policy suggestions:

First, the government should further comprehensively expand “synthetic” tax collection and management reform; build a powerful smart tax-application system; realize “tax management with numbers”; if necessary, design special tax regulatory function modules for high-tech enterprises to implement precise tax regulation with big data, and give play to the demonstration role of high-tech enterprises in technological innovation. After opening up the “artery” of tax big-data information during Golden Tax Phase V, tax authorities can push tax preferential policies for enterprises in a timely manner, and accurately serve their technological innovation. In addition, tax authorities should also actively use smart tax platforms to help enterprises with feasible technology projects, but that lack innovation resources, to seek innovation resources and cooperation. First of all, big-data tax regulation should be used to accurately identify problems such as insufficient resources and policy imperfection faced by enterprises in technological innovation. Secondly, it is necessary to timely civil affairs, land, science and technology, banking and other departments, in a timely manner, of enterprise innovation resource demand and progress status, to help enterprises integrate innovation resources, enjoy policy dividends, promote technological innovation, and protect innovation achievements. Thirdly, a smart tax system can be used to improve the enterprise innovation environment, and gradually eliminate the lack of enterprise innovation vitality caused by external environmental factors, such as low levels of regional development, the unfair investment and financing environment, and the imperfect intellectual-property protection system.

Second, the construction of the tax-credit rating system should be strengthened, and joint incentives such as administrative approval, financial subsidies, tax incentives, loan financing and the bidding for enterprises with high tax credit implemented; enterprises should be given preferential policies in terms of capital, technology and talents, so as to increase their innovation resources and encourage them to carry out technological innovation. For dishonest enterprises, joint punishment should also be carried out, such as disclosing the list of dishonest enterprises to society or restricting loan financing and bidding, so as to maintain the deterrent force of tax non-compliance and the fairness of the flexible collection and management system. However, the punishment had better not “break bones and muscles” of the enterprise (such as revoking the business license or suspending production or business), to leave the space for the improvement of the enterprise. To improve enterprises, tax payment credit ratings can be repaired, so as to tap into the enterprises’ innovation potential and stimulate enterprises’ innovation and development.

Third, for enterprises with different industrial and technological levels, different tax management measures should be implemented to encourage innovation: For high-tech enterprises, tax collection and administration policies should highlight “accurate” management, provide more refined, professional, intelligent and personalized tax services, and exert the incentive effect of tax policy tools. These include creating tax-industry-policy propaganda; interpreting and pushing tax experts’ policy guidance to society on the website of the public bidding of the national key industrial enterprise of science and technology
innovation project list; rewarding industry innovation achievements with bonus tax-credit scores; and giving full play to the exemplary role of high-tech enterprises in developing project technologies and transforming their innovation achievements. For high technology enterprises, big-data tax regulation should take advantage of improving the information asymmetry problem between tax authorities and enterprises, use the supervision model of “credit + risk” to strengthen the enterprise’s daily management, execute “No risk do not disturb, illegal will be investigated”, govern the enterprise internal management by big-data tax regulation, identify innovation potential, save innovation resources for enterprises, enhance the willingness of enterprises to innovate, and encourage enterprises to actively carry out technological innovation.

This paper’s study mainly tested the effect of tax collection and administration on enterprise technology innovation from the perspective of tax credit and Golden Tax Phase III; this approach was created to China to perfect the tax-credit rating system and create an intelligent system that can promote enterprise technology innovation, but it is insufficient to examine the effect of specific tax-collection and management policies on enterprise technological innovation. The next step is to study the effect and mechanism of corporate technological innovation affected by other tax-management policies in some countries, such as bank–tax interaction and other non-mandatory tax enforcement and so on.

**Author Contributions:** Conceptualization, methodology, data curation, investigation, writing—original draft, Y.J.; Supervision, proofreading and structuring, J.Q.; and final draft and arrangement, English editing, proof read and literature were carried out by H.K. All authors have read and agreed to the published version of the manuscript.

**Funding:** This work was funded by The Scientific Research Basic Capacity Improvement Project of Guangxi’s Young and Middle-aged College Teachers, grant number 2019KY0651, and Subject Funding Projects of School of Finance and Public Administration, Guangxi University of Finance and Economics, grant number 2021CZXK014.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** Data is available from the corresponding author upon reasonable request.

**Acknowledgments:** Authors are thankful to the journal editor and three anonymous reviewers for their insightful and constructive comments to improve this article.

**Conflicts of Interest:** The authors declare no conflict of interest.

**References**

1. Porvaznik, J.; Ljudvigova, I.; Čajková, A. Holistic Competence of Leadership and Managerial Subjects. *Politické Vedy* **2018**, *21*, 56–77. [CrossRef]
2. Wang, J. Deepening the Reform of Tax Collection and Administration Meets the Expectations of the People. *Chin. Tax.* **2021**, *10*, 7–11.
3. Žofčinová, V.; Horváthová, Z.; Čajková, A. Selected Social Policy Instruments in Relation to Tax Policy. *Soc. Sci.* **2018**, *7*, 241. [CrossRef]
4. Tomáš, P.; Boris, M.; Patricia, B.; Jana, K. *Simple Company on Shares as Startup Support Tool*; Mendel University Press: Brno, Czech Republic, 2018; Volume 66, pp. 1601–1611.
5. Abdalla Hamza, P.; Qader, K.; Gardi, B.; Hamad, H.; Anwar, G. Analysis the impact of Information technology on Efficient tax Management. *SSRN 2021*, *12*, 31–41. [CrossRef]
6. Hajduova, Z.; Peráček, T.; Hurajová, J.C.; Bruothová, M. Determinants of innovativeness of Slovak SMEs. *Probl. Perspect. Manag.* **2021**, *19*, 198–208.
7. Anel, K.; Akan, N.; Aigerim, Y.; Nazyken, B.; Sharbanu, T. Exploring determinants of innovation potential of enterprises in Kazakhstan. *Probl. Perspect. Manag.* **2021**, *19*, 433–443.
8. Zhang, K.Z.; Ou, Y.J.; Li, W.J. Why “tax cuts are hard to Reduce”: Information technology, tax capacity and corporate tax evasion. *Econ. Res. J.* **2020**, *55*, 116–132.
9. Xue, W.; Liu, J. The influence of tax collection pressure on enterprise tax burden. *Tax. Res.* **2020**, *6*, 104–109.
10. Li, Y.; Yang, W.X.; Chen, B.K. Tax collection and administration, tax burden level and tax burden fairness. *China Ind. Econ.* 2020, 11, 24–41.
11. Wang, X.L.; Chen, J.H.; Xu, J.X. Tax administrator system, independence of tax collection and corporate tax compliance. *Reform Econ. Syst.* 2020, 6, 131–138.
12. Fan, Y.; Li, H.N. Tax Collection, Tax compliance and Tax Preference-Evaluation of policy effect of Golden Tax Phase III Project. *Financ. Trade Econ.* 2020, 41, 51–66.
13. Chen, S.; Chen, X.; Cheng, Q.; Shevlin, T. Are family firms more tax aggressive than non-family firms? *J. Financ. Econ.* 2010, 95, 41–61. [CrossRef]
14. Wang, Y.G.; Zhao, Q.; Pan, Y. Tax Authorities and Enterprises: Zero-Sum Game or Mutual Benefit? -Research from the perspective of information disclosure quality of listed companies. *Bus. Manag.* J. 2019, 33, 15–22, 31.
15. Wang, X.P. Does tax law enforcement improve the quality of corporate financial reporting? A quasi-natural experiment based on “Golden Tax Project III”. *J. Guizhou Univ. Financ. Econ.* 2020, 3, 49–60.
16. Li, Y.Y. Analysis of the effect of tax collection and administration on the policy of additional deduction for R&D expenses. *Tax. Res.* 2018, 406, 73–77.
17. Pan, Y.; Wang, Y.G.; Dai, Y.Y. Tax collection and administration, government-enterprise relationship and debt financing of listed companies. *China Ind. Econ.* 2013, 8, 109–121.
18. Yu, W.C.; Yin, H.; Liang, P.H. Tax collection, financial pressure and enterprise financing constraints. *China Ind. Econ.* 2018, 1, 100–118.
19. Zeng, Y.M.; Zhang, J.S. Can tax collection and administration play a role in corporate governance? *J. Manag. World* 2009, 3, 143–151.
20. Lan, Z.H.; Zeng, X.; Xin, Y.Y. Research on the influence mechanism of tax collection and administration on enterprise technological innovation from the perspective of industrial competition-based on “competition effect” and “resource effect”. *China Soft Sci. Mag.* 2021, 2, 181–192.
21. Xu, H.J. Does big data tax collection reduce the risk of stock price collapse?-Quasi-natural experiment based on “Golden Tax Phase III”. *J. Shanghai Univ. Financ. Econ.* 2021, 23, 93–107.
22. Hericourt, J.; Poncet, S. FDI and Credit Constraints:Firm Level Evidence in China. *Econ. Syst.* 2009, 33, 1–21. [CrossRef]
23. Poncet, S.; Steingress, W.; Vandenbussche, H. Financial Constraints in China:Firm-level Evidence. *China Econ. Rev.* 2010, 21, 411–422. [CrossRef]
24. Chen, D.Q.; Chen, Y.S.; Dong, Z.Y. Policy uncertainty, tax collection and administration intensity and corporate tax evasion. *J. Manag. World* 2016, 5, 151–163.
25. Liu, X.; Ye, K.T. Financial development, property rights and corporate tax burden. *J. Manag. World* 2014, 3, 41–52.
26. Hu, X.; Liu, B.; Jiang, S.Q. Product market competition, tax evasion and capital Investment: An empirical study from the perspective of capital pressure and agency cost. *Econ. Rev.* 2017, 1, 90–105.
27. Lim, Y. Tax Avoidance, Cost of Debt and Shareholder Activism:Evidence from Korea. *J. Bank. Financ.* 2011, 35, 456–470. [CrossRef]
28. Xie, H.B.; Wu, Z.Q.; Hui, L.I. Tax collection and management, replacing business tax with Value-added tax and investment in enterprise technological innovation. *Collect. Essays Financ. Econ.* 2020, 7, 33–42.
29. Desai, M.A.; Dyck, A.; Zingales, L. Theft and taxes. *J. Financ. Econ.* 2007, 84, 591–623. [CrossRef]
30. Chen, X.G. Fiscal stress, tax collection and regional inequality. *Soc. Sci. China Press* 2016, 4, 53–70.
31. Sun, X.J.; Zhai, S.Q.; Yu, S. Whether flexible tax collection can alleviate corporate financing constraints: Evidence from the natural experiment of tax credit rating disclosure. *China Ind. Econ.* 2019, 3, 81–99.
32. Jiang, J.X.; Li, M. The theory of flexible supervision under the governance concept. *Law Sci.* 2013, 10, 29–37.
33. Chen, H.W.; Liu, Q.L.; Yu, J.S. State, Ownership Structure, Integrity and Corporate Governance-A Case Study of Hongzhi Technology. *J. Manag. World* 2005, 8, 134–142.
34. Sun, H.L.; Lei, G.Q. The impact of tax credit rating system on enterprise technological innovation. *Public Financ. Res.* 2019, 12, 87–101.
35. Lederman, I. Reducing Information Gaps to Reduce the Tax Gap: When Is Information Reporting Warranted? *Law Rev.* 2010, 78, 1733–1760.
36. Kleven, H.J.; Knudsen, M.B.; Kreiner, C.T.; Pedersen, S.; Saez, E. Assess or Unable to Cheat? Evidence from a Tax Audit Experiment in Denmark. *Econometrica* 2011, 79, 651–692.
37. Slemrod, J.; Collins, B.; Hoopes, J.L.; Reck, D.; Sebastiani, M. Does Credit-Card Information Reporting Improve Small-Business Tax Compliance? *J. Public Econ.* 2017, 149, 1–19. [CrossRef]
38. Wang, G.Y. Thinking about using big data to promote modernization of tax administration. *Tax. Res.* 2020, 25, 45–52.
39. Ji, Y.; Wang, Z. Do tax burdens discourage business innovation?-Evidence from “Golden Tax Project Phase III”. *South China J. Econ.* 2019, 3, 17–35.
40. Tian, X.; Meng, Q.Y. Can equity incentive plan promote enterprise technological innovation? *Nankai Bus. Rev.* 2018, 3, 176–190.
41. Tian, H.X. The dark side of analyst coverage: The case of innovation. *J. Financ. Econ.* 2013, 4, 856–878.
42. Xu, W.; Zeng, Y.; Zhang, J. Tax Enforcement as a Corporate Governance Mechanism: Empirical Evidence from China. *Corp. Gov. Int. Rev.* 2011, 19, 25–40. [CrossRef]
43. Chen, D.; Xing, M. Tax incentives and R&D investment: An internal control perspective. *Mod. Econ. Res.* 2020, 12, 80–90.
44. Lee, P.M.; O’Neill, H.M. Ownership Structures and R&D Investments of U.S. and Japanese Firms: Agency and Stewardship Perspectives. *Acad. Manag. J.* 2003, 46, 212–225.
45. Li, C.; Song, M. Innovation activities of Chinese manufacturing firms: The role of ownership and CEO incentives. *Econ. Res. J.* 2010, 5, 135–137.
46. Lu, T.; Dang, Y. Corporate Governance and technological innovation: A Sectoral comparison. *Econ. Res. J.* 2014, 49, 115–128.
47. Liu, X.; Yue, Y.Z. CEO succession, performance deviation, and firm R&D investment: A strategic change direction perspective. *Nankai Bus. Rev.* 2015, 3, 36–49.
48. Li, B.; Zheng, W.; Ma, C. The Influence of Tax Collection on R&D investment: Inhibition or incentive? *Econ. Manag.* 2017, 4, 22–38.
49. Duan, J.S.; Zhuang, X.D. Financial Investment behavior and technological innovation: Motivation analysis and empirical evidence. *China Ind. Econ.* 2021, 1, 155–173.
50. Hu, C.L.; Wei, J.G.; Pan, S.; Hu, S.B. Direct and spatial Spillover effects of tax Collection and management on regional technological innovation: Based on principal-agent and Spatial Dubin model under asymmetric information. *Rev. Investig. Stud.* 2020, 39, 147–159.
51. Ye, K.T.; Liu, X. Tax collection, income tax cost and earnings management. *J. Manag. World* 2011, 5, 140–148.
52. Wang, X.L.; Fan, G.; Hu, L.P. *Report on Market Index by Provinces in China (2018)*; Social Sciences Academic Press: Beijing, China, 2019; ISBN 978-7-5201-4220-5.
53. Roberts, M.R.; Whited, T.M. Endogeneity in Empirical Corporate Finance. *Handb. Econ. Financ.* 2013, 2, 493–572. [CrossRef]
54. Melecky, M.; Podpiera, A.M. Institutional Structures of Financial Sector Supervision, Their Drivers and Historical Benchmarks. *J. Financ. Stab.* 2013, 9, 428–444. [CrossRef]
55. Qin, J.W.; Hu, J.C.; Cao, Y.X. Analysts focus and financialization of entity enterprises. *Technol. Econ.* 2022, 41, 139–152.
56. Jiang, F.X.; Shi, B.B.; Ma, Y.B. Information publishers, financial experience and corporate financing constraints. *Econ. Res. J.* 2016, 6, 83–97.
57. Frankel, R.; Li, X. Characteristics of A Firm’s Information Environment and the Information Asymmetry between Insiders and Outsiders. *J. Account. Econ.* 2004, 37, 229–259. [CrossRef]
58. Wang, G.; Xie, F.J.; Jia, Y. Review on the incentive mechanism of R&D subsidy policy-Based on the investigation of external financing incentive mechanism. *China Ind. Econ.* 2017, 2, 60–78.
59. Wang, G.J.; Lu, X.X. “The Belt and Road Initiative” and The upgrading of Chinese enterprises. *China Ind. Econ.* 2019, 3, 43–61.
60. Baron, R.M.; Kenny, D.A. The moderator-mediator variable distinction in social psychological research conceptual, strategic, and statistical considerations. *J. Personal. Soc. Psychol.* 1986, 51, 1173–1182. [CrossRef]
61. Wen, Z.L.; Zhang, L.; Hou, J.T.; Liu, H.Y. The mediating effect test and its application. *Acta Psychol. Sin.* 2004, 5, 614–620.
62. Wen, Z.L.; Ye, B.J. Moderated mediation Model testing: Competition or substitution? *Acta Psychol. Sin.* 2014, 46, 714–726.
63. Li, L.M.; Yu, H.F.; Wang, C.; Fu, Y. Reward and Punishment Mechanism, Tax compliance and Enterprise Performance: A study based on tax payment credit management system. *Econ. Res. J.* 2020, 55, 89–104.