

Digital Tax Supervision and Tax Governance of Platform Economy: Based on the Case Study of "Intelligent Supervision Platform for Refined Oil Products" in Hancheng City, Shaanxi Province

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ABSTRACT

As the core form of digital economy, the platform economy, with its virtual, cross-border transaction and data-driven features, has exacerbated the information asymmetry between tax authorities and taxpayers, leading to the failure of traditional tax supervision and imbalance of tax distribution and other governance problems. This paper reveals the governance mechanism of digitalized tax supervision by conducting a longitudinal case study on the "Smart Supervision Platform for Refined Oil Products" in Hancheng City, Shaanxi Province. The study finds that: (1) the platform collects real-time business data through Internet of Things (IoT) devices, which significantly reduces the marginal cost of supervision and solves the problem of market failure caused by information asymmetry; (2) relying on the industrial Internet platform, the platform promotes the construction of the "three-streams-in-one" supervisory network, so that the year-on-year growth of the declared sales of private gasoline stations is significantly increased; (3) through the "government-technology" platform, the platform can be used to monitor the sales of private gasoline stations. (3) through the "government-technology service provider-enterprise" tripartite collaboration model, the time of single-family audit was compressed, which verified the mechanism of digital technology to enhance the effectiveness of tax governance. This paper provides a localized solution for digital regulation of the real industry for the transformation of "tax management by numbers", and puts forward suggestions for tax regulation and governance of the platform economy.

KEYWORDS

Digital regulation; Platform economy; Tax governance

1 Introduction

With the rapid development of digital technology, the platform economy has become an important engine of China's economic growth. The China Digital Economy Development Research Report (2024) shows that the scale of China's digital economy will reach USD 7.1 trillion in 2023, accounting for 42.1% of GDP, with an average annual growth rate of over 15%. However, its virtualization, cross-border, data-driven and other characteristics also pose a serious challenge to the traditional tax regulatory system, exacerbating the risk of tax loss. According to a study by the Organization for Economic Cooperation and Development (OECD), the global platform economy leads to a tax loss of 100 billion to 240 billion U.S. dollars annually. Against this background, China is actively promoting the digital transformation of tax collection and administration. In March 2021, the Chinese authorities concerned issued the Opinions on Further Deepening the Reform of Tax Collection and Administration, which explicitly proposes to build a smart tax, and to utilize technologies such as big data, blockchain, artificial intelligence, etc., to build a modernized tax collection and administration model that is "taxed by the numbers". The Decision on Further Comprehensively Deepening Reform and Promoting Chinese Modernization also explicitly proposed to "improve the normalized regulatory system for the platform economy" and "study the tax system that is compatible with the new business model", which put forward new requirements for the tax governance of the digital economy.

Currently, there are three structural contradictions in China's platform economic tax governance: one is the spatial mismatch between the place of value creation and the place of tax payment, e.g., the capital-intensive regions in the east absorb 72% of the national platform enterprises' tax registrations, while the labor-intensive regions in the central and western parts of the country are faced with the problem of loss of tax sources, even though 68% of the platform's transaction value is contributed to it. Secondly, the imbalance of the revenue distribution mechanism of data elements, and the value-added income generated by the "digital labor" of platform enterprises, leading to the erosion of the tax base in labor-intensive regions; thirdly, the systematic disconnection between the traditional tax collection and management mode of "controlling the tax by invoices" and the characteristics of virtual transactions of the platform economy. The data of "2024 White Paper on Taxation of Platform Economy" shows that about 38% of the sporadic transactions on platforms are outside the regulation due to the lack of physical bills. Therefore, exploring the enabling mechanism of digital tax regulation has important theoretical and practical value, and there is an urgent need to solve the paradox of governance through technical means and provide a basis for institutional restructuring.

2 Case studies

2.1 Introduction to the cases

This paper selects the longitudinal single case study method to launch the research, and analyzes the case of the refined oil industry in Shaanxi Province, which builds a tax-control platform in Hancheng City. The refined oil market in Hancheng City had faced serious tax loss problems, and before 2022, the phenomenon of private gas stations' hidden income was common, and the discrepancy rate between the third-party payment flow and the declared income was up to 66.7%, with an annual tax shortfall of about 120 million yuan. China Telecom Shaanxi Weinan Branch, in conjunction with relevant government departments, took the lead in November 2023 to enable a comprehensive service wisdom supervision platform for refined oil products in Weinan Hancheng City. Relying on China Telecom's cloud-network convergence advantages, the platform utilizes cutting-edge technologies such as quantum encryption, IoT Internet of Things, big models, AI modeling, big data analysis, etc., and builds up a number of key modules to realize all-around intelligent supervision of the purchase, sale, and storage of refined oil products, which opens up a new path for the supervision of tax revenue for the refined oil products industry.

At the level of real-time data collection and analysis, by installing cameras and data collectors on each gasoline dispenser, it automatically collects information such as the model of the refueling vehicle and the time of entering and leaving the station, and accurately records data such as the main board of the gasoline dispenser, the encoder unit-price oil, the number of the gasoline gun, the refueling volume, the refueling amount, and so on. With the help of AI modeling and analysis, the 360-degree accurate depiction of the daily operation of the gas station "portrait", the formation of a complete data chain, to help the tax department to grasp the business situation, to combat tax evasion.

In terms of accurate monitoring and risk early warning, the platform has set up a liquid level meter data collection system to collect oil tank level data, track oil in and out of storage tanks and real-time tank storage, and upload parameter modification authority to the management department to accurately monitor purchases from the source and provide a visual basis for tax supervision and law enforcement. In addition, intelligent analysis edge terminals are installed in each gas station to realize the digital transformation of "oil sales measurement". The intelligent monitoring system adopts encryption technology and security storage measures in the cloud to ensure data security, and is equipped with a risk warning function that immediately pushes out warning information once an abnormality is detected.

The platform has achieved remarkable results since its pilot operation. In 2024, 53 gas stations under the jurisdiction of Hancheng declared a year-on-year increase of 57.96% in sales and a year-on-year increase of 58.05% in value-added tax (VAT); 29 private gas stations included in the key management declared a year-on-year increase of 142.08% in sales and a year-on-year increase of 101.77% in VAT. The platform has effectively cracked down on illegal behaviors of gas stations such as concealing sales and tax evasion, and standardized the tax order. The platform has opened a new mode of "tax management by numbers" intelligent supervision, and is expected to be promoted in more than 4,000 gas stations in the province and provide ideas for other industry management.

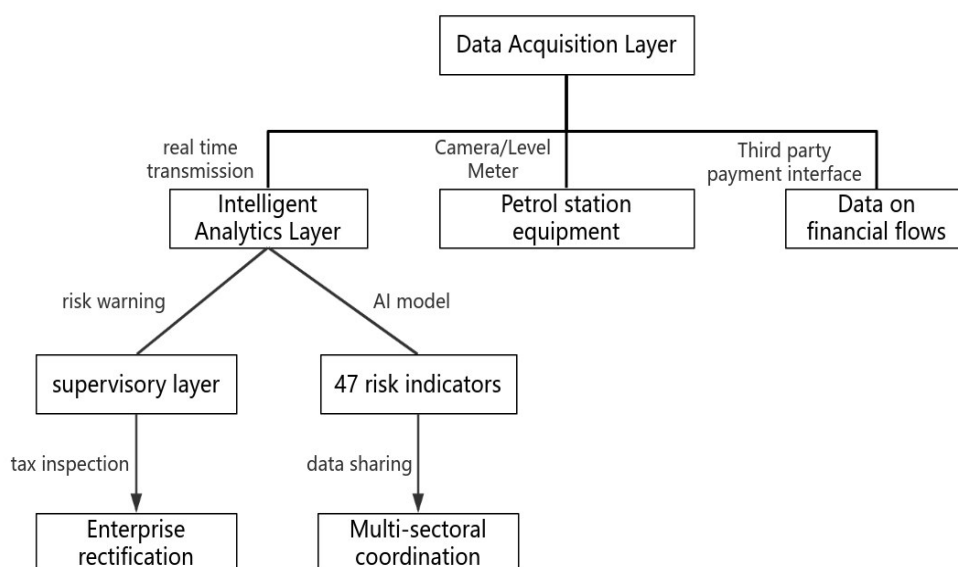


Figure 1 Technical architecture of the platform

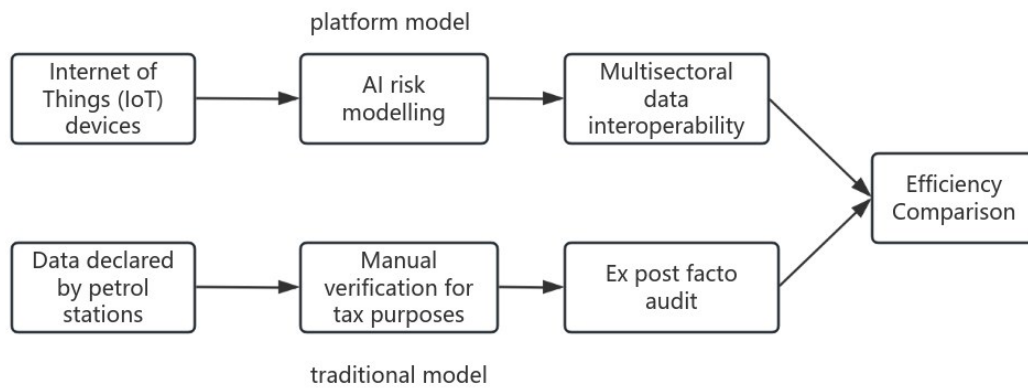


Figure 2 Data flow diagram

2.2 Case study under the perspective of economics

2.2.1 Regulatory mechanism innovation under the theory of information asymmetry

In the traditional market of refined oil products, there exists the problem of information asymmetry and externality, which leads to market failure. Gas stations may have hidden sales, tax evasion and other behaviors, which not only destroys the fair competition environment in the market, but also causes the loss of national tax revenue and is prone to negative externalities. The government's intervention through the construction of the "Intelligent Supervision Platform for Refined Oil Products" is aimed at correcting the market failure. Using advanced technology, the platform collects and analyzes the operating data of gas stations in real time, which enables tax and other relevant departments to grasp the operating conditions of enterprises in a comprehensive and timely manner, effectively crack down on illegal behaviors, promote fair competition in the market, and optimize the allocation of resources. The enterprise side holds the real transaction data, while the regulator relies on the data declared by the enterprise, resulting in a 66.7% discrepancy rate between the third-party payment flow and declared revenue of private gas stations in Hancheng by 2022. The platform collects more than 30 items of data in real time, such as fueling volume and inventory changes, through Internet of Things (IoT) equipment, and builds a "data penetration" mechanism, which reduces the marginal cost of obtaining information for the regulator from 500 yuan per household in the traditional mode to 12 yuan per household.

Table 1 Changes in Difference Rates Between Declared Revenues and Paid Outflows at Gas Stations in the City of Hancock, 2022-2024

Year	Revenue declared (RMB million)	Third-party payment flow (RMB million)	Variance Rate
2022	48000	144000	66.7%
2023	63000	98000	35.7%
2024	77000	85000	9.2%

Source: China Tax News

2.2.2 Multi-party collaboration model under the theory of public governance

The smart monitoring platform for refined oil products in Hancheng City has constructed a tripartite collaboration system of "government-technology service provider-enterprise". Government departments are responsible for formulating regulatory rules, such as setting 47 risk indicators; technical service providers, such as China Telecom, provide technical support such as quantum encryption; and gas stations are required to compulsorily access data collection equipment. This innovative model transforms the traditional "unilateral law enforcement" supervision into a "collaborative governance" model, which greatly improves the efficiency of tax audits and shortens the time for single-family audits from 5-7 days to within 24 hours.

Table 2 Traditional versus digital regulation

Efficiency Dimension	Traditional Regulation	Digital Regulation
Data Acquisition Efficiency	5-7 days	Real-Time Acquisition
Risk Identification Speed	Manual Screening	Seconds Early Warning
Auditing Response Time	≥15 days	≤24 hours
Data Coverage Rate	40%	≥90%

Data source: China Information Industry Network

Table 2 compares the efficiency difference between traditional and digital regulatory models, and it can be seen that the platform has significantly improved in terms of data acquisition, risk identification, and audit response, and the data coverage rate has increased from 40% of the traditional model to more than 90%, which fully reflects the advantages of multi-party collaborative governance.

2.2.3 Dual mechanism analysis of the theory of digital technology availability

(1) Functional structure availability

Through “organizational memory availability”, the platform establishes a database of the whole life cycle of oil products and supports historical traceability, for example, the accuracy of the carbon footprint data traceability of a gas station in 2024 reaches 98%; and through “process management availability”, the platform optimizes the scheduling of energy consumption, with a significant reduction in the daily energy consumption of a single station from 2023 to 2024. With the optimization of energy consumption scheduling through “process management availability”, the average daily energy consumption of a single station decreased significantly from 2023 to 2024.

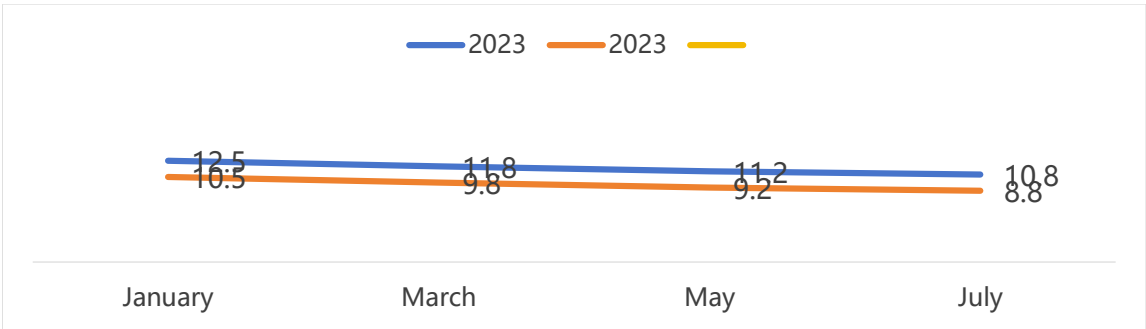


Figure 3 Change in average daily energy consumption of single station in 2023-2024(in tons of standard coal)

Figure 3 shows the trend of the average daily energy consumption of a single station from 2023 to 2024. According to the 2024 energy report of Hancheng City Bureau of Statistics, during the traditional supervision period in 2022, the average daily energy consumption of a single station was 13.2 tons of standard coal due to the serious waste of energy caused by the sloppy manual management, etc.; in the early stage of the platform pilot in 2023, through the liquid level meter data collection and the optimization of the AI energy consumption model, the energy consumption decreased to 12.5 tons, a decrease of 5.3%; after the digitization of the whole process in 2024, the energy consumption further decreased to 8.8 tons, a decrease of 33.3% compared with 2022, and the level of energy consumption continued to decline, reflecting the effectiveness of the platform in optimizing energy management.

(2) Ecological relationship availability

The platform opens up the data interfaces of taxation, market supervision, and third-party payment, forming a “three-streams-in-one” supervision network, and promoting the optimization of the tax growth structure. This cross-sectoral synergy extends the supervision radius from a single enterprise to the entire industrial chain ecology, and promotes the contribution of 29 key private companies in Hancheng City to the tax growth by 52%. gas stations to contribute 52% to tax growth in 2024.

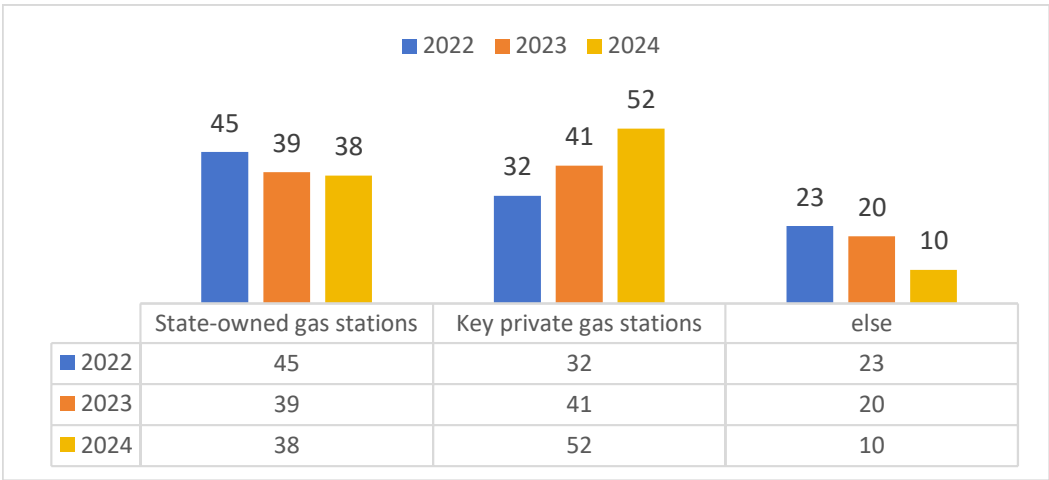


Figure 4 Distribution of Contribution Rate of Gas Station Tax Revenue Growth in Hancheng City, 2022-2024 (Unit: %)

The contribution rate of the private sector increased by 9 percentage points; in 2024, the “three streams in one” supervision network was perfected, and the compliance rate of key private gas stations reached 91%, with the contribution rate doubling compared with that of 2022, accounting for more than half of the total, reaching 52%, indicating that the platform was effective in promoting the compliance of private gas stations. In addition, the Hancheng city government intends to implement a “tax credit score” system in 2025, which will link the contribution rate to the loan amount of enterprises, and it is expected that the contribution rate of private gas stations can be increased to over 60%.

2.2.4 Quantitative assessment of cost-benefit theory

(1) Comparison of direct costs and tax benefits

In terms of enterprise costs, for gas station enterprises, at the initial stage of platform operation, enterprises need to cooperate in the installation of relevant equipment, such as special cameras, information collectors, intelligent level controllers, etc., which to a certain extent increases the enterprise's fixed cost investment. In addition, enterprises need to ensure the normal operation and maintenance of the equipment, which will also generate corresponding operating costs. However, in the long run, with the gradual standardization of the market order, enterprises will enter a level playing field to operate, and their transaction costs may be reduced, for example, by avoiding the risk of loss of customers due to unfair competition is reduced, and the enterprise can focus more on improving the quality of service and operational efficiency. In terms of social benefits, the platform brings significant tax benefits. On the one hand, the increase in tax revenue allows the government to have more funds to invest in infrastructure construction, education, healthcare and other public services, enhancing the overall welfare level of the society. On the other hand, the standardized market order promotes the healthy development of the refined oil industry, and consumers are able to consume in a fair and transparent environment with better protection of their rights and interests. At the same time, the data and technical experience accumulated from the operation of the platform provide reference for the regulation of other industries, generating positive externalities and bringing potential social benefits.

Table 3 Direct costs vs. tax benefits

Project	2022(traditional regulation)	2023 (platform pilot)	2024 (full operation)
Annual regulatory costs	Manual audits RMB 0.5 million	Platform construction RMB 0.8 billion	O&M costs RMB 0.12 billion
Annual tax revenue	RMB 175 million	RMB 210 million	RMB 317 million
Input-output ratio	1:3.5	1:2.625	1:26.4

Data Source: Hancheng City Tax Office 2024 Audit Report

From the data in Table 3, it can be seen that the initial construction investment of the platform is 0.08 billion yuan, and the average annual operation and maintenance cost is 0.12 billion yuan, but in 2024, it will lead to a 50.95% increase in tax revenue, with new tax revenue of 107 million yuan. From the perspective of total social welfare, the platform reduces tax loss far more than the cost of regulation, and the input-output ratio reaches 1:26.4.

(2) Analysis of total social welfare

According to the data of 2024 audit report of Hancheng City Taxation Bureau, it can be obtained that the tax gap is 120 million yuan in 2022, and 115 million yuan is recovered through the platform to recover the levy in 2024, and the gap narrows to 5 million yuan, and the loss of tax revenues is reduced; the market share of the state-owned gasoline stations rises from 12% in 2022 to 21% in 2024, and the industry concentration of CR5 (the top five companies) market share) rises from 38% to 54%, economies of scale effect appears, and resource allocation is optimized; the marginal cost of regulation falls from 500 yuan per household in 2022 to 12 yuan per household in 2024, in line with the characteristics of diminishing marginal cost in digital economy.

2.3 Summary of the case

The operation of the “Smart Supervision Platform for Refined Oil Products” in Hancheng City is a successful practice of the government's use of modern technological means to intervene in the market and solve the problem of market failure. It has played a positive role in promoting fair competition in the market, improving the efficiency of tax collection and management, increasing fiscal revenue and enhancing the overall welfare of the society. In the future, with the continuous optimization and improvement of the platform's technology, on the one hand, the compliance cost of enterprises can be further reduced, for example, by optimizing the performance of the equipment and the data transmission process, reducing the investment of enterprises in equipment maintenance and data docking. On the other hand, the successful experience of the platform is expected to be replicated in more regions and industries, further expanding its positive externality impact and promoting the continuous optimization of the entire market environment and the healthy development of the economy. At the same time, relevant departments can also use the data accumulated by the platform to conduct in-depth mining and analysis, providing strong support for the formulation of more scientific

and reasonable industrial and tax policies, and realizing sustainable economic development.

3 Suggestions for strengthening tax supervision and governance of the platform economy

Taking the successful practice of the “Smart Supervision Platform for Refined Oil Products” in Hancheng City, Shaanxi Province as an example, in order to effectively overcome the difficult problems of tax collection and management of the platform economy, we can learn from the international advanced experience and combine it with China's actual national conditions, and perfect the tax supervision system of the platform economy in a multi-dimensional way. Specific suggestions are as follows:

3.1 Improve the regulatory system and clarify rights and responsibilities

Reform the existing tax system to ensure fairness between online and offline without creating new taxes. Pass high-level legislation to clarify the obligation of platform enterprises to report tax-related information and their withholding and payment responsibilities. Revise the Tax Administration Law to clearly define core systems such as tax jurisdiction, tax-related electronic data inspection rights, electronic invoice rules and the validity of digital signatures, so as to reduce transaction costs and uncertainty.

3.2 Deepening the digital transformation of tax administration

Accelerating the shift from “tax management by votes” to “tax management by numbers”. Drawing on international experience such as the U.S. Simplified Sales Tax Program and the European Union's One-Stop Service OSS, we have integrated the tax base, optimized the management of tax sources, and constructed a clear compliance framework. Create an exclusive supervision module and big data cloud platform for platform enterprises within the Golden Tax Project to realize intelligent analysis. Developing embedded supervision software to be embedded in the platform system to accurately monitor the diversified income within the platform. Implementing differentiated collection and management strategies for different types of platforms to improve collection and management efficiency and accuracy.

3.3 Strengthening international tax cooperation

Actively participate in international tax reforms led by OECD and other organizations, promote the construction of the “Belt and Road” tax collection and administration cooperation mechanism, actively revise tax agreements, draw on the model of the European Union's Administrative Cooperation Directive, and improve the mechanism for tax-related information exchange and consultation. Reduce the space for international tax arbitrage, safeguard national tax rights and interests, and promote the healthy development of cross-border platform economy.

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