

## The Impact of China's Preferential Tax Policy on the Development of the Alternative Fuel Vehicle Industry

Ma Jun<sup>1,2</sup>  , Yu. V. Leontyeva<sup>1</sup> , A. Yu. Domnikov<sup>1</sup> 

<sup>1</sup>Ural Federal University

*named after the First President of Russia B. N. Yeltsin,  
Ekaterinburg, Russia*

<sup>2</sup>Beijing University of Chemical Technology,  
Beijing, China

 [ma\\_dreama@hotmail.com](mailto:ma_dreama@hotmail.com)

**Abstract.** In order to promote the high-quality and sustainable development of the alternative fuel vehicle industry, the Chinese government has given strong tax policy support. In China, the corporate income tax rate is uniformly 25%, and the government gives tax incentives to high-tech enterprises that meet the relevant appraisal standards: the tax rate is reduced by 15%. The purpose of this work is to analyze the impact of China's tax policy on the production of vehicles using alternative fuels and to assess the significance of tax incentives for the formation of significant incentives for the development of this production. The hypothesis of the study is to confirm the need to provide incentives for high-tech production of vehicles using alternative fuel to maintain a positive financial result of such production. This paper uses the OLS analysis model. Deriving data from the annual financial reports of BYD, Geely, SAIC Motor and Great Wall Motor from 2011 to 2020, analysis is carried out of the impact of income tax rate and debt ratio on net profit margin. Research has confirmed that income tax is positively correlated with net profit margin, and the debt ratio is negatively correlated with the corporate net profit margin. The higher the debt ratio, the less conducive to the improvement of the company's net profit margin. Corporate net profit margins are more sensitive to changes in income tax. This also provides an effective way to improve the tax policy to promote the development of new energy vehicles. Tax policy is the most effective tool for the government to carry out macro-control, helping to avoid the harm caused by "market failure" and guiding the development direction of the production of vehicles using alternative fuels.

**Key words:** tax incentives; tax policy; income tax; vehicles; alternative fuel; tax incentives for production.

JEL H23, L98

### 1. Introduction

With the development of science and technology and the improvement of people's quality of life, automobiles have gradually become an indispensable means of transportation for people to work and travel [1]. In 2021, the production and sales of automobiles will be 26.082 million and 26.275 million, a year-on-year increase of 3.4% and 3.8%. As of 2021, the car

ownership will reach 302 million in China, and there are more than 1 million in 79 cities. However, with the continuous increase in the sales of automobiles, the supply of non-renewable energy is in short supply, and the environmental problems are becoming more and more serious. According to the "2020 Domestic and Foreign Oil and Gas Industry Development Report", in 2020, China's oil and natural

gas import dependence has risen to 73% and 43%, and it is imminent to alleviate the energy crisis [2]. The “China Mobile Source Environmental Management Annual Report (2021)” shows that in 2020, the total emission of four pollutants from motor vehicles in the country is 15.93 million tons. Among them, the emissions of carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NOx), and particulate matter (PM) were 7.697 million tons, 1.902 million tons, 6.263 million tons, and 68,000 tons (Figure 1). Vehicles are a major contributor to total pollutant emissions, with more than 90% of CO, HC, NOx and PM emitted. It is urgent to solve environmental problems [3].

In this context, the development and promotion of the alternative fuel vehicle industry is the general trend. In order to promote the progress of the industry, China has promulgated many preferential policies, such as the exemption of vehicle purchase tax and vehicle and vessel tax for some models, and corporate income tax reduction. However, these preferential

policies have not achieved the expected impact, and the progress of the industry is still slow. In 2021, the annual sales of alternative fuel vehicles will exceed 3.5 million, with a penetration rate of 14.8%. Taxation is the first effective tool for national macro-level adjustment [4], and it is bound to play an important role in promoting the development of alternative fuel vehicle industry. In order to better promote the development from the perspective of taxation, it is necessary to analyze the problems existing in the current tax policy in guiding its development through actual data, establish a complete set of tax policies to promote progress, and give full play to the macro-control role of taxation.

Analyzing the taxation system of the alternative fuel vehicle industry is conducive to promoting the overall progress of the industry, which can fundamentally eliminate the domestic heavily polluted environment, improve the high energy consumption and high pollution in the vehicle manufacturing

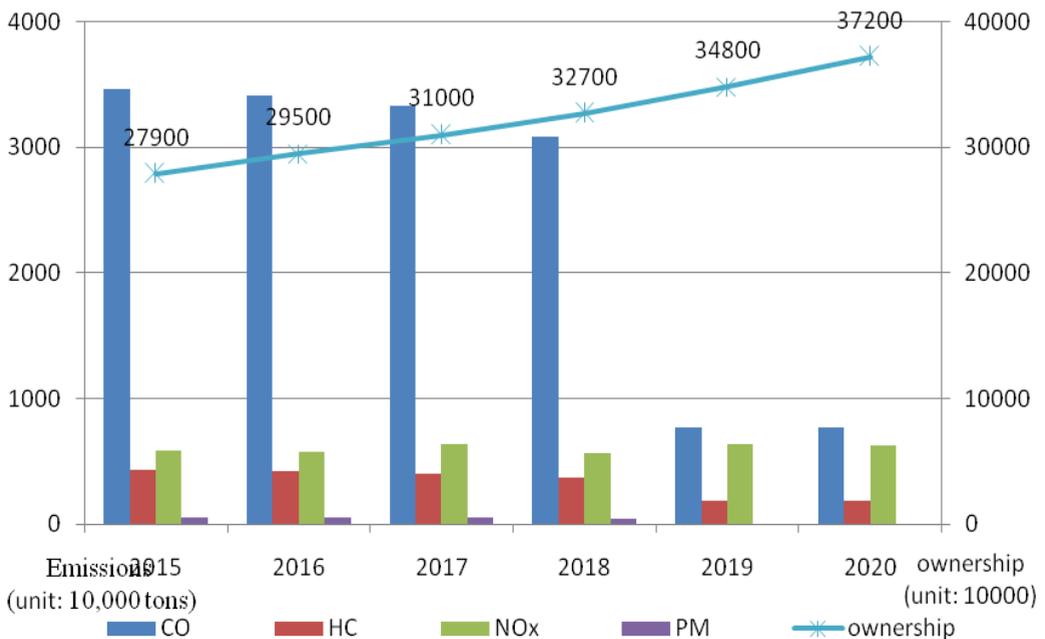


Fig. 1. Trends in China's automobile pollutant emissions

industry, and give more convenient preferential tax treatment [5]. At the same time, resources can be reasonably allocated to the industry, rapidly improving the level of scientific and technological research in related areas, reducing dependence on international natural gas and oil, and promoting the development of the entire industry. From a macro point of view, it is conducive to promoting the reform of China's auto industry structure and enhancing its influence in the world auto industry. From a micro point of view, it is conducive to promoting consumption upgrades and improving people's quality of life. Studying the preferential tax policies of alternative fuel vehicles is a subject of combining theory with practice and applying theory to solve practical problems.

*The purpose* of this work is to analyze the impact of China's tax policy on the

production of vehicles using alternative fuels and to assess the significance of tax incentives for the formation of significant incentives for the development of this production.

*The hypothesis* of the study is to confirm the need to provide incentives for high-tech production of vehicles using alternative fuel to maintain a positive financial result of such production.

## 2. Analysis of China's Preferential Tax Policy

### 2.1. Legislative Framework for China's Preferential Tax Policy

To promote the development of alternative fuel vehicles, China has formulated corresponding preferential tax policies to guide their healthy development. This paper sorts out the current 2009–2021 preferential tax policies for alternative fuel vehicles (Table 1).

Table 1. 2009–2021 Tax Incentive Policy Document

File No	Name	Related information
Order of the President of the People's Republic of China [2007] No. 63	Enterprise Income Tax Law of the People's Republic of China	For the investment of special equipment purchased by enterprises, preferential tax credits are given.
Finance and Taxation [2015] No. 106	Notice on Further Improving the Enterprise Income Tax Policy for Accelerated Depreciation of Fixed Assets"	Enterprises in the automobile industry can choose the depreciation method for the newly purchased fixed assets after January 1, 2015; for the R&D and production equipment newly purchased by small and low-profit enterprises in the automobile industry after January 1, 2015, the unit value shall not exceed 1 million. It is allowed to be included in the cost of the current period as a one-time deduction when calculating the taxable income, and it is no longer depreciated in annual intervals.
Office of the State Council	"Technical Progress and Investment in Technological Transformation of Automobile Industry"	"High-tech fields supported by the state" are newly included in alternative fuel vehicles Industrial production research and development.

Continuation of table 1

File No	Name	Related information
State Administration of Taxation Announcement No. 40 [2017]	“Announcement on Issues Concerning the Collection Scope of Pre-tax Deduction of Research and Development Expenses”	A description of the additional deduction of other expenses such as labor expenses, direct input expenses, depreciation expenses, amortization expenses of intangible assets, and new product design expenses.
Finance and Taxation [2017] No. 71	“Environmental Protection Special Equipment Enterprise Income Tax Preferential Catalog (2017 Edition)”	New energy vehicle waste power battery processing equipment is included in the income tax preferential catalog.
Ministry of Industry and Information Technology of the People's Republic of China [2017] No. 29	“Action Plan for Promoting the Development of the Automotive Power Battery Industry”	The scheme explains that the power battery R&D enterprises that meet the requirements can enjoy preferential tax policies according to the scheme standards.
Ministry of Finance announcement [2017] No. 172	“Announcement of the Ministry of Finance, State Administration of Taxation, Ministry of Industry and Information Technology, Ministry of Science and Technology on Exemption from New Energy Vehicle Purchase Tax”	It is proposed to further support the innovative development of new energy vehicles and exempt new energy vehicles from vehicle purchase tax.
Finance and Taxation [2018] No. 99	“Notice on Increasing the Pre-tax Deduction Ratio of Research and Development Expenses”	It is proposed to further encourage enterprises to increase investment in research and development, support the vigorous development of scientific and technological innovation of enterprises, and increase the pre-tax deduction ratio of enterprise research and development expenses. It is proposed to further encourage enterprises to increase investment in research and development, support the vigorous development of scientific and technological innovation of enterprises, and increase the pre-tax deduction ratio of enterprise research and development expenses.

## End of table 1

File No	Name	Related information
Office of the State Council	“New Energy Vehicle Industry Development Plan (2021–2035)”	It is clarified that from January 1, 2021 to December 31, 2022, new energy vehicles such as pure electric vehicles, plug-in hybrid (including extended-range) vehicles, and fuel cell vehicles will be exempted from vehicle purchase tax.

Source: State Council, Ministry of Industry and Information Technology of the People’s Republic of China, Ministry of Finance of the People’s Republic of China, State Administration of Taxation

The preferential tax policies cover all the links of alternative fuel vehicle production and assembly, sales and purchase, maintenance and use, involving major taxes such as value-added tax, consumption tax, corporate income tax, personal income tax, vehicle and vessel use tax, and vehicle purchase tax. It is helpful for enterprises to reduce production costs, reduce tax burdens, and invest more funds in technological innovation and expansion of production scale. At the same time, it also helps consumers reduce purchase costs and play a role in guiding consumption [6].

## 2.2. Status of tax policy for alternative fuel vehicle industry

### 1. Value-added tax (VAT)

In 2012, China began to reform the tax system, changing the business tax to value-added tax [7]. After the reform, the deduction chain for the upstream and downstream industries of the automobile manufacturing industry was opened up, which is conducive to optimizing the investment, consumption and export structure. According to the “Announcement on Policies Concerning Deepening the Reform of Value-Added Tax”, under normal circumstances, when taxpayers engage in VAT taxable sales or import goods, they need to pay tax to taxation authorities in accordance with the law. Since April 2019, China has implemented a large-scale tax reduction

and fee reduction. In terms of value-added tax, the original tax rate of 16% was reduced to 13%, and the original tax rate of 10% was reduced to 9%. Small-scale taxpayers the tax rate will not be adjusted and remains at the 3% levy rate<sup>1</sup>.

The promulgation of this policy effectively reduces the value-added tax incurred by automobile manufacturers due to purchases, reduces the tax burden of enterprises, and enables enterprises to invest more funds in technological innovation and expansion of development. In addition, alternative fuel vehicles and related core components or large-scale production research and development equipment donated by foreign governments and international organizations free of charge, and enterprises import energy-saving and environmental protection equipment related to alternative fuel vehicles, both of which are exempt from import value-added tax.

For consumers, value-added tax is also levied on motor vehicles during the purchase process, while alternative fuel vehicles enjoy national tax preferential policies and are exempt from value-added tax. If a general taxpayer purchases a vehicle for his own use, the input tax on the purchase of the vehicle can be deducted.

<sup>1</sup> Announcement on deepening the relevant policies of the value-added tax reform. URL: <http://www.chinatax.gov.cn/n810341/n810755/c4160283/content.html>

2. Consumption tax

According to the provisions of the “Interim Regulations on Consumption Tax of the People’s Republic of China”, units and individuals engaged in production, processing, retailing, and importing taxable consumer goods across the country are required to pay consumption tax in accordance with the law<sup>2</sup>. The adjustment effect of consumption tax is reflected in both the alternative fuel vehicle manufacturers and consumers. By adjusting the automobile consumption tax rate, the production and consumption of large-displacement cars are curbed in the purchase process, the production and consumption of small-displacement

cars are encouraged, and consumers are guided to change from traditional vehicles to alternative fuel vehicles.

The “Consumption Tax Items and Tax Rates Table” adjusted on September 1, 2008, divided the passenger car consumption tax rates into 7 grades according to different displacements. Vehicles with a cylinder capacity of 1.0 liter or less are only levied 1% Tax rate, and vehicles with a cylinder capacity of 4.0 liters or more are levied as high as 40%. The adjusted consumption tax rate is conducive to the production and sales of energy-saving and environmentally friendly vehicles (table 2).

At the same time, to help the development of alternative fuel vehicles, the consumption tax policy gives it certain tax incentives, that is, electric vehicles (excluding hybrid vehicles) are

<sup>2</sup>Interim Regulations of the People’s Republic of China on Consumption Tax. URL: <http://www.chinatax.gov.cn/n810341/n810765/n812171/n812680/c1190924/content.html>

Table 2. Car consumption tax rate table

Tax object		Tax rate	
		Production (import)	Retail
1. Passenger car	(1) Cylinder volume below 1.0 L (including 1.0 L)	1 %	
	(2) Cylinder capacity greater than 1.0 L is less than or equal to 1.5 L	3 %	
	(3) Cylinder capacity greater than 1.5 L less than or equal to 2.0 L	5 %	
	(4) Cylinder capacity greater than 2.0 L less than or equal to 2.5 L	9 %	
	(5) Cylinder capacity greater than 2.5 L less than or equal to 3.0 L	12 %	
	(6) Cylinder capacity greater than 3.0 L less than or equal to 4.0 L	25 %	
	(7) Cylinder volume above 4.0 L	40 %	
2. Medium and light commercial bus		5 %	
3. Super luxury car		Based on the tax object 1 or 2	10 %

Source: compiled by the authors based on “Notice on the Collection of the Motor Vehicle Consumption Tax.”

exempt from consumption tax. Through the adjustment of the consumption tax rate, the production cost of alternative fuel vehicle companies can be reduced, thereby promoting its development.

At the same time, in order to promote energy conservation and environmental protection, with the approval of the State Council, since February 1, 2015, consumption tax on batteries and coatings will be levied, but power batteries such as lithium and fuel will be exempted from consumption tax<sup>3</sup>. The main reason for the high price of alternative fuel vehicles is that the cost of power batteries remains high. The tax exemption policy helps reduce costs and increase efficiency in the industry chain.

The adjustment of the refined oil consumption tax also promotes the sales of alternative fuel vehicles. The consumption tax on refined oil refers to the consumption tax paid by consumers when consuming seven types of refined oil, including gasoline, diesel, naphtha, solvent oil, aviation kerosene, lubricating oil, and fuel oil. Since 2009, the government has increased the consumption tax rate on gasoline and diesel several times. Since then, the consumption tax on refined oil has been raised twice in the fourth quarter of 2014, and the consumption tax on refined oil has been raised for the third time in January 2015.

After the increase in the consumption tax on refined oil products, the turnover tax burden on gasoline and diesel will be increased from 32 and 29 % to 34 and 31 %<sup>4</sup>. Appropriately increasing the consumption tax on refined oil can

rationally guide consumer demand, promote the conservation and utilization of oil resources, and reduce atmospheric pollutant emissions; it will help promote the development of alternative fuel vehicle industries, promote the transformation of energy production methods, and promote China's economy to a healthy and sustainable growth model. The adjustment of the consumption tax policy is also conducive to better guiding production and consumption, as well as the adjustment effect on income distribution[8].

### 3. *Vehicle purchase tax*

According to the Announcement No. 21 of the Ministry of Industry and Information Technology of the People's Republic of China and the State Administration of Taxation, the purchase of alternative fuel vehicles will be exempted from vehicle purchase tax until December 31, 2022[9]. Alternative fuel vehicles that are exempt from vehicle purchase tax include pure electric vehicles, plug-in hybrid (including extended range) vehicles, and fuel cell vehicles. The power battery used does not include lead-acid batteries<sup>5</sup>.

### 4. *Vehicle and vessel use tax*

In China, the tax items levied by units or individuals that own vehicles and ships during the tenure stage are called vehicle and vessel use tax. The tax amount of vehicles is determined by the people's government of the province (autonomous region, municipality directly under the Central Government) in accordance with the tax range stipulated in the "Vehicle

<sup>3</sup> Notice on imposing consumption tax on battery coatings. URL: <http://www.chinatax.gov.cn/n810341/n810755/c1489741/content.html>

<sup>4</sup> Notice on continuing to increase the consumption tax on refined oil. URL: <http://www.chinatax.gov.cn/n810341/n810755/c1457410/content.html>

<sup>5</sup> Announcement of the Ministry of Finance, the State Administration of Taxation, and the Ministry of Industry and Information Technology on the Policies Concerning the Exemption of Vehicle Purchase Tax on New Energy Vehicles. URL: <http://www.chinatax.gov.cn/chinatax/n371/c5148803/content.html>

and Vessel Tax Table” attached to the “Vehicle and Vessel Tax Law of the People’s Republic of China” and the regulations of the State Council. According to the Ministry of Finance, State Administration of Taxation, Ministry of Industry and Information Technology, Ministry of Transport, Regulation No. 74 of 2018, alternative fuel vehicles and ships are exempt from vehicle and vessel tax.

For energy-saving vehicles, the vehicle and vessel tax is halved. Among them, alternative fuel vehicles that are exempt from vehicle and vessel tax refer to pure electric commercial vehicles, plug-in (including extended range) hybrid vehicles, and fuel cell commercial vehicles [10]. Pure electric passenger vehicles and fuel cell passenger vehicles do not fall within the scope of the vehicle and vessel tax, and no vehicle and vessel tax is levied on them. In addition, for alternative fuel vehicles that are exempt from vehicle and vessel tax, specific configuration component requirements and parameter indicators are also proposed<sup>6</sup>.

### 5. Corporate income tax

Automobile manufacturers produce and manufacture automobiles, which are sold to consumers by dealers. In this process, profits are made. Therefore, they are subject to corporate income tax. There are no special regulations for alternative fuel vehicle related companies, but related auto companies can enjoy a low tax rate of 15% for high-tech companies. An additional 75% of the R&D expenses of an alternative fuel vehicle company can be deducted. When the company develops and produces the parts required by the

alternative fuel vehicle, it can enjoy a tax deduction method<sup>7</sup>.

### 2.3. Analysis of Problems Existing in Tax Policy of Alternative Fuel Vehicle Industry

For emerging industries, the country’s macro-control directly affects their development. In 2009, China included the alternative fuel vehicle industry in strategic planning, but it has not issued a special tax policy for the alternative fuel vehicle industry, and the guiding role of the tax policy has not been maximized. As of 2020, China only clearly stipulates that the purchase of alternative fuel vehicles can enjoy the preferential treatment of vehicle and vessel tax and vehicle purchase tax [11].

The low tax rate of corporate income tax is a tax concession that all high-tech companies can enjoy, not just for alternative fuel vehicle companies. The 25% corporate income tax rate is already at a relatively high level in countries around the world. Excessive income tax rates will lead to a decrease in the net profit and cash flow of enterprises in the industry, which will affect the production and operation performance of enterprises and is not conducive to promoting the development of the alternative fuel vehicle industry.

The alternative fuel vehicle industry is not only the vehicle manufacturing industry, but also upstream industries such as parts manufacturing and downstream industries such as after-sales service. In the alternative fuel vehicle parts manufacturing stage, after-sales service stage, repair and maintenance stage, as well as investment and financing fields, there is a lack of corresponding tax incentives. In addition, the current policy

<sup>6</sup> Enjoy the energy saving of vehicle and ship tax reduction and exemption. Catalogue of new energy vehicle models (the fourth batch). URL: [https://www.miit.gov.cn/jgsj/zbyz/qcgy/art/2020/art\\_3e876851137d4a45b04d94fe59315fed.html](https://www.miit.gov.cn/jgsj/zbyz/qcgy/art/2020/art_3e876851137d4a45b04d94fe59315fed.html)

<sup>7</sup> The rate of deduction for R&D expenses of small and medium-sized technology-based SMEs has been increased to 75%. Available from: <http://www.chinatax.gov.cn/n810219/n810744/n3213637/n3213679/c3214479/content.html>

only provides reductions and exemptions for technology development, transfer and related consulting services. There are no indirect preferential policies for accelerated depreciation of fixed assets, investment credits, and tax deferrals. It is just that the adjustment of the tax burden of alternative fuel vehicles was added in the process of the original tax and fee reform, and there was no special tax exemption policy for the use of alternative fuel vehicles. Excessive tax burden increases the production cost of enterprises, which will eventually be transferred to the sales price of alternative fuel vehicles and borne by consumers. It is not conducive to stimulating the enthusiasm of production enterprises, but also hinders the optimism of consumers to buy, seriously affecting the output and sales of the entire industry and is not conducive to promoting the progress of the industry.

At present, the focus of China's alternative fuel vehicle related tax policies is still on the control of purchases, and the regulatory effect is relatively limited. According to the "Alternative Fuel Vehicle Catalogue Exempted from Vehicle Purchase Tax" released on March 8, 2021, the catalog of alternative fuel vehicle models that enjoy vehicle tax reductions and exemptions includes two categories: energy-saving vehicles and alternative fuel vehicles. The catalog includes the Tesla Model 3 pure electric vehicle from Tesla (Shanghai) Co., Ltd. The shortlisted list will greatly reduce its purchase price and reduce the financial pressure on consumers. According to the formula of vehicle purchase tax: tax payable = taxable price × 10%, the Model 3 standard endurance version is reduced by 31,000 Yuan. After the vehicle purchase tax is reduced or exempted, consumers of alternative fuel vehicles can indeed get a certain price concession.

However, in the current automobile taxation fees in China, the three links of

purchase, retention and use still have a large tax rate. According to statistics, the taxes and fees borne by Chinese consumers in the process of car purchase accounted for 30–67% of the vehicle price. In 2019, China's vehicle purchase tax revenue was 349.8 billion Yuan, and the consumption tax was 1,256.2 billion Yuan. Among them, the consumption tax of the automobile manufacturing industry exceeds 90 billion Yuan, accounting for 8% of the total consumption tax revenue<sup>8</sup>.

The huge distribution of tax proportions limits the effect of tax policies on encouraging the consumption of alternative fuel vehicles. China's alternative fuel vehicles still follow the traditional automobile taxation policy. The production cost of alternative fuel vehicles is generally higher than that of traditional automobiles, and therefore bears higher tax expenses. Therefore, it is necessary to implement differentiated tax policies for alternative fuel vehicles to reduce the tax burden of alternative fuel vehicles, so as to promote the sustainable development of the industry.

In the sales link, establish a green tax system based on fuel consumption or carbon emissions. At present, China's automobile consumption tax has a single emission standard with a differential tax rate, which is mainly levied on the basis of different exhaust volumes. As the exhaust volume increases, the consumption tax rate also increases, which does not truly reflect the effect of taxation on environmental pollution and energy consumption. In order to improve the automobile consumption tax, it may be considered to levy a comprehensive tax rate based on the three aspects of automobile power

<sup>8</sup> Representative committee members are enthusiastically discussing tax cuts and fees. How much room is there for tax reform in the auto industry? URL: <http://www.nbd.com.cn/articles/2020-05-27/1439116.html>

energy, cylinder displacement, and carbon dioxide emissions. High tax rates for gasoline and diesel that can cause environmental pollution, and low tax rates for energy-saving and environmentally friendly hydrogen, electricity, and solar energy. Let the cylinder displacement and carbon dioxide emissions be positively correlated with the tax rate. Through the differential setting of consumption tax rates, consumers are guided to choose more energy-saving and environmentally friendly models. Implement a separate preferential tax rate for alternative fuel vehicles to improve its strategic position and further stimulate consumer purchases.

At the same time, the taxation of traditional fuel vehicles can be increased to curb consumer demand. When formulating preferential tax policies, it is necessary to highlight the differences between the alternative fuel vehicle industry and the traditional automobile industry, provide clear policy signals to the market, and accelerate the development and market share of alternative fuel vehicles.

### 3. Literature Review

Most of the existing literature focuses on the scientific and technological research results of alternative fuel vehicle technology. Even each country has formulated its own development goals and plans. But in the world, the alternative fuel vehicle is a new product that has just emerged, so there is less research on its industrial development.

Flórez-Orrego et al. [12] using the example of Brazil, showed that the fuel used by alternative fuel vehicles is usually renewable and clean, with high energy utilization efficiency and no pollution to the environment by exhaust gas, which can achieve long-term supply of resources and harmonious coexistence with the ecological environment, which is in line with the concept of sustainable development.

Yazdanie [13] found through empirical research that alternative fuel vehicle has made a considerable contribution to environmental protection, especially reducing greenhouse gas emissions. Therefore, it is feasible to develop clean energy-powered vehicles.

Onat [14] justified that as the center of the current and future development of the global automotive industry, the alternative fuel vehicle will have a greater impact on energy, the environment, the economy, technology, and society.

Tax policy can help alleviate environmental and energy problems, which is the consensus of many scholars.

Mayburov & Leontyeva[15] proved through experiments that tax macro-control can promote the sustainable development of Russian transportation.

Montag [16] believes that Fuel taxes should remain the core instrument for car pollution control. Greene et al. [17] justified that the collection of the fuel tax and the promotion of Alternative Fuel Vehicles saved the United States 2 trillion gallons of gasoline from 1975–2018.

Zongwei et al. [18] proved that Energy efficient and new energy vehicles are key measures in addressing China's energy and environment problems. Song et al. [19] show that in recent years, the government has continued to issue tax policies related to new energy, which further eases the contradiction between the development of the automobile industry and the policies of energy conservation, environmental protection and sustainable development.

Georgina [20] believes that when the market cannot efficiently distribute goods and services due to external influences, in order to ensure the effective development of the economy, government policies can be used to solve market failures. For example, the subsidies and tax policies implemented by the government can play a role in macro-control.

Safi et al. [21] studied the importance of environmental taxes and R&D in achieving carbon neutrality goals. The results show that in the short- and long-run, environmental taxes, environmental R&D, and exports significantly reduce carbon emissions.

Christian [22] mentioned that in the UK, the changes in tax burden and the direction of policies are due to changes in the economic environment or living environment. In order to effectively suppress carbon dioxide and purify the air, the vehicle purchase tax may not be able to improve the choice of car purchases and the living environment, so a series of corresponding policies will be introduced, such as increasing the fuel tax, to guide consumers to choose small-displacement vehicles.

Some scholars believe that tax policies can help reduce the cost of alternative fuel vehicles, increase market share, and increase consumers' willingness to buy.

Mukherjee [23] pointed out that the main reason for restricting the sales of alternative fuel vehicles is that the cost is too high in the use process, reducing electricity bills and reducing the cost in the use process are conducive to promoting the development of the alternative fuel vehicle industry.

Khan et al. [24] analyzed Japanese consumers' preference for Alternative Fuel Vehicles through an exercised a mixed logit model and believed that when the government reduces its tax burden to make it competitive with traditional fuel vehicles in price, consumers will consider Alternative Fuel Vehicles instead.

Costa [25] made a comparative study on the economic and environmental feasibility of different vehicles and concluded that the cost of electric vehicles can be reduced by means of taxes and incentives, and policies can be adopted within the EU to realize the combination of economic and environmental benefits.

Tian [26] believes that it will take a long process to truly realize the industrialization of alternative fuel vehicles. In this process of industrialization, the government needs to play an escort role. To achieve its scale operation as early as possible, the government should implement tax incentives such as tax relief.

Xiong & Wang [27] analyze potential consumers' policy perception and sensitivity to purchase intention. The results show that the policy cognition and purchase intention of potential consumers of alternative fuel vehicle are currently at a low level. Policy announcements can also help increase consumer awareness and purchase intentions of policies. Therefore, it is necessary to comprehensively enhance the policy awareness of potential consumers on various policies and effectively change the status quo of the introduction of marketing policies.

Some scholars have conducted theoretical and empirical research on the impact of tax policy on the alternative fuel vehicle industry.

Meck & Nahm's [28] research found that by determining the applicable tax rate for automobiles according to the emissions of automobiles and implementing a progressive tax rate system, the development of the alternative fuel vehicle industry can be effectively promoted.

Yan & Eskeland [29] confirmed the tax significantly shifts consumers toward lower-emission vehicles through study Norway's vehicle registration tax linked to vehicle CO<sub>2</sub> intensities.

Lasse & Vegard [30] believe that continued application of the purchase tax instrument induces large-scale penetration of electric cars into the passenger car stock, so as to achieve the purpose of reducing energy consumption and environmental protection.

Jenn et al. [31] analyzed US sales figures in 2010–2015 and concluded that

average sales of EVs increase by 2.6% for every \$1,000 offered as rebates to tax credits. The study also highlighted the importance of raising consumer awareness in the success of EV incentive programs.

Mayburov & Ma [32] analyzes the relationship between the state's subsidy to enterprise R&D and the enterprise's own investment in R&D through empirical research. The conclusion shows that government subsidies can directly promote the R&D investment.

In a word, most analysts and researchers focus their research on the alternative fuel vehicle market and the analysis of related policies themselves, rather than expanding their horizons to practical applications. There has been no in-depth research on the impact and extent of the tax relief policy, and research on this part of the issue is still vacant. This paper fully studies and draws on advanced achievements at home and abroad, obtains data from the State Administration of Taxation, applies economic principles to study the current tax policy of China's alternative fuel vehicle industry, analyzes the specific impact of corporate income tax on alternative fuel vehicles through empirical analysis, and puts forward improvement suggestions to promote its better development.

#### 4. Research Methodology

This paper collects the data of four representative alternative fuel vehicle listed companies in the past 10 years, uses SPSS software to establish an OLS regression model to analyze the impact of income tax burden on the net profit margin of enterprises, and quantitatively analyzes the impact of current tax policies restricting its development.

Alternative fuel vehicles belong to strategic emerging industries. Considering the data integrity, the article sample selected 4 representative listed companies with 10 years of relevant financial data from 2011 to 2020. From the China Association of Automobile Manufacturers and Oriental Fortune Network, the original data was collected, and the required ratio was calculated. The samples were selected from the financial report data of BYD, Geely, SAIC Motor and Great Wall Motor in the past ten years. The selected sample financial information is fully disclosed non-ST shares and no missing data.

The main variable investigated in this paper is the corporate income tax, the explanatory variable of the model is the net profit margin, the explanatory variable is the income tax rate, and the control variable is the corporate debt ratio. The specific description, calculation method, and predicted impact are shown in Table 3.

Table 3. Variable description

Variable properties	Variable name	Representation	Variable description	Calculation
Explained variable	Net profit margin	$Y_1$	Operating net profit as a percentage of net sales, which comprehensively reflects the operating efficiency of an enterprise.	Net profit/operating income
Explanatory variables	Income tax rate	$X_1$	A tax levied on the production and business income and other income of operating enterprises.	Income tax expense/operating income
Control variable	Debt ratio	$X_2$	The ratio of liabilities to assets. Business financial situation.	Total Liabilities/ Total Assets

Based on these variables, a regression model was built. According to the variable setting and the sorted sample conditions, the impact of income tax burden on the net profit margin of alternative fuel vehicles companies is analyzed, and a model is established. From the time point of view, there is no significant difference between different enterprises; but from the cross-section point of view, there are significant differences between different cross-sections.

Build the OLS regression model:

$$Y = c + aX_1 + bX_2 + e$$

### 5. Research results

According to the above theoretical and policy analysis, it is theoretically believed that tax policy has a positive effect on the development of alternative fuel vehicles. On the one hand, the current tax policy improves price competitiveness by reducing costs. On the other hand, in the form of financial subsidies, manufacturers are encouraged to actively develop new technologies and improve China's technological level, thereby stimulating industrial development. This paper quantitatively analyzes the impact of preferential tax policies on the development of alternative fuel vehicles based on corporate statement data.

China's preferential tax policies provide the support needed for the development of alternative fuel vehicle

companies. Tax incentives can reduce the hidden costs of enterprises and promote better development of enterprises.

As shown in Table 4, the average net profit margin of enterprises is 6.7%, which is a relatively reasonable value for the automobile industry. The average level of the income tax rate is 1.3%, and the statutory corporate income tax rate in China is 25%, which is significantly lower than the statutory rate. The reason for this situation should be that a large part of the companies meets the identification standards of high-tech enterprises and are exempted from taxes and fees, or the enterprises are in a state of loss. The average Debt ratio is 58%, and the financial situation is good, but the maximum value is 69.3%. The financial situation of individual companies needs to be paid more attention.

According to the analysis result,  $p < 0.01$  which can indicate that  $X$  has an influence on  $Y$ . As can be seen from Table 5. OLS regression analysis was performed with income tax rate and debt ratio as independent variables, and the robust standard error regression method was used for the study. The  $R^2$  value is 0.891, which means that income tax rate and debt ratio can explain 89.12% of the change in net profit margin. When the F test was performed on the model, it was found that the model passed the F test ( $F = 160.628, p = 0.000 < 0.05$ ), which

Table 4. Descriptive Analysis

Items	N of samples	Min	Max	Mean	Std. Deviation	Median
type	40	1.000	4.000	2.500	1.132	2.500
Year	40	2011.000	2020.000	2015.500	2.909	2015.500
Y	40	0.005	0.145	0.067	0.035	0.060
X1	40	0.001	0.030	0.013	0.008	0.010
X2	40	0.420	0.693	0.580	0.077	0.585

Data source: Statistically derived from SPSS

Table 5. OLS regression analysis results (n = 40)

	Coef	Std.Err	t	p	95% CI	R <sup>2</sup>	Adjusted R <sup>2</sup>	F
Constant	0.076	0.02	3.724	0.000**	0.036 ~ 0.116	0.891	0.885	F (2,37)= 160.628, p=0.000
X <sub>1</sub>	3.536	0.373	9.477	0.000**	2.805 ~ 4.267			
X <sub>2</sub>	-0.094	0.029	-3.224	0.001**	-0.151 ~ -0.037			

Dependent Variable: Y

D-W: 1.177

\* p&lt;0.05 \*\* p&lt;0.01

Data source: Statistically derived from SPSS

means that at least one of  $X_1$  and  $X_2$  will have an impact on Y.

The model formula is:

$$Y=0.076+3.536 \times X_1-0.094 \times X_2$$

The regression coefficient value of income tax rate is 3.536, and it is significant at 0.01 level ( $t=9.477$ ,  $p=0.000 < 0.01$ ), which means that income tax rate will have a significant positive impact on net profit margin. The regression coefficient value of debt ratio is  $-0.094$ , and it is significant at 0.01 level ( $t=-3.224$ ,  $p=0.001 < 0.01$ ), which means that debt ratio will have a significant negative impact on net profit margin.

In order to ensure the robustness of the empirical results, this paper tests the robustness of the model by changing the control variable debt ratio. In the model, the control variable is adjusted to the growth rate of the prime operating revenue of the sample company, and the regression is performed after changing the control variable. All variables have passed the significance test. The income tax rate is positively correlated with the company's net profit margin. The growth rate is positively correlated with the net profit margin, which is consistent with the conclusions drawn earlier, proving the robustness of the results.

The empirical results show that the sign of the correlation coefficient of the explanatory variable income tax rate is positive, indicating that both income tax and net profit margin are positively correlated, which is in line with the expected assumptions and in line with macroeconomic principles. When the control variables remain unchanged, income tax expense is inversely proportional to prime operating cost, prime operating cost is inversely proportional to net profit, and income tax is proportional to corporate net profit. That is, the increase in prime operating cost, the decrease in the net profit of the enterprise, and the corresponding decrease in the income tax paid.

From the empirical results, the test value of income tax burden P is 0.000, which is significant at the 0.05 level. The corporate income tax can be obtained by directly querying "income tax expenses" in the corporate income statement. As direct tax, it will be directly deducted when the company calculates the net profit. In addition, there are various forms of incentives such as reduced tax rates, R&D expense deductions, and others. The income tax burden coefficient is 3.536, indicating that the net profit rate of

enterprises is more sensitive to changes in income tax, which also provides an effective way to improve the tax policy to promote the development of new energy vehicles.

By changing the income tax rate, the company's net profit margin can be improved more efficiently. The coefficient of debt ratio to the company's net profit margin is -0.094, and the positive and negative correlation coefficients are in line with the expected assumptions. Under normal circumstances, the same industry, the same product, the higher the debt ratio of the enterprise, the lower the net profit margin, has a large amount of debt, must have large-scale interest expenses, put a certain pressure on the cash flow, and is not conducive to the improvement of the enterprise's net profit margin.

## 6. Conclusion

It is concluded that corporate income tax is positively correlated with corporate net profit margin, and debt ratio is negatively correlated with corporate net profit margin. Tax policy affects the economic consequences of a business. Therefore, changes in corporate tax policies have a positive impact on corporate economic outcomes. This research can provide reliable suggestions for the government to formulate reasonable tax policies. The tax system that promotes the progress of the alternative fuel vehicle industry is conducive to promoting the overall progress of the industry. The tax system can promote the healthy development of the industry and ultimately promote sustainable development.

Through the empirical research and problem analysis, it is found that the 25% corporate income tax rate brings a heavy tax burden to alternative fuel vehicle enterprises. In addition to the value-added tax, customs duties, urban construction tax and education tax surcharge, it is even

more difficult for technology-intensive enterprises that require a lot of R&D investment to develop rapidly. Therefore, the primary task of promoting the development of this industry should be to reduce the tax rate of income tax, thereby reducing the tax burden of enterprises.

The State Council has stipulated that the enterprise income tax shall be levied at a rate of 15% for technology service enterprises recognized as high-tech. For automobile companies, even if they do not carry out innovative research and development of alternative fuel vehicle batteries, they can still enjoy preferential corporate income tax rates due to other high-tech projects, which cannot stimulate their research and development enthusiasm. Therefore, applying a lower tax rate to companies that have achieved practical results in core technology development will help stimulate their R&D motivation. The relevant financial subsidy income obtained by enterprises related to alternative fuel vehicle should be exempted from corporate income tax.

There is no obvious guiding tendency in China's current tax policy to stimulate research and innovation by major automakers. The intermediate test products formed during the research and development process are an important part of the development of the alternative fuel vehicle industry. The state can introduce preferential tax policies to reduce value-added tax on the sale of intermediate test products, reduce R&D investment costs, and encourage R&D companies to increase their R&D efforts. In the research and development stage, not only tax incentives are implemented for enterprises' investment in research and development, but special tax incentives can also be adopted for financing and technical personnel who directly invest in research and development and innovation activities. For companies, R&D is uncertain.

To avoid risks, auto companies will not invest a lot of money in research and development. Therefore, based on the 75% deduction of existing R&D expenses, the government can further reduce the value-added tax rate of alternative fuel vehicle industrial batteries and increase the deduction ratio of power battery and component R&D expenses. The super deduction of R&D expenses also supports enterprises in cultivating relevant talents. From a long-term perspective, it will contribute to the long-term sustainable development of the alternative fuel vehicle industry. In addition, allowing alternative fuel vehicle related companies to adopt accelerated depreciation methods for key equipment used in technology research and development or manufacturing, or to grant investment credits, can speed up the company's capital recovery speed, which is equivalent to indirectly reducing its production and R&D costs.

In the car ownership link, the consumption tax rate of refined oil and fuel will be adjusted. China has not yet levied an environmental tax, so it can be considered to play an environmental role through the adjustment of fuel tax. By increasing the consumption tax rate of refined oil and fuel, increasing the economic burden of consumers using petroleum fuels to curb the market's consumption of traditional fuel vehicles. It can not only promote energy conservation and reduce exhaust emissions, but also

indirectly encourage consumers to choose alternative fuel vehicles.

In the process of automobile recycling and scrapping, the government should establish and improve related tax policies as soon as possible to promote the sustainable development of the entire industrial chain of the alternative fuel vehicle industry. At the same time, it should also pay attention to the improvement of policies in the second-hand automobile trading market, which will help optimize automotive Industrial structure.

As a new technology, alternative fuel vehicle needs to go through a long process of being recognized from research and development to promotion, and government support is indispensable for development, especially in the initial stage of the industry. Tax policy is the most effective tool for the government to carry out macro-control, helping to avoid the harm caused by "market failure" and guiding the development direction of the automobile industry. In the process of formulating policies, the government should follow the principle of supporting the development of the industry to the greatest extent, clarify the purpose, direction and approach of policy formulation, and estimate and evaluate the final implementation effect of the policy.

Although the research on tax policy on alternative fuel vehicles has achieved certain results, there is still a lot of work to be done.

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## INFORMATION ABOUT AUTHORS

### Ma Jun

Post-Graduate Student, Department of Finance and Tax Management, Ural Federal University named after the first President of Russia B. N. Yeltsin, Ekaterinburg, Russia (620002, Ekaterinburg, Mira street, 19); Mechanical Building, Room 309, Beijing University of Chemical Technology, Beijing, China (15, Beisanhuan East Road, Chaoyang District, Beijing, China); ORCID 0000-0001-9227-6191; e-mail: ma\_dreama@hotmail.com.

### Leontyeva Yulia Vladimirovna

Candidate of Economic Sciences, Associate Professor, Department of Finance and Tax Management, Ural Federal University named after the first President of Russia B. N. Yeltsin, Ekaterinburg, Russia (620002, Ekaterinburg, Mira street, 19); ORCID 0000-0003-4676-9926; e-mail: uv.leonteva@mail.ru.

### **Domnikov Alexey Yurievich**

Doctor of Economics, Professor, Department of Banking and Investment Management, Ural Federal University named after the first President of Russia B. N. Yeltsin, Ekaterinburg, Russia (620002, Ekaterinburg, Mira street, 19); ORCID 0000-0002-6260-9423; e-mail: domnikov@efu.ru.

### **ACKNOWLEDGMENTS**

This research was funded by the China Scholarship Council.

### **FOR CITATION**

Ma J., Leontyeva Yu.V., Domnikov A. Yu. The Impact of China's Preferential Tax Policy on the Development of the Alternative Fuel Vehicle Industry. *Journal of Applied Economic Research*, 2022, Vol. 21, No. 2, 194–216. DOI: 10.15826/vestnik.2022.21.2.008.

### **ARTICLE INFO**

Received December 10, 2021; Revised February 2, 2022; Accepted April 1, 2022.

УДК 336.027

## Влияние преференциальной налоговой политики Китая на развитие производства транспортных средств на альтернативном топливе

Ма Цзюнь<sup>1,2</sup>  , Ю. В. Леонтьева<sup>1</sup> , А. Ю. Домников<sup>1</sup> 

<sup>1</sup> Уральский федеральный университет  
имени первого Президента России Б. Н. Ельцина,  
г. Екатеринбург, Россия

<sup>2</sup> Пекинский химико-технологический университет,  
г. Пекин, Китай

 [ma\\_dreama@hotmail.com](mailto:ma_dreama@hotmail.com)

**Аннотация.** В целях содействия качественному и устойчивому развитию автомобильной промышленности, работающей на альтернативном топливе, правительство Китая оказало существенную поддержку в области налоговой политики. В Китае ставка налога на прибыль организаций составляет 25%, а правительство предоставляет льготную ставку 15% высокотехнологичным предприятиям, отвечающим соответствующим стандартам оценки. Целью данного исследования является анализ влияния налоговой политики Китая на производство транспортных средств с использованием альтернативных видов топлива и оценка значимости налоговых льгот для формирования значимых стимулов развития данного производства. Гипотеза исследования заключается в подтверждении необходимости налогового стимулирования высокотехнологичного производства транспортных средств на альтернативном топливе для поддержания положительного финансового результата такого производства. В данном исследовании используется модель анализа OLS. С помощью годовых финансовых отчетов BYD, Geely, SAIC Motor и Great Wall Motor за период с 2011 по 2020 г. проанализировано влияние ставки налога на прибыль и коэффициента задолженности на чистую прибыль. Исследования подтвердили, что налог на прибыль положительно коррелирует с рентабельностью чистой прибыли, а коэффициент задолженности отрицательно коррелирует с нормой чистой прибыли компании. Чем выше коэффициент задолженности, тем меньше он способствует повышению нормы чистой прибыли компании. При этом показано, что норма чистой прибыли компаний более чувствительна к изменениям ставки налога на прибыль. Предоставление льготной ставки по налогу на прибыль является эффективным способом налогового стимулирования производства транспортных средств на альтернативном топливе. Налоговая политика является наиболее эффективным инструментом для государства для осуществления макроконтроля, при этом помогает избежать «провалов рынка» и стимулирует развитие производства транспортных средств на альтернативном топливе.

**Ключевые слова:** налоговые льготы; налоговая политика; налог на прибыль; транспортные средства; альтернативное топливо; налоговое стимулирование производства.

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## ИНФОРМАЦИЯ ОБ АВТОРАХ

### Ма Цзюнь

Аспирант кафедры финансового и налогового менеджмента Уральского федерального университета имени первого Президента России Б. Н. Ельцина, г. Екатеринбург, Россия (620002, г. Екатеринбург, ул. Мира, 19); Механический корпус Пекинского химико-технологического университета, г. Пекин, Китай (15, Weisanhuan East Road, район Чаоян, Пекин, Китай); ORCID 0000-0001-9227-6191; e-mail: ma\_dreama@hotmail.com.

### Леонтьева Юлия Владимировна

Кандидат экономических наук, доцент кафедры финансового и налогового менеджмента Уральского федерального университета имени первого Президента России Б. Н. Ельцина, г. Екатеринбург, Россия (620002, г. Екатеринбург, ул. Мира, 19); ORCID 0000-0003-4676-9926; e-mail: uv.leonteva@mail.ru.

### Домников Алексей Юрьевич

Доктор экономических наук, профессор кафедры банковского и инвестиционно-менеджмента, Уральского федерального университета имени первого Президента России Б. Н. Ельцина, г. Екатеринбург, Россия (620002, г. Екатеринбург, ул. Мира, 19); ORCID 0000-0002-6260-9423; e-mail: domnikov@el.ru.

## БЛАГОДАРНОСТИ

Это исследование финансировалось Китайским стипендиальным советом.

## ДЛЯ ЦИТИРОВАНИЯ

Ма Цзюнь, Леонтьева Ю. В., Домников А. Ю. Влияние преференциальной налоговой политики Китая на развитие производства транспортных средств на альтернативном топливе // Journal of Applied Economic Research. 2022. Т. 21, № 2. С. 194–216. DOI: 10.15826/vestnik.2022.21.2.008.

## ИНФОРМАЦИЯ О СТАТЬЕ

Дата поступления 10 декабря 2021 г.; дата поступления после рецензирования 2 февраля 2022 г.; дата принятия к печати 1 апреля 2022 г.

