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Mathematical Planning and Simulation Joint Strategy for Minimizing Corporate Tax Burden under Tax Incentives

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Abstract In the current digital business environment, the importance of optimizing corporate tax incentives is becoming increasingly important. Based on the theory related to tax burden, this paper adopts genetic algorithm to optimize different tax incentives, and in the process of searching uses the principle of survival of the fittest of the theory of evolution to find the optimal solution, and then obtains a strategy to minimize the tax burden of enterprises. This paper uses a production enterprise as the object of study for specific case study, to obtain a more intuitive research effect, the results show that K, L, M and N four kinds of programs, which can take into account the three single policy objectives determined by the overall goal of the tax incentives. The optimal solution for the "three and two" type of VAT rate simplification and reform party is N. A production enterprise obtains more cash flow through tax planning, which can create more value, and verifies the effectiveness of the genetic algorithm model from the side.

Index Terms genetic algorithm, minimization strategy, enterprise tax burden, case study

I. Introduction

Since China's economy entered a new normal, the rate of economic growth has gradually slowed down. In order to cope with the opportunities and challenges arising from the new normal economy and effectively stimulate the production enthusiasm and innovation vitality of market players, the government has proposed the implementation of supply-side structural reforms and introduced tax preferential policies characterized by "structural tax cuts", and China has been reducing the tax burden on enterprises in order to stimulate the vitality of the market [1]-[4]. In recent years, the tax authorities have introduced a large number of tax incentives, actively promoted the reform of the tax system, effectively reduced the statutory tax rate and statutory fee rate, and ensured that the large-scale tax incentives take effect with practical actions, which in turn support the normal operation and steady development of enterprises [5]-[7]. On the one hand, policies have been introduced to reduce the nominal tax rates of multiple tax types. In terms of corporate income tax, a series of policies favoring the payment of corporate income tax by small and micro-enterprises have been introduced from 2017-2022. In terms of social security contributions, the proportion of urban workers' basic pension insurance unit contributions has been reduced from 20% to 16%, especially the social security contribution burden of small and micro enterprises has been significantly reduced [8], [9]. On the other hand, large-scale tax incentives have lowered the macro tax burden, and during the 13th Five-Year Plan period from 2016 to 2020, the country's new tax cuts and fee reductions will total more than 7.6 trillion yuan, of which 4.6 trillion yuan will be tax cuts, which will reduce China's macro tax burden from 18.13% in 2015 to 15.20% in 2020, a reduction of 15.20%. 15.20%, a reduction of nearly 3 percentage points [10]. Tax incentives have played a huge role in supporting the development of the real economy, especially in reducing the tax burden of small and micro enterprises and manufacturing enterprises, with new tax cuts and fee reductions of more than 1 trillion yuan in 2021 [11], [12]. Continuous and large-scale tax and fee reduction measures have effectively supported the overall situation of "six stabilizations" and "six guarantees", and have made great contributions to restoring the smooth operation of the economy, advancing the high-quality development of the economy, promoting the optimization of the industrial structure, and realizing the fairness and stability of the society [13]-[15].

Although tax incentives have played a positive role in reducing the burden on enterprises and promoting economic growth, they have also created problems that need to be solved. The effect of the implementation of sustained large-scale tax incentives in recent years points out that the actual tax burden of enterprises has not decreased as much as expected, and some enterprises have reflected that the tax burden is still too high, and the pain of the tax burden felt by enterprises is still very strong [16], [17]. The official report shows that compared with 2015, the overall tax burden index of enterprises has increased by 20.18%, 27.69% and 15.73% in 2016, 2017 and 2018 respectively.

According to the World Tax Report 2020, jointly published by the World Bank and PricewaterhouseCoopers, the total tax and contribution rate of Chinese enterprises is 59.2%, which is much higher than the world average of 40%, and ranks 105th out of 190 economies in the world. It is evident that the overall tax burden of Chinese enterprises remains at a high level.

This paper firstly researches on the theory of tax cost, the theory of tax burden transfer and fate, the theory of tax shield effect and the theory of trade-off, and analyzes the relevant tax policies in depth. Facing the problem that traditional algorithms for solving combinatorial optimization problems cannot solve effectively, according to the theoretical basis of tax burden, genetic algorithms are used to encode and optimize tax incentives, and then solve the strategy of minimizing the tax burden of enterprises. Through many iterations to find an approximate global optimal strategy, so as to achieve the goal of minimizing the tax burden. Taking a certain production enterprise in the north as the research object, the problem of its tax burden minimization strategy is explored through the relevant data of the case, which verifies the practicality and effectiveness of the method of this paper.

II. Theoretical foundations related to tax burden

II. A.Tax cost theory

Tax costs can be divided into tax costs to the government and tax costs to enterprises. The research object of this paper is the enterprise, so only the tax cost of the enterprise is studied. Like other costs, when analyzing the cost of taxation for enterprises should be clear about its causes, types, what it includes and how to reduce the cost of tax burden [18].

Tax liability is an important outflow of economic benefits, which arises because of the need for enterprises to fulfill their tax obligations. According to the criteria for the division of cost types, the cost of paying taxes is a mixed cost, i.e., part of the tax is a fixed cost and part of the tax is a variable cost.

According to what is included, tax cost can be divided into narrow tax cost and broad tax cost. Narrowly defined tax cost refers only to the actual tax paid by the enterprise, specifically the tax paid on each tax type of the enterprise. Broad tax costs in addition to the actual payment of taxes include enterprises in the tax activities of other expenditures. For example, in the process of fulfilling tax obligations and paying taxes, the enterprise incurs: the cost of declaration information, the cost of business hospitality, the cost of hiring an external organization to carry out tax planning, the cost of agency declaration, the cost of tax consultants and lawyers, the cost of penalties and late payment of taxes, the tax corresponding to the cost of interest, and the reputation of the enterprise caused by failing to fulfill the obligation to pay taxes, and so on.

Factors such as solvency, profitability, capital intensity, etc. all have an impact on the cost of taxation, which can be reduced by improving the business situation of the enterprise. This paper is precisely from the perspective of the impact factors based on the tax burden to study ways to reduce the cost of corporate taxation.

II. B.Tax Shifting and Fate Theory

Tax burden shifting refers to the process by which a taxpayer shifts the burden of taxes that should have been paid by him or her to others through a certain way, and tax burden shifting in a broad sense includes the shifting and fate of tax burdens. From the point of view of taxpayers, the tax burden of the taxpayers themselves is reduced in absolute amount; from the point of view of the government, the ultimate result of tax burden shifting is only a change in the fate of the tax burden, and the government's tax revenue has not been reduced. The object of this question is the enterprise, so it is possible to reduce the actual tax burden of the enterprise itself through tax burden shifting.

II. C.The theory of the tax shield effect

The theory of tax shield effect contains two main categories: debt tax shield theory and non-debt tax shield theory.MM theory and modified MM theory, illustrate the effect of capital structure on firm value. The debt tax shield theory is derived from the modified MM theory, which argues that the cost of debt can be expensed before taxes compared to dividends, so debt financing is tax deductible, reduces the cost of capital, and increases the value of the firm.

II. D.Trade-off theory (optimal capital structure theory)

The theory of tax shield effect explains the positive role of tax shields in reducing the tax burden of enterprises, but it does not mean that the more tax shields an enterprise has, the better it is. For example, when the enterprise's debt exceeds a certain level will seriously affect the normal operation of the enterprise, and even cause bankruptcy. This shows that the increase of debt in the enterprise to bring interest land tax benefits at the same time, but also to the enterprise has brought a certain cost that is the cost of getting into financial difficulties. The trade-off theory is to emphasize the optimal capital structure to maximize the value of the enterprise on the basis of balancing the tax benefits of interest on debt and the cost of financial distress. The optimal capital structure should be the capital structure when the value of the firm is maximized. The value of a firm with debt can be expressed as equation (1):

$$VL = VU + PV - PV \tag{1}$$

Where VL represents the value of the enterprise with debt, VU represents the value of the enterprise without debt, PV represents the present value of the interest tax credit, and PV represents the present value of the cost of financial distress. The theory of tax shield effect and trade-off theory shows that only when the debt is in a reasonable range, it has the role of tax deduction and can effectively reduce the tax burden of the enterprise.

III. Construction of corporate tax burden minimization strategy based on genetic algorithm

III. A. Genetic Algorithms

Due to the complexity of solving the problem of minimizing the corporate tax burden, it is difficult to do so effectively using traditional algorithms for solving combinatorial optimization problems. Genetic algorithms are superior in solving this type of problem and can provide reasonable and reliable results for this problem [19].

III. A. 1) Basic operations

Genetic Algorithm abbreviated as GA is a stochastic search optimization method that simulates the genetic mechanism of nature and the theory of biological evolution. The algorithm draws on Darwin's theory of evolution and Mendel's and Morgan's genetic theory, simulates the natural genetic evolution of the survival of the fittest and the principle of biological evolution, and introduces it into the coded tandem population formed by the parameter, and firstly, it uses some kind of coding technology to produce a number of solutions to the problem solved by the numerical code of the problem solved by a certain coding technology, i.e., the chromosome, to form an initial population to solve the problem solved by the problem solved by the problem solved by a certain coding technology, then according to the principle of the survival of the fittest and survival of the fittest and the fittest. The principle of survival of the fittest and survival of the fittest.

Then, according to the principle of survival of the fittest and survival of the fittest, we evolve better and better approximate solutions generation by generation, and in each generation, according to the fitness function to find out the size of the fitness of the individuals in the problem, and with the help of natural genetics genetic operators, we carry out selection, crossover, and mutation, eliminating the individuals with a low fitness, and selecting the individuals with a high fitness to enter into the next generation, forming a new population, so that the population conforms to the natural evolutionary mechanism, and the population in the next generation is more adapted to the environment than that in the previous generation. The next generation of population is more adapted to the environment than the previous generation, and the optimal individuals in the last generation of population can be decoded as the approximate optimal solution of the problem. The basic operation of genetic algorithm is divided into:

(1) Selection operation

Selection operation refers to the size of the fitness of each individual, according to certain rules to select individuals from the old population to the new population, so that the fitness value of the individuals in the new population is significantly better than that of the individuals in the old population. Selection operations mainly include: 1) roulette selection. 2) Sorted selection. 3) Optimal individual preservation. 4) Random league selection, etc.

(2) Crossover operation

Crossover is to select two chromosomes from a population, randomly set one or more crossover points, and exchange some genes according to a certain probability, so as to produce a better individual. Commonly used methods of crossover operators based on binary coding and real number system coding are 1) single-point crossover. 2) two-point crossover. 3) Uniform crossover. 4) Arithmetic crossover.

(3) Variation operation

For each individual in the population, with a certain probability to change the gene value on one or some genes should be replaced by the value of other alleles on that locus, to form a better new individual. Commonly used mutation operations are: 1) Basic positional mutation. 2) Uniform mutation. 3) Binary mutation. 4) Gaussian mutation.

III. A. 2) Basic concepts

Concepts related to genetic algorithms include individuals and populations, fitness and fitness functions, and chromosomes and genes. Individuals and populations: an individual is a point in the search space, which generally refers to the solution of the problem. A population is a group of many individuals, i.e., part of the entire solution set of the problem.

Fitness and fitness function: fitness is the degree of adaptation of an individual to its environment, and measures the degree of superiority or inferiority of each individual indicator of a population by drawing on an organism's ability to adapt to its environment and its ability to survive as a cow. The fitness function is the core part of the genetic algorithm, which represents a mapping relationship between the optimization goal of the problem and the individual fitness, and the fitness value calculated by the fitness function is used to search for the optimal solution, so the selection of the fitness function will directly affect the convergence speed of the genetic algorithm and whether it is possible to find the optimal solution.

Chromosomes and genes: Chromosomes are some kind of strings coded to represent the individuals in the problem. Genes are each character in the string. For example, if individual 9, the chromosome is represented as 1001, then 1, 0, 0, 1 are all genes on the chromosome and are alleles.

III. A. 3) Basic processes

(1) Encoding. Choose a coding method to transform the relevant parameter set into genotype string structure data, often used coding methods are real number coding, binary coding, Gray code coding, decimal coding, non-numeric coding and so on.

(2) Define the adaptation function. Define different fitness functions for different problems, genetic parameters such as population size N, crossover probability, genetic probability, mutation probability, selection of crossover mutation methods, evolutionary generations, and termination of evolutionary rules.

(3) Population initialization. Randomly generate N individuals as the initial population based on the given data, which is recorded as the first generation.

(4) Calculate and evaluate the fitness. Calculate the fitness value of each individual in the first generation according to the fitness function, if the genetic algorithm is used to optimize the network, generally the smaller the network output error, the larger the fitness value.

(5) Genetic operation. Genetic operations include selection operation, crossover operation, and mutation operation, which are used to realize the evolution of the population.

(6) Search termination judgment. There are two termination conditions in genetic algorithm, if any one of the conditions is satisfied, the search ends and the optimal individual in the current population is the optimal solution of the current problem. Otherwise, the number of evolutionary generations is increased by 1, and steps 4, 5 and 6 are repeated.

1) The fitness values of the optimal individuals in the populations of the upper and lower generations of a genetic operation many times in a row differ very little, and satisfy $0 < F_n - F_o < \varepsilon$ for some arbitrarily small range of positive numbers ε, where F_n is the fitness of the optimal individual in the population of the next generation, and F_o is the fitness of the optimal individual in the previous generation population.

2) Test whether it reaches the maximum number of evolutionary generations T for the genetic operation.

III. B. Strategies for minimizing corporate tax burden

III. B. 1) Business VAT minimization strategies

Companies can use genetic algorithms for a variety of planning purposes to minimize their tax burden. Common planning tools include using transfer pricing to shift profits, forming debt tax shields, and arranging ownership structures. These tax minimization strategies are analyzed below [20].

Since VAT adopts different tax treatments for taxpayers with different statuses, and China's small and medium-sized enterprises (SMEs) are classified according to relatively broad criteria, these two points provide a lot of space for China's SMEs to make taxpayer status choices.

Assume that the ex-tax sales price of an enterprise is Y, the ex-tax purchase price is X, the VAT rate is r, and the VAT rates of both the purchaser and the seller are the same. The VAT rate is r, and the VAT rates of both the buyer and the seller are the same. The value-added rate of tax-free sales is R.

Then the enterprise's ex-tax sales value-added rate is:

$$R = \frac{Y-X}{Y} \times 100\% \tag{2}$$

The amount of VAT payable by general taxpayers is:

$$Y = \frac{Y-X}{Y} \times r \tag{3}$$

When the amount of VAT paid by a general taxpayer is equal to the amount of VAT payable by a small taxpayer, the tax burden of the general taxpayer is equal to that of the small taxpayer, i.e., the choice of a small taxpayer is the same as that of a general taxpayer:

$$Y \times \frac{Y-X}{Y} \times r = Y \times 3\% \tag{4}$$

According to the above formula, the value-added rate at the tax equilibrium point for general taxpayers and small-scale taxpayers is shown in Table 1. When the actual value-added rate R is greater than the rate at the tax equilibrium point, the enterprise should choose the small-scale taxpayer. On the contrary, it should choose the general taxpayer.

Table 1: Tax balance between ordinary and small-scal tax payers

Small-scale taxpayer	General taxpayer	Non-taxable tax balance
3%	7%	52%
3%	12%	27.86%
3%	15%	23.16%
3%	18%	18.29%

For example, an industrial enterprise is currently a small-scale taxpayer, with annual taxable sales of 600,000 yuan excluding tax, the enterprise has a sound accounting system and meets the conditions of a general taxpayer, applying a tax rate of 17%, the amount of the enterprise's purchased items that can be deducted is only 500,000 yuan (excluding tax), the value-added rate of the enterprise is:

$$\frac{60-50}{60} \times 100\% = 16.67 \tag{5}$$

When SMEs are small-scale taxpayers, since they cannot deduct input tax credits, they should compare their purchases and prioritize those with lower prices. When SMEs are general taxpayers, they can compare the input tax credits provided by general taxpayers with the price concessions that can be provided by small-scale taxpayers to determine the identity of the final supplier.

Assume that the tax-inclusive sales of the general taxpayer enterprise is S, the tax-input amount purchased from the supplier of the general taxpayer is P, and the VAT rate is T1. The ratio of the tax-inclusive price of the goods purchased from the small-scale taxpayer to the tax-inclusive price of the goods purchased from the general taxpayer side is R, and the applicable payment rate of the small-scale taxpayer is T2. The after-tax cash flow of the goods purchased from the general taxpayer after the sale of the goods is:

$$S - P - (\frac{S}{1+T_1} \times T_1 - \frac{P}{1+T_1}) \tag{6}$$

The after-tax cash flow of goods purchased from small taxpayers is:

$$S - P \times R - (\frac{S}{1+T_1} \times T_1 - \frac{P \times R}{1+T_2} \times T_2) \tag{7}$$

When the after-tax cash flows of goods purchased from both are equal, choosing either party to make the purchase is the same, then:

$$S - P - (\frac{S}{1+T_1} \times T_1 - \frac{P}{1+T_1} \times T_1) = S - P \times R - (\frac{S}{1+T_1} \times T_1 - \frac{P \times R}{1+T_2} \times T_2) \tag{8}$$

Derived:

$$R = \frac{1+T_2}{1+T_1} \times 100\% \tag{9}$$

If, for example, a small taxpayer can apply for a 3% VAT invoice to be issued by the competent tax authority on his behalf:

$$R = \frac{1+3\%}{1+T_1} \times 100\% \tag{10}$$

If, for example, small taxpayers can only issue ordinary invoices:

$$R = \frac{1}{1+T_1} \times 100\% \tag{11}$$

After the genetic algorithm calculation, the tax-inclusive price ratios at the tax-inclusive cash outflow balance point of the two different taxpayer statuses are shown in Table 2. Listed from the small-scale taxpayers and general taxpayers out of the purchase of goods from the tax-bearing cash flow equilibrium point of the price ratio, when the actual tax-bearing price ratio is greater than the ratio of the equilibrium point, should choose to purchase goods from general taxpayers; if less than the ratio of the equilibrium point, then consider purchasing from small-scale taxpayers.

Table 2: The price ratio of cash outflow balance

Different situations	VAT rate 7%	VAT rate 12%	VAT rate 15%	VAT rate 18%
Ordinary invoices can only be issued	94.48%	91.15%	88.56%	85.56%
It can be issued by the tax authority for the invoice	97.25%	93.82%	91.25%	88.16%

Small and medium-sized enterprises (SMEs) are more flexible in their operations, whether to choose the VAT taxpayer or the business taxpayer to optimize the tax burden of the enterprise in the activities of mixed sales, and SMEs can also identify themselves through the tax equilibrium point. Assume that the general taxpayer enterprise's tax-inclusive sales are S, the purchased tax-inputs are P, and the VAT rate is T1. The taxpayer's applicable business tax rate is T2.

The VAT payable by the enterprise is then:

$$\frac{S}{1+T_1}\times T_1-\frac{P}{1+T_1}\times T_1=\frac{S-P}{1+T_1}\times T_1 \tag{12}$$

The sales tax payable is:

$$S\times T_2 \tag{13}$$

Either status can be chosen when and only when the amount of VAT payable is equal to the amount of sales tax payable, viz:

$$\frac{S-P}{1+T_1}\times T_1=S\times T_2 \tag{14}$$

To wit:

$$\frac{S-P}{S_1}=\frac{T_2}{T_1}\times(1+T_1) \tag{15}$$

where $\frac{S-P}{S}$ - is the tax-inclusive VAT rate.

Therefore, the value added ratio at the tax equilibrium point for sales tax and VAT is shown in Table 3. When the actual value-added ratio is greater than the tax-inclusive value-added ratio at the tax equilibrium point, it is more favorable to choose business tax. When the actual value-added ratio is less than the tax-inclusive value-added rate at the tax equilibrium point, VAT taxpayer status is chosen.

Table 3: The value added rate of balance between value-added taxs and sales taxs

VAT rate (T_1)	Tax rate (T_2)	Value-added rate ($\frac{S-P}{S}$)
7%	4%	61.14%
7%	6%	91.71%
12%	4%	37.33%
12%	6%	56.00%
15%	4%	30.67%
15%	6%	46.00%
18%	4%	26.22%
18%	6%	39.33%

III. B. 2) Corporate income tax minimization strategies

The Enterprise Income Tax Law stipulates that the taxable income of an enterprise is equal to the total income for each taxable year, less non-taxable income, tax-exempted income, various deductions and losses allowed to be made up for prior years. Different depreciation methods for fixed assets have certain impact on the calculation of taxable income. The general depreciation methods for fixed assets include straight-line depreciation method and accelerated depreciation method. Accelerated depreciation method also includes double declining balance method and sum-of-the-years method, and the use of genetic algorithm to solve the model shows:

Assuming that the original value of the fixed assets of a small and medium-sized enterprise is 100,000 yuan, the discount rate of 10%, the income tax rate of 25%, assuming that there is no salvage value of the fixed assets, the useful life of the fixed assets is 10 years, as determined by the tax authorities, the fixed assets can be subject to accelerated depreciation method of depreciation. The impact of different fixed asset depreciation methods on enterprise income tax and the corresponding annual depreciation amount and the corresponding present value are shown in Table 4. Based on the results of genetic algorithm calculations, enterprises to accelerate the depreciation of fixed assets can increase the present value of depreciation, the present value of depreciation increased can be more deductible enterprise profits, reducing the enterprise's taxable income, which is undoubtedly an invaluable interest-free loan for the financing difficulties of small and medium-sized enterprises. From the table can also be seen, the use of accelerated depreciation method makes the enterprise in the early stage of the credit more, in the later stage of the credit utility is reduced.

Table 4: The present value of different methods of depreciation

Depreciation year	Discount factor	Linear depreciation	Linear depreciation value	Double balance decline	Double balance decline value	Annual sum	Annual sum value
1	0.91	10000	9098	20000	18187	18181.91	16529.09
2	0.8273	10000	8271	16000	13222.46	16363.73	13522.91
3	0.754	10000	7538	12800	9639.74	14545.54	10954.18
4	0.6839	10000	6837	10240	6993.98	12727.36	8692.73
5	0.6218	10000	6216	8198	5086.47	10909.18	6773.45
6	0.5654	10000	5652	6553.9	3699.57	9091	5131.82
7	0.5141	10000	5139	5242.94	2690.71	7272.82	3732.37
8	0.4674	10000	4672	4194.4	1956.7	5454.64	2544.55
9	0.425	10000	4248	8388.74	3557.67	3636.45	1542.18
10	0.3864	10000	3862	8388.72	3233.87	1818.27	700.91
11		100000	61484	100000	68259.73	100000.10	70125.20

IV. Case Studies

This part will analyze the practicality and effectiveness of the corporate VAT and income tax minimization strategy based on genetic algorithm constructed in the previous paper by using a case study of a manufacturing company concerning VAT and income tax.

IV. A. Brief description of the case

A production enterprise is a large state-owned enterprises in the north, the main production of A kind of beer. The enterprise in order to expand the scale of production in order to enhance their competitiveness, in the province of several other counties and cities set up a number of distribution offices, the enterprise and the distributor signed a beer purchase and sale agreement, the agreement was agreed to by both parties to form the statement of opinion, the main content is:

(1) In order to maintain the price stability of beer A, legitimate competition, distribution offices in the sale of beer A produced by the enterprise must be in accordance with the enterprise shall not be lower than the unified pricing.

(2) The two sides in accordance with the contract of agency sales, the beer production enterprise in accordance with the distribution office of the list of agency sales to pay a certain fee, the payment of the fee standard for the distribution office of the current sales of 4%.

(3) All costs of maintaining the business of the distribution office can be spent from the fees paid by the beer producer and discretionary expenses.

(4) Distribution office for the enterprise's internal sales department, sales of beer in the enterprise factory is already taxed, the distribution office does not have to repeat the tax. In the sales process, the distribution office and other departments, such as industry and commerce, taxation, customs and other disputes, the beer enterprise, the distribution office and the third party to jointly negotiate to solve the problem.

The agreement was signed and sealed by both parties and came into effect, and the distribution offices received business licenses to qualify for the sale of Class A beer. In FY2024, the total revenue from the sale of beer A by the distribution offices is 8 million yuan (including tax), and the beer producer pays 320,000 yuan (800*4%) in agency fees immediately upon submitting the bill of sale to the beer producer. The total revenue earned by the beer enterprise from the sale of beer during the year is 15 million yuan (including 8 million yuan from sales at the distribution office). The cost of production of Beer A is 40% of the sales revenue. The VAT input tax deductible by the beer producer for the year is 1.6 million yuan, so the beer producer pays a total of VAT of: $[1500/(1+17\%)]*17\%-160=217.95-160=57.95$.

IV. B. Strategy Utility Analysis

The total objective of tax incentives based on genetic algorithm can get four schemes with the largest summed sorting value as shown in Table 5, they are K scheme, which makes the original applicable tax rate of the industry applying the lowest tax rate of 7% remain unchanged, the original applicable tax rate of the industry applying the middle tax rate of 10% is adjusted downward to 7%, and the original applicable tax rate of the industry applying the highest tax rate of 14% is adjusted downward to 7%. L program, which resulted in an upward adjustment of the applicable tax rate to 8% for industries previously subject to a minimum tax rate of 7%, a downward adjustment of the applicable tax rate to 8% for industries previously subject to an intermediate rate of 10%, and a downward adjustment of the applicable tax rate to 8% for industries previously subject to a maximum tax rate of 14%. Program M, which resulted in an upward adjustment of the applicable tax rate to 9% for industries that were previously subject to the lowest tax rate of 7%, a downward adjustment of the applicable tax rate to 9% for industries that were previously subject to the middle rate of 10%, and a downward adjustment of the applicable tax rate to 9% for industries that were previously subject to the highest tax rate of 14%. N program, which resulted in an upward adjustment of the applicable tax rate to 10 percent for industries that were originally subject to a minimum tax rate of 7 percent, no change in the applicable tax rate for industries that were originally subject to an intermediate tax rate of 10 percent, and a downward adjustment of the applicable tax rate for industries that were originally subject to a maximum tax rate of 14 percent to 10 percent. Although these programs are different, they are all able to better balance the overall objectives of the tax incentives based on three single policy objectives.

Table 5: Tax structure changes

	K	L	M	N
The largest plan for the reform of the pre-reform tax rate structure	7% +10% +14%	7% +10% +14%	7% +10% +14%	7% +10% +14%
A unified tax rate applied after the reform	7%	8%	9%	10%

Also due to the fact that there are many types of tax incentives to maximize the realization of the total objectives of tax incentives is not unique, how to determine the optimal solution needs to be further analyzed. In order to determine the optimal solution, we can also consider the number of solutions to achieve the total objectives of tax incentives, the more the number of total objectives achieved, the greater the space for its application, the more suitable as the optimal solution. The data on the number of total goals achieved by the four schemes with the largest sum ranking values and the achievement of a single policy goal are shown in Table 6, in which the schemes with the largest number of total goals are K (7%) and N (10%), both of which can achieve eight total goals of tax incentives. The advantage of K over the other four schemes is that, in addition to the fact that it can achieve a greater number of total tax incentives, it also shows that it can promote economic growth and promote economic growth. In addition to achieving more tax incentives, the advantages of Scheme K over the other four schemes are that it promotes economic growth (GDP growth rate is greater than 0), stabilizes the industrial structure (stabilization effect is the best), and improves the social welfare level (change in the CV of the social welfare level is less than 0). The advantage of the N option over the other four options, in addition to its ability to achieve more of the overall objectives of the tax incentives, is only in its ability to better maintain the stability of tax revenues (tax revenue volatility is minimized). Combining the number of total objectives achieved by the programs as well as the achievement of the four single policy objectives, while the K program has better economic results than the N program, it faces significant fluctuations in tax revenues, with the K program resulting in a 10.46% decline in tax revenues, while the N program only declines by 0.56%. Since China is facing an increasingly serious fiscal balance problem, it is obviously not feasible to drastically reduce tax revenues, so the N-scenario is more feasible. At this point, one of the 30 “three-tier and two-tier” VAT rate simplification reform scenarios can be selected as the optimal one, which takes into account each single policy objective and achieves the largest number of overall tax incentives, which is the N scenario.

Table 6: The maximum number of solutions and the number of objects of the total

The biggest solution for the total sort value	K	L	M	N
The number of objects of the general object	10	4	4	14
GDP growth rate	0.94%	0.62%	0.26%	-0.07%

Industry output variance	3.6×10-4	4.2×10-4	4.7×10-4	5.3×10-4
Social welfare level changes CV	-2.11%×ϑ	-1.33%×ϑ	-0.59%×ϑ	-0.18%×ϑ
Revenue volatility	10.46%*	7.23%*	3.84%*	0.56%*

IV. C. Analysis of strategy effectiveness

In this subsection we will use the net present value method to verify the validity of the genetic algorithm model. The NPV method is an important concept in financial management, and it is used as an important evaluation index to measure whether an investment project of an enterprise is feasible or not. We calculate the cash flows of tax planning and non-tax planning of a production enterprise in the above case, and compare their sizes to see whether the enterprise's behavioral choices under the NPV method are consistent with the results obtained through the model analysis.

Before the analysis, we assume that the sales size of a manufacturing company in the second year is 1.5 times the sales size of the first year, and we also assume that the distribution office also sells out at the same size. We calculate the respective cash flows of non-tax planning and tax planning in the above case as shown in Table 7.

By calculating the above cash flow statement, we can see from the last line that a production company with tax planning has earned more cash flow in two years than non-tax planning. As a result, a production company has gained more revenue and created more value for the company through tax planning. Recalling the genetic algorithm model we designed, through the model analysis, we conclude that the motivation for enterprises to choose tax planning lies in the minimization of the marginal tax rate difference, because the minimization of the marginal tax rate difference enables enterprises to obtain more benefits from tax planning and achieve the goal of maximizing enterprise value. Through the analysis of the present value of the cash flow of the case, we corroborate the effectiveness of the enterprise tax burden minimization strategy we designed based on genetic algorithm optimization from another perspective.

Table 7: Cash flowmeter

That year:	Tax planning	Non-tax collection planning
Cash income	1500	1500
Sales cost	560(1500*40%)	560(1500*40%)
VAT	198.77([1368/(1+17%)]*17%)	203.42([1500/(1+17%)]*17%)
Amerce		44
Planned cost	14	
Net cash flow	630.25	594.61
The second year	Tax planning	Non-tax collection planning
Cash income	2200	2200
Sales cost	842	842
VAT	298.22	305.14[2200/(1+17%)]*17%)]
Amerce		62
Planned cost	14	
Second year net cash flow	950.28	897.28
Present value of net cash flow	62734	594.67
The present value of cash flow in the second year	836.9	822.46
Net present value	1493.82	1408.06

V. Conclusion

This paper discusses the practicality and effectiveness of the methodology of this paper by empirically studying the case of a manufacturing enterprise concerning VAT and income tax, and by applying the genetic algorithm algorithmic process to the actual situation to obtain the strategy of minimizing the tax burden of the enterprise. It has been shown that

The total goal of tax incentives based on genetic algorithm can get K, L, M and N programs, which can take into account three single policy goals. However, facing the large fluctuation of tax revenue, the tax revenue of N scheme only declines by 0.56%, which is the smallest decline compared with other schemes, so N scheme is more feasible. By analyzing the present value of the cash flows of the case, it can be found that a production enterprise obtains greater benefits through tax planning. From another perspective, it verifies that the genetic algorithm model designed in this paper is effective and practical.

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