

A Payment Optimization Model Based on Social Insurances and Housing Fund

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Abstract

Payment optimization has been a concern of the corporate and academic. This article discusses the four conditions of the social insurances and the housing fund as a kind of benefit. The goal is to maximize the employee's benefits. And the cardinal factors of compensation, such as monthly salary and the year-end bonus, are taken into account as an entire. This paper takes into account the impact of social insurances and the housing fund on labor cost. It makes labor cost as a constraint to construct the compensation optimization model. And this paper takes the actual data of M company as an example. This paper makes up for the deficiency of social insurances and the housing fund in the field of tax planning. It has instructive points in the controlling of labor cost and incentive.

Keywords

Compensation System Optimization, The Social Insurances and the Housing Fund, Labor Cost of Company, Employee Motivation

1. Introduction

With the development of China's economy moving into a new normalcy, enterprises are facing tremendous pressure to transform and upgrade. And high labor cost becomes a key factor restricting the development of enterprise. Because many companies lack scientific salary optimization methods, the labor cost are high while the incentive effect to employee is poverty. This issue gives rise to a serious waste. From 2014 to 2016, the ratio of labor cost in the total cost of the enterprise rose from 5.8% to 9.17% in accordance with the discovery by China Daily. Therefore how to find the best combination of year-end awards and monthly salary, maximizing the employee's benefits while the company's labor cost is unchanged is a subject worth studied for the corporate and academic.

Labor cost of company includes the year-end awards and monthly salary. Dif-

ferent combinations of year-end awards and monthly salary lead employees and companies to pay different social insurances, the housing fund and personal income tax. It leads the staff's actual income and labor cost of company to shift. The employees from different types of enterprises have different standards to determine whether the social insurances and the housing fund is benefits which makes the social insurances and the housing fund become the key factor influencing the optimal salary scheme design. And the cost of staff is affected by the housing fund, social insurance and tax rate. This paper gives priority to the influence of salary combination in order to achieve the goal of controlling labor cost of company and maximizing employee benefits.

Scholars' researches on the optimization of payment focused on the treatment of tax thresholds and the simplification of mathematical models. Gu *et al.* established a mathematical model to solve the optimal solution [1]. Jia tried to minimize the applicable year-end tax rate [2]. Yu and Li focused on the study of wage and salary personal income tax critical point to provide a theoretical basis for compensation program optimization [3] [4]. Chen and Fu *et al.* established a practical model to find the optimal allocation of monthly wages and year-end awards, and quickly solve the problem by the help of computer [5] [6]. Wang presented an improved model which takes into account the three social insurances and one the housing fund and other personal income tax deductible items [7]. Liao established an optimization model of personal income tax and solved the optimal allocation of personal income tax program by the use of MATLAB [8].

To summarize these studies, we can find that they co-ordinate the wages, year-end awards and other payment variables to build a model to minimize the tax payment, effectively calculate the optimal salary system. But these studies have the following two deficiencies: 1) Their goals of optimization are to minimize the personal income tax and there is no direct reflection to the fundamental purpose of increasing employee benefits; 2) They ignore the variables of labor cost and there is no analysis of the impact for social insurances and the housing fund on employee's benefits and the labor cost. For that reason, the conclusions may have a certain degree of deviation.

This paper defines the criteria for employee's benefits and the goal is to maximize employee's benefits by establishing the pay optimization model. It considers the influence of the social insurances and the housing fund for employee benefits and labor cost while the cost of the staff is a constraint. As a consequence, it gets the optimal combination for wage and year-end bonus. The research of this paper not only expands the research scope of personal income tax planning, but also provides guidance for the company's salary, labor cost control and employee motivation. It has theoretical and practical significance.

2. Problems Description and Model Construction

Previous studies' target on personal income tax planning is mostly based on the minimum tax. The studies implied pre-tax wage is a kind of labor cost. And they

consider that the minimum tax, the highest employee actual income. If there is no effect from social insurances and the housing fund, pre-tax wages can really represent the labor cost of company and after tax wages can represent the employees' actual income. But the neglect to social insurances and the housing fund may make the calculation results fairly different from the actual situation. Due to the actual existence of social insurances and the housing fund, we should not only consider the effect of the social insurances and the housing fund to personal income tax by the advance deduction but also consider the judgment of staff to if social insurances and housing fund are kinds of benefits. On one hand, if employees consider that is not a benefit, the insurances and fund should be deducted from the after-tax salary to calculate the employee's earnings. On the other hand, due to the existence of company's part of social insurances and the housing fund, the cost of the company is not only includes the employee's pre-tax wages, but also includes insurances and fund turned over by company. The following optimization model is based on the thinking above.

Assume a company pays employees through two ways including year-end awards and wages. Employees paid personal income tax according to the current tax law after social insurances and the housing fund are deducted. The symbols used were defined as shown in **Table 1**. The local minimum wage, the housing fund and social insurance surrender ratio and the base line of the housing fund and social insurance go ups and downs according to different situations.

Table 1. Symbol explanation.

Symbol	Implication	Symbol	Implication
A	Monthly salary	S	Socialinsurances
A_0	Local minimum wage	S_{11}	Social insurance rate paid by company
B	Annual bonus	S_{12}	Social insurance rate paid by employee
C	The housing fund	$S(c)$	Social insurance paid by company $S(c) = As_{11}$
c_{11}	The housing fund rate paid by company	$S(p)$	Social insurance paid by employee $S(p) = As_{12}$
c_{12}	The housing fund rate paid by employee	s_1	The upper limit of social insurance base number
c_1	The upper limit of the housing fund base number	s_2	The lower limit of social insurance base number
c_2	The lower limit of the housing fund base number	T	Personal income tax
$C(c)$	The housing fund paid by company $C(c) = Ac_{11}$	$T(m)$	Personal income tax from monthly salary
$C(p)$	The housing fund paid by employee $C(p) = Ac_{12}$	$T(y)$	Personal income tax from annual bonus
k	Quick deduction	r	Personal income tax rate
Q	Labor cost	P	Employee benefits

The income tax is equal to the tax rate multiplied by the taxable income and subtracts quick deduction. Tax rates and quick deductions can be found by looking at **Table 2**.

The monthly salary is different from the year-end bonus not only in the relevant tax law, but also in the calculation method. The amount of taxable income earned on monthly income is equal to the total amount of monthly income subtracts the tax exemption project, and then deducted 3500 yuan on the basis of the deduction standard. Among them, the tax-exempt items include the social insurances and the housing fund stipulated by the government, which is divided into one part paid by company and the other part paid by employee. The amount of personal income tax on monthly wages is equal to

$$T(m) = r(m) \cdot [A - C(p) - S(p) - 3500] - k(m) \quad (1)$$

For the year-end bonus tax method, taxpayers can calculate annual one-time bonus as monthly method: if the employee's salary is higher than (or equal to) the tax deduction, dividing the annual one-time bonus by 12, determining the applicable tax rate and quick deduction in accordance with the quotient. On this occasion, do not necessary to deduct the exemption amount when calculating. This article only studies the situation which month wages and salaries are greater than 3500 yuan. The year-end income tax is:

$$T(y) = B \cdot r(y) - k(y) \quad (2)$$

Due to the personal income tax is borne by employees, the company cost of employees just includes the pre-tax monthly wages, pre-tax year-end awards and social insurances and the housing fund spent according to the relevant policy. Labor cost of company is equal to:

$$Q = 12[A + C(c) + S(c)] + B \quad (3)$$

This paper defines the objective function to maximize employee's benefits while the labor cost of company is set to constraints. The goal is to make the employee's benefits maximum by reducing the tax and keep a reasonable balance between the housing fund, social insurance and wages.

For the reason that social insurances have the dual attribute of insurances and welfare, different kinds of people have different understandings on it, some people think social insurances are benefits, while others are not. The following

Table 2. Personal income tax regulations.

Level	Tax notch	Tax rate	Quick deduction
1	0 - 1500	3%	0
2	1500 - 4500	10%	105
3	4500 - 9000	20%	555
4	9000 - 35,000	25%	1005
5	35,000 - 55,000	30%	2755
6	55,000 - 80,000	35%	5505
7	>80,000	45%	13,505

judgments can be drawn according to Liu's research: Women, state-owned enterprise employees and middle-low level managers pay more attention to the future protection [9]. So they see social insurances as a gain, while others are in the opposite. At the same time, people base the actual situation to determine whether the housing fund is a kind of benefit or not. Therefore, this paper takes these differences into account and provides a four-case model as following:

1) Both the housing fund and the social insurances are benefits According to policy marker's view, social insurances and the housing fund are both contribute to employee's life. That the amount of money paid for the insurance and housing fund by the company is an important factor for a candidate to evaluate the company. In this case, the employee's benefits include the monthly income after deducting the personal income tax, the year-end prize, and the social insurances and the housing fund paid by company. Employee benefits can be expressed as:

$$P = 12[A + C(c) + S(c) - T(m)] + B - T(y) \quad (4)$$

The objective function can be expressed as:

$$\begin{aligned} \text{Max}P &= 12[A + C(c) + S(c) - T(m)] + B - T(y) \\ \text{s.t.} &\begin{cases} Q = 12[A + C(c) + S(c)] + B \\ A \geq A_0 \\ A, B, T, Q, R \geq 0 \end{cases} \end{aligned} \quad (5)$$

2) The housing fund is a kind of benefits, but the social insurances are not.

According to a young man, who is just graduates from the university and need to rent a house in the city, he does not need the social insurances temporarily for he has an optimism view of himself. At this time, the employee's benefits include the monthly salary after deduction of personal income tax, year-end awards and the housing fund paid by company, to minus social insurances.

Employee benefits can be expressed as:

$$P = 12[A + C(c) - S(p) - T(m)] + B - T(y) \quad (6)$$

The objective function can be expressed as:

$$\begin{aligned} \text{Max}P &= 12[A + C(c) + S(c) - T(m)] + B - T(y) \\ \text{s.t.} &\begin{cases} Q = 12[A + C(c) + S(c)] + B \\ A \geq A_0 \\ A, B, T, Q, R \geq 0 \end{cases} \end{aligned} \quad (7)$$

3) The social insurances are benefits while the housing fund is not.

According to woman and old people, who own a house, they think it will more worth to take out the money from the housing fund for other potential investment. But in pursue of the indemnity they will also need the social insurances. At this time, the employee benefits include personal income tax after deducting the monthly salary, year-end awards and the social insurances paid by company, to deduct the housing fund paid by the monthly wage.

Employee benefits can be expressed as:

$$P = 12[A - C(p) + S(c) - T(m)] + B - T(y) \quad (8)$$

The objective function can be expressed as:

$$\begin{aligned} \text{Max}P &= 12[A + C(c) + S(c) - T(m)] + B - T(y) \\ \text{s.t.} &\begin{cases} Q = 12[A + C(c) + S(c)] + B \\ A \geq A_0 \\ A, B, T, Q, R \geq 0 \end{cases} \end{aligned} \quad (9)$$

4) Neither of the housing provident fund and the social insurances is benefit

According to people who do not know how to take out and use the money from insurances or fund, they will not greet the policy of social insurances and hosing fund. This kind of people gets the fewest benefits in the four. At this time, the employee benefits include personal income tax after deducting the monthly salary, year-end awards, to minus the social insurances and the housing fund.

Employee benefits can be expressed as:

$$P = 12[A - C(p) - S(p) - T(m)] + B - T(y) \quad (10)$$

The objective function can be expressed as:

$$\begin{aligned} \text{Max}P &= 12[A + C(c) + S(c) - T(m)] + B - T(y) \\ \text{s.t.} &\begin{cases} Q = 12[A + C(c) + S(c)] + B \\ A \geq A_0 \\ A, B, T, Q, R \geq 0 \end{cases} \end{aligned} \quad (11)$$

3. Method and Numerical Analysis

3.1. Specific Method

In the study of tax planning, they used various methods such as exhaustive method, empirical method, computer method and mathematical derivation method. Exhaustive method causes a large workload, and it is difficult to operate. The experience method requires rich experience of the operator and the result is not rigorous enough. Although the method of mathematical derivation is logical and accurate, it is difficult to use in practical work. When the computer method is used alone, it is difficult to use it flexibly because of its lacking of economic meaning. The method in this paper combines the mathematical modeling and computer method, which not only ensures the clarity of logic and economic meaning, but also makes the calculation simple.

There are three algorithms: nonlinear GRG, simple linear programming and evolution to solve the linear programming. Simple linear programming is a method of studying linear problems while evolution is a method of studying non-smoothing problems. Because the problem in the paper is a kind of smooth nonlinear problem, author chooses nonlinear GRG algorithm to solve the problem. However, the nonlinear GRG algorithm can only calculate the local optimal solution, so the paper calculates multiple initial points to make sure that the result is a global optimal solution.

Up to now, the numerical verification shows that the GRG method which is a new method changed from linear simple gradient method is one of the most effective ways to solve the nonlinear constrained programming problems. GRG can get the goal of dimension-reduction by eliminating variables. It also can accelerate the convergence speed of algorithm when the iteration point is to the solution. It includes three steps in that method. The first step is to determine the search direction. The second step is to determine the step length and the third step is to update the basis matrix.

The main train of the method is to divide the variables into two parts including basic variables and free variables, and using free variables to express basic variables, and then put it into the objective function. In this way, we can get the objective function only expressed by free variables as the variable. On one hand we can use unconstrained optimization method to select practical descent directions. On the other hand we can use linear search to get the new iteration point.

3.2 Numerical Analysis

1) Parameter estimation

M company's salary system is divided into three layers: grassroots employees, middle managers and senior managers. The individual labor cost is: 80,000 yuan, 200,000 yuan and 430,000 yuan. The employees in M company hold the view that the housing fund is benefits, while social insurances are not. The housing fund's up and down lines of M company are 27,163 yuan and 1895 yuan. And social insurances' up and down lines are 13,129 yuan and 2945 yuan. The company and individual's the housing funds surrender ratio are 7% and 12%. And the company and individual's social insurances surrender ratio are 23.31% and 10.20%. Put the data into the data collection table as shown in the following **Table 3**.

2) Modeling analysis

We analyze M company according to the actual situation. Employees see the housing fund as a benefit, while social insurances are not. Therefore, we need to use the second model to optimize the solution.

Table 3. M company variable data.

Number	Variate	Value
1	Unit labor cost	80,000
2	Local minimum wage	1895
3	The upper limit of the housing fund base number	27,163
4	The lower limit of the housing fund base number	1895
5	The upper limit of social insurance base number	13,129
6	The lower limit of social insurance base number	2945
7	The housing fund rate paid by company	7%
8	The housing fund rate paid by employee	12%
9	Social insurance rate paid by company	23.31%
10	Social insurance rate paid by employee	10.20%

Table 4. Calculation steps.

Step 1: Draw the calculation area
Draw the “Input Data” form for entering the parameters, and enter the variables in Table 3 . Draw the “Formula Computing” form for calculation (Table 4):
Step 2: Calculate the element
a) Calculate the housing fund Enter “=IF(A2<=Input Data!C5,Input Data!C5,IF(Formula Computing!A2>=Input Data!C4,Input Data!C4,Formula Computing!A2))” in D9 Enter “=D9*Input Data!C8” in D2, Enter “=D9*Input Data!C9” in D3
b) Calculate social insurances Enter “=IF(A2<Input Data!C7,Input Data!C7,IF(Formula Computing!A2>=Input Data!C6,Input Data!C6,Formula Computing!A2))” in D10 Enter “=D10*Input Data!C10” in D6 Enter “=D10*Input Data!C11” in D7
c) Calculate the taxable income Enter “=IF((A2-D3-D7-3500)>=0,(A2-D3-D7-3500),0)” in A4 Enter “=IF(A2>=3500,A6/12,(A6-3500+A2)/12)” in A8
d) Calculate the tax rate Enter “=IF(A4<=1500,0.03,IF(A4<=4500,0.1,IF(A4<=9000,0.2,IF(A4<=35000,0.25,IF(A4<=55000,0.3,IF(A4<=80000,0.35,0.45))))))” in G6 Enter “=IF(A8<=1500,0.03,IF(A8<=4500,0.1,IF(A8<=9000,0.2,IF(A8<=35000,0.25,IF(A8<=55000,0.3,IF(A8<=80000,0.35,0.45))))))” in G7
e) Calculate the quick deduction Enter “=IF(A4<=1500,0,IF(A4<=4500,105,IF(A4<=9000,555,IF(A4<=35000,1005,IF(A4<=55000,2755,IF(A4<=80000,5505,13505))))))” in G9 Enter “=IF(A8<=1500,0,IF(A8<=4500,105,IF(A8<=9000,555,IF(A8<=35000,1005,IF(A8<=55000,2755,IF(A8<=80000,5505,13505))))))” in G10
f) Calculate the personal income tax Enter “=G6*A4-G9” in G2 Enter “=G7*A6-G10” in G3
Step 3: Adding constraints
Add constraints in the “Formula Computing” form. Enter “=(A2+D2-D7-G2)*12+A6-G3” in F12 Enter “=(A2+D2+D6)*12+A6” in F13 Enter “=Input Data!C2” in H13 Enter “=Input Data!C3” in H14
Step 4: Solve the programming
Clicking the “Plan Solve” command in the “Data” menu to bring up the “Solve Parameters” dialog box. In the dialog box, select the radio button in front of the maximum value, set the target cell to \$F\$12, and the variable cell to \$A\$2, \$A\$6. Clicking the “Add” button in the “Solver dialog box” to open the “Add Constraints” dialog box. Click the cell reference box to select the A2 cell of the worksheet and “\$A\$2” will be displayed in the text box, then select “≥” constraint, and F13 cell is selected in the Constraint value text box. Add a second conditional constraint based on the same principle. Click the “Solve” button in the “Solve Parameters” dialog box and the “Solver Results” dialog box pops up. Click the radio button before “Save Plan Solving Results”. Click the “OK” button in the “Solve Results” dialog box, and the worksheet shows the results of the solution.

3) Result analysis

The paper gets the results by using the Excel programming solution and analyze Fu Qiao *et al's* payment optimization model [6]. What's more, it understands the total annual income from Fu's paper as the cost of the company. The analysis that compares the results got from this paper and from Fuqiao's paper is shown in below **Table 5** and **Table 6**:

We can find similar and different points by comparing the two results. The similar points are that the two methods are to establish a mathematical model firstly. And they both use excel linear programming to solve the formula secondly,

Table 5. Contrast of optimal combination.

		optimal combination		Income
		monthly salary	year-end bonus	
Suggested method	Basic-level	2945	33,948	64,867
	Middle-level	9336	54,000	153,903
	High-level	22,219	107,981	324,083
Fu's method	Basic-level	5167	18,000	78,724
	Middle-level	12,167	54,000	180,569
	High-level	31,333	54,000	353,261

Table 6. Contrast of loss.

		Loss		
		Social insurance	minimum tax	total
suggested method	Basic-level	11,842	3290	15,133
	Middle-level	37,548	8552	46,097
	High-level	52,794	53,123	105,917
Fu's method	Basic-level	neglect	1280	1280
	Middle-level	neglect	19,435	19,435
	High-level	neglect	76,735	76,735

and finally get the maximum employee income. The difference between the two methods is that Fu's approach just considers the role of personal income tax, does not consider employees' understanding of the actual income and it lacks in-depth thinking of insurances and housing fund. Therefore, the method provided in this article not only provides tax avoidance function, but also reduces the insurances and housing fund according to the staff's understanding. This method is more applicable to the actual situation in enterprises.

4. Conclusions

In this paper, the planning goal is to maximize the employee's benefits and the author considers the salary variables such as the monthly salary and the year-end prize. The insurances and housing fund are regarded as the key factor while the labor cost is taken as the restriction condition. The paper also makes a practical research taken M company as the case. It uses the actual data to calculate the optimal result and compares it with the past methods to test the model. Following are the two innovations of this paper:

On one hand, this paper makes a breakthrough in the tax planning field. It does not stand on the company's overall perspective, but regards the employees and the company as two main. Keeping the company cost invariant, this paper establishes optimization model to insure employees get the largest benefits.

On the other hand, first of all, different from the neglect to the insurances and housing fund of the past study, this paper considers income tax subtracted by in-

surances and housing fund. What is more, this paper joins the four types of employees' thoughts on whether insurances and housing fund are benefits. Furthermore, this paper considers insurances and the housing fund as the labor cost of company. Last but not the least, it changes the goal from minimizing personal income tax into maximizing the benefits of employees.

This paper also has the following two characteristics in practical application:

To begin with, the paper is helpful for the daily work for the employee payment optimization issues which is related to human resources and financial management in the enterprise. The works of the human resources department in the enterprise include helping employees to increase their actual benefits and increase their incentives while the work of the finance department is cost controlling. So the results of this study are helpful for the salary system designed by the human resources department and the labor cost controlling by the finance department.

What is more, the method in this paper is simple and practical. On account of the deep through to the salary optimization problem, the model designed in this paper is simple and easy to understand. More than that, Excel software is commonly used in various departments. Therefore, staffs can judge the employees' thought whether the insurances and the housing fund are benefits and select the appropriate model to calculate based on their own situation.

However, there are quite a few shortcomings in this paper, such as the precision of the result. Because the pay optimization problem is a nonlinear problem, so if you enter a different initial value, the result will return a different optimal solution. Further research needs to be performed.

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