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Review Article

Modeling of the Least Total Cost and Quantity & the Biggest Total Products with the Best L&K in Hub Process of General Motor on Economics I

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Abstract: In forge process of hub for GM (General motor) with the revenue is supposed that 43~72Yuan/piece the profit point will become smaller. At 72 Yuan/piece the point is 1.8 piece. Meantime with the product step being bigger the biggest total cost will increase too. α、β &γ is calculated to 1.12 、-0.12 & 5 respectively. The least total cost is 100Yuan each minute at the turning point. The biggest total product and capital margin product & average product increases as the labor and capital increase. The effective turn is TP>AP>MP_L>MP_K to total cost and quantity. The biggest AP increases from 3.5~4 to 6~7 pieces whilst the biggest MP_L increases from 3.5~6.5 to 6~11with γ becoming from 3 to 5.

Keywords: modeling; revenue distribution; economic cost and quantity; forge process; total cost; total product; the best L&K; hub; GM.

1. INTRODUCTION

The forge process of hub is an automatic flow production line with expensive machine in GM workshop. This process includes three punches ie. First feeding and second press and third picking off processes in order to form the profile of hub from rod materials so it is an automatic process which completes four functions in whole manufacture. The profit is calculated through revenue and cost (ie. AC, TC, MC) which is an important factor in manufacture. In this paper the revenue has been computed and drawn from their relation with cost. The revenue AC, TC &MC and goods quantity is investigated for search their change in these processes. For the better benefit it must be studied further it can gain the profit use. Since the longrun stability is key as for manufacture. How we can define stable and low cost parameter is significant matter. For the inference the different drawing between profit cost and quantity is made to analyze the change and low cost situation in this study. The constant labor L & capital K is defined to fit to cost value for hub forging process [1, 2].

In the forge process the hub will be granted forge which is a important process to form complete profile finished good. The cost evaluation is a important one to save person and capital. So model is established that includes function of cost and quantity to solve the cheapest cost. It lets labour and capital is a independent variable to find the cheapest cost. In economics the cost may be calculated according to define different parameter so it is solved by the correspondent formula to each parameter. The establishment of fact parameter is based on the forge process only and it is found that the every cost changes in a course with independent variable. The cost is significant in economics which may draw every curve to evaluate the whole trend in quantity. Only in this way can we find the optimum path to choose and solve our cost aim. Certainly in this computation it is optimum original parameters to ensure the reality and optimum. By comparison it is found the whole data fit to well. So it is thought that the establishment is successful by this path. We can compute the formula through a certain parameter and adopt optimum resolution to obtain constant for our cost evaluation. We looks forwards to making a role in our cost and quantity calculation in this paper.

2. Modeling and simulation

For the sake of looking for the revenue point in this paper the 43Yuan per piece is average price, the total price is 172Yuan per minute which is proposed. Below is the modeling programme.

The formulas for cost control are listed as below

$$MP_L / P_L = MP_K / P_K \quad \text{------(1)}$$

$$TC = KP_K + LP_L \quad \text{--------(2)}$$

$$MP_K = dTP / dK \quad \text{------(3)}$$

$$MP_L = dTP / dL \quad \text{------(4)}$$

$$AP = TP / L \quad \text{------(5)}$$

$$AR = TR / Q \quad \text{------(6)}$$

$$P_r = TR - TC \quad \text{----(7)}$$

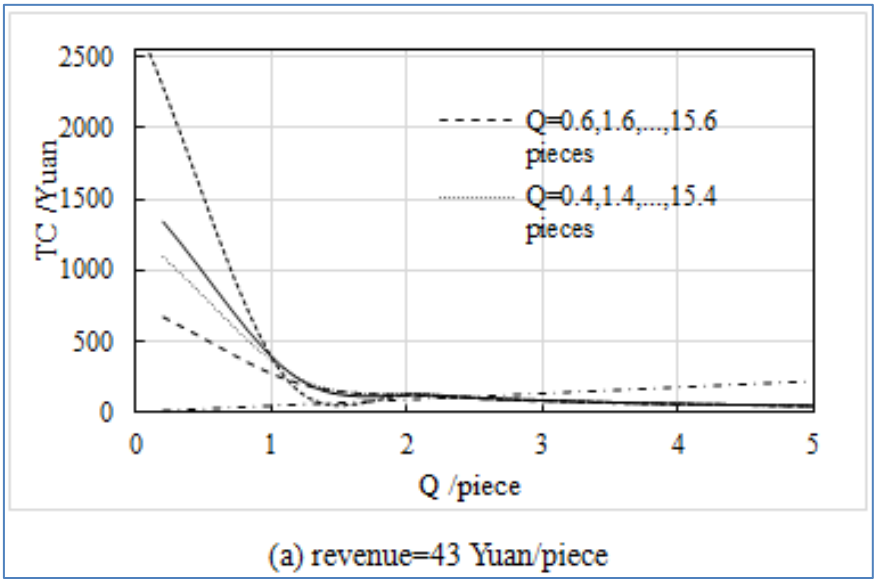
The Cobb-Douglas function is

$$Q = \gamma L^{\alpha} K^{\beta} \quad \text{-------(8)}$$

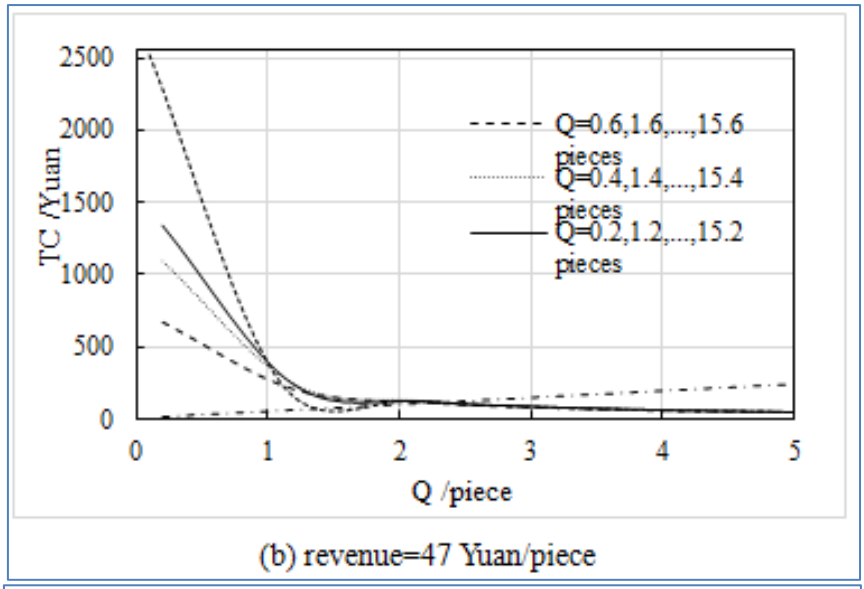
Production quantity Q; γ is technique coefficient; α is producing labour elasticity; β is producing capital elasticity. K is capital; L is labour; TC is total cost; MP_L is labor marginal product. MP_K is capital marginal product; TP is total product; AP is average product; AR is average revenue; TR is total revenue; P_r is the profit. Formula of (6&7) is deduced for the average revenue and profit with quantity in this study. The calculated constant is γ=3; α=1.14; β=-0.12 respectively. Table 1 shows the parameters and average value of these three coefficients according to eleven group data with correlation equation. It is about the above value which was calculated by 0.4 times step before whilst current one is done by 0.5 times. Only big change is γ=5.0 others are α=1.12; β=-0.12.

3. DISCUSSIONS

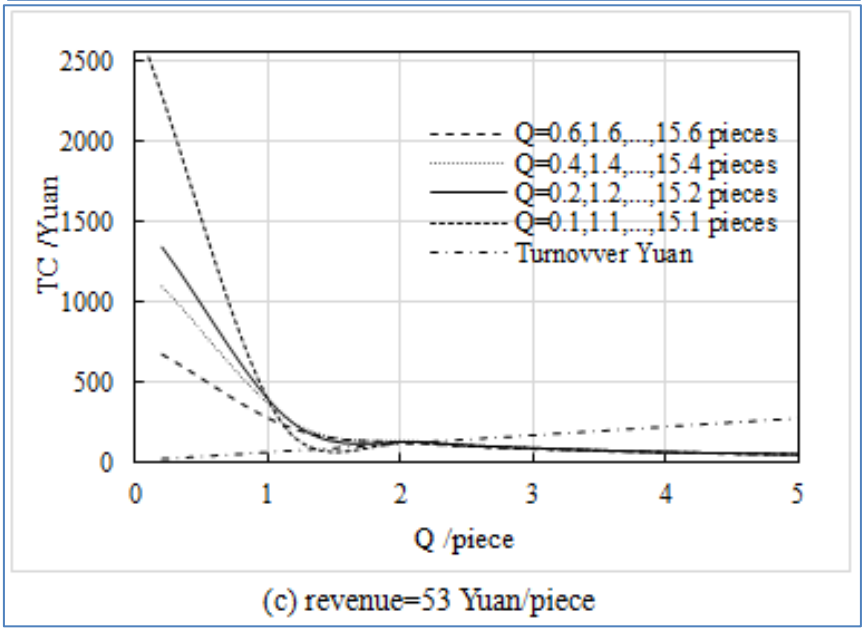
As seen in Figure 1 it is found that with inclining the quantity Q the total cost will decline steep before 1.5 pieces and then it declines sluggishly. Furthermore the revenue line will intersect the four curves at 2.5 pieces which explains the profit point is 130 Yuan at this piece. The parameter is P_l=2Yuan and P_k= 5Yuan. The step quantity will affect the total cost which will decrease from 2500 Yuan、1400Yuan、1100Yuan & 700 Yuan to 200 Yuan with increasing the value from 0.1、0.2、0.4& 0.6 as seen in Figure 1. Meantime the profit point increases from 2.5, 2.3, 2 and 1.8 pieces which explain the bigger profit will be earned by us with the value decreasing as the price increases from 43Yuan to 72Yuan in this best status.



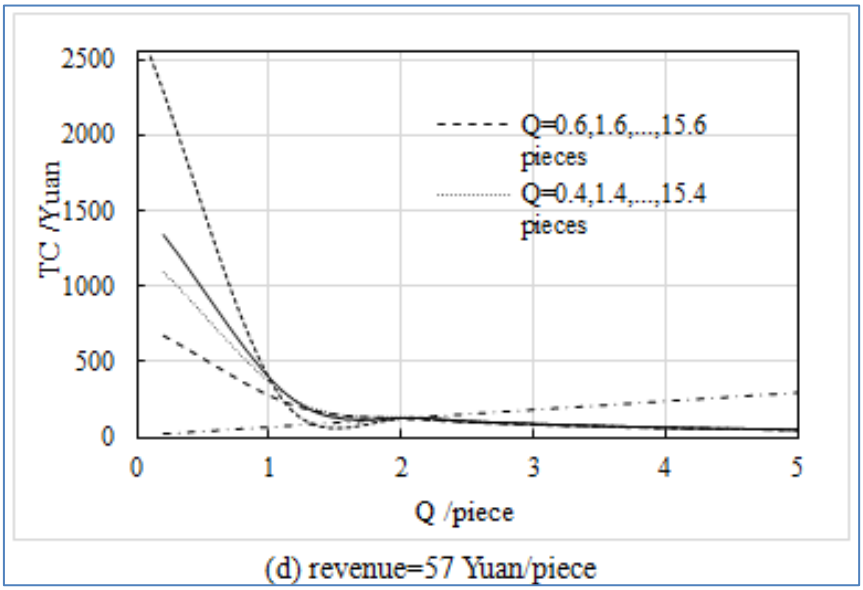
(a) revenue=43 Yuan/piece



(b) revenue=47 Yuan/piece



(c) revenue=53 Yuan/piece



(d) revenue=57 Yuan/piece

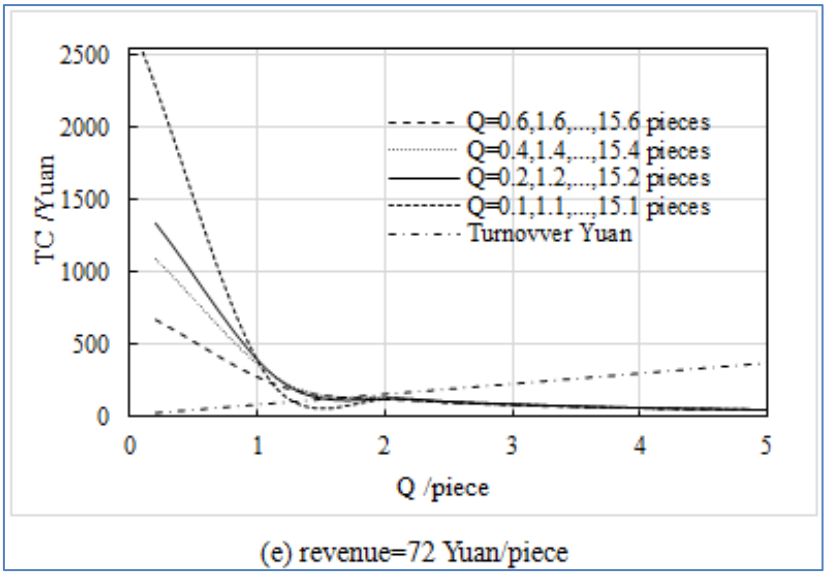


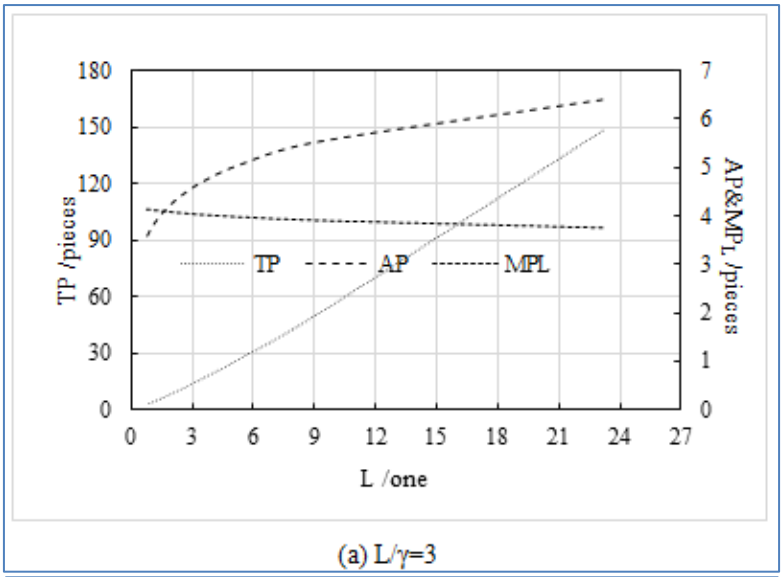
Fig-1: The least total cost and revenue distribution with the quantity of product under different quantity in wheel hub press in vehicle under the best L &K.

As seen in Table 1 it is found that with inclining the quantity Q the three coefficients will decline. So average coefficient is adopted to this programme the labor and capital quantity increase from 0.5 to 1.6. So the above curve is not the same as these coefficients because they are by step 0.4times. We investigate its step and find the little difference.

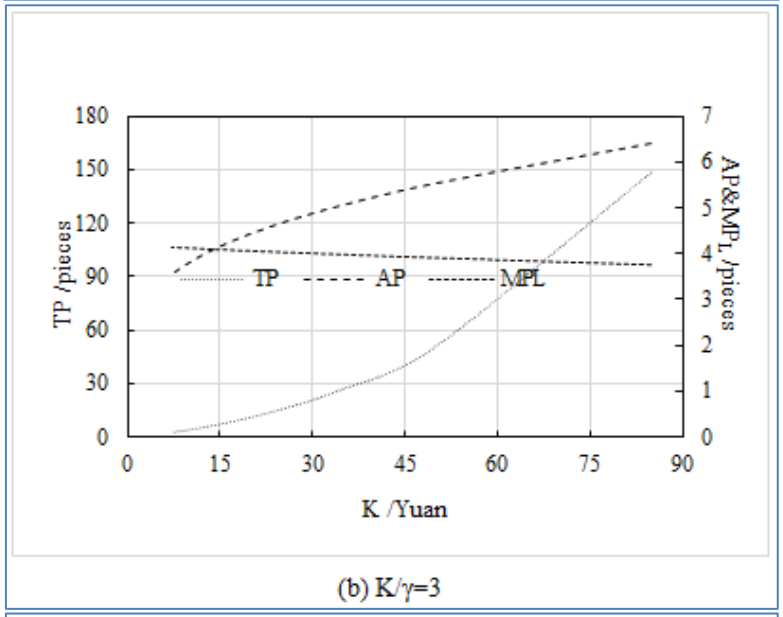
In Figure 2(a~b) the total products will increase as the labor and capital inclines. MPK is the first factor to affect production quantity and then TP, MPL and AP. The turn is MP_K>TP>MP_L>AP in terms of graph. Furthermore K can substitute for L while others are unchangeable. The TP and MP_K is too big to attain several hundred which is super scale factory like the huge order quantity per minute. So bigger than 200 is not admitted.

Table-1: The conditions of original parameters and coefficient

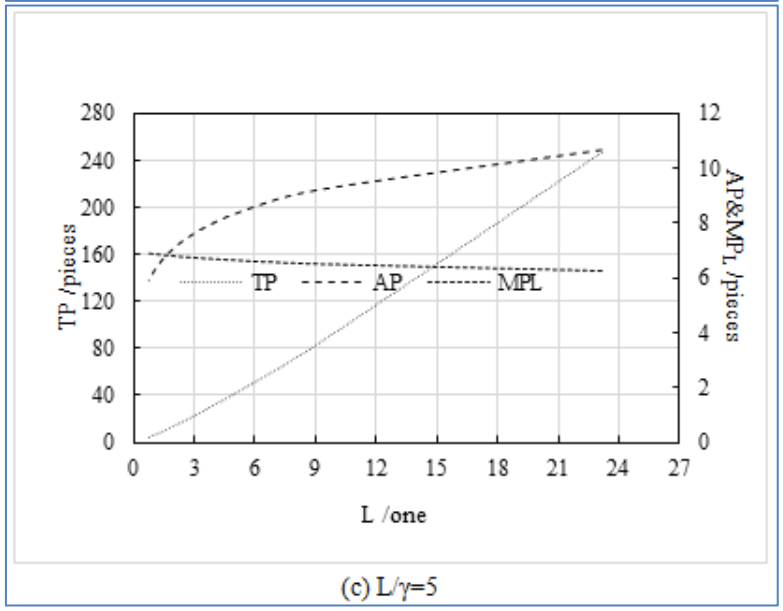
Parameters Value	L /One	K /Yuan	Q /m	α	β	γ
1	0.5	0.5	2.5	1.29	-0.22	5.57
2	0.6	0.6	3	1.22	-0.18	5.23
3	0.7	0.7	3.5	1.18	-0.15	5.11
4	0.8	0.8	4	1.15	-0.13	5.05
5	0.9	0.9	4.5	1.13	-0.12	5.02
6	1	1	5	1.12	-0.11	5.01
7	1.1	1.1	5.5	1.11	-0.10	5.00
8	1.2	1.2	6	1.10	-0.09	5.00
9	1.3	1.3	6.5	1.09	-0.08	4.99
10	1.4	1.4	7	1.08	-0.07	4.99
11	1.5	1.5	7.5	1.07	-0.07	4.99
12	1.6	1.6	8	1.07	-0.06	4.99
Average	-	-	-	1.12	-0.12	5.02



(a) L/γ=3



(b) K/γ=3



(c) L/γ=5

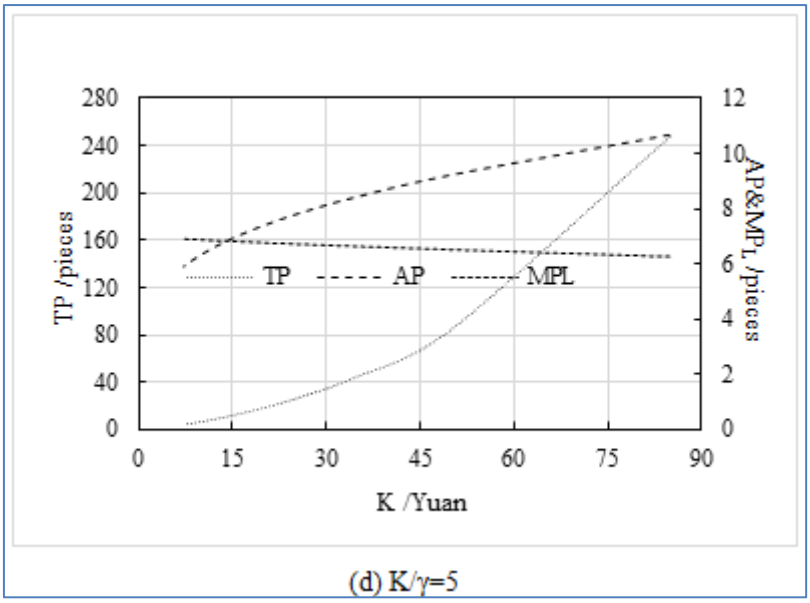


Fig-2: The relation of the biggest TP, MP & AP and L &K in γ=3&5 and best labor & capital for General motor of wheel hub pressing process.

In general as seen in Figure 2 the total product and AP will increase as the labor and capital increases whilst the MP_L will decrease. MP_K is too little about 0.1 to draw. The biggest one has been attained several hundreds pieces. This is only the biggest pieces we can consider it to reduce reasonable one. This needs a factory to produce these price. Due to its biggest total cost we may reduce it some to consider other factor such as sale planning and maintaining machine. The biggest total product is found to be 150 pieces with labor of 23 ones and capital of 88 Yuan in γ=3 meantime it is 240 pieces with the same value. It explains that the bigger times will cause the bigger γ from 3 to 5. Furthermore the average product is bigger than MP_L in quantity. So the turn of effect factor to product is $TP>AP>MP_L>MP_K$. As the γ increases the biggest product will increase whilst the average product will decrease. Finally the biggest AP increases from 3.5~4 to 6~7 pieces whilst the biggest MPL increases from 3.5~6.5 to 6~11with γ becoming from 3 to 5.

Here β is negative for convenience it is changed to positive. The turn point of the least total cost is about 100Yuan which means more than one machine is demanded each minute.

4. CONCLUSIONS

With the revenue is supposed that 43~72Yuan/piece the profit point will become smaller. At 72 Yuan/piece the point is 1.8 pieces. Meantime with the product step being bigger the biggest total cost will increase too. The least total cost is 100Yuan each minute at the turning point. α、β &γ is calculated to 1.12 、-0.12 & 5 respectively. The biggest total product and capital margin product & average product increases as the labor and capital increase. The turn of effect factor to product is $TP>AP>MP_L>MP_K$.

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