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Review Article

Economic Modeling of Profit Distribution with Cost and Quantity in Forge Process I

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Abstract: With the increasing labor quantity the profit may increase after a certain quantity, which means the deficit will be substituted by the benefit in forge process of screw. So that through turnover to be established the benefit may be formed after turn point. Detail value is needed to calculate the field according to the curves between them. The TC and AC is the first factor to consider and then AVC and AFC which is second factor. The profit point is 5.5 and 20.5 piece when labor is two. That means that in the scope of this field the profit may be available. When the labor and capital inclines the total cost will incline. Average cost is no proportion to total cost.

Keywords: Modeling; turnover distribution; economic cost and quantity; forge process; screw.

1. INTRODUCTION

The forge process of screw is an automatic flow production line with expensive machine. This process includes three punches ie. firsţ second and third punch and drawing & picking off processes in order to form the profile of screw from rod materials so it is an automatic process which completes five functions in whole manufacture. The profit is calculated through turnover and cost (ie. AC, TC, MC) which is an important factor in manufacture [1, 2]. In this paper the turnover has been computed and drawn from their relation with cost. The turnoveŗ 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 profiţ Longrun 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 longrun cost value for screw forging process [3, 4].

In the forge process the screw will be granted forge which is a important process to form complete profile semi-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. [3,4] 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. THE ECONOMICS MODELING

The Cobb-Douglas function is

$$Q = \gamma L^{\alpha} K^{\beta} \text{ --(1)}$$

Production quantity Q; γ is technique coefficient; α is producing labour; β is capital elasticity. It has

$$LN\gamma = LNQ - \alpha LNL - \beta LNK \text{ -----(2)}$$

Due to equation (2) it obtains

$$LN(Q_1/Q_2) = \alpha LN(L_1/L_2) + \beta LN(K_1/K_2) \text{ ----(3)}$$

Here, subscript 1 and 2, 3 is three coordinate.

$$LN(Q_2/Q_3) = \alpha LN(L_2/L_3) + \beta LN(K_2/K_3) \text{ -----(4)}$$

α is solved in terms of (3) it can be gotten

$$\alpha = \frac{LN(Q_1/Q_2) - \beta LN(K_1/K_2)}{LN(L_1/L_2)} \text{ -----(5)}$$

$$\text{And } \alpha = \frac{LN(Q_2/Q_3) - \beta LN(K_2/K_3)}{LN(L_2/L_3)} \text{ -----(6)}$$

In terms of above equation it can be gotten

$$\beta = \frac{LN(Q_1/Q_2)LNL_1 - LN(Q_1/Q_2)LN(L_1/L_2)}{LN(K_1/K_2)LNL_1 + LN(K_1/K_2)LN(L_1/L_2)} \text{ ---(7)}$$

$$\beta = \frac{LN(Q_1/Q_2)LN(L_1/L_2) + LN(Q_2/Q_3) - LN(Q_1/Q_2)}{[-LN(K_1/K_2) + LN(K_2/K_3)]LNL_3 + LN(K_2/K_3)} \text{ ---(8)}$$

From equation(2) it has

$$\gamma = EXP(LNQ - \alpha LNL - \beta LNK) \text{ ----(9)}$$

The formulas for cost control are listed as below

$$AC = TC/Q \text{ -------(10)}$$

$$MP_L/P_L = MP_K/P_K \text{ ------(11)}$$

$$TC = KP_K + LP_L \text{ --------(12)}$$

$$MP_K = dTP/dK \text{ ------(13)}$$

$$MP_L = dTP/dL \text{ ------(14)}$$

$$AP = TP/L \text{ ------(15)}$$

$$\text{And } Q = T_t^{'} \text{ -------(16)}$$

$$A_t = T_t/Q \text{ ------(17)}$$

Here, K is capital; L is labour; TC is total cost;VC is variable cost. AC is average cost; AFC is average fixed cost; AVC is average variable cost ; A_t is average turnover; T_t is turnover. Formula of (16) is deduced for the average turnover with quantity in this study. The calculated constant is γ=4; α=1.28; β=0.11 respectively. The parameter P_l (Labor price) is 0.7RMB and P_k (Capital price) is 0.1RMB. Turnover is in terms of 0.55RMB/unit per unit ie. 10 pieces in this paper. The price per minute is 1.65 RMB/min for one unit. The detail narration is expressed as below.

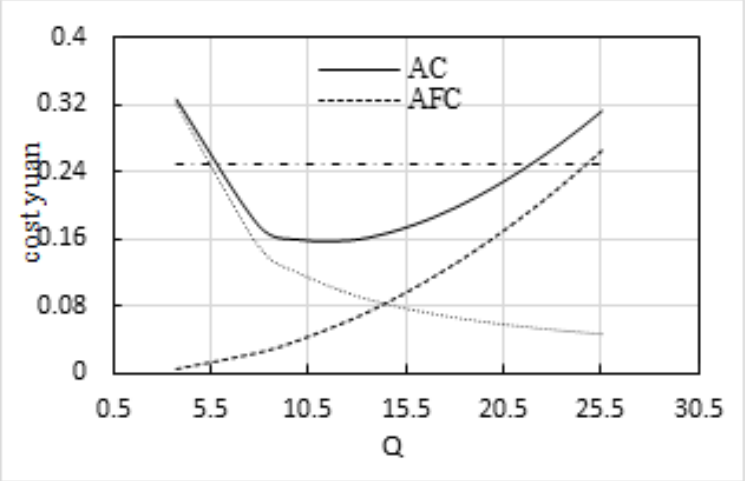
Table-1: The conditions of original parameters and coefficient

Parameters No.	L /No.	K / yuan	Q, /m	α	β	γ
1	0.4	0.4	1.6	1.4	0.2	4.6
2	0.5	0.5	2	1.3	0.2	4.4
3	0.6	0.6	2.4	1.2	0.2	4.1
4	0.7	0.7	2.8	1.2	0.2	4
5	0.8	0.8	3.2	1.2	0.1	4
6	0.9	0.9	3.6	1.1	0.1	4
7	1	1	4	1.1	0.1	4
8	1.1	1.1	4.4	1.1	0.1	4
9	1.2	1.2	4.8	1.1	0.1	4
10	1.3	1.3	5.2	1.1	0.1	4
Average	0.6	0.6	2.4	1.2	0.1	4

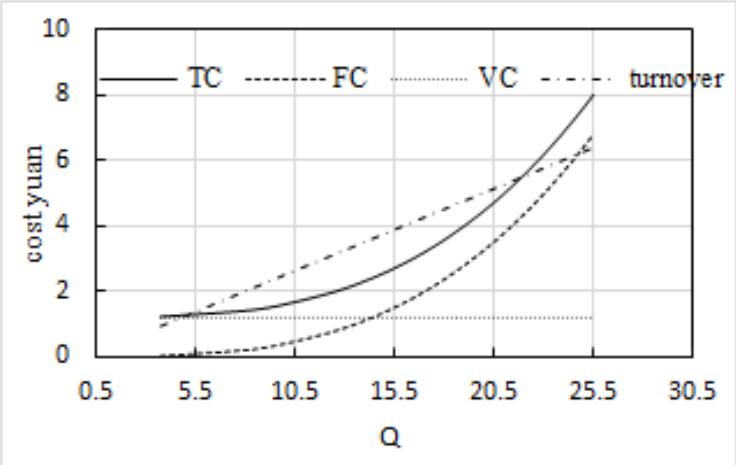
3. DISCUSSIONS

As seen in Table 1 the data is shown that it is status of original parameters L, K &Q and solved coefficient α, β& γ in terms of above equations in this study. It is adopted that 10 numbers of these three coefficient to solve the average to define their value. In terms of these data the cost and profit curve is simulated and the graphs are drawn. Figure 1(a,b) according to independent variable L and K the AC is main factor, its value is less than AVC and more than AFC under 0.2RMB. The turnover is about 0.2 Yuan which intersects with AC at quantity of 5.5 which may be the turning point when the labour and capital quantity is variable. It may be said that the beyond this point the profit will be gained and less than it the loss will gained. As seen in Figure 1(b) when L and capital quantity is variable the longrun costs TC shows linear distribution with goods quantity when they are variable. They are intersected at 20.5 of goods quantity too which explains when the quantity is below this value it will produce deficit. Only the quantity arrives more than this value we will benefit from this process. In this study the total cost is preciser than average cost ie. TC>AC. Meantime the turnover line will meet VC at less than 2 quantity which expresses that low VC in this case. With the increasing the goods quantity these three longrun cost will incline too. As seen in Figure 2(a ~f) the different status will happen with Figure 1(a &b), (c &d) and (e &f) of L=2, L=4 &L=6 respectively besides their value being big. This is cost inclined since the labour quantity inclines. Moreover the point inclines from 20.5 to more than 60 quantity when labor increases from 2 to 4 which is bad effectiveness. So the total quantity inclines from 2 labors to 6 labors which is also due to the inclining labors quantity.

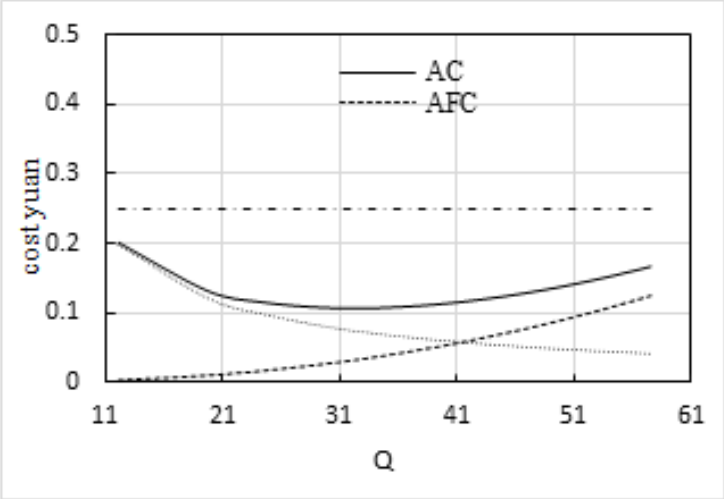
In Figure 1(e~f) when L and K increases the turnover line intersects with 4 at turnover of 0.2Yuan/piece. If the turnover is below it the littler turnover may be earned but that benefits to large sale. If it is above it the high turnover is necessary to meet small sale.



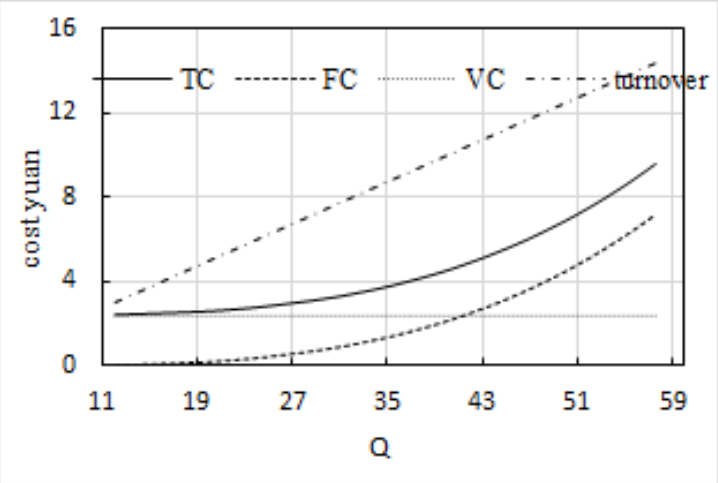
(a) L=2



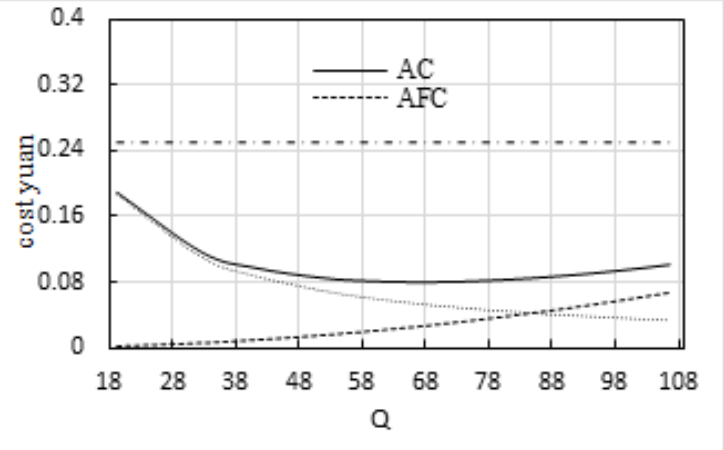
(b) L=2


0.5
0.4
0.3
0.2
0.1
0
cost yuan
AC
AFC
11
21
31
41
51
61
Q

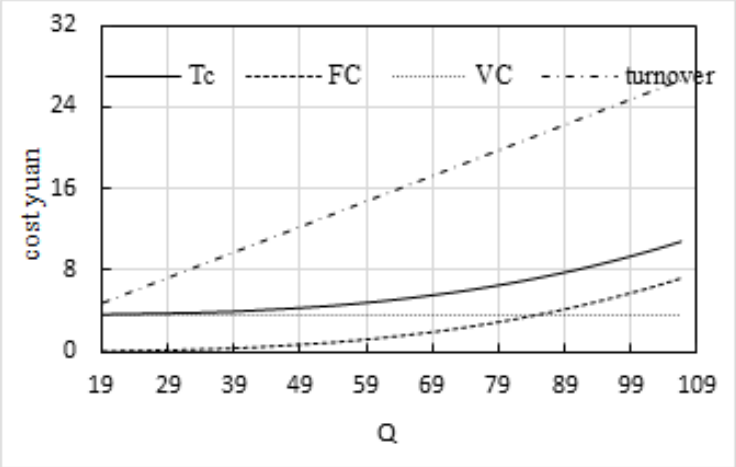
(c) L=4


16
12
8
4
0
cost yuan
TC
FC
VC
turnover
11
19
27
35
43
51
59
Q

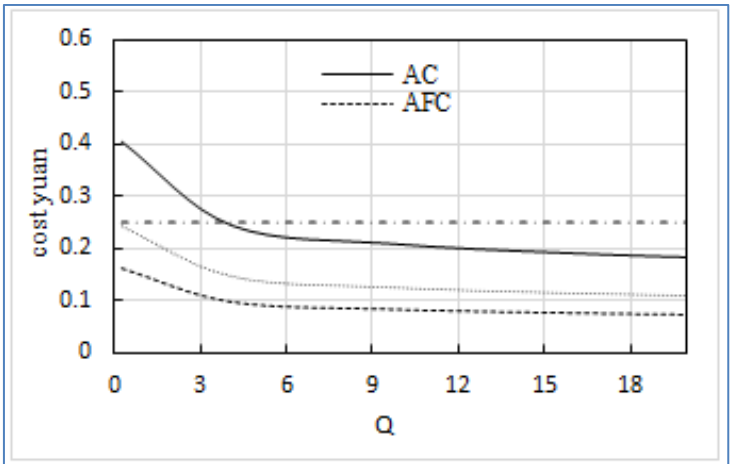
(d) L=4


0.4
0.32
0.24
0.16
0.08
0
cost yuan
AC
AFC
18
28
38
48
58
68
78
88
98
108
Q

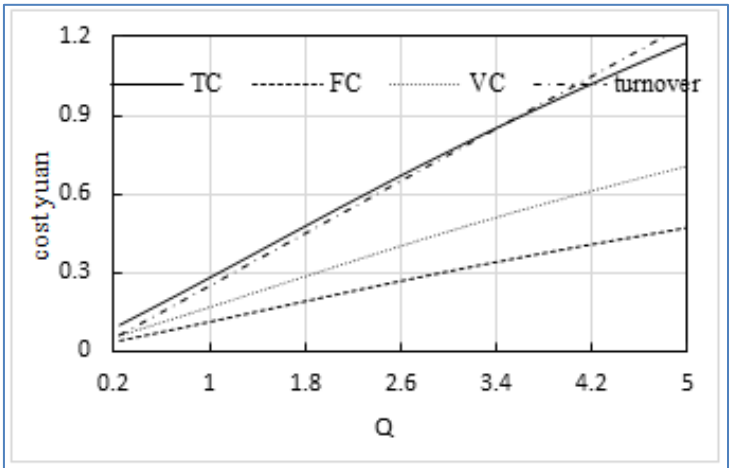
(e) L=6



(e) L=6



(e) L &K=1,2,...14

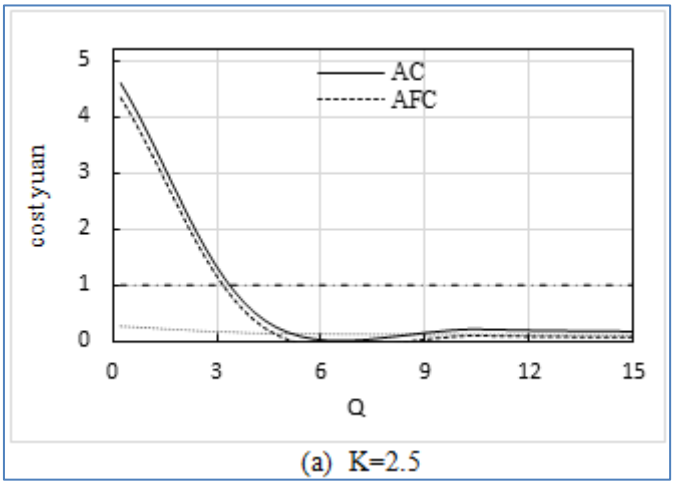


(f) L &K=1,2,...14

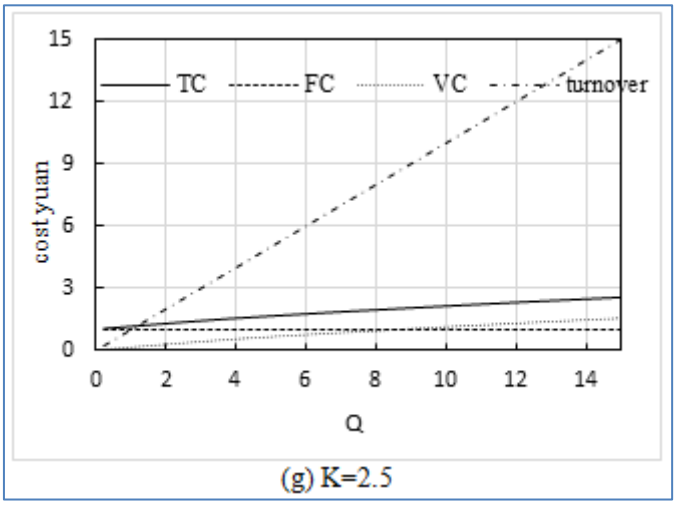
Fig-1: The drawing between turnover and cost with quantity and K under L and 0.2 RMB/piece in forging process

As seen in Figure 2(a~f) with the increasing goods quantity the TC will incline too while the other two will incline under 0.2RMB. The decreasing TC is due to increasing goods quantity and L. With the labor K inclining the TC inclines. TC declining means total cost will decline which causes good effectiveness if there is a more control. It is needed that the TC is main parameter so it is firstly needed check. It is big value than AC&VC and FC， then check later two. Usually AC is cost in a piece, AVC and AFC is cost a piece. AC is larger than AVC and AFC while TC is larger than the AVC&AFC. TC is usually the first factor to estimate the cost; VC and FC is the second factor to estimate. Here

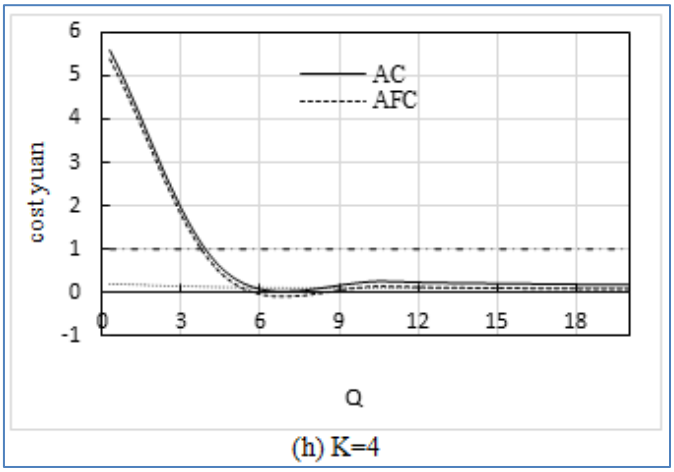
when K increases the AC has bigger good quantity. The AC quantity may incline when the K inclines from 2.5 to 5.5 yuan, meantime their point with turnover has inclination which is from 5.5 to 20.5 quantity. It explains that more capital will decline the AC one but it can change the turn point more ie incline the turn point value which explains bigger quantity is needed. Due to the declination of AC the more benefit may be earned because the capital is increased.



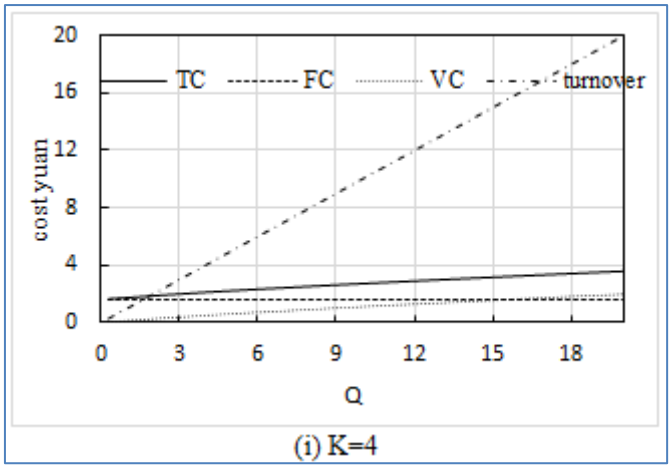
(a) K=2.5



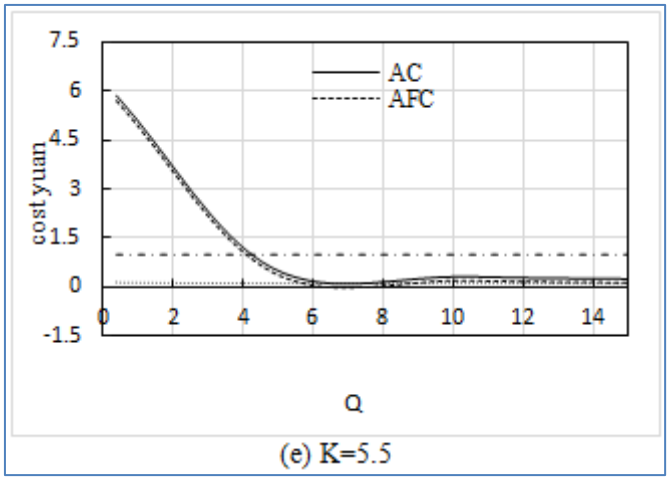
(g) K=2.5



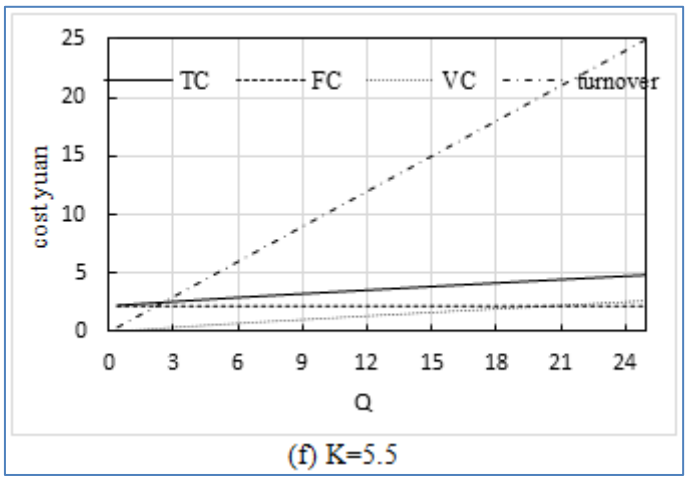
(h) K=4



(i) K=4



(e) K=5.5



(f) K=5.5

Fig-2: The drawing between turnover and cost with quantity and L under K and 0.9RMB/piece in forging process

The reasonable value we can calculate is K with 2.2 and L with 1.4 as seen in Figure 2 and 3 while the turn point changes from 5.5 to 20.5 in Figure 3 with K increasing by step that means that the labour and capital may increase the total cost as above. To find these ones three figures are drawn respectively. It is found that turn point 20.5 changes big profit at L being 2 and the quantity is 3 with a little incline at K being 4. In Figure 2(a~d) the second point is formed with AC at the 20.5 quantity. Moreover the AFC meets turnover at 25 pieces in Figure 1(a,b) as L=2 and it meets turnover at more than 60 as L=4 in Figure 1(c, d). When the capital and labor is defined the benefit and cost may be known under the condition being defined.

In short the AC changes from 15.5 to 20.5 whilst TC changes a little with the same value in terms of K=2.5 and 4. It explains that AC is more sensitive than TC even if TC is more precision. It is needed that both of AC and TC will be considered in this study. AC is clearer than TC in terms of average one, on the other side TC will include objective directly. Even if TC satisfies the total amount AC may not have more benefit which is considered more. The profit is the turnover subtracts the TC. When the difference is bigger the profit is big. Here the 1yuan is proposed as for K value but as for L 0.5yuan is proposed. This difference is caused by the parameters in Cobb-Douglas function. So the turnover is higher to K than to L.

4. CONCLUSIONS

With the increasing labor quantity the profit may increase after a certain quantity, which means the deficit will be substituted by the benefit in forge process of screw. So that through turnover to be established the benefit may be formed after turn point. Detail value is needed to calculate the field according to the curves between them. The TC and AC is the first factor to consider and then AFC and AVC which is second factor. When the relation between turnover and TC will be known so the quantity of goods may exceed the turn point. But the quantity can not be too big because the labor cost may be increased. The AC quantity may incline when the K inclines from 2.5 to 5.5 yuan.

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