Scholars Journal of Engineering and Technology

OPEN ACCESS

Abbreviated Key Title: Sch J Eng Tech
ISSN 2347-9523 (Print) | ISSN 2321-435X (Online)
Journal homepage: https://saspublishers.com

Economic Modeling of Profit Distribution with Cost and Quantity & Technology on Wheel Hub Pressing in Dongyue Maker

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DOI: 10.36347/sjet.2021.v09i06.001 | **Received:** 23.05.2021 | **Accepted:** 28.06.2021 | **Published:** 04.07.2021

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Abstract **Review Article**

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 hub. 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 has one piece when labor is constant. 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. With increasing stress and diameter the force may increase.

Keywords: modeling; turnover distribution; economic cost and quantity; P_L &P_K; L & K; forge process; hub; Dongyue.

1. INTRODUCTION

The forge process of hub is an automatic flow production line with expensive machine. This process includes three presses ie. First heat second feeding and third pressing and 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 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 turnover 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 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 hub forging process [3-4].

So drawing the graph of cost and parameters has important role as for the machines one of which is heat press and the another is cold press. But in terms of calculating the heat capability has less fee so it is only several cents neglected by us. Only if the more than several ten rods it is considered further.

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. THE ECONOMICS MODELING

The Cobb-Douglas function has been fundamental formula in microeconomics. It has included labor and capital & coefficient in function. It is needed that firstly to solve and then we can proceed next step, like quantity and Total cost which can be solved. The reasonable value for labor and capital is defined too in terms of equations finally. We use ten group of data to define the three coefficients and compare their distinction to use with mean method. Eventually the production graph and original raw material size and condition has been given in this paper to check the production properties and cost have been investigated in terms of technology. The modeling is not included in this paper because it will be published in another paper simultaneously in this journal. Let us modeling this course now.

It has

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

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

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

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

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

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

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

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

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

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

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; Labor price P_L=25 & capital price P_K=5 is defined here so L=9 & K=20 is the reasonable parameter after careful computation. Formula of (16) is deduced for the average turnover with quantity in this study. The calculated constant is γ=3; α=1.14; β=0.12 respectively. The parameter of 108 Yuan/min &54 Yuan/piece has been used to simulate then use ATH and ATL represents average high turnover and low one respectively. The detail narration is expressed as below.

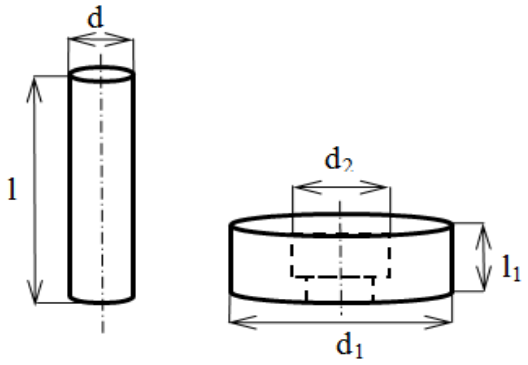


Fig-1: The drawing on rod materials and product after process in forging process.

As seen in Figure 1 the raw material is left and right is hub form which is after forging press. Here the form is completed by once. In the Table 1 all the technological parameters are shown in terms of Figure 1. Here d is material diameter; l is its length; d_2 is hub internal diameter; d_1 is hub external diameter; l_1 is length of hub.

Table-1: The conditions of original parameters and coefficient

Parameters / Value	l /cm	l_1 /cm	d/cm	d_1/cm	d_2/cm
-	30	5	5	20	15

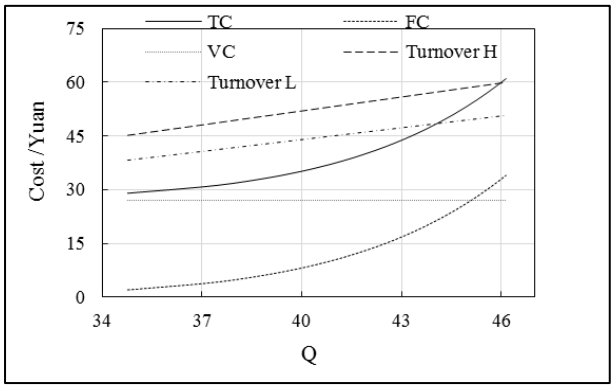
Table-2: The conditions of original parameters and coefficient

Parameters / No.	L /quantity	K /Yuan	Q/m	α	β	γ
1	0.1	0.1	0.3	-	-	-
2	0.2	0.2	0.6	1.6	0.7	3
3	0.3	0.3	0.9	1.4	0.4	3
4	0.4	0.4	1.2	1.2	0.3	3
5	0.5	0.5	1.5	1.2	0.2	3
6	0.6	0.6	1.8	1.2	0.2	3
7	0.7	0.7	2.1	1.1	0.1	3
8	0.8	0.8	2.4	1.1	0.1	3
9	0.9	0.9	2.7	1.1	0.1	3
10	1	1	3	1.1	0.1	3
11	1.1	1.1	3.3	1.1	0.1	3
Average	1.15	1.15	3.45	1.11	0.1	3

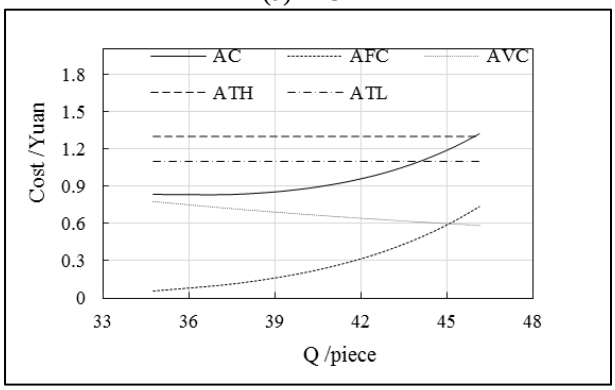
3. DISCUSSIONS

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 11 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 the total of AVC and AFC under 1.3 and 1.1Yuan. The turnover is about 1.3 and 1.1Yuans which intersects with AC at quantity of 46 &43 respectively 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(a) when L and capital quantity is variable the longrun costs TC shows nonlinear distribution with goods quantity when they are variable. They are intersected at 46 of goods quantity too which explains when the quantity is below this value it will produce deficit. Here the intersection point is the same which expresses that the consistency attribution. 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 lower VC than one quantity in this case. With the increasing the goods quantity these three longrun cost will incline too. As seen in Figure 1(a-f) the different status will happen with Figure 1(a & b), (c & d) and (e & f) of L=9 L=11 & L=1-17 respectively besides their value being big. This is cost inclined since the labour quantity inclines. Moreover the point inclines from 45 to more than 57 quantity when labor increases from 9 to 11 which is bad effectiveness. So the total quantity inclines from 9 labors to 11 labors which is also due to the inclining labors quantity.

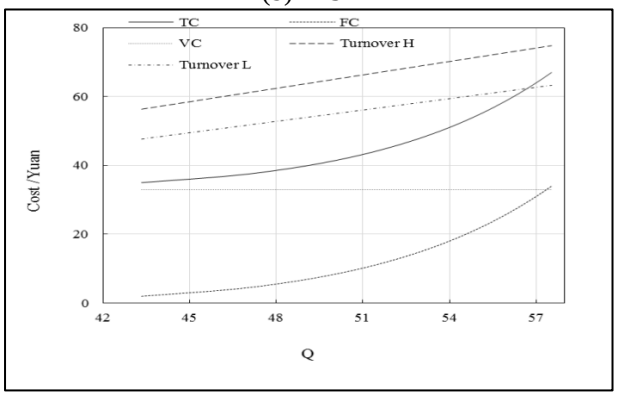
In Figure 1(e-f) when L and K increases the turnover line intersects with 11 at turnover of 1.3 Yuan/piece. If the turnover is below it the littler turnover may be earned but that benefits to large sale. If it is above it the high turnover is necessary to meet small sale. In this study the total cost and average cost is the same which explains that it is consistency from this calculation and precision.



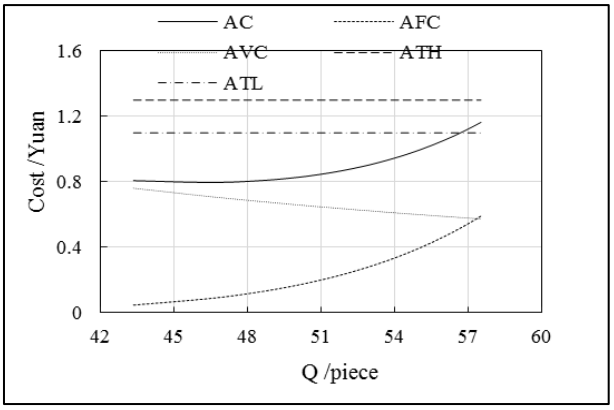
(a) L=9



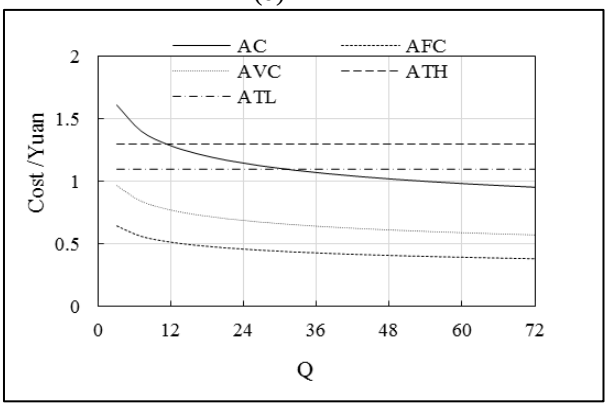
(b) L=9



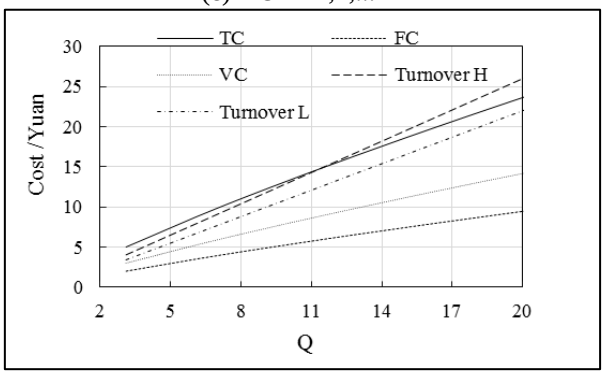
(c) L=11



(d) L=11



(e) L &K=1,2,...17

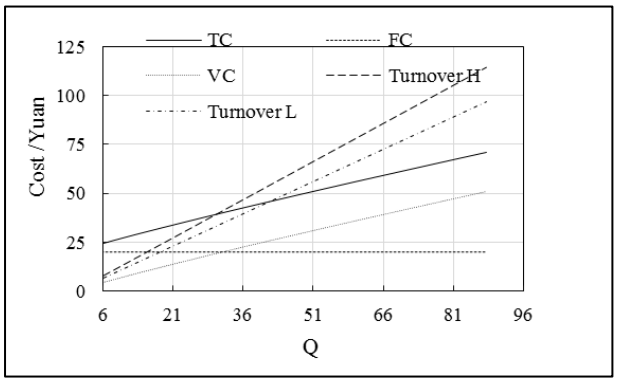


(f) L &K=1,2,...17

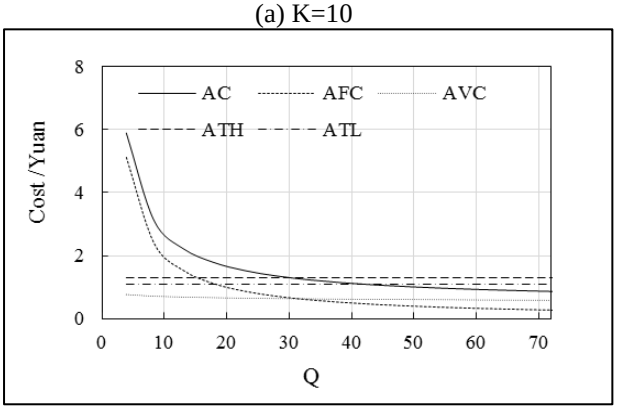
Fig-1: The drawing between turnover and cost with quantity under L and K in forging process.

As seen in Figure 2(a-f) with the increasing goods quantity the TC will incline too while the other two will incline under 0.2Yuan. 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

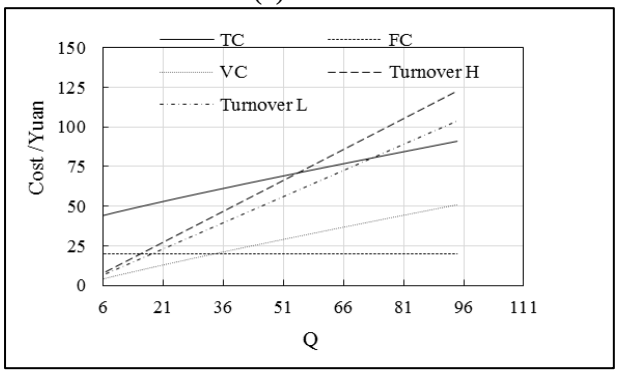
inclines from 10 to 20 Yuan, meantime their point with turnover has inclination which is from 37 to 68 quantity. It explains that more capital will decline the AC one but it can change the turn point more ie incline the turn point value which explains bigger quantity is needed. Due to the declination of AC the more benefit may be earned because the capital is increased. In this study the turn point is the same with turnover line intersecting to TC, FC,VC & AC, AFC, AVC in Figure 2(a, b, c & d) respectively. So this may have plastic in terms of this modeling and it will wield its function in economic activity. For example the automatic flow line need control like labour quantity, capital quantity and commodity quantity & all kinds of cost and turnover to determine the profit quantity for manufacturer. Not only in the process but also in a factory may it be used to complete all kinds of information to check the price and turnover in terms of requirement quantity in the end.



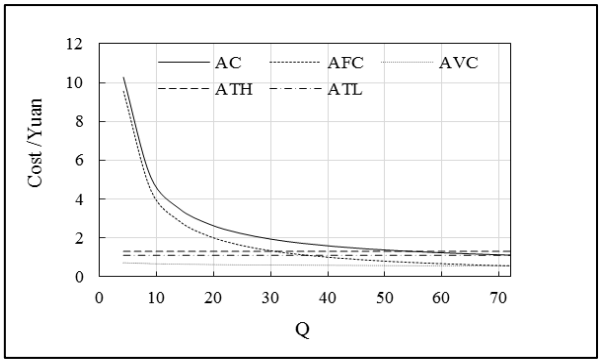
(a) K=10



(b) K=10

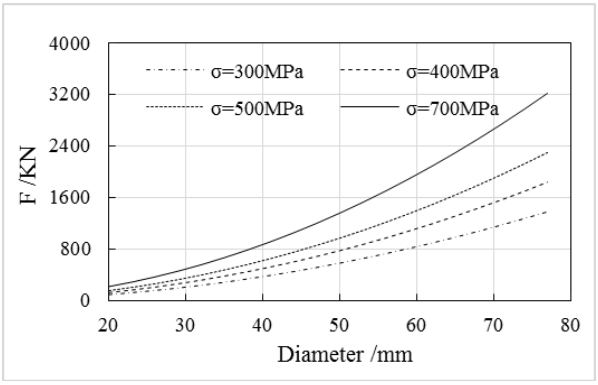


(c) K=20

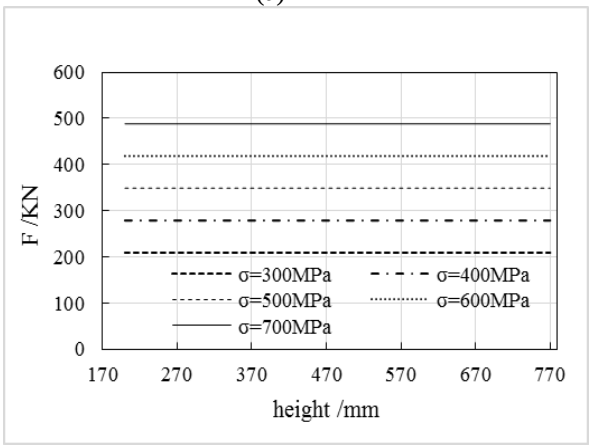


(d) K=20

Fig-2: The drawing between turnover and cost with quantity under K in forging process.



(a) F-D



(b) F-H, D=30mm

Fig-3: The drawing between force and diameter &length with strength and diameter at 6r/m in forging process.

The reasonable value we can calculate is L with 9 and K with 20 when P_L=37, P_K=7.5 drawn as seen in Figure 2(a, b, c & d) while the turn point changes from 37 to 68 in Figure 2 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 37 changes big profit at K being 10 and the quantity is 68 with a little incline at K being 20. In Figure 2(a-d) the point is formed with AC and ATH at 52 with AC and ATL at the 68 quantity. Moreover the AVC meets turnover at 15 pieces as L is constant in Figure 1(a, b, c

& d). When the capital and labor is defined the benefit and cost may be known under this condition.

From Figure 3(a-b) the force may incline when the diameter and pressure inclines and it may maintain the constant one when the height inclines at 6r/m in this process. If the stress of 400~500MPa is reasonable from the drawing. Furthermore if diameter is 30mm the stress of 500MPa is the mediate one. The reasonable force is 80Tons with diameter of 50mm and 400 MPa while it is 35Tons with diameter of 30mm and 500MPa. They are both satisfied big capacity and usual one.

In general that AC is more sensitive than TC while 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 Yuan is proposed as for K value but as for L 1.1Yuan 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 hub. 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 10 to 20 Yuan.

The reasonable force is 80Tons with diameter of 50mm and 400 MPa while it is 35Tons with diameter of 30mm and 500MPa. They are both satisfied big capacity and usual one for lower cost.

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