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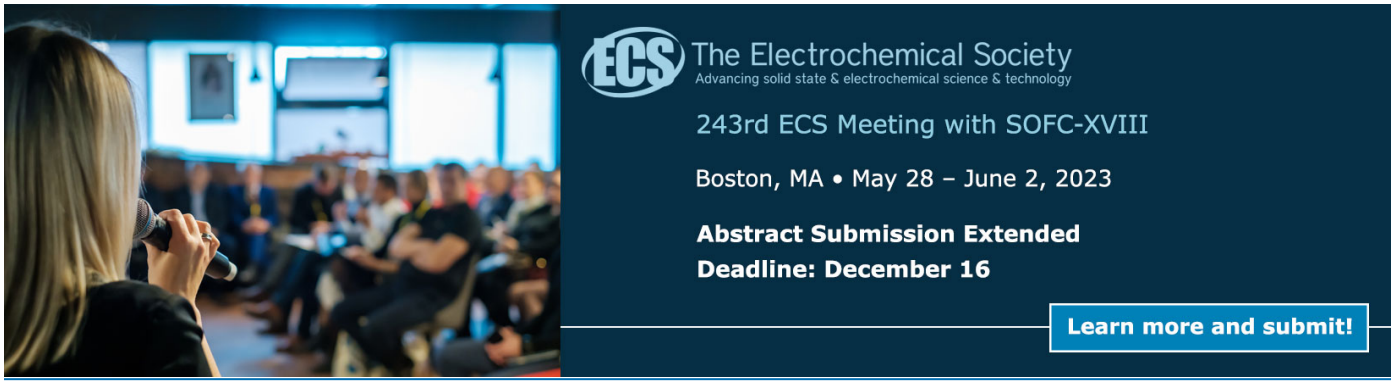

Profit functions of catfish farming for increasing household income in Pekanbaru City Riau Province

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Abstract. The profit of catfish farm is a description of performance of the business, where the profit is determined by output and inputs price. This study aims to analyze of catfish farm profits and determinants of catfish farm profits. This study used a survey method, located in Pekanbaru City. The research data are cross section data what was obtained by using the inverview method, The sampling method used simple random sampling method with 98 catfish farmers, Data analysis used statistical analysis with multiple linear regression. There are several findings: First, catfish farms in Pekanbaru City is profitable. Second, the catfish price, labor wages, feed price PF 1000 depresiation costs are significantly to affect profits, but the price of seed and feed PF 800 do not significantly to effect it. The Third, catfish price s responsive to changes in profit of catfish farm. This is means to changes catfish prices have a major impact on changes in catfish farm profits. However, labor wages, feeds and depreciation cost are not responsive to farm profits. This study recommends that the output price policy is very important for the sustainability of this business.

1. Introduction

Catfish is a freshwater fish, Catfish is widely consumed by the peoples because tastes delicious fried or grilled, Furthermore, it contains nutritional value of protein, fat, phosphorus, calcium, iron, sodium, or thiamine and riboflavin are needed for body, The advantage catfish is high amino acids leucine and lysine important for growth and development children [1].

Nutritional needs of fish consumption are increasing, Statistical data shows the national fish consumption in 2020 is 56.39 kg/capita, it up 3.47% from the previous year, Increasing fish consumption, would be promote increasing fish production, one of which is catfish.

Fish needs in Pekanbaru city are obtained from marine fish, originating from West Sumatra, Tembilahan, and Bengkalis. Fish availability depends on season, strong winds such as north wind season, fishermen difficult it, Supply of fish to Pekanbaru city will decrease. The lack supply of fish can be fulfilled from freshwater fisheries, one of which is catfish.

Pekanbaru City is one of the freshwater fish producing areas. Farmers cultivate catfish, because; short harvest age (3 months); large fast; and maintenance is easy. Catfish production in Pekanbaru City is found in Tenayan Raya District, Tampan District, Bukit Raya District, and Rumbai Pesisir District. Catfish production in Pekanbaru City tends to increase from 2016-2020, Data on the development of catfish is presented in Figure 1.

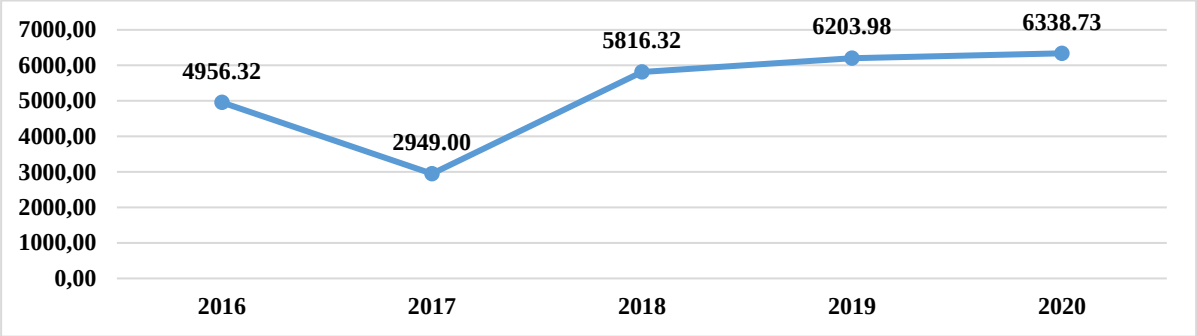

Figure 1. Development of Production Catfish in Pekanbaru City. 2016-2020

Figure 1 shows catfish production an increasing trend, although in 2017 its production decreased. The average growth is 0.16 per year. The increase in fish production makes fish farmers interested in continuing the catfish farming, The sustainability of the business can be seen from the profits.

Catfish farm profit is determined by the cultivator as a decision maker. Fish farmers allocate production factors to achieve their goal, maximum profit. Production factors in catfish farm consist of; ponds, labour, seeds, feed, fertilizer, and lime [2–4]. Fish farmers allocate production factors efficiently, Efficient production factors will produce optimal production with maximum profit.

Profit enlargement catfish farm is the difference between revenue and production costs that have been allocated in the catfish farm enlargement. The level of profit will be obtained if total revenue is greater then cost of production (total cost). Revenue is the multiplication of price with the sold production. Production costs are all costs incurred by fish farmers, which include labour costs, seeds costs, feed costs, fertilizer costs, and lime costs. The amount production costs are determined by price factors production and amount using factors production [5–8].

The profit function is a function of the output price and variable input price. Output prices are directly proportional to profits, meanwhile input prices are inversely proportional to profits [5,9]. Several studies show business profits are determined by output prices, variable input prices and fixed inputs [7,10–12]. The concept of profit can be applied to catfish farm enlargement.

Problem this research is how much the catfish profit level and factors affect the catfish farm profit. This study aims to analysis profit of catfish farm and factors influence profits, and response of catfish prices, prices of their inputs to profits business.

2. Method

This study used survey method, located in Pekanbaru City, Riau Province. Population was all catfish farmers in Pekanbaru City, samples were taken 4 sub-districts, i,e, Tenayan Raya sub-districts; Tampan sub-districts; Bukitraya sub-districts; and Rumbai Pesisir sub-districts. Reason for choosing the location is catfish producer area. The sampling method used simple random sampling, total sample of 98 catfish farmers. Research data are primary data, involve characteristics of farmers catfish, use of catfish production factors, production, price of production factors. Data analysis using farming analysis, consist of:

2.1. The level of profits cathfish,

Obtained with formula:

$$\pi = TR - TC \quad (1)$$

Description:
π : Profits of catfish (Rp/harvest)
TR : Total Revenue (Rp/harvest)
TC : Total Cost (Rp/harvest)

Total Revenue (TR) is obtained multiplying production with price of catfish, Total Cost (TC) is calculated entire costs, involve fixed costs (depreciation of equipment) and variable costs. Total costs or production costs are obtained by formula:

$$TC = TFC + TVC \quad (2)$$

$$TC = (FC1+FC2) + (VC1+VC2+VC3+VC4) \quad (3)$$

Description:
TC : Total Costs (Rp/harvest)
TFC : Total Fixed Costs (Rp/harvest)
TVC : Total Variable Costs (Rp/harvest)
FC1 : Cost of equipment depreciation (Rp/harvest)
FC2 : Cost of fishpond depreciation (Rp/harvest)
VC1 : Cost of labour (Rp/harvest)
VC2 : Cost of seeds (Rp/harvest)
VC3 : Cost of feed PF800 (Rp/harvest)
VC4 : Cost of feed PF1000 (Rp/harvest)

2.2. Factors of catfish profit business

Influencing factors of profits used multiple linear regression, with estimation method *Ordinary Least Square* (OLS). The profit model of catfish farm enlargement in this study can be formulated as follows [5,9];

$$\pi = f(\rho.r_{1.}r_2 \ldots . r_n) \quad (4)$$

Description:
π : Profit
ρ : Output price
r_1 : Input price $_1$
r_2 : Input price $_2$
r_n : Input price $_n$

Based on equation (4), inputs used catfish farm enlargement are labour; seeds; and feed. Furthermore, for this study, the profit function catfish farm enlargement is influenced by price of catfish; labour wages; seed prices; and feed prices. Equation (4) can be converted as a profit function for the enlargement business.

$$\pi = f(\rho.r_{1.}r_2.r_3.r_4) \quad (5)$$

Equation (5) written with profit model of catfish farm enlargement i.e.

$$\pi = a_0 + b_1\rho + b_2r_1 + b_3r_2 + b_4r_3 + b_5r_4 + b_6r_5 + \epsilon \quad (6)$$

Expected estimated parameters: α_0, $b_1 > 0$ dan $b_1, b_2, b_3, b_4, b_5, b_6, < 0$,

Description:
π : Profit catfish farm (Rp/harvest)
ρ : Price catfish (Rp/harvest)
r_1 : Labour wages (Rp/harvest)
r_2 : Price of seed (Rp/harvest)
r_3 : Price of feed PF1000 (Rp/harvest)
r_4 : Price of feed PF800 (Rp/harvest)
r_5 : Cost of depreciation (Rp/harvest)

The assumptions used in this study are: (1) catfish cultivators as businessmen maximize profits, and (2) catfish cultivators buy production inputs and selling in perfectly competitive market.

Before the estimation of multiple regressions model, the data used should be ensured free of irregularities classical assumptions for multikolinearitas, heteroskesdasitas, and autocorrelation [13–18]. The classic test can be regarded as an econometric criterion to see if the results meet the basic classical linear estimation or not. With the fulfilment of these classical assumptions then the estimator Ordinary Least Squares (OLS) regression coefficient of linear bias is not the best estimator BLUE (Best Linear Unbiased Estimator) [13,17,19–22], that phase estimate obtained corectly and effectively. One of the assumptions that must be met to satisfy BLUE properties are homoskedasticity, when assumptions are not met, then the opposite is true, which means that heteroskedasticity test error variance is not constant. Variance this constant error that does not lead to the conclusion reached is invalid or bias.

In order to provide valid results in econometric necessary to test some of the assumptions of normality econometrics covering, multicollinearity, heteroscedasticity and autocorrelation of the equation in the regression model [13,17,19–22]. For the normality test is to use the Shapiro Wilk test statistic as follows [14,17,21–23]:

$$W = \frac{\left[\sum_{i}^{h} a_n\left(\tilde{e}_{(V-1+1)} - \tilde{e}_{(i)}\right)\right]^2}{\sum_{i=1}^{h}(\tilde{e}_i - \tilde{e})^2} \quad (7)$$

$$V = T - K\ nj$$

Description
H : n/2 for even numbers or the (n-1) for an odd number,
v : degrees of freedom
T : number of observations
K : number of variables
a,i…n = parameters of the Shapiro-Wilk statistical,

Multicolinierity test is used to determine whether there is a correlation between the independent variables in the regression model. To mendektesi multikolinieritas in a model made by looking Variance Inflation Factor (VIF) to the equation, as follows [13,20,21]: Variance Inflation Factor = 1/ tolerance.

Multicollinearity problems become very serious if the variance inflation factor of greater than 10 while the multicollinearity problem is not considered serious if the value is smaller variance inflation factor equal to 10.

Heteroskedastisitas detection is used to determine whether a variant of the confounding variable is not constant for all observations. Heteroscedasticity problem detection using Breusch-Pagan test [21–23] with the following formula:

$$\sigma_i^2 = \sigma^2 h\left(z_i^1 \alpha\right) \quad (8)$$

Description
h : Unknown elements, which is a function derived continuously (does not depend on i) that h (,)> 0 and h (0) = 1.
z : variables that affect terms distrubance variance. Value Statistics Bruesch-Pagan insignificant showed no problems heteroskedastisitas.

Autokolerasi used to determine whether a linear regression model there is a correlation between the member observai one other observation moved at different times. To test for autocorrelation using Durbin Watson, with the following formula [21–23]:

$$d = \frac{[\sum_{t=1}^{t=n}(\hat{e}_t - \hat{e}_{t-1})]}{\sum_{t=1}^{t=n}\hat{e}_t^2} \quad (9)$$

Description
d : coefficient of Durbin-Watson
n = sample
e = residual
When du <d <4 - du means no autocorrelation positive / negative

3. Result and Discussion

3.1. Profit Catfish Farm

The profit is determined sustainability business. Catfish farm profits are obtained from reducing total revenue (TR) with total costs (TC), The level of profit catfish farm is presented in Table 1.

Table 1. Production Cost, Revenue and Profit Farm Catfish in Pekanbaru City, 2021

Explanation	Value (Cultivated Area)	Value (1 M^2)	Percentage (%)
Fixed Cost (Rp/Production)	212,719.53	584.80	0.42
Variable Cost (Rp/Production)	50,841,830.68	139,773.32	
a, Labor	6,553,583.23	18,016.98	12.84
b, Fish Seed	4,455,517.86	12,249.02	8.73
c, Feed	39,832,729.59	109,57.32	78.02
Total Cost (Rp/Production)	51,054,550.21	140,358.12	-
Revenue (Rp/Production)	69,958,456.89	164,836.56	-
Profit (Rp/Production)	18,903,906.68	24,478.44	-
RCR	1.37		-

Table 1 shows the production cost catfish IDR 51,054,550.21/production period/ arable area. Total costs consist of depreciation costs, labour, fish seeds and feed. Largest cost is feed cost of 78.02 % and smallest is depreciation cost of 0.42 %, The amount of fish feed costs will determine fish production. The more feed given will increase catfish production.

The results of research by [12,24,25] total costs catfish consist of variable costs (such as catfish seeds, feed, labour, fuel, water, electricity, transportation, and other costs). Fixed costs (such as depreciation of equipment, concrete pool, ground pool and loan interest. Of all these, cost of feed is biggest in the costs structure catfish farm.

Cost structure catfish consists of variable costs and fixed costs, Contributed variable costs to total cost of 98.06% and fixed costs 1.91%[24]. The largest variable cost is from feed it was 73.56%, Several other studies have shown that the cost feed for catfish contributed largest more than 60% of the total production costs [12,24–26]. Catfish feed is the main ingredient in catfish farming. While other costs (such as labour costs, fish seeds and depreciation cost) are the smallest component in catfish farming.

This study resulted in a catfish farm profit IDR 8,903,906.68/production period or 24,478.44 per M^2. Farming efficiency is calculated using the return cost ratio (RCR). The RCR value of this study was 1.37. This value means if the cost catfish farm is allocated IDR 1, then catfish farm will a profit IDR 0.37. RCR values of catfish farm in Nigerian countries such as Abia, Anambra and Ebonyi were 1.29; 1.34; and 1.20 [25]. When compared with the results of this study, RCR value of catfish farm is not

much different. The other hand, there is a difference with research prepiously is obtained RCR value 1.66 [27].

3.2. Determinants of Catfish Profit

The profit of catfish farm is thought to be influenced by catfish prices, labor input prices, catfish seed prices, feed prices and depreciation cost. Results of estimation variables that affect catfish profits, are presented in Table 2.

Table 2. Estimation Result of Catfish Farm Profit Model in Pekanbaru City, 2021

Variable	Parameter Estimation	t Value	Pr > |t|	VIF	Elasticity
Intercept	7,204,956	0.60	0.55		
Price of catfish	1,337.84	1.98	0.05*	1.04	1.29
Labor wages	-49.52	-1.81	0.07**	1.32	-0.32
Price of Seed	-6,145.73	-0.18	0.86	1.40	-
Price of Feed PF 1000	-551.69	-8.34	<.0001*	1.32	-0.15
Price of Feed PF 800	-95.18	-0.14	0.89	1.34	-
Depreciation	-13.10	-3.22	0.002*	1.95	-0.18
R-Square					0.6374
Fsig					<0.0001
Durbin-Watson					0.67

* : Level of confidence 95 %
** : Level of confidence 95 %

Table 2 shows variable price of catfish, price of feed PF 1000, depreciation costs and labour are significantly affected the profits catfish enlargement, with confidence level at 95 and 90 percent. Meanwhile, variables price of catfish seed and price of feed PF 800 did not significantly affect profit catfish farm. Price of catfish is significant and has a positive effect on production. Its means, higher price of catfish, profits will increase. Thus, sign variable price catfish is in accordance with hypothesis. Input price variables (labour wages, prices of seed, price of feed PF 1000, price of feed PF 800 and depreciation) have a negative effect on catfish farm profit. This means, the higher (labour wages, prices of seed, price of feed PF 1000, price of feed PF 800 and depreciation), the lower of catfish farm profit. Thus, sign variables are in accordance with hypothesis. More number of significant independent variables (4 of 6 significant variables), the household expenditure model of catfish farm is good.

The results F test probability value of F = 0.0001, with confidence level of $\alpha = 0.001$. This means that the variables of catfish prices, labour wages, prices of seed, price of feed PF 1000, price of feed PF 800 and depreciation simultaneously have a significant effect to catfish farm profit variables. This means, catfish farm profit model is statistically good,

According to the statistical model, it can be seen the value of the coefficient of determination (R^2). The results showed that the value R^2 was 0.6374 (63.74%). This means that the variation of independent variables (prices of catfish, labour wages, prices of seed, price of feed PF 1000, price of feed PF 800 and depreciation) can explain the profit of catfish farm by 63.74%. Residual 36.26% is explained by other variables, and they are not entered into model which is represented by error term variable. The household expenditure model of catfish farm statistically is good.

A model is a good or appropriate, if the model can be identified, has a model suitability (Goodness of Fit) and theoretical consistency. The model can be identified, meaning that the parameter estimation results have only one estimate for each parameter. Model suitability is the basic strength analysis can explain as much as possible the variation independent variable on the dependent variable in the model. This is indicated by value of coefficient of determination (R^2). The higher value R^2 is considered a good

or appropriate model. Assessment of theoretical consistency can be seen by the sign of the estimated parameters in accordance with the theory or not deviating from the theory [14,19,21,23,28].

Based on the explanation above, it can be concluded that the catfish farm profit model is good or appropriate. This can be seen from the estimation result; one independent variable only has one parameter value. The value of the coefficient determination (R^2) is above 50 % and is classified as high. It means the model Goodness of Fit criteria are achieved. The theoretical consistency criteria in this profit model are also in accordance with the theory and the research hypothesis is proven. Thus, the profit function model of catfish farm enlargement in Pekanbaru city is:

$$\pi = 7{,}204{,}956 + 1{,}337.84HL - 49.52WTK - 6{,}145.73HB - 551.69PF1000 - 95.18PF800 - 13.10BP \quad (10)$$

Description:

π	: Profit of enlargement catfish farm
HL	: Prices of catfish
WTK	: Labour wages
HB	: Prices of seed
PF1000	: Price of feed PF 1000
PF800	: Price of feed PF 800
BP	: Cost of depreciation

3.2.1. Price of Catfish. The result of catfish farm production is fresh catfish. Fish are sold by farmers to collectors, then the price of catfish used in this study is the price at the farm level. Selling price of catfish at the catfish farmers is around 14,000-15,000 IDR per kg.

Table 2 shows, price of catfish have a significant and positive effect on the profits received by fish farmers, with a confidence level of 95 %. The estimated parameter value is 1337.83, its means that an increase price of catfish 1 IDR, will increase the profit received farmer 1337.83 IDR.

Elasticity value of catfish price to profits farm is 1.29. This value means if price of catfish increases 1 percent, profit received by catfish farmers is 1.29 %. Elasticity value means the price of catfish is responsive to changes to profits farm. In other words, changes in catfish prices have a big impact on changes in profit farm. To increase the profits of catfish farmers, a catfish price policy is needed.

The results of this study are in line with [15]; catfish farm is profitable. The price of catfish has a positive effect to profits farm. This indicates that the higher output price will increase the income and profits of catfish production.

3.2.2. Labour Wages. Labour wages are remuneration provided by employers to workers due to the working time allocated to a business, Labour wages have a positive effect on production costs, the higher of wages thus the higher production costs. When production costs are high, farm profits are low.

The results of study (Table 2) show that labor wages have a significant and negative effect on farm profits at the 90 % confidence level. Estimated parameter value is 49.52, the value means an increase in labor wages 1 IDR, will reduce fish farm profit 49.52 IDR. The results are in accordance with hypothesis based and theory, that input prices are negatively related to profits [5,9,29,30]. The results of previous studies show that the results same, labor wages are negatively related to profits received by farmers [8,10,30–32].

Elasticity value of labor wages to farm profit is 0.32. Its means if labor wages increase 1%, profit received catfish farmers is 0.32%. Labor wages are not responsive to changes in farm profits. Thus, changes in labor wages have a small impact on changes in farm profit.

3.2.3. Prices of Seed Catfish. Catfish seeds are an important production factor to produce catfish production, the more spread of catfish seeds will increase catfish production. Utilization of these production factors is determined by the price of the seed, the higher price of seed, fish farmers will

reduce the amount of seed utilization because total costs will be high. The alternative, farmers can utilization local fish seeds that are not superior seed and the price is cheaper. Higher total costs will reduce farm profits.

Table 2 shows that the price of catfish seed has no significant effect on farm profits, because number of seeds used by farmers is still below the recommended standard and the quality is still not seed superior. Standard number of catfish as much as 200 fish/m^2 [4,11,33], while the amount of catfish seeds used by farmers is 150.92 fish per M^2. Although the price of seeds does not significantly affect the profit, thus the sign estimated parameter is in accordance with the theory, the sign is negative. This means that the higher price of catfish seeds, the lower the profit received by farmers.

3.2.4. Prices of Feed Catfish. The feed used by catfish farmers is pellets trademarks PF 800 and PF 1000, PF 800 pellets are catfish seed feed, is given when the seeds spread in the pond, until catfish is 10 days old. PF 1000 pellets were given by farmers when the catfish 10 days old until catfish were harvested.

Table 2 shows that PF 1000 pellets had a significant and negative effect on profits, at 90 % confidence level, yet PF 800 did not significantly affect profits. Estimated parameter value PF 1000 is 551.69, it means an increase price of PF 1000 1 IDR, will reduce profit received by catfish farmers 551.69 IDR.

The results of this study are suitable with theory, price of production factors is negative on farm profits [5,9]. Later, price of feed PF 1000 have a negative effect on farm profits, [32] feed of fish had a negative effect on profits received by farmers.

Value elasticity of feed PF 1000 on farm profits is 0.15, it means if price PF 1000 is increases 1 percent, profit received by catfish farmers decreases 0.32 %. The elasticity value shows that the price of PF 1000 is not responsive to changes in farm profits, changes in the price PF 1000 have a small impact on changes in farm profits.

3.2.5. Cost of Depreciation. Depreciation cost is the depreciation value of the equipment used in enlargement catfish farm, depreciation cost is calculated in rupiah per production process. Depreciation costs in this study are very small, 0.42 % of total production costs.

The results showed that depreciation costs were significant and had a negative effect on farm profit, at 95 % confidence level (Table 2). Parameter value of estimated depreciation cost is 13.10. It means an increase in depreciation costs 1 IDR, will reduce profit received by catfish farmers 13.10 IDR.

Results are suitable with research hypothesis; in some studies, the depreciation cost is represented by the investment capital variable [32]. Equipment depreciation cost is represented as investment capital, yet investment capital does not significantly affect to farm profits.

Elasticity value of depreciation cost to farm profit is 0.18. It means if depreciation cost increases 1%, profit received by catfish farmers decreases 0.18%. Elasticity value shows that depreciation costs are not responsive to changes in farm profit, changes in depreciation costs have a small impact on changes farm profit.

3.2.6. Classic Assumption Test. Classical assumption test is needs in this research, because used multiple linear regression analysis which is estimated using Ordinary Least Square (OLS) method. The classical assumptions are normality, multicollinearity, heteroscedasticity, and autocorrelation. The results of the classical assumption test of this study are presented in Table 3.

Table 3. Classical Asumption Test for Catfish Enlargement Farm Profit Model in Pekanbaru City, 2021

Classical Asumption Test	Statistics Test	Statistics Value	Probability
Normality Test	Shapiro-Wilk	0.95	0.0019
Multicollinearity Test	VIF	1.04-1.95	-

Heteroscedasticity Test	White's Test	54.39	0.0014
Autocorrelation Test	Durbin Watson	0.673	<.0001

Table 3 shows the probability value for each test below 5 percent and VIF value (Variance of Inflation Factor) below 10. This means that the catfish farm profit model does not infringe the assumptions of normality, multicollinearity, heteroscedasticity, and autocorrelation. The profit model of enlargement catfish farm is econometrically correct.

4, Conclusion

Enlargement catfish farm in Pekanbaru city is profitable and feasible. The total costs of the catfish farm consist of depreciation cost for ponds and equipment, labor costs, seeds, and feed. Cost of feed is the largest contribution to total costs of catfish farm. Significantly factors affect to profit catfish farm are price of catfish, labor wages, feed FP 1000 and depreciation costs. Meanwhile, price of seed variable and feed FP 800 variable did not significantly affect to profit farm. Price of catfish has a positive effect on profits, while price of feed; price of seeds; and labor wages have a negative effect on profit catfish farm. Price of catfish is responsive to changes in the profit enlargement catfish farm. It means changes in catfish prices have a major impact on changes in catfish farm profit. However, labor wages; feed; and equipment depreciation are not responsive to farm profits. Although feed is higher contributing to production costs, it will reduce profits, yet an increase in catfish prices will be able to eliminate the increase of feed prices. Further, catfish price policy is very necessary, is profitable and its farming continues.

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