

ECONOMIC ANALYSIS OF TEMPEH INDUSTRY HOUSEHOLDS IN BEJI VILLAGE, JUNREJO SUB-DISTRICT, BATU CITY

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Abstract. The household economy of the tempeh industry is inseparable from several blocks of production equations, work time, income, and expenses. Generally, tempeh makers use imported soybeans as the main raw material because it has more suitable characteristics compared to local soybeans. This study aimed to analyze the household economy at home in the tempeh industry in Beji Village, Junrejo Subdistrict, Batu City based on the four blocks, namely production, work time, income, and expenses. The population in this study were active tempeh crafters in Beji Village, totaling 131 crafters. Thus using the Simple Random Sampling method which is done randomly. The data analysis method uses simultaneous equation analysis, formulated into a simultaneous equation with the two-stage least squares (2SLS) method. The results of the research show that the household economic research of the tempeh industry in Beji Village consists of 4 blocks, 8 structural similarities and 4 identity similarities. From the model identification above, it shows that all equations are over identified so they can be directly analyzed using 2SLS. Based on the results of parameter estimation in the production, working time, income and expenditure blocks, the R^2 value in each equation in each block analyzed, the coefficient of determination value ranges between 90-100%, this shows that all the independent variables analyzed are able to explain the dependent variable. The Fcount and Tcount values for each equation also show that all equations have an effect both simultaneously and partially.

Keywords: Household economy; production; income; labor time; expenditure; two stage least squares.

INTRODUCTION

Tempeh industry in Beji Village, specifically focusing on the use of imported soybeans as raw materials and the impact of the COVID-19 pandemic on the industry. Tempeh, a traditional food in Indonesia, is made from fermented soybeans processed with *Rhizopus* sp. mould microorganisms. While tempeh production in Beji Village has thrived and become a Micro, Small and Medium Enterprises (MSME), it heavily relies on imported soybeans due to their lower prices compared to local soybeans. This is a cause for concern as it affects the quality of the tempeh and could lead to financial losses and a decrease in consumers.

The COVID-19 pandemic has had a significant impact on various aspects of society, including MSMEs. The tempeh industry in Beji Village has also been affected, with many MSMEs experiencing a loss of buyers and their sales channels being cut off. Despite the Indonesian government's efforts to provide financial stimuli to MSME actors, these measures have not been enough to prevent the bankruptcy of MSMEs. The pandemic has disrupted not only the health and mobility of individuals, but also the productivity of industries and economies, as well as the needs of families for daily living, education funding, and unexpected expenses.

To further illustrate the effects of the pandemic on the tempeh industry in Beji Village, data from the Beji Village Hall in Batu City shows a significant decline in the number of operating tempeh industry houses. In 2020, there were 200 tempeh industry houses, but by 2022, 69 of them had ceased operating. This represents a decrease of more than one-third, leaving only 131 tempeh industry houses still in operation. This decline in productivity and the closure of businesses highlights the challenges faced by the tempeh industry in Beji Village due to the ongoing pandemic.

In conclusion, the tempeh industry in Beji Village heavily relies on imported soybeans, which impacts the quality of the product. Additionally, the COVID-19 pandemic has resulted in a loss of buyers and disrupted sales channels, leading to a decrease in the number of operating tempeh industry houses. The pandemic's effects on health, mobility, and the economy have also created difficulties for MSMEs, despite government efforts to provide financial support. This highlights the need for sustainable solutions to address the challenges faced by the tempeh industry in Beji Village, such as promoting local soybean production and finding innovative ways to boost sales and adapt to the changing market conditions brought about by the pandemic.

METHODS

2.1 Materials

The material and method of determining the sample of artisans for the primary data was carried out in stages. At first, Beji Village, Junrejo Sub-district, Batu City was selected purposively with the consideration that the production of tempeh is the largest with the name of Tempeh Kreasi Village. The research area was chosen with the justification that the tempeh artisans of the village did: (a) non-house diversification of the tempeh industry, especially raising livestock, employees, and the results of processed tempeh and processed soybeans. Such non-household diversification is generally a source of income for the crafters' households apart from the tempeh industry; (b) some crafters conduct work activities mainly in non-farm activities; and (c) based on BPS criteria, some crafters' households are classified as poor.

The sampling technique used, namely Simple Random Sampling. Based on the calculation using the slovin formula method, a sample of 58 respondents was taken in this study. Secondary data is taken from various sources that are considered relevant and the data is able to support research activities.

2.2 Methods

The analysis method used in this research is descriptive analysis, useful for analysing the household economy of the tempeh industry in Beji Village. The analysis used is a simultaneous equation to answer the problems that affect the household economy of the tempeh industry in Beji Village.

The household economic model was formulated into a simultaneous equation with the two-stage least squares (2SLS) method (Widarjono and Pengantar 2016). The equation is specified into four blocks, as follows:

1. Production block.

a. Production capacity

$$KPRO = a_0 + a_1 JKRM + a_2 JTGK + a_3 MDUH \dots \dots \dots (1)$$

Where:

KPRO : production capacity
JKRM : machine working hours
JTCK : labour hour
MDUH : business capital once production

b. Tempeh production

$$PTKD = b_0 + b_1 JMKD + b_2 TKDK + b_3 TKLK + b_4 HRRG + b_5 HRAB \dots \dots \dots (2)$$

Where:

PTKD : soybean tempeh production
JMKD : the amount of soybean
TKDK : family labour
TKLK : labour from outside the family
HRRG : price of yeast
HRAB : price of clean water

c. Productivity of soybean tempeh

$$PRTK = PTKD / KPRO \dots \dots \dots (3)$$

Where:

PRTK : the productivity of soybeantempeh
PTKD : the production of soybean tempeh
KPRO : production capacity

2. Labour time block

a. Husband's working time in tempeh industry home business

$$\text{CKSU} = c_0 + c_1 \text{CKST} + c_2 \text{BYTK} + c_3 \text{JMAK} + c_4 \text{PTKE} + c_5 \text{USUA} \dots (4)$$

Where:

CKSU : the husband's work time in the tempeh industry house
CKST : the husband's work time other than the tempeh industry house
BYTK : the cost of labour
JMAK : the number of family members
PTKE : tempeh business income
USUA : the husband's age

b. The wife's working time in the tempeh industry house

$$\text{CKIU} = d_0 + d_1 \text{CKIT} + d_2 \text{BYTK} + d_3 \text{PNPG} + d_4 \text{JMAK} + d_5 \text{PTKE} \dots (5)$$

Where :

CKIU : the wife's work time in the tempeh industry house
CKIT : the wife's work time other than the tempeh industry house
BYTK : labour cost
PNPG : non-food expenditure
JMAK : the number of family members
PTKE : tempeh business income

c. Family labour time in the tempeh industry house

$$\text{CKRT} = \text{CKSU} + \text{CKIU} \dots (6)$$

Where :

CKRT : family working time
CKSU : the husband's work time
CKIU : the wife's work time

3. Income block

a. Household income from tempeh industry house

$$\text{PDRT} = e_0 + e_1 \text{CKSU} + e_2 \text{CKIU} + e_3 \text{CKLT} + e_4 \text{PDLT} + e_5 \text{MDU} \dots (7)$$

Where:

PDRT : household income from the tempeh industry house
CKSU : the husband's work time in the tempeh industry house
CKIU : the wife's work time in the tempeh industry house
CKLT : the work of non-household tempeh industry families
PDLT : non-household income of the tempeh industry
MDUH : one-time production capital

b. Non-household income of tempeh industry

$$\text{PDLT} = f_0 + f_1 \text{CKLT} + f_2 \text{USUA} + f_3 \text{TBKS} \dots (8)$$

Where :

PDLT : household income non home tempeh industry
CKLT : the labour expenditure of non-household tempeh industry families
USUA : husband's age
TBKS : health savings

c. Total household income

$$\text{PTRT} = \text{PDRT} + \text{PDLT} \dots \dots \dots (9)$$

Where;

- PTRT : total household income
- PDRT : household income from the tempeh industry house
- PDLT : household income other than the tempeh industry house

4. Household expenditure block

a. Household food expenditure

$$\text{PPRT} = g_0 + g_1 \text{PNIT} + g_2 \text{JMAK} + g_3 \text{PNPG} + g_4 \text{JMAS} + g_5 \text{TBGN} \dots \dots \dots (10)$$

Where:

- PPRT : household food expenditure
- PNIT : revenue from the tempeh industry house
- JMAK : the number of family members
- JMAS : the number of school children
- PNPG : household non-food expenditure
- TBGN : savings

b. Household non-food expenditure

$$\text{PNPG} = h_0 + h_1 \text{PDTK} + h_2 \text{JMAS} + h_3 \text{IPDD} + h_4 \text{TBGN} \dots \dots \dots (11)$$

Where:

- PNPG : household non-food expenditure
- PDTK : total household income
- JMAS : school children
- IPDD : education investment
- TBGN : savings

c. Total household expenditure

$$\text{PGRT} = \text{PPRT} + \text{PNPG} \dots \dots \dots (12)$$

Where:

- PGRT : total household expenditure
- PPRT : household food expenditure
- PNPG : household non-food expenditure

RESULT AND DISCUSSION

4.1 Production Block Estimation

The results of the estimation of the household economy of the tempeh industry in Beji Village are divided into 3 different equations within the production block but are interrelated, these 3 equations are production capacity, tempeh production, and soybean tempeh productivity.

Table 1. Estimation of production capacity

Model	Variable	Parameter Estimation	P. value (Sig)	R.Square
KPRO	Constant	-2.819	0.304	0.999
	JKRM	0.987	0.268	
	MDUH	8.6745	0.000	

Source: Primary data, processed

$$\text{KPRO} = a_0 + a_1 \text{JKRM} + a_2 \text{JTGK} + a_3 \text{MDUH} \dots \dots \dots (1)$$

- F table = 2.40
- R² = 0.999
- F count = 26328.22

Table 2. Estimation of tempeh production

Model	Variable	Parameter Estimation	P. value (Sig)	R.Square
PTKD	Constant	-6.022	0.648	0.952
	JMKD	0.058	0.079	
	TKDK	-1.838	0.654	
	TKLK	0.377	0.080	
	HRRG	0.030	0.000	
	HRAB	-3.709E-5	0.838	

Source: Primary data, processed

$$PTKD = b_0 + b_1 JMKD + b_2 TKDK + b_3 TKLK + b_4 HRRG + b_5 JMAB \dots\dots\dots(2)$$

$$F \text{ table} = 1.96$$

$$R^2 = 0.952$$

$$F \text{ count} = 208.15$$

4.2 Estimation of Working Time Block

In this second block, it is grouped into 3 blocks of work time, including the husband's work time in the tempeh business, the wife's work time in the tempeh business, the family's work time in the tempeh business which is interrelated.

Table 3. Estimation of husband's working time in tempeh business

Model	Variable	Parameter Estimation	P. value (Sig)	R.Square
CKSU	Constant	709.884	0.002	0.489
	CKST	-0.745	0.000	
	BYTK	0.000	0.002	
	JMAK	-28.578	0.287	
	PTKE	3.4756	0.021	
	USUA	4.704	0.031	

Source: Primary data, processed

$$CKSU = c_0 + c_1 CKST + c_2 BYTK + c_3 JMAK + c_4 PTKE + c_5 USUA \dots\dots\dots(4)$$

$$F \text{ table} = 1.96$$

$$R^2 = 0.489$$

$$F \text{ count} = 9.97$$

Table 4. Estimation of wife's working time in tempeh business

Model	Variable	Parameter Estimation	P. value (Sig)	R.Square
CKIU	Constant	456.428	0.000	0.445
	CKIT	0.030	0.821	
	BYTK	-3.528E-5	0.700	
	JTGK	9.6027	0.068	
	JMAK	-19.025	0.532	
	PTKE	1.087E-7	0.952	

Source: Primary data, processed

$$CKIU = d_0 + d_1 CKIT + d_2 BYTK + d_3 JTGK + d_4 JMAK + d_5 PTKE \dots\dots\dots(5)$$

$$F \text{ table} = 2.19$$

$$R^2 = 0.445$$

$$F \text{ count} = 0.10$$

4.3 Revenue Estimation

In the income block there are 3 equations including household income from tempeh business, non tempeh business household income, total household income. The following are the estimation results:

Table 5. Estimation of household income from tempeh business

Model	Variable	Parameter Estimation	P. value (Sig)	R.Square
PDRT	Constant	91046360.15	0.000	0.455
	CKSU	24187.412	0.028	
	CKIU	3302.409	0.857	
	CKLT	-30684.329	0.048	
	PDLT	4.139	0.035	
	MDUH	2.329	0.560	

Source: Primary data, processed

$$PDRT = e_0 + e_1 CKSU + e_2 CKIU + e_3 CKLT + e_4 PDLT + e_5 MDUH \dots\dots\dots(7)$$

$$F \text{ table} = 2.40$$

$$R^2 = 0.455$$

$$F \text{ count} = 0.25$$

Table 6. Estimation of non tempeh business household income

Model	Variable	Parameter Estimation	P. value (Sig)	R.Square
PDLT	Constant	781855.080	0.375	0.457
	CKLT	8301.373	0.000	
	USUA	6141.248	0.730	
	TBKS	0.033	0.516	

Source: Primary data, processed

$$PDLT = f_0 + f_1 CKLT + f_2 USUA + f_3 TBKS \dots\dots\dots(8)$$

$$F \text{ table} = 2.19$$

$$R^2 = 0.457$$

$$F \text{ count} = 15.15$$

4.4 Expenditure Estimation

The expenditure block is the last of the four blocks that states about the expenditure aspect with 3 equations, namely household food expenditure, household non-food expenditure and total household expenditure which will be related to one another.

Table 7. Estimation of household food expenditure

Model	Variable	Parameter Estimation	P. value (Sig)	R.Square
PPRT	Constant	1279952.267	0.000	0.799
	PNIT	0.125	0.049	
	JMAK	-14155.576	0.061	
	PNPG	0.030	0.055	
	JMAS	38128.764	0.020	
	TBGN	0.004	0.598	

Source: Primary data, processed

$$PPRT = g_0 + g_1 PNIT + g_2 JMAK + g_3 PNPG + g_4 JMAS + g_5 TBGN \dots\dots\dots(10)$$

$$F \text{ table} = 1.96$$

$$R^2 = 0.799$$

$$F \text{ count} = 0.90$$

Table 8. Estimation of household non-food expenditure

Model	Variable	Parameter Estimation	P. value (Sig)	R.Square
PNPG	Constant	-1059079.733	0.000	0.968
	PDRT	0.943	0.000	
	JMAS	25757.241	0.037	
	TBGN	-0.001	0.872	

Source: Primary data, processed

$$\text{PNPG} = h_0 + h_1 \text{PDTK} + h_2 \text{JMAS} + h_3 \text{TBGN} \dots \dots \dots (11)$$

$$\text{F table} = 2.19$$

$$\text{R}^2 = 0.068$$

$$\text{F count} = 552.24$$

The results of this study are similar to research conducted by (Arianty 2017); (Mariyanto, Dwiastuti, and Hanani 2015); (Sina 2020); and (Datau, Saleh, and Murtisari 2017) who also used the household economic approach. Therefore, even if the price of yeast increases, it will not affect the production of tempeh. But on the contrary, if the price of soybeans increases, it will affect the production of tempeh and is influenced by other variables such as labor costs, food expenditures, clean water prices, electricity prices, and so on.. The results of this study are consistent with the results of research by Dwiastuti (2013) which shows that the production itself is positively influenced by the variable number of household members. (Widyanti, Susiladewi, and Alfisah 2020) emphasized that household size variables should be explicitly included in the consumption equation because household size is positively correlated with consumption expenditure.

This phenomenon can be explained by the actual conditions in the research area, where crafters' households have managed the time available to devote part of their time to work on activities outside the home industry to still obtain additional income without sacrificing their business. Therefore, the relationship between work allocation in the industrial house and outside the industrial house in this study is complementary, so the relationship between income from the industrial house and income from outside the industrial house is also complementary.

In general, the policy of dividing labour outside the industrial house is able to increase the total income of tempeh crafters' households, while the policy of relying solely on profits from industrial houses alone is considered less able to support household needs, so this policy is less appropriate. Therefore, the majority of tempeh artisans have jobs outside the industrial house, but if this is implemented in the study area, it will actually reduce the total household income of tempeh artisans.

There is a need for a policy to increase employment and the formation of a special association for tempeh artisans in rural areas by optimising the potential of local resources and home-based, for example increasing the added value of tempeh products such as processing tempeh brownis, tempeh pia, sule noodles made from soybean skin based on household scale or making a secretariat and so on. This policy is expected to optimise the potential of household labour so that crafters do not increasingly leave their industrial home business activities that have been carried out for generations better.

CONCLUSION

Based on the results of the study, it can be concluded that the economic model of the tempeh industry households built is able to explain the relationship between production decisions, allocation of labour, income, and expenditure on the household economic system of the tempeh industry. The estimation results show that the value taken in order to increase the income of crafters has a different impact depending on the specific conditions of industrial houses in a region so that specific policies are needed. The household economy of the tempeh industry needs to pay attention to several important points above so that everything can run smoothly and bring in better inputs/income, and not just "running a business for generation.

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