



UDC 332

EXPLORING THE DYNAMICS OF FOOD PRICES AND FARMER'S TERMS OF TRADE: REFLECTING ON THE WELFARE OF INDONESIAN FARMERS

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ABSTRACT

This research explores changes in staple food price trends and their impact on the Farmers' Term of Trade (FTT) as a primary indicator of farmer prosperity. Utilizing secondary data analysis, the study processes monthly staple food price data from January 2018 to July 2023 and FTT data from January 2019 to July 2023. This analysis employs a coefficient of variation method to track food price changes and calculates the FTT value based on the comparison of the price index received by farmers to their expenses, serving as a marker of farmer welfare. The study's findings reveal a significant influence of food price alterations on FTT and farmer welfare. There is a marked difference in the dynamics of staple food prices and FTT across various regions in Indonesia. These price variations are influenced by changes in agricultural input costs, such as fertilizers and labor wages, impacting the FTT value. Sectoral analysis indicates that during the Covid-19 era, food crop farmers have a lower level of prosperity (<100) compared to the livestock sector. Meanwhile, farmers in the horticulture, plantation, and fisheries sectors show higher welfare levels with FTT values above 100. Plantation farmers record the highest FTT values (>>100) during the pandemic. This study highlights the importance of farmers' understanding and adaptation to the dynamics of food prices and FTT. Adaptation strategies may include changes in production strategies, government support, crop diversification, and the adoption of new technologies, even amidst external challenges such as climate change. The interaction between food price dynamics, FTT, and its relation to farmer welfare provides essential insights for formulating more effective policies to support farmer welfare and food security in Indonesia.

KEY WORDS

Price dynamics, coefficient of variation, farmer's terms of trade, welfare of farmers.

Development in the agricultural sector plays an important role in providing sufficient food for the population, as well as increasing farmers' income and welfare. Farmers' welfare is not only determined by the amount of production they produce, but also by the value of the rewards they receive from that production. These rewards must be sufficient to cover the costs of consumer goods and services, including the purchase of agricultural production inputs. Price stability of agricultural products is one of the key factors in improving farmer welfare, along with production input costs. Maintaining stability in agricultural commodity prices and input costs, especially for staple foods, is a challenge because production and prices often fluctuate.

Price fluctuations are influenced by various factors, including climatic conditions or seasons that are difficult to control, government policies, changes in demand and supply that often fluctuate, economic situations, as well as geographic and demographic conditions. Several studies show that price fluctuations can occur due to price policies, as explained by Pinckney, T. C. (1993). Apart from that, price fluctuations also occur due to demand elasticity, as explained by SN, M. S., & Matsuda, T. (2022). The COVID-19 pandemic has also had a significant impact on price fluctuations, as explained by Sadiyah (2021), Firdaus, M. (2021), SN, M. S., & Matsuda, T. (2022), and Riniati, R., et al. (2022). Trade policy also influences



price fluctuations, as researched by Octania, G., & Biru, M. D. (2019). Globally, the world political situation, especially in food producing countries, influences food prices, as proven by research by Nasir, M. A., et al. (2022), Abay, K. A., et al. (2023), Ahsan, H., et al. (2023), Ben Hassen, T., & El Bilali, H. (2022), Bullock, D. W., et al. (2023), He, X., Carriquiry, M., (2023), Jagtap, S., et al. (2022), McGuirk, E., & Burke, M. (2022), and Pal, H. (2023). In particular, the war between Russia and Ukraine has had an impact on fluctuations in global food prices, including in Indonesia, as explained by Kennedy, P. S. J. (2023) and Simanjuntak, T. M., & Dermawan, D. (2023). Fluctuations in food prices that occur together with instability in the prices of production inputs have an impact on increasing the number of poor people, especially in rural areas, including farmers.

Indicators of farmer welfare can be measured through Farmer's Terms of Trade (FTT), which describes the comparison of the exchange rate between agricultural products and the goods and services used, both for consumption purposes and in the production process. FTT is the ratio between the price index received by farmers from their agricultural products and the price index paid by farmers for production inputs and goods and services consumed by farmer households. The price index received by farmers reflects the price variability of the agricultural commodities produced by them. Meanwhile, the price paid by farmers' index reflects the costs of goods and services consumed by farmers in the rural environment, emphasizing farmers as the main group and highlighting the dynamics of price fluctuations for goods and services that are essential for the production of agricultural products. Therefore, the dynamics of food prices, especially staple foods, is an important factor in determining Farmer's Terms of Trade, which affects the welfare of farmers.

The fluctuating dynamics of staple food prices in Indonesia, such as rice, cayenne pepper, shallots, beef, chicken and cooking oil, have a significant direct impact on income stability and FTT. The development of farmers' welfare can be measured from the evolution of Farmer's Terms of Trade over time.

Prices of agricultural commodities, especially staple foods needed for daily consumption by the community, are very dynamic and fluctuating. This food group is very sensitive to price changes, such as rice, onions, chillies, cooking oil, beef and chicken. If the demand and supply of food in the market is disrupted, the market will immediately react by increasing or decreasing prices. Prolonged conditions like this will cause price instability. Price fluctuations will affect the price index received and paid by farmers, as well as the impact on their income. Currently, there is still little literature that discusses the relationship between price changes over time and changes in farmer welfare as seen from the Farmer's Terms of Trade. The aim of this study is to explore the dynamics of staple food prices and changes in FTT that affect the welfare of farmers in Indonesia. This research is expected to provide a real contribution to understanding how policies related to food and trade, including trade liberalization and market intervention, affect farmers' income and welfare.

METHODS OF RESEARCH

This study looks at developments in the prices of six types of staple food commodities which greatly determine inflation in Indonesia, namely rice, onions, cayenne pepper, beef cooking oil and chicken. Monthly price observation period from January 2018-July 2023. Data source from Bank Indonesia via the National Strategic Food Price Information Center (PIHPS). Monthly price index data from the Central Statistics Agency of the Republic of Indonesia (BPS RI) for 2019-2023, as well as basic food price data from the Ministry of Trade of the Republic of Indonesia.

Figure 1 shows the study area with emphasis on four provinces: East Nusa Tenggara, Bali, Lampung, and D.I.Y. Yogyakarta. Among the 38 provinces in Indonesia, these four provinces had the lowest FTT values during the study period. To measure fluctuations in food prices, the Coefficient of Variation (CV) is used; the formula:

$$CV = \frac{\sigma}{\mu} \times 100\% \quad \sigma = \sqrt{\frac{\sum_{i=1}^n (X_i - \mu)^2}{n}}$$



Where: CV = Coefficient of Variation; σ = Standard deviation (Standard deviation); μ = average price; x_i = Average number of observations to-i.



Figure 1 – Location Map of 4 Provinces (East Nusa Tenggara, Bali, Lampung and DIY Yogyakarta)

The use of the coefficient of variation (CV) to study price fluctuations has received widespread attention, especially in the economic and financial sectors, as explained by Basher & Sadorsky (2006)., Priyadarshani, M. D., & Wickramasinghe, Y. M. (2018)., Al-Mogren, N. B. A. (2020)., Ali, A. (2021) and Chiaie, D. S. (2022) have demonstrated various uses of CV in the context of price fluctuations. Study Nendissa, et al (2020)., Roy N.D., et al, (2018) Roy N. D., et al. (2020) used CV to measure fluctuations in food prices (garlic, shallots and beef). Thus, the use of CV analysis is quite relevant in measuring price fluctuations, especially in terms of risk evaluation and market dynamics.

The CV criteria according to the Ministry of Trade of the Republic of Indonesia (2020) are as follows: CV between 5-9% indicates stable to moderate fluctuations, while CV above 9% indicates high fluctuations. According to Arnhold & Milani (2011), CV below 5.95% is considered low, indicating stable or normal fluctuations.

To measure changes in farmer welfare, Farmer's Terms of Trade (FTT) is used, which is the ratio of the price index received by farmers (PI_y) to the price index paid by farmers (PI_x , with the formula:

$$FTT = \left(\frac{PI_y}{PI_x} \right) \cdot 100$$

Price Index received by patani (PI_y) is the ratio of prices received by farmers in the current year (P_{ytn}) with the price received by farmers in the base year (P_{yt_0}); with the formula:

$$PI_y = \left(\frac{P_{ytn}}{P_{yt_0}} \right) \cdot 100$$

The price index paid by farmers (PI_x) is the ratio of prices paid by farmers in the current year (P_{xt_n}) divided by what was paid in the base year (P_{xt_0}). With formula:

$$PI_x = \left(\frac{P_{xt_n}}{P_{xt_0}} \right) \cdot 100$$

FTT is a complex indicator influenced by various factors including productivity, inflation, and consumer prices. The use of FTT calculations by several previous studies offers a diverse and in-depth perspective on FTT dynamics in global and regional contexts, providing additional insight into how factors such as the COVID-19 pandemic, advanced predictive models, and trade policies influence FTT (Pinilih, M., Rakhmawati, D., & Rosyidi, R. (2021, April)., Aufar, Y., & Sitanggang, I. S. (2019, October)., Mahargya, I. L., & Shidik, G. F. (2020).



Parameters for assessing farmer welfare through FTT:

- If $FTT < 100$: indicates that the costs incurred by farmers for daily needs are higher than income from agriculture (not yet achieving prosperity);
- If $FTT = 100$: it means that the costs of the farmer's needs are balanced with his income;
- If $FTT > 100$: indicates that the farmer's income is greater than the cost of his needs, which means the farmer is more prosperous (reaches the standard of welfare).

RESULTS AND DISCUSSION

Stable and reasonable food prices are a key factor for farmers, who depend heavily on income from the sale of their agricultural produce. This price stability allows farmers to plan and run agricultural businesses more efficiently, and ensures they can cover production costs and make a profit. Fluctuations in food prices can trigger inflation which has an impact on the economy at large. Rising food prices often lead to an increase in the general cost of living, affecting people's purchasing power. Study by Headey, D. D., & Martin, W. J. (2016) shows that short-term sudden price increases increase poverty, but long-term can have the opposite effect. The findings of Woolard & Leibbrandt, (2013); Mutenje et al., (2016); Choga & Giwa (2020) prove the substantial positive impact of food price dynamics on economic welfare in several southern African countries. Stabilization of food prices has proven to be beneficial for food sellers and buyers.

Staple food prices that are of concern to the Indonesian government to maintain stability include rice, beef, cooking oil, cayenne pepper and chicken, as well as other food commodities. Figure 2 shows the price dynamics of six types of staple food in Indonesia from January 2018 to July 2023. In the context of purchasing power and farmer welfare, the price of strategic food commodities is an important indicator that has a direct impact on farmer income. Figure 2 shows that price fluctuations for rice, beef and fresh chicken are relatively more stable, with low coefficients of variation (4.75-6.25). Even with fresh chicken there are some peaks and valleys that indicate seasonal changes or responses to certain events, such as the COVID-19 pandemic. Rice price stability is very important and is the government's task because rice is the staple food of Indonesian people. Price stability is important to maintain certainty of farmer income. Beef prices have shown an upward trend since January 2023, but overall prices are relatively stable (CV 6.10%), indicating increasing costs for this type of food, which may reduce the purchasing power of farmers who consume it."

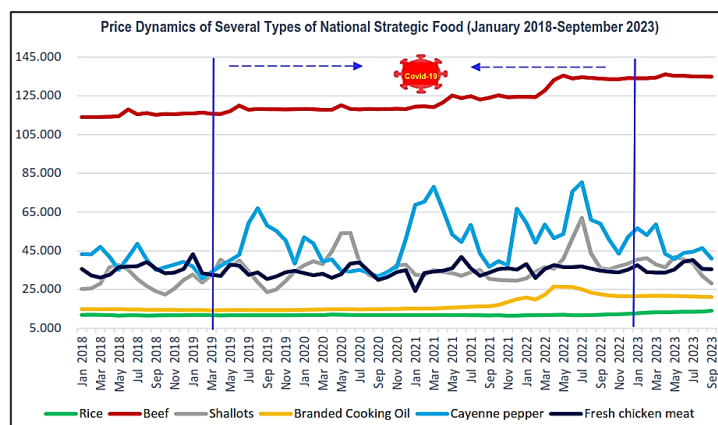


Figure 2 – Dynamics of prices for 6 basic food commodities in Indonesia for the period, 2018-2023

The price of branded cooking oil showed a significant increase, accompanied by large fluctuations (CV 21.33%). This price increase occurred in line with the Indonesian government's policy of reducing CPO (crude palm oil) exports, as well as the impact of the conflict between Russia and Ukraine. More than 65% of Indonesia's CPO production is exported to meet various global industrial needs. Indonesia and Malaysia are two countries



in Southeast Asia which are the largest CPO producers in the world. Based on data released by the United States Department of Agriculture (USDA) in 2022, Indonesia is recognized as the main producer of palm oil in the world.

Table 1 – Coefficient of Variation of 6 staple food commodities

Food Commodities	Average	St. dev	CV (%)
Rice	12023,19	571,39	4,75
Beef	122952,9	7498,96	6,10
Fresh Chicken Meat	35123,19	2194,49	6,25
Shallots	35101,45	7166,14	20,42
Branded Cooking Oil	17320,29	3695,27	21,33
Cayenne pepper	47896,38	11816,05	24,67

Source: Results of price data analysis for 6 commodities (2023).

The prices of shallots and cayenne peppers show very dynamic movements, as seen in Figure 2, with a high level of fluctuation, as evidenced by the coefficient of variation (CV) of more than 20% according to Table 1. The dynamic price movements of these two food commodities reflect volatility market. These fluctuations have the potential to cause income uncertainty for farmers who depend on these food commodities. These price fluctuations also affect the food price index received by farmers.

The graphical analysis shown in Figure 3 uses an index value of 100 as a reference point. If the Financial Transaction Tax (FTT) value in a sector is below 100, this indicates that farmers in that sector are experiencing economic difficulties. The graph illustrates the volatility of FTT in each sector, with several sectors experiencing a sharp decline below 100. In the food crops and livestock sectors, the FTT value is below 100, even though the coefficient of variation (CV) is low. This means that during that time period, the FTT value was consistently at a low position. This indicates that there is a period where farmers' income does not grow in proportion to the costs incurred. The increase in production input prices is higher than the increase in the selling price of their products. This condition may reflect a decline in the economic conditions of farmers in this sector.

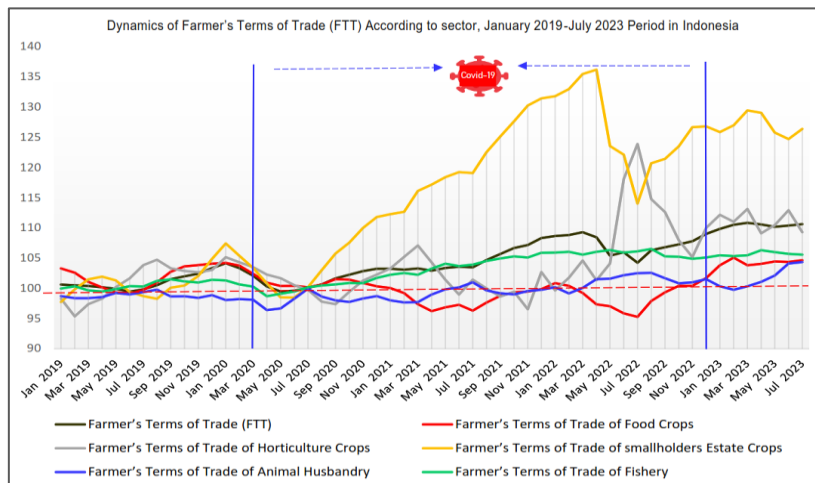


Figure 3 – Dynamics of FTT between sectors, period January 2019-July 2023

Figure 3 depicts various lines representing sectors such as horticulture, food crops, smallholder plantations, livestock and fisheries. Certain drastic changes in the graph, such as spikes related to COVID-19, indicate the significant impact of external factors on FTT, especially in certain sectors. From the FTT comparison between sectors, it can be seen that the food crops, livestock and horticulture sectors are more vulnerable to price volatility. For example, if the FTT of the horticulture sector shows greater variability than other sectors, this



could indicate that farmers in that sector are more affected by changes in commodity prices, such as shallots and cayenne pepper, which have a high coefficient of variation (CV).

The use of FTT to observe the welfare of farmers in four provinces in Indonesia shows that from 2019 to 2023, the level of welfare of farmers in the provinces of East Nusa Tenggara (NTT) and Bali has decreased and is stable at below 100.

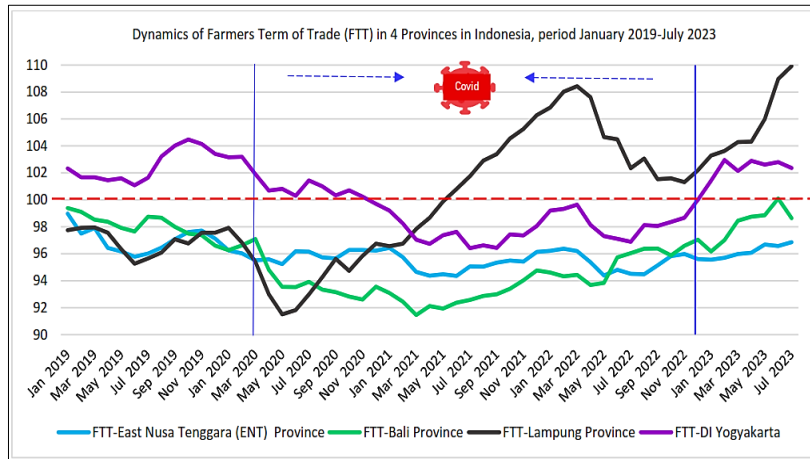


Figure 4 – Dynamics of FTT in 4 Provinces in Indonesia 2019-2023

During the COVID-19 pandemic, FTT in Yogyakarta experienced a sharp decline to below 100. However, after the pandemic ended, FTT increased above 100, in line with the Indonesian Government's statement at the end of December 2022. East Nusa Tenggara and Lampung Provinces also experienced an upward trend FTT, even though this value is still below 100.

Table 2 – Farmer Terms of Trade (FTT) Fluctuations, January 2019-July 2023

Province (FTT)	Average	St. dev	CV (%)
FTT-East Nusa Tenggara	95,94	0,94	0,98
FTT-Bali Province	95,57	2,37	2,48
FTT-Lampung	100,14	4,72	4,71
FTT-DI Yogyakarta	100,20	2,32	2,32

Source: Results of price data analysis for 6 food commodities (2023).

Figure 5 shows that the prices received by farmers and the prices they pay are experiencing an increasing trend. After the COVID-19 pandemic ended, both prices experienced quite sharp increases. However, the graph indicates that the price increases received by farmers are more volatile and generally lower than the prices they pay. This is clearly seen from the CV value which is greater for the price paid by farmers compared to the price received, as recorded in Table 3.

Table 3 – Results of analysis of price index data received and paid by farmers, FTT of food crop and ABTT food crop, 2019-2023

n/n	Average	St. dev	CV (%)
Price Index Received by farmers	109,29	5,662975	5,181544
Price Index Paid by Farmers	108,64	4,649209	4,279299
Farmers Term of Trade of Food Crop	100,59	2,570098	2,555097
Agriculture Business Term of Trade of Food Crop	101,00	2,607064	2,581192

Source: Results data analysis (2023).

The impact of price dynamics, affecting the FTT of food crops and the Agricultural Business Terms of Trade (ABTT) of food crops, fluctuates around the number 100. ABTT shows the ratio of the price index received by farmers to the price index paid by farmers



specifically to purchase food crop production inputs. Meanwhile, FTT is an index of the prices that farmers have to pay not only to buy production inputs but also other household consumption needs. The FTT of food crops tends to move up slowly to move above 100. External and internal factors can be the cause. FTT and ABTT of food crops will experience pressure making it difficult to increase significantly. This often happens because many agricultural inputs are influenced by global markets and currency fluctuations. This description indicates that food crop farmers in the period January 2019-July 2023 have relatively low purchasing power and have not been able to enjoy the expected prosperity, especially during the Covid-19 pandemic.

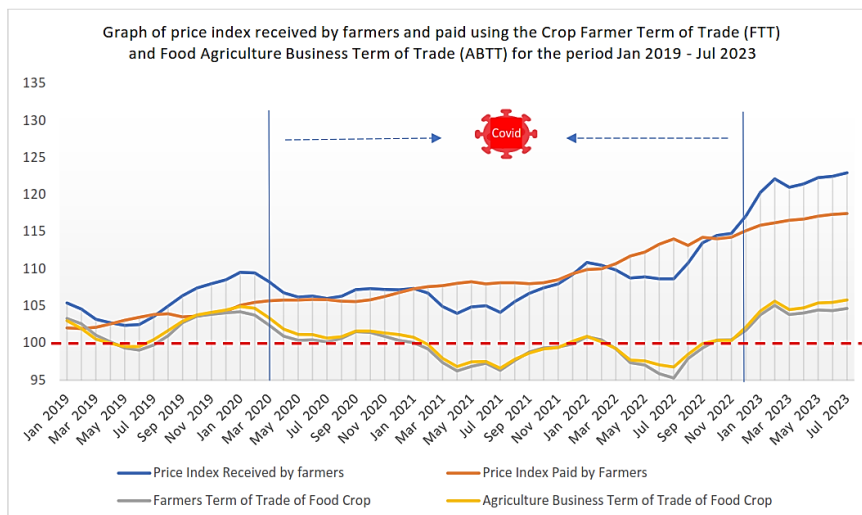


Figure 5 – Dynamics of prices received and prices paid by farmers for Food Crop FTT and Food Crop Agricultural Business Term of Trade

The price dynamics of several staple foods (rice, beef, shallots, branded cooking oil, cayenne pepper and fresh chicken), in Figure 2, informs how the prices of each of these commodities fluctuate over time (2019-2023). Fluctuations in food prices are shown by the CV amount (in table 1) which is different for each food commodity. The greater the variability and CV, the higher the fluctuation. Price dynamics also contribute to changes in FTT over time with 2018 as the basis, because in 2018 the economic situation was relatively stable as in Figure 4. Changes in FTT differ between regions, each region has a different response to the price dynamics that occur. Many factors play a role in these differences, in the form of external factors such as climate, the Covid-19 pandemic, economic situation, and internal factors such as production capacity and productivity, production technology and innovation, use of production inputs, and farmer skills.

Changes in FTT are used as a measure of changes in farmer welfare over a period of time; whether the value of the results of the farming business is able to finance all goods and services needed for consumption by farmers, including production inputs. The more farmers are able to finance their consumption needs and agricultural production inputs (increase >> 100), the more prosperous farmers will be. The results of this study research prove that food crop farmers have not been able to consistently achieve prosperity as expected, as shown by the values of FFT and FTT of food crops and ABTT of food crops generally <<100). Price fluctuations that occur from time to time due to external and internal factors have not been able for farmers to adapt to this situation, especially experienced by farmers in the provinces of Bali, ENT, Lampung and DI Yogyakarta.

Food commodity prices increase without a proportional increase in input costs, so farmers' FTT will increase, which means farmers get more profits. Conversely, if commodity prices are stable but input costs rise, farmers' FTT will decrease, indicating pressure on their income. Commodities with a high coefficient of variation may indicate more unstable incomes



for farmers who depend on them for their income. For example, high price fluctuations in cayenne pepper can cause unstable FTT for horticultural farmers.

CONCLUSION

A significant increase in food prices can increase farmer incomes, but also increase input costs. These price dynamics, characterized by high CV, have the potential to disrupt the stability of farmers' incomes and hinder their ability to plan long-term investments. The highest price fluctuations occurred in the commodities of cayenne pepper, shallots and packaged cooking oil. The food crop, livestock and animal husbandry sectors show low FTT, especially below 100, indicating a decline in the purchasing power and welfare of Indonesian farmers. Higher costs for inputs and daily necessities compared to income from product sales result in reduced profit margins, worsening household economic conditions and reducing farmer welfare. Each province's resilience to external pressures, such as the COVID-19 pandemic, varies; for example, the welfare of farmers in Bali and East Nusa Tenggara is lower than in Lampung and D.I. Yogyakarta, reflected by FTT below 100. Policies targeting commodity price stabilization and input cost reduction, such as subsidies or access to efficient technology, are needed to increase FTT.

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