ANALYZING FACTORS AFFECTING INDONESIAN FOOD PRICE INFLATION

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Abstract

In the last decade, Indonesia's inflation is predominantly influenced by volatile food, consists mostly of food commodities, and administered price; while the core inflation has been relatively stable. The food contribution in the living cost survey has a substantial contribution to measuring inflation. This paper aims to analyze the empirical condition of food prices movements and other commodities prices changes, particularly on energy commodities (housing and transportation). Using a monthly consumer price index from 2004 to 2017 with 168 total series observations, we estimated a vector error-correction model (VECM). The assumption that the price variable in the estimation process has perfect information shows that the major drivers of Indonesian food price inflation are the food commodities itself by the demand-supply interaction and the shock of transportation prices rather than housing prices. Therefore, the authorities of inflation control are likely to focus on maintaining the supply and demand as well as keeping the cost structure of food stable to control food price inflation.

Keywords: inflation; *food; energy*
JEL Classification: *E31, L66, O13*

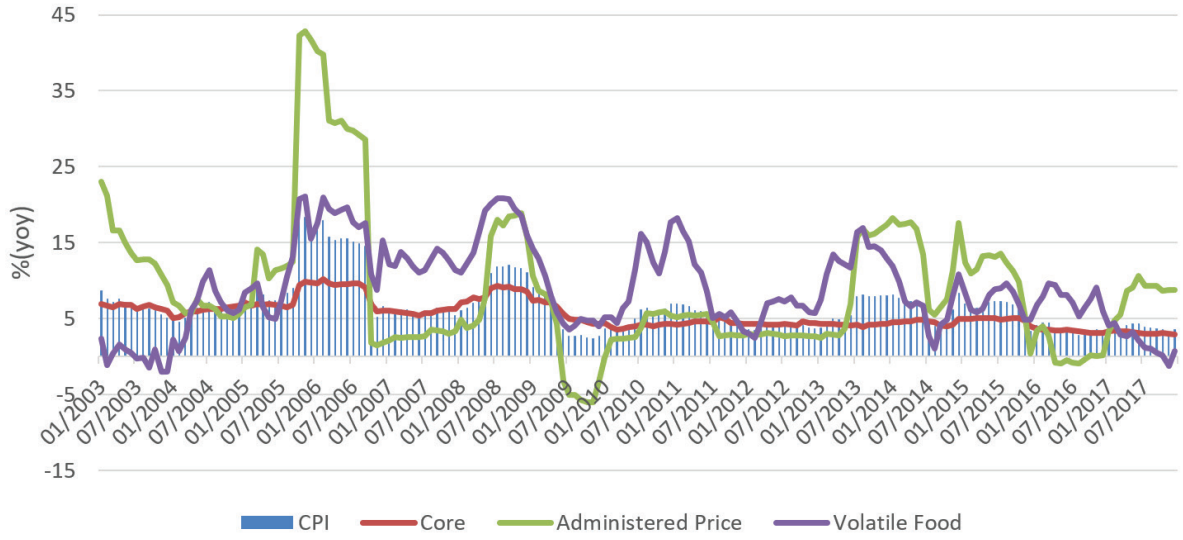
INTRODUCTION

Inflation is a sustained increase in the general price level of goods and services in an economy over time; the Consumer Price Index (CPI) is often used to measure inflation. CPI captures the price movements of goods and services consumed by the consumer. Maintaining inflation is essential to keep people's purchasing power. A rise in the inflation rate affected people's purchasing power, whereas people's income is constant.

In the last decade, Indonesian inflation is mostly influenced by inflation in volatile food and administered prices; the core inflation has been relatively stable (see Figure 1.). Demand and supply were the main determinants of food inflation due to crop failure, high demand, and others. Administered prices such as fuel, LPG, and others also contributed significantly to inflation.

The food contribution in the Living Cost Survey (*Survei Biaya Hidup*/SBH) conducted by BPS substantially contributed to measuring inflation. In the 2002 SBH and 2007 SBH, the food group contributed the second largest consumption after the housing, water, electricity, gas, and fuel group, with 25.5% and 19.57%. Furthermore, in the 2012 SBH, the portion of food consumption declined to the third rank with a share of 18.85% after the housing, water, electricity, gas, and household energy group; and transport, communication, services, and financial groups. However, in the last SBH, namely 2018 SBH, the portion of food consumption back to the second largest as shown in table 1.

Figure 1. Indonesia Inflation Trend (2003-2017)



Source: BPS (2018, Modified)

Table 1. Percentage of Consumption Value

Commodity	SBH 2002 (%)	SBH 2007 (%)	SBH 2012 (%)	SBH 2018 (%)
TOTAL	100,00	100,00	100,00	100,00
Food	25,50	19,57	18,85	18.02
Processed Food, Beverages, Tobacco	17,88	16,55	16,19	15.67
Housing, Electricity, Household Energy	25,59	25,41	25,37	26.70
Clothing	6,41	7,09	7,25	7.21
Health		4,45	4,73	6.12
Education, Recreation and Sports	6,04	7,81	8,46	8.88
Transportation, Communication and Finance	14,27	19,12	19,15	17.40

Source: Bank Indonesia (2014) & BPS (2020) (Modified)

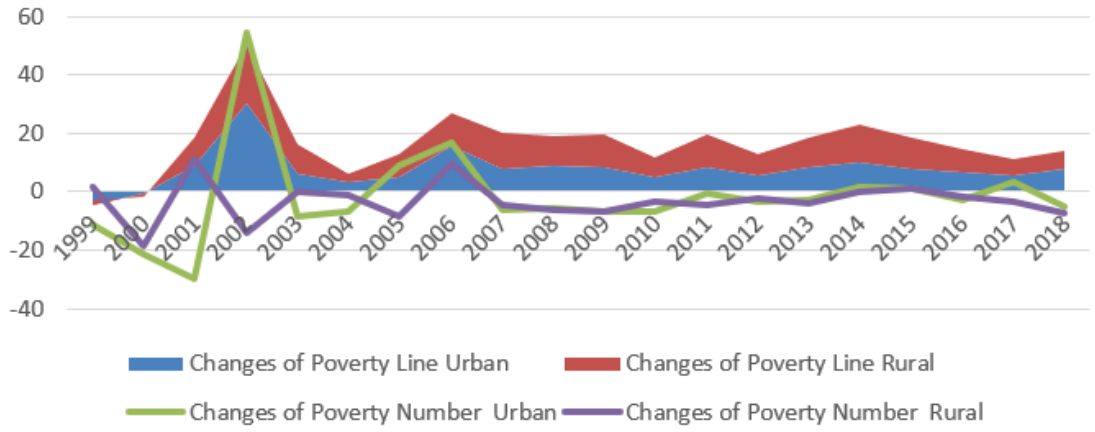
On the other hand, food commodities have the most significant role in the poverty line. According to BPS, the food poverty line's contribution to the poverty line in March 2018 was 73.48%; the rest was contributed by non-food commodities (housing, clothing, education, and health). It showed that if there is an increase in the price level or inflation of the food commodity, it would raise the poverty line and increase the numbers of poverty, with the condition the people's income constant.

The relationship between the poverty line and the number of poor people can be seen in Figure 1, which showed that the poverty line changes aligned with the number of poverty in Indonesia after the 1998 crisis, both urban and rural. Inflation was one factor that causes an increase in the poverty line. Therefore, the relationship between inflation and the numbers of poverty could be positive. It was also supported by the result of Fatma's study (2005), which showed that the increase in inflation positively affected the numbers of poverty.

The relationship of price between commodity groups and food commodities in Indonesia is critical to identify as the basis for policies to control inflation. It can show how the process of forming food prices related to other commodity groups. This study is conducted to determine how the pattern of movement of food commodities with other commodities, particularly in energy variables such as housing and transportation. In the value chain, food distribution needs the cost of transportation and electricity for produced goods and services.

Research related to food inflation had conducted by studies from Irz, Niemi, & Liu (2013)such as the energy market. Using monthly

Figure 2. Changes in the Poverty Line and Changes in the Number of Poverty in Indonesia (1999-2018)



Source: BPS (2018, Modified)

series of price indices from 1995 to 2010, we estimate a vector error-correction (VEC, Baek & Koo (2010), Rehman & Khan (2015), Norazman, Khalid, & Ghani (2018), Fujii (2013). The study of Irz et al. (2013)such as the energy market. Using monthly series of price indices from 1995 to 2010, we estimate a vector error-correction (VEC showed that a statistically significant long-run equilibrium relationship exists between the prices of food and agricultural commodities, labor, and energy. While Bima (2017) and Ramadhan (2009) conducted a study using the CPI data series to show the extent of the price linkages between commodity groups. Stock & Watson (2005) also conducted a linkage analysis between economic variables dynamically, using the consumer price index and the Vector Auto Regression (VAR) model for the method. This study was intended to see how the prices react or respond to change other prices between commodity groups focus on food, housing and transportation commodity.

CONCEPTUAL FRAMEWORK

Although this study does not try to build a full structural model of food price, economic theory guides the selection of explanatory variables. Food price reflects the equilibrium between supply and demand forces. According to Subervie (2008), a supply-shock is generally considered the main cause of price instability. In the short run, food supply shocks affected food inflation, causing large deviations from long-run price trends (Durevall, Loening, and Ayalew Birru, 2013). Long-run expansion in supply is primarily driven by technological progress, which reduces costs. Supply expansion may be constrained in the short-term by the cost and availability of key inputs and other supply-side problems and in the longer term by the availability of land and water resources, labor, and climate change. While exogenous shocks due to factors such as the weather also have a major impact on food prices.

The cost structure of food production depends on raw or supporting materials prices, for instance, the cost of fuel and electricity both in the production and distribution process. Energy prices have a big effect on the food sector. Some of these are fairly obvious. When higher oil prices result in higher gasoline and diesel fuel prices, it costs more to get products from farms to final consumers. Whether a food item is moved by ship, train, semi, or pickup, the fuel price will affect the cost of transportation, and higher transportation costs generally mean higher food prices. Another example, increasing the tariff on electricity will cost the producer that uses electricity appliances more. It might not be affected directly by the price of food, but it could be a second-round effect the same as the impact of the increasing price of fuel.

On the demand side, demand is influenced by income or an increase in needs. In Indonesia, people often buy more when the holy day, such as Ramadhan, Eid day, or Christmas. In 2012-2018, average inflation on Eid al-Fitr reached 0.75% month to month (BPS). The evidence has been found by Indalmanie (2015), there is a feedback effect between inflation and narrow money. It was in line with Khan & Schimmelpfennig (2006), who discovers that the money supply is also one of the significant factors affecting inflation (money supply reflects money demand), besides private credit. So, supply and demand shocks can produce wide swings in price.

This study focuses on the empirical model attempts to explain in the supply side, how the shock of the bundles commodity in energy commodities, namely group of housing (electricity, household fuel, and water) and transportation (fuel and cost of transportation), also food commodities to price of food. At the same time, income and other factors are assumed as ceteris paribus. In this paper, food commodities consist of raw food, such as rice, vegetables, fruits, tubers, and many more, not included processing food. In Irz, Niemi, & Liu (2013)such as the energy market. Using monthly series of price indices from 1995 to 2010, we estimate a vector error-correction (VEC, they found the correlation of food price and energy price generally, while this study discussed more detail about energy and food price through housing and transportation variables.

According to Boediono (1992), inflation might be associate with structural factors that can only alter gradually and in the long run. In this theory, the economic structure, which unable to anticipate rapid economic development, causes inflation. Baek & Koo (2010) conducted an analysis using VECM, and the result was that the prices of agricultural commodities and exchange rates affected the prices of food in the short and long term. Also, energy prices had a significant impact on food prices in the long term but had a weak impact on the short term. In the study of Irz et al. (2013)such as the energy market. Using monthly series of price indices from 1995 to 2010, we estimate a vector error-correction (VEC, they used time-series econometrics to investigate food price formation dynamics in Finland. The result showed that a statistically significant long-run equilibrium relationship existed between the prices of food and agricultural commodities, labor, and energy in Finland. A simple vector auto-correction model showed that after controlling for seasonal effects, those three variables alone explain half of the variability in food prices. Following a shock, convergence to the long-run equilibrium takes more than two years, although half of the adjustment typically occurs within six to eight months.

A study of Ismaya and Anugrah (2018) found that food inflation in Indonesia is significantly determined by both backward-looking and forward-looking expectations, food production, GDP of the agricultural sector, infrastructure, food imports, domestic oil price, credit to the agricultural sector, M1/consumption, and seasonal events (Ramadhan-Eid). They used quarterly data (2008: Q1 to 2017: Q4) and a GMM estimator. Backward-looking and forward-looking expectations, domestic oil price, and demand level have contributed to high food prices, while factors relating to general food price inflation have reduced food prices.

An empirical result from Pratikto and Ikhsan (2016) showed a relationship between inflation components, namely food, and non-food commodity groups. Food inflation has a positive influence on non-food inflation and aggregate inflation, but not vice versa. Non-food inflation has a positive role in the movement of aggregate inflation, which implies that Indonesia's inflation control is relatively complex if there is an increase in food inflation. They found that monetary policy as a policy given authority in controlling inflation was not effective enough in suppressing the level of food inflation. Food inflation is more determined by factors from the supply side, so the inflation control policies should be calibrated with other policies that encourage structural factors such as expediting distribution and increasing productivity. This finding is consistent with Affandi's (2015) study, which discovers that Indonesia's inflation is not only a monetary phenomenon. Cost-push inflation factors play a fundamental role in formulating the inflation process. The supply-side issues, especially in integrating the domestic economy through

improving infrastructure and transport facilities, remain key problems to bring inflation down to the regional level.

Specific interrelationships between commodity groups, Ramadhan (2009) conducted a study related to inflation in West Sumatra by using VECM. At the food commodity price, the price movement was more dominantly influenced by price movements in the food commodity itself. It was related to the characteristics of food prices, which consist mainly of agricultural commodities that are influenced by weather factors. The increase in food price was persistent, reaching 1-10 months ahead. Besides, the food was also influenced by the transportation, communication, and financial services groups, especially in the transportation group, which influenced the structure of food commodity costs in the distribution process.

METHODOLOGY AND DATA

In analyzing the relationship between prices between food, housing, and transportation commodities, stationarity tests are necessary to determine whether the data has a constant mean, standard deviation, variance, and covariance for each observation and determine the degree of integration from the variables. The Augmented Dickey-Fuller Test for Unit Roots was used for the stationary test.

Based on the unit root stochastic process, we followed the first-order autoregressive model Markov [AR (1)] (Gujarati and Porter, 2012), namely equation (1):

$$Y_t = \rho Y_{t-1} + x_t'\delta + u_t \quad (1)$$

Where is time-series data that tested, is a form of white noise, and is a parameter to be estimated, and if then the equation above becomes a random walk model, which is a non-stationary series. Thus, the hypothesis of stationarity can be tested by estimating the value of .

H_0:$\rho = 1$

H_1:$\rho < 1$

To estimate the value of ρ, we cannot directly test equation (1) because the estimation will be biased for the case of a unit root. Therefore, through the Augmented Dickey-Fuller Test, equation (1) is reduced on both sides with , so it becomes the equation (2):

$$\Delta Y_t = aY_{t-1} + x_t'\delta + u_t \quad (2)$$

Where , the hypothesis used is:

H_0:$a = 1$

H_1:$a < 1$

After knowing the stationary test results, the next step is to test the co-integrity between variables using Johansen Cointegration Test. According to Engle & Granger (1987), a combination of liners between two or more non-stationary data series can produce stationary integration. Furthermore, if there is a stationary linear combination or cointegrating equation, the variables are cointegrated, which means that the variables have a long-term balance relationship. The form of relationship in cointegration used the primary form of the Vector Error Correction (VEC) specification based on the implementation of Vector Auto Regression (VAR) with order developed by Johansen (1991), namely the equation (3):

(3)

$$Y_t = A_t Y_{t-1} + \ldots + A_p Y_{t-p} + Bx_t + u_t \quad (3)$$

Where is the vector x 1 of the variable , is the vector x 1 of the determinant variable, and is the error vector, then the equation (3) above can be written as the equation (4):

$$\Delta Y_t = \pi Y_{t-1} + \sum_{t=1}^{p-1} \tau_t \Delta Y_{t-1} + Bx_t + u_t \quad (4)$$

Where:

$$\pi = \sum_{t=1}^{p} A_j - I$$

$$\tau_t = -\sum_{j=i+1}^{p} A_j \quad (5)$$

The cointegration method estimated the matrix from unrestricted VAR and tested whether it could reject the existing restrictions by reducing the rank of .

In analyzing the relationship between food and energy prices, this study constructed using the Vector Auto Regression (VAR) model, which considered all variables in the model to be endogenous, then estimated together (Gujarati and Porter, 2012). This VAR model has not used a logical framework with structural equations with specifications based on existing economic theory.

The VAR model's estimation involved endogenous variables that were influenced by the variables themselves in the previous period and other endogenous variables in the model. The equations in the Vector Auto Regression system in this study were as the equation follows:

$$Food_t = a_1 + \sum_{i=1}^{k} \beta_j \, Food_{t-i} + \sum_{i=1}^{k} \gamma_j \, Housing_{t-i} + \sum_{i=1}^{k} \theta_j \, Trans_{t-i} + u_{1t} \quad (6)$$

$$Housing_t = a_1 + \sum_{i=1}^{k} \beta_j \, Food_{t-i} + \sum_{i=1}^{k} \gamma_j \, Housing_{t-i} + \sum_{i=1}^{k} \theta_j \, Trans_{t-i} + u_{2t} \quad (7)$$

$$Trans_t = a_1 + \sum_{i=1}^{k} \beta_j \, Food_{t-i} + \sum_{i=1}^{k} \gamma_j \, Housing_{t-i} + \sum_{i=1}^{k} \theta_j \, Trans_{t-i} + u_{3t} \quad (8)$$

Food	=	Price Index of Food
Food Housing	=	Price Index of Housing, Electricity, Household energy
Trans	=	Price Index of Transportation
u_{it}	=	Stochastic Error Term or impulse or shock in VAR
k	=	lag length

The estimation uses VAR in level if all variables are stationary at the level, but if one variable is stationary at the level of the level and the other at the first difference and not integrated into the same degree, then using VAR in difference. If all variables are non-stationary but cointegrated to the same degree, the estimation will use the Vector Error Correction Model (VECM).

Generally, equation (6) (7) (8) can be summarized into the matrix-vector as the equation (9):

$$Z_t = [Food, Housing, Trans]' \quad (9)$$

Then the VAR model can be written as the equation (10):

$$Z_t = \sum_{i=1}^{k} \pi_i \, Z_{t-1} + u_t \;\; is]' \quad (10)$$

Then the first-difference model for estimating the Vector Error Correction Model as the equation (11):

$$\triangle Z_t = \pi_i Z_{t-i} + \sum_{i=1}^{k-1} \tau_i \triangle Z_{t-1} + u_t \quad (11)$$

Where is the first-difference vector matrix, is a matrix of cointegrating vector x matrix coefficients and is a matrix of error vector. In the VECM model, an Impulse Response Function analysis can be performed to track current and future responses on each variable by utilizing past empirical data. Also, forecast error variance decomposition can predict the percentage variance of each variable's contribution to altering certain variables.

This study used consumer price index data from 2004 to 2017 on a monthly basis in Indonesia, with the base year of 2012. In this study, the analysis groups are food, a group of electricity and household energy (Housing), and a group of transportation.

Table 2. Descriptive Statistic of Data for Estimation

	Food	Housing	Transportation
Mean	93,05	99,16	100,64
Median	94,10	99,42	96,26
Maximum	142,35	161,17	143,64
Minimum	45,66	52,19	49,93
Std. Dev	30,61	29,33	26,53
Observations	168	168	168

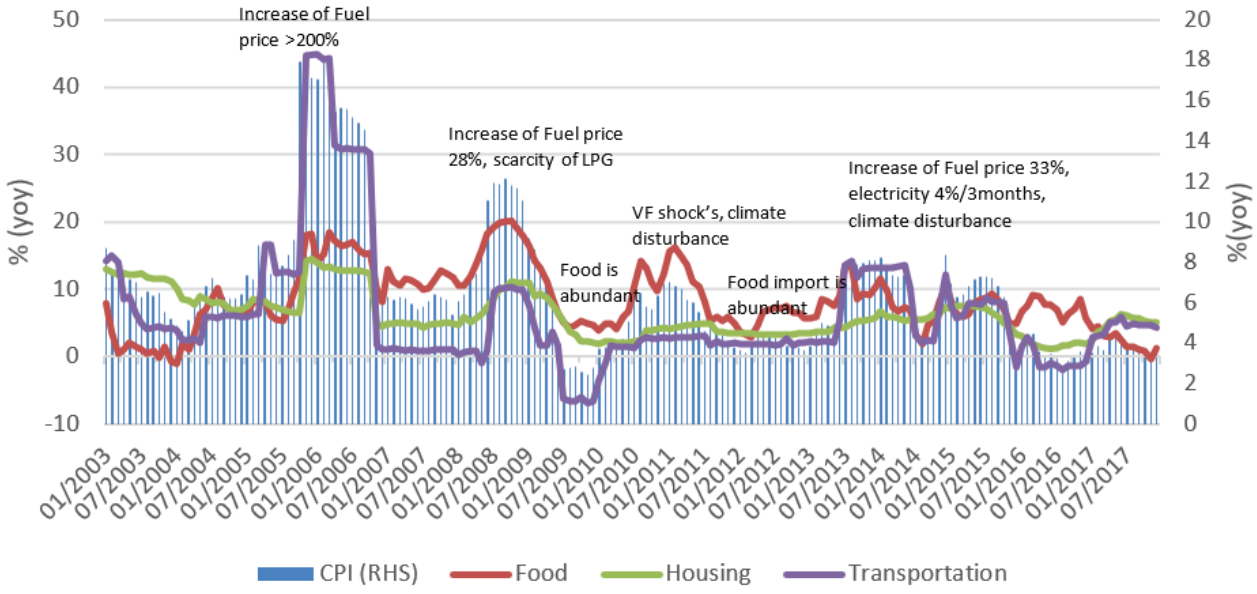
The estimate's total observations are 168 series, with several variables: food, housing, and transportation. The housing definition included electricity, household energy, and water commodity inside, and a group of transportation consists of fuel and cost of transportation commodity. Moreover, the definition of food variable here included primary agriculture such as rice, vegetables, fruits, and many more, not included processing food.

Table 3. Correlation between Variables

	Food	Housing	Trans
Food	1	0,978418	0,947312
Housing		1	0,960987
Trans			1

The correlation in the table above showed that between variables had a strong correlation; the value was above 0.8. Therefore, the VAR model can apply to see the variables that are considered endogenous variables that received influence from themselves and other variables. While the table below showed the empiric data from three variables and the analysis of the spesific moment when the shock existed.

Figure 3. Indonesia Inflation Trend (CPI, Food, Housing, Transportation)



Source: BPS (2018, Modified)

RESULT AND DISCUSSION

The result of formal stationarity testing on all variables using the Augmented Dickey-Fuller Test are shown in table 4. The test result showed that all series were stationary in the first difference and not stationary at the level. This result explained that the first difference data has a constant average, standard deviation or variance, and covariance for each observation.

Table 4. Augmented Dickey-Fuller Test

Variable	Level	First Difference
Food	-0,087	-11,033*
Housing	1,081	-11,439*
Transportation	-1,196	-11,402*

Note: t-statistic showed the significant result at * α=1%

The next step is to examine whether the variables have cointegration or not in the long run. However, before conducting the cointegration test, we necessary to know the optimal lag by observing at five information criteria: Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HC), and the Schwarz Information Criterion (SIC). The optimal lag showed in table 4, which showed that the optimal lag is three lags. This criterion is selected by the most chosen lag, which is in the 3rd lag chosen by FPE and AIC.

Table 5. Lag Length Criteria

Lag	LR	FPE	AIC	SIC	HQ
1		30.4267	11.9289	12.1027°	11.9995
2	40.0533	26.2282	11.7804	12.1278	11.9214°
3	17.2376	26.1901°	11.7787°	12.2998	11.9903
4	7.8422	27.8196	11.8385	12.5334	12.1207
5	21.5376°	26.8484	11.8022	12.6707	12.1549
6	13.5526	27.3450	11.8192	12.8615	12.2425
7	8.6238	28.8174	11.8700	13.0859	12.3638
8	7.2268	30.6605	11.9296	13.3193	12.4940

Note: ° is the lag that is chosen by the criterion. LR, FPE, AIC, SIC, dan HQ stands for Likelihood Ratio, Final Prediction error, Akaike Information Criterion, Hannan-Quinn Information Criterion, and Schwarz Information Criterion.

The Cointegration test result using Johansen Cointegration Test can be seen in table 6. In the table, we can see that all equations are significant at α = 5%, which means that all variables have cointegration in the long run at first difference. Whereas there is no cointegration at level, so we use the Vector Error Correction Model (VECM).

Table 6. The Cointegration Result

Maximum Rank	Trace Statistic	5% Critical Value	Eigenvalue	5% Critical Value
0	140,836*	29,797	77,745*	21,132
1	63,090*	15,495	41,308*	14,265
2	21,782*	3,841	21,782*	3,841

Note: significant at *α=5%

Table 7 is the estimation result of the Vector Error Correction Model that used three lags. In this section, the discussion will focus on variables that affect the food price. This result indicated that the food price was significantly influenced by the food commodities itself (up to the two previous periods). An alter in food prices at this time would still have an impact for the next two months.

Furthermore, food prices are also influenced by the Transportation group that consists of fuel and transportation costs for the previous two periods. The price change of fuel used for transportation contributes to food inflation through cost structure. However, a group of household energy, lighting, and water (Housing) such as electricity, LPG, kerosene, and water tariffs does not significantly affect food prices.

Table 7. The Result of Vector Error Correction Model Estimation

Variable	ΔF_t	ΔH_t	ΔT_t
ΔF_{t-1}	0.766519*	0.327042***	0.251579
ΔF_{t-2}	0.383264*	0.178548	-0.03409
ΔF_{t-3}	0.122629	0.179358	-0.10915
ΔH_{t-1}	0.034738	-0.82767*	-0.05716
ΔH_{t-2}	-0.00952	-0.47987*	0.424705**
ΔH_{t-3}	0.010277	-0.20297**	0.230406
ΔT_{t-1}	-0.14408*	0.044184	-0.60281*
ΔT_{t-2}	-0.11728*	0.002157	-0.55645*
ΔT_{t-3}	-0.01615	0.000147	-0.30821*
C	0.012987	-0.00188	0.006228

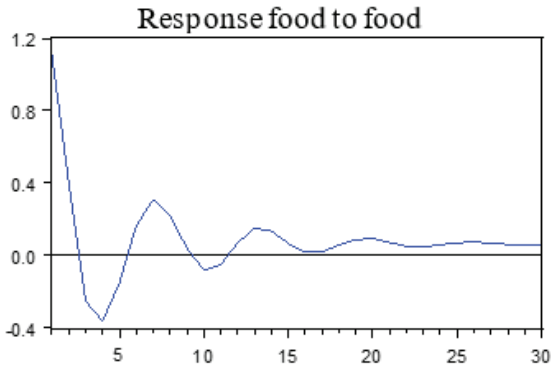
Variable	ΔF_t	ΔH_t	ΔT_t
R-squared	0.515918	0.402401	0.35291
F-stat	16.19962	10.23512	8.289794

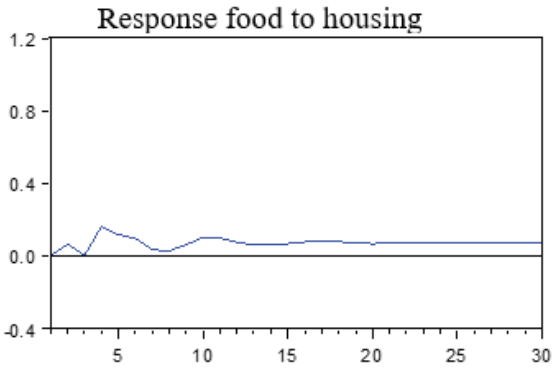
Note: t-statistic showed significant result at * α=1% ** α=5% ***α=10%

The results of impulse responses showed that if there was a positive shock of one standard deviation (1 SD) at the price of food, it affected the rise in the price of food by 1.1%, but the impact began to decline until the third month. A shock on the Housing group will increase food prices up to 0.16% and subsided around the seventh month. Whereas, if there were a shock in the Transportation group, food prices would increase to 0.32% and subside around the sixth month. The Transportation price shock's peak effect on food prices occurred in the fourth month after the shock. It showed that an increase in fuel prices impacted transportation costs and then increased the price of food from the start of the shock to the fourth month's peak and subsides in the sixth month. This empirical evidence is almost similar to the result of the study by Irz, Niemi, and Liu (2013) that the shock of energy commodity prices to the food prices subside within six to eight months.

Food price has its characteristics; it has high volatility of price than other commodity groups. In line with the impulse response result, the food price estimated in this study had relatively high volatility in the fluctuating impulse response. Therefore, BPS in calculating food inflation divide the commodity, which has high volatility to volatile food group.

Figure 4. Impulse Response





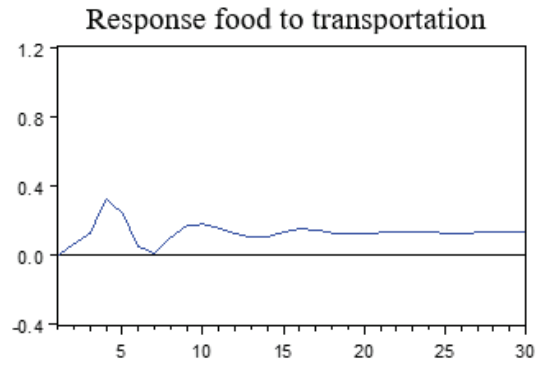


Table 8. Impulse Response

Period	Food	Housing	Transportation
1	1.104647	0.000000	0.000000
2	0.403704	0.063353	0.064288
3	-0.253290	0.000334	0.125115
4	-0.362708	0.162785	0.325929
5	-0.151265	0.116542	0.243529
6	0.166477	0.094272	0.052998
7	0.306949	0.033994	0.007367
8	0.221304	0.024902	0.102049
9	0.039376	0.060002	0.173622
10	-0.081220	0.102424	0.179584

The result of the variance decomposition indicated each endogenous variable's contribution to the fluctuations in food price. Data in the first month of food price were caused by food price itself at 100%, in the next months, it was also still dominated by the food group itself, in line with the result of a study conducted by Ramadhan (2009). This result supported that structural factors such as season, weather, crop failure, and demand increasing had a strong influence on food prices and linear with Pratikto and Ikhsan (2016) finding. Boediono (1992) also explained that structural

economic shocks usually influence inflation in developing countries like Indonesia. When there is a change in supply and demand, the market cannot quickly respond to these changes and adjust the price.

The food group consists of sub-products, such as production in the primary agricultural sector, sensitive to supply and demand. In the fourth month, the biggest shock of price fluctuations in the food price was influenced by itself (90.98%), also influenced by the price of the transportation group (7.26%) and housing group (1.76%). However, the influence of the housing and transportation group was relatively small compared to the food group. If the effect of shock Housing and Transportation on food was compared, the effect of the Transportation group was more significant than the effect of the Housing group. The effect of price changes in Transportation groups such as gasoline, diesel fuel, and transportation tariffs has more influence on food prices than changes in housing groups' prices such as household energy (LPG, kerosene) and electricity tariffs.

Table 9. Variance Decomposition

Period	S.E.	Food	Housing	Transportation
1	1.104647	100.0000	0.000000	0.000000
2	1.179562	99.41449	0.288466	0.297042
3	1.212921	98.38221	0.272825	1.344961
4	1.317370	90.98055	1.758184	7.261269
5	1.353230	87.47196	2.407918	10.12012
6	1.367714	87.11066	2.832275	10.05706
7	1.402166	87.67473	2.753582	9.571683
8	1.423404	87.49519	2.702631	9.802182
9	1.435749	86.07229	2.831006	11.09670
10	1.452829	84.37289	3.261850	12.36526

This paper aims to analyze the empirical condition of the price movement between food and energy commodities. With the assumption that the price variable in the estimation process has perfect information, the overall estimation results indicate that the increase in food price is dominantly sourced from the food commodities itself rather than the energy variables (housing and transportation). Its mechanism is indicated through the influence of supply and demand. Generally, the price of food commodities (rice, chili, tomatoes, onions, vegetables, and others) are affected by the season can be managed if they have post-harvest technology to store the stock during the harvest simultaneously. If the commodity can be controlled by storing it, then price adjustments during the harvest season or crop failure will occur.

However, it is not an easy effort to control food commodity stock. Food which easily damaged or rotten (perishable) is one of the challenges for stakeholders, both private and government. The post-harvest technologies involved drying, packaging, and even storing has different characters in each food commodity. For example, rice can be stored at a specific temperature using a refrigerator, but red onion required special treatment by controlling the air condition in the storage room so that the shrinkage value is small. Maintaining people's purchasing power has to be considered to keep the stability of food prices. The population on the poverty threshold or slightly above the poverty line is very vulnerable to become poor when there are shocks of economics that result in rising food prices. Therefore, monitoring the food price and controlling the food stock to keep food inflation low and stable is responsible for the stakeholders.

This study also showed that the reaction of shock from transportation groups such as fuel and transportation cost was more significant than the shock of housing groups such as electricity, household fuel, and water to the food prices. Energy prices, especially fuel, has a significant effect on the food sector. When higher oil prices result in higher gasoline and diesel fuel prices, it costs more to get products from farms to final consumers. Whether a food item is moved by ship, train, semi, or pickup, the fuel price will affect the cost of transportation, and higher transportation costs generally mean higher food prices. While housing groups have a small effect on the cost production of food, compare with transportation groups. For example, maize's cost structure in the first 10 kg cost 9% of transportation costs higher than housing expenditure (FAO, 2016).

CONCLUSION AND RECOMMENDATION

This paper aims to analyze the price movement's empirical condition between food and energy (housing and transportation). Result of the VECM model assuming that the price variable in the estimation process has perfect information, food price was significantly influenced by the food group itself up to the two previous periods. It is related to this group's composition, which consists mostly of agricultural commodities whose production is vulnerable to being influenced by weather factors and their seasonal nature. On the other hand, shocks of transportation groups such as fuel and transportation costs are more significant in influencing the food price than shocks in housing variables like household energy (LPG and kerosene) and electricity tariffs. Shocks in the Transportation and Housing group made the food price fluctuate and subsided around the sixth and seventh months.

The authority of inflation controlling, such as the National or Regional Inflation Control Team (TPIN and TPID), can focus on maintaining the supply and demand of food commodities, which often contribute to large inflation. Controlling supply can be in the form of maintaining stock availability both during harvest season, or crop failure might be through warehousing technology. On the demand side can be done through socialization by the government or ask for help from the public figure (religious leader, artist, or influencer). Food supply and demand control are expected to intervene when there is an imbalance between supply and demand that affects price fluctuations. These tasks can be coordinated through the inflation control team both in national or regional under their respective task areas.

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