Investigation of Relationship Between World Food Prices and Energy Price:

A Panel SUR Approach

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Abstract

Although food prices are at or near a historical low in major world markets, there is increasing concern about food security. The high food prices experienced over recent years have led to the widespread view that food price volatility has increased. In this study, factors affecting food prices are investigated for subgroups of foods such as cereals, meats, beverages, and vegetable oils, using Seemingly Unrelated Regression panel data approach with monthly world food prices from January 1994 to July 2016. Estimation results show crude oil and gasoline prices have a positive significant impact on food price subgroups such as cereals and meats. With the rise in Di-Ammonium Phosphate and Triple Superphosphate prices, the cereals, beverages, and vegetable oil prices increased. Potassium chloride fertilizer price has a positive significant effect on cereals, but in most cases, the meats and beverages' subgroups were not affected by fertilizer prices. Also, the exchange rate had a negative significant effect on all food price subgroups.

Keyword: Food Prices, Panel SUR, Food Security, Exchange Rates.

Introduction and background

Today global attempt to achieve food security focuses on agricultural protection and food price policies. While increasing capacity to food production is an important and necessary, stabilizing food prices is another priority. World food prices have different effects on export and import countries (Arezki and Brückner 2014). While low international food price is due to supply surplus of agricultural products by developed countries, it causes the undervaluation of agriculture in developing countries (Timmer 2014).

As a result, a decrease in domestic production has been coupled with food imports and developing countries would become more dependent on world market price (Urbanchuk and Director 2007). According to FAO report, most people in developing countries are faced with food insecurity (FAO 2015). On the other hand, the world total population will increase to 9.7 billion by 2050 and most of them will live in poor countries of Asia and Africa (UN, 2016). Increased dependence on world markets creates more problems through food price volatility.

Durevall, Loening et al. (2013)suggested world food prices and domestic agricultural production should be considered in developing economies with a large food share in consumer prices. Dawe, Morales-Opazo et al. (2015)argue in any particular country domestic food price changes are not necessary due to volatility in world market prices. In developing countries, weather disturbance and international price shocks have the most effect on local market food price changes in short-run respectively 20 and 9 percent(Brown and Kshirsagar 2015). The high food prices experienced after last world crisis in 2008- 09 had a profound impact on food security at national levels for importing countries and provided a widespread view that food price volatility has increased(Ahmed, Siwar et al. 2014). Food price shocks can come from several sources and these have different impacts on each commodity markets(Baffes 2007).

Government programs and household budgets of individual consumer influenced by food price shocks(Baffes 2007). Hochman, Rajagopal et al. (2014) in a study on causes of global food price crisis noted to the combination of several factors affecting on food commodity price inflation including economic growth, biofuel expansion, exchange rate fluctuations and energy price inflation. In other word supply and demand policies will modify the serial dependence and interaction between world market and access to food by effects on agents such as consumers, local producers, traders, local state and so on(Abbott and De Battisti 2011). On the supply side, rising energy prices have an important role through increasing cost of tractor fuel, fertilizer, and transportation. While on the demand side income growth is noted(Sasmal 2015). for more explanation, evidence achieved from experimental research in both laboratory and intervention settings shows the potential effects of food price volatility changes on consumers preferences with limiting their ability choice in access to healthy food(Jayne 2012, Ahumada and Cornejo 2016). But this is not the whole of fact.

Food price volatility issues transformed to major problems with respect to the causal relationship between it and multiple factors- including crude oil prices, exchange rates, growing demand for food and slowing growth in agricultural productivity (Abbott, Hurt et al. 2008). In parallel, other factors include impact of agricultural policies on food supply and prices, large and persistent seasonal variations in food prices and impact of famines, the effect on food price and health nutrition(Cornia, Deotti et al. 2016). Food price face with biofuel production as an Additional problem. In last two decades, US ethanol production from corn makes more food price volatility (Elobeid, Tokgoz et al. 2006). Similar results are found for Europe(Abdelradi and Serra 2015, Abdelradi and Serra 2015).(Waage 2008) and (Al-Maadid, Caporale et al. 2015) illustrated global ethanol production has a positive effect on international food prices.

While Enciso, Fellmann et al. (2016)in a futuristic study show abolishing biofuel policies as mandates, tax credits, import and export tariffs for the major world players would not lead to an increase in food security because other variables such as fertilizer prices, energy prices, and transport costs drive the price variation in food commodities. Baek and Koo (2014) analyzed prices of energy and agricultural commodities and exchange rate effects on U.S. food price inflation and found energy prices and exchange rate as significant factors in both the short and long-run. Reboredo and Ugando (2014) investigated the relationship between the US dollar exchange rate and selected food prices and results show corn, wheat, and rice prices were not caused by extreme USD depreciation while for soybean the dependence is confirmed.

Catão and Chang (2010) noted to risk sharing and found the price elasticity of exports, the real exchange rate and the terms of trade have opposite direction in response to world food price shocks. Tadasse, Algieri et al. (2016) in exploring the quantitative importance of supply, demand and market shocks in international food markets consider set of variables affecting food prices such as oil price and financial crises in a separate model and concluded oil price volatility intensifies the food price volatility in medium- term. Lambert and Miljkovic (2010) confirmed the most significant role of innovations in farm prices and manufacturing wages rather than production inputs including fuel in the US. Pal and Mitra (2017) mentioned to cointegration relationship between crude oil and a subgroup of food prices such as dairy, cereals, vegetable oil and sugar with monthly data in the period 1990- 2016.

Based on this background the purpose of this study is assessment the effective factors on four groups of food prices and their subgroup with scenarios setting. Both crude oil and gasoline prices and price variability of five main fertilizers used in agriculture production are scenario components.

Data Description

The data utilized in this paper consist of monthly observations of the period from January 1994 to July 2016 for the world prices of 21 Agricultural Commodity in 4 subgroups (cereals, meat, beverages and vegetable oils and protein meal), fertilizer prices, the world crude oil prices and the real effective US dollar exchange rate. Data of World prices of agricultural commodity, fertilizer prices and the world crude oil prices downloads from the website of IndexMundi and data of real effective US dollar exchange rate is obtained from official website of the bank for international settlements. Table 1 shows the detailed description of dependent variables. Table 2 illustrates the detailed description of the explanatory variables

Table1. Data description: dependent variables.

NO	Group	subgroups	Unit
1	Cereals	Barley	US Dollars per Metric Ton
1	Cereals	Maize	US Dollars per Metric Ton
1	Cereals	Rice	US Dollars per Metric Ton
1	Cereals	Wheat	US Dollars per Metric Ton
2	Meat & seafood	Poultry (chicken)	US cents per Pound
2	Meat & seafood	Beef	US cents per Pound
2	Meat & seafood	Fish(salmon)	US Dollars per Kilogram
2	Meat & seafood	Shrimp	US cents per pound
3	Beverages	Coffee Arabica	US cents per Pound
3	Beverages	Cocoa beans	US Dollars per Metric Ton
3	Beverages	Coffee Robusta	US cents per Pound
3	Beverages	Tea	US cents per Kilogram
4	Vegetable oils and Protein Meals	Sunflower Oil	US Dollars per Metric Ton
4	Vegetable oils and Protein Meals	Coconut Oil	US Dollars per Metric Ton
4	Vegetable oils and Protein Meals	Palm oil	US Dollars per Metric Ton
4	Vegetable oils and Protein Meals	Olive Oil	US Dollars per Metric Ton

Table2. Data description: The explanatory variables

The explanatory variables		Unit
Fertilizer	Potassium Chloride	US Dollars per Metric Ton
Fertilizer	Di-Ammonium Phosphate	US Dollars per Metric Ton
Fertilizer	Phosphate Rock	US Dollars per Metric Ton
Fertilizer	Triple Superphosphate	US Dollars per Metric Ton
Fertilizer	Urea	US Dollars per Metric Ton
Energy	Crude Oil (petroleum)	US Dollars per Barrel
Energy	Gasoline	US Dollars per Gallon
Exchange Rate	Real effective US dollar exchange rate	Narrow index (2010=100)

Methodology

On the previous discussion, the factors various can impact on world food price. According to the research objectives, we analyze the relationship between energy prices, exchange rate, and world food price. The empirical analysis is based on seemingly unrelated regression (SUR) in the context of panel data. The SUR method is utilized because residuals in the isolation regression can be interrelated(Zellner 1962, Fiebig 2001, Panta 2016).we can write for each gth equation in the system the model as follows.

$$FP_{git} = \beta_g EN_{git} + \alpha_g EX_{git} + \delta_g FE_{git} + u_{git} \quad \text{i= 1,..., 1084;} \quad \text{t=1,...,271;} \quad \text{g=1,...,4} \qquad (1)$$

$$u_{git} = v_{gi} + e_{git}$$

Where g are a number of equation (g=1 Cereals, g=2 Meat & seafood, g=3 Beverages, g=4 Vegetable oils and Protein Meals), i are individual observation, t are period of time. EN is the energy prices (Crude Oil and Gasoline), EX is the exchange rate, FE (Potassium Chloride, di-ammonium phosphate, Phosphate rock and triple superphosphate) is fertilizer prices(a proxy of input price), v are unobserved individual level effects in the gth equation, e are the observation-specific errors in the gth equation. We run random-effects regressions which generate more efficient estimates(Ma and Wu 2011). In order to minimize spurious regression. In many of studies are utilized of unit root tests in order to improve the estimation power. For this purpose, we use of unit root test of LLC [1](Levin, Lin et al. 2002). The results this test show that all variables are stationary in level. Additional information on the data and unit root test of the utilized variables in this study can be provided by the authors upon request.

Results and Discussion

First, we calculated the Breusch-Pagan test for examining the dependence between residual of equations. Results show that Breusch-Pagan test is significant at 1%. This indicates the existence of the interrelation between equations.

The empirical results about equation 1 are presented in Table 3 to 12. In each of the tables, the different type of fertilizers and energy prices are replaced with others as independent variables. Table 3 to 7 show that energy price (Gasoline) has a positive significant impact on cereals, meat & seafood, beverages, vegetable oils and protein meals. This result is in line with the findings of Abbott, Hurt et al. (2008), Avalos (2014), Akram (2009), Mitchell (2008) and Hezareh et al. (2016). In these tables, the coefficient of the exchange rate has a negative significant impact on cereals, meat & seafood, beverages, vegetable oils and protein meals except in tables 4, 5, 6 and 7, where exchange rate has a negative impact on cereals, meat & seafood. These variables have a positive impact on vegetable oils and protein meals. This result is in line with the findings of Harri, Nalley et al. (2009), Baek and Koo (2010) and Kwon and Koo (2009).

Table 3, 4 and 7 show the di-ammonium phosphate, potassium chloride and urea have a positive significant impact on cereals, beverages, vegetable oils and protein meals. As seen from table 5 and 6, phosphate rock and triple superphosphate have a positive significant impact on cereals and beverages. This result is in line with the findings of Abbott, Hurt et al. (2008) and Hezareh et al. (2016).

On the other hand, Table 3 to 7 show that energy price(Gasoline) has not the same impact on food price subgroups. For instance, energy price (Gasoline) has the most impact on beverages and the least impact on meat & seafood.

[1] Levin, Lin and Chu

Table3. Results of Panel SUR ($EN(Gasoline)$ and $FE(di-ammonium\ phosphate)$)

Eq(No)	Depended variables	Independent variables	Coefficient	Z
Eq(1)	$FP(Cereals)$	$EN(Gasoline)$	24.84^{***}	7.30
		$FE(di-ammonium\ phosphate)$	0.17^{***}	12.18
		EX	-2.76^{***}	-11.50
Eq(2)	$FP(Meat\ \&\ seafood)$	$EN(Gasoline)$	14.28^{***}	11.44
		$FE(di-ammonium\ phosphate)$	-0.004	-0.82
		EX	-0.02	-0.34
Eq(3)	$FP(Beverages)$	$EN(Gasoline)$	77.95^{***}	3.90
		$FE(di-ammonium\ phosphate)$	0.30^{***}	3.64
		EX	-4.59^{***}	-3.35
Eq(4)	$FP(Vegetable\ oils\ and\ Protein\ Meals)$	$EN(Gasoline)$	25.45	0.83
		$FE(di-ammonium\ phosphate)$	0.47^{***}	3.72
		EX	-15.37^{***}	-7.08

* Statistical significance at 10% level. ** Statistical significance at 5% level.

***Statistical significance at 1% level

Table4. Results of Panel SUR ($EN(Gasoline)$ and $FE(Potassium\ Chloride)$)

Eq(No)	Depended variables	Independent variables	Coefficient	Z
Eq(1)	$FP(Cereals)$	$EN(Gasoline)$	32.98^{***}	11.00
		$FE(Potassium\ Chloride)$	0.17^{***}	12.10
		EX	-3.02^{***}	-12.75
Eq(2)	$FP(Meat\ \&\ seafood)$	$EN(Gasoline)$	12.77^{***}	11.69
		$FE(Potassium\ Chloride)$	-0.007	1.44
		EX	-0.008	0.10
Eq(3)	$FP(Beverages)$	$EN(Gasoline)$	79.40^{***}	4.55
		$FE(Potassium\ Chloride)$	0.41^{***}	5.03
		EX	-4.75^{***}	-3.53
Eq(4)	$FP(Vegetable\ oils\ and\ Protein\ Meals)$	$EN(Gasoline)$	126.97^{***}	4.66
		$FE(Potassium\ Chloride)$	0.24^{**}	-1.90
		EX	-18.05^{***}	-8.37

* Statistical significance at 10% level. ** Statistical significance at 5% level.

***Statistical significance at 1% level

Table5. Results of Panel SUR ($EN(Gasoline)$ and $FE(Potassium\ Chloride)$)

Eq(No)	Depended variables	Independent variables	Coefficient	Z
Eq(1)	$FP(Cereals)$	$EN(Gasoline)$	28.58***	9.50
		$FE(Phosphate\ rock)$	0.43***	14.02
		EX	-3.06***	-13.21
Eq(2)	$FP(Meat\ \&\ seafood)$	$EN(Gasoline)$	13.71***	12.27
		$FE(Phosphate\ rock)$	-0.002	-0.19
		EX	-0.013	-0.17
Eq(3)	$FP(Beverages)$	$EN(Gasoline)$	94.54***	5.26
		$FE(Phosphate\ rock)$	0.57***	3.09
		EX	-5.32***	-3.94
Eq(4)	$FP(Vegetable\ oils\ and\ Protein\ Meals)$	$EN(Gasoline)$	92.08***	3.31
		$FE(Phosphate\ rock)$	0.14	0.51
		EX	-17.25***	-8.05

* Statistical significance at 10% level. ** Statistical significance at 5% level.

***Statistical significance at 1% level

Table6. Results of Panel SUR ($EN(Gasoline)$ and $FE(triple\ superphosphate)$)

Eq(No)	Depended variables	Independent variables	Coefficient	Z
Eq(1)	$FP(Cereals)$	$EN(Gasoline)$	28.58***	9.50
		$FE(triple\ superphosphate)$	0.43***	14.02
		EX	-3.06***	-13.21
Eq(2)	$FP(Meat\ \&\ seafood)$	$EN(Gasoline)$	13.71***	12.27
		$FE(triple\ superphosphate)$	-0.002	-0.19
		EX	-0.013	-0.17
Eq(3)	$FP(Beverages)$	$EN(Gasoline)$	94.54***	5.26
		$FE(triple\ superphosphate)$	0.57***	3.09
		EX	-5.32***	-3.94
Eq(4)	$FP(Vegetable\ oils\ and\ Protein\ Meals)$	$EN(Gasoline)$	92.08***	3.31
		$FE(triple\ superphosphate)$	0.14	0.51
		EX	-17.25***	-8.05

* Statistical significance at 10% level. ** Statistical significance at 5% level.

***Statistical significance at 1% level

Table7. Results of Panel SUR ($EN(Gasoline)$ and $FE(Urea)$)

Eq(No)	Depended variables	Independent variables	Coefficient	Z
Eq(1)	$FP(Cereals)$	$EN(Gasoline)$	23.76***	5.75
		$FE(Urea)$	0.27***	9.02
		EX	-2.49***	-9.61
Eq(2)	$FP(Meat\ \&\ seafood)$	$EN(Gasoline)$	15.07***	10.20
		$FE(Urea)$	-0.01	-1.32
		EX	-0.06	-0.69
Eq(3)	$FP(Beverages)$	$EN(Gasoline)$	108.21***	4.54
		$FE(Urea)$	0.17	0.97
		EX	-5.25***	-3.61
Eq(4)	$FP(Vegetable\ oils\ and\ Protein\ Meals)$	$EN(Gasoline)$	-20.08	-0.55
		$FE(Urea)$	1.18***	4.39
		EX	-13.14***	-5.75

* Statistical significance at 10% level. ** Statistical significance at 5% level.

***Statistical significance at 1% level

Table 8 to 12 show that energy price (crude oil (petroleum)) has a positive significant impact on cereals, meat & seafood, beverages, vegetable oils and protein meals that it is consistent with the finding of Abbott, Hurt et al. (2008), Avalos (2014), Akram (2009), Mitchell (2008) and Hezareh et al.(2016). The coefficient of the exchange rate has a negative significant impact on cereals, meat & seafood, beverages, vegetable oils and protein meals. This result is in line with the findings of Harri, Nalley et al. (2009), Baek and Koo (2010) and Kwon and Koo (2009).

Table 8, 9, 11 and 12 show that di-ammonium phosphate, potassium chloride, and triple superphosphate have a positive significant impact on cereals, beverages, vegetable oils and protein meals. Also, in table 10, phosphate rock variable has a positive significant impact on cereals, beverages and has a positive impact on vegetable oils and protein meals. Table 8 to 12 show the potassium chloride, di-ammonium phosphate, phosphate rock and triple superphosphate variables have a negative impact on meat & seafood. This result is in line with the findings of Abbott, Hurt et al. (2008) and Hezareh, et al. (2016).

Examining the relationship between energy price (crude oil (petroleum)) and food price subgroups show that crude oil price has not the same effect on food price subgroups. For example, in table 12, crude oil has the most effect on beverages and the least effect on vegetable oils and protein meals.

Table 8. Results of Panel SUR ($EN(Crude\ Oil\ (petroleum))$ and

Eq(No)	Depended variables	Independent variables	Coefficient	Z
Eq(1)	$FP(Cereals)$	$EN(Crude\ Oil\ (petroleum))$	0.69^{***}	7.42
		$FE(di-ammonium\ phosphate)$	0.16^{***}	11.32
		EX	-2.68^{***}	-11.06
Eq(2)	$FP(Meat\ \&\ seafood)$	$EN(Crude\ Oil\ (petroleum))$	0.35^{***}	10.19
		$FE(di-ammonium\ phosphate)$	-0.003	-0.59
		EX	-0.02	-0.32
Eq(3)	$FP(Beverages)$	$EN(Gasoline)$	1.94^{***}	3.51
		$FE(di-ammonium\ phosphate)$	0.30^{***}	3.57
		EX	-4.59^{***}	-3.30
Eq(4)	$FP(Vegetable\ oils\ and\ Protein\ Meals)$	$EN(Crude\ Oil\ (petroleum))$	-0.17	-0.21
		$FE(di-ammonium\ phosphate)$	0.56^{***}	4.25
		EX	-16.14^{***}	-7.34

* Statistical significance at 10% level. ** Statistical significance at 5% level.

***Statistical significance at 1% level

Table 9. Results of Panel SUR ($EN(Crude\ Oil\ (petroleum))$ and $FE(Potassium\ Chloride)$ **)**

Eq(No)	Depended variables	Independent variables	Coefficient	Z
Eq(1)	$FP(Cereals)$	$EN(Crude\ Oil\ (petroleum))$	0.91***	11.27
		$FE(Potassium\ Chloride)$	0.16***	11.41
		EX	-2.89***	-12.03
Eq(2)	$FP(Meat\ \&\ seafood)$	$EN(Crude\ Oil\ (petroleum))$	0.31***	10.49
		$FE(Potassium\ Chloride)$	-0.008	1.59
		EX	-0.0007	-0.01
Eq(3)	$FP(Beverages)$	$EN(Crude\ Oil\ (petroleum))$	1.99***	4.20
		$FE(Potassium\ Chloride)$	0.42***	4.96
		EX	-4.76***	-3.47
Eq(4)	$FP(Vegetable\ oils\ and\ Protein\ Meals)$	$EN(Crude\ Oil\ (petroleum))$	2.96***	3.99
		$FE(Potassium\ Chloride)$	0.21*	-1.66
		EX	-18.39***	-8.35

* Statistical significance at 10% level. ** Statistical significance at 5% level.

***Statistical significance at 1% level

Table 10. Results of Panel SUR ($EN(Crude\ Oil\ (petroleum))$ and $FE(Phosphate\ rock)$ **)**

Eq(No)	Depended variables	Independent variables	Coefficient	Z
Eq(1)	$FP(Cereals)$	$EN(Crude\ Oil\ (petroleum))$	0.77***	9.36
		$FE(Phosphate\ rock)$	0.41***	13.07
		EX	-2.99***	-12.68
Eq(2)	$FP(Meat\ \&\ seafood)$	$EN(Crude\ Oil\ (petroleum))$	0.34***	11.10
		$FE(Phosphate\ rock)$	-0.003	-0.27
		EX	-0.01	-0.23
Eq(3)	$FP(Beverages)$	$EN(Crude\ Oil\ (petroleum))$	2.43***	4.90
		$FE(Phosphate\ rock)$	0.55***	2.89
		EX	-5.29***	-3.85
Eq(4)	$FP(Vegetable\ oils\ and\ Protein\ Meals)$	$EN(Crude\ Oil\ (petroleum))$	1.93***	2.51
		$FE(Phosphate\ rock)$	0.22	0.76
		EX	-17.85***	-8.16

* Statistical significance at 10% level. ** Statistical significance at 5% level.

***Statistical significance at 1% level

Table 11. Results of Panel SUR ($EN(Crude\ Oil\ (petroleum))$ and $FE(triple\ superphosphate)$

Eq(No)	Depended variables	Independent variables	Coefficient	Z
Eq(1)	$FP(Cereals)$	$EN(Crude\ Oil\ (petroleum))$	0.76***	8.42
		$FE(triple\ superphosphate)$	0.16***	11.18
		EX	-2.88***	-11.96
Eq(2)	$FP(Meat\ \&\ seafood)$	$EN(Crude\ Oil\ (petroleum))$	0.35***	10.63
		$FE(triple\ superphosphate)$	-0.003	-0.64
		EX	-0.02	-0.29
Eq(3)	$FP(Beverages)$	$EN(Crude\ Oil\ (petroleum))$	2.32***	4.37
		$FE(triple\ superphosphate)$	0.24***	2.76
		EX	-5.09***	-3.69
Eq(4)	$FP(Vegetable\ oils\ and\ Protein\ Meals)$	$EN(Crude\ Oil\ (petroleum))$	0.22	0.27
		$FE(triple\ superphosphate)$	0.52***	3.86
		EX	-16.91***	-7.75

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* Statistical significance at 10% level. ** Statistical significance at 5% level.

***Statistical significance at 1% level

Table 12. Results of Panel SUR ($EN(Crude\ Oil\ (petroleum))$ and $FE(Urea)$)

Eq(No)	Depended variables	Independent variables	Coefficient	Z
Eq(1)	$FP(Cereals)$	$EN(Crude\ Oil\ (petroleum))$	0.71***	6.40
		$FE(Urea)$	0.25***	8.28
		EX	-2.40***	-9.26
Eq(2)	$FP(Meat\ \&\ seafood)$	$EN(Crude\ Oil\ (petroleum))$	0.35***	8.75
		$FE(Urea)$	-0.005	-0.46
		EX	-0.03	-0.36
Eq(3)	$FP(Beverages)$	$EN(Crude\ Oil\ (petroleum))$	2.77***	4.28
		$FE(Urea)$	0.18	1.05
		EX	-4.98***	-3.41
Eq(4)	$FP(Vegetable\ oils\ and\ Protein\ Meals)$	$EN(Crude\ Oil\ (petroleum))$	-1.59*	-1.62
		$FE(Urea)$	1.41***	5.16
		EX	-13.49***	-5.88

* Statistical significance at 10% level. ** Statistical significance at 5% level.

***Statistical significance at 1% level

Conclusion

Although food prices in major world markets are at or near a historical low, there is increasing concern about food security. Therefore, identifying the effective factors on food price can be as a guidance for policy makers to make suitable planning for improving the food security in the world. The objective of this paper was to investigate the relationship between world food prices and energy prices. The analysis is based on a panel SUR approach .

We have also found that energy prices (gasoline and crude oil (petroleum)) have a positive significant impact on the price of cereals, meat & seafood, beverages, vegetable oils and protein meals. Also, the exchange rate has a negative and significant effect on all food price subgroups. the results show that energy price has not the same impact on food price subgroups.

The results of this study suggest that the influence of energy prices on food price should be further examined. The implication of this study for policy planning is important especially for improving the food security.

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