International Journal of Food and Agricultural Economics
ISSN 2147-8988
Vol. 2 No. 2 pp. 97-112

PROCESS OF GLOBAL SHOCKS TRANSMISSION TO DOMESTIC FOOD PRICE LEVEL: CASE OF BANGLADESH

Fakir Azmal Huda
Humboldt University of Berlin, Chair of Agricultural Policy, Philippstrasse 13-Haus-12A Room: 61 D-10115 Berlin. Germany
&
Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh. E-mail: fahmithus@hotmail.com

Abstract

The world experienced in dramatic price surge of food commodities since mid of 2007 to 2008. It was claimed that the crisis were being mainly for backdrop of global shocks in food and energy price. But how the shocks come to domestic market from external sources is a researchable phenomenon. Surprisingly few attempts have been made to systematically analysis of shock transmission from international to domestic market. The study analyzed the effect of global commodity market factors and domestic exchange rate development on domestic food price in Bangladesh. A bi-variants co-integration approach was applied for the analysis of shock transmission. Finally an error correction model was developed. The overall magnitudes of the pass through suggest that only 46 per cent of the total world shock pass-through in domestic economy.

Key words: *Co-integration, error correction model, instability, pass-through, and price transmission.*

1. Introduction

A food crisis started at mid 2007 in Bangladesh. Researcher claimed it was arises for two main national perspectives. The first one was rice production shortage and second was sharp increase food price level. The genesis of the production short fall begins in July-September 2007 because of floods in planting season and devastating cyclone *Sidre*. The two frequent disasters damaged near about 2 million tons of the *Aman* crop. This consequence seriously appeared before the second largest cropping season *Boro* harvest. The crisis seems severe when the global perspective of food shock turns in acute form. In terms of volume, the world rice market is very fragile. And rice is a political commodity for most of the Asian countries. In any shortfall, exporting and importing countries are carefully observed the price movement in international market. They try to keep domestic rice price in stable form. On the other hand in response to the world wide food shock the rice exporter countries are encountering their domestic shock just by imposing export banned.

All the market and non-market causes of price hike are the subject of much analytical and policy debate. The researcher notably Timmer (2008) found that three basic factors for international food price shock that highly correlated to boost up food prices at a steady rising level since first-decade of 21st century.

The First one is the drastic economic growth in two main Asian giant economies China and India. Those are significantly uplifting the demand for natural resources such as oil, metals, timber, and fertilizers. The demand is sustain rise greater than supply for these resources. Consequently the prices of non-food commodities climbed steadily after 2004.

The second one is, a persistent fall of the US dollar value since mid-decade of the century. It added a dimension to the upward price pressure on dollar-dominated commodity prices directly. Which gear up for speculative hedges against the declining dollar worldwide indirectly? The third and most interesting factor was the high-energy price associated with legislative mandates to increase production of bio-fuels. This were established a price link between energy prices and ethanol/bio-diesel which feed stock corn in the US and vegetable oil in Europe. From 2005 to the end of 2007 the world crude oil price also climbed steadily.

The world price shocks are pass-through in domestic economy especially in small open economy by exchange rate development. On the other hand trade policy and structure of food sector. Bangladesh is a small economy and food sectors depend on the import. At the same time making export items competitive the country also devaluated domestic currency against US dollar. But as a marginal importer of food it leads to add another dimension of domestic food price by double declining of currency valuation when the US dollar sustain depreciated and other partner currency appreciated.

The study empirically analyzed how, the identified factors of worldwide food price instability factors pass-through to Bangladesh food sector in co-integration frame work. Theoretical ground of world's food price instability comes from traditional dynamic supply and demand balance of commodities. The dynamic supply of commodity depends on the integrated factors like level of technology, climate variability and energy price. On the other hand dynamic demand constitute of food, feed, fiber and bio-energy policy.

For analyzing world price instability Gilbert (2008) use simply the magnitude of supply and demand curves. He argued that most of the commodity price movement occurs for shift in the demand curve and rightward shift in a demand curve is a reason behind price rises. However, the extent of the price instability depends on the slope of the supply curve. In case of elastic supply, price variability modestly approached in rising. They test the pass-through by developed an econometric modeling based on Generalized Least Squares (GLS) regression under co-integration framework.

The existences of stationerity in the international and domestic market are difference in price of two markets. The difference is helps to conclude the short run and long run dynamics of price adjustment precisely. They also introduced lags of domestic and world price in estimating domestic price at given period by the error correction model which developed Baffes and Gardner (2003). Their model also expresses the short-term adjustment. It indicates how much of the price change in world market at a given time are transmitted to the domestic price series. Estimating the adjustment coefficient both lag term of domestic price and world price of the model mean, how much of the difference between the global and domestic prices in the one lag period might affect the price change from the lag period to the current period. In-case of pass-through of exchange rate development, Aghevli, Khan, and Montiel (1991) argued continuous devaluation have a strong ground to effect on inflation and income distribution. This kind of pass-through deals with the factors that effect of devaluation on the price of tradables. As the price of tradables in small open economy is determined by international market through foreign currency. On the other hand for less responsive supply curve price instability relatively high. But in extreme inelastic case, the supply associated with a small shift in demand creates substantial price variability. The theoretical ground behind the global shock pass-through to the domestic economy is exchange rate development and the extent of price transmission across borders.

Finally a key question arise about domestic price instability for a small open economy is; how much world market prices is pass-through to domestic economy? The extent and magnitudes of pass-through influence on the adjustment of producers and consumers in stabilizing world price movements. These adjustments would squeeze consumption; encourage production. Some time it creats volatililty of domestic price, only when world

prices are completely transmitted to economy. All causes of world market shocks are take place to domestic market (Imai, Gaiha, & Thapa 2008).

Considering the purchasing power parity proposition, the price of tradable in domestic currency may change in response to a change in exchange rate (ER) or price of tradable in foreign currency. According to Prachchowny (1975), holding other things remaining constant the exchange rate or devaluation may lead to rise in domestic price level is considering an exogenous policy instrument. For market specific factor the present study will focus on the relationship between world petroleum price with domestic food prices as well as world rice price to domestic food rice separately. In-case of aggregate or macroeconomic factor, the relationship between exchange rate and food price will also be analyzed. The study aim at to provide information on how shocks in product of one market are pass through to another in the commodity price line reflecting competitiveness in marketing for inter-sectorial resource and effectiveness of arbitrage. At the same time how the monetary policy relating to exchange rate development transmitted to food price shock.

2. Methodology

2.1 Data Source

The sample period chosen for this study extend from July 2005 to the December 2009. The monthly food price indexes of Bangladesh were used as a proxy for food price that obtained from Bangladesh Bank online publication archive. The monthly official exchange rate taka (Bangladeshi Currency) per doller used as exchange rate variable as a indicator of devaluation. The monthly world average crude petroleum price in fob Dubai represent fuel price (USD per barrel) that obtained from International Financial Statistics (IFS) online service. In case of world rice price, the study used monthly f.o.b price of 5 percent broken Thai in the Bangkok origin. The data of world rice price and petroleum price were adjusted in domestic level for making c.i.f price, just adding the ocean freight per unit of commodity from port of origin to Chittagong port in Bangladesh. Usually monthly ocean freight rate from Bangkok to Bangladesh and Dubai to Bangladesh is not available. Therefore the study used annual ocean freight rate from U.S. Gulf port to Bangladesh as a proxy, assuming the rate is constant over a year. The other supportive data were collected from published and un-published documents from Bangladesh Bureau of Statistics (BBS), Bangladesh Bank and Department of Agricultural Marketing (DAM).

2.2 Empirical Model

The study developed a simple model to focus the pair wise relationship between world rice price and domestic food price, petroleum and domestic food prices as well as exchange rate and domestic food price. It test the hypothesis of whether or not changes in world price, petroleum price and exchange rate play a significant influence in changing national food price. As the study dealing with pair wise series simple Engle and Granger (1987) residual based co-integration testing technique seems to be appropriate in the study. In initial step the study use the simple regression equation for further proceed of testing the co-integration as follows:

$$LnFoodex = \alpha_0 + \alpha_1 \, LnWRPrice_t + v'_t \quad (1)$$

$$LnFoodex_t = \beta_0 + \beta_1 \, Fuelprice_t + v_t' \quad (2)$$

$$LnFoodex_t = \gamma_0 + \gamma_1 \, LnOER_t + v_t' \quad (3)$$

Where $LnFodex_t$ is natural log of domestic food price level, $LnWRPrice_t$ is natural log of world rice price. $Fuelprice_t$ is crude oil price, $LnOER_t$ is natural log of exchange rate and v'_t is the error term at time t. While α,β and γ are respective regression co-efficient.

2.2.1 Unit Root Test

Before investigate whether or not a stable linear steady-state relationship exists, between the variables. The study conducted a unit-root test or identify the order of integration for each series. The tests showed the existence of stationarity in each time series. The stationarity stochastic process rear to find in time series data but many of the non-stationary stochastic time series can be approximated by a polynome of certain order. The non-stationarity time series have often a property that if they are differentiated in certain times order the resulting time series will be at-least mean stationarity.The most popular technique of testing a process is stationarity is Dickey-Fuller test with a simple Autoregressive Moving-Average ARMA process. This study applied both Dickey-Fuller (DF) and the Augmented Dickey-Fuller (ADF) (Dickey & Fuller, 1981) unit-root tests to decide the order of integration of the series. If a non-stationary process y_t is (weak) stationary after the difference operator k times, we can call the process y_t is integrated of order k (or different stationary or homogenous). Starting from an original form of ARMA series,

$$y_t = ay_{t-1} + u_t \quad (4)$$

u_t is a white-noise process, which is an infinite time series of jointly distributed random variables with a constant mean and finite variance σ^2. If $|a| < 1$ and significant in the model 4 the process is (weak) stationary otherwise $|a| > 1$ the process is non-stationary.

To make a non-stationary process to stationary (at least mean stationary) the so called different filter of first order were used as follows:

$$\Delta y_t = by_{t-1} + u_t \quad (5)$$

Which links to (4) as

$$y_t + (y_{t-1} - y_{t-1}) = ay_{t-1} + u_t \text{ or } \Delta y_{t-1} = y_{t-1}(a-1) + u_t \quad (6)$$

if a-1= b the final equation 6 would be same as equation 5. Therefore for the value of a = 1, b would be 0, if $|a| < 1$then b would be -2< b < 0. Ultimatly, for time series process if the b is not significantly equal to zero and -2 < b < 0, then a is not significantly equal to 1 and , the process will be weak stationary.

The Dickey-Fuller test is considering the equation (5) and significance of b. The null hypothesis would be H_0: b = 0 or alternative hypothesis would be Ha: -2<b<0, for the case $\hat{t} \geq DF_{n\text{-}K}$ (n = number of observations and k = number of parameters accept constant). If H_0 is accepted, the conclusion comes at the process is not weak stationary. On the other hand if , $\hat{t} \leq DF_{n\text{-}K}$ H_0 is rejected and the process conclude the weak stationary.

To follow the requirement of the regression in least square estimator, where no autocorrelation for u_t is required but in some case the equation (5) u_t may show the autocorrelation. To overcome the problem of autocorrelation in u_t Augmented Dickey-Fuller test were used. Where autocorrelation is approximate by lagged-endogenous variables of y_t, the equation (5) then transformed as:

$$\Delta y_t = by_{t-1} + \sum_{i=1}^{m} ci\, \Delta y_{t-i} + u_t \quad (7)$$

Where, the number of m has to be increased until the error term u_t become a white-noise process. The parameter b and c are estimated by using the OLS method. For the test, study compare statistics same as previously mention Dickey-fuller statistics and concluded on the hypothesis.

2.2.2 Co-integration Test

To investigate whether or not a stable linear steady-state relationship exists between the variables, we need to conduct cointegration tests for them. The concept of co-integration is the long-term relationship between two or more process, existing same order of integration or at least greater than equal to one. At the same time a linear combination of the residuals of the regression model to integrated series.

The two process y_t and x_t is said to be co-integrated of an order k and m in which $k \geq m \geq 1$,. Symbolically co-integration between two process expressed as: y_t , $x_t \tilde{}$CI (k, m). The both process have to be same order $k \geq 1$ of integration and it exist a significant linear combinations like $u_t = y_t + \alpha x$, so that u_t is integrated of (k-m)-th order. This is called the co-integrated parameter . It can be estimated by two steps procedure as follows:

In first step, the simple regression model $y_t = \alpha x_t + u_t$ were fitted to have the conclusion of α significantly different from zero as well the residuals of the regression model. In this study equation (1), (2) and (3) of empirical model were fitted to have the specific conclusion of co-integration.

In second step, the residuals were analysed for each model to have co-integration of order k and m of two series which ensured by the residuals of regression integration of (k-m)-th order. In special economic interest is the case, that k = m, or zero order of integration.

Residuals regression was set in the study as follows:

$$\Delta u_t = bu_{t-1} + \sum_{i=1}^{m} c_i\, \Delta u_{t-I} + e_t \quad (8)$$

This study applied again the Augmented Dickey-Fuller (ADF) (Dickey & Fuller, 1981) test to decide existence of co-integration of each pair of the series by residuals order of integration from equation (8) at zero. Because if the two processes are co-integrated of order k and m, the residuals of the regression must have to be integrated of (k-m)-th order, as k = m it 0 order integrated. In other word the linear combination $u_t = y_t + \alpha x$ of the original processes y_t and x_t is integrated of the order zero which satisfy the (weak) stationarity (Franke,2009).

2.2.3 Vector Error Correction Model

The first step in the Engle-Granger method is estimating regression model of the co-integrated variable by using OLS. The assumption of the two co-integrated variables should be integrated otherwise the model would be 'spurious regression'. It may contain high R squared and significant t values, without economic meaning. When the results of OLS estimations tested for co-integrated series the parameter would be supper consistent estimator of the long-run equilibrium.

In final stage the study examined the Engle-Granger (1987) casual relationship between each pair of series within bi-variate framework. In the bi-variate case, the casual relationship

term as vector error correction model (VEM) and it's general forms is as follows for medium sample size.

$$\Delta y_t = \alpha_0 + \lambda\,(y_{t-1} - bx_{t-1}) + \sum_{m=1}^{M} \alpha_m \Delta y_{t-m} + \beta_0 \Delta x_t + \sum_{n=1}^{N} \beta_n \Delta x_{t-n} + \varepsilon_t \qquad (9)$$

In the error correction model, the short run dynamics of long run equilibrium between two integrated processed are quantified. According to Granger, if two processes is co-integrated then VECM exist. With a VECM that corresponding to the long-run equilibrium of two processes, one integrated process can be described by the other. The temporary difference of the long-run equilibrium of the previous period (y_{t-1-} a+bx_{t-1}) quantified by this error correction term (ECT) that express the information about the long run relation and the temporary shock.

The parameter λ has to be significantly negative in the model to ensure temporary differences converge to zero in long run. The other parameters α and β are the co-efficients of the stationary variables that explain the short term behaviour of the dependent variable. The parameters of VECM are estimated by the OLS and significancy were tested with the t-statistics and stepwise selection. The overall goodness of fit model tested by F test and R square test. Assumption of normal distribution of residuals and autocorrelation of the models were tested by $\chi 2$ test and Durbin-Watson test respectively.

3. Results and Discussion

3.1 Unit Root Test of Food Price and Its Selective Determinants

The Table 1 presents DF test statistics for the level and first differences of the food price series. The selective determinants are world rice price, fuel price and exchange rate series. The results suggest that, the null hypothesis about the series, non-stationary cannot be rejected for all series selected at level. Thus it is clear; the series are non stationary in level.

On the other hand, the null hypothesis of existence of unit root may be rejected at the 5% level of significance for all of them. The first differences are integrated I (I) in order one. This implied that the non stationary time series achieved stationarity after the first order diffencing i.e. all the selected series in the study are integrated in first order I (1).

Table 1. Unit root tests of food price and its selective determinants.

Items	Variable form	Level		1st difference	
		DF Parameter	DF test statistics	DF Parameter	DF test statistics
Food Price	LnFodex	0.0027	3.78	-0.472	-4.022**
Fuel Price	Fuelprice	-0.0015	0.105	-0.483	-4.094**
World Rice Price	LnWRprice	0.0021	1.045	-0.475	-4.028**
Official Exchange Rate	LnOER	0.00032	1.115	-0.963	-7.019**

Note: ** denote 5% significance level.The tabulated $DF_{n-2,k}$ or $DF_{52,1}$=-1.95.

3.2 Co-Integrated Relationship Between Food Prices with Its Selective Determinants

Using the conventional co-integration testing procedure, by Engle Granger (1987), the study determined the existence of long run relationship of food price with international rice price, fuel price and exchange rate. The approach involved two-stage procedure in which first estimate pair wise regression equation of food price as dependent variable with each determinant as independent variable (International rice price, fuel price and exchange rate) using OLS. Then testing the unit root of each pair's residuals of the regression equation. Again, DF test statistic used to conclude on the hypothesis of the presence of co-integration among the series.

On the basis of Granger causality test, the Table 2 presented the long run uni-directional causality from international rice price, fuel price and exchange rate to food price. The result of the test indicate, that the null hypothesis of absence of co-integrating relation between food price and world rice price, food price and fuel price as well as food price and exchange rate are denied at 5% level of significance. The final interpretation of co-integrating relationship between each pair of the series would be the linear combinations of them are stationary. Consequentely, the series tend to move towards the equilibrium relation in the long run and each pair co-move over the time.

Table 2. Co-Integration of Food Price with Its Selective Determinants.

Name of co-integrated Variable	Estimated parameter	DF test statistics	F statistics	Decision H_0:No co-integration relation H_A: At most one co-integration relation
Food price/world rice price	-0.144(0.001)	-3.461	17.25(000)	$H_{0:}$ is rejected
Food price/exchange rate	-0.153 (0.04)	-2.06	4.25(0.04)	$H_{0:}$ is rejected
Food price/fuel price	-0.494(0.05)	-3.634	15.59(000)	$H_{0:}$ is rejected

Note: Numbers in parentheses give the asymptotic significance level (p values).

The theory of integrated liberalized economic system postulates that the co-integration between domestic and international price for commodity a small open economy. For agricultural commodity such evidence of integration is found when the country is an exporter. In an increasingly-integrated global economic system, the co-integration displayed by national and international prices for a staple such as rice. But as a net importer of a staple, international price shock may be instantly muted. The imperative test of co-integration between Bangladesh national food price level and international rice price of Bangkok, indicate existence of controlled and such muted relation.

On the same ground energy price in international market co-integrated to domestic's food price level through production channel. High energyl price will result in higher food production cost in three ways. One is link with nitrogen based fertilizer like urea which heavily used in rice production. Comparing 4th quarter 2007 of with 2003, world market prices increased by 107% for urea. It is a source of nitrogen that the main fertilizer used by Asian farmers (Timmer, 2008). In second way rice production cost is linked in HYV technology for tillage, irrigation, post harvest processing etc. The thirdly food commodity price may effected by transportation cost that directly link with energy price. In case of Bangladesh food production technology is not highly energy intensive but the fuel cost positively correlated with food price.

Typically annul food import is a significant issue in Bangladesh Economy. The most essential food items like rice, wheat, sugar, pulses and edible oil are imported. Cost of imports expected to have substantialinfluence on food price level. The exchange rate exerts inflationary pressure mainly via import prices as well as food prices Majumder (2006). While intermediate goods and raw materials like Triple Supper Phosphate (T.S.P), Murate of Potash (M.P), pesticides and fuel for irrigation and tractions in HYV technology are also imported. High import price of such intermediate have goods link via exchange rate regime that increased cost of production and lead food price raise. The next section discussed dynamics of the co-integration relations in details with shock transmission.

3. 3 Analysing The Shock Transmission Process to Food Price.

An important question for analysing factors affecting the food price instability is the extent to which world market prices have been pass-through to the domestic economy. The extent of price transmission is depends on three key factors such as the exchange rate at which the dollar prices are exchange to domestic currency;- existence trade policy and the restriction or barrier that control the flow of commodities across the border;- and the speed of adjustment in domestic economy of world price shock. The transmission of cereal price to domestic price varies across countries.

The normal market lags and moderate policy of intervention delay the immediate transmission of world price shock into domestic economy. But longer and restricted trade policy substantially differ the two prices and make more pressure for moves towards convergence of steady state (Timmer, 2008).The following sections analysed the pair wise transmission dynamics to identify the factors speed in steady-state equilibrium.

The most prominent technique of detection of, the changing relationships for price formation across commodities and factors speed is Granger causality in the vector error correction model. Simply select independent variable which is said to "Granger Cause" (in the study world rice price, world fuel price and official exchange rate in natural log form) dependent variable (represent domestic food price level also log form). If these, time series information on independent variable adds to the explanation of dependent variable over and above the ability of past values of dependent variable to explain the current value.

Econometrically, vector autoregressive (VAR) techniques are used to determine how much of dependent variable can be explained using by lagged values of dependent variable itself. After which lagged values of independent variables are added to the regression. If these lagged values are statistically significant in contributing additional explanatory power to independent variable, then it *is* said to "Granger cause" of dependent variable.

3.3.1 Long Run and Short Run Dynamics of Shock Transmission Relation To World Rice Price Shock

The world price of rice measured in domestic currency was passed through to domestic markets. The short run, long run magnitudes and speed of adjustment in pass through to domestic economy indicate country specific policy option as "stabilizer and free trader" Dawe (2008).

This section examined the extent to which changes in global rice price are transmitted to domestic food prices in Bangladesh. The focus is on short and medium-run adjustment processes using an error correction specification and finally indicator of pass through that identify the position of country's sheild level.

On the basis of coefficients of the VECM 10 (Vector Error Correction Model), the Error Corretion Term ECT with $\Delta LnFodex_t$ as dependent variable found negative and statistically

significant. It indicates the existence of a relationship between domestic food prices to world rice price. The co-efficient of independent variable $LnWRprice_{t-1}$ in the model is significant at 10 percent. It specifies the Bangladesh food price has positive relationship with world rice price. It implied an increase in world rice price causes a rise in Bangladesh food price in long run. With regard to causality result ECT value -0.10 measure the speed of adjustment indicating that 10 percent of disequilibrium is corrected each month for reaching long run equilibrium for steady state position. This is a moderate speed to adjustment. In the case of short run the relationship between two integrated variable is not significant as the difference lag term of world price of rice $\Delta LnWRprice_{t-n}$ is not statistically significant in the model.

$$\Delta LnFodex_t=0.169-0.104^{*}(LnFodex_{t-1}-0.27^{*}LnWRprice_{t-1})-0.078\Delta LnWRprice_{t-5}+0.742\ LnFodex_{t-1}-0.579\ LnFodex_{t-2}+0.437\ LnFodex_{t-3} \quad (10)$$

In fact, the adjustment is the weakest for food price to world market price of rice. In the figure 1 the domestic food price co-movement with global price is clear but the transmission is not completed because of government interventions in both input market subsidization in production and price support program to consumer.

According to Dawe (2008) criteria, Bangladesh is classified as "stabilizers" in response to global price shock**.** The nature of "stabilizers" domestic prices is that it should move less volatility and variance than world price. The rate of pass-through percentages that referred by Dawe (2008) as "stabilizers" have to be less than 50 percent of global shock.

This is turns out to truth in Bangladesh where price signals from the world market not fully getting through to consumer and farmers. But are controlled by policy intervention. The Table 3 indicates a range of pass-through between pre-shock and shock period in Bangladesh. It provides the evidence of effort to shield consumers from the spike in prices.

Source: Bangladesh Bank.

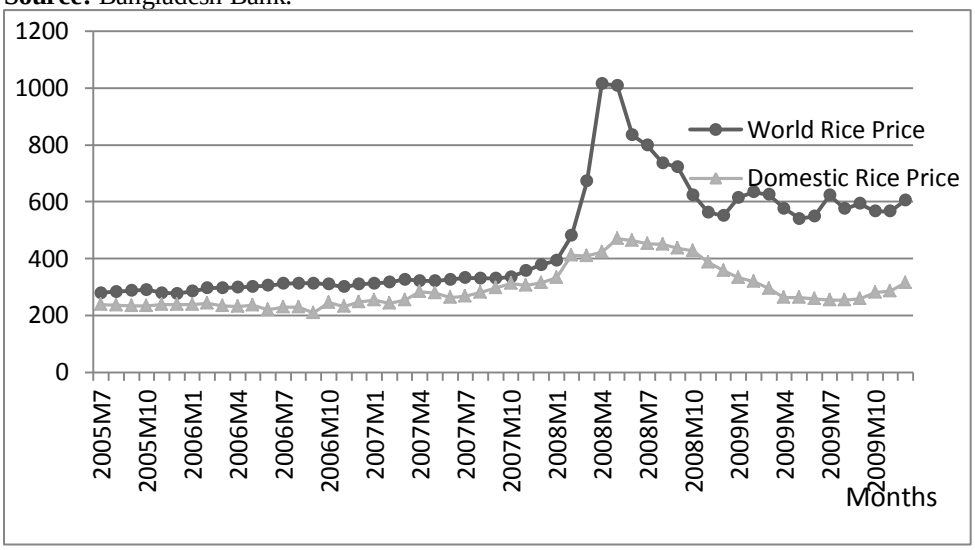


Figure 1. Co-Movement of World and Domestic Price of Rice US$/MT

The real increase in domestic rice prices has been averaged only about one half in pre-shock period of the hike in international prices in real dollar terms. This indicates that the

pass-through of international to domestic rice prices was muted though the end of 2007.When world food price began to increase very rapidly and reaching a peak of more than $1000 per tonne in April and May of 2008. That was extreme price surged in world market but transmission to domestic market is very controlled and some time muted.

Table 3. Cumulative Changes in Real Rice Prices, Q4 2003 To Q4 2007 And "Early" 2007 To "Early" 2008 (Percent).

Peried / Indicators	Q4 2003 to Q4 2007	"Early" 2007 to "Early" 2008
World Price (US$)(1)	56	203
World Price (DC) (2)	55	171
Domestic Price (DC) (3)	24	54
DC Pass through (%) = (3)/(2), (4)	44	32

DC = domestic currency. Sources: Timmer (2008).

In Bangladesh, prices increased nearly 44% in the span of 1st year, whereas prices did not increase more than 32% in peak of price shock in 2008. But inspite of low pass-through such comparative price rises have been serious repercussions for household food security, and often for domestic politics as well. As mention earlier Indian policy of banned non-basmati rice in April 2008. In a thinly trading international rice market had no possibility of procuring rice from elsewhere .So the domestic price shot up but not as much as proportion to world price surge.

Because of that period was a second largest harvesting season. The government also re-acting to the global price situation and encourage the farmers to plan a *bumper Boro c*rop. Subsidizing farm inputs mainly fuel and fertilizer fortunately favors the result of the effort towards outstanding performance. The country got a crop of 17.8 million tons that was more than the projection. While arriving of the Boro crop in the domestic market the retail price started to decline. Finally country successfully mitigate world price shock by in completing transmission in both shot run and long run. But continuation of the export ban by India that was important contributor of Bangladesh rice price shock tried to continued again after the May 2008. In the absence of import channel farmers and all actors intent to hoard a significance portion of the Boro harvest in anticipation of the future lean period and expectation of higher price. But rice price declining trend in world market signaling the domestic price to decline again.

3.3.2 Long run and short run dynamics of transmission in case of energy price shock

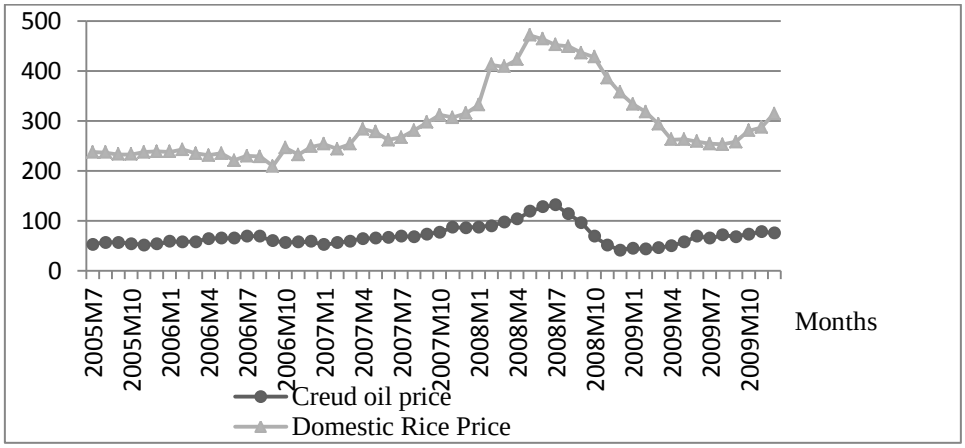
The energy sector of Bangladesh constitute of natural gas, fossil fuel and hydro power. Natural gas now contributes 68 percent of the energy basket, followed by oil 30 percent and rest 2 percent comes from hydro-electric power (Islam, 2008b). Domestic production of oil is estimated 10% of the total requirement and rest of the fossil fuel imported from international market. The annual oil import is 3.8 million tonnes of which diesel are 2.1 million tonnes. Bangladesh usually provides subsidy in diesel for low cost transport and for agriculture policy goal of self sufficiency in food production, Islam (2008b). In the time of world shock some adjustment to administer price of energy product especially on diesel and kerosene. The Bangladesh energy sector mainly depends on imported fuel and domestic fuel. The price more or less reflects from the movement of world fuel price.

As a basic input of production, fuel constitutes a significant portion of the production cost in every sector of the economy. So increased cost of imported fuel passed on to the end users. Mujumder (2006) found that an increase in the diesel price (proxi for oil price)

stimulates food inflation both in urban and rural areas. The report estimated the correlation co-efficient of food to oil price 0.36 and 0.41 rural and urban areas respectively. Baffes (2007) found the pass through of oil prices into agricultural commodity price is 17 percent, while Mitchell (2008) measured the combined effect of higher energy price and transportation cost to U.S.agriculture by 15 percent to 20 percent.

According to IMF,(2008) the global price index for all primary commodity has been increased 204 percent from 2000 to 2008.While major sources of this price hike claimed in petroleum price raise which increased of more than 300 percent crude oil price index has increased 272 percent. On the other hand the food price increased by 107 percent during the same period. Such global fuel prices shock is argued to be one of the major factors behind the surge in the cereal prices (USDA, IFAD and FAO, 2008).

This section of the study intends to examine the co-movements' dynamics of the world petroleum price and Bangladesh food prices and causality between them.



Source: International Financial Statistics & DAM.

Figure 2. Co-Movement of World Crude Oil Price & Domestic Rice Price

After having the existence of the long-run relationship between domestic food prices with world fuel price, the selected Granger Casualty is used to estimate the short run long-run coefficients in error-correction model. Specifically, the error correction model is estimated from the reduced-form solution of equation (8). To that end, step wise backward selection procedure was applied to find the significant lag length of the variables and fit model only with the significant parameter.

The coefficients of the error-correction terms ECT are found to be negative and statistically significant at the 5% significance level. Where the model with domestic food price ($LnFodex_t$) as dependent variable and world fuel price ($Fuelprice_t$) as independent variable. The ECT value is ensuring the existence of the long-run relationship between variables (equation 11). The estimated coefficients of $LnFodex_{t-1}$ cases is 0.64, implying that deviation from the long-run equilibrium is corrected by 6.4% in one month which is low speed in adjustment process in long run steady state position. The precise interpretation of the model is that the Bangladesh food price has a positive long-run relationship with energy price. This implied that an increase in energy price leads to a rise in food price through the costs of producing fuel intensive technology, transporting and processing of agricultural commodities. The figure 2 clearly depicts the long-run steady state relationship between world fuel prices to domestic rice price.

The error-correction model also estimated the coefficients of difference lag term of independent variable $\Delta LnFodex_{t-n}$. It captures the short-run dynamics that seem to exist between the Bangladesh food price and world fuel price (equation 11). The results show that, world fuel price is the factor affecting food price in the short-run as well as long run. As the estimated, co-efficient is statistically significant at 5% level for selected lag length that is Bangladesh food price has a positive short-run relationship with fuel price.

$$\Delta LnFodex_t=0.135-0.064*(LnFodex_{t-1}+0.004*Fuelprice_{t-1})-0.74*\Delta LnFodex_{t-2}+ 0.0002*\Delta Fuelprice_t-0.0003\Delta Fuelprice_{t-1}-0.0003*\Delta Fuelprice_{t-2}-0.0002*\Delta Fuelprice_{t-5}- 0.0003*\Delta Fuelprice_{t-6}- 0.0002*\Delta Fuelprice_{t-7}- 0.0002*\Delta Fuelprice_{t-10} - 0.0007*\Delta Fuelprice_{t-11..} \quad (11)$$

The high oil price is a significant factors of high food price because it leads to increase production cost of food. Although agricultural production is not highly energy intensive but it link with through nitrogen based fertilizer and transportation cost of agricultural commodity as mention, earlier. Bangladesh agricultural sector depends on energy-intensive irrigation, only in the dry season. Therefore, a small positive correlation between the fuel price and food price level is found. The speed of adjustment in long run steady state is comparatively low. Because the country has not pass through international oil price change the domestic economy in a timely fashion or some time political pressure. As a result pass through of international oil price hike to domestic market is also incomplete.

3. 3.3 Long-run and short-run dynamics of global shocks in relation to exchange rate.

Exchange rate movement has been played an important role in determining in domestic price level. On the basis of the exchange rate regime, the magnitudes of pass through of price shock from international market to domestic market can be determined. Appreciation of a currency might mute high world price shock, while depreciation would minimize the effect of declining world food prices on border prices in domestic currency. The exchange rate polices of the Bangladesh Bank always favors export sector. As a result sustained devaluation of the BDT, since the independent of Bangladesh and still it was persisting. In the pre-food price shock period in 2007, the domestic currency of Bangladesh first time appreciation against the USD very modestly while, the USD has seen significant decline against major currencies, including Bangladesh. Therefore net effect of the importers in Bangladesh has been paying higher import bills in terms of domestic currency that ultimately being pass-through to the food price level.On May 31, 2003 the country adopted Floating exchange rate system and experienced the transition to a floating regime as it was smooth.The first ten months, the exchange rate remained stable experiencing a depreciation of less than 1 per cent from June 2003 to April 2004. After that, the BDT has depreciated around 16-18 percent against the USD (Islam, 2008a).

Depreciation of currency in the intervene floating system effect on the economy perspectives. It directly affect on the rate of inflation through the level of pass through in Bangladesh mainly food inflation. Since Bangladesh import dependent country, both for food import and food production inputs. Any fluctuations in prices in international market highly pass through domestic market in under-valued exchange rate regime.

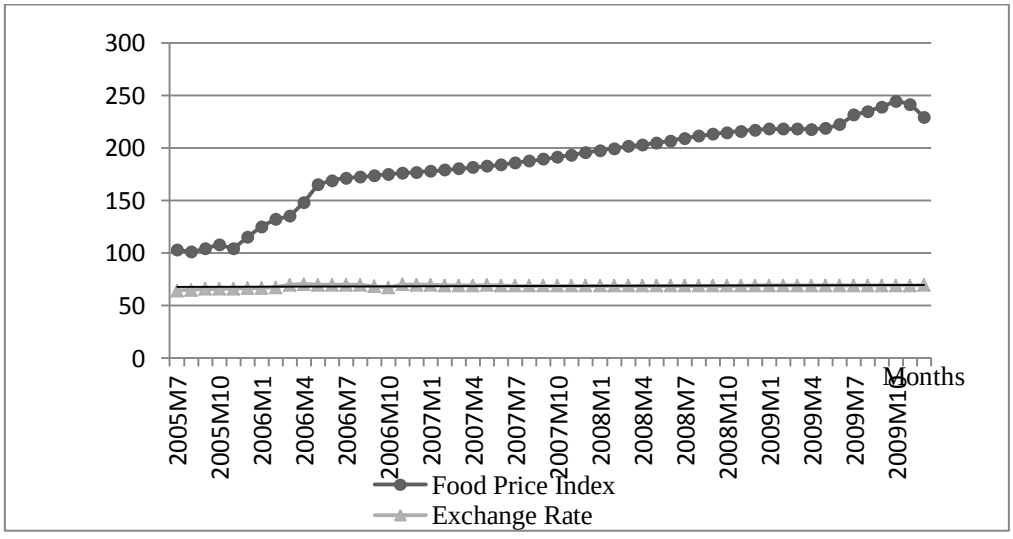
After experimentation of the general form of the error correction model with 4 lagged first difference terms dependent variable ($LnFodex_t$) and explanatory variable ($LnOER_t$), the parsimonious specification are found to fit the data best as in equation (12). The Error correction model of food price with the exchange rate gave the following results in the equation.

$$\Delta LnFodex_t=1.122-0.062(LnFodex_{t-1}-8.831LnOER_{t-1})+0.904\Delta LnOER_{t-1}+1.029\Delta LnOER_{t-2}+0.582\Delta LnOER_{t-3} \quad (12)$$

The results of the Granger causality test show that there exists a long run uni-directional causality from exchange rate to the food price. The coefficient of the error correction term ECT is negative (-0.062). This means that if the food price in period t-1 is below the long run equilibrium, and then the error correction mechanism will drive the food price to be high up to long run steady state condition. The short run (SR) contemporaneous elasticity of food price with respect to exchange rate is -0.90. This means that in the very short run, a 10% devaluation of BDT against U.S. dollar will cause a 9% increase in the food price.

From abandoning the two-decade long BDT-USD peg, the BDT weak over the period from 2003 to 2007 after adopted market-based floating exchange rate system as mentioned earlier. Inspite of theoretical property of non intervention by monetary authority in new system of market oriented exchange rate, like other central bank BB substantially intervene. The BDT has continued depreciation against the USD since 2003 to 2007. But in 2007, the BDT has experienced in a modest appreciation against the USD. In the time of pre-shock USD start to sustained devaluation interms of major currencies. Instead of good reserve of foreign currency, highly depreciated USD turns against the Indian Rupee, the Thai Bhat, the Singapore dollar, and the Australian dollar, among others. Specifically those are Bangladesh's major importing country of Bangladesh.

It was evident from the different studies that from the pre-shock period of food surge in price in 2008. The global market prices had increased in real dollar terms. Comparing to fourth quarter of 2007 with the same quarter of 2003, the observed global market prices were increased 56% for rice, 91% for wheat, 40% for corn, and 107% for urea. In same period however, the dollar depreciated sharply against many currencies. Comparison of the percentage appreciation of the real exchange rate for the seven Asian countries, Bangladesh, China, India, Indonesia, Philippines, Thailand and Vietnam who are the major exporter and importer of rice in the world.



Sources: Bangladesh Bank

Figure 3. Monthly Food Price Index & Official Exchange Rate BDT/US$

Their real exchange rate appreciation against the dollar, help to mediate some of the impact of increased prices in dollar terms in respective country. These appreciation policy impacts of real exchange rates are uneven for the same commodity for different country. The world market price of rice did not in effect increase by as much as was commonly believed some countries of the group. But in-case of Bangladesh, world price increase appeared because of the real exchange rate was approximately constant (Timmer, 2008). Consequently the nominal value of the BDT fall substantially against the Euro, the Indian Rupee, the pound sterling, the Thai bath, the Australian dollar, the Swedish Crone, the Singapore dollar, the Japanese yen and the Chinese Yuan. Among others, the Bangladesh needs to import with the U.S.dollar from trading partner Islam (2008b).

The USD appreciating significantly against the Bangladesh's other trading partners' currencies. However, the evident from the monthly exchange rate and food price index in the figure 3 illustrate, constancy of valuating Bangladesh currency against dollar.While other trading partner currency appreciating. High inflation regime occurs in food price level. That chocked out those advantages in months of shock period. An undervalued exchange rate taxed consumer in case of tradable commodity consumption in domestic market. The importers pass-through the excess domestic currency they pay for the import payments to the consumers for food. As a results, the prices of tradable food rises in the domestic markets. (Islam, 2008a).

4. Conclusions

It can be conclude that food inflation or price instability in Bangladesh dominated by the world prices of rice and fuel as a market factors. In spite of import consumption ratio of rice is very low, world rice price mainly Indian export price significantly affect Bangladesh food inflation. Another dimension of domestic price movement were found; the under valuation of domestic currency or constant real exchange rate at the time of sustained devaluation of dollar when other trading partners exchange rate were appreciated. Consequently import payment for both food commodity and inputs of food production became higher at the time of production shock by two consecutive floods and devastating cyclone sidre at the end of 2007. Interestingly the pass-through is "stabilizers" in nature for rice which means domestic prices is move less volatility and variance than world price. The world price signals in short run muted by policy intervention but in long run moderately controlled and takes ten months for co-movement with world price.

In-case of fuel, pass-through via fuel price more or less reflects from the movement of world fuel price in short run. The full or significant passes through of oil prices pose huge political risk for the government in Bangladesh. Moreover, from food security perspectives, the government cannot afford to withdraw subsidy for the agricultural sector considerably Islam (2008 b). In the time of world food price shock, some adjustment to administer price of energy product especially on diesel and kerosene. But increased cost of imported fuel passed on to the end users in long run. Of course, the sharply fall of BDT real exchange rate or constant value of nominal exchange rate were reflected directly in prices increase of food commodities in country. Because when Bangladesh imports food from India or Thailand other than U.S, the import bill should be paid in U.S dollar which sharply depreciated. Consequently cumulative effect of trading partner's currency appreciation and U.S. dollar depreciation substantially increase the imported food price. For the same reason in domestic supply side, high price of imported inputs for production like fuel, fertilizer and pesticide etc, pass through to food price. In long run adjustment by importer or wholesaler to change in the value against U.S. dollar and trading partner's currencies to domestic currency causes

the price of food to rise when dollar fall and trading patterns rise. In short run in monthly price formulation, such movement of dollar and import trading partner currency might be stimulate financial speculation into commodity markets which established a direct price link even before importer or producer have a change to adjust and disappear in long run.

The overall analysis of the price movement factors and magnitude carryout some key policy recommendations that may help in food price stability in the country. The first is (i) Maintain short-run trade policies to reduce domestic food prices; and (ii) stimulating agricultural investment and enhancing productivity to increase long-term food supply (iii) Efficient public stock management (iv) Cautious exchange rate development.

References:

Aghevli, Bijan B., Mohsin S.K., & Peter J. M. (1991). Exchange Rate Policy in Developing Countries: Some Analytical Issues. IMF Occasional Paper 78 Wasington:International Monetary Fund.

Baffes, J. & Gardner B. (2003). The Transmission of World Commodity Prices to Domestic Markets under Policy Reforms in Developing Countries., *Journal of Policy Reform.* 6(3), 159-180.

Dawe, D. (2008). Have Recent Increases in International Cereal Prices Been Transmitted to Domestic Economies? The experience in seven large Asian countries. ESA Working Paper No. 08-03. Rome, Agricultural Development Economics Division, Food and Agriculture Organization.

Dickey, D. A. & Fuller, W. A. (1981). Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. *Econometrica*, 49, 1057-72.

Engle, R.F. &.Granger C.W.J. (1987). Co integration and Error Correction: Representation, Estimation and Testing. *Econometrica*, 55, 251-276.

Franke, C. (2009). Stochastic Processes, Co-integration and Vector Error Correction Model. Lecture Series of Econometrics Course 2009 Chapter 6 & 7, Humboldt University of Berlin, Germany http://moodle.hu-berlin.de . (Need password).

Gilbert, C.L (2008). How to Understand High Food Prices .CIFREM and Department of Economics, University of Trento, Italy and Department of Economics, Birkbeck College, University of London, England .draft report 17 November 2008. Page (4-5). http://www.fao.org/es/esc/foodpriceswing/papers/HowtoUnderstandHighFoodPrices.pdf last visited on 25.06.2010.

Imai, K.. Gaiha, R. & G.Thapa (2008). Transmission of World Commodity Prices to Domestic Commodity Prices in India and China. Working Paper No.45. Brooks World Poverty Institution: Manchester, UK, Electronic copy available at:http://ssrn.com/abstract=1265633.

IMF (2009, February,15). IMF Primary Commodity Prices. http://www.imf.org/external/np/res/commod/index.asp. International Monetary Fund, 2010, International Financial Statistics online database. www.imfstatistics.org/imf/logon.aspx.

International Fund for Agricultural Development (IFAD) (2008). Growing Demand on Agriculture and Rising Prices of Commodities: An Opportunity for Smallholders in Low-income,AgriculturalbasedCountries? .www.fao.org/es/esc/common/ecg/538/en/RisingPricesIFAD.pdf .

Islam, M.S. (2008a, June), Commodity Boom and Inflation Challenges for Bangladesh. Institute of South Asian Studies (ISAS) Working Paper No: 40 Singapore.

Islam, M.S. (2008b, June), The Third Oil Shock: The Path Forward for Bangladesh.. Institute of South Asian Studies ISAS brief no 71 Singapore.

Majumder, M.A. (2006). Inflation in Bangladesh: Supply Side Perspectives. Bangladesh Bank Policy Note series No: PN 0705 .Bangladesh Bank, Dhaka Bangladesh.

Mitchell, D. (2008). A Note on Rising Food Prices. Policy Research Working Paper WPS 4682,World Bank, Washington, DC.

Prachchowny M. (1975). *Small Open Economies*. Massachusetts: Lexington USA.

Rahman A. & W. Mahmud (1988). Rice Market Intervention in Bangladesh. In Evaluation Rice Market Intervention Policies, Asian Development Bank, Manila, Philippines.

Timmer C. Peter (2008). Causes of high Food Prices, ADB Economic Working Paper series No.128 Asian Development Bank Manila, Philippines.

Acknowledgement:

The article based on the Master's thesis of the author co-ordinate by The Ghent University, Belgium. It was elaborated and defended at Humboldt University of Berlin (Germany) within the framework of the European Erasmus Mundus Programme "Erasmus Mundus International Master of Science in Rural Development 2010.

The author very gratefully acknowledges Professor Dr. Dieter Kirschke, Division of Agricultural Policy Humboldt University of Berlin Germany and the European Commission IMRD secretariat for the financial and logistic support through Erasmus Mundus Fellowship.