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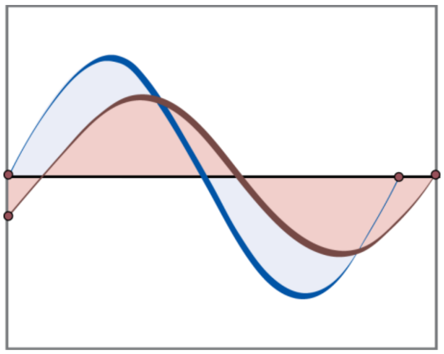

An Examination of the Import Price Transmission Mechanism in Trinidad and Tobago

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This paper analyses the impact of international price changes of rice, wheat, milk and soya beans on the domestic price of corresponding goods in Trinidad and Tobago. The paper uses monthly data between 2004 and 2010, from the IMF's International Financial Statistics database for international prices, and the Consumer Affairs Division of the Trinidad and Tobago Ministry of Legal Affairs for domestic prices. The results of a Vector Autoregression Model (VAR) illustrate that for the four commodities the transmission of a change in the international price of the corresponding item is felt by the second month, and the effects last between five to nine months. The knowledge of the influence of an international price shock on domestic prices can aid the Central Bank both in the development and implementation of appropriate policies/strategies to combat inflation.

JEL Classification Numbers: E31, F19, C30

Keywords: Price Transmission, Inflation, Food Prices, Trinidad and Tobago.

An Examination of the Import Price Transmission Mechanism in Trinidad and Tobago

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1. Introduction

The inflation rate in Trinidad and Tobago has been quite volatile over the past few years. While the popular perception has been to attribute this volatility to the effects of changes in the international market place, weather-related issues and their impact on domestic production have also been identified as contributing factors. There have however been limited formal investigations into the pass-through effects of price movements in the international commodity market on the domestic prices in Trinidad and Tobago.

Building on a previous study done by Primus et al (2011) this paper seeks to analyse the impact of international price changes of rice, wheat, milk and soya beans on the domestic price of corresponding goods. The monitoring of the developments in the international commodity market is of importance for Trinidad and Tobago given its high food import bill, which over the years has averaged 8 per cent of the country's non-energy import bill. Further, as indicated in the 2008/2009 Household Budgetary Survey (HBS), expenses on food and non-alcoholic beverages account for 17.1 per cent of the average household consumption expenditure[2]. This figure is higher for the poorer persons in the society: specifically, persons whose average income is less than TT$1000 a month, spent 26.2 per cent of their overall expenditure on food and non-alcoholic beverages.

Following this introduction, Section 2 of this paper provides a description of the recent trends in the domestic price of food in Trinidad and Tobago. This is followed by Section 3 which presents a brief summation of some of the literature that sought to explain the recent high cost of food globally. In Section 4 we provide a review of the literature on the transmission mechanism. A description of data and methodology used is then provided in Section 5 accompanied by the estimation results. Section 6 concludes.

[1] The authors are economists in the Research and Policy Department of the Central Bank of Trinidad and Tobago. Views expressed are those of the authors and do not necessarily reflect those of the Central Bank. The authors wish to thank Dr. Alvin Hilaire and Ms. Angela Henry for their comments on earlier drafts.

[2] Total consumption expenditure excluding home produced food and gifts.

2. Description of Food and Non-Alcoholic Beverages Prices[3] in Trinidad and Tobago

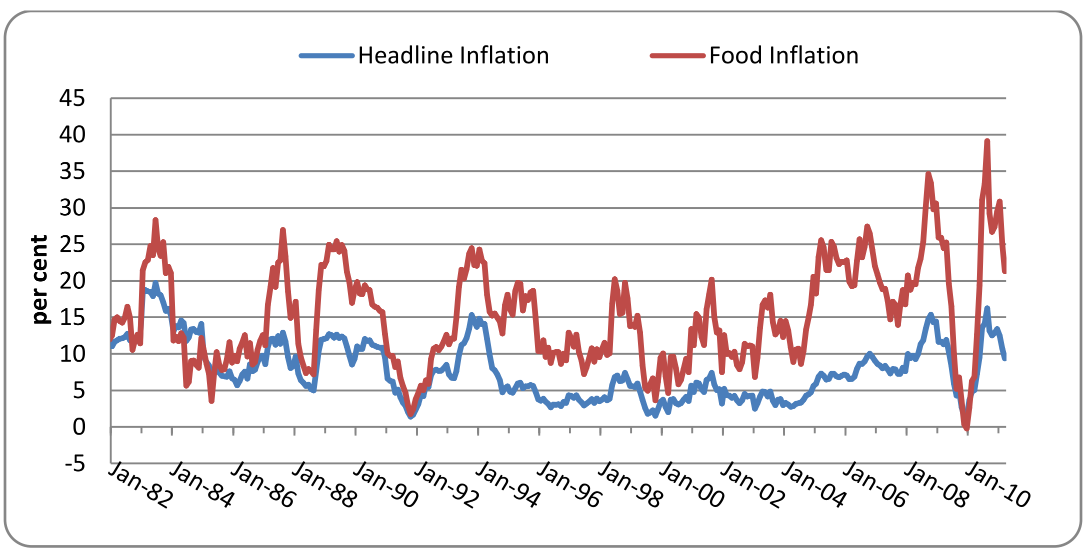
Rising international commodity prices and weather-related disruptions contributed to in an average food inflation rate of 12.8 per cent and 23.0 per cent in 2004 and 2005 respectively. Food inflation picked up in 2007 and peaked at 25.6 per cent in 2008. Some moderation of the average rate of food inflation was observed in 2009 but inflationary pressures intensified in 2010 on account of adverse weather conditions and heavy flooding in key agricultural regions. In 2008, the Bread and Cereals category recorded the largest increase (43.7 per cent) as grain prices increased in international commodity markets. Prices of fruits and vegetables were also significant contributors to the increase in food prices in 2008, with increases of 33.3 per cent for fruits and 27.9 per cent for vegetables. The moderation in the average rate of inflation in 2009 was on account of lower international agricultural prices coupled with relatively few disruptions to domestic agricultural supply. However, in 2010, poor weather conditions led to a sharp rise in the prices of domestically produced food items. Not surprisingly, fruits and vegetables recorded the most substantive increases averaging 41.5 per cent and 33.0 per cent, respectively.

As indicated by Primus *et al* (2011), two-thirds of the overall weight in the Food and Non-Alcoholic Beverages sub-index comprises of food items sourced within Trinidad and Tobago with the remaining one-third comprised of imported items. Therefore as increases in international food prices transmit to the domestic market in 2011 and 2012, food inflation may increase in the medium term.

Figure 1.

Headline and Food Inflation

(Year-on-Year Percentage Change)



Source: The Central Statistical Office of Trinidad and Tobago.

[3] In the rest of the paper, the Food and Non-Alcoholic Beverages sub-index is collectively referred to as the food category.

3. Possible Causes and Impact of Rising International Food Price

Over the last five years there has been a dramatic increase in international food prices. This rise is linked to a combination of both demand and supply factors. On the demand side, the increase in demand for biofuels[4], and greater demand from rapidly growing emerging economies are the main contributory factors. Strong growth in emerging economies has provided a potent and persistent stimulus to the demand for agricultural items. In these economies, rising populations combined with higher levels of disposable income not only increased the demand for staple foods but also for higher-valued foods such as meat and dairy products, as consumer diversified their diets. Increased demand for biofuels has been price-supportive due to the use of commodities such as grains, sugar and other food staples such as feedstock in its production. The use of crops for biofuels has also diverted agricultural land away from producing crops used for food, thereby impacting on food supply.

On the supply-side, higher energy prices have led to higher food prices via increases in production and transport costs. Another critical factor contributing to the increase in international food prices was a decline in the production of cereals in major exporting countries due to adverse weather conditions in key growing areas. These factors were further exacerbated by low stock levels. In 2006, stock-to-use ratios, particularly for grains and oilseeds, began to decline and eventually reached their lowest level in 2008. Stocks play a vital role in equilibrating demand and supply conditions. Consequently, low stock-to-use ratios may result in markets being lesser able to cope with supply and demand shocks, thereby driving up prices.

Other factors which have been attributed to the increase in international food prices include an increasing inflow of speculative funds into agricultural commodity futures markets and the depreciation of the US dollar. According to a report by the Food and Agricultural Organization of the United Nations (2009), between 2004 and 2009, global trading activity in both futures and options more than doubled. As the global financial crisis ensued, bond and equity markets weakened and investment banks and other institutional investors targeted agricultural commodity futures markets. The increased investment in futures contracts for agricultural commodities resulted in increased inflationary pressures on spot prices, thereby contributing to increased prices. The depreciation of the US dollar was also price supportive, since the prices of global agricultural commodities are denominated in this currency.

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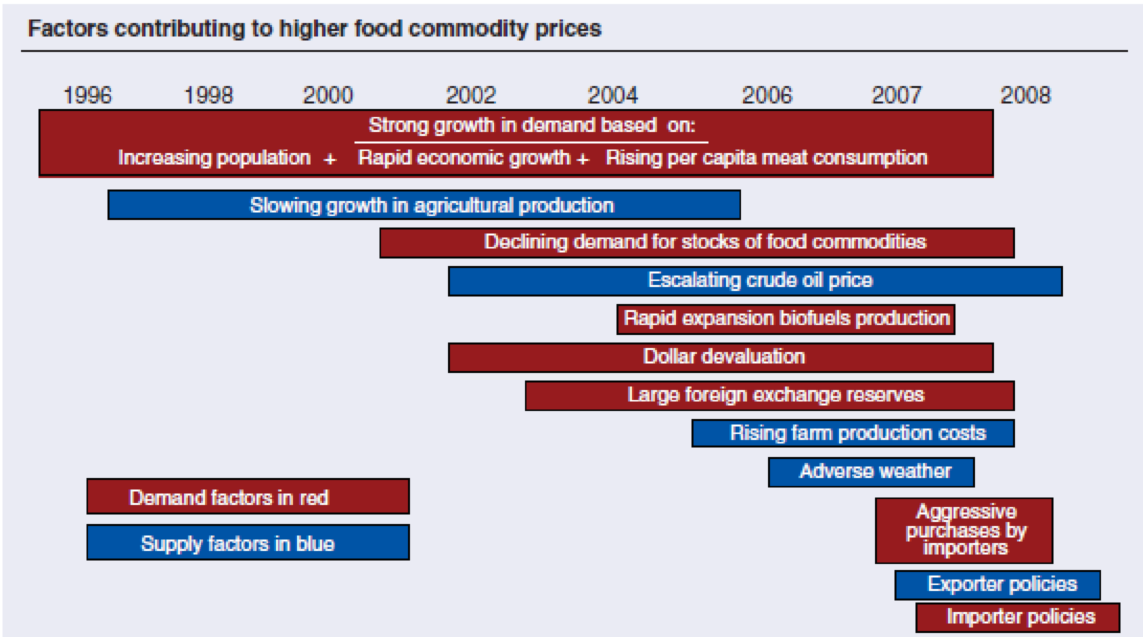
[4] Biofuels are derived from biomass, a biological material from living organisms.

Figure 2

Factors Contributing to Higher Food Commodity Prices



Source: Trostle (2008).

Rising food prices result in an increase in the overall rate of inflation in most countries. The higher the dependence of a country on food and the greater the weighting of food in the "basket" of goods measured by the Consumer Price Index (CPI), the greater are the upward pressures exerted on overall inflation when world food prices rise. Ultimately, the consumers' cost of living will increase, especially in developing economies that are net importers of food. This erosion of income is particularly severe for the poor who are especially vulnerable to higher food prices. In response to higher food prices, households may adjust their consumption patterns by reducing the quantity and/or quality of food items. Rising food prices can also have indirect effects on domestic inflation should they prompt wage increases and can result in an upward inflationary spiral. Generally, higher levels of inflation along with their associated costs can negatively impact an economy. These costs include the redistribution effects from savers to borrowers, increased business uncertainty, higher interest rates and eventually lower levels of investment and growth.

An increase in international food prices can also negatively impact trade balances as a result of higher import bills. This is especially true for countries that are net importers of food. Rising food prices can severely inhibit import capacity and significantly compromise food security in these countries.

4. Review of the Literature

Studies conducted specifically on the import price transmission mechanism tend to focus on specific products for which the international prices or the landed import prices can be found. For example Woolsey, Brown,and Lee (1992) examined the price of grapefruit, Feinberg (2008) the prices of bananas and virgin olive oil, while Mortaza and Rahman (2008) studied the prices of rice, wheat and edible oils. In the case of Woolsey, Brown,and Lee (1992) it was found that price changes were not fully passed on at the retail price level, though notably, import price increases were passed on more fully than price decreases. Feinberg (2008) on the other hand found that the pass-through effect of changes in the import prices was not statistically significant. Mortaza and Rahman (2008) concluded that while there was minimal impact of the changes in the international prices of rice and wheat on domestic prices, there was a significant relationship with edible oils.

The price ridigity literature tends to focus on the transmission of changes in international or import prices to the domestic price of indvidual countries. A more global analysis has been conducted by Mundlak and Larson (1992) who examined the world and domestic prices of some 60 agricultural products in 58 countries for the period 1968-78. Mundlak and Larson (1992) found that variations in world prices are almost fully transmitted to domestic prices and a high proportion of the variations in domestic prices are accounted for by variations in world prices. Conforti (2004) examined the prices of 18 food items in 15 countries across Latin America, Asia and Africa. The author found that the African countries had a low degree of price transmisson, while the Asian countries had a high degee, with the relationship in Latin America being mixed. Conforti (2004) also concluded that a high degree of transmission was more frequent for cereals and oilseeds, while it was generally lower for livestock products. More recently the World Bank (2011) has conducted similar analysis on the Middle East and North African region (MENA). The report states that in most of the countries there is a high rate of pass-through effect of international prices to domestic prices. In countries such as Algeria and Tunisia which have a low pass-through, government policy including subsidies and appropriate monetary policies assist in mitigating the impact of international food prices on the domestic prices.

These studies tend to use simple OLS regression, combined in several cases with a Vector Autoregression (VAR) Model to undertake their analyses. Warr (2008) for example examined the transmission of the import price of rice to the domestic price in Indonesia in pre-crisis, post crisis and non-crisis periods from 1985 to 2003 using both methodologies. The estimates for the long term pass-through elasticities were between 0.3 (pre-crisis), 0.4 and 0.7 (post-crisis) and 0.27 and 0.37 (whole non-crisis period). Other derivations include Brummer and Zorya (2005) utilising a Markov-switching Vector Error Correction Model to examine the price relationship between wheat and wheat flour in Ukraine from June 2000 to November 2004. This study found that the interventionist policy to stabilize flour prices may have had the opposite effect to what was intended, and that the prices were also influenced by the effects of the electoral campaign in 2004.

Studies examining the price transmission mechanism in the case of Trinidad and Tobago have been very limited. Christopher-Nicholls and Des-Vignes (2002) examined the exchange rate pass-through effect on inflation in Trinidad and Tobago. The study used a VAR model with quarterly data for the period 1982:1 to 2001:4, and five endogenous variables of the Index of Retail Prices (RPI), the index of Gross Domestic Product (GDP), base money, the nominal effective exchange rate, the United States export prices, and two exogenous variables - the treasury bill rate and oil prices. They found that the effect of an exchange rate shock persisted up to two and a half years. In addition, the results showed that a shock to import prices immediately affected domestic prices. Further, import price shocks accounted for the variation in inflation, from 1.2 per cent in period 2 to 27.8 per cent by period 30.

ECLAC[5] (2008) sought to examine how a 40 per cent increase in international commodity prices would affect the inflation rate in Caribbean countries. ECLAC (2008) first constructed an approximation to the pass-through effect by dividing domestic food inflation by world food inflation (using data for July 2006 to March 2008). In the case of Trinidad and Tobago the estimated pass through coefficient was 66 per cent, thus indicating that approximately two-thirds of world food inflation was transmitted to the domestic inflation rate. Using this information it was estimated that a 40 per cent increase in world food prices would result, for Trinidad and Tobago, in an increase in the overall inflation rate of 2.6 per cent.

More recently Primus *et al* (2011) using a visual inspection of the movements on international and domestic prices of various items, determined that there was an asymmetry in the transmission of changes in the international commodity market to the domestic prices in Trinidad and Tobago. They found that price increases were reflected in the domestic market within 2 to 5 months, while price decreases took much longer to be transmitted. While the current paper builds upon this work some essential differences should be noted. Firstly the current paper does not take into account asymmetry in the price transmission mechanism. Additionally unlike Primus *et al* (2011) actual prices collected at the retail stores are used in this analysis, while in the previous paper movements in the indices of the individual products calculated by the Trinidad and Tobago Central Statistical Office (CSO) were examined.

[5] Economic Commission for Latin America and the Caribbean.

5. Data and Methodology

5.1. Description of Data

For our study we examine the transmission of prices of milk, wheat, rice and soybean on the international market to the domestic prices of milk, flour, rice and cooking oil over the period 2004 to 2010. These four items were chosen due to their importance in the basket of retail items. At present rice, flour, powered milk and cooking oil account for 0.64 per cent, 0.68 per cent, 0.70 per cent and 0.04 per cent of the RPI. Additionally the items chosen are perceived to need limited processing in moving from the raw materials sourced in the international market to the consumable product sold in the domestic market. Thus the impact of factors affecting domestic production, and the market price, such as the cost of labour, raw materials and other infrastructural costs such as the cost of electricity is limited. Further from the 2008/2009 HBS breads and cereals account for 19 per cent of the overall expenditure on food and non-alcoholic beverages for the average household in Trinidad and Tobago, while milk (and cheese and eggs) represent 12 per cent, and oils and fats 6 per cent.

Monthly prices for the specified items in the domestic market place were sourced from the Consumer Affairs Division of the Trinidad and Tobago Ministry of Legal Affairs, as the CSO provides only price indices. The prices were for 2 kilogram packs of rice and flour, a 4 litre bottle of soybean oil and a 800 gram pack of powdered milk. The prices were all converted to US dollars[6] in order for comparability with the prices on the international market and represent the nominal value. Notably though a comparison of the prices of the specific items from the Ministry of Legal Affairs and the indices calculated by the CSO show a high degree of correlation. Data on the domestic inflation rate is sourced from CSO. While the information on world prices for rice, soybean oil, and wheat is taken from the International Monetary Fund's International Financial Statistics database and the price of milk is taken from the US Department of Agriculture website. These prices are all quoted in US$ per metric tonne[7].

While not explored in the current paper, changes in the international prices of the four items under consideration will not only affect the domestic price of the corresponding items, but also the prices of numerous other items that constitute the RPI such as bread, cakes, pasta, ice cream, cheese and butter. Changes in the prices of the selected products may also feed into the RPI though increases in the category of hotels, cafes and restaurants, which measures the changes of items such as the cost of buying sandwiches, roti, pizza, and fried-rice and chow-mein[8].

[6] Note that re-estimating the following models using all prices denominated in TT dollars did not fundamentally change the results.

[7] Note the estimations that follow were conducted using the converted collected prices. The results of the re-estimation of the equations using the domestic prices scaled to represent US$ tonne were consistent with these findings,

[8] Within this category the food component has a weight of 28.57.

5.2. Methodology and Results

In undertaking the analysis of the transmission of price changes in the international market to the domestic market., an estimation of the pass-through elasticities are calculated by examining the trend between the domestic price of a commodity and the international price. Further Warr (2008) expanded the model linking the pass-through elasticities of prices with the Armington assumption of substitution. Thus the domestic price of a commodity is affected by the price on the international prices as well as the prices of other goods in the market.

Following in the vein of the literature, for each of the products under consideration, the following equation was estimated:

$$\ln P_d = a + b \ln P_m + c \ln P_o + \varepsilon$$

Where P_d is the domestic price, P_m is the international price, P_o is the inflation rate and ε is the residual. The results from this initial model are presented in the table below.

Table 1

Estimates of Relationship

Item	Variable	Coefficient	T stats	Probability
flour	c	-1.258	-2.228	0.0224
	ln International Price	0.319	2.912	0.0046
	ln RPI	0.031	0.510	0.6111
milk	c	-2.163	-3.925	0.0002
	ln International Price	0.420	5.901	0.0000
	ln RPI	0.263	6.380	0.0000
soya	c	-0.816	-2.455	0.0162
	ln International Price	0.416	7.946	0.0000
	ln RPI	0.061	1.935	0.0565
rice	c	-2.944	-17.141	0.0000
	ln International Price	0.605	19.709	0.0000
	ln RPI	0.070	3.019	0.0034

The results of the pass-through elasticity were 0.319 for flour, 0.420 for milk, 0.416 for soya and 0.605 for rice. The pass-through effect from the international prices to retail prices is significant in all four cases. However tests for stationarity of the price variables and the residuals of the equations indicate the presence of unit roots, thus suggesting that the results from this simple model may be spurious.

In order to overcome the issue of the unit roots, we instead employ the use of a VAR model. The use of a VAR model is driven by the lack of a cointegrating relationship between the domestic price and international price of the goods under investigation. According to World Bank (2011) the lack of cointegration is related to imperfect arbitrage which occurs due to costs of arbitrage and the impact of institutional factors on domestic prices. The model that we estimate takes the form of:

$$lnP_{d_t} = a_{11} lnP_{d_{t-1}} + b_{12} lnP_{m_{t-1}} + c_{13}\, lnP_{o_{t-1}} + \varepsilon_{1t}$$

$$lnP_{m_t} = a_{21} lnP_{d_{t-1}} + b_{22} lnP_{m_{t-1}} + c_{23}\, P_{o_{t-1}} + \varepsilon_{2t}$$

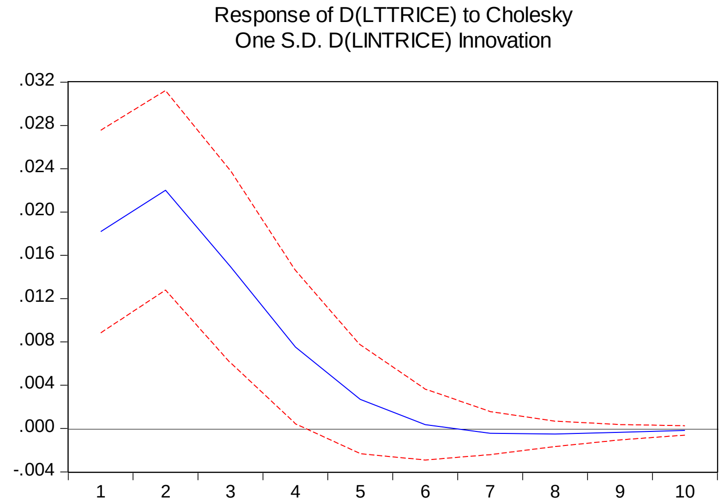
$$lnP_{o_t} = a_{31} lnP_{d_{t-1}} + b_{32} lnP_{m_{t-1}} + c_{33}\, P_{0_t - 1} + \varepsilon_{3t}$$

Where the variables are as described above.

The interpretation of VAR models is not as clear-cut as that of a simple OLS. To interpret the results the impulse response function and variance decomposition information are used. Impulse response functions measure the effect of a one-standard deviation innovation of a variable on the system. Variance decompositions illustrate the percentage of the forecast error variance in one variable that is due to changes in the other variables. Additionally, for each commodity the direction of Granger causality was determined. Weinhagen (2005) describes the determination of Granger causality as "a variable is said to cause a second variable when adding past values of the variable to an autoregressive model of the second variable improves the predictability of the second variable". In the case of Trinidad and Tobago *a priori* expectations are that international prices would granger cause domestic prices.

In the case of rice we find that we can reject the hypothesis that the domestic price of rice Granger causes the international price of rice, and we do not reject that the international price of rice Granger causes the domestic price of rice. The results of the VAR indicate that there is a positive and significant relationship between the domestic price of rice and the international price. Further from the analysis of the impulse response function we find that the impact of a change in the price of international rice peaks in the second period, (suggesting a lag of around two months), and abates by the seventh period. Also we find that in the first period, 16 per cent of the forecast error of the domestic price of rice is accounted for by the international price of rice, and by the second period some 30 per cent of the error is as a result of shocks in the international price.

Figure 3



It should be noted that much of the imported rice that comes into Trinidad and Tobago is sourced from Guyana and there is some limited domestic supply (as indicated in the table below).

Table 2

Supply of Rice Available in Trinidad and Tobago (000 KGS)

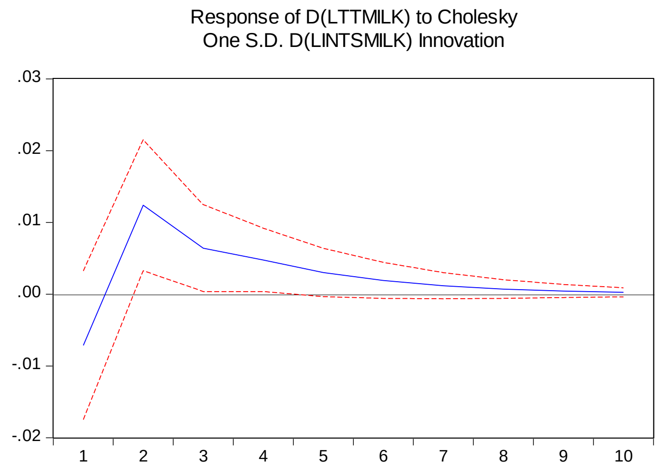
Year	**Domestic Production**	**Imported**
2004	1,720	30, 550
2005	2,082	33,549
2006	3,789	32,246
2007	2,740	38,401
2008	2,683	32,769
2009	2,225	46,334
Jan-June 2010	665	14,628

Source: The Central Statistical Office of Trinidad and Tobago

Trade data indicate that over the period under review Guyana has been the primary source of rice for Trinidad and Tobago accounting for an average of 60 per cent of the imports into the country. One advantage that Guyana has over its international competitors in the Trinidad and Tobago market is related to the level of applied tariff on rice which is currently 25 per cent. Thus, while imports of rice from outside the CARICOM region are subjected to this 25 per cent tariff, imports from Guyana are able to enter the market duty free.

In the case of milk we find that we can reject the hypothesis that the domestic price of milk Granger causes the international price of milk, and we do not reject that the international price of milk Granger causes the domestic price of milk. The results of the VAR model indicate that there is a positive and significant relationship between the domestic price of milk and the international price.

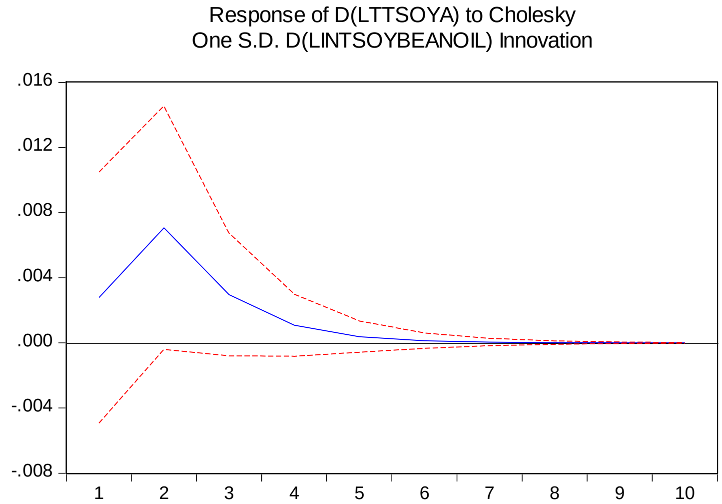
Figure 4



From the examination of the impulse response function and the effects of an increase in the international price of milk on the domestic market are observed between the first and the ninth period, though the maximum absolute effect seems to occur in the second period. Notably there was a fall in the rate of change of the domestic price due to the shock in the international price in the first period. Additionally we find that in the first period, 2.28 per cent of the forecast error of the domestic price of rice is accounted for by exogenous shocks to the international price of rice, however by the second and third period this grows to 8 and 9 per cent respectively. Notably while Trinidad and Tobago does have some small scale production of milk for the domestic market, this is often sold either in the form of fresh cows' milk or to the local Nestle production plant. Thus the domestic demand for powdered milk is satisfied by imported product.

Trinidad and Tobago does not produce soybeans, and thus the main input (crude soybean oil) in the production of soybean oil at the National Flour Mills has to be imported. However it should be noted that given the significant importation of refined soybean oil (with the US, Argentina and Brazil being the main sources of the refined product), one can hypothesize that the domestically produced soybean oil has only a small share of the market. In the case of soybean, estimating a system with one lag we find evidence to support the hypothesis that the international price of soybean oil Granger causes the price of soybean oil sold on the domestic market. The results from the VAR indicate a positive relationship between the domestic price of soybean oil and the international price of crude soybean oil, and the result is significant at the 10 per cent level.

Figure 5

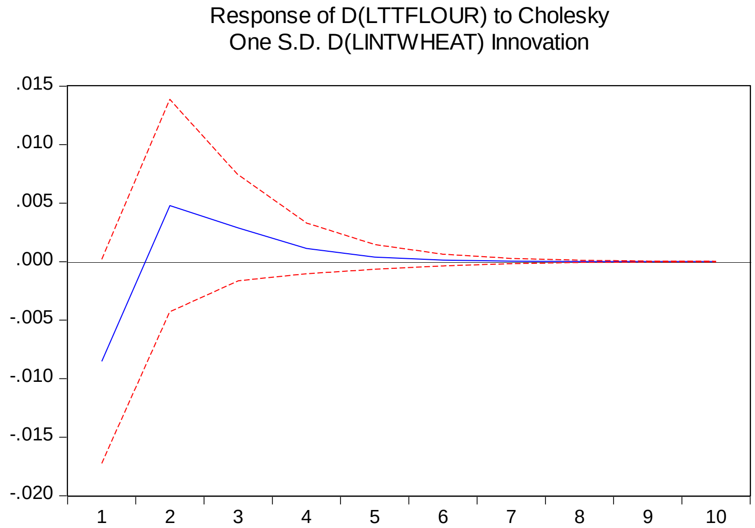


As can be seen from the impulse response function the effect of an increase in the international price of soybean oil affects the domestic price of soya bean oil almost immediately, with the peak occurring in the second period. The impact subsides by the sixth period. Further a shock to the international price of soybean oil accounts for less than 1 per cent of the forecast error of the domestic price of soybean oil in period 1 before rising to 4 and 5 per cent in the two subsequent periods.

A perusal of the supermarket shelves in Trinidad and Tobago indicates that much of the flour that is sold in the county is made by the processing of wheat. Of course the climatic conditions in the country are not conducive to the production of wheat and thus all must be imported, the majority from the US. It is therefore not surprising that in regards to the changes in the international wheat price to domestic price of flour[9] we find that we cannot reject the hypothesis that the international price of wheat affects the domestic price of flour; however the reverse does not hold true. The results from the VAR indicate a positive relationship between the domestic price of flour and the international price of wheat, and the result is statistically significant at the 10 per cent level. The results show that the increase in the international price of wheat is felt in the domestic market by the second period, with the effect dying out by the sixth period. Notably there was a fall in the rate of change of the domestic price due to the shock in the international price in the first period.

[9] Ideally the analysis of the transmission of the changes in the international wheat price to domestic flour prices should be modelled via an error correction model as the presence of co-integration is noted. The results from the VECM model are presented in Appendix 4. However the results should be viewed with caution as the time span may be too short to provide an accurate estimation of the long run relationship. For consistency with the other results we present the estimates from the unrestricted VAR.

Figure 6



From the variance decomposition matrix we see that a shock to the international price of wheat accounts for 4.55 per cent of the forecast error of the price of domestic flour in period one and then rises slightly in the subsequent periods. Given that flour is a necessary prerequisite to the production of many other items which are included in the calculation of the RPI, such as bread, cakes, etc, there should be a second generation impact of a rise in the international price of wheat on the country's inflation rate.

6. Conclusion

This review of the transmission of international prices to the domestic prices in Trinidad and Tobago reveals that for the four commodities under consideration, changes in the international commodity prices have an impact on related domestic items. The full impact of a change can be felt domestically by the second month after the change in the international price, reflecting some delay in the transmission of the international price. Without further information regarding the pricing and purchasing strategies of the domestic firms one can only hypothesize that the delay in the transmission of the price change may be related to the presence of stocks of raw materials, existing contracts, the time to ship new stocks at increased prices, and/or the use of derivative instruments to hedge against price changes. The results of the estimation also indicated that the impact of these changes lasts between five and nine periods.

This paper provides an initial econometric investigation into some of the factors influencing the inflation rate in Trinidad and Tobago. Future work can include an examination of any asymmetry in the transmission of the international prices to the domestic market, as well as the transmission of price changes along the domestic distribution change. Such investigations will aid in increasing the understanding of the factors influencing domestic inflation.

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Appendix 1: OLS Results

Dependent Variable: LTTRICE
Method: Least Squares
Sample: 1 84
Included observations: 84

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.944375	0.171771	-17.14132	0.0000
LINTRICE	0.604927	0.030691	19.70996	0.0000
LYYINFLA	0.070206	0.023251	3.019492	0.0034

R-squared	0.864317	Mean dependent var	0.809063
Adjusted R-squared	0.860967	S.D. dependent var	0.269677
S.E. of regression	0.100555	Akaike info criterion	-1.721168
Sum squared resid	0.819011	Schwarz criterion	-1.634353
Log likelihood	75.28907	Hannan-Quinn criter.	-1.686269
F-statistic	257.9903	Durbin-Watson stat	0.249561
Prob(F-statistic)	0.000000		

Dependent Variable: LTTFLOUR
Method: Least Squares
Sample: 1 84
Included observations: 84

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.258772	0.540685	-2.328106	0.0224
LINTWHEAT	0.318886	0.109515	2.911818	0.0046
LYYINFLA	0.031201	0.061123	0.510458	0.6111

R-squared	0.137176	Mean dependent var	0.506903
Adjusted R-squared	0.115871	S.D. dependent var	0.269057
S.E. of regression	0.252989	Akaike info criterion	0.124119
Sum squared resid	5.184277	Schwarz criterion	0.210934
Log likelihood	-2.213005	Hannan-Quinn criter.	0.159018
F-statistic	6.438873	Durbin-Watson stat	0.041449
Prob(F-statistic)	0.002540		

Dependent Variable: LTTMILK
Method: Least Squares
Sample: 1 84
Included observations: 84

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.163731	0.551229	-3.925284	0.0002
LINTSMILK	0.420043	0.071087	5.908858	0.0000
LYYINFLA	0.263131	0.041244	6.379805	0.0000

R-squared	0.535207	Mean dependent var	1.668003
Adjusted R-squared	0.523731	S.D. dependent var	0.274029
S.E. of regression	0.189114	Akaike info criterion	-0.457876
Sum squared resid	2.896884	Schwarz criterion	-0.371061
Log likelihood	22.23077	Hannan-Quinn criter.	-0.422977
F-statistic	46.63565	Durbin-Watson stat	0.137026
Prob(F-statistic)	0.000000		

Dependent Variable: LTTSOYA
Method: Least Squares
Sample: 1 84
Included observations: 84

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.815966	0.332331	-2.455277	0.0162
LINTSOYBEANOIL	0.416483	0.052414	7.945996	0.0000
LYYINFLA	0.061168	0.031613	1.934881	0.0565

R-squared	0.505788	Mean dependent var	2.044464
Adjusted R-squared	0.493585	S.D. dependent var	0.198442
S.E. of regression	0.141217	Akaike info criterion	-1.041975
Sum squared resid	1.615326	Schwarz criterion	-0.955160
Log likelihood	46.76294	Hannan-Quinn criter.	-1.007076
F-statistic	41.44866	Durbin-Watson stat	0.096658
Prob(F-statistic)	0.000000		

Appendix 2: VAR Results

Pairwise Granger Causality Tests
Sample: 1 84
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LTTRICE does not Granger Cause LINTRICE	82	3.26098	0.0437
LINTRICE does not Granger Cause LTTRICE		12.5302	2.E-05
LYYINFLA does not Granger Cause LINTRICE	82	0.63162	0.5345
LINTRICE does not Granger Cause LYYINFLA		0.48416	0.6181
LYYINFLA does not Granger Cause LTTRICE	82	0.43373	0.6497
LTTRICE does not Granger Cause LYYINFLA		0.66883	0.5153

Vector Autoregression Estimates
Sample (adjusted): 3 84
Included observations: 82 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D(LINTRICE)	D(LTTRICE)	D(LYYINFLA)
D(LINTRICE(-1))	0.671054	0.290575	-0.025127
	(0.10782)	(0.07238)	(0.29988)
	[6.22362]	[4.01477]	[-0.08379]
D(LTTRICE(-1))	-0.445514	0.207360	0.344830
	(0.16085)	(0.10797)	(0.44734)
	[-2.76979]	[1.92055]	[0.77084]
D(LYYINFLA(-1))	0.001941	0.039628	0.311746
	(0.03923)	(0.02634)	(0.10911)
	[0.04947]	[1.50476]	[2.85705]
C	0.006080	0.000773	0.010916
	(0.00741)	(0.00497)	(0.02061)
	[0.82055]	[0.15542]	[0.52969]
R-squared	0.340821	0.330560	0.111158
Adj. R-squared	0.315468	0.304813	0.076972
Sum sq. resids	0.339442	0.152944	2.625550
S.E. equation	0.065968	0.044281	0.183469
F-statistic	13.44299	12.83845	3.251557
Log likelihood	108.6210	141.3075	24.74562
Akaike AIC	-2.551733	-3.348964	-0.505991
Schwarz SC	-2.434332	-3.231563	-0.388590
Mean dependent	0.011258	0.006110	0.017889
S.D. dependent	0.079733	0.053109	0.190966
Determinant resid covariance (dof adj.)		2.34E-07	
Determinant resid covariance		2.01E-07	
Log likelihood		283.1343	
Akaike information criterion		-6.613032	
Schwarz criterion		-6.260829	

Period	S.E.	D(LINTRICE)	D(LTTRICE)	D(LYYINFLA)
1	0.065968	16.88037	83.11963	0.000000
2	0.077324	31.66033	66.33119	2.008477
3	0.080315	36.83127	60.81334	2.355384
4	0.081013	37.75951	59.93048	2.310008
5	0.081179	37.73619	59.95897	2.304842
6	0.081230	37.67812	59.99869	2.323195
7	0.081247	37.66885	59.99685	2.334296
8	0.081253	37.67241	59.99000	2.337590
9	0.081255	37.67463	59.98728	2.338085
10	0.081255	37.67512	59.98680	2.338084

Cholesky Ordering: D(LINTRICE) D(LTTRICE) D(LYYINFLA)

Vector Autoregression Estimates
Sample (adjusted): 3 84
Included observations: 82 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D(LINTSOYBEANOIL)	D(LTTSOYA)	D(LYYINFLA)
D(LINTSOYBEANOIL(-1))	0.359438	0.099607	-0.049403
	(0.10807)	(0.05641)	(0.28284)
	[3.32600]	[1.76568]	[-0.17467]
D(LTTSOYA(-1))	0.065815	0.068255	1.579997
	(0.20955)	(0.10938)	(0.54843)
	[0.31408]	[0.62399]	[2.88094]
D(LYYINFLA(-1))	-0.000108	-0.005925	0.354440
	(0.03972)	(0.02073)	(0.10395)
	[-0.00273]	[-0.28578]	[3.40979]
C	0.003899	0.001838	0.006723
	(0.00750)	(0.00391)	(0.01962)
	[0.52001]	[0.46959]	[0.34263]
R-squared	0.135632	0.054009	0.190015
Adj. R-squared	0.102388	0.017625	0.158861
Sum sq. resids	0.349296	0.095180	2.392617
S.E. equation	0.066919	0.034932	0.175142
F-statistic	4.079797	1.484411	6.099345
Log likelihood	107.4478	160.7541	28.55464
Akaike AIC	-2.523118	-3.823270	-0.598894
Schwarz SC	-2.405717	-3.705869	-0.481493
Mean dependent	0.006574	0.002660	0.017889
S.D. dependent	0.070633	0.035244	0.190966

Determinant resid covariance (dof adj.)	1.57E-07
Determinant resid covariance	1.35E-07
Log likelihood	299.3641
Akaike information criterion	-7.008881
Schwarz criterion	-6.656678

Period	S.E.	D(LINTSOYBEANOIL)	D(LTTSOYA)	D(LYYINFLA)
1	0.066919	0.633609	99.36639	0.000000
2	0.071211	4.514310	95.40609	0.079604
3	0.071807	5.166246	94.74046	0.093293
4	0.071893	5.252355	94.65259	0.095058
5	0.071905	5.263217	94.64151	0.095273
6	0.071907	5.264576	94.64012	0.095299
7	0.071907	5.264746	94.63995	0.095302
8	0.071907	5.264767	94.63993	0.095303
9	0.071907	5.264770	94.63993	0.095303
10	0.071907	5.264770	94.63993	0.095303
Cholesky Ordering: D(LINTSOYBEANOIL) D(LTTSOYA) D(LYYINFLA)				

Pairwise Granger Causality Tests
Sample: 1 84
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LTTSOYA does not Granger Cause LINTSOYBEANOIL	82	0.34825	0.7070
LINTSOYBEANOIL does not Granger Cause LTTSOYA		8.46979	0.0005
LYYINFLA does not Granger Cause LINTSOYBEANOIL	82	0.84782	0.4323
LINTSOYBEANOIL does not Granger Cause LYYINFLA		0.72286	0.4886
LYYINFLA does not Granger Cause LTTSOYA	82	0.66637	0.5165
LTTSOYA does not Granger Cause LYYINFLA		4.50759	0.0141

Vector Autoregression Estimates
Sample (adjusted): 3 84
Included observations: 82 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D(LINTWHEAT)	D(LTTFLOUR)	D(LYYINFLA)
D(LINTWHEAT(-1))	0.252231	0.101527	0.123513
	(0.11223)	(0.05858)	(0.26905)
	[2.24736]	[1.73321]	[0.45906]
D(LTTFLOUR(-1))	-0.163583	0.226109	0.365706
	(0.20998)	(0.10959)	(0.50337)
	[-0.77905]	[2.06321]	[0.72652]
D(LYYINFLA(-1))	0.044591	0.031567	0.326294
	(0.04495)	(0.02346)	(0.10775)
	[0.99209]	[1.34563]	[3.02829]
C	0.006477	0.003003	0.009670
	(0.00862)	(0.00450)	(0.02067)
	[0.75109]	[0.66730]	[0.46777]
R-squared	0.080780	0.088362	0.110293
Adj. R-squared	0.045425	0.053299	0.076073
Sum sq. resids	0.457319	0.124573	2.628107
S.E. equation	0.076571	0.039964	0.183558
F-statistic	2.284854	2.520100	3.223100
Log likelihood	96.39990	149.7198	24.70572
Akaike AIC	-2.253656	-3.554142	-0.505017
Schwarz SC	-2.136255	-3.436741	-0.387617
Mean dependent	0.007823	0.005425	0.017889
S.D. dependent	0.078371	0.041073	0.190966
Determinant resid covariance (dof adj.)		2.89E-07	
Determinant resid covariance		2.48E-07	
Log likelihood		274.4793	
Akaike information criterion		-6.401935	
Schwarz criterion		-6.049732	

Period	S.E.	D(LINTWHEAT)	D(LTTFLOUR)	D(LYYINFLA)
1	0.076571	4.547276	95.45272	0.000000
2	0.079672	5.554338	92.57614	1.869520
3	0.079899	5.950091	91.31647	2.733435
4	0.079915	6.005172	91.04812	2.946709
5	0.079916	6.010919	91.00132	2.987758
6	0.079917	6.011484	90.99367	2.994844
7	0.079917	6.011545	90.99243	2.996020
8	0.079917	6.011554	90.99223	2.996214
9	0.079917	6.011555	90.99220	2.996246
10	0.079917	6.011555	90.99219	2.996251

Cholesky Ordering: D(LINTWHEAT) D(LTTFLOUR) D(LYYINFLA)

Pairwise Granger Causality Tests
Sample: 1 84
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LTTFLOUR does not Granger Cause LINTWHEAT	82	0.41911	0.6591
LINTWHEAT does not Granger Cause LTTFLOUR		13.7712	8.E-06
LYYINFLA does not Granger Cause LINTWHEAT	82	1.68673	0.1919
LINTWHEAT does not Granger Cause LYYINFLA		0.82019	0.4442
LYYINFLA does not Granger Cause LTTFLOUR	82	0.72226	0.4889
LTTFLOUR does not Granger Cause LYYINFLA		0.45177	0.6382

Vector Autoregression Estimates
Sample (adjusted): 3 84
Included observations: 82 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D(LINTSMILK)	D(LTTMILK)	D(LYYINFLA)
D(LINTSMILK(-1))	0.614249	0.266604	-0.401344
	(0.09461)	(0.08080)	(0.29246)
	[6.49230]	[3.29957]	[-1.37229]
D(LTTMILK(-1))	-0.058765	-0.025031	1.306846
	(0.12413)	(0.10601)	(0.38370)
	[-0.47342]	[-0.23613]	[3.40588]
D(LYYINFLA(-1))	-0.004551	0.056163	0.288674
	(0.03402)	(0.02905)	(0.10517)
	[-0.13377]	[1.93302]	[2.74496]
C	0.003087	0.006722	0.004251
	(0.00626)	(0.00534)	(0.01934)
	[0.49327]	[1.25771]	[0.21976]
R-squared	0.380635	0.130430	0.231010
Adj. R-squared	0.356814	0.096985	0.201433
Sum sq. resids	0.237721	0.173379	2.271521
S.E. equation	0.055206	0.047147	0.170652
F-statistic	15.97850	3.899820	7.810574
Log likelihood	123.2254	136.1658	30.68409
Akaike AIC	-2.907937	-3.223557	-0.650832
Schwarz SC	-2.790536	-3.106156	-0.533431
Mean dependent	0.006295	0.009079	0.017889
S.D. dependent	0.068836	0.049614	0.190966
Determinant resid covariance (dof adj.)		1.78E-07	
Determinant resid covariance		1.54E-07	
Log likelihood		294.1924	
Akaike information criterion		-6.882741	
Schwarz criterion		-6.530538	

Period	S.E.	D(LINTSMILK)	D(LTTMILK)	D(LYYINFLA)
1	0.055206	2.287840	97.71216	0.000000
2	0.065176	8.287261	88.26309	3.449652
3	0.068415	9.743714	86.68065	3.575638
4	0.069545	10.54553	85.86651	3.587958
5	0.069940	10.86376	85.55720	3.579039
6	0.070078	10.99014	85.43567	3.574186
7	0.070125	11.03768	85.39004	3.572276
8	0.070142	11.05513	85.37326	3.571608
9	0.070147	11.06139	85.36722	3.571388
10	0.070149	11.06361	85.36508	3.571318
Cholesky Ordering: D(LINTSMILK) D(LTTMILK) D(LYYINFLA)				

Pairwise Granger Causality Tests
Sample: 1 84
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
D(LTTMILK) does not Granger Cause D(LINTSMILK)	81	1.86758	0.1615
D(LINTSMILK) does not Granger Cause D(LTTMILK)		3.94915	0.0234
D(LYYINFLA) does not Granger Cause D(LINTSMILK)	81	0.43890	0.6464
D(LINTSMILK) does not Granger Cause D(LYYINFLA)		2.35298	0.1020
D(LYYINFLA) does not Granger Cause D(LTTMILK)	81	0.54354	0.5829
D(LTTMILK) does not Granger Cause D(LYYINFLA)		6.32758	0.0029

Appendix 3: VECM Results

Sample (adjusted): 4 84
Included observations: 81 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
D(LTTFLOUR(-1))	1.000000
D(LYYINFLA(-1))	1.713598
	(0.45267)
	[3.78554]
D(LINTWHEAT(-1))	-4.840025
	(1.15534)
	[-4.18925]
C	-0.003946

Error Correction:	D(LTTFLOUR,2)	D(LYYINFLA,2)	D(LINTWHEAT,2)
CointEq1	-0.022593	-0.192041	0.100736
	(0.01174)	(0.05397)	(0.02160)
	[-1.92507]	[-3.55844]	[4.66305]
D(LTTFLOUR(-1),2)	-0.461055	0.347674	-0.187243
	(0.09844)	(0.45268)	(0.18121)
	[-4.68353]	[0.76803]	[-1.03331]
D(LYYINFLA(-1),2)	0.055289	-0.073887	-0.071721
	(0.02545)	(0.11701)	(0.04684)
	[2.17279]	[-0.63144]	[-1.53121]
D(LINTWHEAT(-1),2)	0.022540	-0.306393	-0.092937
	(0.06200)	(0.28509)	(0.11412)
	[0.36356]	[-1.07471]	[-0.81438]
C	-0.000573	0.002193	0.001110
	(0.00492)	(0.02265)	(0.00907)
	[-0.11629]	[0.09685]	[0.12242]
R-squared	0.319409	0.213608	0.313427
Adj. R-squared	0.283589	0.172219	0.277292
Sum sq. resids	0.149303	3.157182	0.505892
S.E. equation	0.044323	0.203818	0.081587
F-statistic	8.916924	5.160978	8.673696
Log likelihood	140.0631	16.47913	90.63921
Akaike AIC	-3.334891	-0.283435	-2.114548
Schwarz SC	-3.187086	-0.135630	-1.966743
Mean dependent	-0.000418	0.001883	0.001013
S.D. dependent	0.052366	0.224019	0.095971

Determinant resid covariance (dof adj.)	5.10E-07
Determinant resid covariance	4.21E-07
Log likelihood	249.7689
Akaike information criterion	-5.722690
Schwarz criterion	-5.190590