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Evaluating Transmission Prices between Global Agricultural Markets and Consumers' Food Price Indices in the EU

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EVALUATING TRANSMISSION PRICES BETWEEN GLOBAL AGRICULTURAL MARKETS AND CONSUMERS' FOOD PRICE INDICES IN THE EU

1. Abstract

The rise of price levels and volatility of world agricultural commodities since 2006-2008 was followed by increased and more volatile food price inflation around the world. Using error correction models, this paper evaluates the velocity and extent to which world agricultural commodity price movements affect consumer food prices in the 28 EU's Member States. Results show a significant long run relationship between world agricultural commodity prices and food consumer prices in over half of the Member States. They present varying long run price transmission elasticities and a slow adjustment of prices. In general first members of the Eurozone have lower transmission elasticities than the others.

Keywords: Commodity prices, Consumer food prices, Error correction models, Price transmission, European Union

2. Introduction

The price surges occurred during 2006-mid 2008 and 2011-2012 and the rise in the volatility of agricultural commodity prices have resulted in the increase of the variability of consumer food price indices, both in developing and developed economies. This increase in consumer food prices has raised concerns about their potential effect on the most vulnerable consumers and households around the world (McCorrison 2012). To evaluate how movements in global agricultural commodity markets affect movements in consumer prices in the developed world, it is fundamental to assess the degree and speed of price transmission between world agricultural commodity and consumer food prices.

The literature suggests that the relationship between world and domestic prices may not be too strong (McCorrison 2012). Still, the impact on consumers in developed economies depends on the extent to which consumer food prices respond to agricultural commodity prices but this transmission is usually incomplete due to several factors, softening consumers' food price instability (Gilbert and Morgan 2010). The structure and efficiency of the food sector of an economy affects the level and velocity of transmission. Furthermore, higher or more volatile prices may cause greater welfare losses to those consumers who devote a larger proportion of their income to food.

The impact of global food price volatility on consumers is higher in developing countries through the direct consumption of staples, whereas richer consumers have a more indirect dependency on agricultural commodities through feed grain to produce meat (Gilbert and Morgan, 2010). Furthermore, the relationship between both prices depends on horizontal and vertical price transmission (Ferrucci et al 2012; Lloyd et al 2012). The impact on consumers seems to be limited due to the small percentage of the raw commodities' expenditure in the final retail product, which has undergone a certain level of processing. Despite this, commodity prices represent a large fraction of consumer price of fresh products, meat and dairy (Richards and Pofahl 2009).

This paper evaluates price transmission in the 28 EU Member States (MS) - the extent and speed to which agricultural commodity price movements affect consumer food prices in

the MS of the EU - using Engle and Granger error correction models for each of the MS. Two are the main contributions of this paper: firstly, all MS of the EU are being analyzed taking into account not only agricultural commodity prices but also supply and demand shifters. Secondly, three different world commodity price indices are used to capture different impacts on the transmission of prices due to the coverage of commodities and the weighting structure used to compile each of them. Besides, we do not focus on the transmission of a particular agricultural commodity to a single food category along a specific supply chain but instead on an aggregate index of consumer food prices, since the main research question is to evaluate how movements in global agricultural commodity markets affect overall EU households' costs of food.

3. Method

To evaluate the level of integration and the price transmission between world agricultural commodity prices and consumer unprocessed food prices in the MS of the EU we formulate error correction models between both price series for each MS in the EU. These models are augmented with several exogenous variables - the unemployment rate, the exchange rate and a world crude oil price index. The unemployment rate is introduced in the model as a proxy of demand, whereas the exchange rate and the world oil price index are introduced as proxies of supply.

Data for the unprocessed food harmonized index of consumer prices (HICP) were obtained from EUROSTAT. The unprocessed food price index includes certain sub indices of the more aggregate food index, namely, those corresponding to meat, fish, fruit and vegetables sub indices. The unprocessed food HICP index is used instead of a more aggregate food HICP index in order to minimize the underestimate of price transmission due to potential processing and retail costs which are not taken into account.

Three indices of world agricultural commodity prices are used - one from the International Monetary Fund (IMF) and two compiled by the European Central Bank (ECB). The two ECB's indices differ in that one of them is weighted according to the euro area import values and the other one is weighted according to the domestic demand or use in the euro area. The world price index compiled by IMF¹ is a weighted average of individual commodity price indices and weights depend on their relative trade volumes of each commodity² compared to total world trade. Both ECB's price indices³ cover the same range of food commodities⁴ and their prices are world market prices. Both ECB's indices, which are euro denominated, have been converted to US dollars.

4. Results

Most of the series were found to be non stationary and integrated of order one. The results of the cointegration tests between each of the three world agricultural commodity price indices and the unprocessed food HICP index show that world commodity markets are cointegrated with consumer unprocessed food prices in certain MS. The cointegration tests

¹ IMF Primary Commodity Prices (<http://www.imf.org/external/np/res/commod/index.aspx>)

² The world price index compiled by IMF includes cereals, vegetable oils, meat, seafood, sugar, bananas and orange price indices

³ ECB Statistical Data Warehouse (<http://sdw.ecb.europa.eu/browse.do?node=6513466>)

⁴ The world price indices compiled by ECB include maize, wheat, barley, rice, soybeans, sunflower seeds, coconut oil, palmoil, sunflower seed oil, beef, pork, cocoa, coffee, sugar, tea, tobacco, bananas and oranges.

performed using the IMF world index yield a higher number of MS whose consumer prices are cointegrated with world prices than the other two indices. However, there are less MS cointegrated with world markets, when the cointegration tests are performed using the ECB price indices.

Table 1 classifies the MS according to whether the price series are cointegrated or not cointegrated into three categories - MS which have belonged to the euro area from the beginning (plus Greece which acceded in 2001), MS which have recently acceded the euro area and MS which do not belong to the euro area. When considering cointegration tests between the IMF's price index and the unprocessed food HICP index, 22 of the 28 MS exhibit a long run equilibrium relationship between both price series (as shown in Table 1). When considering the ECB's import weighted index, 19 of the 28 MS show a long term relationship between both price series. Finally, when considering the ECB's use weighted index, 17 of the 28 MS show a long term relationship between both price series. Cointegration between both price series seems to be more common among the EU MS when using the IMF's index than when using the indices compiled by the ECB. In turn, cointegration between both price series seems to be more common among the EU MS when using the ECB's import weighted index than when using the ECB's use weighted index.

Table 1. MS which are cointegrated and non-cointegrated with the three world agricultural price indices according to the cointegration tests

		Alternative world price indices		
		IMF's WP	ECB's import-weighted WP	ECB's use-weighted WP
Euro area	Cointegrated	Austria, Belgium, Finland, France, Germany, Greece, Italy, Luxembourg, Netherlands, Portugal (10/12)	Austria, Belgium, France, Germany, Greece, Italy, Luxembourg, Netherlands, Portugal (9/12)	Austria, Belgium, France, Germany, Greece, Italy, Luxembourg, Netherlands, Portugal (9/12)
	Non-cointegrated	Spain (1/12)	Finland, Spain (2/12)	Finland, Spain (2/12)
Recently acceded euro area	Cointegrated	Cyprus, Estonia, Latvia, Malta, Slovakia, Slovenia (6/6)	Cyprus, Estonia, Malta, Slovakia, Slovenia (5/6)	Cyprus, Estonia, Malta, Slovakia, Slovenia (5/6)
	Non-cointegrated	-	Latvia (1/6)	Latvia (1/6)
Non euro area	Cointegrated	Bulgaria, Croatia, Denmark, Hungary, Poland, Sweden (6/10)	Bulgaria, Denmark, Hungary, Poland, Sweden (5/10)	Bulgaria, Hungary, Poland (3/10)
	Non-cointegrated	Czech R., Lithuania, UK (3/10)	Croatia, Czech R., Lithuania, UK (4/10)	Croatia, Czech R., Denmark, Lithuania, Sweden, UK (6/10)

Note: WP stands for world agricultural commodity price index. The euro area heading refers to MS which have belonged to the euro area from the beginning (plus Greece which acceded in 2001). The recently acceded euro area heading refers to Slovenia (which acceded in 2007), Cyprus and Malta (which acceded in 2008), Slovakia (which acceded in 2009), Estonia (which acceded in 2011) and Latvia (which acceded in 2014). The non euro area heading refers to Bulgaria, Croatia, Czech Republic, Denmark, Hungary, Lithuania, Poland, Romania, Sweden and UK. Ireland and Romania not included because the series of unprocessed food HICP index are stationary.

Table 2 shows the long term price transmission elasticities, and the parameters of the error correction terms. As shown, the parameters of the long term price elasticities are positive, as expected. The parameters of the error correction terms are significantly

Table 2. Price transmission elasticities for each MS with the three alternative world price indices

MS	IMF's WP		ECB's import-weighted WP		ECB's use-weighted WP	
	ECT	WPt	ECT	WPt	ECT	WPt
Austria	-0.130 (0.043)	0.247 (0.019)	-0.147 (0.044)	0.216 (0.007)	-0.118 (0.032)	0.230 (0.013)
Belgium	-0.124 (0.037)	0.247 (0.018)	-0.115 (0.036)	0.199 (0.014)	-0.107 (0.045)	0.227 (0.015)
Bulgaria	-0.107 (0.033)	0.559 (0.051)	-0.104 (0.025)	0.412 (0.039)	-0.093 (0.024)	0.465 (0.043)
Croatia	-0.138 (0.029)	0.256 (0.029)				
Cyprus	-0.207 (0.055)	0.607 (0.025)	-0.182 (0.055)	0.496 (0.022)	-0.174 (0.036)	0.490 (0.034)
Denmark		0.195 (0.015)	-0.113 (0.0256)	0.161 (0.015)		
Estonia	-0.056 (0.027)	0.467 (0.037)	-0.069 (0.026)	0.389 (0.031)	-0.098 (0.020)	0.434 (0.033)
Finland	-0.143 (0.043)	0.239 (0.027)				
France	-0.26 (0.048)	0.226 (0.011)	-0.320 (0.058)	0.181 (0.01)		0.216 (0.011)
Germany	-0.052 (0.025)	0.174 (0.023)		0.140 (0.017)		0.157 (0.019)
Greece	-0.205 (0.046)	0.247 (0.035)	-0.200 (0.043)	0.209 (0.024)	-0.201 (0.040)	0.205 (0.024)
Hungary	-0.063 (0.019)	0.770 (0.046)	-0.038 (0.02)	0.624 (0.035)	-0.064 (0.017)	0.707 (0.039)
Italy		0.256 (0.024)		0.204 (0.018)	-0.042 (0.016)	0.228 (0.020)
Latvia	-0.005 (0.024)	0.782 (0.044)				
Luxembourg	-0.056 (0.012)	0.263 (0.021)	-0.04 (0.015)	0.219 (0.020)	-0.052 (0.012)	0.248 (0.023)
Malta	-0.080 (0.025)	0.440 (0.046)	-0.091 (0.031)	0.356 (0.036)	-0.092 (0.018)	0.404 (0.039)
Netherlands	-0.125 (0.038)	0.169 (0.023)	-0.154 (0.033)	0.134 (0.015)		0.148 (0.016)
Poland	-0.173 (0.036)	0.369 (0.037)	-0.161 (0.024)	0.312 (0.026)	-0.222 (0.034)	0.367 (0.032)
Portugal	-0.129 (0.039)	0.113 (0.015)	-0.059 (0.028)	0.102 (0.018)	-0.0995 (0.0314)	0.101 (0.013)
Slovakia	-0.220 (0.048)	0.180 (0.024)	-0.099 (0.042)	0.159 (0.019)	-0.180 (0.033)	0.193 (0.020)
Slovenia	-0.138 (0.042)	0.338 (0.028)	-0.188 (0.041)	0.274 (0.019)	-0.206 (0.042)	0.307 (0.019)
Sweden	-0.161 (0.043)	0.227 (0.023)	-0.183 (0.035)	0.178 (0.015)		

Note: WP stands for world agricultural commodity price index and ECT for error correction term. Newey West standard errors are shown in parentheses below the parameter estimates. Only countries whose food prices are co-integrated are reported.

different from zero in most cases and negative, as expected.

In general, the long term price elasticities are slightly higher when the models are estimated using the IMF's world price index, followed by those estimated using the use-weighted ECB's index. The fact that the magnitudes of the elasticities are slightly higher when using the IMF's world price index than when using the other two indices may be due to the commodity coverage of the index - the commodity index compiled by IMF accounts for seafood apart from other commodities whereas the unprocessed food HICP index comprises the fish category. The different commodity coverage may reveal different transmission channels depending on the specific commodity we are considering. On the other hand, the fact that the use weighted index generally yields slightly higher elasticities in magnitude than the import weighted index may be due to the use of a more adapted weighting structure to that of the HICP index.

The magnitude of the long term elasticities depend on the MS considered. First members of the Eurozone present relatively similar long run price transmission elasticities in magnitude and lower than those of the new MS. The lower transmission elasticities in the euro area show that variations in commodity prices are assimilated to some extent into a reduction in profit margins in the processing and/or the food retail sector. The average size of firms of retail sale of food, beverages and tobacco in non-specialized and specialized stores in the traditional euro area MS are generally bigger than those in the new MS⁵, suggesting that the retail sector may be more competitive than that of the new MS (as suggested in Bukeviciute et al 2009). Apart from the fact that the average firm size is larger, in the traditional euro area MS commodity costs take up a smaller proportion of the final product (Bukeviciute et al 2009), which is consistent with having smaller elasticities in magnitude.

In evaluating the estimated adjustment parameters, the results show that consumer unprocessed food prices run back to equilibrium slowly after a shock in world commodities markets.

5. Conclusions

The results show differences between MS, both in the number of MS whose consumer food prices are cointegrated with global markets, and within these, in the magnitude and the speed of adjustment to their long run equilibrium relationship. These differences may be due to differences in consumption baskets, food processing industry, retail market structure, and purchasing habits and food import dependency degrees across MS.

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⁵ Source: Own calculations with data from EUROSTAT.

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