Intra-industry Trade in Agricultural Products on intra-EC level: The Impact of the Common Agricultural Policy (CAP) Funds

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Abstract

This paper aims at specifying the main determinants of the intra-industry trade in agricultural products, associated with the funds of the Common Agricultural Policy (CAP) of the EC, and more precisely, with its "price support mechanism" and its "structural reform policy." It presents CAP's reformed main tools and mechanisms, and explains the choice of selected variables as determinants of intra-industry trade in agricultural products at intra-EC trade. The econometric analysis covers the period 1973-2005, following recent developments in time-series analysis employing the ARDL approach to cointegration. The empirical results provide evidence of Granger causal effects in both on short-run and long-run horizon running from CAP's above mentioned policy tools to intra-industry trade.

Key words: *Common Agricultural Policy (CAP), Economic integration, intra-industry trade*

JEL Classification: Q17, F15, C32

Introduction

The Common Agricultural Policy (CAP) of the European Community (EC) started being formulated in 1966, following the "Luxemburg compromise" of January 28. The Treaty of Rome (1957) made a specific reference to this policy through Articles 39 to 47. During the first twenty five years of its operation, CAP focused on a price support policy while the structural reforms policy remained a secondary task. The latter has been progressively reinforced since 1992. Although this approach boosted production and intra-EC trade, it created imbalances in EC external trade relations in agricultural products. Indeed, the price policy, operating in a Customs Union context, favored high market prices in agricultural products (without any discrimination among products and varieties), within the EC member-states markets. The prices under consideration, still remain higher than the international ones. This, in turn introduced a protection system against competitive extra-EC imports and subsidies mechanism favoring extra-EC exports (Demekas et al. 1988; Borrell and Hubbard, 2000).

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In recent years, CAP has been in favour of structural intervention and of a selective price policy. However, all these CAP mechanisms since 1966, despite the ensuing criticism, have managed to promote: the GDP *per capita*, the convergence process and the cohesion among EC member-states (Esposti, 2007; Zanias, 2002; Badinger, 2005). In terms of the intra-EC trade relations, since 1966, the above price policy resulted in a significant Customs Union "trade creation effect" in agricultural products, which in turn favored intra-industry trade within the EC member-states.

This paper aims at specifying the main determinants of intra-industry trade in products under examination, which are associated with expenditures for agriculture and more precisely with the CAP price support and structural reform policies. Analysis is organized as follows: Section two presents CAP's reformed main tools and mechanisms; section three presents the determinants and the specification of the model employed in the empirical analysis. The next section presents briefly the ARDL coindegration technique. Section five reports the empirical results, while the final section summarizes and concludes.

The CAP reform process

During the Stressa Summit in July 1958, an *ad hoc* Committee was created in order to specify the basic tools of CAP. In this frame, discussions focused on two alternative solutions: the first supported low market prices and income subsidies while the second supported the creation of a single market in agricultural products, which would be based on high market prices (common *per* product and *per* quality) and, consequently, not on income subsidies. Te latter policy implied an increased protection against competitive imports. Although five EC founding member-states were more in favor of the first scenario, however for the sake of the European integration and under French political pressures the second alternative solution, in favor of a protectionist CAP, was adopted in 1966 (Tangermann, 1983; Sampson and Yeats, 1977; Koester and Tangermann, 1986).

In the frame of Kennedy Round (1963-1968), the first efforts were made to open the agriculture market to international competition. Through the Rabot report, the Americans tried to gear Europeans towards an agricultural policy favoring low market prices and income subsidies. Because of the timeframe proposed, though, EC denied any further discussions on this issue and thus the agriculture dossier was not included in the agenda of the Kennedy Round.

In 1968, the first proposal about restructuring the EC agriculture appeared, through the Mashold plan. Although the Mashold plan was initially rejected by member-states governments, because of the drastic measures proposed for the agriculture restructuring process, the first measures in favor of structural interventions appeared from 1972 to 1978. By the end of the 70's, and under US pressure again, the first agreements on agriculture were signed on a multilateral level in the context of the Tokyo Round (1973-1979). This development marked the beginning of the opening up of agricultural products to competition, which finally materialized fifteen years later *via* the Uruguay Round agreements (1994).

Following the European Summit in Stutgard in June 1984, CAP was slightly revised to adopt more rational and selective measures, which could lead to better market adjustments and mainly to the control of production surpluses and budget expenditures towards agriculture. The mechanism on production restriction surpluses, in conjunction with a more selective price policy were the main policy tools of that period. During the same period, a series of new regulations focused on measures dealing with investments in agriculture. They had however a poor impact on agricultural reforms, because of restricted budget expenditures. Despite interventions favoring restructuring, the community preference of high prices persisted. CAP' s price mechanisms operating in the context of a protected Customs Union environment was reflected into the "guarantee policy" of the "European Agricultural Guarantee and Guidance Fund" (EAGGF) and hence into the budget expenditures.

In 1992, significant changes took place in EC agriculture following the Mac Sharry report. Since that period, for the sake of agriculture income support, income subsidies started being a main tool in the hands of policymakers. Thus, the lower price support policy was overcompensated by additional direct payments (Thompson et al., 2002). However, EC agriculture prices still remained higher compared to international ones. In 1994, the agreement on agriculture in the context of the Uruguay Round was signed. Following this agreement, competition in agriculture would become the main determinant of trade flows in a long term horizon. Consequently, all production subsidies schemes and tariffs had to be abolished in the future (Hampicke and Roth, 2000).

This agreement significantly impacted the reform of the EC agricultural policy. Indeed, in 1997, in the frame of the preparation of "Action Plan 2000", the European Commission produced a report entitled "Common Agricultural and Rural Policy for Europe" (CARPE). This report supported the revision of the price support policy, (under the constraints of the Uruguay Round agreement), and the continuation of income subsidies. This new policy, besides market stability and rural development, *inter alia* could serve additional goals such as environment protection, cultural aspects etc.

In Berlin, in March 1999, a political agreement took place for the "Action Plan 2000." The opening up of the agricultural market to competition was the new challenge for EC agriculture. Regarding structural interventions, agricultural policies on development and structural changes absorbed only 14% of the total budget of CAP during the medium term period 2000-2006, a situation which, however, could change, because the reform process continued. In conclusion, the poor impact of structural reforms to EC agriculture, was a main characteristic of the CAP, since 1966.

By mid-2002, a new series of negotiations on the terms of acceding the CAP restarted. In the light of the Doha Round, expectations on market openness in agricultural products and taking into account the new enlargement of the EC as well as the spending limit agreed in Berlin, covering the period 2000-2006, a new reform took place in 2003, which made price and income policy more selective (Ackrill, 2003). Demand constraints, quality and environmental standards became the main determinants of the policy under examination (Latacz-Lohmann and Hodge, 2003). All the above mentioned policies, through their funds have been developing in an environment, favoring the increase in intra-industry trade of agricultural products, on intra-EC trade.

Intra-industry trade: Determinants and the model structure

Intra-industry trade, i.e. the simultaneous exports and imports of the same good, is associated with differentiated products and intermediate goods (Grubel, 1967; Grubel and Llloyd 1971, 1975; Balassa, 1963, 1965, 1986a; Gray, 1973, 1980; Finger, 1975; Greenaway and Milner, 1987; Tharakan, 1981). Horizontally differentiated products are close substitutes to both production and consumption while vertically differentiated products, which constitute the dominant pattern of intra-industry trade, are close substitutes to consumption, mainly due to quality characteristics (Gray and Martin, 1980; Willmore, 1978; Lancaster, 1979, 1980; Caves, 1981; Caves and Williamson, 1985; Brander, 1981; Shaked and Sutton, 1987).

Regarding the measurement of intra-industry trade, despite the discussion about the choice of the appropriate level of statistical aggregation, the international practice considers the three digit aggregation level of SITC code as an acceptable level for that, because at this level of aggregation, it is possible to efficiently capture product differentiation (Lloyd, 1994). Thus, the three digit level of aggregation has been used in the present study to construct the dependent variable of the model, which is the intra-industry trade in agricultural products on intra-EC level (LIB) expressed in logarithms. Grubel and Lloyd (1975) proposed the index $\overline{B_i}$ properly constructed to be used for this goal. $\overline{B_i}$ is an expression of a weight average of intra-industry trade for (n) products, for all member-states. Specifically, when a value of $\overline{B_i}$ is equal to 0, that country exports without importing and *vice versa*. On the other hand, a value of 1 shows a two-way trade flow for similar products with exports equal to imports. For industry (i), B is given as follows:

$$\mathrm{B_i} = \left(X_\mathrm{i} + M_\mathrm{i}\right) - \left|\mathrm{X_i} - \mathrm{M_i}\right| / \left(X_\mathrm{i} + M_\mathrm{i}\right) \tag{1}$$

For (n) industries B_i is given as follows:

$$\overline{B_i} = \sum_{i=1}^{n}(X_i + M_i) - \sum_{i=1}^{n}| X_i - M_i | / \sum_{i=1}^{n}(X_i + M_i) \tag{2}$$

where: i =1, … n, industries
X_i = exports of product i by a country
M_i = imports of product i by country

Following the empirical researches, intra-industry trade flows behaviour is affected by various determinants. Among them, the more important are considered to be: product differentiation, economies of scale, distance, income similarity, similarity in development levels, low trade barriers, the similarity of non tariff barriers, the Customs Union effects etc. In the context of the empirical analysis, this paper examines the impact of CAP funds on intra-industry trade flows of agricultural products at the EC level.

Two independent variables are used for this goal following data availability:

i) LVG, which stands for the EC budget expenditures to support price policy (guarantee section of the EAGGF) and is expressed in logarithms, reflects the increased importance of EC price policy in agriculture, which favors higher common prices on EC level compared to international ones. Thus, it depicts the impact of price policy on production and trade. In the long run, high prices in agricultural products of all possible qualities, in conjunction with the absence of any internal protection measures and with increased protection against extra-EC imports (due to EC Customs Union), are expected to increase production in the EC member-states, and at the same time reinforce differentiation. Thus, following the existing empirical investigations, (Toh, 1982; Pagoulatos and Sorensen, 1975; Greenaway and Milner, 1984; Culem and Lundberg, 1986; Tharakan, 1984, 1986; Balassa, 1986a), the LGV variable, which is a proxy of product differentiation –as a result of the "production effect" of "trade creation" of Customs Union (Balassa 1965)– is expected to be positively correlated to LIB. LGV reflects consequently the expenditures, associated with price policy effect of CAP, in product differentiation, through Customs Union mechanisms of the EC.

ii) LVD, which stands the EC budget expenditures to promote structural reforms policy (guidance section of the EAGGF) and is expressed also in logarithms represents the impact of structural funds and reforms. As funds are used to support structural reforms aiming at reducing the average cost, the LVD variable could be considered as a proxy for the economies of scale. Following the empirical results, the extent of economies of scale is negatively related to the extent of intra-industry trade. Indeed, the extent of economies of scale tends to create "dominant suppliers" on industry level and thus it tends to reduce intra-industry trade. In contrast, the lack of economies of scale tends to create an environment favoring many suppliers and hence product differentiation. This in turn leads to increase in intra-industry trade (Loertscher and Wolter 1980; Caves, 1981; Balassa, 1986b; Jacquemin and Sapir, 1988). The relatively poor EC budget expenditures towards structural reforms in favor of agriculture did not push extensive economies of scale on national and industry level. Thus, the process of creating a dominant supplier in agricultural products for all qualities did not take place. As expected, the poor economies of scale caused inverse impacts to intra-industry trade.

According to the above presentation the econometric specification constructed to investigate the relationship in question is of the following general form:

$$LIB = f\left(LVD,\, LVG\right) \quad (3)$$

Methodological issues

The autoregressive distributed lag (ARDL) approach to cointegration applied in this paper is a relatively new technique for detecting possible long-run relationships among economic variables. The ARDL approach is considered a more efficient technique for determining cointegrating relationships in cases with small data samples available. An additional advantage of the ARDL approach is that it can be applied irrespective of the regressors' order of integration (Pesaran and Shin 1999); that is, it can be applied regardless of the stationary properties of the variables in the sample, thus allowing for statistical inferences on long-run estimates which are not possible under alternative cointegration techniques. Hence, we are not concerned whether the applied series are *I(0) or I(1)*. The general form of the ARDL model (Pesaran and Shin, 1999) is defined as:

$$\Phi(L) y_t = \alpha_0 + \alpha_1 w_t + \beta'(L) x_{it} + u_t\,, \quad (4)$$

where: $\Phi(L) = 1 - \sum_{i=1}^{\infty} \Phi_t L^i$, and $\beta(L) = \sum_{j=1}^{\infty} \beta_j L^j$, with *(L)* being the lag operator and (w_t) being the vector of deterministic variables such as the intercept, seasonal dummies, time trends or any exogenous variables (with fixed lags). This approach follows three steps; namely, step one is the establishment of the long-run relationship between the examined variables (unrestricted error correction mechanism regression). Step two is the estimation of the ARDL form of equation (4), where the optimal lag length is chosen according to the Akaike Information Criterion (AIC) or the Schwarz Bayesian Criterion (SBC). Step three refers to the estimation of the error correction equation, using the differences of the variables and the lagged long-run solution, where the speed of adjustment to equilibrium is determined.

Empirical results

Integration analysis

In the first step of the empirical analysis we examine the integration properties of the variables involved by means of the conventional Augmented Dickey-Fuller (ADF) test. It should be noted that statistical inference with non-stationary data may lead to invalid results. The findings (see Tables 1 and 2), demonstrate that the examined series are non stationary in levels while they become stationary when tested in first difference form In particular, when the Dickey-Fuller (ADF) test is applied on the levels of the variables and the testing statistic includes only an intercept LIB and LVD are non stationary but LVG exhibits stationary properties. However, when the test statistic includes a linear trend all variables become non-stationary.

Furthermore, when the variables are tested in first difference form, in case where only an intercept is included in the testing equation DLVD is found stationary while DLVG is stationary at the 10% and DLIB is clearly non-stationary. Finally, when the testing equation includes both an intercept and trend all variables exhibit stationarity.

Since the results might be considered vague and having in mind that the conventional stationarity tests are of low power, we decided at this step, to consider that all series are I(1) and proceed with the examination of the joint integration properties of the series using the cointegration methodology which implies the possible existence of a long run equilibrium relationship (cointegration) among them and hence causal interactions among the examined variables in the short and long run time horizon.

Table 1. Unit-Root Tests for the Variables in Levels

Variable	*k*	*with intercept no trend*	*k*	*with intercept and linear trend*
LIB	2	–2.8319	2	–.52227
LVG	2	–4.5638	2	–3.5572
LVD	1	–2.2249	1	–2.5169
95% critical value for the augmented Dickey-Fuller statistic with intercept but not a trend = –2.949 95% critical value for the augmented Dickey-Fuller statistic with intercept and a linear trend = –3.546				

Table 2. Unit-Root Tests for the Variables in First Differences

Variable	*k*	*with intercept no trend*	*k*	*with intercept and linear trend*
DLIB	0	–2.4987	0	–5.3393
DLVG	0	–3.5602	0	–4.2106
DLVD	0	–3.8757	0	–4.0477
95% critical value for the augmented Dickey-Fuller statistic with intercept but not a trend = –2.9665 95% critical value for the augmented Dickey-Fuller statistic with intercept and a linear trend = –3.5731				

Cointegration and Granger causality analysis

Instead of employing the traditional methodology proposed by Johansen (1988) and Johansen and Juselius, (1990), which requires clearly non-stationary variables of integration order I(1), we apply the ARDL cointegration method proposed by Pesaran (1992). Actually, the ARDL method has the advantage to avoid the problem of pretesting for the order of integration of the individual series; besides, ARDL is a singe equation estimation technique and requires the estimation of a fairly smaller number of parameters compared to the Johansen's method. Consequently, ARDL proves to be more efficient when small data samples are available. In the next step, we estimate the unrestricted error correction (EC) model (1), with DLIB as the dependent variable and apply an *F*-test on the group of the lagged level variables.

The optimal lag structure of the model is chosen based on the Akaike Information Criterion (AIC), using a max lag length of four periods. The F-test along with the critical value bounds are reported in Table 3. The evidence is in favor of the existence of a long-run equilibrium relationship with long-run causality running from LVD and LVG towards LIB.

Table 3. Testing the Existence of a Long Run Relationship

Dependent Variable	*F-statistic*	*Intercept*	*Trend*	*Bounds Testing (at 90%)*
DLIB	9.298	yes	no	lower: 4.042 upper: 4.778

Having confirmed the existence of cointegration among the involved variables, we proceed with the estimation of the appropriate ARDL model for the LIB variable. The optimal ARDL (1, 4, 3) specification has been chosen based on the Schwarz Bayesian Criterion and is presented in Table 4. The corresponding diagnostic tests (lower part of Table 4), validate the estimates while the plots of the corresponding CUSUM and CUSUMSQ tests, based on the recursive residuals (See Appendix, Graphs 1 and 2), identify long-run structural stability for the model's coefficients. Hansen (1992), stresses that unstable over time parameters result in model misspecification and potentially produce biased estimates.

Table 4. Autoregressive Distributed Lag Estimates. ARDL(1,4,3) selected

Dependent variable is LIB 29 observations used for estimation from 5 to 33			
Regressor	*Coefficient*	*Standard Error*	*T-Ratio[Prob]*
LIB(–1)	–.089131	.17071	–.52213[.608]
LVG	.17431	.044553	3.9125[.001]
LVG(–1)	–.052088	.049886	–1.0441[.310]
LVG(–2)	.067520	.050301	1.3423[.196]
LVG(–3)	.049846	.046258	1.0776[.295]
LVG(–4)	.14904	.043403	3.4338[.003]
LVD	–.060096	.021673	–2.7728[.013]
LVD(–1)	.039933	.031139	1.2824[.216]
LVD(–2)	–.048266	.029561	–1.6328[.120]
LVD(–3)	–.037445	.021148	–1.7706[.094]
C	1.6283	.25230	6.4540[.000]

R-Squared	.99589	R-Bar-Squared	.99360
S.E. of Regression	.010939	F-stat.	F(10, 18) 435.8230[.000]
Mean of Dependent Variable	4.3429	S.D. of Dependent Variable	.13676
Residual Sum of Squares	.0021541	Equation Log-likelihood	96.7122
Akaike Info. Criterion	85.7122	Schwarz Bayesian Criterion	78.1921
DW-statistic	2.0969	Durbin's h-statistic	–.66267[.508]

Diagnostic Tests		
Test Statistics	*LM Version*	*F Version*
A: Serial Correlation	CHSQ(1)= .14454[.704]	F(1, 17)= .085155[.774]
B: Functional Form	CHSQ(1)= .30974[.578]	F(1, 17)= .18353[.674]
C: Normality	CHSQ(2)= 1.1028[.576]	Not applicable
D: Heteroscedasticity	CHSQ(1)= 1.6779[.195]	F(1, 27)= 1.6581[.209]

A: Lagrange multiplier test of residual serial correlation
B: Ramsey's RESET test using the square of the fitted values
C: Based on a test of skewness and kurtosis of residuals
D: Based on the regression of squared residuals on squared fitted values

The estimated long-run coefficients from the implied ARDL structure are reported in Table 5. The estimates reveal strong causal effects (at a smaller than the 1% level of statistical significance) directed from LVG and LVD towards LIB.

Finally, Table 6 presents the estimates from the EC specification. The existence of a long-run causal relationship among the examined variables is confirmed once again since the coefficient of the lagged EC term is found statistically significant (the p-value

Table 5. Estimated Long Run Coefficients using the ARDL Approach. ARDL(1, 4, 3) selected

Dependent variable is LIB 29 observations used for estimation from 5 to 33			
Regressor	*Coefficient*	*Standard Error*	*T-Ratio[Prob]*
LVG	.35682	.012319	28.9658[.000]
LVD	–.097210	.0070967	–13.6981[.000]
C	1.4951	.094514	15.8185[.000]

Table 6. Error Correction Representation for the Selected ARDL Model ARDL(1,4,3) selected

Dependent variable is dLIB 29 observations used for estimation from 5 to 33			
Regressor	*Coefficient*	*Standard Error*	*T-Ratio[Prob]*
dLVG	.17431	.04455	3.9125[.001]
dLVG1	–.26640	.04141	–6.4326[.000]
dLVG2	–.19888	.04913	–4.0474[.001]
dLVG3	–.14904	.04340	–3.4338[.003]
dLVD	–.060096	.02167	–2.7728[.012]
dLVD1	.085712	.02303	3.7214[.001]
dLVD2	.037445	.02114	1.7706[.092]
dC	1.6283	.25230	6.4540[.000]
ecm(–1)	–0.5432	.10201	–5.3321[.000]
R-Squared	.86833	R-Bar-Squared	.79518
S.E. of Regression	.010939	F-stat.	F(8, 20) 14.8386[.000]
Mean of Dependent Variable	.015195	S.D. of Dependent Variable	.024172
Residual Sum of Squares	.0021541	Equation Log-likelihood	96.7122
Akaike Info. Criterion	85.7122	Schwarz Bayesian Criterion	78.1921
DW-statistic	2.0969		
R-Squared and R-Bar-Squared measures refer to the dependent variable dLIB and in cases where the error correction model is highly restricted, these measures could become negative.			

of the applied t-test is smaller than the 1%) and has the correct negative sign suggesting that any deviation from the long-term income path is corrected by 54 percent over the following year.

With regard to the short-run dynamics of the estimated relationship, (see table 7) there is evidence of significant Granger-type causal effects running from LVG to LIB (the p-value of the applied Wald test is smaller than the 1%) as well as from LVD to LIB (p-value = 0.012).

Table 7. Wald test of restriction(s) imposed on parameters

Based on ARDL regression of dLIB on:				
dLVG	dLVG1	dLVG2	dLVG3	dLVD
dLVD1	dLVD2	dC	ecm(-1)	
29 observations used for estimation from 5 to 33				
Coefficients A1 to A9 are assigned to the above regressors respectively.				
List of restriction(s) for the Wald test: a2=0; a3=0; a4=0;				
Wald Statistic CHSQ(3)= 45.3016[.000]				

Wald test of restriction(s) imposed on parameters

Based on ARDL regression of dLIB on:				
dLVG	dLVG1	dLVG2	dLVG3	dLVD
dLVD1	dLVD2	dC	ecm(-1)	
29 observations used for estimation from 5 to 33				
Coefficients A1 to A9 are assigned to the above regressors respectively.				
List of restriction(s) for the Wald test: a6=0; a7=0;				
Wald Statistic CHSQ(2)= 15.7586[.000]				

Concluding remarks

In this paper we attempted to specify the main determinants of the intra-industry trade in agricultural products, in the context of the price support mechanism and the structural reform policy of the Common Agricultural Policy (CAP). Since the beginning of the decade of 1970, all CAP's reforms and mainly of the price support mechanism – operating in a protected Customs Union environment for agriculture– through high common prices, favored product differentiation and consequently intra-industry trade. We could expect an inverse effect if the structural reform policy was the dominant policy instrument, which could create dominant suppliers on industry level. This did not happen and thus the poor impact of structural reform policy has been reflected by the increasing trend of intra-industry trade. The empirical analysis used the autoregressive distributed lag (ARDL) approach to cointegration. ARDL is considered more efficient in cases with small data samples available and can be applied irrespective of the regressors' order of integration. The evidence supports the existence of long-run causality running from both EC major policy measures towards intra-industry trade. Moreover, Granger-causality tests provide evidence in favor of the existence of significant short-run causal effects from both the policy instruments under consideration towards intra-industry trade.

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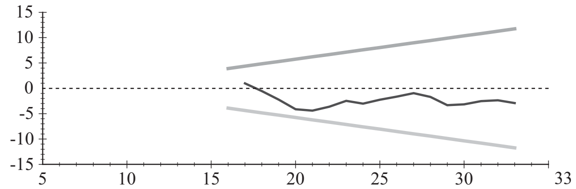
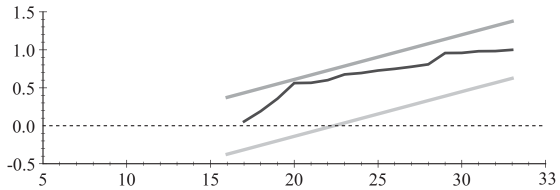
APPENDIX



The straight lines represent critical bounds at 5% significance level

Graph 1: *Plot of Cumulative Sum of Recursive Residuals*



The straight lines represent critical bounds at 5% significance level

Graph 2: *Plot of Cumulative Sum of Squares of Recursive Residuals*