WHEAT AND BARLEY TRADE PATTERNS IN EUROPE

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Abstract

Trade pattern of soft wheat, hard wheat and barley in the market of the European Union is investigated using the Armington trade model for differentiated products by kind and by country of origin. Change in trade flows, market shares and prices are forecast for 1996. The impact of 10% and 15% tariff reduction on extra-EC imports is also simulated. Thus, the implications of member-countries' integration and the possible implications of the GATT agreement for these products are identified and certain policy-measure questions are addressed.

Résumé

Le travail porte sur l'évolution commerciale du blé tendre, du blé dur et de l'orge dans le marché de l'Union Européenne en utilisant le modèle commercial Armington pour des produits différenciés par type et par pays d'origine. Les auteurs expriment des prévisions de changements des flux commerciaux, des quotas de marché et de prix pour l'année 1996. Ils simulent également l'impact d'une réduction tarifaire de 10 et 15% sur les importations extra-communautaires. Enfin, ils discutent des implications de l'intégration des pays membres et les retombées possibles sur ces produits à la suite des accords GATT en discutant aussi de quelques questions de mesures politiques.

Since the implementation of the Common Agricultural Policy (CAP), there has been a turnaround in the agricultural trading position of the European Union (EU). The EU is now the world's largest exporter of agricultural products, while it used to be one of the world's largest importers.

The European market besides bringing about dynamic changes by itself, bore very broad and extensive changes in consumers' preferences and in policy perception by policy makers and European institutions. Agricultural products and particularly grains consisting the largest part of intra-EU trade will suffer dramatic changes affecting consumers, farmers and member States.

There is a large body of literature that investigates trade patterns on world grain sector and the implication of changes in policy variables, but literature that focuses on the EU trade between members is relatively limited. Even if it exists, it aggregates countries together in groups as well as products. Grennes *et al.* (1978) studied the world trade in wheat. They divided the world into six endogenous regions and one exogenous, the rest of the world; among these six regions was the European Economic Community (EU) which was treated as an important importer.

Sarris (1981) showed that their model preserves some comments and did not predict trade flows well. Honma and Heady (1984) studied the international wheat trade using an econometric model. Their study focuses on trade flows of wheat connecting exporting countries with importing ones, clarifying then the international wheat linkages. They divided the world into five exporting countries and ten importing ones. The five exporting countries are Argentina, Australia, Canada, France and the United States. The breakdown for the importing region was based on the degree of similarity in response to price changes. Among them, there are the six original EU countries (EU-6) (1), the three later entrants (EU-3) (2) and the rest of developed countries (rest of DCs) which include Greece, Portugal, Spain and others. Schmidt *et al.* (1987) studied the implication of lowering EU grain prices to world levels which is consistent with the commission efforts to adapt the price policy to the realities of the internal and external markets.

In this work, the trade pattern of soft wheat, hard wheat and barley in the European Market is examined and the future changes in trade flows, market shares and prices are identified through the implementation of the Armington (1969a) model in the version that Sarris (1984) has introduced. After concentrating on the current grain situation, a brief review on the theoretical procedure of the Armington model will be made and then the model will be applied to the EU wheat and barley markets. The estimation procedure of the model parameters will be explained, followed by a description of the projection procedure. Finally, the outcome will be demonstrated, the possible implications of the projection on wheat and barley markets will be indicated and the effects of integration on member-countries will be identified.

The grain outlook in the EU

Imports of grain into the EU exceeded exports by around 20 million tons in the early 1960's (BAE, 1985). Since then, imports declined and exports grew leading the community to become a net exporter of grain by 1979-80. Clearly, the Common Agricultural Policy (CAP) has greatly contributed to these transformations and transition of the structure of the grain sector (Leonard, 1988; Tracy, 1993). Of course, it is not just the CAP which had made the change, but also the combined effects of technological advances, the development of infrastructure and the adjustments to farm structure, factors which had simulated both the demand and supply for grains. All these factors encouraged a rapid expansion of production at a much faster rate than growth in utilisation, leading to rapid growth in exports.

Figures 1, **2** and **3** present the transformation of the EU from a net importer to a net exporter. The picture is very clear; in each case, exports have risen while imports have been steady or falling over the same period. Thus, the balance between the two, i.e. the net export balance, has been growing very rapidly(3). Many factors have led to an expansion in the production of the cereal sector. This expansion, combined with a low rate of growth in consumption, has increased the EU's level of self-sufficiency. Further, the post-EU barriers to external trade are higher than the pre-EU

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(1) Belgium, Luxembourg, France, Italy, Netherlands and Germany.
(2) Denmark, Ireland and the United Kingdom.
(3) Up until 1979/80, figures refer to the EU of nine members, from '81 to '85 they refer to EU of ten, and from '86 onwards, they refer to the EU of twelve.

barriers (Saunders, 1991). Therefore, the shift from extra to intra-community trade would increase at the expense of the extra-Community trade. **Table 1** clearly depicts the growing preferences and interdependence among the EU members on intra-EU trade of barley, hard wheat and soft wheat, as both exporters and importers sell or purchase primarily within EU market.

Methodology and estimation procedure

Empirical research in the international trade of agricultural commodities has utilised a variety of approaches. The increasing interest and interdependence of the agricultural economies of countries involved in trade has led to the development of agricultural trade models that have been surveyed by several researchers (such as: Sarris (1981) and (1983), Thompson and Abbot (1982) and Maclaren (1991), among others).
According to Maclaren (1991), agricultural trade models can be grouped into two broad categories: trade models for homogeneous products, and trade models for differentiated products. Among the different versions, the Armington models are considered as very appropriate for investigating the trade of agricultural products (Sarris, 1981). Armington was the first who developed (1969a) and applied (1969b) a world trade model differentiating products by their place of production as well as by their kind.
Several theoretical frameworks that differentiate products by origin have appeared in the literature of agricultural trade commodities. Despite variations, these models exhibit the basic characteristics of Armington's model (Haniotis and Ames, 1988). Ito *et al.* (1990) argued that the Armington procedure has become increasingly popular in agricultural trade analysis, while Alston *et al.* (1990) judged the results given by the Armington model to be successful because of both the plausible parameters estimates and their statistical significance.
In this work, Armington's model has been applied in a way similar to that used by Sarris (1984) in fruits and vegetables. The final equations of the model and the meaning of each parameter involved in, are shown in **table 2** (4).
All these parameters (except $\tilde{a}_{ik}$ and Δt) have to be estimated and in some cases they are extracted from previous studies when the estimation procedure is impos-

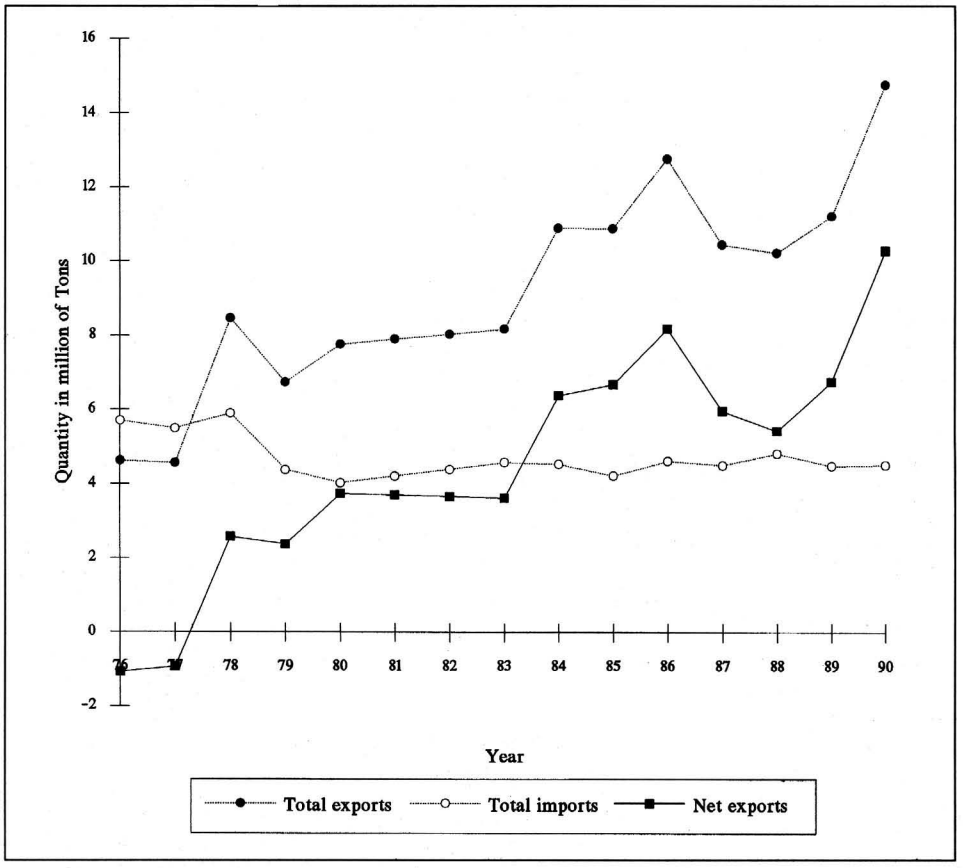

Figure 1 - Trade in barley.

Table 1 ***Percentage of intra-EU export and import quantity (1990).***

Destination or origin	Intra -EU exports			Intra-EU imports		
	Barley	Soft wheat	Hard wheat	Barley	Soft wheat	Hard wheat
France	60 (99) (1)	49 (60)	61 (3)	99 (51)	91 (37)	100 (83)
Belg-Lux (2)	38 (100)	33 (85)	80 (32)	99 (26)	95 (12)	74 (100)
Netherlands(	5 (99)	9 (64)	100 (1)	99 (60)	99 (89)	99 (100)
Germany	23 (98)	45 (95)	99 (64)	99 (35)	99 (56)	99 (98)
Italy	18 (59)	93 (76)	2 (2)	100 (0)	83 (92)	85 (13)
UK	45 (95)	42 (21)	n3 (4)	100 (34)	58 (95)	79 (77)
Ireland	97 (100)	100 (93)	100 (51)	98 (100)	98 (100)	100 (n)
Denmark	60 (100)	22 (92)	100 (41)	100 (17)	97 (21)	0 (100)
Greece	n	n	87	100	98	100
Portugal	n	n	n	0	0	0
Spain	3	65	8	100	99	59
Total EU	34 (86)	42 (64)	67 (10)	96 (45)	87 (43)	82 (91)

Source: EUROSTATa, external trade, analytical tables on imports and exports (1980 and 1990).

(1) Figures in parentheses indicate the corresponding values for 1980. The calculus is ,ade for EU of 9 Belgium-Luxembourg.
(2) Belgium-Luxembourg.
(3) The corresponding country is not exporter or importer of the product.

(4) Details can be found in *Chokri Rekik «Trade patterns of Wheat and Barley on the Single European Market», MSc Thesis, MAI Chania, 1993.*

sible or results insignificant figures. During the projection procedure, certain value figures are assumed for $\tilde{a}_{ik}$ and Δt. This depends upon the additional hypothesis and assumptions.

Results and their implications

The base period value matrices and those projected for 1996 are presented in **table 3** which summarises the volume trend for barley, soft wheat and hard wheat in 1996. These figures are obtained by summing up all the countries' imports from any origin or all countries' exports to any destination.

In other words, this Table shows that trade of barley and soft wheat is expected to increase substantially in the future, whereas trade of hard wheat will decrease. The decreasing trend in the value figures for hard wheat is expected and it is on line with the disposable recent trade statistic analysis. However, the percentage variation (in quantity) in the total hard wheat exports between 88/89 and 89/90 is –16.7% (The Agricultural Situation in the Community, Report 1991).

The projected total trade patterns changes differ considerably among different products and among countries. Thus, the implications of the projections will be examined separately for each product, stressing the analysis on the main importers, exporters and the Extra-EU region:

Implications in the barley market

Table 4 summarises the overall situation and illustrates trend in values, shares and export price indices. The overall trade of barley in the EU is expected to increase. The way this increase is distributed among exporters is interesting. *Spain* is expected to improve its status within the EU member countries gradually and its export share will increase at the expenses of *France* and *UK* shares, despite the substantial fall in its export price index. By the year 1996, *France* will have increased its export value while its export share is expected to fall and it will have exported only 25% of the total EU exports.

The *extra-EU* export share and value figures are expected to fall. This is on line with the EU protectionism policy that tends to shift imports from extra community to intra community. The extra-

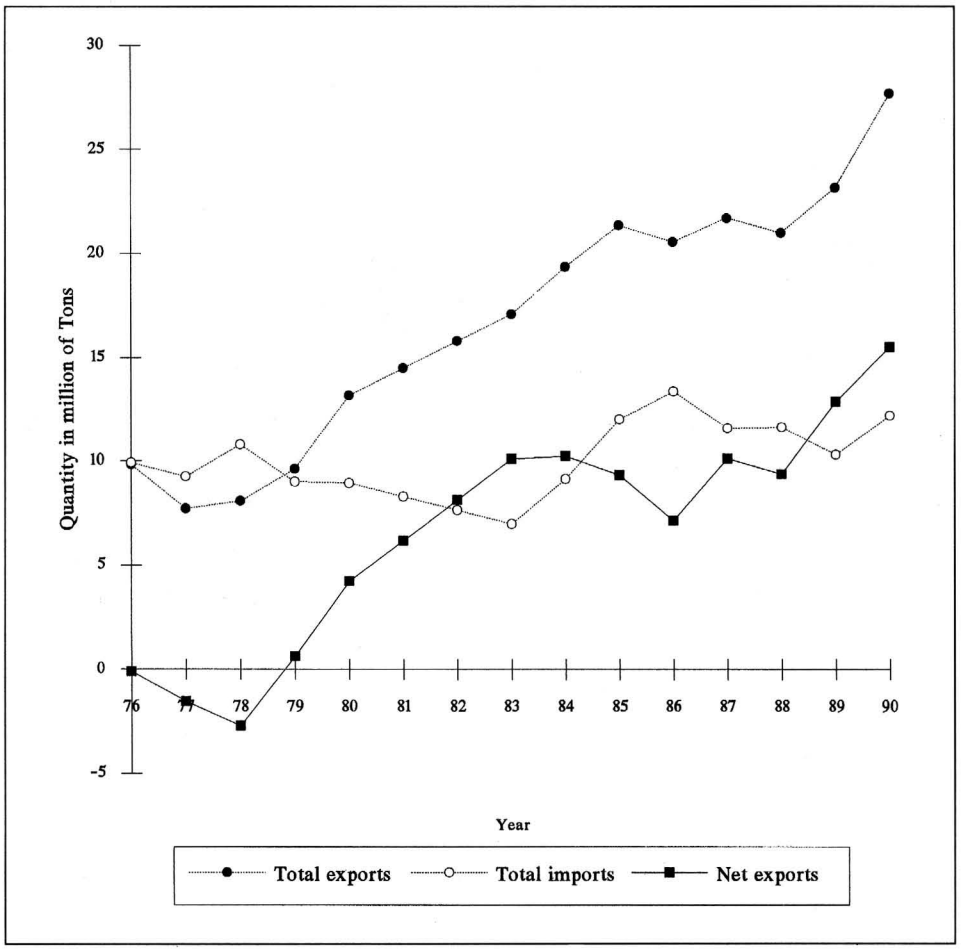

Figure 2 - Trade in soft wheat.

Table 2 ***Equations of the model.***

$$\tilde{X}_{ik} = \Theta_k \cdot \tilde{Y}_k - \sigma k \cdot \tilde{P}_{ik} + \sum_{j=1}^{r} S_{jk0} (\sigma k - \varepsilon_k) \cdot \tilde{P}_{jk} \quad (1)$$

$$\tilde{P}_{ik} = \tilde{P}_i + \tilde{a}_{ik} \quad (2)$$

$$\eta i \cdot \tilde{P}_i + \Phi i \cdot \Delta t + \sum_{k=1}^{n} H_{jk0} \cdot \tilde{X}_{jk} \quad (3)$$

Where:
- i and j denote the exporting country, while k denotes the importing one ($i, j, k = 1, \ldots, 12$).
- $\tilde{X}_{jk}$, $\tilde{P}_{jk}$, and $\tilde{P}_j$ are the percentage changes in traded quantities and in import and export price indices respectively.
- S_{ik0} and H_{ik0} are the import value and the export quantity shares in the base period (1990).
- Θ_k and ε_k are respectively the income and the price elasticities of demand for imports of the product in the k_{th} importing country.
- σ_k is the elasticity of substitution among products of different exporting countries in the demand of country k for the product.
- η_i is the price elasticity of export supplies.
- Φ_i is the growth rate of exports.
- $\tilde{Y}_k$ is the growth rate of real expenditure.
- $\tilde{a}_{ik}$ is the change in trade policy parameter.
- Δt is the time interval for the projection.

Table 3 ***Total EU trade values in 1990 and 1996 (1).***

Product	1990	1996
Barley	1702845	2846367 (+67.15) (2)
Soft wheat	4280946	5829883 (+36.18)
Hard wheat	471865	311665 (–51.41)

(1) 000s of 1990 ECU's.
(2) Figures in parenthesis are the percentage changes.

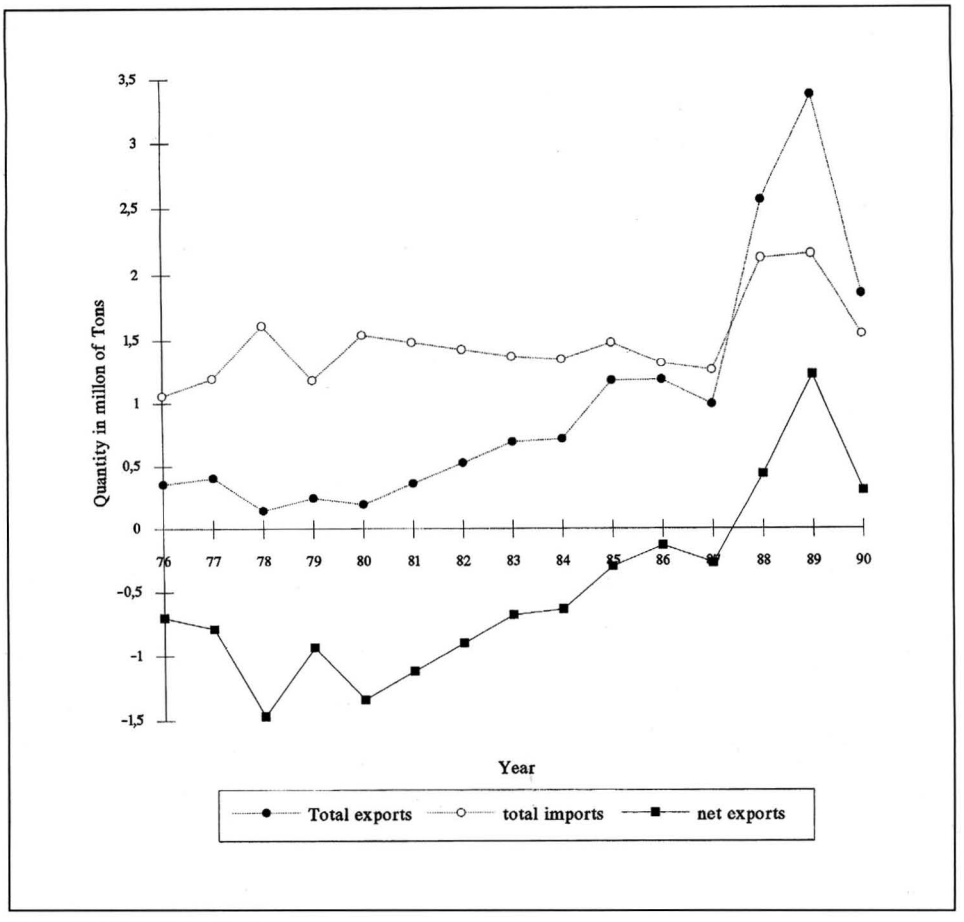

Figure 3 - Trade in hard wheat.

EU export price index will increase because it reflects primarily improvement. For the import side, projected value figures are expected to increase for *France, Belgium and Luxembourg, Netherlands, United Kingdom, Denmark and Spain* while it will decrease for the other members. Generally, the trend of the import share is decreasing for each member country. Extra-EU region will increase rapidly its import value and share. This is understandable, taking into consideration that under the CAP regulations, the Community overall level of self-sufficiency for every member country is growing and is expected to do so in the future as well. Thus, the only solution for each country is to market its product into the rest of the world (the extra-EU region).

Implication in the soft wheat market

The total value figure is expected to increase substantially compared with other products (**table 5**). The allocation among exporters is as follows: *France* will face a substantial fall in its export value as well as in its export share but it will remain the major exporter by 1996. It will export only the 38% of the total trade value figure while other producers will take its market share losses

Table 4 ***Export and import trade value of barley in 1990, 1996 and the corresponding per unit export price indices (1990 = 100) (1).***

Country	Total exports		Total imports		Export price index
	1990	1996	1990	1996	1996
France	585227 (34.37) (2)	722888 (25.40)	34650 (2.04)	52951 (1.86)	97.20
Belg-Lux (3)	100178 (5.88)	142802 (5.02)	349147 (20.5)	397776 (13.97)	101.03
Netherlands	148827 (8.74)	218401 (7.63)	300831 (17.67)	579575 (20.36)	77.23
Germany	192755 (11.32)	394256 (13.86)	111673 (6.56)	69045 (2.43)	62.35
Italy	142 (0.01)	249 (0.01)	113022 (6.64)	37603 (1.32)	88.04
U.K.	265795 (15.61)	84083 (2.95)	50073 (2.94)	81007 (2.85)	90.13
Ireland	59786 (3.51)	94737 (3.33)	2584 (0.15)	1525 (0.05)	64.64
Denmark	207191 (12.17)	339195 (11.92)	5518 (0.32)	6562 (0.23)	76.99
Greece	0 (0.00)	0 (0)	37330 (2.19)	36791 (1.29)	(4) -
Portugal	1 (0.00)	0 (0)	19276 (1.13)	6261 (0.22)	210.89
Spain	121584 (7.14)	842715 (29.61)	3869 (0.23)	4648 (0.16)	26.90
Extra-EU	21359 (1.25)	7041 (0.25)	674874 (39.63)	1572623 (55.25)	142.11

(1) '000s of 1990 ECUs.
(2) Figures in parentheses show the share of the total EU trade value. They may not add up to unity because of rounding.
(3) Belgium-Luxembourg.
(4) Missing values indicate either share or the projected trade values are negligible (the model cannot predict accurately changes in prices in these cases).

such as *Netherlands* and *Germany. Netherlands* is expected to improve its export position and will increase both its export value figure and export market share by more than double.

The projected value figures of the remaining exporters show generally a moderate change both in value figures and in market share, except *Spain* and

Table 5 ***Export and import trade value of soft wheat in 1990, 1996 and the corresponding per unit export price indices (1990 = 100) (1).***

Country	Total exports		Total imports		Export price index
	1990	1996	1990	1996	1996
France	2411382 (56.33) (2)	2214167 (37.98)	42096 (0.98)	58709 (1.01)	171.02
Belg-Lux (3)	93391 (2.18)	61852 (1.06)	449227 (10.49)	697941 (11.97)	244.33
Netherlands	320063 (7.48)	922986 (15.83)	597183 (13.95)	1000359 (17.16)	139.49
Germany	410838 (9.60)	825818 (14.17)	284220 (6.64)	243510 (4.18)	115.68
Italy	1184 (0.03)	0 (0.00)	680880 (15.91)	1183708 (20.30)	(4) –
U.K.	597983 (13.97)	1104224 (18.94)	141753 (3.31)	118214 (2.03)	82.08
Ireland	16411 (0.38)	12842 (0.22)	44376 (1.04)	72060 (1.24)	48.82
Denmark	182422 (4.26)	373650 (6.41)	4718 (0.11)	4977 (0.08)	98.80
Greece	536 (0.01)	0 (0.00)	69544 (1.62)	42373 (0.73)	–
Portugal	0 (0.00)	0 (0.00)	63082 (1.47)	53859 (0.92)	–
Spain	35133 (0.82)	0 (0.00)	100419 (2.35)	78415 (1.35)	–
Extra-EU	211603 (4.94)	314344 (5.39)	1803448 (42.13)	2275758 (39.04)	163.04

(1) '000s of 1990 ECUs.
(2) Figures in parentheses show the share of the total EU trade value. They may not add up to unity because of rounding.
(3) Belgium-Luxembourg.
(4) Missing values indicate either share or the projected trade values are negligible (the model cannot predict accurately changes in prices in these cases).

Table 6 ***Export and import trade value of hard wheat in 1990, 1996 and the corresponding per unit export price indices (1990 = 100) (1).***

Country	Total exports		Total imports		Export price index
	1990	1996	1990	1996	1996
France	216595 (45.90) (2)	52328 (16.79)	627 (0.13)	507 (0.16)	74.46
Belg-Lux (3)	13594 (2.88)	6736 (2.16)	21565 (4.57)	8986 (2.88)	69.76
Netherlands	2940 (0.62)	1437 (0.46)	2902 (0.62)	302 (0.10)	112.75
Germany	453 (0.10)	327 (0.10)	53408 (11.32)	8954 (2.87)	72.31
Italy	20647 (4.38)	46735 (15.00)	275148 (58.31)	182972 (58.71)	62.90
U.K.	0 (0.00)	0 (0.00)	12250 (2.60)	6565 (2.11)	155.09
Ireland	126 (0.03)	26 (0.01)	991 (0.21)	776 (0.25)	48.28
Denmark	161 (0.03)	223 (0.07)	7 (0.00)	1 (0.00)	100.87
Greece	148124 (31.39)	114542 (36.75)	4726 (1.00)	622 (0.20)	87.58
Portugal	1 (0.00)	2 (0.00)	8520 (1.81)	1217 (0.39)	86.68
Spain	22891 (4.85)	74258 (23.83)	14794 (3.13)	1112 (0.36)	23.09
Extra-EU	46333 (9.82)	15051 (4.83)	76927 (16.30)	99651 (31.97)	98.63

(1) in '000s of 1990 ECUs.
(2) Figures in parentheses show the share of the total EU trade value. They may not add up to unity because of rounding.
(3) Belgium-Luxembourg.

Table 7 ***Projected changes in values of intra-EU trade in 1996 (¹).***

Product	No change in trade policy	10% reduction in tariff	15% reduction in tariff
Barley	1.171.035	1.170839	1.170.743
Soft wheat	3.711.269	3.705.541	3.702.666
Hard wheat	233.015	232.109	231.651

(¹) '000s of 1990 ECUs.

Greece which will have no exports by 1996. The *extra-EU's* export value figures and shares will increase by 1996 as well as the export price index. This can be explained by the quality advantage of the imported soft wheat from North America for domestic food consumption. For the *import side, Netherlands, Italy and Belgium-Luxembourg*, the main importing member-countries, will increase significantly their imports. The trend for the other members is moderately increasing for *Denmark, Ireland* and *France* while it is decreasing for *Greece, Portugal Germany, Spain and the United Kingdom.* The *extra-EU region*, although it is expected to increase its import value by 1996, its share in the total imports will decrease. This can be explained by the important overall trade growth rate and particularly between members. In 1994, the extra-EU region will decrease its import value as well as its share resulting from the relatively high export prices of the member-countries. In 1996, although it is expected to increase its import value about 50%, its share in the total imports will increase only by around 13%. This also can be explained by the important overall trade growth rate and particularly between members.

Implication in the hard wheat market

The total trade value figure as well as the export price indices for some countries are expected to decrease substantially (**table 6**). This trend is reflected on the country member's behaviour, specially *France and Greece*, the main exporters in 1990. In contrast, *Italy and Spain* will increase substantially their export value as well as their export market share, but the increase will not be great enough to prevent the overall trade value figure from falling.

In the *import side*, each member-country is expected to decrease its import value significantly, while the extra-EU region will increase both its import value and its share as it is expected.

Implications of the GATT Agreement

Trade patterns might alter substantially when even a moderate change in trade policy is introduced. Thus, by assuming a ten or fifteen percent tariff reduction in EU imports a vague picture of expected trade changes in grains after the implementation of GATT Agreement can be perceived. Thus, by introducing a ten and fifteen percent decrease in tariffs, significant changes will occur. The extra-EU region is expected to increase its export value figure and share resulting from the shift of the members from the intra to the extra-EU trade (**table 7**). Clearly, the intra-EU trade is expected to decrease. The level of reduction is linked to the importance of the extra-EU as an exporter to the member-countries.

Conclusions and policy implications

The main purpose of this study was to analyse the structure and future trade pattern of soft wheat, hard wheat and barley among European Union members in relation to the rest of the world (extra-EU). To investigate the simultaneous import and export of each product, the latter was considered differentiated by kind and by the country of origin.

The theoretical framework of the model was first developed by Armington (1969a) and then extended by Sarris (1984). Throughout the analysis, twelve countries were considered at the same time as destination and origin countries, that is, the eleven European members (Belgium and Luxembourg's data have been aggregated) and the extra-EU region (rest of the world). Results reveal that:

– the total trade value of soft wheat and barley is expected to increase substantially whereas trade of hard wheat will decrease;

– European Community imports from the rest of the world are expected to fall substantially, reflecting the growing interdependence and preference among country members;

– extra-EU imports from member-countries will increase resulting from the growing EU self sufficiency level;

– a reduction in the tariff on imports from extra-EU region will decrease the intra-EU trade while extra-EU region will profit and increase their export value trade;

The model can also be used to experiment various assumptions and policy variables, so the projected value figures can be compared to show other aspects of the market structure. ●

References

Alston J.M., Carter C.A., Pick D. (1990): Whiter Armington trade model ?, *American Journal of Agricultural Economics*, 72, 455-467.

Armington P.S. (1969a): A theory of demand for products distinguished by place of production, *IMF Staff Papers*, 16, 159-176.

Armington P.S. (1969b): The geographic pattern of trade and the effects of price changes, *IMF Staff Papers* , 16, 179-199.

B.A.E. (Bureau of Agricultural Economics) (1985): Agricultural Policies in the European Community. Their Origin, Nature and Effects on Production and Trade, *Policy Monograph 2*, Government Publishing Service, Canberra.

Commission of the European Community (1991): The Agricultural Situation in the Community: 1990 Report, Office for Publications of the European Community, Luxembourg.

EUROSTAT, External trade analytical tables on imports and exports (1976-1990): Eurostat, theme 6 - series C.

Grennes T., Johnson P.R., Thursby M. (1978): The Economics of World Grain Trade, Preager Publishers, New York. (Cited by Ito S., D.T. Chen and E.W.F. Peterson 1990 below)

Haniotis T., Ames G. (1988): US corn and soybean exports to the enlarged European Community, *The Georgia Agricultural Experiment Stations*, College of Agriculture, the University of Georgia, Research Bulletin 381.

Honma M., Heady E.O. (1984): An econometric model for international wheat trade: exports, imports, and trade flows, The center for agricultural and rural developments, Iowa State University, Ames.

Ito S., Chen D.T., Peterson E.W.F. (1990): Modelling international trade flows and market shares for agricultural commodities: a modified Armington procedure for rice. *Agricultural Economics*, 4, 315-333.

Leonard D. (1988): Pocket Guide to the European Community. Basil Blackwell, Oxford.

Maclaren D. (1991): Agricultural trade policy analysis and international trade theory: A review of recent developments. *Journal of Agricultural Economics*, 42(3), 250-297.

Rekik C. (1993): Trade pattern of wheat and barley in the Single European Market, MSc Thesis, Chania.

Sarris A.H. (1981): Empirical models of international trade in agricultural commodities, in *A. F. McCalla, and T. Josling*, Imperfect Markets in Agricultural Trade, Allanheld, Osmun and Co, Montclair.

Sarris A.H. (1983): European Community enlargement and world trade in fruits and vegetables, *American Journal of Agricultural Economics*, 65, 235-246.

Sarris A.H. (1984): World trade in fruits and vegetables: Projections for an enlarged European Community. US Dept. of Agric.: Foreign Agriculture Economic Report 202.

Saunders C. (1991): The CAP and intra EC trade in *C. Ritson and D. Harvey*, The Common Agricultural Policy and World Economy, CAB International, Wallingford.

Schmidt S.C., Frohberg K.K., Maxwell D.L. (1987): Implication of grain trade liberalization in the European Community, *Agricultural Experiments Station*, College of Agriculture, the University of Illinois at Urbana-Champaign. Agricultural Economics Research Report 202.

Thompson R.L., Abbot P.C. (1982): New developments in agricultural trade analysis and forecasting. *in G.C., Rausser*, New Directions in Econometric Modeling and Forecasting in US Agriculture, Elsevier Science Publishing Co. Inc., New York.

Tracy M. (1993): The common agricultural Policy: Market organisation. Food and Agriculture in a Market Economy, APS, Belgium.