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SPECIAL ISSUE: ENLARGEMENT, STRUCTURAL CHANGE, CAP REFORM, AND TRADE LIBERALIZATION IN EUROPEAN AGRICULTURE

Guest Editors: Frank H. Fuller and John C. Beghin

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ENLARGEMENT, STRUCTURAL CHANGE, CAP REFORM, AND TRADE LIBERALIZATION IN EUROPEAN AGRICULTURE: HIGHLIGHTS OF THE SPECIAL ISSUE

Frank H. Fuller and John C. Beghin
Center for Agricultural and Rural Devlopment (CARD)
Iowa State University, Ames Iowa 50011

This special issue of the *Journal of International Agricultural Trade and Development* provides an in-depth look at Europe's changing agricultural and food markets, focusing on the impacts of recent policy reforms, enlargement of the European Union (EU), and trade liberalization. The eight papers contained in this issue were originally presented at the meetings of the International Association of Agricultural Economists in Gold Coast, Australia, August 12–18, 2006. The papers included in this issue braid together four important themes in European agriculture and food markets: the impacts of EU enlargement on productivity growth and catching up in the Central and Eastern European countries (CEECs), the influence of food quality standards on market structures in the CEECs and on trade, the impacts of common agricultural policy (CAP) reforms on EU and world markets, and the costs of adjusting to CAP reforms in specific sectors. The insights provided in these papers into the empirical interactions between policies, institutions, and market outcomes, both domestically and internationally, are valuable to policy makers and researchers interested in the future of European agriculture.

The papers by Rungsuriyaboon and Lissitsa, Rau and Tongeren, and Swinnen explore the market and institutional changes in the EU new member states (NMS) and transition countries (TC) leading up to and following enlargement of the EU in 2004. Rungsuriyaboon and Lissitsa use a parametric distance function approach to decompose the total factor productivity (TFP) growth in the EU-15, NMS, and TCs during the period from 1992–2002. The results of their analysis show that agricultural productivity the EU-15 grew by more than 1.1% annually over the decade, largely due to improvements in technology. Productivity in the NMS and TCs grew more rapidly (1.3% and 1.4% annually, respectively) than in the EU-15, but improvements in technical efficiency and technology were the important drivers, implying some "catching up" occurred. Technical efficiency in all three groups of countries show some pattern reversal with large losses of efficiency in early years and significant gains in later years. Scale efficiency is a small component of TFP in the three country groups. The authors suggest that the process of enlargement accelerated productivity growth in the NMS,

and they conjecture that further enlargement to the East may have a similar impact on other TCs.

Rau and Tongeren take a close look at the impact of adopting EU food quality standards in the NMS on the structure of agricultural industries. The authors develop a conceptual model of oligopolistic market structure with compliance costs and firm heterogeneity taken into account; they then apply this model to the Polish meat sector. Their analysis shows that targeted subsidies, perhaps using EU structural adjustment funds, to reduce compliance costs can have a significant impact on market outcomes. In particular, the number of firms that comply with the new quality standards more than doubles, market prices decline, and new export and growth opportunities are created for producers in the NMS. The simulation result also show that there is diminishing marginal effectiveness as the subsidy value increases beyond some optimal level.

The article by Johann Swinnen provides a comprehensive overview of how private investment by domestic and international firms, rather than government assistance, has been an important driver of productivity growth, quality improvement, and structural change in agricultural markets in the CEECs and TCs via coordination between producers and processors. Swinnen provides unique insights into the motivations behind the development of private vertical coordination schemes in the TCs and how these mechanisms address fundamental problems of exchange that arose during the transition process. Private vertical coordination can lead to better provision of inputs, fewer payment and production delays, dramatic productivity gains, and improved quality of food goods. The examples of successful and failed attempts at market coordination between producers and processors offer a microeconomic perspective on the productivity growth analysis in the Rungsuriyaboon and Lissitsa paper. Swinnen concludes with a perspective on the future of vertical coordination in agricultural markets of the TCs, noting that some coordination activities will likely fall by the wayside as markets develop and institutions needed to support market transactions are established.

The article by Fabiosa et al. provides a bridge between the first three papers and the last four papers by offering an overview of the impacts of reforms of the EU's common agricultural policy (CAP) and the 2004 enlargement to include 10 new member states. Using a large, multi-market, partial equilibrium model of global agriculture, the authors simulate the impacts of the 2003 CAP reforms and EU enlargement in two consecutive scenarios. The simulation results suggest that the impacts of CAP reforms on internal EU markets are modest, with the largest changes occurring in markets that received substantial commodity-specific support under the previous policies. Echoing the findings of the previous papers, enlargement to the East is projected to generate significant changes in the agricultural markets in NMS as they adjust to new policy measures and quality standards. However, the direct impacts of these two important events on international prices and trade in agricultural commodities are minor at best and negligible in several markets. From an international perspective, the authors suggest that the greatest impact of the CAP reforms and enlargement may be their indirect impacts on the EU's role in facilitating agricultural trade liberalization in the Doha negotiations in the WTO.

The papers by Dixon and Matthews and Arriaza and Gómez-Limón take a deeper look at the implications of CAP reforms for particular sectors in selected countries. Dixon and Matthews use a general equilibrium model of the Irish economy to analyze the impacts of CAP reforms on agriculture in Ireland. The dependence of the Irish agricultural sector on

coupled payments prior to the reforms enable Dixon and Matthews to highlight the importance of replacing commodity-specific payments with the decoupled single farm payment (SFP) for production in heavily supported sectors, such as beef, sheep, and grains. In addition to reducing the overall level of agricultural output in Ireland, CAP reforms are expected to cause a shift in agricultural resources away from those heavily supported sectors toward the lesser supported swine, poultry, and fruit and vegetable industries. As part of the process of adjustment, a growing number of workers in the agricultural sector are expected to seek off-farm employment, and there is a general increase in the extensification of agricultural production. However, the lack of deep reforms in the dairy sector and the additional income provided by the SFP prevents farm incomes from significant declines in response to the reforms.

Arriaza and Gómez-Limón analyze the impacts of CAP reforms on the heavily subsidized cotton industry in Spain. The authors use survey data collected from cotton farms in Southern Spain to build a farm decision model based on a multi-criteria programming approach. Simulation results from their model suggests that the significant decline in market support combined with the lax production requirements that must be met to receive coupled payments will induce most cotton farmers in Spain to adopt a semi-abandonment approach to cotton production. Farmers will plant cotton but use only the minimum inputs required to ensure the cotton reaches the bole stage to receive direct payments; however, the cotton is never harvested. Arriaza and Gómez-Limón show that introducing an additional payment to encourage environmentally sustainable production practices and modulation of payments based on the quality of delivered cotton may prevent the wholesale abandonment of cotton production in Spain. Their result illustrates how fine tuning the new CAP policies may reduce adjustment costs for regions that are particularly hard hit by the reforms.

The papers by Conforti and Rapsomanikis and Götz and Grethe focus on the impacts of CAP reforms on trade and preferential trade arrangements. Conforti and Rapsomanikis examine the effects of recent reforms of the EU sugar regime on trade with developing and least developed countries (LDCs) with preferential access to the EU market through various trade agreements. The key finding is that the reduction in EU market support under the sugar market reforms leads to a reduction in export revenues to developing countries and LDCs that export sugar to the EU under preferential agreements. Actual export volumes to the EU from exporters with preferential access are not greatly affected by the reforms, but the value of the preferences to developing countries and LDCs is clearly eroded.

Götz and Grethe look at the complex import regime governing EU orange imports and find that the regime has not been particularly effective at protecting domestic orange producers, nor have the preferential components of the regime been widely utilized by exporting countries. The authors examine prices for oranges imported by the EU from 1995–2005, and compare these prices to minimum import prices established under the orange import regime. The period covered includes changes to the regime and preferential import quotas in response to the Uruguay Round Agreement on Agriculture. Götz and Grethe find that prices of oranges imported from Mediterranean orange exporters are significantly higher than the minimum entry price on average; moreover, the fill rate for preferential quotas offered to Mediterranean orange exporters has fallen for most countries, averaging below 60% for the last 8 years. They suggest that the decline in Mediterranean orange exports may be due to improved quality, lower transportation costs, and greater availability of oranges from Spain and Portugal rather than preference erosion. Thus, the authors conclude that

liberalization of orange trade between the EU and Mediterranean countries will have little impact on trade outcomes. The latter authors further analyze similar preferential trade regimes for table grapes, mandarins, and tomatoes. The trade regime for table grapes is mostly redundant. For mandarins and tomatoes, however, import prices are much are closer to entry prices, restricting imports.

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AGRICULTURAL PRODUCTIVITY GROWTH IN THE EUROPEAN UNION AND TRANSITION COUNTRIES

Supawat Rungsuriyawiboon [*] ***and Alexej Lissitsa***

[1] Faculty of Economics, Chiang Mai University , 50200 Chiang Mai, Thailand.
Tel +66 53 944923, Fax +66 53 942202, Email: supawat@econ.cmu.ac.th.
[2] Leibniz Institute of Agricultural Development in Central and Eastern Europe (IAMO), Theodor-Lieser-Strasse 2, D-06120 Halle (Saale), Germany,
Tel +49 345 2928121, Fax +49 345 2928399, Email: lissitsa@iamo.de.

ABSTRACT

The Central and Eastern Europe Countries (CEECs) have experienced significant changes in politics, economy, and society over the past decade. Economic reform in the CEECs helped transform the structure and volume of agricultural production and resulted in significant productivity improvement. However, large differences persist among the transition countries in the magnitude and direction of these changes. This study measures and compares the levels and trends in agricultural productivity in transition countries with those of the European Union (EU) countries using a panel data set on 46 European countries during 1992-2002. This study employs a parametric distance function approach to measure the Malmquist total factor productivity index as well as the magnitude and direction of technical change. Our major findings indicate that the transition countries achieved a higher agricultural performance and showed more input- and output-biased technical change than the EU countries.

Keywords: agriculture, productivity, transition countries, biased technical change, catch-up, Central and Eastern Europe
JEL Code: O33, P23, Q16

In the late 1980s and early 1990s, the Central and Eastern European countries (CEECs) and Newly Independent States (NIS) of the former Soviet Union began major market-oriented reforms of their planned economies. Prior to 1990, the factors of agricultural production in most of these countries were collectively or state owned, providing little individual incentive for productivity improvement and investment. The viability of many agricultural enterprises was heavily dependent on production subsidies and publicly financed debt. The market-

[*] Corresponding Author: Supawat Rungsuriyawiboon, Faculty of Economics, Chiang Mai University, 50200 Chiang Mai, Thailand, Tel +66 53 944923, Fax +66 53 942202, Email: supawat@econ.cmu.ac.th

oriented reforms cut producer and consumer subsidies and liberalized prices for agricultural inputs and outputs. With falling real incomes, consumer demand for domestic and imported food products declined, resulting in a significant fall in the terms of trade for agricultural sectors throughout the region. As a result, input use and output from the agriculture sector declined precipitously compared with the non-agriculture sector (Csaki and Lerman, 2000; Deininger, 2003).

In hindsight, the reforms, which sought to rapidly replace socialized agriculture with a market-oriented system based on private ownership, have produced mixed and sometimes unintended outcomes (Csaki and Lerman, 2000; Lerman, 2001; Trzecial-Duval, 1999; Csaki and Zuschlag, 2004; Ellman, 2003). Outside of the most authoritarian Central Asian republics and Belarus, all of the countries in the region have moved, at least nominally, to private systems (Childress, 2002). Elements of the socialist agricultural system persist, however, in many farm structures, distribution networks, and in the often blurry role of the state in its putative support for the new system.

More than a decade after reforms began, a recent analysis found that a very large gap remains between global agricultural development and the performance of the transition countries (World Bank, 2005). The report indicates that there are notable differences in the pace of agricultural reform between the CEECs and NIS. In the leading CEECs, such as Poland, Hungary and Czech Republic, the reform process is close to completion. In several new EU members the agriculture and agro-processing sectors now resemble those of a market economy and are experiencing very dynamic growth (see Swinnen, 2007, in this issue). On the other end of the spectrum, countries like Belarus and Moldova are far from a market economy and desired productivity growth. Differences region's agricultural performance is particularly evident with respect to the levels of efficiency in OECD countries, as indicated by an international comparison of grain yields but also labour productivity (FAOSTAT, 2005; World Bank, 2005).

Given this historical background, we analyze the magnitude and the nature of agricultural productivity growth in the transition countries to better understand the impacts of reform on the agricultural sectors of these countries. Utilizing a parametric distance function approach, we decompose the total factor productivity (TFP) growth in CEECs and NIS countries into improvements due to technical change (TC), technical efficiency change (TEC), and scale efficiency change (SEC). The TC component is further decomposed to uncover evidence of input and output bias. The TFP decomposition for the transition countries is compared to a similar decomposition for other European countries. The major findings of this paper show that TFP change in European agriculture over the study period was mainly driven by technological progress. The EU countries operated at higher levels of technical efficiency (TE) than the transition countries; however, the transition countries achieved higher TFP growth than the EU countries. In addition, they indicated an impressive "catch-up" effect and showed input- and output-biased TC more than the EU countries.

The remainder of this paper is organized as follows. The next section presents the methodology used to decompose TFP change, followed by a discussion of the empirical techniques used to estimate the decomposition. Then, we describe the data set and the definitions of all variables. The empirical results are presented and discussed, and the final section summarizes our main conclusions.

DECOMPOSITION OF A TFP CHANGE

TFP change is theoretically defined as the residual change in outputs not explained by the change in input use. The most widely used measure of factor productivity in the empirical literature is the Malmquist TFP Index (MPI) presented in Caves, Christensen, and Diewert. (1982) and Färe et al. (1994). The change in the MPI can be analyzed using a distance function. The distance function is defined as a rescaling of the length of an input or output vector with the production frontier as a reference. Because either inputs or outputs can be scaled, the distance function can have an input or output orientation. The output distance function is defined as

$$D_t^o\left(x_t, y_t\right) = \min\left\{\theta : \left(x_t, y_t / \theta\right) \in S_t\right\}, \tag{1}$$

where superscript *o* refers to an output orientation of the distance function, S_t is the production technology which transforms inputs $x_t \in R_+^K$ into net outputs $y_t \in R_+^M$ for each time period $t = 1,...,T$. $D_t^o\left(x_t, y_t\right) \le 1$ if and only if $\left(x_t, y_t\right) \in S_t$. Furthermore, $D_t^o\left(x_t, y_t\right) = 1$ if and only if $\left(x_t, y_t\right)$ is located on the outer boundary of the feasible production set which occurs only if production is technically efficient. The $D_t^o\left(x_t, y_t\right)$ measures output-oriented TE as defined in Farrell (1957) because it calculates how far an observed input-output combination is from the production frontier.

Following Färe et al. (1994), a change in the output-oriented MPI measures the TFP change between two data points by calculating the ratio of the output distances of each data point relative to a common technology. Färe et al. (1994) assumes constant returns to scale (CRS) is imposed upon any technology that is used to estimate distance functions for the calculation of the MPI. The output-oriented MPI change $\left(m^o\right)$ can be decomposed into TEC $\left(\Delta TE^o\right)$ and TC $\left(\Delta TC^o\right)$ components,

$$\begin{aligned} m^o\left(x_{t+1}, y_{t+1}, x_t, y_t\right) &= \frac{D_{t+1}^o\left(x_{t+1}, y_{t+1}\right)}{D_t^o\left(x_t, y_t\right)} \left[\frac{D_t^o\left(x_{t+1}, y_{t+1}\right)}{D_{t+1}^o\left(x_{t+1}, y_{t+1}\right)} \times \frac{D_t^o\left(x_t, y_t\right)}{D_{t+1}^o\left(x_t, y_t\right)} \right]^{1/2} \\ &= \Delta TE^o\left(x_{t+1}, y_{t+1}, x_t, y_t\right) \cdot \Delta TC^o\left(x_{t+1}, y_{t+1}, x_t, y_t\right) \end{aligned} \tag{2}$$

where ΔTE^o measures the change in the output-orientated measure of Farrell TE between periods *t* and *t*+1 and ΔTC^o is the geometric mean of shifts in the production frontier from *t* to *t*+1 measured at input levels x_t and x_{t+1}. The value of m_o can be less than, equal to, or greater than one, depending upon whether productivity is declining, unchanged, or improving, respectively.

Färe et al. (1997) extends equation (2) and shows that the TC can be decomposed into a magnitude index of TC $\left(\Delta M^{o}\right)$ and a bias index of TC $\left(\Delta B^{o}\right)$. The bias index can be further decomposed into output-biased TC $\left(OB\Delta T^{o}\right)$ and input-biased TC $\left(IB\Delta T^{o}\right)$.

$$\begin{aligned}\Delta TC^{o}\left(x_{t+1},y_{t+1},x_{t},y_{t}\right) &= \frac{D_{t}^{o}\left(x_{t},y_{t}\right)}{D_{t+1}^{o}\left(x_{t},y_{t}\right)}\left[\frac{D_{t+1}^{o}\left(x_{t},y_{t}\right)}{D_{t}^{o}\left(x_{t},y_{t}\right)}\times\frac{D_{t}^{o}\left(x_{t+1},y_{t+1}\right)}{D_{t+1}^{o}\left(x_{t+1},y_{t+1}\right)}\right]^{1/2} \\ &= \Delta M^{o}\left(x_{t+1},y_{t+1},x_{t},y_{t}\right)\cdot\Delta B^{o}\left(x_{t+1},y_{t+1},x_{t},y_{t}\right),\end{aligned} \tag{3}$$

where

$$\begin{aligned}\Delta B^{o}\left(x_{t+1},y_{t+1},x_{t},y_{t}\right) &= \left[\frac{D_{t+1}^{o}\left(x_{t+1},y_{t}\right)}{D_{t}^{o}\left(x_{t+1},y_{t}\right)}\times\frac{D_{t}^{o}\left(x_{t+1},y_{t+1}\right)}{D_{t+1}^{o}\left(x_{t+1},y_{t+1}\right)}\right]^{1/2} \\ &\times\left[\frac{D_{t+1}^{o}\left(x_{t},y_{t+1}\right)}{D_{t}^{o}\left(x_{t},y_{t}\right)}\times\frac{D_{t}^{o}\left(x_{t+1},y_{t}\right)}{D_{t+1}^{o}\left(x_{t+1},y_{t}\right)}\right]^{1/2} \\ &= OB\Delta T^{o}\left(x_{t+1,}y_{t+1,}y_{t}\right)\times IB\Delta T^{o}\left(x_{t,}y_{t,}x_{t+1}\right).\end{aligned} \tag{4}$$

If $OB\Delta T^{o}$ and $IB\Delta T^{o}$ are simultaneously equal to one, the ΔM^{o} equals the TC under joint Hicks neutrality.

The component distance functions in equations (2)–(4) can be measured using either nonparametric or parametric techniques. One main criticism of the MPI is that it is constructed under CRS assumption of production technology. Therefore, it may not provide an accurate measure of productivity change because it ignores a measure of scale economies. Ray and Desli (1997) and Grifell and Lovell (1999) develop a method using a nonparametric technique to decompose the MPI change in which the contribution of scale economies is taken into account. The contribution of scale economies can be measured using the ratios of distance function values corresponding to CRS and variable returns to scale (VRS) technologies. However, this framework can not be applied to a parametric technique because the CRS distance function measured by the parametric approach does not necessary envelop the distance function with VRS, leading to an inaccurate measure of the SE contribution. Subsequently, Balk (2001) extends the results obtained by Ray (1999) and derives the framework to decompose the MPI change using a parametric technique. The MPI change decomposition in Balk (2001) consists of the components of TC, TEC, SEC and an input- or output-mixed effect. Although Balk's approach is appealing, it does require the prior calculation of scale efficiency (SE) measures in which the scale effects are measured using the most productive scale size as a reference. As Orea (2002) points out, the SE measures are not bounded for either globally increasing, decreasing, CRS, or ray-homogenous technologies. Therefore, some practical problems may occur when adopting Balk's approach.

As a result, Orea (2002) offers an alternative approach using a parametric technique to decompose the MPI change, in which the contribution of scale economies is taken into account without requiring the prior calculation of SE measures.

Figure 1 illustrates the output-orientated MPI change decomposition under VRS production technology. Measures of the TEC, TE and SEC components in the MPI change are graphically illustrated in input-output space as follows. Let S_t and S_{t+1} be the technology under VRS at the time period t and $t+1$, respectively. Define T_t (T_{t+1}) as a ray from the origin that is at a tangent to the production frontier S_t (S_{t+1}). The ray T_t (T_{t+1}) can represent a distance function when S_t (S_{t+1}) satisfies free disposability, convexity and CRS. Therefore, the T_t and T_{t+1} represent the CRS technology that shifts at the most productive scale size at the time period t and $t+1$, respectively. Consider the time periods t and $t+1$, the observed input-output combinations are located inside the production frontiers, implying that production is not technically efficient in either period. The output distance function for the observation at time t, relative to the production frontier S_t, is given by the ratio $\left(\overline{0a}/\overline{0b}\right)$, while the output distance function for the observation at time $t+1$, relative to the production frontier S_{t+1}, is given by the ratio $\left(\overline{0c}/\overline{0d}\right)$.

TEC which measures the change in the output-orientated measure of Farrell TE between periods *t* and *t*+1 is given by the ratio $\frac{\left(\overline{0c}/\overline{0d}\right)}{\left(\overline{0a}/\overline{0b}\right)}$. The movement of the production frontier from S_t to S_{t+1} indicates TC. Färe et al. (1994) shows that TC can be measured in terms of the CRS benchmark technology. A measure of TC defined as the geometric mean of the shift in T_t and T_{t+1} at input levels x_t and x_{t+1} is given by the ratio $\left[\frac{\left(\overline{0c}/\overline{0e}\right)}{\left(\overline{0c}/\overline{0g}\right)}\times\frac{\left(\overline{0a}/\overline{0b}\right)}{\left(\overline{0a}/\overline{0f}\right)}\right]^{1/2}$.

The tangent points, A and B, in figure 1 represent maximum possible productivity or technically optimal scale of the production frontier S_t and S_{t+1}, respectively. In figure 1, a firm is operating at the most productive scale size in period t while the firm is operating at non-optimal scale in period $t+1$. The firm may still be able to improve its productivity by exploiting scale economies. A measure of SEC represented by the change in output SE between the period t and period $t+1$ data is given by the ratio $\frac{\left(\overline{0d}/\overline{0g}\right)}{\left(\overline{0b}/\overline{0b}\right)}$.

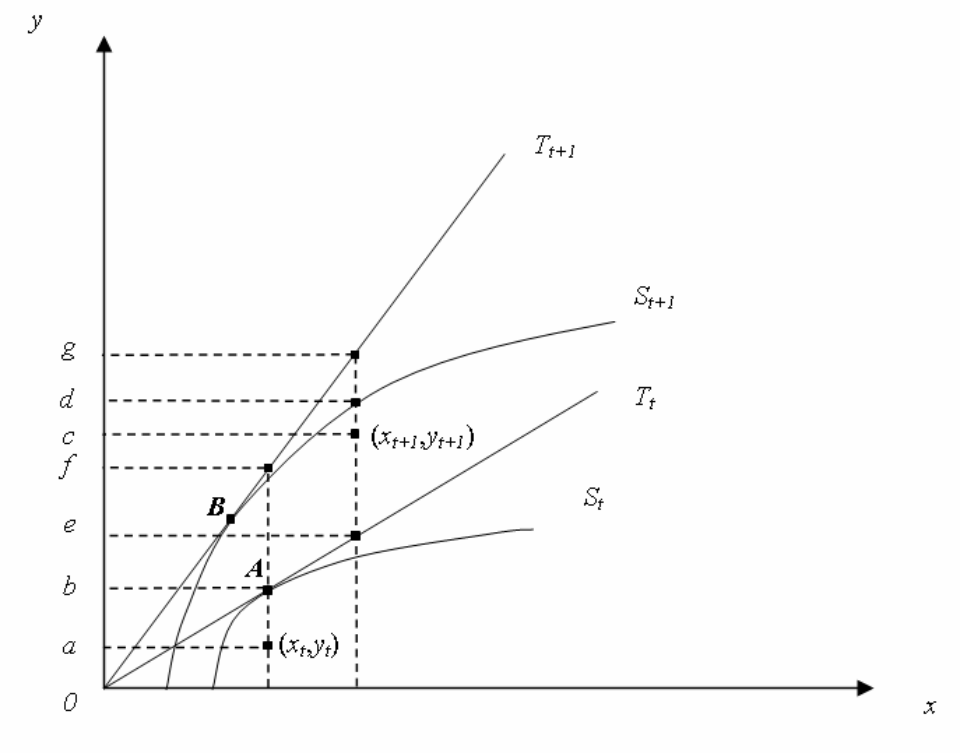

Figure 1. Output-orientated MPI decomposition under VRS production frontier.

A Generalized MPI Change Decomposition and a Parametric Framework

Orea (2002) applies Diewert's (1976) Quadratic Identity Lemma to derive a generalized MPI change decomposition. The logarithmic form of a generalized output-oriented MPI change index between periods t and $t+1$ can be written as[1]

$$\begin{aligned}\ln\left(m_v^o\left(x_{t+1}, y_{t+1}, x_t, y_t\right)\right) &= \left[\ln D_{t+1}^o - \ln D_t^o\right] - \frac{1}{2}\left[\frac{\partial \ln D_{t+1}^o}{\partial t} + \frac{\partial \ln D_t^o}{\partial t}\right] \\ &+ \frac{1}{2}\sum_{k=1}^{K}\left[\left(-\sum_{k=1}^{K} e_{kt+1} - 1\right)\cdot s_{kt+1} + \left(-\sum_{k=1}^{K} e_{kt} - 1\right)\cdot s_{kt}\right]\cdot \ln\left(\frac{x_{kt+1}}{x_{kt}}\right) \\ &= \ln \Delta TE_v^o + \ln \Delta TC_v^o + \ln \Delta SCE_v^o,\end{aligned} \tag{5}$$

[1] When information on output and input prices is available, one can also calculate an allocative efficiency change (AEC) component, which is equal to the difference between a Törnqvist TFP index and the MPI obtained from the output distance frontier. Therefore, the TFP growth can be decomposed into TC, TEC, SEC and input- or output- mix AEC effects like Balk's decomposition.

where subscript v refers to a measure that is calculated from the distance function corresponding to VRS technology, $e_{kt} = \partial \ln D_t^o \big/ \partial \ln x_{kt}$ is the distance elasticity for the k^{th} input in period t, and $s_{kt} = e_{kt} \Big/ \sum_{k=1}^{K} e_{kt}$ is the distance elasticity share for the k^{th} input in period t. ΔTE_v^o represents the TEC, ΔTC_v^o represents the TC, and ΔSCE_v^o represents the SEC. Equation (5) is expressed in terms of proportional rates of growth instead of a product of indices as in equation (2). The $\ln(m_v^o)$ is viewed as the parametric counterpart of the MPI.

The components of the generalized MPI change can be measured by estimating a translog output distance function. The estimating form of the translog output distance function can be defined as

$$\begin{aligned} -\ln y_{Mit} = {} & \beta_0 + \beta_{y_m} \sum_{m=1}^{M-1} \ln y_{mit}^* + \frac{1}{2} \sum_{m=1}^{M-1} \sum_{n=1}^{M-1} \beta_{y_m y_m} \ln y_{mit}^* \ln y_{mit}^* + \sum_{k=1}^{K} \beta_{x_k} \ln x_{kit} \\ & + \frac{1}{2} \sum_{k=1}^{K} \sum_{l=1}^{K} \beta_{x_k x_l} \ln x_{kit} \ln x_{lit} + \sum_{k=1}^{K} \sum_{m=1}^{M-1} \beta_{x_k y_m} \ln x_{kit} \ln y_{mit}^* + \beta_z t + \frac{1}{2} \beta_{tt} t^2 \\ & + \sum_{k=1}^{K} \beta_{x_k t} \ln x_{kit} t + \sum_{m=1}^{M-1} \beta_{y_m t} \ln y_{mit}^* t - \ln D_{it}^o , \end{aligned} \tag{6}$$

where βs are unknown parameters to be estimated, $y_{mit}^* = \left(y_{mit} / y_{Mit} \right)$ and $-\ln D_{it}^o = v_{it} - u_{it}$. The translog output distance function in equation (6) satisfies symmetry by imposing the restriction that $\beta_{x_k x_l} = \beta_{x_l x_k}$ and $\beta_{y_m y_n} = \beta_{y_n y_m}$, and it is homogeneous of degree one in outputs when the additional restrictions $\sum_{m=1}^{M} \beta_{y_m} = 1$, $\sum_{n=1}^{M} \beta_{y_m y_n} = 0$ $\left(m = 1,...,M \right)$, $\sum_{m=1}^{M} \beta_{x_k y_m} = 0$ $\left(k = 1,...,K \right)$ and $\sum_{m=1}^{M} \beta_{y_m t} = 0$ are imposed. Homogeneity can also be imposed by estimating the model with M-1 output variables normalized by the M^{th} output variable.

By replacing the distance term, $-\ln D_{it}^o$, with a composed error term, $v_{it} - u_{it}$, equation (6) can be estimated as a standard stochastic production frontier where v_{it} is the random error, and u is a non-negative random variable. The unknown parameters are estimated using the maximum likelihood routine in FRONTIER 4.1 (Coelli, 1996). The components of the MPI change decomposition can be computed using the estimated output distance function. Formulas for the individual components of the MPI change decomposition in terms of parameter estimates in equation (6) are presented in Appendix.

DATA

A panel data set of 46 European countries during the time period of 1992 to 2002 is used in the empirical analysis. Countries are divided into three categories: EU15, EU10, and the

transition (Trans) countries. Table 1 lists the countries in each category. The data were obtained from the Food and Agriculture Organization (FAO) and contain agricultural output and input quantities.

Table 1. Lists of the Countries

Group	Country
EU15	Austria, Belgium-Luxembourg, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK
EU10	Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia
Trans	Albania, Armenia, Azerbaijan, Belarus, Bosnia-Herzegovina, Bulgaria, Croatia, Georgia, Kazakhstan, Kyrgyzstan, Macedonia, Moldova Republic, Romania, Russian Federation, Serbia-Montenegro, Tajikistan, Turkey, Turkmenistan, Ukraine, Uzbekistan

In this study, the production technology is represented by two outputs (crops and livestock) and five inputs (land, tractors, fertilizer, labor, and livestock inputs). Output series are derived by aggregating detailed output quantity data on 127 agricultural commodities (115 crop commodities and 12 livestock commodities) as follows. First, the Geary-Khamis method[2] was used construct output aggregates from output quantity data and average international prices (expressed in US dollars) for the base period 1999 to 2001. Then, the aggregate output values during the base period were used to generate an aggregate output series from 1992-2002 using the FAO production indices for crops and livestock separately.[3]

The land input represents the arable land, land under permanent crops and the area under permanent pasture in hectares. The tractor input includes the total number of wheel and crawler tractors used in agriculture. Labour refers to the economically active population in agriculture. Following other studies on inter-country comparison of agricultural productivity (Hayami and Ruttan 1970, Fulginiti and Perrin 1997), the fertilizer input is the sum, in nutrient-equivalent terms, of the commercial use of nitrogen, potassium, and phosphate expressed in thousands tons. The livestock input is the sheep-equivalent of buffalo, cattle, swine, sheep, and goat inventories. Numbers of these animals are converted into sheep equivalents using conversion factors: 8.0 for buffalos and cattle; and 1.00 for sheep, goats and pigs. All variables are scaled to have unit means, and livestock output and livestock input variables are used to normalize the output and input series.

RESULTS

We estimated the translog output distance function under the VRS in equation (6) and the CRS (see equation (A-4) in the Appendix). Hypothesis tests regarding the structure of production technology, such as the presence of TE and TC, were conducted using the likelihood ratio (LR) tests. The null hypotheses of no TE and TC are rejected, implying the existence of TE and TC in the data. The estimated coefficients are shown in table 2.

[2] Detailed information on how international average prices are constructed can be found in Rao (1993)
[3] See the FAO STAT (FAO, 2004) for details regarding the construction of production index numbers.

Table 2. Estimated Parameters of the Output Distance Model[a]

Parameter	VRS Model		CRS Model	
	Estimates	*t*-Statistic	Estimates	*t*-Statistic
β_0	0.3694	8.4473	0.3731	12.1027
β_{y1}	0.2986	12.7308	0.2984	12.6969
β_{y1y1}	0.8281	9.4575	0.7190	8.5861
β_{x1}	-0.1175	-5.2767	-0.1686	-6.7910
β_{x2}	-0.1945	-9.2042	-0.1580	-9.1738
β_{x3}	-0.2154	-8.3084	-0.2429	-10.7577
β_{x4}	-0.0259	-1.0267	-0.0367	-1.5445
β_{x5}	-0.4675	-10.9166		
β_{x1x1}	0.0936	2.1319	-0.0511	-1.3885
β_{x2x2}	0.0010	0.0288	0.0005	0.0156
β_{x3x3}	-0.1328	-5.0181	-0.1506	-5.3123
β_{x4x4}	0.3414	6.8838	0.3275	6.5980
β_{x5x5}	0.4778	4.1586		
β_{x1x2}	-0.0455	-1.3196	-0.0134	-0.3712
β_{x1x3}	0.0943	3.0327	0.0281	0.8866
β_{x1x4}	-0.1264	-3.7959	-0.0660	-2.1123
β_{x1x5}	-0.0897	-1.4725		
β_{x2x3}	0.1276	7.1548	0.1025	5.6955
β_{x2x4}	-0.0554	-1.8007	-0.0446	-1.5798
β_{x2x5}	-0.1225	-1.9714		
β_{x3x4}	0.0760	1.7289	0.0560	1.4690
β_{x3x5}	-0.0860	-1.2925		
β_{x4x5}	-0.1442	-2.0204		
β_{x1y1}	-0.1999	-3.5792	-0.0970	-1.9060
β_{x2y1}	-0.1379	-3.7666	-0.0894	-2.5437
β_{x3y1}	-0.1351	-3.7880	-0.1621	-4.2278
β_{x4y1}	-0.1762	-3.1119	-0.1373	-2.5177
β_{x5y1}	0.5039	5.6849		
β_t	-0.0257	-8.2120	-0.0285	-8.5171
β_{tt}	0.0023	1.0809	0.0016	0.6952
β_{x1t}	-0.1789	-3.7616	-0.1206	-2.3928
β_{x2t}	-0.0121	-0.2991	0.0037	0.0850
β_{x3t}	0.0424	0.8754	0.0829	1.6432
β_{x4t}	0.1328	2.5739	0.0832	1.5929
β_{x5t}	0.0995	1.2228		
β_{y1t}	-0.0599	-0.9429	-0.0542	-0.8118
σ^2	0.0754	5.6135	0.1039	8.4026
γ	0.7186	5.7077	0.8050	13.3691

[a] Subscripts on β_x coefficients refer to inputs: 1 = land; 2 = tractors; 3 = fertilizer; 4 = labor; 5 = livestock input and subscripts on β_y coefficients refer to outputs: 1 = crops; 2 = livestock output.

The estimation results from both models are similar and provide the same sign for all parameter estimates except for the estimated parameters, β_{x1x1} and β_{x2t}. All first-order coefficients have the expected signs, implying that the output distance functions are increasing in outputs and decreasing in inputs at the sample mean. Tests of the regularity conditions are checked at each data point in all 506 observations. We find the convexity condition and the monotonicity constraints on outputs are satisfied at all observations in the output distance function for both models. The monotonicity constraints in inputs are violated at 12, 0, 2, 14, and 0% of all observations in the case of land, tractors, fertilizer, labor and livestock inputs, respectively, for the VRS model. In the CRS model, the monotonicity constraints in the corresponding inputs are violated at 12, 1, 0, 15, and 0% of all observations.

The first-order coefficients of the time trend variable in table 2 provide estimates of the average annual rate in TC. The output distance function estimates suggest that the technology is improving at a rate of 2.57% per annum in the VRS model and 2.85% per annum in the CRS model. The estimates of the output elasticities under VRS model are 0.2986 and 0.7014 for crops and livestock, respectively, while the CRS model estimates of the output elasticities are 0.2984 and 0.7016 for crops and livestock, respectively. The estimates of the input elasticities under the VRS model are -0.1175, -0.1945, -0.2154, -0.0259 and -0.4675 for land, tractors, fertilizer, labor, and livestock, respectively. Similar elasticities from the CRS model estimates are -0.1686, -0.1580, -0.2429, -0.0367 and -0.3939 for land, tractors, fertilizer, labor, and livestock, respectively. The sum of the input elasticities from the VRS model provides information about scale economies and is -1.0208, indicating that the technology exhibits moderately increasing returns to scale at the sample mean. The LR test of the null hypothesis of variable returns to scale was rejected at the 95% level but could not be rejected at the 90% confidence level. This result implies that the scale economies may be marginally significant. Consequently, the parameter estimates of the VRS model are used to calculate the components of the MPI change decomposition reported in table 3. Measures of input-biased TC require CRS, so the estimates from the CRS model are used to calculate the TC results shown in table 4.

Table 3. Weighted Annual Growth Rates of the MPI Change Decomposition by Country Group (in %)

Period	Region	TEC	TC	SEC	TFPC
1992-1994	EU15	-0.793	1.440	-0.001	0.646
1994-1996	EU15	0.181	1.164	0.043	1.388
1996-1998	EU15	0.074	0.931	0.033	1.038
1998-2000	EU15	0.310	0.690	0.099	1.099
2000-2002	EU15	0.180	0.479	0.046	0.705
1992-2002	**EU15**	**-0.182**	**1.262**	**0.064**	**1.144**
1992-1994	EU10	-0.883	1.216	0.014	0.347
1994-1996	EU10	0.636	1.171	-0.032	1.775
1996-1998	EU10	0.315	0.916	-0.015	1.216
1998-2000	EU10	0.151	0.659	0.056	0.866
2000-2002	EU10	0.226	0.431	-0.028	0.629
1992-2002	**EU10**	**0.189**	**1.127**	**-0.004**	**1.312**
1992-1994	Trans	-0.142	1.496	0.260	1.614
1994-1996	Trans	-0.384	1.374	0.009	0.999
1996-1998	Trans	-0.003	1.233	0.008	1.238
1998-2000	Trans	0.407	1.058	-0.122	1.343
2000-2002	Trans	0.279	0.895	0.021	1.195
1992-2002	**Trans**	**0.039**	**1.261**	**0.035**	**1.435**
1992-1994	All	-0.606	1.384	0.091	0.869
1994-1996	All	0.144	1.236	0.007	1.387
1996-1998	All	0.129	1.027	0.009	1.164
1998-2000	All	0.289	0.802	0.011	1.103
2000-2002	All	0.228	0.602	0.013	0.843
1992-2002	**All**	**0.015**	**1.250**	**0.032**	**1.297**

Table 3 presents weighted growth rate of TFP decomposition by the group of the countries during 1992-2002. TFP growth by all countries increases by 15.70% over the sample period with a weighted average of about 1.297% per annum. Overall, TC explains most of the TFP growth. It increases by 15.14% with a weighted average of 1.25%. SEC is less important; it increases by 0.39% over the sample period (average of 0.032% per annum). TEC is nearly negligible; it increases by 0.18% over the sample period (average of about 0.015% per annum). These aggregate figures dissimulate the diversity of effects across the three groups of countries, although TC changes are dominant in all three groups.

The EU15 shows TFP growth of 13.1% over the sample period, and TC and SEC increase by 13.4 and 0.41%, respectively. TEC decreases by 1.32% in the EU15, with a weighted average decline of about -0.182% per annum although the entire decline is due to the negative TEC during 1992-1994. This negative TEC is consistent with the findings of Mathijs and Swinnen (2001) on Germany for the same period. Decreasing labor productivity in family farms and lower crop prices led to negative TEC in East Germany. Other deteriorations in TEC were also observed for Ireland, the UK, Finland and Norway. This finding corresponds to similar results by Serrao, 2003. The negative TEC in these countries is correlated, perhaps, with the BSE and FMD crises in the EU, as well as with price fluctuations on the beef and pork markets.The TFP growth by the EU15 was also low in 2000-2002 showing a deceleration of all TFP components.

TFP in the EU10 increases by 14.2% over the sample period, and TEC and TC increase by 1.29 and 12.32%, respectively. SEC slightly decreases in the EU10 by 0.04% over the sample period but is negligible relative to TC and TEC. TC changes tapered over time by about two thirds, leading to some tapering of TFP changes as well, after 1994. Negative TEC changes took place at the start of the market reforms during 1992-1994. This is consistent with abundant labor in family farm and "learning" at the early stages of transition as it was for East Germany. In the Czech Republic, Hungary, Poland, Slovenia and Estonia, the growth in private ownership and investment in the sector, supported by a liberal policy framework and the prospect of EU accession, has led to significant improvements in the efficiency of agricultural production in recent years and explain both the positive TEC in recent years and the diffusion of new technology in the EU10 countries. These countries have benefited from a substantial influx of capital, mainly from foreign sources, which has contributed to a renewal of the capacity and performance of the sector. As a result, their agricultural sectors are increasingly competitive on European and world markets.

The Trans countries experienced a TFP increase of 19.80% over the sample period exhibiting strong convergence with the EU25. TEC, TC and SEC increase by 0.39, 18.75 and 0.48%. There TEC improvements took longer to occur in Trans countries relative to the EU10 countries but became large starting in 1998, after 6 years on negative TEC, consistent with a slower adaptation to transition than in the EU10. The TFP growth by the Trans countries was low during the period 1994-1996, which could be explained by very unfavorable weather conditions in the region, especially in Ukraine and Russia. TFP growth for each group of countries was mainly driven by technology progress. The results indicate deterioration in TE in the EU15, mostly in early years, but acceleration in TE in the EU10 and Trans countries. This result implies that the EU10 and Trans countries increased output by improving technical efficiency, providing evidence of "catching up" relative to the EU15. Technological progress by the Trans countries was higher than the EU15 and EU10 respectively. However, this significant increase in TFP in the Trans countries, especially in Central Asian countries

but also in Moldova and Caucasus, should be interpreted with caution. This is consistent with a diffusion of new technologies coming from established market economies and with stabilization of agricultural output at a high level and exceeding the pre-reform 1989-91 levels (Csaki and Zuschlag, 2003), and also with a drastic reduction of the variable inputs use like fertilizers, machinery, and livestock. The technical progress achieved in the Trans countries is also biased with respect to inputs. For this purpose, we break the TC measure into the input-biased and output-biased TC. The results are shown in table 4.

Table 4. Weighted Annual Growth Rates of TC Decomposition by Country Group (in %)

Period	Region	Magni-tude TC	Output-Biased TC		Input-Biased TC				
			Output 1	Output 2	Input 1	Input 2	Input 3	Input 4	Input 5
1992-1994	EU15	2.047	-0.057	0.008	-0.010	0.000	-0.044	0.095	-0.018
1994-1996	EU15	1.676	0.087	-0.021	-0.009	0.001	-0.036	0.097	0.008
1996-1998	EU15	1.542	-0.011	-0.017	-0.004	0.001	0.043	0.100	-0.006
1998-2000	EU15	1.202	0.048	0.004	-0.015	0.001	0.141	0.102	-0.003
2000-2002	EU15	1.217	-0.034	-0.006	-0.006	0.000	0.096	0.113	-0.024
1992-2002	**EU15**	**1.537**	**0.009**	**-0.009**	**-0.012**	**0.001**	**0.054**	**0.140**	**-0.011**
1992-1994	EU10	1.720	0.002	0.144	-0.006	-0.004	-0.161	0.064	-0.141
1994-1996	EU10	1.573	0.113	-0.026	-0.013	-0.002	-0.143	0.071	-0.059
1996-1998	EU10	1.200	0.001	-0.019	-0.006	0.000	0.048	0.073	-0.029
1998-2000	EU10	1.187	-0.091	0.038	-0.019	-0.003	-0.052	0.076	-0.086
2000-2002	EU10	0.863	-0.037	-0.025	-0.030	-0.001	-0.041	0.082	-0.021
1992-2002	**EU10**	**1.309**	**-0.003**	**0.030**	**-0.020**	**-0.003**	**-0.095**	**0.100**	**-0.092**
1992-1994	Trans	1.643	-0.130	0.073	-0.011	0.003	1.155	0.061	-0.079
1994-1996	Trans	2.597	-0.002	0.112	0.011	0.006	0.052	0.062	-0.133
1996-1998	Trans	2.441	-0.071	0.049	-0.026	0.005	0.165	0.063	-0.133
1998-2000	Trans	2.192	0.085	0.024	-0.013	0.005	0.000	0.063	-0.048
2000-2002	Trans	2.149	0.100	-0.007	0.017	0.000	-0.124	0.060	-0.039
1992-2002	**Trans**	**2.204**	**-0.005**	**0.069**	**-0.006**	**0.005**	**0.341**	**0.085**	**-0.117**
1992-1994	All	1.803	-0.079	0.047	-0.010	0.001	0.418	0.078	-0.054
1994-1996	All	1.949	0.057	0.028	-0.002	0.002	-0.015	0.082	-0.051
1996-1998	All	1.728	-0.029	0.007	-0.011	0.002	0.086	0.084	-0.054
1998-2000	All	1.527	0.048	0.014	-0.015	0.002	0.074	0.086	-0.026
2000-2002	All	1.410	0.015	-0.008	0.000	0.000	0.003	0.091	-0.029
1992-2002	**All**	**1.683**	**0.003**	**0.024**	**-0.010**	**0.002**	**0.155**	**0.116**	**-0.058**

[a] $Output_1$ = crops; $Output_2$ = livestock output and $Input_1$ = land; $Input_2$ = tractors; $Input_3$ = fertilizer; $Input_4$ = labor; $Input_5$ = livestock input

For all countries, the sum of input-biased TC is larger than that of output-biased TC, which implies technology improvements have increased the efficient use of inputs (input saving) more than they has increased the capability to produce output (output or yield enhancing). Trans countries show input- and output-biased TC more than the EU10 and EU15, respectively. Overall, output-biased TC by all countries increases by 0.30% over the sample period. The sum of input-biased TC by all countries increases by 2.24%. TC is biased toward tractors, fertilizer and labor but against land and livestock input. The EU15 shows the sum of output-biased TC is equal one, while the sum of input-biased TC increases by 1.89%

over the sample period. TC is biased toward crops at the same rate as it is biased against livestock output. This finding supports the previous statement about the correlation between productivity change and price fluctuations in the beef and pork markets. On the input side, TC is biased toward tractors, fertilizer and labor but against land and livestock input. The EU10 shows the sum of output-biased TC increases by 0.30% over the sample period, but TC is biased toward livestock output but against crops. The sum of input-biased TC decreases by 1.21% over the sample period and is significantly lower than in the EU15. TC is biased toward land, tractors, fertilizer and livestock input while it is biased against labour. These results imply that the direction of TC uses more land, tractors, fertilizer, and livestock inputs but less labor. These results are not surprising because agricultural productivity in the CEECs began to grow in the mid 1990s as a consequence of improved economic conditions and access to capital, technology, and know-how through the EU enlargement process. In the new member countries there has been a significant increase in agricultural labour productivity after the initial transition in the early 1990s (as measured by value added per worker), which has allowed the labour force to shrink by about 30% on average. Notably, labour productivity in agricultural sector in Slovenia, Hungary, Czech Republic and Poland has increased by an average of 50% between 1992 and 1999 (Csaki and Zuschlag, 2004).

In the Trans countries, the sum of output-biased TC increases by 0.70% over the sample period, and the sum of input-biased TC increases by 3.36%. This increase in input-biased TC is much higher than in the EU15 and EU10 countries. TC is biased toward tractors, fertilizer, and labor exhibiting the largest bias especially in early years, but against land and livestock input. This outcome suggests that technology changes in the Trans countries increase use of tractors, fertilizer, and labor but decrease use of land and livestock inputs. These results support the above mentioned hypothesis regarding the possible biases in the measurement of TC in the Trans countries, especially in Central Asia and Moldova. In those countries, which have drastically reduced use of such inputs as fertilizers and agricultural machinery and have not increased the output, the significant productivity growth should be interpreted with caution.

CONCLUSION

This study utilizes a parametric distance function approach presented in Fuentes, Grifell-Tatjé, and Perelman (2001) and Orea (2002) to decompose the change in agricultural productivity growth in 46 European countries over the period from 1992-2002. The empirical findings indicate that the weighted average TFP growth in the European agriculture over the study period grew at 1.297% per annum, which was driven primarily by a 1.250% increase in TC and significant changes in TEC, first negative in early years, then positive starting in 1994. SEC is a small to negligible component of TFP. The EU15 operated at higher TE levels than the EU10 and Trans countries over the study periods; however, the EU10 and Trans countries, demonstrated greater growth in TE and TFP than the EU15. The process of EU membership has accelerated reforms for the EU10 countries, most notably in Lithuania, Slovakia and Latvia, and to a lesser extent also in Bulgaria and Romania. Bulgaria, Romania, Croatia and Turkey are preparing for accession. Furthermore, as a result of the "Orange Revolution" in Ukraine in 2004, and the "Rose Revolution" in Georgia in 2003, both

countries have begun reform programs, thus possibly creating an "open door" to EU for both Ukraine and the South Caucasus. As researchers and policy makers discuss the “pros and cons” of possible future enlargements of EU, the analysis in this study suggests that there may be benefits in improved TE and TC growth for the candidate countries.

Given anticipated increases in world population and with most of this growth occurring in the poorest regions, there is growing concern regarding the availability of resources for agricultural production and sources of productivity improvements in different regions of the world. With 20% of the potential agricultural resources but only 8% of the world’s population, it is clear from a global perspective that the East European and Central Asian region has the potential to supply a substantial share of the expected growth in food demand forecast for the first half of this century. (Csaki and Zuschlag, 2004). However, realizing that potential will require serious improvements in performance and efficiency, as well as continued technology transfer and adoption.

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APPENDIX

The components of the MPI change decomposition in terms of parameter estimates in equation (6) are presented in the following. The TEC can be calculated by

$$\ln \Delta TE_v^o = \ln\left(\frac{TE_{it+1}}{TE_{it}}\right) = \ln\left(\frac{E\left(\exp\left(-u_{it+1}\right)\middle|\left(v_{it+1}-u_{it+1}\right)\right)}{E\left(\exp\left(-u_{it}\right)\middle|\left(v_{it}-u_{it}\right)\right)}\right) \tag{A-1}$$

where TE_{it} represents the TE prediction of the i^{th} firm in the t^{th} time period. The other components of the MPI change yield

$$\ln \Delta TC_v^o = -\frac{1}{2}\left[\begin{array}{l} 2\left(\beta_t + \beta_{tt}\left(t+1/2\right)\right) + \sum_{k=1}^{K}\beta_{x_k t}\left(\ln x_{kit+1} + \ln x_{kit}\right) \\ + \sum_{m=1}^{M-1}\beta_{y_m t}\left(\ln y^*_{mit+1} + \ln y^*_{mit}\right) \end{array}\right], \tag{A-2}$$

$$\ln \Delta SEC_v^o = \frac{1}{2}\sum_{k=1}^{K}\left[\left(-\sum_{k=1}^{K}e_{kit+1}-1\right)\cdot s_{kit+1} + \left(-\sum_{k=1}^{K}e_{kit}-1\right)\cdot s_{kit}\right]\cdot \ln\left(\frac{x_{kit+1}}{x_{kit}}\right), \tag{A-3}$$

where $e_{kit} = \partial \ln D_t^o \big/ \partial \ln x_{kit} = \beta_{x_k} + \sum_{k=1}^{K}\beta_{x_{kk}} \ln x_{kit} + \sum_{m=1}^{M-1}\beta_{x_k y_m} \ln y^*_{kit} + \beta_{x_k t} t_{it}$, and $s_{kit} = e_{kit} \Big/ \sum_{k=1}^{K} e_{kit}$.

In order to examine the effects on the input- and output-biased TC from the MPI change in equation (2), Fuentes, Grifell-Tatjé, and Perelman (2001) developed a parametric distance function approach for the period t MPI decomposition. Therefore, a parametric distance function approach of the MPI change decomposition between periods t and $t+1$ can be derived in the same manner. The MPI change in equation (2) requires the assumption of CRS on production technology. The CRS assumption implies homogeneity of degree minus one in inputs, so we restrict $\sum_{k=1}^{K}\beta_{x_k} = -1$, $\sum_{l=1}^{K}\beta_{x_k x_l} = 0$ $\left(k = 1,...,K\right)$, $\sum_{k=1}^{K}\beta_{x_k y_m} = 0$ $\left(m = 1,...,M-1\right)$ and $\sum_{k=1}^{K}\beta_{x_k t} = 0$. These restrictions can be imposed in equation (6) by normalizing input data by one of the *K* inputs.

The translog output distance function under the CRS model is

$$
\begin{aligned}
-\ln y_{Mit} + \ln x_{Kit} = {} & \beta_0 + \beta_{y_m} \sum_{m=1}^{M-1} \ln y_{mit}^{*} + \frac{1}{2} \sum_{m=1}^{M-1} \sum_{n=1}^{M-1} \beta_{y_m y_m} \ln y_{mit}^{*} \ln y_{mit}^{*} + \\
& \sum_{k=1}^{K-1} \beta_{x_k} \ln x_{kit}^{*} + \frac{1}{2} \sum_{k=1}^{K-1} \sum_{l=1}^{K-1} \beta_{x_k x_l} \ln x_{kit}^{*} \ln x_{lit}^{*} + \sum_{k=1}^{K-1} \sum_{m=1}^{M-1} \beta_{x_k y_m} \ln x_{kit}^{*} \ln y_{mit}^{*} \\
& + \beta_t t + \frac{1}{2} \beta_{tt} t^2 + \sum_{k=1}^{K-1} \beta_{x_k t} \ln x_{kit}^{*} t + \sum_{m=1}^{M-1} \beta_{y_m t} \ln y_{mit}^{*} t - \ln D_{it}^{o},
\end{aligned}
\tag{A-4}
$$

where $x_{kit}^{*} = \left(x_{kit} / x_{Kit}\right)$ and $-\ln D_{it}^{o} = v_{it} - u_{it}$.

The components of the TC decomposition in equations (3) and (4) can be computed after equation (A-4) is estimated. The magnitude of TC for the period t, the output- and input-biased TC between periods t and $t+1$ in terms of the parameter estimates of the output distance function are given in equations (A-5) – (A-7).

$$
\ln \Delta M_c^{o} = -\beta_t - \beta_{tt}\left(t + 1/2\right) - \sum_{k=1}^{K-1} \beta_{x_k t} \ln x_{kit}^{*} - \sum_{m=1}^{M-1} \beta_{y_m t} \ln y_{mit}^{*}, \tag{A-5}
$$

$$
\ln OB\Delta T_c^{o} = -\frac{1}{2} \sum_{m=1}^{M-1} \beta_{y_m t} \ln\left(y_{mt+1}^{*} / y_{mt}^{*}\right), \tag{A-6}
$$

$$
\ln IB\Delta T_c^{o} = -\frac{1}{2} \sum_{k=1}^{K-1} \beta_{x_k t} \ln\left(x_{kt+1}^{*} / x_{kt}^{*}\right), \tag{A-7}
$$

where subscript c refers to a measure that is calculated from the distance function corresponding to CRS technology.

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EUROPEAN INTEGRATION, REFORMS, AND GOVERNANCE OF FOOD SUPPLY CHAINS IN EASTERN EUROPE

Johan F.M. Swinnen*

Katholieke Universiteit Leuven, Director, LICOS Center for Institutions and Economic Performance, and Senior Research Fellow at Center for European Policy Studies (CEPS), Brussels.

ABSTRACT

This paper investigates the role of the reform and international integration of the CEE food industry as an engine of supply chain restructuring and growth of competitiveness of the CEE agri-food sector. Private investments in the food industry by domestic companies and multinationals have been pivotal drivers of change and growth in the agri-food chains, including farm-level restructuring and productivity and quality improvements. The paper explains how and why this occurred and what the implications are. Government regulations and private sector demands for high quality standards have been imposed on the CEE agrifood sector. Investment-induced vertical coordination (VC) has contributed to dramatic changes in management, technology, and capital investments resulting in massive gains in productivity. Reliance on contracting between producers and processors is widespread. Successful VC is commodity-specific, transition-stage specific, heterogeneous in its extent, and often non-traditional. VC has excluded fewer small farms than expected.

Keywords: economic integration, Europe, transitions countries, food supply chains, governance, reform, restructuring, competitiveness, private investment.
JEL Code: P21, D21, Q13

In 1989 the Berlin Wall fell, marking the beginning of a vast set of changes and reforms throughout the countries of the former Soviet Bloc. These changes culminated almost fifteen years later in eight Eastern European countries joining the European Union (EU), with more likely to follow in the coming years. While agriculture is a politically sensitive issue in international negotiations, few citizens of the new member states had expected that the final

* Corresponding author: J. Swinnen, Professor, Department of Economics, Katholieke Universiteit Leuven, and Director of LICOS Center for Institutions and Economic Performance, Debériotstraat 34, B-3000 Leuven – BELGIUM; Tel : 32-16-326598, Fax : 32-16-326599. Email: Jo.Swinnen@econ.kuleuven.ac.be.

days before this historic event would be spent mostly on intense negotiations on farm subsidies, milk quotas and land sales. Agriculture was sensitive for several reasons. First, while trade restrictions between the Central and Eastern European countries (CEECs) and the EU had been mostly removed in other sectors, they remained important in agricultural and food products. Second, the EU's Common Agricultural Policy (CAP) and veterinary and phytosanitary policies raised politically sensitive accession issues (e.g. budget, World Trade Organization (WTO) negotiations). Third, agriculture makes up a large share of employment in several CEECs. Poland and Romania—which is expected to join later in the decade—combined have almost as many farmers (more than 7 million) as the EU-15 and more than three times as many as the other CEE countries combined (table 1). However, the share of CEE agricultural production compared to the EU-15 was much smaller, reflecting the lower productivity in the Eastern countries and changes to come with integration in the EU.

Table 1. Some Basic Indicators on the Agri-food Sector in Europe, 2000

	Agricultural output		Employment in agriculture		Land
	Billion €	% GDP	Million	% total	Million ha
EU-15	167	2	6.8	4.3	131.6
CEE-8	11.9	3.6	3.3	18.9	38.4
%EU	7	-	49	-	29
CEE-10	18.6	4.5	9	22	58.8
%EU	11%	-	132%	-	45%
Poland	5.0	2.9	2.6	19	18.2
Romania	4.6	11.4	4.9	43	14.8

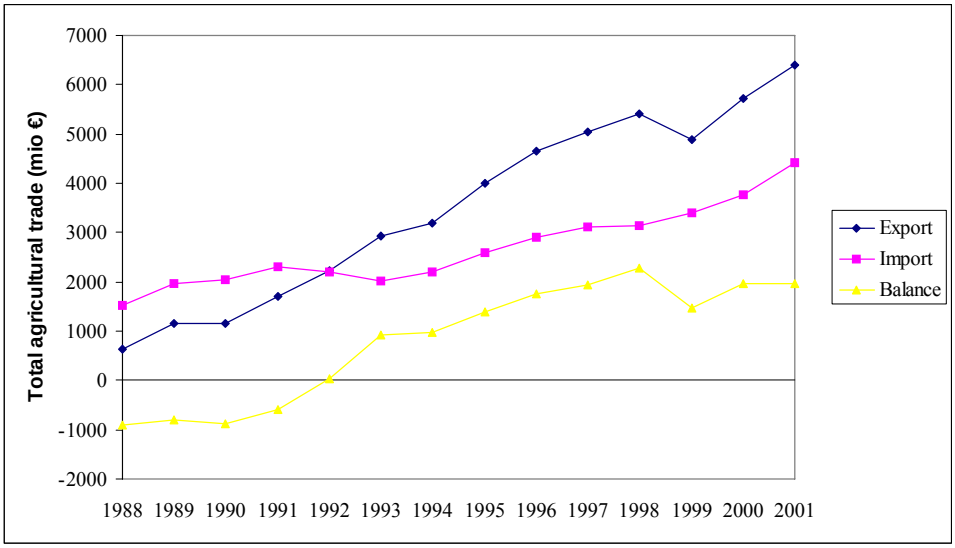
Source: European Commission, USDA, OECD.

In this paper I focus on the role of the reform and international integration of the CEE food industry as an engine of supply chain restructuring and growth of competitiveness of the CEE agri-food sector. The policy debate on enlargement and the CAP has paid little attention to agribusiness and the food industry. While policies such as the CAP and the Special Accession Program for Agriculture and Rural Development (SAPARD) occupied the attention of policy-makers and officials, private investments in the food industry by domestic companies and multinationals have been vastly more important drivers of change and growth in the agri-food chains, including farm-level restructuring and productivity and quality improvements. In the rest of this paper, I explain how and why this occurred and what the implications are.

SOME FACTS ON REFORMS AND EUROPEAN INTEGRATION IN THE AGRI-FOOD SECTOR

European integration started many years before the accession of eight CEECs to the EU in 2004. Trade and capital markets integrated, and the gap in prices and quality between Eastern and Western Europe has declined since the mid 1990s. Trade flows in agricultural and food products between the EU-15 and the CEECs have increased strongly since 1990, and in both directions (see figure 1). Early predictions that the EU markets would be flooded

by cheap eastern imports turned out wrong. While agri-food imports from CEECs doubled over the 1990s, exports from the EU to CEECs increased more than ten-fold.



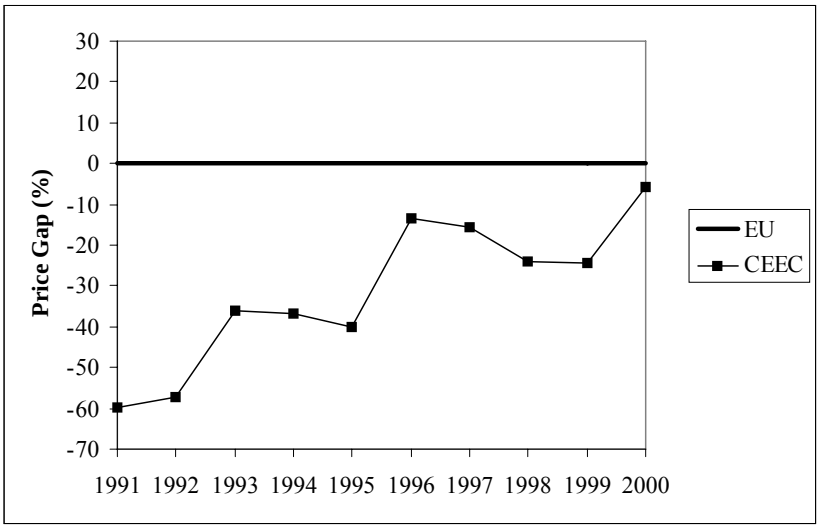
Source: European Commission.

Figure 1. Trade between CEECs and EU-15 in agricultural and food products (billion euros).

Besides EU export subsidies, the development of the EU-CEEC agri-food trade has been driven by quality differences, the competitiveness of the EU food marketing, processing, and retailing industries, and the more developed EU institutional framework. Quality, hygiene and health requirements, are extremely important for agricultural and food products. Recent food crises (for example dioxine and BSE) have reinforced the importance of these characteristics, and from this perspective, the growing trade deficit between the CEECs and the EU-15 is less surprising.

The imposition of higher standards on CEEC products comes both from government regulations and private sector demands. Government regulations are related to the adaptation of the EU regulatory framework as a prerequisite for accession. An important part of the agricultural acquis communautaire (the set of rules and regulations of the EU that the CEECs have to implement) focuses on health and hygiene requirements for food and agricultural products. Quality demands by private processing and distribution companies are sometimes higher than government regulations, especially quality requirements by companies exporting to the EU final consumption market and those with foreign investment.

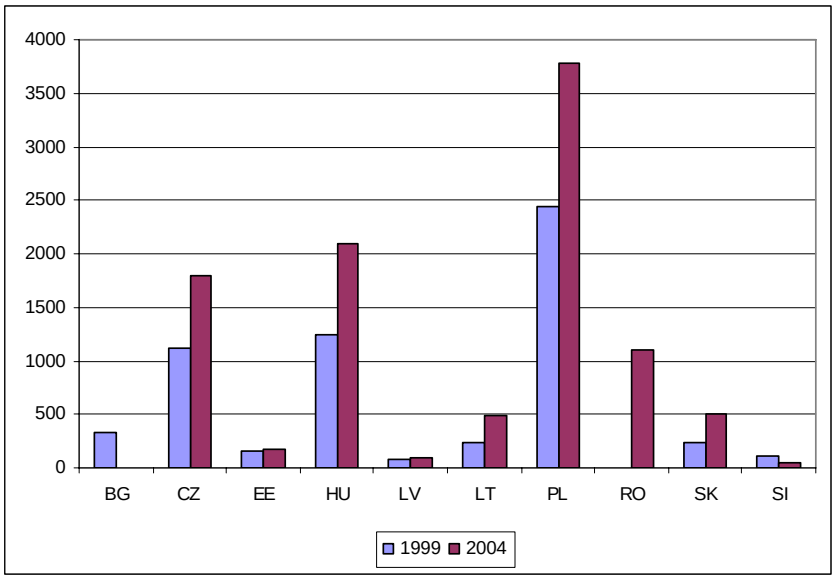
Quality changes also affected the substantial gaps in agricultural prices that existed between East and West in the early 1990s. These price differences were a major factor behind the predictions that Eastern agricultural and food products would swamp Western markets after accession. However, the gap in prices between Eastern European countries and the EU-15 declined significantly throughout the 1990s (see figure 2). This is due to a combination of factors, including exchange rate realignments (with CEEC currencies appreciating), CAP reforms (MacSharry and Agenda 2000 reforms leading to lower EU prices), subsidies and, importantly, commodity quality improvements in CEECs.



Source: European Commission.

Figure 2. Price gap between EU and CEECs, wheat.

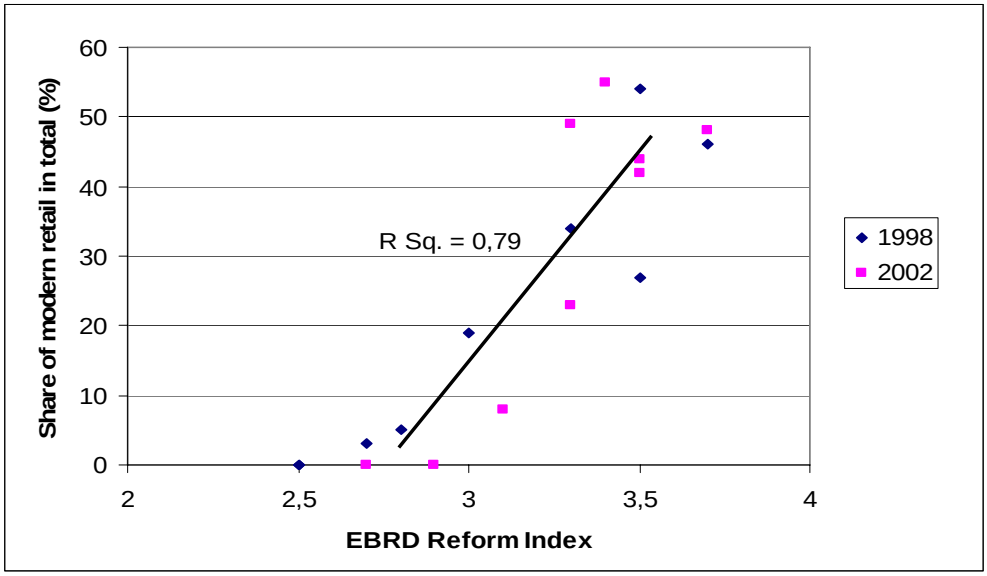
Quality improvements in CEE reflected general productivity improvements. Transition initially caused a fall in productivity following institutional disruptions, subsidy cuts and price liberalization (Macours and Swinnen, 2000). However, since the mid 1990s, productivity recovered as institutional and economic reforms started to have effects. Productivity increases were especially strong in countries, such as Hungary, with much foreign investment in the food industry.



Source: WIIW.

Figure 3. FDI in the food industry by country (millions of euros).

Foreign direct investments (FDI) by western companies have played an instrumental role in this process. On average, FDI stock in the food industries grew by 26% annually from 1996 to 2004 in the 10 CEECs shown in figure 3. For example, by the end of the 1990s, most of the sugar-processing sector in Eastern Europe was in Western hands. Investments in other sectors are equally impressive. Figure 4 illustrates the strong positive correlation between reform progress in transition countries and investments by multinational retailers.



Data include Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Russia, Slovakia, Ukraine. Source: Dries *et al.* (2004).

Figure 4. Impact of reforms on modern retail investments.

Foreign investment plays an important role as an initiator of change and institutional innovation (Dries and Swinnen, 2004). Dramatic changes in management, technology, and capital investments followed. These changes occurred not only at the company level, but also with farms through various forms of vertical coordination (VC). In this context, VC refers to the entire range of institutional arrangements lying between the two extremes of spot market exchanges and full ownership integration.[1] By the end of the 1990s, 80% of the corporate farms in the Czech Republic, Slovakia and Hungary, which dominated farm production in these countries, sold crops on contract and 60-85% sold animal products on contract.[2]

For example, in the dairy and the sugar sectors, we observe extensive production contracts between dairy processors and farms, including the provision of credit, investment loans, animal feed or fertilizer and seed, extension services, and bank loan guarantees (World Bank, 2005). In fresh fruits and vegetables, the rapid growth of modern retail chains with high

[1] Marketing contracts are verbal or written agreements between a contractor and a grower that specifies some form of price determination and outlet ex ante. Production contracts are more extensive forms of coordination and include a detailed specification of production practices, inputs supplied by the contractor, quality and quantity of the commodity delivered, and a price (or pricing mechanism). See Williamson (1985) for the key factors determining the use of various contract forms or other vertical coordination arrangements.

[2] There are important commodity-specific differences in vertical coordination arrangements (see Swinnen, 2006 for details).

demands on quality and timeliness of delivery is changing the supply chains. New supplier contracting, which is developing rapidly as part of these retail investments, includes farm assistance programs, which are more extensive than typically observed in Western markets. As in Western countries, there is extensive contracting going on for malting barley across the region, but VC is often much more extensive than in the West, with brewing and malting companies vertically coordinating across several stages of the chain. The same process spread further east later on when economic and institutional conditions for investment improved. A survey of agri-food processors in five Commonwealth of Independent States (CIS) countries (Armenia, Georgia, Moldova, Ukraine and Russia) found that number of food companies that used contracts with suppliers grew from slightly more than one-third in 1997 to almost three-quarters by 2003 (White and Gorton, 2006).

FROM STATE TO PRIVATE GOVERNANCE OF SUPPLY CHAINS

Before transition, the state controlled the supply chains for agricultural and food commodities. This state governance system included strong VC in the supply chains. The exchange of inputs and outputs along the chain was coordinated by the central planning authorrity from production, processing, to marketing and retailing.

Exchange Problems During Transition

In early transition there was a breakdown of the relationships of farms with input suppliers and output markets. The simultaneous privatization and restructuring of the farms and of the up- and downstream companies in the agri-food chain caused major disruptions. During the transition, long payment delays or non-payments for delivered products were widespread and caused major cash-flow problems for suppliers (Gow and Swinnen, 1998). Many farms could not access essential inputs (feed, fertilizer, seeds, and capital) or sell their products.

This was a major problem for all companies in the food chain. Food processing companies in Eastern Europe in the late 1990s considered late payments one of their most important obstacles to growth (Gorton, Buckwell, and Davidova, 2000). These problems have diminished notably in most countries, often as a result of supply chain restructuring, but not everywhere.

Guaranteed supplies of quality raw materials are crucial for processors. In TCs, processors often have severe problems in obtaining sufficient quality supplies. Suppliers may not deliver the quality or quantity of raw materials agreed on for several reasons. First, farms may not be willing to supply their output to the processor because they fear not being paid once they deliver the product. Second, if farms want to supply, they may not be able to because they cannot access basic production factors. Third, if farms want to supply, they may only supply poor quality supplies because (a) they lack the necessary inputs to improve the quality and (b) they lack expertise and know-how for producing high quality. Exchange problems are exacerbated by the lack of public institutions necessary to support market-based transactions, such as for enforcing property rights and contracts.

Private Vertical Coordination as Response to Market Constraints

To overcome problems of enforcement and constraints on quality supplies, VC systems have been set up by processors, traders, retailers, and input suppliers, often as part of their own restructuring. While foreign companies have played a leading role in this development, there have been important spill-over effects on domestic companies who have started copying foreign management innovations. Empirically successful VC is commodity-specific, transition-stage specific, heterogeneous in complexity, and often 'non-traditional' because successful models address specific transition-related problems not prevalent in a normal market economy environment. Some of the contract variations are determined by the same factors which determine variations in contracting in developed market economies, such as transaction cost differences and commodity characteristics, others are transition-specific.

In light of the exchange problems noted above, successful VC has typically included conditions for payments and product delivery as well as farm assistance programs for suppliers. A critically important component of the contractual arrangements is prompt payments. White and Gorton (2006) find that 90% of farms get prompt payments in the first year of contracting in their study across five CIS countries.

Farm assistance has taken many forms depending on the level of market development and stage of transition. In early stages, most of the emphasis in VC goes to 'getting the thing going' and on securing supplies. Therefore, most effort goes to helping farmers overcome basic supply problems, such as input (feed, seeds, etc.) and credit (working capital) constraints. This is still the case in some of the emerging food supply chains in South East Europe. In more advanced situations, as in many sectors in Central Europe, the emphasis is on product quality. Addressing quality issues requires more sophisticated forms of VC, such as extension services and farm-level investments in technology and equipment, leasing, bank loan guarantees, and investment assistance.

VC requires sufficient funds to finance the supplier contracting system. Therefore, initiators of contracting with supplier financing include: (a) foreign investors with their own resources or access to international financial markets (e.g. foreign/multinational processing companies); (b) companies investing in the food sector with financial resources from other sectors; (c) domestic processors or traders who sell on the international market and have sufficient turnaround to have financial liquidity; or (d) domestic processors who access international finance through contracts with international companies.

In some instances, VC has involved more than the establishment of contractual relationships between farmers and processors; indeed, the organization of the supply chain may be entirely restructured. For example, in the case of modern retail investments, important changes in procurement systems occur step-by-step in the supplier-retailer relationship (Dries, Reardon, and Swinnen, 2004). These changes include: (1) a shift from local store-by-store procurement to large, nationally centralized distribution centers; (2) an incipient shift to regionalization of procurement over countries; (3) a shift from the use of traditional brokers to new specialized/dedicated wholesalers; (4) increasing local use of multinational logistics firms; (5) a shift to preferred supplier systems; (6) and a shift to high private standards of quality and safety. These changes dramatically change the contracting relationships between retailers and suppliers.

Motivations and Constraints of Farmers

The different contract forms reflect the constraints faced by farms in input and output markets. For example, table 2 shows how the dominant motivation for farms in Central Europe (Hungary, Slovakia and Czech Republic) at the end of the 1990s was guaranteed access to markets (52% of the farms listed this as their primary motive) and to a lesser extent guaranteed prices (21%). Access to credit or other inputs was the main motive for very few farms. The farms in table 2 are mostly large farms, as they are the dominant contractors.

Table 2. Contract Motivations for Farms in Central Europe

Most Important Reason for Contracting	Czech 1999	Slovak 1999	Hungary 1997	Average
Contract price higher	9	8	10	9
Avoid price uncertainty	7	22	33	21
Guarantee product sales	64	50	43	52
(Part) pre-payment	7	13	3	8
Easier to get credit	0	0	9	3
Contract - inputs & TA	7	6	2	5
Other	6	2	0	3

Source : Leuven ACE datasets.

The motivations for farmers in less developed regions are typically very different. This is reflected in the results of a survey of small cotton farmers in southern Kazakhstan, a transition region which is less developed than Central Europe. The reasons these farmers enter into contracts with gins are very different. For them credit constraints are by far the most important constraint still in 2003, as is clearly reflected in the survey results in table 3.

Table 3. Contract Motivations for Cotton Farms in Kazakhstan, 2003

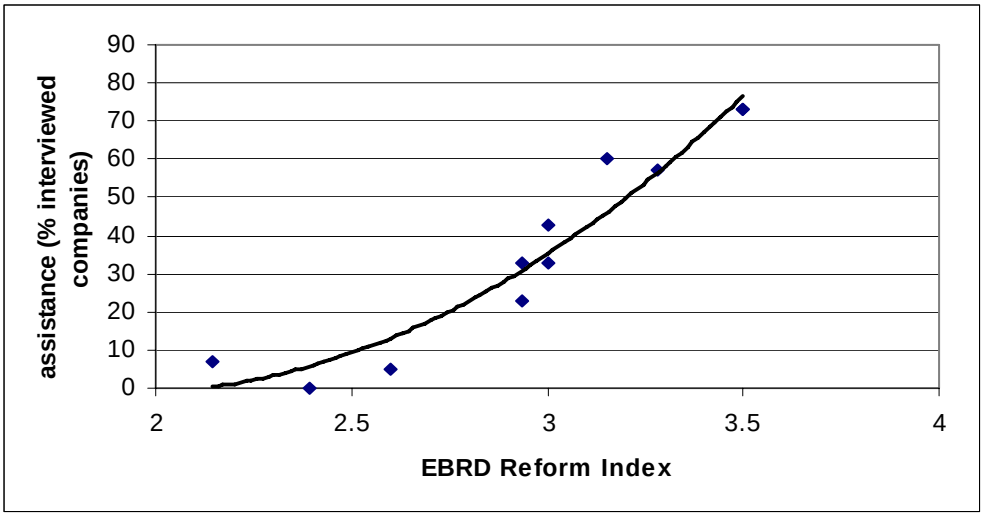
Reason for contracting (%)	Yes	No	Most important reason
Guaranteed product sales	9	91	8
Guaranteed price	4	96	3
Access to pre-financing	81	19	75
Access to quality inputs	11	89	10
Access to technical assistance	0	100	0
Other	4	96	3

Source: Sadler (2006).

Vertical Coordination and the Policy Environment

Some of the more sophisticated VC programs require complex implementation and enforcement systems and contract (pre-)financing. Institutional and economic reforms are essential for the implementation and enforcement of complex VC, such as investment loans, trade credit, and bank loan guarantees. Therefore, both investment in the food industry and

the emergence of sophisticated VC programs are conditional upon the level of reforms in a country. Figure 5 illustrates a strong positive relationship between the amount and complexity of VC in the East European dairy sector and the level of reforms.



Data include observations from Albania, Bulgaria, Poland, and Slovakia.
Source: Swinnen *et al.* (2006).

Figure 5. Economic reforms and farm assistance programs in the dairy sector.

Contract Enforcement and Interlinking Markets

Enforcement is crucial to make any of the contracts or supplier assistance programs sustainable, but in transition environments court enforcement of contracts was generally not efficient; even approaches based on collateral are often flawed in TCs. Either farms cannot provide the necessary collateral, or collecting on the collateral is problematic.

In such environments the best one can do is create *'self-enforcing contracts'* by designing the terms of the contracts such that nobody has an incentive to breach the contract (Gow and Swinnen, 2001). This can be done by increasing the costs of breaching the contract or by introducing flexible terms that reduce the chance of breach when conditions change unexpectedly. Institutional innovations to ensure supplies for processors or payments for input suppliers help to enforce contracts. Effectively, what companies do is '*interlinking markets*'. The enforcement of the credit transaction (loan and repayment) occurs through the output market. Yet, whether interlinking markets is an adequate enforcement mechanism depends on a variety of factors, and, as the evidence shows, it is not always sufficient.

There are numerous stories of failed enforcement leading to cancellation of the VC program in some cases across many countries and industries. Even in the successful cases, it has taken considerable fine-tuning of the contracts over time to make the contracts self-enforcing. In addition, circumstances change so rapidly during transition that contracts required continuous adjustments as the self-enforcing range itself changes. Creating the right conditions for successful and self-enforcing contracting, requires extensive knowledge of the

sector and of local conditions and an ability to flexibly adjust the contract terms to circumstances which can change rapidly in transition.

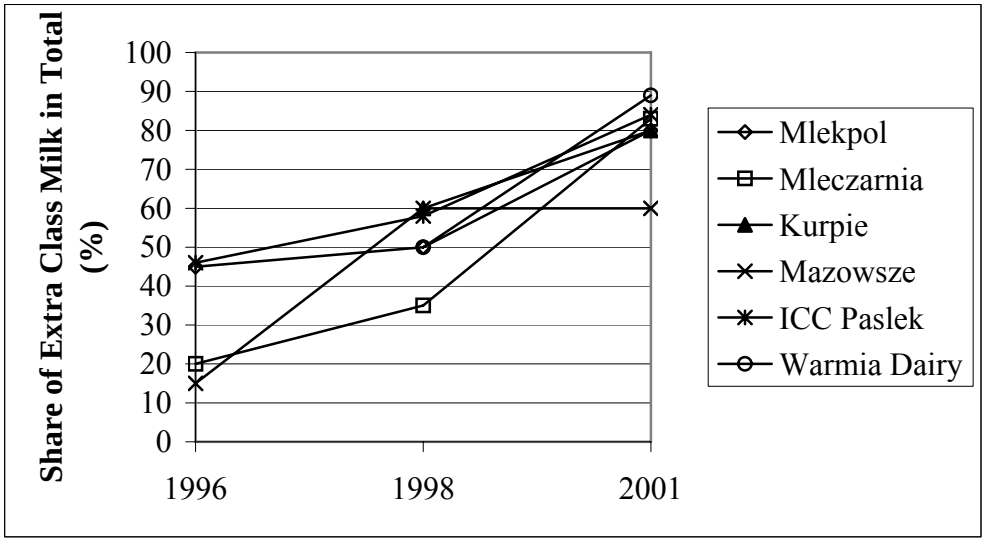
Ultimately, the best way of solving the exchange, contracting, and collateral problems in transition countries is to base exchanges and contract enforcement on trust. Unfortunately due to traumatic experiences during both the communist and the transition periods, trust was generally lacking as a base for business exchanges in transition. However, empirical evidence does suggest that once companies are able to successfully instigate new contractual exchange forms, trust as a basis for business exchanges can develop relatively rapidly.

EFFICIENCY EFFECTS

The impact of these contract innovations is difficult to quantify because several other factors affect output simultaneously and because company level information is difficult to obtain. Still, the evidence suggests that successful private contract enforcement with vertical contracting has important positive effects, both direct and indirect. The direct impact is on the output and productivity of the processing company that initiates vertical contracting and on its suppliers. Supplying enterprises have experienced beneficial effects on output, productivity and product quality through better access to inputs, timely payments, and improved productivity with new investments. Case studies indicate that the programs can lead to double digit annual growth in output and productivity. For example, a case study of the Slovakian sugar sector shows how new contracts and farm-assistance programs caused output, yields, and contracts to grow dramatically (Gow, Streeter, and Swinnen, 2000). Other studies confirm that relatively small changes in the industry's practices can already have a major impact at the farm level (Van Berkum, 2006).

In their survey of TC agri-business enterprise executives, White and Gorton (2006) concluded that various contract support measures individually had caused an average increase in yields of around 10%. The measures with the greatest impact on yields were specialized storage, veterinary support and physical inputs. Specialized storage in the form of on-farm cooling tanks has been particularly important in raising yields and quality in the dairy sector, an effect also found in other countries (Dries and Noev, 2006). Market measures such as prompt payments, guaranteed prices, and market access also had large positive effects.

Quality of output also improved due to these measures. In the case of Polish dairy farms, milk quality rose rapidly following contract innovations by dairy processors in the mid 1990s. The share of the market held by highest quality milk increased from less than 30% on average in 1996 to around 80% on average in 2001 (see figure 6). Direct loans and loan guarantee programs contributed strongly to farm investments. In the Polish study, more than three quarters (76%) of all farmers in the survey made investments in the past years, including many small farmers of less than 10 cows (Dries and Swinnen, 2004). Dairy loans are used for investments in enlarging and upgrading the livestock herd (30%) and cooling tanks (56%). Moreover, dairy assistance in the form of guarantees for bank loans helped farm investments. Also, programs which assist farms in accessing inputs (mainly feed) enhance investment indirectly by lowering input costs or by reducing transaction costs and improving profitability.



Source: Dries and Swinnen (2001).

Figure 6. Milk quality in Poland: change in the share of extra class milk deliveries.

Indirect effects, in particular cross-company spillovers, occur as firms competing for the same suppliers, and their fixed inputs, are forced to offer similar contractual arrangements. For example, in the case of the Slovak sugar sector, competition induced other sugar processors to introduce similar contracts. With some delay, this resulted in increases in productivity in the rest of the sugar sector. Other studies confirm the importance of this competitive effect. Swinnen et al (2006) and Dries, Reardon, and Swinnen (2004) find that in the dairy sector and in contracting by modern retail companies, competition for suppliers forces other companies to replicate farm assistance programs in order to secure supplies.

IMPACTS ON EQUITY

One potential equity problem is the exclusion of poor farms from the vertically coordinated modern supply chains. There are three important reasons for exclusion. First, transaction costs favor larger farms in supply chains. Second, when some amount of investment is needed in order to contract with or supply to the company, small farms often have more difficulty obtaining the financial resources necessary for the investments. Third, small farms typically require more assistance from the company per unit of output.

Case studies and interviews with companies generally confirm that transaction costs and investment constraints are serious considerations, and companies express a preference for working with a small number of large and more modern suppliers. However, empirical observations show a very mixed picture of actual contracting, with much more small farms being contracted than predicted based on the arguments above. In fact, surveys in Poland, Romania and CIS find no evidence that small farmers have been excluded over the past six years in developing supply chains.

More sophisticated supplier assistance programs tend to be more available for larger farms. Often, supplier programs differ to address the characteristics of the farms. For example, in case studies of dairy processors, investment support for larger farms include leasing arrangements for on-farm equipment, while assistance programs for smaller dairy farms include investments in collection units with micro-refrigeration units. Hence, despite the apparent disadvantages noted earlier, the empirical evidence suggests that VC with small farmers is widespread. Furthermore, our empirical evidence indicates that companies work with surprisingly large numbers of suppliers and of surprisingly small size.

There are several reasons for widespread inclusion of small farms in VC arrangements. First, the most straightforward reason is that companies have no choice. In some cases, small farmers represent the vast majority of the potential supply base. This is, for example, the case in the dairy sector in Poland and Romania, and in many other sectors in the TCs. Second, while processors may prefer to deal with large farms because of lower transaction costs in collection and administration, contract enforcement may be more problematic, and hence costly, with larger farms. Processors repeatedly emphasized that a farm's willingness to learn, take on board advise, and a professional attitude were more important than size in establishing fruitful farm-processor relationships. Third, in some sectors small farms may have cost advantages. This is particularly the case in labor intensive, high maintenance production activities with relatively small economies of scale. Fourth, processors may prefer a mix of suppliers to avoid becoming too dependent on a few large suppliers. Finally, processing companies differ in their willingness to work with small farms. Some processing companies continue to work with small local suppliers even when others do not. These companies have been able to design and enforce contracts that are mutually beneficial for the small firms and the contracting companies. This suggests that small-scale farmers may have a future when effectively organized.

Further, the collapse of farm output and livestock numbers created excess demand for high-quality supplies because quality has been historically low and reduced access to inputs and finance negatively affected quality. This makes it a "suppliers market" and this, in turn, supports the farms' bargaining position vis-à-vis the processing sector in the distribution of supply chain rents. Moreover, in cases where quality supplies are scarce and non-trivial investment is required for quality upgrading, the bargaining power of quality suppliers may increase substantially (post investment) vis-à-vis the processor or trader.

Putting the Exclusion Problem into Perspective

Clearly the equity issues are important challenges. However, several factors suggest that the impact modern supply chains will be nuanced. First, the impact of is likely to differ significantly between countries and sectors. In countries such as Slovakia, the Czech Republic, Russia, Ukraine, etc. a large share of output is produced by corporate farms. In other countries, the importance of farm organizations often differs significantly among sub-sectors, reflecting economies of scale.

Second, the impact is likely to be a continuation of important agri-food chain restructuring which started fifteen years ago. Farms have dramatically restructured over the past fifteen years. In countries such as Estonia, Hungary, the Czech Republic and Slovakia, more than 50% of workers left agriculture early on in transition. This process continued as

investments in the food industry and international competition have continued pressure for restructuring. In other countries this adjustment process has been delayed by a variety of problems, but a significant reduction in agricultural employment will be necessary with economic growth in any case.

Third, VC processes have positive effects by addressing major weaknesses of the farms. The farms are most in need of finance for investments, technology and quality improvements, and access to high-value markets. All these factors contribute to weak competitiveness of TC food supply chains with negative effects on their trade balances. Investments by modern processing companies and VC with suppliers plays a significant role in addressing these weaknesses and improving the global competitiveness of the supply chains.

Fourth, modern agribusiness and food company investments will not only affect rural suppliers, but will have a wider impact on rural development. This includes improved access of better quality and a wider variety of foods and other products for rural households; and the creation of off-farm employment, directly or indirectly, in the supply chain. Investments in packaging, quality control, and extension services will create new jobs in the rural areas; while at the same time the competition from the new chains will cause traditional shops and processors to close. Modern agribusiness and food companies, as motors of market development, will also generate opportunities for differentiation of products and value added.

In summary, modern vertically coordinated supply chains have the potential for important positive effects in this region, despite the challenges that they pose. These investments may bring very significant benefits to the region, but could also pose significant threats where inefficient or undercapitalized farmers cannot "make the grade".

THE FUTURE OF VERTICAL COORDINATION AND PRIVATE GOVERNANCE

A key remaining issue is how VC will develop in the future in these countries. VC addresses (transition-specific) problems that traditional financial instruments do not address. This holds also for farm assistance programs, leasing, warehouse receipt systems, pre-financing in vertical contracts, etc. Hence, when markets start working better, there is less need for VC. An intriguing question is, therefore, to what extent does the process, as described in this paper, represent a transition-specific phenomenon? Once disruptions in exchanges are overcome by vertical integration and coordination, will the latter be reinforced or will it retreat as markets work better and with the development of new public institutions and market actors that are sufficiently strong to enforce contracts?

A hybrid path is most likely to develop in the medium term. For some aspects of transactions, some forms of VC will remain important, as they are in Western Europe and the US. However, for other aspects more closely aligned with transition conditions, VC may retreat. For example, recent information suggests that some of the multinational companies, where possible, return to their core business and leave farming to farmers, lending to financial institutions, and input supplies to other agribusiness companies. These companies are involved with suppliers at the minimum level necessary to keep the quality and reliability of supplies at a desirable level. We already observe these processes taking place in Central Europe where international brewing companies have withdrawn from their upstream activities

and have simple supply contracts with malting companies instead of VC through the chain. One should keep in mind that these processing companies vertically integrated out of necessity rather than intrinsic interest. These companies want to get out of VC if they can, because it is not their core business and because they do not want to carry the risk. Their preference is to withdraw from the extensive forms of VC which we observed in "medium" stages of transition, and move towards more 'normal' forms of exchange.

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DIFFERENTIATED FOOD QUALITY STANDARDS AND INDUSTRY STRUCTURE IN THE ENLARGED EU: THE POLISH MEAT SECTOR

Marie-Luise Rau[1] and Frank van Tongeren*[,2]

[1] Humboldt-University of Berlin, Faculty of Agriculture and Horticulture,
Institute of Agricultural Economics and Social Sciences;
[2] OECD Trade and Agriculture Directorate.

ABSTRACT

This paper looks at impacts of quality related standards from the supply side of the exporting country. We argue that food quality standards imposed by an importing country have profound effects on the market structure of the exporting industry, and hence a significant impact on the supply response. For our analysis we develop a stylized oligopoly model that allows for the co-existence of complying and non-complying suppliers. We take the Polish meat sector as an empirical example. After Poland's accession to the European Union (EU) the tight EU food quality standards apply but the process of adjusting to them is not complete, particularly in Polish meat production and processing. The model simulations show that a subsidy scheme, such as the EU's SAPARD program in Poland, that assists producers in complying with standards creates new export and growth opportunities but is also characterized by diminishing marginal effectiveness.

Keywords: food quality standards, meat trade, market structure, Poland.
JEL code: F13, Q18, Q17, L13

In industrialized, high-income countries such as the European Union (EU), food quality has become an increasingly important concern of consumers and policy makers. The scope of the term "food quality" has been broadened beyond food safety to include aspects of animal welfare, environmental protection, and related issues. Government intervention in this area is motivated by markets failures that would lead to an inadequate provision of food quality. Information asymmetries between consumers and producers and free rider problems amongst producers are probably the most salient instances of failing markets. In order to address food quality matters tighter and more numerous standards have been set at the EU-level. They are

* Corresponding Author: Dr. Frank van Tongeren: Phone: +33 1 45 24 78 81. E-Mail: frank.vantongeren@oecd.org

typically mandatory for all producers with the EU and target all stages of food production within the entire food chain "from the farm to the fork" (European Commission, 2004).[1]

With EU enlargement, food quality issues have become even more prominent on the policy agenda. The EU food quality standards also apply to the new member states of Central and Eastern Europe that have taken over the entire body of EU rules and regulations (acquis communitaire). Contemporaneous with the alignment of regulations during the preparation period towards EU membership, several measures have been provided to assist the candidate countries and new member states in complying with the EU food quality standards. Nevertheless, the implementation and enforcement of the tight standards do not yet meet the requirements at all levels, and the issue of community-wide compliance has returned to the policy debate.

Meeting the EU food quality standards has constituted a major challenge for the candidate countries and the new member states, which continue to face adjustment pressures even after their EU accession (Network of Independent Agricultural Experts in the CEE Candidate Countries, 2004). According to country experts, adjustment has been particularly challenging for those countries where the agri-food sector is rather fragmented and consists of a large number of small firms struggling to undertake the necessary investments to adopt the EU standards. Poland, Bulgaria and Romania have been facing the greatest difficulties in this regard. Since the EU health and safety requirements are particularly strict for food of animal origin, which often present hazards to human health, meat and dairy production have been affected most. Consequently, food quality and safety in these sectors is given top priority in the National Agricultural and Rural Development Plans 2000-2006 of the candidate countries and new member states.

Since only food products compliant with the EU standards are allowed on the EU market, the standards influence trade flows across member states. In fact, as long as the implementation and enforcement of the EU standards is not fully accomplished, they can be considered as impediments to trade between the new and old member states. That has been confirmed in recent studies (e.g. Chevassus-Lozza et al., 2005; Hagemejer and Michalek, 2005; and Nahuis, 2004).

Given the wide-ranging differences across member states, harmonization of standards is seen as a crucial prerequisite for ensuring a well-functioning single EU food market. For other sectors the alternative strategy of mutual recognition, whereby access to the entire common market is granted once a product has been approved in any of the member states, has widely been followed to remove technical barriers to trade.

De Frahan and Vancauteren (2006) calculate that in the period 1998-2001 as much as 61% of the intra-EU15 trade in food products (NACE 151-158) has been subject to harmonization of standards. However, only 16% of the intra-EU15 trade in meat is covered by harmonized standards, and the authors' results indicate that a complete harmonization would at least double the intra-EU meat trade. This points towards scope for further harmonization and expansion of trade in meat products.

[1] In the literature, the term "standard" is sometimes reserved for private initiatives, whereas "regulation" is used for mandatory rules (Baldwin, 2001). In this paper, standards refer to rules and regulations defined by government.

Given this background, the purpose of this paper is twofold. The first objective is to analyze the impact of foreign-imposed standards on the market structure in the exporting country in the context of EU enlargement. We highlight that standards applying to intra-EU trade but not to national sales lead to an asymmetric distribution of firms: a modern export-oriented segment that complies with standards next to a traditional one that does not. The second objective is related to policies that aim at supporting producers in meeting stricter standards imposed by importing countries. We investigate the efficiency of such subsidies for quality compliance.

For our analysis, we develop an oligopoly framework that allows for the co-existence of complying and non-complying suppliers. This situation corresponds to the new EU member states because the process of adjusting to the tight EU food quality standards in these countries is still not completed. Due to the considerable deficiencies of meeting the EU standards in the Polish meat sector even after accession, we choose this sector as an empirical case study for the application of our model. The model is quite general in structure and is equally suited to depict the situations in many developing countries where a modern segment produces for exporting to rich-country markets.[2] The simulations show that a subsidy scheme, such as the existing EU program in Poland, that assists producers in complying with standards, can be an effective instrument to promote compliance and increase readiness for export opportunities. But it is also characterized by diminishing marginal effectiveness.

THE FRAGMENTED POLISH MEAT SECTOR

According to the Polish Ministry of Agriculture and Rural Development (2004) substantial deficiencies of meeting the EU hygiene and veterinary standards remain in Polish meat production and processing even after accession. Before elaborating on the state of compliance and the compliance costs in the Polish meat sector, we first give a brief overview of the EU hygiene and veterinary standards.

Background: EU Hygiene and Veterinary Standards

The EU hygiene and veterinary standards predominantly comprise process standards. As opposed to product standards, process standards specify the method of producing food products. In the meat sector, product-related process standards refer to certain requirements concerning handling and storage (e.g. temperature control, cleaning of equipment, packaging and veterinary checks). Non-product related process standards do not directly influence product characteristics per se, although they may have an indirect impact on the quality and safety of meat products. Non-product related process standards comprise requirements for facility conditions (e.g. separation of "clean" and "dirty" rooms, washing and disinfection facilities), administrative requirements (e.g. record keeping, carcass classification/labeling) as well as the implementation of the hygiene-control system, the so-called Hazard Analysis and

[2] Most studies of the trade effects of standards concern developing countries and their access to markets in industrialized countries that require compliance with certain food quality standards (e.g. World Bank, 2005).

Critical Control Points (HACCP)[3]. For a detailed overview of the entire array of EU standards relevant to the meat sector see Becker (2000).

The EU hygiene and veterinary standards are obligatory for all firms operating in meat production and processing within the EU. However, exemptions exist for small firms that potentially face considerable problems in the practical application of the EU hygiene and veterinary standards. They are granted special provisions that allow them to continue producing for the domestic market without fully meeting the EU requirements.[4] The exemptions particularly relate to administrative requirements such as documentation and record keeping. Note that with the new "EU food hygiene package" the rules applicable to small-scale enterprises become stricter.[5]

In addition to the standards in the domestic market, EU enterprises have to fulfill further requirements of product testing, storage and transportation to be eligible for exporting to other member states. The requirements for slaughterhouses, cutting plants and meat processing firms are laid down in Directive 64/433/EEC on health conditions for the production and marketing of fresh meat and in Directive 77/99/EEC on health problems in the production and marketing of meat products.[6]

Compliance in the Polish Meat Sector

Figure 1 illustrates the current Polish situation of compliance with the EU hygiene and veterinary standards of Directive 64/433/EEC and 77/99/EEC. As shown, Polish meat production and processing are characterized by two groups of firms: One group contains firms that fully comply or are about to comply with the EU standards (about 30% of all Polish meat firms).[7] Being large-scale enterprises with high production capacity, their output makes up for about 70% of the total meat production in Poland. In contrast, the other group consists of small-scale firms with low production capacities and generally not meeting the EU standards. These firms produce only 30% of the total meat output in Poland but account for about 70% of all Polish meat firms.

The market access of Polish meat firms is largely determined by their compliance with the EU standards. Hence the Polish meat firms can again be differentiated according to their production capacity, as above. As illustrated in figure 1, Polish meat firms of high capacity

[3] The HACCP system, which provides a systematic approach to identify, monitor and control food hygiene and safety, is mandatory in EU meat production/processing (see Directive 93/43/EEC, OJ L175, 19.7.1993).

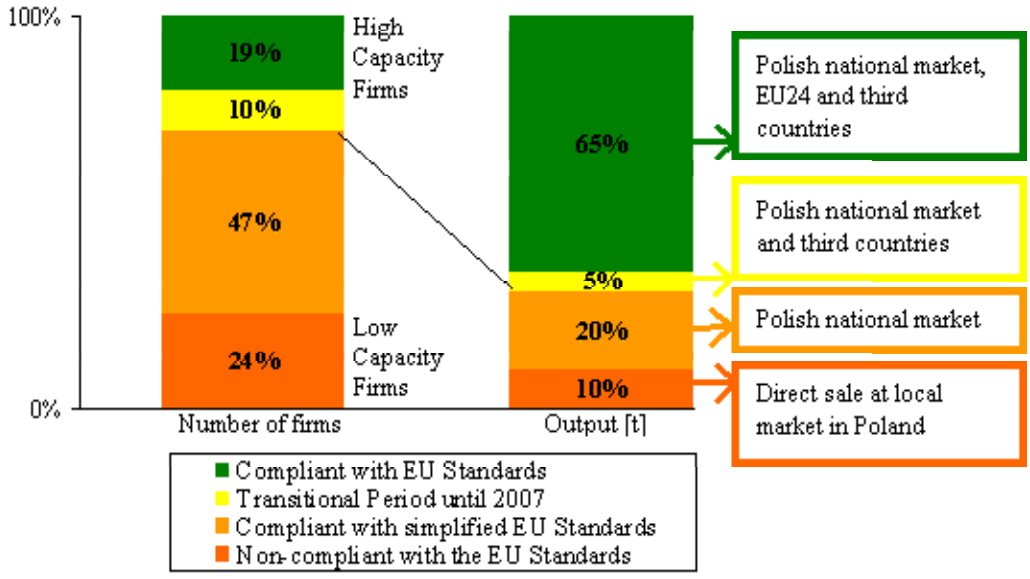
[4] For the fresh meat sector, Directive 95/23/EC (OJ L243, 11.10.1995) defines the production capacity of small-scale enterprises eligible for special provisions as follows: slaughter houses: ≤ 20 livestock units/week and ≤ 1000 livestock units/year; cutting plants: ≤ 5 metric tons/week. Meat processing enterprises with a production output ≤ 7.5 metric tons/week are considered to be of low capacity (Commission Decision 94/383/EC, OJ L174, 8.7.1994); see Pieniadz, Hockmann and Glitsch, 2003.

[5] Regulation (EC) No 852/2004 on the hygiene of food stuff (OJL 139, 30.04.2004), Regulation (EC) No 853/2004 about specific hygiene rules for food of animal origin (OJL 139, 30.04.2004) and Regulation (EC) No 882/2004 about official controls to ensure compliance with feed and food law, animal health and animal welfare rules (OJL 165, 30.04.2004).

[6] Directive 94/65/EC (OJ L368, 31.12.1994) on placing minced meat and meat preparations on the EU market is not considered in the following. That is because it prescribes very specific and rather technical standards that tend to exceed those of Directive 64/433/EEC (OJ P121, 29.7.1964) and 77/99/EEC (OJ L26, 31.1.1977).

[7] In prospect of their compliance in the near future, the high capacity firms about to satisfy the EU standards are granted a transitional period, which allows them to continue producing without fully meeting the EU standards until December 2007.

are commonly licensed to supply the EU market, except for those firms that have been granted a transitional period to fully comply with the EU standards. Their non-compliant products are only permitted on the Polish market or to be exported to third countries, outside of the EU-25 region. In contrast to the high-capacity firms, low-capacity firms not fulfilling the EU standards are not authorized to sell on the EU market. Meeting the "simplified" EU standards under the special provision for small-scale enterprises, the latter firms are only allowed to sell on the Polish national market (47% of all Polish meat firms). Because the Polish meat firms with capacity of less than 4 metric tons/week (24% of all Polish meat firms) have faced tremendous problems of adopting even the "simplified" EU standards, a special law was enacted just before accession (Pieniadz and Hanf, 2005). This law allows the very low capacity firms to keep up their production but their non-compliant products are to be sold on the very local market only (i.e. directly to end-consumers).



Note: refers to slaughterhouses and processing enterprises of pork, beef/veal and poultry meat complying with Directive 64/433/EEC and 77/99/EEC.
Source: own illustration based on Pieniadz and Hanf (2005) and data from IERiGZ (2005).

Figure 1. State of compliance in Polish meat production/processing in 2004.

Complying with standards leads to compliance costs that add to both the fixed and variable costs of production. Preidl and Rau (2006) provide detailed information about the fixed and variable costs of complying with the EU hygiene and veterinary standards of Directive 64/433/EEC and 77/99/EEC. Additional fixed costs occur because firms usually have to undertake investments to meet standards. That is particularly the case for process standards, such as the EU hygiene and veterinary standards, which do not leave much flexibility for how the necessary requirements are achieved (Antle, 1998). In order to fulfill the EU standards, almost all Polish meat firms substantially invested in modernizing production facilities and upgrading their equipment (IERiGZ, 2005). Some Polish meat firms even abandoned their old facilities and built completely new ones according to the EU

standards. Apart from on-site investments, Polish meat firms also had to invest in human capital by training personnel in the new production methods and procedures.

In general, the fixed costs of compliance tend to be a considerable burden for the Polish small-scale firms that commonly lack easy access to bank loans and do not benefit from investment by foreign partners. This can certainly be considered as one reason why many small-scale Polish meat firms have not yet been able to fully adopt the EU standards. To support small and medium-size meat firms in undertaking these serious investments, the Polish government has introduced specific support measures such as preferential conditions for bank loans. EU funds have been made available principally under the EU's Special Accession Programme for Agriculture and Rural Development (SAPARD).

Variable costs are also affected by compliance. The effect depends on the firms' initial technology and production efficiency. In the case of the Polish meat sector, standards advance production technology by upgrading this traditional sector, which improves productivity and can lower average variable costs of production. Adopting EU standards, especially the new management methods under the HACCP-system, has led to productivity gains but also resulted in considerably increased labor costs due to more frequent controls and detailed documentation requirements (Preidl and Rau, 2006). Furthermore, the EU requirements concerning certification and labeling add to variable costs. On this basis, the variable costs of Polish meat firms complying with the EU standards can be expected to be significantly higher than those of non-complying ones.

To summarize, the state of compliance with the EU hygiene and veterinary standards determines the market possibilities of Polish meat firms. Whereas firms not meeting the EU requirements are only allowed to offer their products at the Polish national or very local market, complying firms in fact serve two different markets. On the one hand, they can sell their products on the Polish national market. On the other hand, they can also export their products to the other EU member states. Since meeting the EU standards raises production costs (fixed and variable), complying firms face additional costs that non-complying firms do not incur. In the next section we develop a partial equilibrium model that captures these structural features of the Polish meat market, and we subsequently use the model to analyze the effects of subsidizing fixed costs of compliance.

AN ASYMMETRIC OLIGOPOLY MODEL WITH COMPLIANCE COSTS

Our model, which is described in more detail in Rau and van Tongeren (2006), distinguishes between firms that comply with the standards required for exporting (subscript c) and those that do not (subscript n). Complying firms supply their output to two markets, the domestic (superscript d) and foreign market (superscript f). In the model, the behavior of both complying and non-complying firms is driven by the asymmetry in cost structures. As argued above, complying firms incur additional variable and fixed costs of compliance, which non-complying firms do not need to bear. With the total number of complying firms n_c, we postulate the following cost function for each complying firm:

$$C_c(q_c) = h_c(q_c^d + q_c^f) + g_c(q_c^f) + F \qquad c = 1,2...n_c$$

where h_c refers to the variable costs of production that are identical for the product no matter whether it is sold domestically (q_c^d) or exported (q_c^f). Respectively, g_c and F refer to the additional variable and fixed costs when meeting standards.

For each non-complying firm that does not supply the foreign market the cost function reduces to

$$C_n(q_n) = h_n(q_n^d) \quad n = 1,2...n_n$$

where n_n denotes the total number of non-complying firms.

Assuming that complying firms are identical and non-complying firms are also identical, we can solve for the Cournot-Nash equilibrium on both markets. With Cournot conjectures, we arrive at the following expressions for each complying firm's first order conditions to the profit-maximizing problem:

$$p^f * [1 + 1/n_c * 1/\varepsilon^f] = C'_{q_c^f} \qquad c = 1,2...n_c$$

$$p^d * \left(1 + \left(q^d \Big/ n_c q_c^d + n_n q_n^d\right) * 1/\varepsilon^d\right) = C'_{q_c^d} \qquad c = 1,2...n_c$$

where ε^f denotes the elasticity of foreign demand with respect to the foreign market price p^f, and ε^d denotes the elasticity of domestic demand with respect to the domestic market price p^d. Since complying firms are identical each firm's market share on the export market is given by $1/n_c$.

Note that by assumption marginal costs depend on each complying firm's supply to both markets: $C'_{q_c^f} = \frac{\partial C_c}{\partial q_c^f} = \frac{\partial h_c}{\partial q_c^f} + \frac{\partial g_c}{\partial q_c^f}$ and $C'_{q_c^d} = \frac{\partial C_c}{\partial q_c^d} = \frac{\partial h_c}{\partial q_c^d}$. How the interaction between supplying to the domestic and foreign markets enters into the marginal cost depends on the parametric specification of the functions $h()$ and $g()$.

For non-complying firms, which do not supply to the foreign market, the first order conditions are given by just one equation:

$$p^d * \left(1 + \left(q^d \Big/ n_c q_c^d + n_n q_n^d\right) * 1/\varepsilon^d\right) = C'_{q_n^d} \qquad n = 1,2...n_n$$

Together with market clearing conditions on both markets, the system of equations yields equilibrium values for the prices on the domestic and foreign markets and the associated output levels.

It is easily seen that increasing the number of firms lets prices converge towards marginal cost. In addition, the lower the price elasticity, given the number of firms, the higher the price-cost margin or mark-up above marginal cost. Since export demand for food products is typically more price elastic than domestic demand due to the importer's ability to substitute between alternative suppliers, one might expect domestic price-cost margins to be higher than

those obtained on the export market. However, this depends on the number of firms as well. If the domestic market is populated by a large number of small firms, a competitive fringe, mark-ups on the domestic market will be driven towards zero.

Imposing zero-profit conditions allows us to determine the number of firms endogenously. In the zero-profit equilibrium the number of firms varies inversely with the level of fixed compliance costs, and it is this feature that we shall explore in our numerical application.

Parameterization and Calibration

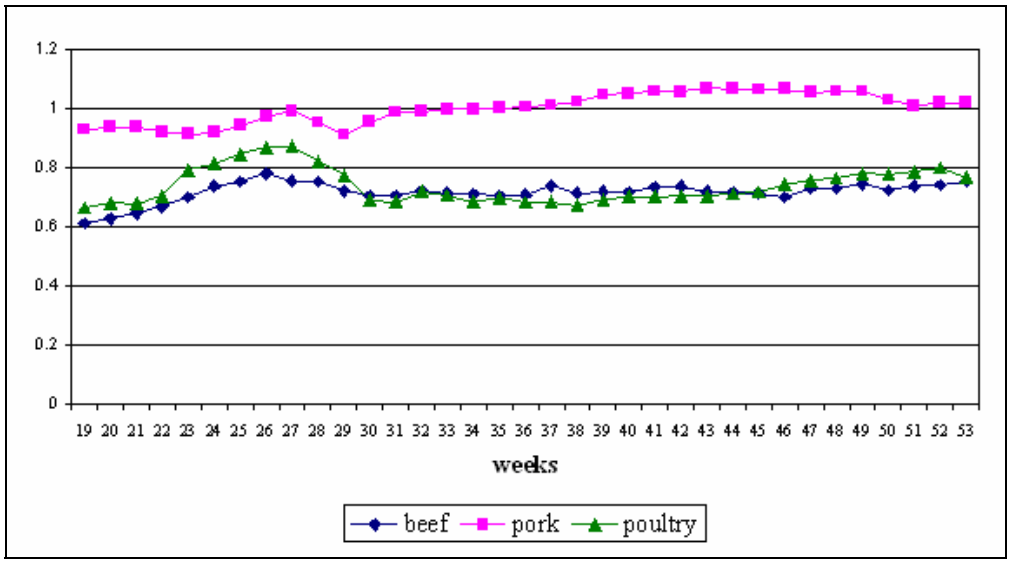
For the application of our model to the Polish meat sector, we choose specific functional forms for the cost and demand functions. The cost function incorporates two important notions: First, the distinction between production costs and costs of compliance (both variable and fixed) and secondly, the interdependence of marginal costs between the supply to the domestic and foreign market. A functional form that fulfils these requirements is the quadratic one: $C_c(q_c) = a_c \cdot (q_c^f + q_c^d)^2 + b_c(q_c^f) + F$. Since q^f and F are zero for non-complying firms their cost function reduces to $C_n(q_n) = a_n \cdot (q_n^d)^2$. Note that the quadratic form implies increasing marginal production cost, but due to the fixed cost of compliance we have increasing returns to scale.

To calibrate the cost and demand functions, we use data from various sources; see table A.1 in the appendix for a summary account and overview of the Polish meat sector in 2004. Table A.2 in the appendix reports on the parameters used for the simulations. The fixed costs of compliance are approximated by information on the investments Polish meat firms have undertaken to adjust their production to the EU standards. Variable costs of compliance are considered to be reflected by the difference between the Polish and EU15 price for meat. Figure 2 illustrates the gap between meat prices in Poland and the EU15. It shows that price levels show no sign of convergence yet, except for pork. According to our estimate, about one third of the total cost of meat production in Poland is due to compliance costs.

Calibrating the cost functions, we derive point estimates for the parameters *a* and *b*. For non-complying firms we set average costs equal to price in order to obtain an estimate of the parameter a_n. For complying firms we solve simultaneously for two conditions to retrieve the parameters a_c and b_c: 1) average variable costs equal average unit revenue on the domestic and foreign market and 2) marginal costs to the foreign market equal marginal revenue on the foreign market. The following two observations on the parameter estimates should be noted: First, the calibration procedure implies non-zero profits for complying firms and zero profits for non-complying ones, as their average costs equal price in the base. Secondly, the cost parameter estimates imply that complying firms are more efficient in their production than non-complying ones.

Due to the rather simple constant elasticity specification, the demand functions for both markets ignore the intricacies of consumer demand in a market for differentiated products. The estimate of the demand elasticity for the domestic meat demand in Poland (-0.429) comes

from the database of the ESIM model. The elasticity of demand for Polish meat export to the EU15 (-7.6) comes from the GTAP v.6 database.[8]



Source: European Commission, 2005.

Figure 2. Ratio of weekly meat prices in Poland and the EU in 2004.

SIMULATIONS AND RESULTS

We conduct two sets of simulations.[9] The first simulation implements a long-run equilibrium benchmark by imposing a zero-profit condition with free entry and exit on the market and letting the number of complying firms (n_c) adjust. The second set of simulations pertains to subsidies that lower the fixed costs of compliance, such as the EU's financial support under the SAPARD scheme.

Under the benchmark simulation of zero profit and free entry and exit by complying firms, the structure of the industry changes. Table 1 shows that the number of complying firms more than doubles, but each firm is about 40% smaller in terms of output than in the base. In addition, total industry supply rises by only 3%. Free entry drives size down. Furthermore domestic and export prices fall significantly, but the export market remains the largest source of revenues for complying firms. They are able to boost their collective export revenues from 97 to 260 million euros. Against this long-run equilibrium benchmark the investment subsidy scenario is simulated.

[8] We are grateful to the ESIM team of the University of Göttingen for providing the elasticity estimates.
[9] The model is solved with GEMPACK 9.

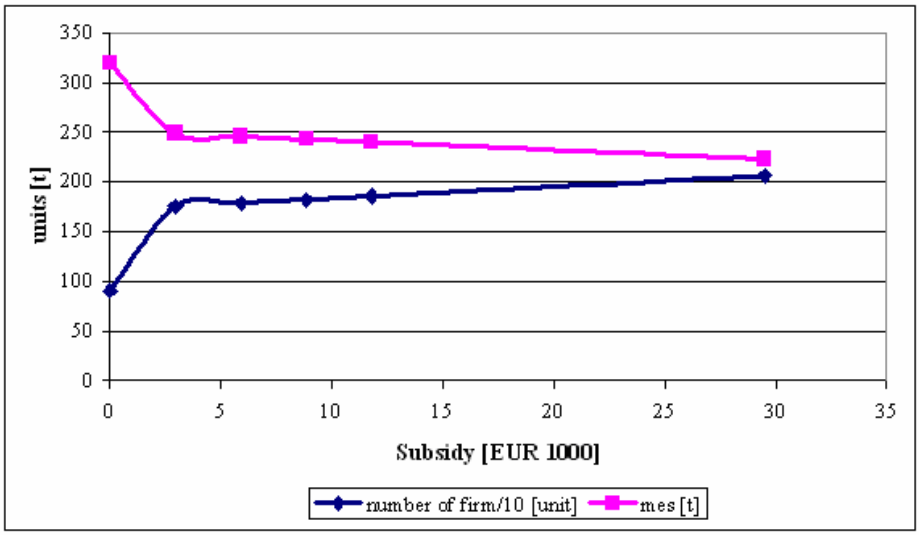
Table 1. Simulation of Investment Subsidy for Compliance

			Simulations					
				1	2	3	4	5
	BASE level		Zero profit	**Percent change relative to zero profit benchmark**				
Fixed cost	59	EUR 1000	0	-5	-10	-15	-20	-50
Number of firms								
Complying firms	397	unit	903	94	98	102	106	129
Non-complying firms	1 693	unit	1 693	0	0	0	0	0
Price on domestic market	1 342	EUR/ton	814.2	-22.2	-23.1	-24.0	-24.9	-30.4
Export price	2 088	EUR/ton	1 557.4	-11.7	-12.2	-12.7	-13.2	-16.0
Supply to export market/firm								
Complying firms	117	tons	193.6	-5.0	-5.2	-5.4	-5.6	-6.8
Non-complying firms	0	tons	0.0	0.0	0.0	0.0	0.0	0.0
Total supply to export market	46 431	tons	174 933	89.0	92.7	96.3	99.9	122
Supply to domestic market/firm								
Complying firms	464	tons	126.2	-63.6	-66.1	-68.7	-71.3	-86.9
Non-complying firms	73	tons	44.6	-22.2	-23.1	-24.0	-24.9	-30.3
Total supply to domestic market	308 474	tons	189 458	9.5	9.9	10.3	10.7	13.0
Quantity share of modern firms on domestic market(*)	60	%	73.9	89.4	90.0	90.7	91.3	95.1
Total supply per firm								
Complying firms	581	tons	319.8	-28.1	-29.3	-30.4	-31.5	-38.4

Table 1 (Continued).

			Simulations					
				1	2	3	4	5
	BASE level		Zero profit	**Percent change relative to zero profit benchmark**				
Non-complying firms	73	tons	44.6	-22.2	-23.1	-24.0	-24.9	-30.3
Total industry supply	354 905	tons	364 390	43.8	45.6	47.4	49.1	59.8
Industry sales revenues				**EUR million**				
Total export value	97	EUR Mill	260	460	468	477	485	534
Domestic sales	414	EUR Mill	321	280	279	277	275	265
Total	511	EUR Mill	581	741	747	754	760	799
Welfare indicators				**EUR million**				
Change consumer surplus				107	111	116	120	149
Change industry profits				0	0	0	0	0
Subsidy				-27	-103	-158	-215	-548
Total welfare change				80	8	-42	-95	-399

Note: (*) percent level in simulation, not percent change.
Source: model simulations.



Note: MES is calculated as output per firm in the zero-profit equilibrium.
Source: model simulations.

Figure 3. Investment subsidy and minimum efficient scale (MES).

The simulation of an investment subsidy that is modeled as a reduction of the fixed costs of compliance (in the range of -5% to -50%) reveals drastic changes in industry structure. The number of complying firms already more than doubles if the fixed costs of compliance are reduced by 15%. Due to the investment subsidy the average costs of complying firms are lowered and the minimum efficient scale drops. The relationship between the equilibrium number of complying firms and the minimum efficient scale (MES) is illustrated in figure 3.

Due to the massive entry of subsidized complying firms, the non-complying firms are almost completely driven out of the market. Their market share falls from about 30% initially to just 5% when the fixed costs of compliance are halved by the subsidy. Total domestic and export supply increases and prices fall; nevertheless, total sales revenues of the industry increase.

The big winners are Polish and EU15 consumers, as their consumer surplus increases with lower prices and a higher average quality supplied to the market. Given the demand elasticities and the size of the market, the consumer surplus of EU15 consumers exceeds the gain to Polish consumers. Of course, the cost of the subsidy needs to be balanced against the gain in consumer surplus. The net welfare gain, defined here as the difference between total consumer surplus and subsidy expenditure, increases with the size of the subsidy, but the cost effectiveness declines rapidly. Figure 4 shows that subsidizing fixed compliance costs enhances welfare of domestic and foreign consumers, but at a diminishing rate. Although the benefit/cost ratio stays above one in all our simulations, it rapidly approaches this critical cut-off level.

Source: own calculations.

Figure 4. Consumer benefit as ratio to subsidy expenditure.

Rau and van Tongeren (2006) explore the effects of tightening export standards without complementary measures. These experiments show that tightening standards leads to a diversion of supply towards the domestic market and increased competition between complying and non-complying firms, which mainly benefits domestic consumers. With our simple demand specification, we are not able to quantify the utility gain obtained from the supply of products of improved quality. Particularly in the case of product-related standards that are communicated to consumers and that might lead to observable quality improvements in the end product, consumers are likely to attach a positive value to the increased availability of compliant meat products. To capture these effect, imperfect substitutability between complying and non-complying products must be introduced into the demand side of the model.

CONCLUDING REMARKS

This paper looks at the issue of trade impacts of quality related standards from the supply side of the exporting country. Standards imposed by an importing country have profound effects on the market structure of the exporting industry. We develop a stylized model that allows for the co-existence of complying and non-complying suppliers; a configuration that is present in the enlarged EU25, particularly in Polish meat production and processing. However, co-existence of complying and non-complying suppliers is also commonly found in developing countries, where a modern segment produces for rich-country markets.

The simulations show that a subsidy scheme that lowers the fixed costs of compliance, such as the EU's SAPARD program, can be a very effective instrument to promote the compliance with standards and to upgrade the industry in the exporting country. This creates new export and growth opportunities for producers. But the results also indicate a diminishing marginal effectiveness of such subsidy schemes. Our model thus provides a structured way to

help to determine the level and type of assistance to upcoming exporters, both in the context of EU enlargement and in the context of support to developing country producers.

There are obviously a number of extensions of the analytical framework presented. On the theoretical side the most relevant one may be to endogenize the investment decision of non-complying firms to become "modern." Another improvement would be the modeling of consumer preferences for differentiated products and the derivation of a more complete welfare measure that accounts for quality changes. An alternative application of the model that requires only minimal extension is the presence of foreign food companies and their investments in the supply chain. It can be argued that these companies find it easier to cover compliance costs, both because they have 'deeper pockets' and because they have already accumulated experience in the compliance process in their home countries.

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APPENDIX

Table A.1. The Polish Meat Sector in 2004

		Compliant firms (Modern)	Non compliant firms (Traditional)	Total	Note/source
Number of firms		397	1 693	2 090	Pieniadz and Hanf (2005), IERiGZ (2005)
Output	1000 t	231	124	355	ZMP (2005), calculation based on IERiGZ (2005)
Output per firm	1000 t	0.58	0.07	0.17	calculated
Volume domestic demand	1000 t	184	124	309	ZMP (2005) (calculated per cap*pop), for modern firms calculated as residual
Value domestic demand	EUR 1000	247 280	166 702	413 983	calculated
Value Export demand, EU15	EUR 1000	96 954	0	96 954	COMEXT (2005)
Volume Export demand, EU15	1000 t	46	0	46	COMEXT(2005)
TOTAL REVENUE	EUR 1000	344 234	166 702	510 937	calculated
Price domestic market	EUR/t			1 342	EU commission, calculated from EU15/PL price ratio
Unit value export	EUR/t			2088	calculated

Table A.2. Cost and Elasticity Estimates

		Cost structure per firm	
		Complying firms	Non complying firms
Cost function parameters:			
Variable production cost per unit: *a*		0.001	0.009
Variable compliance cost per unit: *b*		0.897	-
Variable production cost	EUR 1000	338	98
Variable compliance cost	EUR 1000	105	0
Annual fixed cost (linear depreciation, 15 years lifetime)	EUR 1000	59	0
TOTAL COST	EUR 1000	502	98
		Demand elasticities	
Price elasticity domestic market	(1)	-0.429	
Price elasticity export demand PL-EU15	(2)	-7.6	

Notes: source (1) ESIM database, (2) Calculated from GTAP v.6.

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THE IMPACT OF THE EUROPEAN ENLARGEMENT AND CAP REFORMS ON AGRICULTURAL MARKETS. MUCH ADO ABOUT NOTHING?

Jacinto F. Fabiosa[2], John C. Beghin[2], Fengxia Dong[2], Amani Elobeid[2], Frank H. Fuller[2], Holger Matthey[1], Simla Tokgöz[2] and Eric Wailes[3]

[1] Food and Agriculture Organisation of the United Nations
[2] Iowa State University [3] University of Arkansas.

ABSTRACT

Policy reforms in the EU require careful consideration because the EU is a significant player in international agricultural markets for many commodities. We analyze the effects on world agricultural markets of the 2003 Common Agricultural Policy (CAP) reform and the accession of ten new member states (NMS) to the EU on May 1, 2004. Given past reforms, changes introduced in the 2003 CAP have only a moderate impact on the EU-15, causing small decreases in production for most commodities and raising domestic prices marginally. Beef, rice, and dairy experience the greatest changes. Accession leads to substantial increases in domestic prices of several commodities in the ten NMS because their prices were historically below EU-15 prices. Consequently, consumption of agricultural products in these countries decreases while production rises. Trade with the NMS causes EU-15 prices to decline modestly, and the two reforms combined have moderate or negligible effects on world markets.
[1]

Keywords: CAP reform, Common Agricultural Policy, EU enlargement, European agriculture, New Member States.
JEL Code: Q17, Q18, F18

Following a historical agreement on the EU enlargement, ten New member States (NMS) (Poland, Hungary, the Czech Republic, Slovakia, Slovenia, Estonia, Latvia, Lithuania, Cyprus and Malta) acceded to the European Union on May 1, 2004. This enlargement is unprecedented in its scope and diversity of countries. The effects of the EU enlargement on

current and future member countries and on world commodity markets require careful consideration, as the EU is a major player in these markets. In preparation for enlargement and to position itself for the Doha round of negotionations in the World Trade Organization.

(WTO), the EU also embarked on a series of reforms to the Common Agricultural Policy (CAP) in 2004. These reforms generally increase the market orientation of production decisions by EU farmers and better prepare domestic markets for the likely reduction in border protection following the conclusion of the Doha round.

In this paper we analyze the effects of the latest CAP reforms and enlargement on the EU-15, the acceding countries, and world agricultural markets. We compare three ten-year agricultural outlook scenarios (a reference scenario, midterm-review reform in the EU-15, CAP reform, and CAP Reform with NMS accession). Our analysis contributes to the recent literature analyzing EU integration and CAP reforms (Ackrill, 2003; Bouamra-Mechemache and Requillart, 2004; Dixon and Matthews, 2007; Fuller et al., 1999 and 2002; Nahuis, 2004; Schrader, 2000; and others). The simulation results suggest that, while CAP reforms and enlargement have important implications for agricultural markets in member countries, the direct impacts on world markets are modest at best.

In order to assess the impacts of CAP reforms and EU enlargement, a reference baseline is constructed by extending the Agenda 2000 reform policies in the EU-15 and by keeping the candidates countries separate from the Union. Given these assumptions, we simulate EU and world agricultural market outcomes for the ten-year period from 2004 to 2013. Then, our analysis incorporates the major policy changes associated with the 2003 Midterm Review of the CAP. In our third scenario, we combine the CAP reforms with the provisions of the accession agreements for the ten NMS. We consider the associated policy changes in the NMS during an implementation period, which culminates in convergence to fully vested CAP recipients.

The CAP reform and EU enlargement scenarios are conducted using the 2004 baseline models developed by the Food and Agricultural Policy Research Institute at Iowa State University (FAPRI-ISU). To conserve space, we refer interested readers to the online description and documentation of the models (http://www.fapri.iastate.edu/models/). In addition, the discussion of the results in the next section is limited to key findings. Detailed results by commodity are available in Fabiosa et al. (2005).

CAP REFORM SCENARIO

Table 1 summarizes the major CAP changes that form the basis for the CAP scenario. Implementation of the reforms began in 2004. Continuing the process initiated in the 1992 reforms, farm support in the EU is further decoupled from production decisions under the 2004 reforms, and the remaining price incentives linked to production are lowered. Decoupling, when fully implemented in 2007, will take the form of a Single Farm Payment (SFP). Under the SFP scheme, direct support payments received by farmers during the 2000–2002 reference period form the basis for future CAP payments. The payments are tied to farm acreage, and producers are required to keep the land eligible for payments in good environmental conditions (cross-compliance provisions). However, eligibility for the payments is not dependent on actual production of any commodity. Thus, the SFP should

satisfy the WTO's green-box criteria. Limited coupled elements may be maintained under the SFP implementation rules; furthermore, the SFP is expected to generate some wealth effects in farm households. Consequently, we assume that the SFP, although largely decoupled, has a small supply-inducing effect.

The CAP reform also includes commodity-specific measures. The monthly payment increments in the cereals sector are reduced by half, but the current intervention price for cereals is maintained, with the exception of rice. The rice intervention price is cut by 50% from €298.35/mt to €150/mt. Moreover, rye is removed from the intervention system. The supplement for durum wheat decreases progressively to €285/ha by 2006 and is eventually included in the SFP. Because we use an aggregate EU-15 model for our analysis, we assume decoupling is phased in from 2005 to 2007, mimicking an aggregate of the different decoupling strategies utilized by member countries. Modulation (reduction in direct payments for large farms) rates are set at 3% for 2005, 4% for 2006, and 5% after that. In the EU-15, the set-aside rate is assumed to be 5% for 2004 and 10% for 2005 and onward. Some slippage is assumed, so the effective set-aside rate is closer to 7.5%. In dairy, the intervention price for butter is reduced by 25% over four years, and the skimmed milk powder price is cut by 15% over three years. Dairy quotas grow marginally in the EU-15 members, rising from 118.953 million metric tons (mmt) in 2004 to 120.505 mmt in 2009 and staying at that level for the rest of the simulation period.

Table 1. Summary Table of EU CAP Reform and Enlargement Assumptions

Policy	**2004**	**2005**	**2006**	**2007**	**2008**
Decoupling (%)*					
Livestock	0	23	47	70	70
Crops and dairy	0	33	67	100	100
Modulation (%)	0	3	4	5	5
Set-aside (%)					
EU-15	5	10	10	10	10
EU NMS	0	0	0	10	10
Dairy Quota (mmt)					
EU-15	118.95	119.04	119.30	119.78	120.26
EU NMS	18.33	18.33	18.37	19.00	19.00
Intervention Price and premium					
Durum Aid (euros/mt)	313	291	285	285	285
Rye (euros/mt)	0	0	0	0	0
Rice (euros/mt)	150	150	150	150	150
Butter (euros/mt)**	316.72	293.84	270.98	252.96	246.39
NFD (euros/mt)**	200.38	190.61	180.33	176.69	174.69
NMS Top-up payments (%)	20	27	22	17	7

* We assume a modest crop response to the SFP due to wealth effects.

**Calendar-average prices of marketing-year prices.

The major production, consumption and trade effects of the CAP reform are summarized in tables 2 and 3 for the EU-15 and NMS, respectively. The tables also show results for the enlargement scenario. The tables report the ten-year average of annual levels for each scenario, and average of the annual percentage change for major commodities and aggregates experiencing significant changes relative to the baseline. As the CAP reform percentage changes are measured in deviation from the baseline, the results expressed in percentage

changes for the enlargement scenario are measured in deviation from the CAP reform scenario. This approach is intended to highlight the incremental contribution of the individual scenarios to the total market impact.

The CAP reforms have their greatest production impact on the beef sector. This is consistent with the direction and magnitude of impacts of the CAP reform analysis conducted by the EU Commission (2003a and 2003b) and the OECD (2004). The replacement of commodity-specific payments with the SFP diminishes the attractiveness of beef production, prompting producers to reduce cow numbers by 5% and beef production by 1.2% on average over the simulation. Beef prices rise, causing a secondary shock in pork and poultry through substitution effects in demand. Demand shifts away from beef in favor of pork and poultry, raising the price and production of pork and poultry slightly.

The EU CAP reform deepens previously scheduled reductions in the butter intervention price and retains cuts in NFD intervention. These support price cuts shift the allocation of milk for processed products away from butter and NFD and toward cheese, eventually pulling cheese prices down slightly. The EU butter price declines an average of 3.5% per year, and as much as 5.3% in the first 5 years following the reform. Butter prices remain 1 to 2% below the Agenda 2000 levels in the long run, and butter stocks average 81 thousand metric tons (tmt) lower. In 2013, EU butter stocks are 31 tmt, and NFD stocks are 24 tmt.

Table 2. CAP Reform and Enlargement Effects on EU-15 Production, Consumption, and Trade

	Baseline (tmt)	CAP reform (tmt)	CAP reform impact (%)	Enlargement and CAP reform (tmt)	Enlargement impact (%)
Production					
Rice	1,741	1,573	-9.64	1,573	0.00
Grains	196,401	195,779	-0.31	195,603	-0.09
Oilseeds	13,078	13,046	-0.25	13,036	-0.08
Beef	7,226	7,143	-1.17	7,138	-0.07
Butter	1,753	1,747	-0.33	1,750	0.21
NFD	972	967	-0.45	970	0.26
Consumption					
Rice	2,498	2,543	1.82	2,543	0.00
Grains	207,187	206,224	-0.46	206,155	-0.03
Oilseeds	36,766	36,760	-0.02	36,761	0.00
Beef	7,457	7,388	-0.94	7,385	-0.04
Butter	1,646	1,658	0.74	1,654	-0.27
NFD	904	900	-0.33	898	-0.32
Net Exports					
Rice	-730	-988	43.89	-988	0.00
Grains	8,670	8,635	-0.39	8,572	-0.91
Oilseeds	-21,458	-21,485	0.12	-21,498	0.06
Beef	-227	-241	5.58	-244	1.23
Butter	126	115	-9.67	123	7.88
NFD	84	82	-2.41	88	11.00

The cereals and oilseeds sectors also experience primary supply shocks as a consequence of decoupling and the reduction of some support prices. Given the cut in the intervention price, rice production is impacted most severely, with output decreasing by nearly 10%. Grain and oilseed areas both decline slightly, reducing production and raising market prices. At the same time, feed demand declines due to lower beef and dairy cattle numbers. The decrease in feed demand from cattle is moderated by greater feed use in the pork and poultry sectors. Figure 1 shows the change in total feed use and the change in standard grain consuming animal units (GCAUs) for the EU-15. The general shapes of the curves illustrate the impacts of decoupling on the livestock sector. Other uses for grains do not decline as much as feed consumption, and the net reduction in feed use lessens some of the upward price pressure created by lower grain production. Non-feed use of corn is higher in the latter part of the outlook period because of lower corn prices, but the growth in non-feed consumption does not fully offset feed use declines.

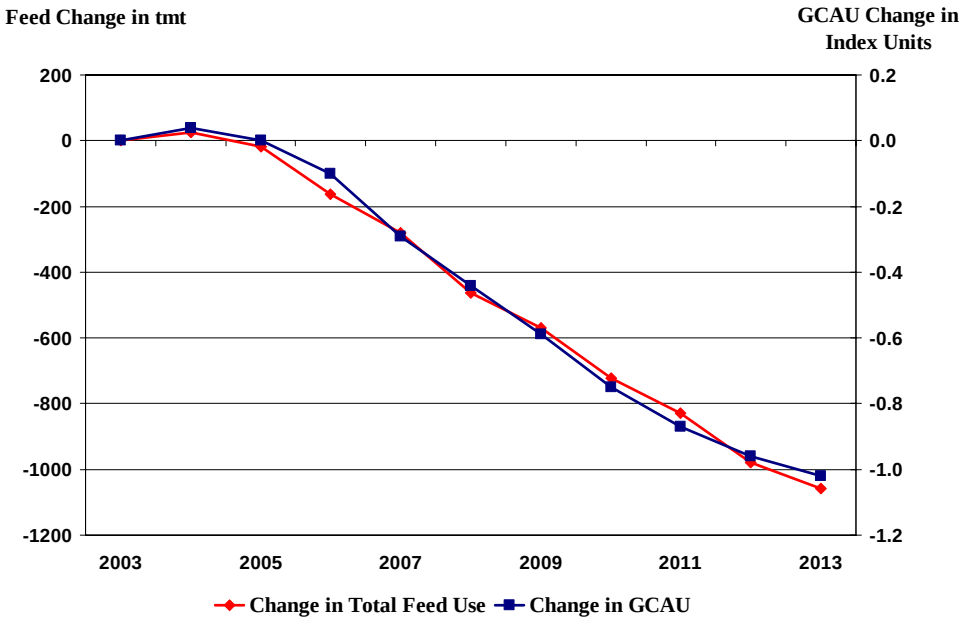

Figure 1. CAP reform: change in feed use and grain consuming animal units in the EU-15.

Lower crop production causes net grain exports from the EU-15 to decline on average. Net imports of corn are higher in the first 5 years, but imports decline in the outer years in response to lower feed demand. Non-feed use of barley in the outer years increases slightly as consumers switch to barley from wheat, which experiences a much greater price increase. Consequently, barley net exports decrease. Rice consumption increases by 1.8%, inducing an increase in net imports of around 250 tmt. CAP reforms have virtually no impact on vegetable oil prices and consumption in the EU-15. Despite a decline in domestic beef consumption by 1%, lower production and higher domestic beef prices stimulate an increase in net imports by 5.6%.

The impacts of the CAP reforms on the rest of the world are negligible. For example, U.S. agricultural exports grow by less than 1%. Net U.S. exports of corn are also higher but only in the first half of the outlook period. In the latter half of the scenario, U.S. net corn exports decline slightly because of higher feed demand at home. Corn feed use in the U.S. increases as a result of the higher percentage increase in U.S. soybean meal prices relative to corn prices. U.S. exports of wheat fill the void on world markets created by lower EU-15 exports. The higher beef price in the EU is transmitted to international markets, causing secondary effects on pork and poultry markets, but the implications for world pork and poultry markets are nearly insignificant.

World prices for grains and oilseeds and derived products are slightly higher because of the EU-15's decrease in net exports or rise in net imports. All of the average world price effects are 1% or less. The world market prices of sunflower and rapeseed oils increase marginally, while the soybean oil price remains unchanged. World soybean meal prices remains nearly constant until 2007/08; the impacts of falling animal numbers and rising grain and other meal prices on soybean meal demand offset each other. From 2008/09 onward, the growth in the swine and poultry sectors put upward pressure on soybean meal prices. Sunflower and rapeseed meal prices increase for similar reasons but also because of decreases in production. Vegetable oil prices are the least effected by the CAP reform because of the fixed-proportion technology of producing vegetable oil and the lack of indirect effects on consumption.

Soybean imports increase slightly, as do soybean meal imports, but EU-15 soybean oil trade does not change. EU-15 sunflower seed imports go up because domestic production declines, but sunflower meal imports follow the pattern of feed consumption changes. EU-15 rapeseed imports rise 3.3% as a result of lower plantings, but meal imports fall. An exportable surplus of rapeseed oil is created by the CAP reform as a consequence of the demand response to higher domestic prices.

ENLARGEMENT SCENARIO

In May 2004, the NMS were incorporated officially into the European Union, but agricultural policy changes are phased in over time. CAP policies are extended to the NMS with some accommodations. For example, a single-area payment begins at the time of accession as a simplified area payment, which is then a replaced by the SFP in 2007. There is no financial modulation in the NMS until their CAP support reaches 100% of the EU-15 level in 2013. Direct payments are new instruments in many of the NMS. Countries are allowed to provide additional "top-up" payments using national finances or EU rural-development funds until 2006 to bring payments to NMS farmers closer to EU-15 levels. However, we assume that no top-up payments are used after 2008 (see Fabiosa et al., 2005 for details).

We assume set-aside in the NMS starts in 2007 at 10% with the implementation of the SFP and stays at that level. Dairy production quotas in the NMS are set slightly below pre-accession production levels in most countries, but they are allowed to increase marginally in 2007. Poland is the largest dairy producer, followed by the Czech Republic, Hungary, and Lithuania. The trade policy regime in the NMS has changed. Tariff rates applied to nonmembers were harmonized with the EU-15 levels, and tariffs on internal trade are

eliminated. Also, the NMS adopted the more restrictive EU sanitary and phytosanitary standards and ensure stricter compliance. Specifically, the ban on hormone use (e.g., estradio-17b) in beef production, beta agonist (e.g., paylean) as feed additive in swine production, and the use of antimicrobials for decontamination in poultry are likely to cause trade diversion favoring intra-EU trade in meat. Moreover, meat and meat products must come from EU approved establishments under supervision of the Food Safety and Inspection Service. Price convergence between the EU-15 and EU NMS is assumed to take three to four years, mimicking the gradual decline of transaction costs with greater integration and improvements in NMS product quality. Chevassus-Lozza et al. (2005) note that quality and SPS barriers to NMS trade with the EU declined during the period leading up to accession, but SPS and other non-tariff barriers (such as import certificates) continue to be important transaction costs for NMS exporters (See Rau and van Tongeren, 2007, and Swinnen, 2007 in this issue) . Table 1 also summarizes the important policy parameters for the accession scenario.

The simulation results summarized in table 3 suggest that production quotas are binding constraints on the supply of milk and sugar in the NMS, causing production to decline relative to the CAP scenario despite increases in domestic prices. World and EU-15 prices also increase as a result. Milk production in the NMS declines 12% (2.8 mmt) relative to the baseline by 2013, as new quality standards and limitations on informal marketing drive many small producers out of business. Even at these reduced production levels, total milk output for the NMS remains nearly 12% above the total marketing quota (compared to about 2% for the EU-15), which is assumed to account for continued high on-farm use in some countries. The bulk of the change in milk production is accomplished through declines in dairy cow inventories. Changes in Poland accounts for nearly three-quarters of the decrease in NMS milk production, with the Baltic States accounting for the bulk of the remaining change.

Fluid milk consumption in the NMS declines by about 8%, accounting for roughly 34% of the total decline in fluid milk use. The reduction in dairy product exports from the NMS reflects the smaller quantities of milk available for processing. The production changes in the NMS have a significant influence on the trade flows of dairy products between the old and new EU members. Before enlargement, the EU-15 was a net importer of all dairy products from the NMS. The changes in the total EU-25 market supplies result in a 1 to 2% increase in domestic prices, with NFD and butter price experiencing the largest changes. With higher dairy product prices, EU-15 consumption of all dairy products declines slightly. EU-15 net exports of butter, cheese, and NFD increase 4 to 11% relative to the baseline, but the vast majority of that growth in trade is with the NMS. In the aggregate, EU-15 dairy exports to the rest of the world decrease. Dairy product net exports from the EU-25 decline following enlargement. These lower supplies to international markets boost international cheese and NFD prices by an average of 3% and butter and WMP prices by a bit more than 1%. Australia, New Zealand, and Argentina are the primary beneficiaries from increased export opportunities following the decrease in EU exports.

Table 3. CAP Reform and Enlargement Effects on NMS Production, Consumption, and Trade

	Baseline (tmt)	CAP reform (tmt)	CAP reform impact (%)	Enlargement and CAP reform (tmt)	Enlargement impact (%)
Production					
Grains	38,697	38,701	0.01	40,773	5.36
Oilseeds	3,484	3,486	0.04	3,511	0.79
Beef	804	804	0.00	781	-2.73
Butter	314	314	0.15	299	-4.48
NFD	288	289	0.22	260	-9.93
Sugar	3,651	3,651	0.00	3,378	-7.40
Consumption					
Grains	36,785	36,768	-0.04	36,106	-1.76
Oilseeds	2,844	2,843	-0.01	2,879	1.24
Beef	682	682	-0.01	663	-2.75
Butter	278	278	-0.05	275	-1.15
NFD	153	153	0.02	151	-1.28
Sugar	3,657	3,657	0.00	3,627	-0.81
Net Exports					
Grains	1,762	1,784	1.31	4,582	164.75
Oilseeds	640	642	0.28	637	-0.98
Beef	122	122	0.02	118	-0.98
Butter	35	36	1.80	23	-36.89
NFD	135	136	0.44	109	-20.00
Sugar	0.86	0.83	-0.28	-234.92	446.82

Sugar production in the NMS declines by an average of 7% due to the introduction of the production quota. The consumption of sugar in the NMS decreases by about 1%, because domestic price of sugar increases substantially as a result of the intervention price. The EU-25, through the NMS, decreases its exports of sugar to the rest of the world and world prices increase by a modest 2%. Although not included in this analysis, the implementation of the EU sugar reforms, which took effect in July 2006, would further decrease sugar production both in the EU-15 and EU NMS (Council Regulation (EC) No 320/2006). The sharp cut in the intervention price and the restriction of sugar exports to comply with the WTO panel ruling on export subsidies means a drastic reduction in EU sugar production (Conforti and Rapsomanikis, 2007). In the NMS, this is likely to occur in the relatively high cost regions such as the Czech Republic, Hungary, Latvia, Lithuania, Slovakia and Slovenia. The incorporation of the sugar reforms in this analysis would result in a significant fall in the level of sugar exports, and the enlarged EU would switch to a net importer of sugar.

In the NMS, the contraction of the dairy herd eventually reduces beef production, despite high beef prices. The drop in beef production generates additional demand for beef imports. Poultry, and to a lesser extent pork, production expands in the NMS in response to higher domestic prices, but meat consumption declines in most of the acceding countries, leading to

some growth in net exports. The impacts of higher livestock prices are mitigated by higher feed crop prices in some countries.

In contrast to milk and sugar, the supply of grains and oilseeds expands in the NMS, pushing down EU-15 prices and eventually putting downward pressure on world prices. Rising domestic prices in the NMS and the introduction of CAP payments for some commodities incite producers to expand crop production. Starting in 2008, the introduction of set-aside requirements constrains supply growth. The increases in prices for the NMS are large for some commodities. For example, corn prices increase by 37% in Poland and 44% in Hungary, and the wheat price increases by 33% in the Czech Republic. However, substitution effects cause production of some crops to decline, notably wheat and barley in Poland.

Food use of wheat and corn is slightly higher in the outlook period because of lower prices. Despite declining absolute prices, the food use of barley falls in the latter half of the scenario because barley prices rise relative to wheat and corn. Wheat feed use decreases throughout the outlook period, but lower animal inventories do not reduce corn and barley feed consumption until 2008. Figure 2 illustrates the changes in feed use and animal unites in the enlarged EU. EU-15 net exports of wheat decrease throughout the outlook period, and corn net imports increase because of lower domestic supplies. Barley net exports mirror feed demand patters, increasing after 2008 as feed use declines.

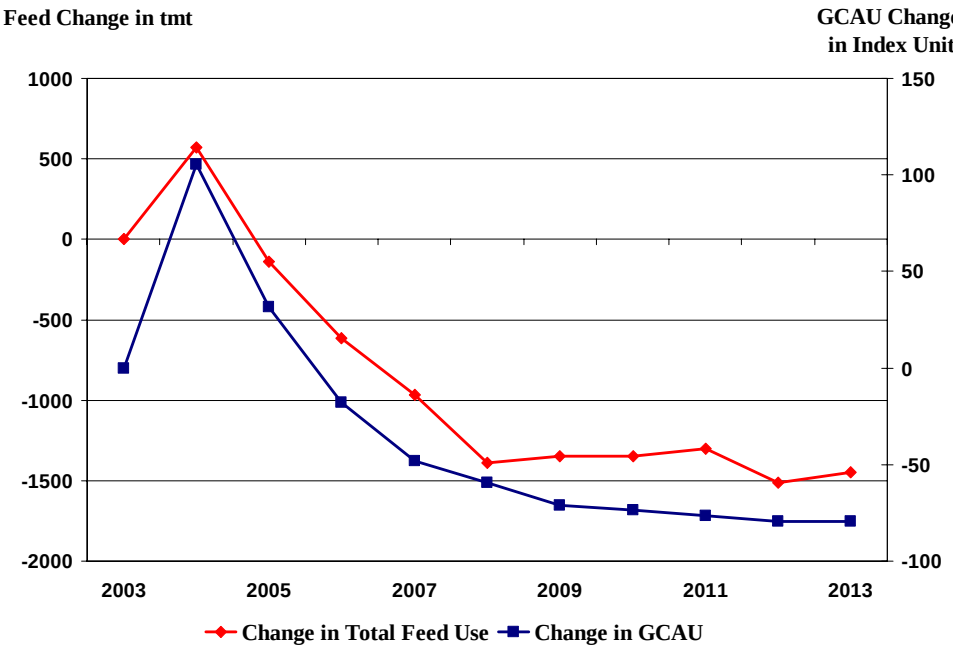

Figure 2. Enlargement: change in feed use and grain consuming animal units in the EU-25.

Before enlargement the domestic prices for sunflower seeds, meal and oil in the NMS were 4% below the EU level. Upon accession this difference is phased out over three years. The domestic price of sunflower seeds in the NMS decreases in the first year, along with world prices, because production responds strongly to the new area payments. In the following years, as domestic prices in the NMS approach EU-15 prices, this convergence

effect becomes dominant, and NMS prices rise above the baseline. After 2007/08 the domestic price for sunflower seeds in the NMS increases in step with the world price. Domestic prices of sunflower meal and oils increase throughout the entire outlook period because they rise to the EU level. These price changes in sunflower seed markets are extremely modest. A similar dynamic occurs in the rapeseed complex in the NMS, but with effects of even smaller magnitude.

The crush margins for sunflowers and rapeseed increase during the entire outlook period relative to the baseline, leading to an expansion in sunflower and rapeseed oil and meal production. The production growth is larger in the first three years, driven by price convergence effects. The NMS produce and use few soybeans compared to the EU-15; consequently, the small changes arising in the NMS are dwarfed by the stable market situation in the EU-15. Nevertheless, the enlargement causes a shift in sourcing consumption from domestically produced rapeseed and sunflower oil to imported soybean oil. This change is driven by the soybean oil tariff reduction and price convergence for sunflower and rapeseed oil toward EU levels. Imports of soybean meal and oil expand relative to the baseline, but sunflower oil imports fall and rapeseed oil exports increase.

One factor that may influence the results of this scenario is the explosive growth in biodiesel in the EU. The 2003 Biofuel Directive set indicative targets for biofuel consumption in the EU (Directive 2003/30/EC). Given that biodiesel makes up the major share of the EU's biofuel production, rapeseed production in the EU New Member States will be affected by the Directive guidelines. Currently, EU New Member States do not have the crushing capacity to produce enough rapeseed oil, and therefore biodiesel, to meet the Biofuel Directive's targets. However, with the increasing interest in expanding crushing capacity and biodiesel production, the EU rapeseed production and use may result in higher levels than indicated by the enlargement scenario.

CONCLUSION

We analyzed the effects of the recent CAP reforms and enlargement to include the ten NMS, on the EU-15, the NMS, and world agricultural markets, using the FAPRI multimarket models. A qualified much-ado-about-nothing applies for the two scenarios, depending on where one looks for impacts. The CAP reforms and EU enlargement are essentially an EU matter in the sense that both reforms have little impact on world markets. The CAP reform's impact on the aggregate EU-15 has a limited impact as well, except in the beef and rice sectors. This outcome is comparable to results obtained by the OECD (2004) and Gohin and Latruffe's (2006) partial decoupled scenario. By aggregation we abstract from potential strong country-specific effects as allowed in Dixon and Matthews (2007).

However, our analysis does show big impacts induced by the enlargement within the enlarged EU. This is particularly true in the NMS as a result of policy changes and price convergence, especially in dairy, sugar and corn markets. The accession and associated policy reforms have a large impact first on NMS for commodities falling under supply control such as dairy and sugar. The supply contraction in these sectors causes corresponding increases in prices. Dairy quotas in the NMS have some important repercussions for the beef market, first increasing supply with the culling of the dairy herd but then later reducing the supply of beef.

Second, new policies induce grain prices to increase substantially in most NMS, increasing the cost of meat products and reducing grain use. The impact of enlargement on EU-15 agriculture is moderate for most crops.

The more important implications of CAP reforms and enlargement for international markets may be the indirect effects of these events on trade liberalization negotiations. The CAP reforms have clearly improved the EU's ability to participate in international negotiations by preparing markets in advance for the likely reduction in domestic support and export subsidies that will be part of an eventual Doha agreement. Nevertheless, depending on depth of cuts to domestic support and export subsidies, the 2003 reforms may not be sufficient to achieve the agreement's liberalization objectives, and further reforms may be necessary (FAPRI, 2005). Given that political goodwill has been expended to pass the Midterm Review reforms, it is conceivable that further cuts in farm support and protection may be unpalatable to EU farm interests.

The 2003 CAP reforms were also intended to construct a fiscally sustainable agricultural policy for an enlarged EU, and in that sense, the enlargement process acts as a catalyst for policy change. Likewise, planned expansions of the EU to include Bulgaria, Romania, Croatia, and eventually Turkey may also put the CAP under pressure for further reform (Swinbank, 2005). A negative aspect of EU expansion under the CAP is the increasing number of producers that participate and become vested in a highly codified domestic support scheme. In the future, the resistance to reforms that effectively reduce producer support may increase. Successive expansions of the CAP through EU enlargements may benefit international markets and the trade liberalization process if they lead to further reforms with real reductions in producer support. However, entrenching a growing number of producers in a system of subsidy and protection may also lead to deadlock and a breakdown in the existing liberalization process.

Last we also noted that consumers in NMS face higher consumer prices for a series of food goods. Consumers are also likely to experience improved quality in consumption goods (Rau and van Tongeren, 2007), although we did not investigate this point in our analysis.

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THE 2003 MID-TERM REVIEW OF THE COMMON AGRICULTURAL POLICY: A COMPUTABLE GENERAL EQUILIBRIUM ANALYSIS FOR IRELAND

Janine Dixon [*] ***and Alan Matthews***
Department of Economics, School of Social Sciences and Philosophy, Trinity College, Dublin, Ireland. *

ABSTRACT

Irish agriculture is very dependent on direct payments financed by the EU's Common Agricultural Policy (CAP). This paper investigates the likely impact on the level and structure of Irish agricultural output arising from the Luxembourg Agreement Mid-Term Review (MTR) of the CAP in 2003 which led to the decoupling of these payments. The results project that, *ceteris paribus*, there will be a fall in agricultural output as a result of the MTR but that aggregate farm value added will be little affected in the longer run. However, there will be a significant reshuffling of agricultural resources away from activities that previously benefited from coupled direct payments as well as a clear trend towards production extensification. Sensitivity analysis shows the importance of the assumed parameter for the elasticity of export demand in determining the impacts on value added and the composition of output.

Keywords: Agricultural policy reform, Common Agricultural Policy, decoupling, Ireland.
JEL: Q18.

INTRODUCTION

This paper presents an analysis for Ireland of the economic effects of the Luxembourg Agreement Mid-Term Review (MTR) reform of the EU's Common Agricultural Policy (CAP) agreed in June 2003 (CEU, 2003), using a computable general equilibrium (CGE) model of the Irish economy. The major feature of this reform was to decouple from production the direct payments introduced to compensate farmers for reductions in administered prices under previous CAP reforms. These direct payments were replaced by a Single Farm Payment (SFP) for which eligibility is determined solely by compliance with

[*] Corresponding Author: Dr. Janine Dixon, Department of Economics, School of Social Sciences and Philosophy, Trinity College, Dublin 2, Ireland, Email: Janine.dixon@exemail.com.au

statutory requirements relating to the environment, food safety and animal welfare and by the obligation to maintain land in good agricultural and environmental condition. Individual member states were given various options in implementing the MTR (CEU, 2003). Ireland opted to implement full decoupling on a historic basis by the earliest possible date on January 1, 2005. We report results for the projected changes in the level and structure of agricultural output, employment, land use and value added, as well as for aggregate GDP, as a result of the MTR reforms.

Ireland is a particularly interesting case study because of the importance of the agri-food sector of its economy and its very high dependence on CAP direct payments. In 2003, the agricultural and food processing sectors accounted for 9.5% of GDP and 9.2% of total employment (DAF, 2005). Irish agriculture is largely grass-based (over 90% of its utilized agricultural area is devoted to grass) and livestock production, of which beef, dairying and sheep are the most important components, accounted for 73% of the value of output at producers' prices (i.e., excluding direct payments) in 2003 (DAF, 2005). Compensatory direct payments in that year amounted to €1.1 billion, compared to a total value of agricultural output at producers' prices of €4.8 billion and an operating surplus of €2.2 billion (CSO, 2004).[1] Almost half of the 2003 agricultural operating surplus thus consisted of direct payments coupled to production, leading to distortions in farm output decisions.

The distribution of direct payments within the agricultural sector contributed further to distortions. The premia paid to cattle farmers comprised around two-thirds of direct payments, although cattle output, valued at producer prices, comprised less than one-third of agricultural output (table 1). Grains received the highest rate of subsidy, with the direct payment adding an extra 78% to the value of output. Sheep production was also heavily subsidized, while other agricultural activities received no direct support under Agenda 2000.[2] National Farm Survey data show that all direct payments (including those not affected by the MTR, see footnote 1) amounted to 149% of family farm income on cattle rearing farms, 178% of farm income on other cattle farms, 121% of farm income on sheep farms, and 92% of farm income on mainly tillage farms in 2003 (Connolly, Kinsella and Quinlan, 2004).[3] We would expect the decoupling of these payments from production of specific farm enterprises to have significant repercussions for the behavior of farmers and their use of agricultural resources.

Widespread interest in the MTR has spawned numerous studies of its anticipated effects (CEC, 2003a, 2003b; Frandsen, Gersfelt and Jensen, 2003; OECD, 2004). Previous Irish studies have used both partial equilibrium econometric and programming models (Binfield et al., 2003; Breen, Hennessy and Thorne, 2005; Garvey, McInerney and Cuddy, 2004; Fabiosa et al., 2007). This study is the first to assess the MTR impact for Ireland using a CGE model.

[1] Compensatory payments include livestock premia and arable aid payments. In addition, Irish producers receive direct payments under a range of other schemes, including headage payments, agri-environment payments and forestry premia. The total value of direct payments to Irish farmers in 2003 was €1.6 billion (DAF, 2005).

[2] Agricultural production in Ireland also benefits from market price support under the CAP as a result of high import tariffs, export subsidies and intervention support. Apart from a reduction in dairy product intervention prices, this aspect of Irish agricultural support was not affected by the MTR.

[3] Direct payments account for more than 100% of family farm income whenever market based output is not sufficient to cover total costs.

Table 1. Composition of Agricultural Output in 2003 and Projected Changes Arising from the MTR

	Value of Output at Producers' Prices, €m	Value of Direct Payments, €m	Projected Change in Output Volume as Result of MTR, %	
			Short Run	Long Run
Agriculture				
Milk	1166.0	0.0	0.76	0.55
Cattle	1244.0	695.0	-15.44	-18.60
Calves	341.7	0.0	-16.85	-20.24
Sheep and Wool	231.0	109.0	-15.45	-15.93
Pigs	283.1	0.0	14.02	5.13
Poultry	137.2	0.0	14.02	5.13
Horses	213.7	0.0	15.34	9.07
Grains	171.7	133.7	-41.76	-52.77
Fruit and Vegetables	233.5	0.0	15.52	3.67
Sugar	75.6	0.0	0.00	0.00
Potatoes	98.7	0.0	13.15	6.86
Other Crops	87.0	0.0	14.81	4.51
Forestry	390.5	0.0	5.38	10.06
Processed Food				
Beef	2323.5	0.0	-14.49	-17.54
Sheepmeat	325.6	0.0	-11.95	-12.48
Pork and Poultry	882.5	0.0	14.87	6.56
Milk Products	3136.5	0.0	0.00	0.00
Animal Feed	741.5	0.0	-0.12	-4.20

Source: CSO (2004) and authors' calculations.

The next section describes the simulation performed. This is followed by a brief overview of the IMAGE2 model used for the analysis. The results are then presented, followed by a sensitivity analysis. The conclusions highlight the main findings of the paper.

MID-TERM REVIEW SIMULATION

The key aspects of the MTR simulated in this paper are: i) full decoupling of support in the cattle, sheep, and grains sectors; ii) reduction in the intervention price for dairy products, and compensatory payment, and iii) changed export conditions faced by Ireland, due to the implementation of the MTR in the rest of the EU.

One feature of the MTR which is not modeled is modulation, or the gradual reduction in subsidy payments to larger farms. The CGE model used does not allow distinction between farms based on their size or other characteristics. Nor does the study incorporate the effects of other policy changes, such as nitrogen limits under the Nitrates Directive due to come into force in 2006, nor any changes in tariffs which might emanate from a successful conclusion of the Doha Round trade negotiations of the World Trade Organization. Thus, the results from the simulations are comparative static. That is, the simulations show how the economy would

have been different from its initial position (its position in 2003), if the policy measures in the MTR had been in existence at that time.

Decoupling is modeled by removing the direct payments, to simulate farm decision making in an undistorted market. Following Frandsen, Gersfelt and Jensen (2003), the decoupled SFP is modeled as a subsidy to agricultural land, which may be used to produce any agricultural commodity (apart from fruits and vegetables, see CEU 2003), or forestry. The subsidy is paid at a flat rate, to eliminate policy induced distortions in farm decision-making. The rate at which the subsidy is paid is calculated such that the reallocation of the subsidy is budget neutral. The decoupled payment is linked to land to reflect the condition of cross-compliance, that land must be maintained in good agricultural condition.

The intervention price for dairy products is reduced, compensated by an increase in the SFP. The Commission's medium term forecasts are for the price of butter to fall by 11.2% by 2006 and 23.4% by 2009, and the price of skimmed milk powder to fall by 0.7% by 2006 and 4.8% by 2009 (CEC, 2003b). Using weighting coefficients for Irish dairy produce, the corresponding fall in the price of Irish milk products is 5.3% by 2006 and 12.9% by 2009, applied in the model as short run and long run shocks, respectively. From 2006 onwards, compensation is paid at €3.65 per liter. This amount is simply modeled as a transfer from the EU budget to farm households.

Under the MTR, agricultural producers in the EU face similar policy changes to Irish producers. Given that around three-quarters of Irish exports of agri-food produce are destined for the EU, and almost 90% of Irish imports of beef and sheepmeat come from within the EU, it would be inaccurate to assume that there is no change in external trade conditions. The effect of the implementation of the MTR elsewhere in the EU is captured by exogenous changes to export and import prices faced by Ireland, based on DG Agri analysis of the MTR (CEC, 2003a and 2003b). A similar shock is not applied to the price of exports of grains to the EU, because the CEC studies do not predict large changes in prices for the main Irish grain crops, barley and wheat.

THE MODEL

The analysis uses the IMAGE2 model (*I*rish *M*odel of *A*griculture *G*eneral *E*quilibrium version 2), which is a comparative static, general-equilibrium, single region model of the Irish economy (see Dixon, 2006 for a detailed description of the model). It is part of the ORANI-G family of economic models, which originated in Australia (Dixon et al. 1982;, Horridge, 2003) and which have now been used in many countries. The model is written and solved using GEMPACK (Harrison and Pearson, 1996).

Characteristic of CGE models, IMAGE2 assumes rational economic agents, including profit-maximizing producers and utility-maximizing consumers. There is a high level of disaggregation, particularly in the agricultural and food processing sectors. There are 66 commodities and 65 industries identified in the model, of which 14 commodities and 13 industries relate to the agriculture and land use sector, and 7 commodities and industries relate to food processing. The close link between dairying and beef production in Ireland is captured by allowing the Milk sector to produce both milk and calves, a proportion of which are transferred for rearing to the Cattle sector. Sales of milk to the Dairy Sector for processing

are limited by quota. Further, multiple types of households, export destinations, soil types and labor occupations are identified. The database for the model depicts the Irish economy in 2003, the year in which the MTR was agreed, based on statistics from the Irish Central Statistics Office and Department of Agriculture and Food.

Employment in agriculture is modeled as a combination of two types of workers: immobile workers, who are employable in the agriculture sector only, and mobile workers who are also employable outside the agriculture sector. While labor supply is assumed to be fixed, voluntary unemployment is built into the model, with aggregate employment falling in response to lower wages.

The Irish economy and the rest of the world are linked via import demand and export supply functions. As a small country, changes in Irish demand for imports are assumed to have no impact on world market demand, therefore import prices are assumed exogenous. The Armington assumption governs preferences, so imports are assumed to be imperfect substitutes for domestic products. Exporters have a small degree of market power, with export demand elasticities of -20 assumed for most agricultural commodities. The model allows some divergence in price between the local and export markets, via a CET structure.

The MTR simulation is run twice, using short-run and long-run closures for the IMAGE2 model. The main differences between the closures concern the allocation of resources. In the short run, the total capital stock in the agriculture, manufacturing, and services sectors is fixed (although mobile between activities *within* each sector). Changes in land use are also constrained by the imposition of sluggish land mobility, which relaxes the requirement that the return to land from all activities is equalized. Therefore, the main driver of changes in sectoral resource allocation in the short-run simulation is movements in labor. In the long run, the economy-wide capital stock is fixed but sectoral capital is endogenous. Time is also presumed sufficient for the return to land to equalize across all activities. As a result of these assumptions, the long-run impacts are generally larger.

RESULTS

Economy-Wide Results

The MTR leads to the reallocation of resources, across the economy and in the agricultural sector in particular. Despite the importance of the agri-food sector in the Irish economy, the economy-wide effects of reform are minimal. The primary agricultural sector contributes only 2.7% to Irish GDP (CSO 2004), and there is no change in the factors of production available to the economy, although the level of employment can vary. Hence the change in real GDP is negligible.

Several aspects of the MTR exert a positive influence on GDP. The increase in EU prices for Beef and Sheepmeat has a positive effect on Ireland's terms of trade. The compensation package in the dairy reform exceeds the loss in value added in the short run, so there is a further gain from the substitution of market price support (which is partly funded by Irish consumers) by the decoupled compensation payment (which is fully funded by the EU taxpayer). Decoupling also has a positive impact by improving allocative efficiency within the agricultural sector. However, decoupling also decreases the return to labor in the

agricultural sector, which discourages labor supply, particularly amongst immobile agricultural workers. This translates into a small reduction in the national workforce of 0.05% and exerts a negative influence on GDP. The net effect in both the short run and the long run is an increase in real GDP of 0.03%.

Results for the Land Use and Food Processing Sectors

The removal of production-based subsidies reduces the incentive to employ resources in the agricultural sector, diverting the mobile factor, labor, away from agriculture and into other uses. In the short run, aggregate agricultural output falls by 5.6%, with a fall in labor input of 11.8%. Decoupling alone accounts for a fall in agricultural output of 6.1%, which is slightly offset by a small increase in output as a result of the improved terms of trade for agricultural products. In the long run, when the capital stock in the agricultural sector also has time to adjust, agricultural output falls by 9.5%. Capital used in agriculture falls by 9.4%, and labor falls by 12.9%. In the land use sector (including both agriculture and forestry), the fall in agricultural output is offset by a small increase in the output of forestry. Output falls by 4.7% in the short run, and 7.9% in the long run.

Changes in the composition of output in the land use sector are also dominated by the decoupling shock, with relatively small effects as a result of dairy reform and the implementation of the MTR in the rest of the EU. As a result of decoupling, there is a fall in the output of products which initially received direct payments. The effect on output can be seen in table 1. In the short-run, the output of cattle falls by 15.4%, calves by 16.8%, sheep by 15.5%, and grains by 41.8%, with even larger reductions in the long run. Resources released from the previously subsidized activities underpin the expansion of output of Other Livestock, Fruit and Vegetables, Other Crops, and Forestry, even though the area under Fruits and Vegetables does not benefit from the SFP. A similar effect would be seen in Milk production, except that the quota system remains in place.

Cattle and Beef

Looking more closely at the short-run results for the Cattle and Beef sectors, decoupling alone accounts for a fall of 17.1% in the output of cattle, which is slightly offset by the positive improvement in net export prices resulting from the trade effect, for a net fall of 15.4%.[4] Output of the Beef sector falls by 14.5%; the stimulus provided by the improved export price for beef provides for a 1.9% increase in beef output, which slightly dampens the fall of 16.4% which occurs as a result of decoupling alone. In the long run, the fall in Cattle output is 18.6% and in the Beef sector 17.5%.

The change in the composition of value added in the cattle sector is illustrated in table 2. Because alternative uses for land are limited, especially in comparison to the alternative uses for labor and capital, the fall in land use is disproportionately small, representing

[4] The results reported in this section refer to the Cattle industry which produces both Cattle and Calves and not just the commodity Cattle, which explains the differences in the reported output changes for Cattle between Table 1 and Table 2.

extensification of beef production. Land use is reduced by 5.7% in the short run, although output contracts by 15.4%. Thus the ratio of land to output increases by approximately 9.7%. In the long run, as more capital moves away from the cattle sector, land use falls further. The fall in labor input is commensurate with the fall in output, in both the long and short run.

Table 2. Changes in Value Added in Cattle and Raw Milk Sectors, Short and Long Run, Percent

	Cattle		Raw Milk	
	Short Run	Long Run	Short Run	Long Run
Output	-16.85	-20.24	0.76	0.55
Capital	-17.96	-26.22	-0.44	-7.93
Labor	-19.05	-20.81	-1.14	-0.62
Land	-5.69	-7.81	7.39	14.68

Dairy Sector

In the dairy sector, production is constrained by the dairy quota, which remains binding despite the cut in the intervention price. There is a very small increase in raw-milk output for farm and household use (table 2), but no change in the output of processed milk. Results for price changes are more interesting. Unprocessed (raw) milk is produced on the farm and sold to the milk processors, who produce processed milk. The quota is a constraint on the sale of unprocessed milk to the milk processing industry. The basic price of unprocessed milk, defined as the producer price plus subsidies minus taxes, reflects its cost of production, and represents the incentive for farmers to produce. It does not include quota rent, which is considered super-normal profit. The purchaser price of unprocessed milk sold to the milk processing industry includes quota rent. The basic price of processed milk reflects the production costs of processed milk, including quota rent.

In the short run, dairy market reform, or the cut in the intervention price, is reflected in the reduction of 4.6% in the basic price of processed milk (table 3). The price cut for processed milk is almost entirely passed on to unprocessed milk, and not to the factors of production used in processing milk. Thus the purchaser price of unprocessed milk sold to the milk processing industry falls by 9.4% as a result of the dairy reform. Quota rent, or supernormal profit which occurs as a result of the quota policy, is estimated to be worth approximately 20% of the value of unprocessed milk output (INRA-University of Wageningen Consortium, 2002). Therefore, the 9% reduction in price, with negligible change in the cost of milk production due to dairy reform, eliminates 41.8% (approximately 9% of 20%) of the value of quota rent. Supernormal profits remain, albeit reduced, as the quota remains binding and milk output does not fall.

Thus, dairy reform alone would leave the basic price of unprocessed milk almost unchanged. However, decoupling of direct payments exerts significant downward pressure on the price of agricultural factors of production, leading to a decrease of 17.5% in the basic price of unprocessed milk. Because milk output cannot expand, the decreased costs are reflected in an increase of 60.9% in quota rent, while the price of unprocessed milk used by the milk processing industry hardly changes.

Table 3. Decomposition of Short and Long Run Price Changes for Raw and Processed Milk, Percent

	Short Run				Long Run			
Cause	Dairy	Decou-pling	Trade	Total	Dairy	Decou-pling	Trade	Total
Basic Price, Processed Milk	-4.61	-0.05	0.00	-4.66	-11.35	-0.11	0.01	-11.45
Basic Price, Unprocessed Milk	0.03	-17.46	1.26	-16.18	-0.06	-16.96	1.11	-15.91
Purchaser Price, Unprocessed Milk Used by Milk Processing Industry	-9.37	0.14	-0.01	-9.25	-22.96	0.11	-0.01	-22.86
Quota Rent	-41.81	60.86	-4.40	14.66	-102.0	59.01	-3.86	-46.83
Primary Factor Price Index, Production of Unprocessed Milk	7.05	17.58	0.58	25.21	-8.19	14.86	0.62	7.29

When the trade effect is included, the decoupling effect dominates the change in the basic price of unprocessed milk, a fall of 16.2%, reflecting the reduced pressure on agricultural resources from the formerly subsidized cattle producers. The purchaser price of unprocessed milk used by the milk processing industry falls by 9.3%, mainly as a result of the reduced intervention price. The difference between the fall in the basic price and the fall in the purchaser price is reflected in increased quota rent of 14.7%.

The primary factor price index reflects returns to capital, labor, and land, as well as supernormal profits from quota rent and the compensatory dairy payment of €185m. The payment more than compensates for the reduction in the intervention price in the short run, increasing returns to primary factors by 7.1%. Dairy incomes are further improved by decoupling, which increases returns by 17.6%. The total change in dairy incomes, including a small effect from trade, is an increase of 25.2%.

The analysis for the long run changes in the price of raw and processed milk is similar. However, in the long run, the cut in the intervention price is much greater, at 12.9%, which translates into a fall of 23.0% in the price of unprocessed milk. Because quota rent is assumed to be worth approximately 20% of the value of output of milk, this would lead to the complete elimination of quota rent. If the dairy reform were the only aspect of the MTR, the quota would cease to be binding. However, the decoupling and trade effects are positive for quota rent. Hence, the quota remains binding, and the primary factor price index increases by 7.3%.

Although output of raw milk changes very little, the composition of value added in milk production does change, as shown in table 2. In the short run, milk production becomes more extensive in land use. The degree of extensification increases further in the long run. In the short run, there is a small decrease in the use of labor and capital in milk production. In the long run, the decrease in the use of capital is much more pronounced, because there has been sufficient time for the capital stock to adjust.

Farm Income

Given that most factors of production used in agriculture are owned by farm households, Gross Value Added at factor cost (GVAF) is used as a proxy for farm income. In the short run, there is an increase of 3.5% in GVAF in the land use sectors (table 4).

Table 4. Decomposition of the Short and Long Run Change in Gross Value Added at Factor Cost in Land Use Sectors, Percent

	Short Run				Long Run			
Cause	Primary Factor Price Index (a)	Output (b)	(c)= (a)+(b) [1]	GVAF (d)	Primary Factor Price Index (e)	Output (f)	(g)= (e)+(f)	GVAF (h)
Dairy Market Reform	2.34	0.01	2.35	2.30	-2.66	0.04	-2.62	-2.55
Decoupling	4.10	-5.11	-1.00	-1.00	9.14	-8.64	0.50	0.84
Rest of EU implements MTR	1.79	0.38	2.17	2.18	1.38	0.66	2.03	2.00
Total	8.24	-4.72	3.52	3.48	7.85	-7.94	-0.09	0.29

[1] This gives a good approximation to GVAF.

Dairy market reform has a positive effect on GVAF in the short run, but a negative effect in the long run. This is because, in the short run, the fall in the intervention price is smaller, although the compensatory payment is exactly the same. In the short run, the compensatory payment outweighs the negative effect of the fall in the intervention price, for a clear increase in the profitability of dairy farming.

The positive impact from the implementation of the MTR in the rest of the EU is not surprising, given the terms of trade improvement. However, the exact magnitude of this result depends on the exogenous shocks assumed for export prices, which were based on the forecasts from DG-Agri (CEC 2003a and 2003b), unlike the decoupling and dairy market reform scenarios which were based on actual policy announcements.

The short run increase in value added in the land use sectors of 3.5% occurs despite a reduction in output of 4.7%. The increase is due to the compensatory payment to dairy farmers and the assumed improvement in trade conditions, and not to decoupling. The effect of decoupling on aggregate agricultural incomes is almost negligible, with fewer resources remaining in agricultural production, but commanding a higher return.

GVAF in the land use sectors increases by 0.29% in the long run. In the long run, the primary factor price index for land use sectors increases by 7.9%, while the use of primary factors varies proportionately with output in the land use sectors, falling by 7.9%, for approximately no change in value added at factor cost.

Employment

Reduction in employment in agriculture of 11.8% in the short run and 12.9% in the long run is found to be a combination of three factors: a reduction in employment of immobile workers which are only found in agriculture, a reduction in aggregate employment of mobile workers, and increased non-agricultural employment of mobile workers. In both the short and long run, the majority (10.5% and 11.4% respectively) of the change in employment is attributable to the movement of mobile agricultural labor into employment outside the agriculture sector. A fall in aggregate employment may occur as a result of the same number of workers choosing to work fewer hours, or as a result of a reduced labor force, or a combination thereof. The model results do not distinguish between these cases. Note that unemployment of mobile agricultural workers has a negligible effect, indicating that workers can remain employed if they are willing and able to enter other sectors. The reduction in employment, combined with the increase (in the short run) or stability (in the long run) of gross value added from farming activities implies a significant increase in value added per labor unit in agriculture as a result of the MTR.

SENSITIVITY ANALYSIS

The parameters used in the IMAGE2 model are an important determinant of the results presented above. In this section, the sensitivity of these results to the export demand elasticity is examined. Demand elasticity is particularly important in determining the effect of the MTR on agricultural incomes, as illustrated in figure 1. On the left, the trade effect is shown as an upward shift in the demand curve for agricultural products, from the initial position at point A (the original demand curves have been omitted to avoid cluttering the diagram). Under the relatively high export demand elasticity, demand curve D_1, the increase in price and the quantity demanded is large. Conversely, if demand is assumed to be inelastic, as in demand curve D_2, the increase in quantity and price is small. Thus the lower is the elasticity of demand in absolute value, the lower is the increase in agricultural income.

The effect of decoupling is illustrated in the right hand diagram, where the removal of subsidies linked to production is represented as a leftward shift in the supply curve. From the initial position at point A, if demand is assumed to be elastic (demand curve D_1) agricultural income after decoupling would be less than if demand is assumed to be inelastic (demand curve D_2). This is contrary to the trade effect.

The sensitivity analysis around the demand elasticity was conducted by varying the export demand elasticities for Beef, Sheepmeat, and Pork and Poultry in the short-run simulation. These elasticities were chosen for two reasons. Firstly, exports comprise the major source of demand for these products. Secondly, the values for export elasticities are more open to debate than those for domestic demand. The “High” value for export elasticities is -20, which is the value used in the main simulation. The “Medium” and “Low” values are -5 and -1, respectively.

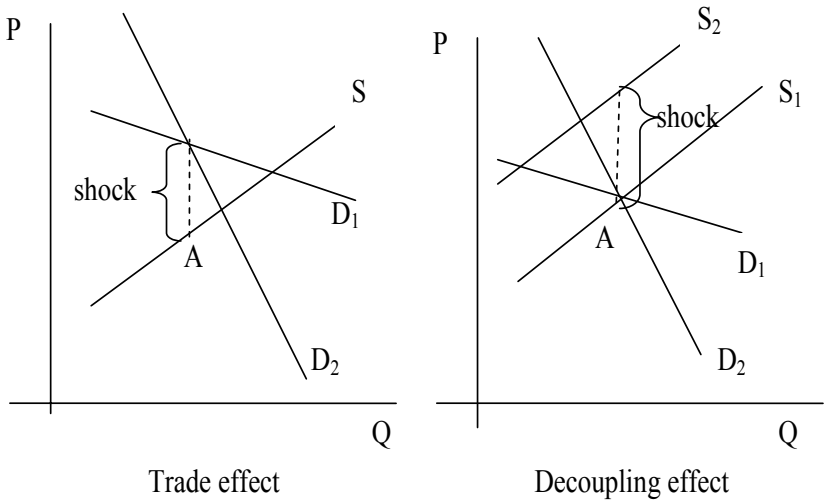

Figure 1. A demand shock (trade effect) and a supply shock (decoupling effect), under high and low demand elasticities.

Table 5. Decomposition of the Short Run Results for GVAF, Percent

Component of Shock	Elasticity of Export Demand	Primary Factor Price Index (a)	Output (b)	(a) + (b)	Value Added
Decoupling	*high*	4.10	-5.11	-1.00	-1.00
	medium	5.21	-4.83	0.38	0.47
	low	8.13	-4.09	4.03	4.21
Dairy	*high*	2.34	0.01	2.35	2.30
	medium	2.34	0.01	2.35	2.30
	low	2.34	0.01	2.35	2.31
Trade	*high*	1.79	0.38	2.17	2.18
	medium	1.57	0.33	1.89	1.90
	low	0.97	0.20	1.17	1.17
Total	*high*	8.24	-4.72	3.52	3.48
	medium	9.11	-4.49	4.62	4.67
	low	11.43	-3.88	7.55	7.68

Recall that in the main simulation (high elasticity), decoupling has a negative effect on GVAF. The sensitivity analysis shows that if a medium or low elasticity is assumed, the effect on value added is, respectively, almost neutral or positive (see table 5). This variation is significant in comparison to the sensitivity of the other components of the MTR. The trade shock has less impact on GVAF if a lower elasticity is assumed, while the effect of dairy reform is barely altered by assuming different demand elasticities. The analysis finds that if low export demand elasticities are assumed, the increase in GVAF would be 7.68%, more than double the increase reported in the main simulation. However, the export elasticity of -1

used in the low-elasticity simulation may be considered unrealistic, overstating the likely increase in agricultural value added.

Results for GDP, aggregate agricultural output, and agricultural employment (see table 6) appear to be insensitive to changes in the export demand elasticity. This is a reflection of the short-run assumption that land and capital are fixed in agriculture. The main determinant of aggregate agricultural output is the tendency for labor to move away from the sector, which is not significantly influenced by the elasticity of demand.

Under the lower elasticity of demand, price movements tend to be less extreme, with the agricultural basic price index falling by 15.2% in the low-elasticity case compared with 17.8% in the high-elasticity simulation. However, given the scale of variation in the elasticity parameter, the variation in this result is quite low.

Table 6. Selected Short Run Results Reported by Export Demand Elasticity, Percent

	Elasticity of Export Demand		
	High	*Medium*	*Low*
Real GDP	0.030	0.025	0.016
Agricultural Output	-5.62	-5.35	-4.61
Agricultural Employment	-11.80	-10.85	-8.88
Agriculture Producer Price Index	-2.65	-1.66	0.75
Agriculture Basic Price Index	-17.81	-17.08	-15.22
Cattle Output	-15.44	-13.45	-9.57
Pig Output	14.02	10.65	5.90

Output of Pigs and Cattle are included in the analysis as an indicator of the change in the composition of agricultural output. In the high-elasticity simulation, Cattle output falls by approximately 2.7 times the average fall in agricultural output. In the low-elasticity simulation, it falls by only 2.1 times the average fall, implying a less pronounced change in the composition of output. The increase in Pig output is correspondingly larger in the high-elasticity simulation. Therefore, while the elasticity of demand has a limited impact on the change in aggregate agricultural output, it does influence the composition, with the higher elasticity stimulating more pronounced increases and decreases in the output of individual commodities.

CONCLUSION

The high dependence of Irish agriculture on CAP compensatory direct payments, which accounted for almost 50% of the operating surplus of Irish agriculture in 2003, means that it is particularly exposed to the changes to these payments introduced in the CAP 2003 MTR. This paper projects that, abstracting from the other challenges facing the Irish agri-food sector, including more stringent environmental conditions and possible reductions in the level of market protection following a successful outcome to the Doha trade round, the decoupling of direct payments plus the revision of dairy-market policy will lower the volume of agricultural output by almost 10% in the long run. Because the coupled direct payments were

unevenly distributed across the main agricultural enterprises prior to the MTR, this fall in the overall level of output will be accompanied by substantial structural change. Production of the more heavily-supported beef, sheep and grains activities will fall, while unsupported activities such as pigs and poultry, fruits and vegetables, horses and forestry will expand.[5] Despite the reduction in support prices for dairy production in the MTR, there would also be an expansion in dairy production if the milk quota were not binding. Overall, there will be a significant extensification of agricultural production. The overall value of agricultural value added (including the new SFP) will be maintained despite the fall in output, and there will be a significant increase in the farm value added per labor unit as a result of the projected movement of agricultural labor from farm to non-farm employment. Nonetheless, these significant changes in the farm and food-processing sectors will have little overall effect on Irish GDP.

Other analysts have also projected that the MTR is likely to lead to lower agricultural output and a shift away from beef, sheep and grains (Binfield et al. 2003; Breen, Hennessy and Thorne 2005; Garvey, McInerney and Cuddy 2004). However, studies of farmers' intentions suggest they plan relatively limited adaptation in resource use in response to the MTR, and particularly the decoupling component (Breen, Hennessy and Thorne 2005; Hennessy and Thorne, 2005). It appears that a significant number of farmers intend to use their SFP to subsidize unprofitable production.

This does not seem credible when the impact of decoupling direct payments, which on the majority of the affected farms make up more than the family farm income, is more widely understood. In the past, farmers were forced to produce at a market-based loss in order to be eligible for payments which effectively accounted for the whole of their income from farming. Under the SFP, their only requirement is to maintain their land in good agricultural and environmental condition. Once this realization sinks in, we would expect to see the structural changes projected here take hold. Already, in the first year of the MTR, corroborating changes have occurred in the Irish agricultural sector, although it is always dangerous to draw conclusions on the basis of a single year's data. The total grains area was down -11% in 2005 compared to the previous year, barley output fell by 35% and wheat output by 31%. Cattle numbers fell by 1.8% and sheep numbers by 8.5% (CSO, 2006a and 2006b). The strong tendency for farmers to find off-farm employment has been evident for many years (Connolly, Kinsella and Quinlan, 2003), and the MTR together with the buoyant non-farm economy will continue to encourage farmers in this direction. However, for the time being, the SFP and the compensation for dairy farmers ensure that farm incomes are safeguarded.

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[5] Support here is used to refer to the receipt of compensatory direct payments. Forestry benefits from substantial premia payments and agricultural production continues to benefit from market price support which, apart from the reforms to the dairy regime, was hardly touched in the MTR.

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POLICY IMPLICATIONS OF THE DECOUPLING OF THE EU COTTON SUBSIDIES

Manuel Arriaza*[1] and José A. Gomez-Limon[2]

[1] Department of Agricultural Economics. IFAPA (Junta de Andalucía). Córdoba, Spain, Centro "Alameda del Obispo". Apartado 3092. 14080 Córdoba, Spain
[2] Department of Agricultural Economics. ETSIIAA Palencia. University of Valladolid, Spain, Avda. de Madrid 57. 34071 Palencia. Spain.

ABSTRACT

The reform of the cotton regime in the EU has meant the change from a guaranteed minimum price to a decoupled subsidy. Under the new scheme producers are entitled to 65 per cent of the amount received in the reference period irrespective of the crop chosen to grow. The remaining 35 per cent is paid as cotton area payment. Using an initial characterization of producers based on a survey of 835 producer, we assess the impact of two policy scenarios: (a) the implementation of the reform without any additional measures, and (b) the addition of a complementary, environmentally-based area payment plus the modulation of the decoupled subsidy according to raw cotton quality. In the first scenario, producers reduce inputs to a minimum and leave the raw cotton in the fields. In the second scenario, the production decreases by 30% with respect to the historic area.

Keywords: Cotton, Spain, EU, midterm reform, multi-criteria decision making.
JEL classification: Q11, Q18.

With an average area of 90,000 hectares and 9,200 farmers, cotton is the most important irrigated arable crop in Andalusia (Southern Spain). From a social point of view, the on-farm employment represents two thirds of the total farm labor used in irrigated extensive arable crops (Arriaza, Rodríguez, and Ruiz-Avilés, 2000). Although cotton production represents 3.8% of the final agricultural output of Andalusia (0.5% in the EU), there are some municipalities heavily specialized in this crop, resulting in local economies deeply linked to cotton production and processing.

Following the decoupling of EU cotton subsidies (EC No 864/2004 of 29 April 2004), the minimum guaranteed price (1,010 €/t) is replaced by a decoupled subsidy based on a fixed payment (1,509 €/ha). The decoupled subsidy represents 65% of the subsidies obtained during

* Corresponding Author: Manuel Arriaza. Department of Agricultural Economics. IFAPA Centro "Alameda del Obispo". Apartado 3092. 14080 Córdoba, Spain. Email: manuel.arriaza.ext@juntadeandalucia.es

the reference period (2000-2002) for an eligible area of 70,000 ha. In addition producers may receive an area payment (up to 1,039 €/ha) if the cotton crop reaches the open capsule stage. Since there are no additional compliance requirements, it will be more profitable for most producers to shift from the current production system (conventional production) to a semi-abandonment cotton production system (hereafter semi-abandonment production), which would involve a drastic reduction in, if not the elimination of, input use (fertilizers, pesticides and irrigation water) and harvested cotton. Since a minimum amount of seed without additional inputs or farming practices would suffice to reach the open capsule stage. From an environmental point of view, this option is close to the set-aside alternative but with a much higher area payment and some deadweight loss.

Within this framework, the objective of the paper is to analyze the foreseeable impacts of the implementation of subsidy decoupling and check the above hypothesis regarding the downsizing of the Spanish cotton sector. As an alternative to crop abandonment, a second scenario considers two additional policy measures under the new EU policy rules to explore the feasibility of growing quality cotton in a more environment-friendly and fiscally responsible manner. The first measure is a supplementary crop-specific environmental area payment to encourage a shift from conventional production to integrated production. Unlike conventional production, integrated production is regulated by the regional government to limit both agricultural practices and input levels, implying a reduction of approximately one third of the previous fertilizer and pesticide usage. This measure has already been implemented by the regional government with approximately 350 €/ha. The second measure is the modulation of the cotton area payment to a maximum of 50%, according to the quality of the raw cotton that producers sell to the ginning companies.

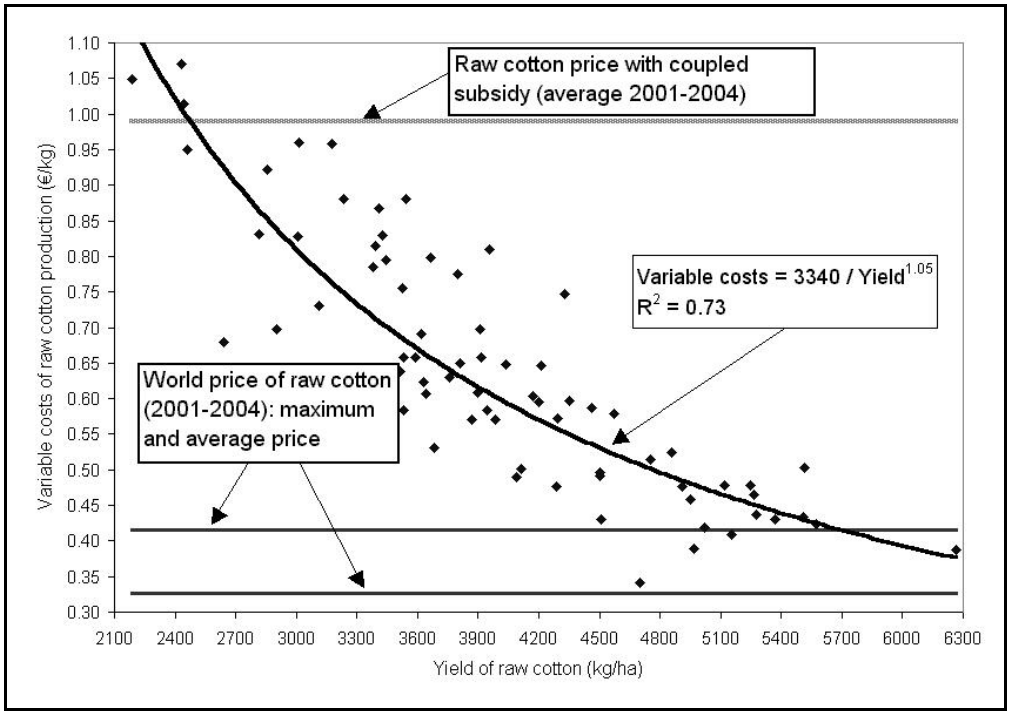
We find that in the first scenario, producers reduce inputs to a minimum and leave the raw cotton in the fields reducing Spain's effective cotton production to zero with dire implications for the local ginning industry. This result reflects the lack of competitiveness of most Spanish cotton producers in unfettered world markets under the conventional production system. In the second scenario, the production only decreases by about 30% with respect to the historical levels of sown area. This second policy menu represents a viable option to mitigate the cost of adjustment of the Spanish cotton sector in its transition to world markets while reducing the negative environmental consequences of cotton production.

ECONOMIC ANALYSIS OF COTTON CULTIVATION IN SPAIN

The database of an accounting company containing data on 125 farms for the seasons 1999/2000 to 2002/2003 was used to calculate average yields, variable costs and gross margins of cotton and other substitutive crops such as cereals, oilseeds, sugar beets and vegetables. The cotton output response to input dosage (water and fertilizer) was estimated from the Andalusian Agricultural Experimental Network (RAEA) trials. Finally, a mail survey targeting a census of cotton producers in Andalusia made it possible to build a typology of farmers to distinguish among different responses to agricultural policy scenarios according to individual utility functions. The survey was carried out in 2004 through the European Agricultural Guidance and Guarantee Fund (EAGGF) regional organism and had a response rate close to 10% (835 valid questionnaires).

Cotton Variable Costs by Yields

Statistical analysis of the data reveals that variable cost per kg of raw cotton depends on cotton yield, which itself depends on the farm irrigation system (gravity, sprinkle or drip) and the type of sowing (with or without plastic protection). Our analysis of the production variable cost, therefore, does not consider either farm size or any other structural characteristic, but exclusively cotton yields as shown in figure 1.



Source: Survey Data on variable cost and yield of 73 farms during the period 2000/01–2002/03.

Figure 1. Relationship between variable cost and yields in cotton cultivation.

The figure shows the average cotton producer price with the previous coupled subsidy and the inverse nonlinear relationship between variable costs and yields. For most cotton producers, the optimum strategy has been the maximization of production through yields increase. However, following the midterm reform, the lower price of raw cotton for EU producers in the 2006/07 season would not cover their variable costs. Even assuming the maximum world price in the 2001-2004 period, only producers with yields above 5,600 kg/ha would be competitive and produce. In the survey, which returned 835 valid questionnaires, only 2% of producers match this target. The initial conclusion becomes straightforward: unless some mitigating measures were introduced, Spanish cotton production would effectively end.

Decomposition of Variable Cost

Given that the decoupling of cotton subsidies will have a significant effect on the level of input usage, it is important to analyze the composition of the variable cost of cotton cultivation. Variable cost depends on yields which depend on the type of sowing technique and irrigation system. There are six types of cotton farms and cost structures in Spain, as shown in table 1.

Table 1. Structure of Cotton Variable Cost by Sowing Technique and Irrigation System (€/ha)

Group	Concept	Gravity		Sprinkle		Drip	
		No plastic	Plastic	No plastic	Plastic.	No plastic	Plastic
Purchase of inputs	Seeds	102*					
	Fertilizers	203					
	Pesticides	430					
	Materials	16	136	16	136	16	136
Crop tasks	Sowing	57	110	57	110	57	110
	Fertilization	35					
	Sowing; plastic handling	0	122	0	122	0	122
	Plowing	328					
	Irrigation	228	228	383	383	292	292
	Pesticide management	96					
	Harvesting	278	319	263	288	352	388
Misc.	Insurance, financial costs...	65					
Total variable costs (€/ha)		*1,838*	*2,174*	*1,978*	*2,298*	*1,976*	*2,307*
Yield (kg of raw cotton/ha)		*3,018*	*3,469*	*2,860*	*3,129*	*3,831*	*4,217*

Source: Survey Data from 125 farms during the period 1999/00 to 2002/03.
* Rows with only one data imply equal costs for all type of farms.

As the data suggest, pesticides and pesticide management are the most important costs, representing approximately one fourth of total variable costs. Pest management cost is followed in importance by ploughing, harvesting and irrigation costs, each of them ranging between 15% and 17% of the total. The use of plastic for the protection of the plants at the initial stages represents some 11% of the costs.

If the price of raw cotton price falls to a level similar to that of the world price, a significant reduction in use of plastic, fertilization, pesticides and irrigation can be expected. Even so, such a reduction would not bring average variable cost below the product price, so the rational decision would be to sow cotton with a drastic reduction of all inputs and not to harvest it in order to optimize the area payment of 1,039 €/ha, for which the only requirement is to bring the crop to the open capsule stage. This new activity is described in our study as "semi-abandonment".

Crop Profitability

Taking into account the variables costs of cotton and the average raw cotton price that farmers have received in the previous three years, table 2 shows that cotton cultivation has been a relatively profitable activity in comparison with other irrigated extensive arable crops in Southern Spain (mainly maize and sugar beet, see Annex table 1).

Table 2. Cotton Profitability in Spain in 2002-2004 with Coupled Subsidy

	Gravity		**Sprinkle**		**Drip**	
	No plastic	Plastic	No plastic	Plastic	No plastic	Plastic
Raw cotton yield (kg/ha)	3,018	3,469	2,860	3,129	3,831	4,217
Total variable costs (€/ha)	1,838	2,174	1,978	2,298	1,976	2,307
Sale of raw cotton (1.01 €/kg)*	3,048	3,504	2,889	3,160	3,869	4,259
Gross margin (€/ha)	1,210	1,330	911	862	1,893	1,952

* Average price received by Spanish farmers in 2002-2004 (Directorate-General for Agriculture).
Source: Yields from survey in 2004 and total variable costs from accounting data firm.

This higher profitability in comparison with maize and sugar beets has compensated producers for the higher level of risk associated with cotton production due to the fluctuations in world fiber prices and crop yields. In order to estimate the profitability of this crop in the future, we calculate the gross margin for the minimum, maximum and average prices for the past four seasons, as shown in table 3.

Table 3. Cotton Profitability of Conventional Cultivation after Decoupling of Subsidies

	Gravity		**Sprinkle**		**Drip**	
	No plastic	Plastic	No plastic	Plastic	No plastic	Plastic
Raw cotton yield (kg/ha)	3,018	3,469	2,860	3,129	3,831	4,217
Cotton fiber yield (kg/ha)	966	1,110	915	1,001	1,226	1,349
Farmer's total variable costs (€/ha)	1,838	2,174	1,978	2,298	1,976	2,307
Ginning costs (€/ha)[1]	363	417	344	376	460	507
Sale of cotton seed (€/ha)	261	300	247	270	331	364
Sale of cotton fiber -min pr- (€/ha)[2]	744	855	705	771	944	1,039
Sale of cotton fiber –aver pr- (€/ha)[2]	985	1,132	934	1,021	1,250	1,376
Sale of cotton fiber –max pr- (€/ha)[2]	1,255	1,443	1,190	1,302	1,594	1,754
Area payment (€/ha)	1,039	1,039	1,039	1,039	1,039	1,039
Gross margin -min pr- (€/ha)	*-157*	*-397*	*-331*	*-594*	*-123*	*-371*
Gross margin –aver pr- (€/ha)	*84*	*-120*	*-102*	*-343*	*184*	*-34*
Gross margin –max pr- (€/ha)	*354*	*191*	*154*	*-63*	*527*	*344*

[1] Ginning costs provided by two ginneries.

[2] World minimum price of 0.77 €/kg, average of 1.02 €/kg and maximum of 1.30 €/kg for the period 2001-2004.

The data in tables 1–3 enable us to draw some conclusions about the continuation of cotton production in Spain. First, most producers are not competitive on world markets; a cotton area payment of 1,039 €/ha and average world prices do not cover their variable costs.

Second, even for high world prices, only farms with drip systems would achieve a positive gross margin similar to that of maize. For other production systems, the gross margin is close to those of wheat and sunflower, both crops which have much lower production costs and more stable world prices.

Under these circumstances, current cotton production and related economic linkages and social externalities favoring rural development seem to be at risk, since cereal, oilseed and protein (COP) crop alternatives are more attractive from an economic and management point of view. The environmental intensity of agriculture would also decrease. However, the continuation of cotton in Spanish fields as a semi-abandonment production system does seem to be possible. Under this assumption, cotton would be sown and managed with minimum use of inputs, as shown in table 4.

Table 4. Economic Results for The Semi-Abandonment System of Cotton Production

Group of costs	Type of cost	% of cost reduction*	Sowing without plastic		
			Gravity	*Sprinkle*	*Drip*
Input purchase (€/ha)	Seeds	63	38	38	38
	Fertilizers	88	25	25	25
	Pesticides	88	54	54	54
	Materials	75	4	4	4
Crop tasks (€/ha)	Sowing	28	41	41	41
	Fertilization	50	18	18	18
	Sowing; plastic handling	50	0	0	0
	Ploughing	72	91	91	91
	Irrigation	58	95	159	122
	Pesticide management	88	12	12	12
	Harvesting	100	0	0	0
Misc.		67	33	33	33
Total variable costs			411	476	438
Gross margin (area payment – total variable costs)			628	563	601

* Average reduction from a panel of experts.

Given the gross margins in table 4, rational economic behavior would be to sow cotton and leave the crop in the field. This semi-abandonment of the cotton cultivation is slightly more profitable than sowing COP crops. However, this does not address the rural development dimension of cotton production, although environmental intensity of semi-abandonment would be much lower than for conventional cotton production.

Now that we have established the impact of the CAP reform on cotton production profitability, and thus how this new regulation actually jeopardizes the future of this sector, we attempt to simulate the productive behavior of cotton growers in order to quantify the foreseeable impact on areas sown to cotton and other related indicators.

METHODOLOGY

The methodology adopted by this study is graphically displayed in Figure 2. The proposed methodology is divided into four principal stages.

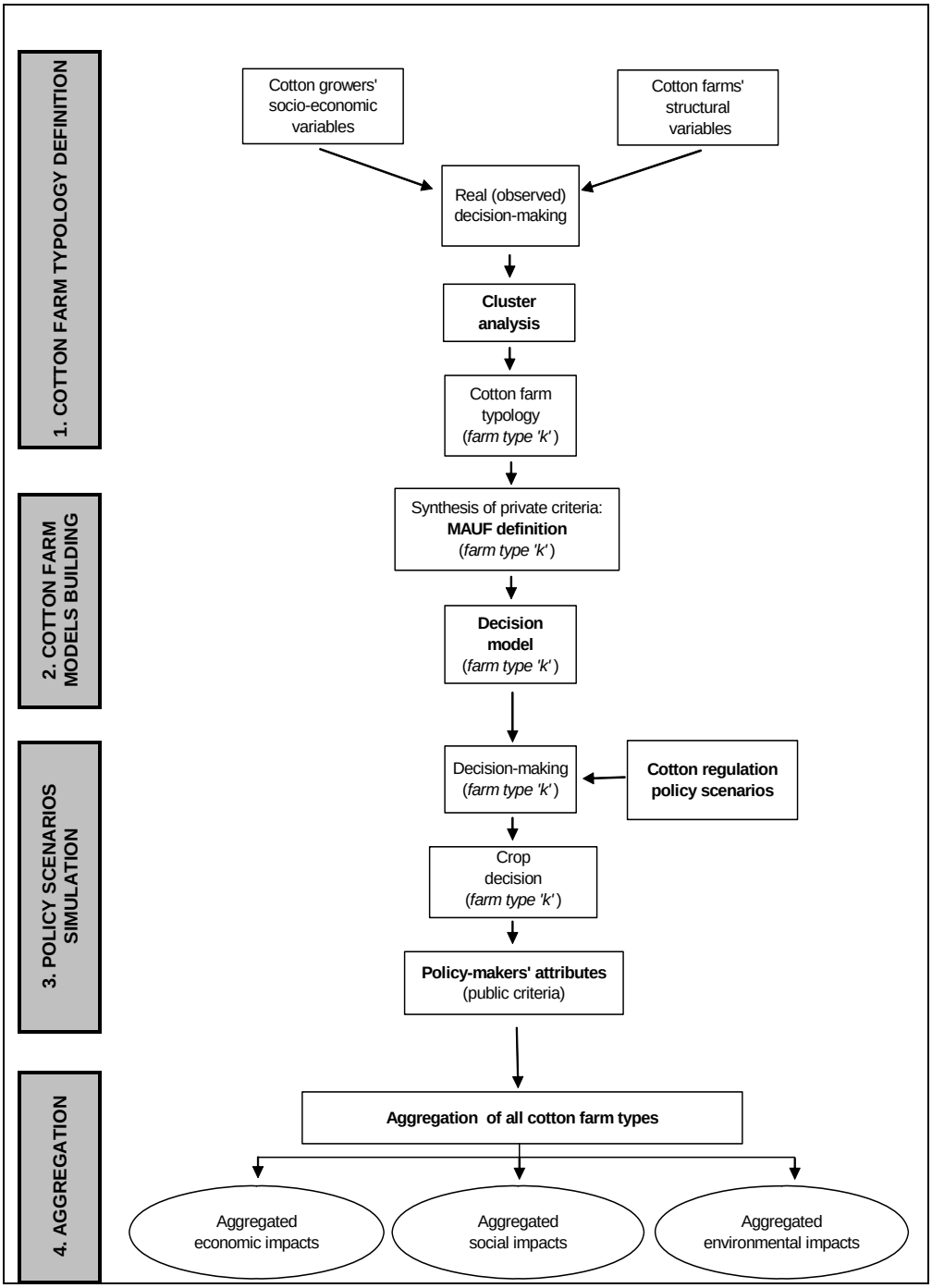


Figure 2. Outline of methodology.

The first stage differentiates among the different groups of cotton growers to be analyzed. These groups should be sufficiently homogeneous in their decision-making behavior (weighting of the objectives considered) to allow aggregate models to be constructed and resolved without unwanted bias. This classification of farmers is performed using cluster

analysis. Once homogeneous groups of farmers have been defined, *the second stage* builds the mathematical models. For each cluster a different multi-criteria model is developed, in order to allow independent simulations based on the decision-making behavior of the various groups of farmers. *The third stage* of the study performs the simulations. Thus, considering the design of the cotton sector scenarios already explained, the decisions taken by the clusters of farmers, i.e. crop mixes, were obtained in the different cases.

Multi-Criteria Programming Approach

Taking into account the evidence about how farmers make their decisions while trying to simultaneously optimize a range of conflicting objectives, we have proposed Multi-Attribute Utility Theory (MAUT) as the theoretical framework for the multi-criteria decision model (MCDM) programming technique to be implemented. MAUT, particularly as developed by Keeney and Raiffa (1976), has often been claimed to have the soundest theoretical structure of all multi-criteria techniques (Ballestero and Romero, 1998). At the same time, the empirical elicitation of utility functions has presented many difficulties. In this paper, we have followed a methodology that tries to overcome these limitations, assuming some reasonable simplifications.

In an additive Multi-Attribute Utility Function (MAUF), alternatives are ranked by adding contributions from each attribute. Since attributes are measured in terms of different units, normalization is required to enable the attributes to be added. The weighting of each attribute expresses its relative importance. Although the additive utility function represents a simplification of the mathematical form of the true utility function, Edwards (1977); Farmer (1987); Huirne and Hardaker (1998); and Amador, Sumpsi, and Romero (1998) have shown that the additive function yields extremely close approximations to the hypothetical true function even when the conditions of utility independence are not satisfied (Fishburn, 1982; Hardaker, Huirne, and Anderson, 1997).

Having justified the use of the additive utility function, we take the further step of assuming that the individual attribute utility functions are linear. Its simplest mathematical form is:

$$U_j = \sum_{i=1}^{n} w_i r_{ij} \ ,i= 1, ..., m \qquad (1)$$

where r_{ij} is the value of attribute i for alternative j.

Finally, from a theoretical point of view, it is worth mentioning that in addition to the theoretical advantages of this approach explained above, the linear-additive utility specification used in this paper has been chosen on the basis of a comparison with other specifications, as explained in Arriaza and Gómez-Limón (2003).

After a survey of the study area, we concluded that cotton growers choose a crop distribution that takes the two following objectives into account:

1 Maximization of total gross margin (TGM), as a proxy of profit. TGM is obtained from the average crop gross margins from a time series of seven years (1993/1994 to 1999/2000) in constant 2000 euros.
2 Minimization of variable cost (TVC). This objective implies not only a reduction of costs but also a decrease of risk assumed by farmers and a reduction of managerial involvement (variable costs-intensive crops are most risky and require more technical supervision).

MAUF Elicitation Technique

We have selected a methodology that avoids the necessity of a process of interaction with farmers, and in which the utility function is elicited on the basis of the revealed preferences implicit in the real values of decision variables (i.e. the actual crop mix). The methodology adopted for the estimation of the additive MAUFs is based upon weighted goal programming and has previously been used by many studies (Gómez-Limón, and Upton, 2004; Gómez-Limón, Arriaza, and Berbel, 2002; Gómez-Limón, Riesgo, and Arriaza, 2004; and Gómez-Limón and Riesgo, 2004). As Dyer (1977) demonstrated, the weights obtained are consistent with the following separable and additive utility functions:

$$U = \sum_{i=1}^{q} \frac{w_i}{k_i} f_i(x) \qquad (2)$$

where k_i is a normalizing factor.

Models for Scenario Simulations

To simulate the various cotton regulations considered, we estimate optimal crop-mixes in each case (groups of cotton growers and policy scenarios) through the individual mathematical models developed. These models include a set of *decision variables* representing the surface devoted to each crop. Thus, the cotton growers' production adjustments as they face different policy scenarios are based on substitution of crops, depending on their contribution to the farmers' MAUFs.

Beyond semi-abandonment, two further cotton production possibilities exist: the conventional system ("conventional cotton"), without the 352 €/ha environmental area payment in Scenario B, and the integrated system ("PI cotton"), which includes that area payment. The modulation considered in scenario B applies to all three cotton production possibilities. Detailed information on simulation coefficients is provided in Annex Tables 1-3.

Constraints

For each group of cotton growers a utility function was elicited in order to simulate their response to the policy scenarios. These MAUFs, as explained above, are the objective

functions. In order to build the model, we identify the following constraints applied to each group of farmers. First, there is a *land constraint.* The sum of all crops must be equal to the total surface available to the farm type of each cluster.

Second, we have a series of *CAP constraints*. The level of the area payment is proportionately reduced as eligible cotton area exceeds the maximum area (70,000 ha for Spain). It is forbidden to substitute either COPs or cotton for vegetables. Further, the maximum feasible increase in vegetables area is limited to 10% of the observed area. Last, sugar beet area is limited because of the quota. In each cluster this crop is limited to the maximum area sown during the period studied (1999-2004).

Finally, *rotational constraints* follow the criteria revealed for the farmers in the survey, and *market constraints* dictate that we limit the area of perishable crops (vegetables) to the maximum in the period 1999-04, because of the inelasticity of demand for these crops. Due to the low volume of Spanish cotton production (around 0.6 per cent of the world production), cotton prices were held constant during the simulations.

Finally, it is also worth noting that the implementation of CAP Reform developed through the Midterm Review (MTR) has been considered. Thus, the area payment of COP crops is reduced to 25% of the current level. The rest is paid as single payment to the producers, following a recently approved national regulation. We also assume the implementation of the Commission's proposal for the reform of the sugar Common Market Organization (CMO), with a sugar beet price of €32.8/t for 2005/06.

RESULTS

In order to simulate the behavior of farmers who face agricultural policy changes, first, due to clear agro-climate differences in the Guadalquivir River Basin, we have classified the survey sample into two sub-samples as follows: *High Guadalquivir* (186 cases) and *Low Guadalquivir* (430 cases). The classification variables used to group cotton growers within each group are the area percentages of each crop in their farms. Since a total of 11 crops exceed the maximum suitable for cluster analysis, we carried out factor analysis to reduce the number of classifying variables. In both groups, the number of cases was more than 10 times the number of variables, as a necessary sample size for factor analysis (Nunnally, 1978; and Kass and Tinsley, 1979).

Using SPAD 5.0, two factors with eigenvalues greater than 1 and a cumulative explained variance of 55% were retained following Stevens' rule of sample size and importance of factor loadings (Stevens, 1992). While the first factor explains the farm's cotton specialization, the second refers to irrigation water requirements.

Once the number of decision variables was reduced, the cluster analysis used the two factors as classifying variables. Based on the Euclidean distance among cases and the minimum variance method (Ward method) to aggregate them (Hair *et al*., 1998), three clusters in each sub-sample were obtained. Table 5 summarizes the characteristics of each cluster.

Table 5. Characteristics of the Farm Clusters

High Guadalquivir	Cluster H1	Cluster H2	Cluster H3
Main crops	Cotton (47%) Maize (36%)	Cotton (39%) Wheat (23%)	Cotton (99%)
Average farm size (ha)	43.1	49.2	4.4
% of producer's income from farming	83%	80%	72%
% of farmers that hire workers	76%	64%	35%
% of irrigation systems (gravity-sprinkle-drip)	52%-29%-19%	39%-39%-22%	33%-12%-55%
Number of farmers	49	36	101
Aggregated area	2,112	1,771	444
Low Guadalquivir	Cluster L1	Cluster L2	Cluster L3
Main crops	Cotton (45%) Maize (39%)	Cotton (44%) Sugar b. (27%)	Cotton (98%)
Average farm size (ha)	30.2	45.2	6.9
% of producer's income from farming	88%	87%	76%
% of farmers that hire workers	76%	66%	48%
% of irrigation systems (gravity-sprinkle-drip)	13%-5%-82%	32%-21%-47%	28%-10%-62%
Number of farmers	87	128	215
Aggregated area	2,627	5,784	1,492

Source: Survey of cotton producers in Andalusia (2004).

Weights of the Farmers' Objectives

From the observed crop distribution of each group of farmers six MAUFs were elicited. The following table shows the current total gross margin (TGM) and total variable costs (TVC) of the farm derived from the observed crop distribution, the theoretical maximum TGM and its associated TVC, the theoretical minimum TVC subject to the achievement of a minimum TGM (forcing the model to sow the whole farm) and its associated TGM, and finally, the weight attached to each objective in the utility function using the multicriteria technique described above.

Data in table 6 suggest that farms in the H3, L1 and L3 groups could be named as true seekers of profit maximization. On the other hand, farms in groups H2 and L2 seem to opt for a more conservative crop distribution, i.e. a higher proportion of COP crops, resulting in a greater weighting being given to minimization of TVC.

Table 6. Current and Theoretical Extreme Values of Farm Total Gross Margin (tgm) and Total Variable Cost (tvc). Weight of Each Objective of the Utility Function

		High Guadalquivir			**Low Guadalquivir**		
		H1	*H2*	*H3*	*L1*	*L2*	*L3*
Current values (€/ha)	TGM	1,207	1,169	1,572	1,374	1,218	1,548
	TVC	1,538	1,646	2,297	1,859	1,682	2,238
Maximize of TGM (€/ha)	TGM	1,365	1,487	1,583	1,468	1,468	1,612
	TVC	1,789	2,232	2,320	2,034	2,088	2,354
Minimize of TVC (€/ha)	TGM	390	390	390	390	390	390
	TVC	243	243	243	243	243	243
Weight of the maximization of TGM (w_1)		84%	71%	99%	90%	78%	95%
Weight of the minimization of TVC (w_2)		16%	29%	1%	10%	22%	5%

Simulated Changes in Crop Distribution

Optimization of the six utility functions in both policy scenarios through the farm type simulation model led to important changes in crop distribution of the area of study. In *Scenario A*, without any additional policy measures, most of conventional cotton (93%) is substituted by a cultivation system of semi-abandonment. The remaining 7% is substituted by other crops. Thus, the aggregated impact shows increases in maize (57% higher than the current level), sunflower (42%) and wheat (34%). According to these results, no cotton farmer would harvest the raw cotton. This radical forecast might be less severe during the first season for psycho-sociological reasons, such as the farmer's tendency to continue production even when it is not economically rational, attempting to justify accepting the subsidies, etc.

In *Scenario B*, with the additional environmental area payment and the modulation of the area subsidy, 69% of the current cotton area would continue under integrated production, finishing the crop season with the harvest of all the raw cotton. Most of the cotton growers who would abandon this crop (31% of the current level) would change to maize and wheat, as is shown in table 7.

As we can see in table 7, in both scenarios sugar beet area disappears due to the assumption of the implementation of the Commission's proposal for reform of the sugar CMO, with a sugar beet price of €32.8/t for 2005/06. This price represents a 35% reduction of the sugar beet price, making sugar beet production no longer viable in Southern Spain. Finally, the scheme proposed in this paper has a net cost of 8 million euros due to the environmental payment for the estimated crop area, as well as an area reduction of approximately one third of the current area. This extra cost could be justified by an overall reduction of the pesticide use (40%) and the water consumption (17%).

Table 7. Aggregate Crop Distribution Changes in Both Policy Scenarios (Ha)

Crop / Policy scenario	Current	Scenario A	Scenario B
Cotton	5,979 [a]	0	4,147[b]
Cotton: semi-abandonment	0	5,546	0
Sunflower	466	661	1,399
Protein crops	283	226	226
Vegetables	388	427	427
Maize	2,262	3,547	3,444
Potatoes	252	258	267
Sugar beet	1,564	0	0
Wheat	1,535	2,063	2,819
Total area in Spain (ha)	90,000	70,000	58,650
Program cost (mill. of euros)	212	211	220
Overall pesticide usage (%)	100	19	52
Overall water consumption (%)	100	60	83

[a] Conventional cotton.
[b] Integrated production of cotton.

CONCLUSION

According to our economic analysis, the reform of the cotton market, as stated in April 2004, would mean the complete end of cotton production in Spain. Due to the situation of low world prices, far below the variable costs of production, the decoupling of subsidies would probably lead to farmers sowing the current cotton area (some 90,000 ha) but in a semi-abandonment system of cultivation, that is, minimizing the use of inputs and leaving the raw cotton in the field. Likewise, the sugar reform has reduced the internal market sugar beet price to a level where it does not cover the variable costs in Southern Spain, resulting in zero hectares cultivated with sugar beets in the simulation.

The alternative scenario proposed in this study includes two measures. The first measure, already implemented by the Spanish regional government, consists of an additional area payment of approximately 350 €/ha of environmental nature for shifting from conventional cotton production to integrated production. Under this new production system, both agricultural practices and input levels are regulated by the regional government, implying a reduction of approximately one third of the previous fertilizer and pesticide usage. The second measure, not implemented by the Spanish authorities yet, refers to the modulation of the area payment by up to 50% of the total 1,039 €/ha according to the quality of the raw cotton delivered. When both measures are simultaneously considered, the results of the simulation suggest that the current cotton area of Spain, some 90,000 ha, could be reduced to approximately 59,000 hectares.

In general, a net increase in EAGGF expenditures of €8 million would result from the implementation of these additional measures, the environmental payment plus the modulation of the subsidy. The growth in expenditures would be justified by an overall reduction of the pesticide use by 40% and water consumption by 17%. From a social point of view, the

proposed scheme would allow a partial continuation of the cotton production in Spain under more stringent environmental regulations. This situation would avoid the negative consequences of a drastic adaptation of the EU cotton sector to a much lower world prices, allowing in the medium term a progressive reduction of the cotton sector in the EU.

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Annex Table 1. Simulation Coefficients: Before Reform Scenario

		Conventional cotton	Semi-abandonment cotton	Sunflower	Protein crops	Vegetables	Maize	Potatoes	Sugar beet	Wheat
Gross Margin	€/ha	1,579		367	412	1,902	1,012	2,806	1,300	556
Total Variable Costs	€/ha	2,304		231	255	3,653	1,085	3,242	2,043	395
Labor Costs	€/ha	350	35	12	55	2,536	136	1,043	331	9
Pesticide Costs	€/ha	588	59	36	96	187	68	249	331	39
Water Requirements	m^3/ha	8,318	2,000	5,280	3,262	8,000	9,116	3,060	7,994	2,038

Source: Data on variable costs and yields of 73 farms during the period 2000/01–2002/03.

Annex Table 2. Scenario A Coefficients: Decoupling Without Environmental Payment and Modulation

		Conventional cotton	Semi-abandonment cotton	Sunflower	Protein crops	Vegetables	Maize	Potatoes	Sugar beet	Wheat
Yield	kg/ha	3,831	0	1,982			10,763		62,882	4,130
Raw Cotton Price	€/kg	0,26	0,26	0,25			0,16		0,035	0,16
Sales	€/ha	996	0	496	412		1,722		2,201	661
Decoupled Subsidy	€/ha	1,039	1,039	63	90		106		0	117
Variable Costs	€/ha	1,976	479	317	324	3,653	1,113	3,242	2,043	395
Water Requirements	m^3/ha	59	560	242	178	1,902	715	2,806	158	383

Annex Table 3. Scenario B Coefficients: Decoupling with Environmental Payment (350 €/Ha) and Modulation (50%)

	Pesticide Costs	**Water Requirements**	**Variable Costs**	**Gross Margin**
	€/ha	m^3/ha	€/ha	€/ha
Integrated Cotton Production	400	7,500	2,079	737
Conventional Cotton	588	8,318	1,976	578
Semi-abandonment Cotton	59	2,000	479	41
Sunflower	36	5,280	317	242
Protein Crops	96	3,262	324	178
Vegetables	187	8,000	3,653	1,902
Maize	68	9,116	1,113	715
Potatoes	249	3,060	3,242	2,806
Sugar Beet	331	7,994	2,043	158
Wheat	39	2,038	395	300

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PREFERENCES EROSION AND TRADE COSTS IN THE SUGAR MARKET: THE IMPACT OF THE "EVERYTHING BUT ARMS" INITIATIVE AND THE REFORM OF THE EU POLICY

***Piero Conforti*[*,1] *and George Rapsomanikis*[2]**

[1] Trade and Markets Division, Food and Agriculture Organisation of the United Nations, Viale delle Terme di Caracalla – 00153 Rome, Italy, e-mail: piero.conforti@fao.org, tel. +39 06 57053664 fax. +39 06 57054495

[2] Trade and Markets Division, Food and Agriculture Organisation of the United Nations, Viale delle Terme di Caracalla – 00153 Rome, Italy; e-mail: george.rapsomanikis@fao.org, tel. +39 06 57055995 fax. +39 06 57054495.

ABSTRACT

Recent changes in the EU Common Market Organization for sugar will affect preferential imports from developing and least developed countries. This article focuses on the impact of the Everything But Arms initiative and the EU sugar policy reform on the African, Caribbean, and Pacific countries and the Least Developed Countries. Simulations are conducted with an empirical modelling structure comprising of a partial equilibrium model for the world sugar market and gravity equations that replicate least developed countries' bilateral trade with Europe. Gravity is employed to model the abolition of import tariffs for sugar originating in least developed countries, subject to trade costs, while the partial equilibrium model is employed to assess the effects of EU sugar policy reform. Results suggest that the African, Caribbean, and Pacific countries will experience significant reduction in their export revenues, whilst the initial impact on least developed countries may be limited but increasing in the medium run.

Keywords: EBA, sugar, gravity model, trade preferences, LDC, CMO;
JEL Classification: Q18, C23 C53.

[*] Corresponding Author: Piero Conforti, Trade and Markets Division, Food and Agriculture Organisation of the United Nations, Viale delle Terme di Caracalla – 00153 Rome, Italy, e-mail: piero.conforti@fao.org, tel. +39 06 57053664 fax. +39 06 57054495

Preferential trade agreements are thought of as an important instrument for integrating the developing (DCs) and least developed countries (LDCs) into the world trading system. The Everything But Arms initiative (EBA) of the European Union (EU) and the African Growth and Opportunity Act of the United States consist of trade agreements that aim at increasing trade flows between developed countries and LDCs in order to stimulate growth. The EBA initiative came into effect in 2001, aiming at discriminating in favor of the LDCs by granting duty free access to imports of all products that originate in these countries with the exception of arms and munitions. Total access to the EU markets was immediate except for bananas, rice, and sugar. Imports of these commodities are subject to tariff rate quotas, with increasing duty-free in-quota imports and a gradual reduction in the tariff for out-of-quota imports until 2009, after which all LDC products will enjoy unconstrained market access to the EU.[1]

On average, the initial impact of the EBA initiative on LDCs' total exports to the EU is small, whilst the limited export success is not uniform across countries due to a number of reasons. Firstly, rules that govern trade under the EBA, such as those on transport and the definition of the origin of the products, are thought to result in under-utilization of preferences due to increasing trade costs (Brenton, 2003). Secondly, the EBA has extended duty free access to a small number of agricultural products, whilst access for the majority of products was complete under the Generalized System of Preferences and the Cotonou Agreement. In addition, a number of LDCs are unable to take advantage of EBA due to the current composition of their exports, as products that are traditionally exported to the EU markets have been receiving duty-free access under other agreements.

This article focuses on sugar-producing and exporting countries, in the context of the EBA, the recent reform of EU sugar policy, and preference erosion. Sugar policy in the EU is characterized by price support, intervention mechanisms, and production controls, as well as by a series of preferential trade agreements with a number of African Caribbean and Pacific (ACP) sugar exporting countries. The recent EU sugar policy reform, in conjunction with the already established preferential agreements and the EBA initiative, will result in EU's developing and least developed trade partners being affected either positively or negatively, depending on the nature of the trade arrangement. We quantify the impact of the EBA initiative on selected LDCs and identify the winners and losers of the EU sugar policy reform using an empirical model structure comprised of a global partial equilibrium model for the sugar market and gravity equations to replicate LDCs' bilateral trade with Europe. The sugar partial equilibrium model is a standard non-spatial model with a rich policy specification, whilst the gravity equations are used to quantify the maximum potential export flows from LDCs to the EU under the EBA initiative on the basis of both tariff and natural barriers. Therefore, the model structure takes into account the opposite forces of comparative advantage, which enhances trade between countries, and trade costs, which hamper it.

[1] Council Regulation (EC) No 416/2001of 28 February 2001 provide details on the Everything But Arms initiative. For a comprehensive description of the initiative see United Nations Conference on Trade and Development, UNCTAD (2005).

BACKGROUND

The pre-2006 EU sugar Common Market Organization (CMO) comprised various policy instruments, including minimum support prices enforced by an intervention buying mechanism and production controls, the A and B quotas, determining the amount of sugar receiving protection. Exports of sugar are subject to subsidies, whilst sugar in excess of the A and B quotas, formerly known as C sugar, could be exported without any export subsidies.

The reform agreed by the European Union agricultural ministers in late 2005 (Commission of the European Communities, 2005), consists of four main changes in the sugar CMO. First, the intervention mechanism is substituted with a private storage scheme, which triggers when the domestic price reaches a "reference price," which is to be set to a level 36 percent lower than the current intervention price starting in 2008. Second, the A and B quotas are merged and an additional quota of one million tons is established, which can be bought by producers in countries producing over-quota sugar (the so-called C-sugar producers). Third, a voluntary and temporary restructuring scheme financed with the purchases of the additional quotas, aims at assisting factories willing to cease production. Last, national "envelopes" are established to grant farmers additional direct decoupled payments, offsetting 64 percent of the estimated loss arising from the reduction in the price guarantee on the basis of 2001-02 as a reference period.

All sugar exports, including re-export of ACP sugar and surplus C-sugar exports, now are included in the volume limit on subsidized sugar exports set by the World Trade Organization (WTO). The reform of the sugar CMO was necessary in order for the EU to reduce exports to comply with the WTO panel ruling on EU sugar subsidies. The panel deemed exported surplus sugar, or C-sugar, as cross-subsidized by the minimum support prices paid for in-quota sugar (A and B sugar). ACP sugar re-exports were also declared part of subsidized exports and should be tallied against the volume limit commitment on subsidized exports. The sugar CMO reform is consistent with the aim of the on-going WTO negotiations on agricultural trade and the three pillars of reform, namely, the elimination of export subsidies, the reduction of domestic support, and the improvement of market access.

Preferential access to the EU sugar market is extended to a number of ACP countries through the Sugar Protocol (SP), the Special Preferential Sugar (SPS), and the EBA initiative. The SP is a long standing preferential access agreement, according to which the EU imports a fixed amount of ACP raw sugar, approximately 1.3 million tons, at the EU minimum support, or intervention price. The SPS arrangements allow for an additional 200 thousand tons of raw sugar to be imported at a price level slightly lower than the EU minimum support price, taking into account an adjustment for refining costs, in order to provide adequate quantities of raw material for the European processing sector. The fixed amount of sugar that is imported under the SPS is subject to gradual reduction, in a mirror-like manner to the increase in the EBA in-quota imports. From 2009 onwards, the SPS arrangement will be eliminated.

The complexity which characterizes the series of trade arrangements between the EU and a number of country groups, suggests that the sugar CMO reform is expected to affect, apart from producers and consumers in the twenty-five Member States, the trade flows between the EU and developing and least developed countries that are signatories of the SP, or beneficiaries of the EBA initiative. A number of studies focused on the potential impact of EBA on both the EU and the beneficiary countries' sugar sectors. Among these, UNCTAD

(2005) indicates that potential increases in sugar exports to the EU under the initiative are likely to be limited, due to the constraints arising from natural resource endowments and transport infrastructures, which are analyzed in country case studies. Similarly, Stevens and Kennan (2001) suggest that total LDCs' sugar exports may reach some 300 to 500 thousand tons on top of the EBA quota. van Berkum, Roza, and van Tongeren (2005) suggest that these may reach 450 thousand tons. Opposing this view, Witzke and Kuhn (2003) estimate that LDCs' sugar exports to the EU market may reach 2 million tons in 2011.

Although informative, studies on the impact of the EBA initiative do not adequately cover important issues that relate to international trade and the trade costs countries face. Firstly, relative productivities and differences in technology concur in determining trade flows. Secondly, trade diminishes with distance, whilst infrastructure determines trade costs. Moreover, it is not only the natural trade barriers that determine trade costs and flows. Import tariffs in the EU increase the cost of trade nearly twofold. Due to trade costs, few LDCs that are not subject to the Cotonou agreement between the EU and the ACP countries export sugar to the EU. Sugar exports from Sudan, Mozambique, and Ethiopia to the EU in 2003 amounted to about 42 thousand tons, whilst those originating from Burkina Faso, Chad, the Democratic Republic of Congo, Mauritania, Somalia, Niger, and Sierra Leone amounted to 14 thousand tons. Apart from these countries, other LDCs do not export sugar to the EU. In assessing trade costs, Anderson and Wincoop (2003, 2004) distinguish between border and non-border barriers. The former refer to barriers that involve rents such as tariffs and quotas, whilst the latter relate to natural trade barriers such as distance, infrastructure, transport, and communication technologies. Natural trade costs, therefore, include freight costs, information costs, contract enforcement costs, costs related to the use of different currencies, inventory costs and regulatory costs that may be prohibitive for LDCs.

The relationship between trade costs and trade flows is best represented by the notion of gravity that postulates that after controlling for size, trade between two countries depends on the magnitude of trade costs. The rationale behind gravity is simple and intuitive: decreasing tariffs and decreasing transport costs lead to higher trade flows between two countries, holding everything else constant. Recent years have experienced a surge in the use of the gravity model in analyzing bilateral trade, the impact of regional trade agreements, as well as in estimating trade costs (Anderson, 1979; Bergstand, 1989; Baier and Bergstand, 2001; Deardoff, 1998; Eaton and Kortum, 2002; Harrigan 2002; Feenstra, 2002 and 2003; and Piermartini and Teh, 2005).

MODELING FRAMEWORK

We utilize the non-spatial, partial-equilibrium, recursive, dynamic COSIMO-AGLINK model of the world sugar market in combination with gravity equations, which are used to quantify the maximum potential export flows from LDCs to the EU under the EBA initiative. COSIMO-AGLINK contains 782 equations and identities and covers 56 countries and regions, allowing two types of traded sugars, refined and raw sugar, and two sugar crops, cane and beet.[2] World and domestic prices are determined endogenously by clearing the

[2] The COSIMO-AGLINK model was developed by the Organization for Economic Cooperation and Development (OECD) and the Food and Agriculture Organization (FAO). Details of the AGLINK model are available in

world market, as well as domestic markets of countries insulated from world price effects via quantitative trade restrictions, such as the EU, Mexico, the United States, and China.

In the ACP countries, the marginal economic incentive is calculated as a weighted pool, or blend price, of the price received for sugar exported under the SP and the SPS, the price received for exports within the US tariff rate quota (TRQ), and the world price for production exported to the world market. Thus, ACP countries are modeled as price-takers, with imperfect transmission of world price signals. For those ACP countries which are also classified as LDCs and where the EBA initiative implies a TRQ increase of 15 percent per year between 2002 and 2008 and unlimited duty-free access after year 2009, the price determination described above is applied until 2008.

No bilateral flows are determined by the non-spatial COSIMO-AGLINK model. Trade flows from selected LDCs to the EU are specified as standard empirical gravity equations that relate the exports from country *i* to *j* to the gross domestic products (GDP) of the importer and the exporter, policy trade barriers, such as tariffs, and natural trade barriers, such as distance between countries and infrastructure. Empirical studies frequently utilize a number of proxies in order to capture natural trade barriers. Often, average distance between two countries is an observable variable representing transport costs, whilst abstract trade barriers, such as information costs and communication costs are represented by variables such as language differences.

We apply the gravity model utilizing a panel data set for food and tobacco exports to the EU from 47 LDCs during the period 1988-2004. There are some clear advantages in applying the gravity model to panel data relative to cross-section data, which are typically used in such studies. Panel data allows the estimation of dynamic models and the investigation of the adjustment process. Adjustment to a new trade relationship with the EU, that is characterized by no tariff barriers after 2009 may be gradual and not instantaneous for LDCs that, without doubt, face significant adjustment costs not only in increasing production to take advantage of the preferences, but also in administering exports under the EBA initiative. Therefore, the dynamic specification reflects the possibility that exporting firms in these countries will become gradually more efficient and will generate positive spillovers for domestically orientated agents.[3] In addition, panel data allow more variation in the data used to estimate the relevant parameters in a consistent manner.

Data on the value of food and tobacco exports to the EU and the relevant weighted tariff levels are collected from COMTRADE. We use food and tobacco exports instead of sugar exports for two reasons. Firstly, data on sugar exports is limited, as few LDCs exported sugar to the EU during the period 1988-2004. Secondly, as the EBA initiative allowed duty free imports in the EU since 2001 for all products except sugar, rice, and bananas, the data on food and tobacco exports contain information on the impact of the initiative on trade. Data on infrastructure are collected from the World Development Indicators provided by the World Bank. Transport costs are collected in the form of the Samuelson's convenient 'iceberg' assumption, as the proportion of the value of exports that is dissipated in transportation. Data on the length of the paved and unpaved roads, the length of railways, the number of fixed

OECD (2004). COSIMO-AGLINK extends AGLINK to cover major developing producing countries, ACP countries and LDCs (OECD-FAO, 2006).

[3] Export led growth in production has been investigated by Aw and Hwang (1995).

telephone lines and mobile phones per thousand inhabitants are collected to represent information and communication costs. The empirical gravity model is as follows:

$$x_{ie,t} = c + \alpha x_{ie,t-1} + \beta\left(\frac{y_i}{y_e}\right)_t + \sum_0^n \delta_n tar_{ie,t-n} + \sum_k \zeta_k z_{ie,t}^k + \left(\eta_{ie} + \varepsilon_{ie,t}\right), \qquad (1)$$

where $x_{ie,t}$, $y_{i,t}$, and $y_{e,t}$ denote exports from country i to the EU in year t, the GDPs of the exporting country i and the EU, respectively, in the same year. The variable $tar_{ie,t}$ denotes the level of the *ad valorem* tariff faced by the exporting country in time t, whilst the k variables z_{ij} refer to several variables relating to natural barriers. $\varepsilon_{ie,t}$ is a standard error term, whilst η_{ie} is an unobserved country-specific and time-invariant effect that can be thought of as an additional determinant of exports on the basis of characteristics that are idiosyncratic to each country. The lagged dependent variable and the lagged tariff terms capture the adjustment process to the new environment. We estimate the gravity equation in double-log form, using the Generalized Method of Moments (GMM), a standard procedure for dynamic panel data models. GMM developed by Hansen (1982) and extended for first-differenced dynamic panel models by Arellano and Bond (1991) consists of an asymptotically efficient estimator in this context. [4]

We experimented with different natural barrier variables, such as the length of paved roads, the number of telephone lines per thousand inhabitants and other. However, parameter estimates were not statistically significant for all available variables, mainly due to the lack of variation of the series. The final specification is parsimonious and the estimated parameters are presented in table 1. In addition to the GDP ratio, gravity equations included lagged tariff terms and a transport cost variable.

Table 1. Dynamic Gravity Equation Estimates

$\ln(x_{ie,t-1})$	$\ln((y_i/y_e)_{t-1})$	$\ln(tar_{ie,t-1})$	$\ln(tar_{ie,t-2})$	$\ln(z(\text{trnsp})_{ie,t})$
0.3643	0.1283	-0.0529	-0.0796	-0.0859
(-0.0052)	(-0.0472)	(-0.0096)	(-0.0068)	(-0.0156)
Sample 1988-2004				
J-Statistic	51.26			
Instrument rank	55			
Sargan test *p*-value	0.42			
Number of observations	539			

Note: Standard errors in parentheses.

The parameter estimates can be interpreted as short-term elasticities. They are statistically significant and highlight the importance of tariff barriers in determining trade flows in the medium run. Reductions in the tariff level are expected to increase significantly the flow of exports from the LDCs to the EU. The estimated parameters indicate that a 10-percent reduction in the tariff level will result in a 2-percent increase of exports to the EU in the long

[4] Detailed descriptions of the GMM estimation method and its application to panel data are provided by Arellano and Bond (1991), Blundell, Bond and Windmeijer (2000) and Arellano and Honore (2001), and Bond (2002).

run. The estimated parameter for transport costs also confirms the importance of well functioning and efficient transport infrastructure.

SIMULATION RESULTS

Both partial equilibrium model and gravity equations are calibrated using data on sugar for the year 2003 and are utilized to generate a set of solutions up to 2013. The gravity equations are calibrated for the LDCs that have exported sugar to the EU during the period 1988-2004.[5] For the whole sample of countries in the panel data set, exports of raw and refined sugar to the EU comprise a small share of total food and tobacco exports, amounting to 3.7 percent in terms of value in the year 2003. For the countries under consideration, this share is significantly higher, amounting to 9.2 percent in terms of value. However, these exports are subject to tariffs that are determined by the EBA in-quota and out-of-the-quota tariffs, as well as transport costs.

This approach is based on the implicit assumption that exports of sugar from the countries that have exported to the EU are subject to constraints, such as trade and other transaction costs, that are common to all other food and tobacco products. In terms of distance to the EU and transport infrastructure, this assumption is realistic. However, exporting sectors may not be homogeneous and, therefore, the approach may underestimate the adjustment rate of the sugar sector by a imposing a dynamic structure that is estimated using data on total food and tobacco exports. In the simulation, the gravity equation approach is utilized to determine the share of sugar exports from the selected LDCs to the EU, and thus, the model structure for these countries reflects both the allocation of trade and the allocation of production and consumption at the same time.[6]

We simulate a baseline to 2013 according to assumptions that include implementation of the EBA initiative, but no EU sugar CMO policy reform. The modeling framework is subsequently employed to simulate the impact of policy reform and the erosion of preferences. In more detail, the abolition of intervention is modeled as a 36 percent reduction in the intervention price, assuming that private storage will support market prices in a similar way to the intervention mechanism. The merging of the two quotas and the provision of an additional quota of one million tons to current C sugar producers is approximated through an increase in the quota level for the relevant countries.[7]

The simulated world price for the period up to 2013 is shown in figure 1. Under the baseline assumptions that include the implementation of the EBA initiative, but no policy reform in the EU, prices are expected to decline from a high level of 2005, as world supply increases in response to a period of high prices. From 2009 onwards, prices appear to recover, as supply adjusts to consumption. The results suggest that the EU domestic production is expected to contract, whilst there will be a significant increase in imports, from 2009 onwards, by approximately 700 thousand tons, mainly because of the EBA initiative (see figure 2). The hierarchy of preferential agreements identifies four distinct country groups

[5] Ethiopia, Sudan, Mozambique, Mali, Mauritania, Chad, and Sierra Leone.

[6] There is no gravity relation to determine the share of exports to other countries. The remainder, that is what is not exported to the EU, is assumed to be destined to all other countries. In practice, it is not surprising that these countries after exporting to the EU, trade with countries in the region.

[7] This model structure allows the simulation of policy changes (i) and (ii) discussed in the Background section.

among the actual and potential exporters to the EU market. Firstly, DCs that are SP signatories will continue enjoying preferential access under the SP arrangement. A second group comprises of LDCs that are expected to export to the EU under the SP and the EBA. LDCs which are not SP signatories will export under the EBA initiative consist of a third group. Finally, other developing and developed countries that may potentially export sugar to the EU form the fourth group. Exports from this last group to the EU are currently negligible and consist of minor TRQs, such as those granted to Brazil and Cuba. Therefore, the group is not expected to be directly affected by the implementation of the EBA initiative. However, the other three groups will experience changes in their trade patterns.

Figure 1. World price of raw sugar (US $ per ton).

Table 2 presents the results of the baseline and the simulated EU policy reform. The baseline suggests that SP and SPS signatory DCs are expected to be affected by the abolition of the SPS, whilst the group consisting of LDCs that are SP signatories is expected to enjoy unlimited duty-free access to the EU market. Malawi and Tanzania are simulated to increase their exports to the EU significantly. Trade costs are assumed not to pose significant barriers to exports, as these countries have been exporting to the EU for a long time. The implementation of the EBA initiative will result in significant benefits for LDCs that are not SP signatories. Some of these LDCs, such as Ethiopia, Mozambique and Sudan, are important sugar producers. In the simulation, exports of these countries to the EU are constrained by transport and other costs and determined by means of gravity equations. Exports from Ethiopia to the EU are simulated to reach more than 100 thousand tons by 2013, whilst those from Mozambique are expected to increase to 60 thousand tons during the same period (see table 2). In a like manner, Sudan is simulated to increase its exports to the EU nearly fivefold.

Figure 2. Imports of sugar in the EU (thousand tons).

For other LDCs a group that is made up of countries that are not significant sugar exporters, but have been exporting regularly small amounts of sugar to the EU in the recent years, such as Mali, Mauritania, Chad and Sierra Leone, the simulated baseline indicates that exports may experience a moderate increase mainly due to the constraints imposed by transport costs. In total, the EBA initiative is simulated to result in LDCs' sugar exports to the EU reaching about 465 thousands tons in 2013. This amount includes exports from LDCs that are not SP signatories, as well as exports from SP signatory LDCs in excess of the quota granted under SP, thus reflecting the net result of the EBA initiative. During the same period, exports from LDCs to the rest of the world are expected to decline by over 40 percent.

Table 3 presents the impact of the EBA initiative on sugar export revenues. The simulation suggests that the abolition of SPS will affect DCs that are signatories to the SP, such as Swaziland, Mauritius, Guyana, Fiji and the Cote d'Ivoire. LDCs will enjoy considerable benefits irrespectively of whether they are signatories to the SP. Export revenues for Malawi and Zambia are expected to increase more than threefold. Increases in sugar export revenues of Sudan, Tanzania, Ethiopia and Mozambique are substantial. It is important to note that these countries currently export very low volumes to the EU, however, the simulation of gravity equations suggests that, for these countries, adjustment to a new trade environment may be rapid.

Table 2. Exports (Volume) of Sugar to the EU from DCs and LDCs

	Exports to the EU under SP			Exports to the EU under SPS, then EBA			Exports to the Rest of the World		
	2001-03	Baseline 2011-13	Reform 2011-13	2001-03	Baseline 2011-13	Reform 2011-13	2001-03	Baseline 2011-13	Reform 2011-13
	thousand tons	2001-03 =100	2001-03 =100	thousand tons	2001-03 =100	2001-03 =100	thousand tons	2001-03 =100	2001-03 =100
Belize	40.3	100.0	100.0	5.2	0.0	0.0	57.0	123.9	134.0
Trinidad and Tobago	45.7	98.6	100.0	5.5	0.0	0.0	0.6	0.0	0.0
Swaziland	123.0	100.0	100.0	32.4	0.0	0.0	282.9	124.8	147.9
Mauritius	512.4	96.3	97.5	27.0	0.0	0.0	22.2	0.0	0.0
Jamaica	123.9	100.0	100.0	17.4	0.0	0.0	17.4	121.4	72.3
Guyana	166.3	100.0	100.0	17.8	0.0	0.0	114.9	113.9	102.2
Fiji	172.5	100.0	100.0	19.3	0.0	0.0	83.0	101.3	89.0
Cote d'Ivoire	10.6	100.0	100.0	9.1	0.0	0.0	42.0	79.8	72.6
Barbados	41.3	14.8	12.5	0.0	0.0	0.0	0.0	0.0	0.0
Kenya	0.0	0.0	0.0	4.1	0.0	0.0	0.0	0.0	0.0
Zimbabwe	31.5	100.0	100.0	23.4	0.0	0.0	69.7	81.6	80.5
ACP DCs SP signatories	1267.6	95.7	96.1	161.3	0.0	0.0	863.2	108.2	105.1
Tanzania	10.6	100.0	100.0	2.2	1,836.1	1,836.1	7.1	0.0	0.0
Malawi	21.7	100.0	100.0	9.3	952.0	890.4	58.8	0.0	0.0
Madagascar	11.2	100.0	100.0	9.9	210.1	272.7	0.0	0.0	511.9
ACP LDCs SP signatories	43.6	100.0	100.0	21.4	697.5	699.7	65.9	0.0	0.0
Mozambique	-	-	-	0.8	6,685.6	6,810.6	107.5	87.1	86.2
Ethiopia	-	-	-	15.0	755.9	755.9	74.2	0.0	0.0
Burkina Faso	-	-	-	0.7	235.0	235.3	11.8	0.0	0.0

Table 2. (Continued).

	Exports to the EU under SP			Exports to the EU under SPS, then EBA			Exports to the Rest of the World		
	2001-03	Baseline 2011-13	Reform 2011-13	2001-03	Baseline 2011-13	Reform 2011-13	2001-03	Baseline 2011-13	Reform 2011-13
	thousand tons	2001-03 =100	2001-03 =100	thousand tons	2001-03 =100	2001-03 =100	thousand tons	2001-03 =100	2001-03 =100
Sudan	-	-	-	18.4	531.5	508.8	223.3	53.1	56.1
Zambia	-	-	-	12.0	329.9	363.3	27.2	0.0	0.0
Bangladesh	-	-	-	0.0	0.0	0.0	31.0	41.1	41.1
other LDCs	-	-	-	2.4	254.7	254.7	39.2	127.2	130.3
LDCs non SP signatories	-	-	-	49.3	637.9	639.6	514.3	53.4	54.8
Total ACPs	1,311.2	95.0	95.4	229.6	198.4	199.0	1,355.8	84.5	83.0
Total LDCs	43.6	74.2	74.2	70.7	655.9	657.8	580.2	47.4	48.6

Source: Authors' calculations on OECD and World Bank data

Table 3. Changes in the Value of Exports to the EU (2001-2003=100)

	Baseline 2011-13	Reform 2011-13
Belize	92	59
Trinidad and Tobago	92	60
Swaziland	82	53
Mauritius	95	62
Jamaica	91	58
Guyana	94	60
Fiji	94	60
Cote d'Ivoire	56	36
Barbados	15	9
Kenya	0	0
Zimbabwe	60	38
ACP DCs SP signatories	88	57
Tanzania	409	262
Malawi	370	225
Madagascar	102	85
ACP LDCs SP signatories	291	187
Mozambique	6959	4542
Ethiopia	787	504
Burkina Faso	245	157
Sudan	553	339
Zambia	343	242
Bangladesh	100	64
other LDCs	265	170
LDCs non SP signatories	664	427
Total ACPs	115	74
Total LDCs	452	290

Source: Authors' calculations on OECD and World Bank data

The EU sugar CMO reform simulation indicates that the policy reform results in an approximately 5-percent increase in the world prices of raw and white sugar. This price increase is caused by the joint reduction of EU supply and exports of sugar (see figure 1). The difference between the simulated and the baseline price is wider between 2007 and 2010, when the EU reform is fully implemented and before this gap is narrowed by a moderate growth in the exports of major producers, such as the Brazil, Thailand, and the USA.

Total EU sugar beet production is expected to decrease by an average of 4 percent, corresponding to more than 6.5 million tons of beet, due to the decrease in the market price brought about by the reform, which more than offsets the impact of the increase in the production quota.[1] It is worth highlighting that such a reduction would take place against a baseline which already suggests a *per se* reduction in the EU output of about 12 million tons in 2013, due to EBA initiative imports. Consumption is expected to increase marginally by

[1] Results on the impact on the EU are not presented due to space limitations.

about 2 percent, consistent with the expected weak reaction of European consumers to lower prices. Given the contraction in supply, the EU is expected to be capable of substantially reducing its C sugar exports, from little less than 4 million tons in 2006, to about half a million tons in 2010. This would help the EU to comply with the WTO panel ruling on the cross-subsidization of C sugar. Total sugar imports in the EU are simulated to further increase following the domestic policy reform, albeit by a lower rate than that indicated by the baseline, particularly after 2009 (see figure 2).

The reduction in the EU reference price is expected to affect all countries that enjoy access to the EU market. In general, although sugar export volumes originating from both DCs and LDCs are not expected to decline by the end of 2013, export revenues will be negatively affected, thus eroding the value of preferences as shown in the last column of table 3. The results suggest that export revenues of DCs that are signatories to the SP are expected to fall to 57 percent of the average 2001-2003 amount due to both the implementation of EBA and the EU sugar CMO reform. For LDCs that are SP signatories, policy reform in the EU is also expected to erode the value of preferences resulting from the EBA initiative. For these countries, export revenues are expected to increase twofold as compared to the 2001-2003 average, instead of the threefold increase, suggested by the baseline simulation. For LDCs that are not signatories to the SP, the reduction in the EU minimum support price will also curtail the substantial benefits conferred by the EBA initiative. On average for these countries, policy reform is expected to result in export revenues that, although they are substantially higher than the average 2001-2003 level, amount to approximately 60 to 70 percent of those simulated under the baseline assumptions.

CONCLUDING REMARKS

The results suggest that the EU sugar policy reform will bring about an erosion of preferences for the ACP countries that export to the EU under the SP, as well as for the LDCs that export under the EBA initiative. Under the baseline assumptions, LDCs' exports to the EU, under the EBA initiative, are simulated to amount to less than half a million tons, given the combined effect of the natural trade costs and price changes. In this respect, our results are consistent with the conclusions of UNCTAD (2005) and Steven and Keenan (2003) but not with the estimates of Witzke and Kuhn (2003). The EU sugar CMO reform is expected to significantly affect all EU trade partners in terms of export revenues, rather than in terms of export volume. As the reform's effect on the world price is too small, no significant trade creation and diversion effects, outside the administered SP quotas and the EBA preferences, are expected, given that the EU domestic price, however reduced, still remains far higher than the world market price.

Further analysis would be useful to deepen the understanding of the production and export perspectives of individual countries, both inside the ACP group and LDCs and among the other major producers, in at least two main areas. Firstly, the possibility that other LDCs, which currently are not exporting sugar to the EU, could start doing so on the basis of the EBA initiative could be explored. Our assumption that these countries face prohibitive trade costs, as they have not exported sugar to the EU to date, is rather strong. UNCTAD (2005) has highlighted that in some of them it would also be possible that local production starts to

be exported, while imports are increased to cover consumption. A qualitative approach, focusing on the whole value chain, may improve the understanding of each individual country's potential to produce and export. Secondly, one of the limitations of the analysis presented is that sugar is mostly treated as a homogenous product. Although, a simple differentiation between raw and refined sugar is available in the COSIMO-AGLINK model, other forms of differentiation, especially on the consumption side, are not taken into account.

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THE EU IMPORT REGIME FOR ORANGES – MUCH ADO ABOUT NOTHING?

Linde Götz[1] and Harald Grethe[2]

[1]PhD Student, Institute of Agricultural Economics and Rural Development, Georg-August-University Göttingen, Germany

[2] Assistant Professor, Institute of Agricultural Economics and Social Sciences, Humboldt-University of Berlin, Germany

ABSTRACT

EU orange imports are restricted by ad valorem tariffs and an entry-price system establishing a minimum import price. In addition, the EU applies a comprehensive system of trade preferences. Despite its complexity, the effectiveness of the EU import system for oranges is low. Import prices for oranges from extra-EU countries are 40% higher than the EU entry price on average. Also, at least 72% of extra-EU orange imports during the EU harvest season enter the EU tariff free. Concordantly, the preferential entry price is not utilized by eligible orange exporters, and quota fill rates have decreased over time. The analysis suggests that EU trade preferences for oranges were not decisive for the development of Mediterranean countries' orange exports to the EU. In the light of the low effectiveness of the entry-price system for oranges and high transaction costs involved, the system's abolishment should be considered.

Keywords: trade preferences, oranges, tariff rate quota, entry price, Mediterranean countries
JEL code: F13, Q17, Q18.

The EU import system for oranges is designed to follow two contrasting goals. On the one hand, it intends to protect EU orange growers by the means of an *ad valorem* tariff and a *de facto* minimum import price established by the EU entry-price system. This allows creating an EU market price, which is higher than the world market price. On the other hand, the EU aims to induce orange imports from preferred trading partners by a comprehensive system of trade preferences. Countries that are granted trade preferences have superior EU orange market access compared to countries that are not covered by trade preferences, the so-called most-favored-nation (MFN) suppliers. Preferential market access is established by a preferential *ad valorem* tariff, which is lower than the MFN *ad valorem* tariff, and is in some cases supplemented by a preferential entry price, which is lower than the MFN entry price.

This article investigates the effectiveness of the EU import system for oranges. In particular, it addresses the following questions. Does the EU entry price indeed affect the EU import price level for oranges? Do the preferred trading partners actually utilize the trade preferences for oranges? Is the origin of EU orange imports determined by the development of trade preferences? We show that the EU market price for oranges is substantially higher than the entry price and hence, the entry-price system for this product has little effect. In addition, it becomes evident that EU trade preferences for oranges are complex. They are specified, negotiated and repeatedly revised for each preferred trading partner individually.

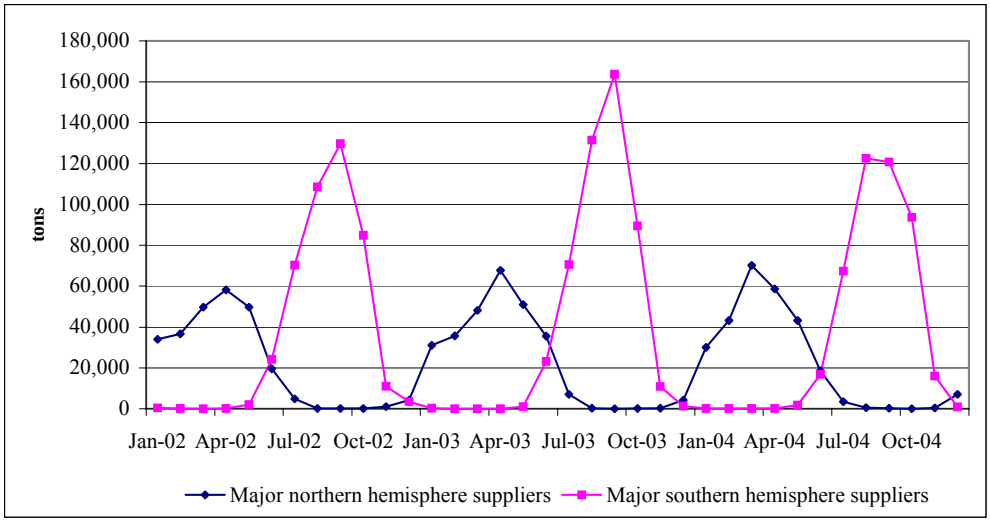
The results of this study demonstrate that, in contrast to its complexity, the effectiveness of the EU import system for oranges is low with respect to its goals, i.e. protecting EU orange growers on the one hand and creating orange imports from the preference receiving countries on the other. The low effectiveness of trade preferences for oranges in contrast to their high complexity is in line with findings from other authors for trade preferences in general (e.g., Brenton and Ikezuki, 2005), as well as for the Mediterranean countries (Grethe, Nolte, and Tangermann, 2005).

This article is organized as follows. Section 2 describes in detail EU orange imports and import policies for oranges, including trade preferences. Section 3 explains the methodology and presents the results of the analysis of the entry-price system and the preferential orange quotas. Section 4 draws summarizing conclusions and puts results in perspective.

EU IMPORTS OF ORANGES

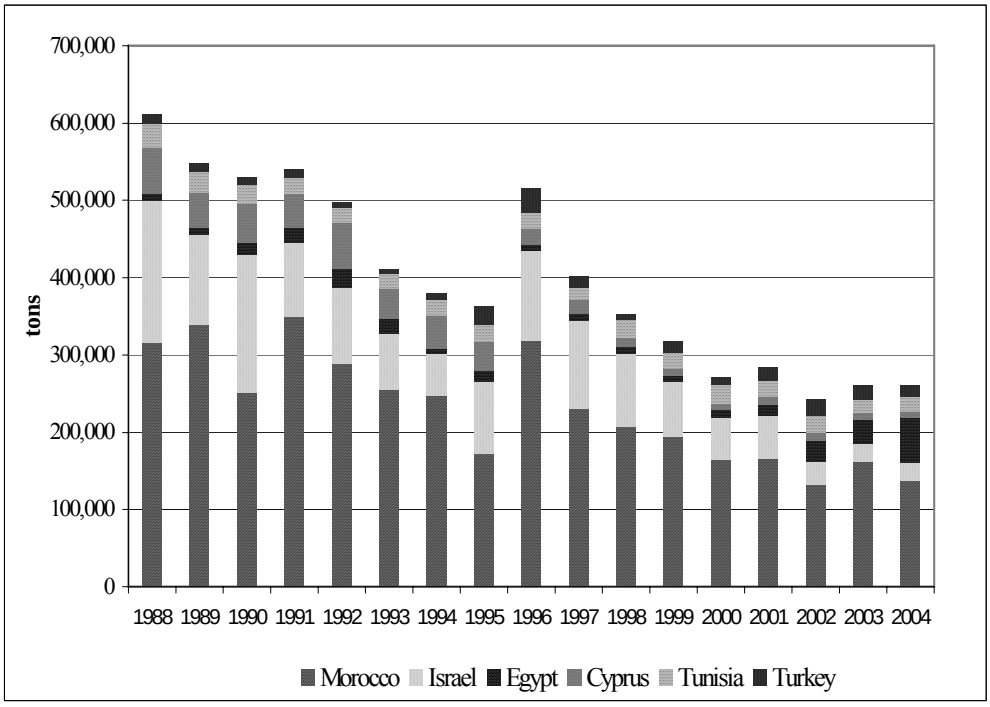
The EU is the largest orange importer in the world. In 2003, EU orange imports amounted to about 805,000 metric tons (mt), equivalent to 23% of world orange imports (FAO, 2005). In addition, EU intra-trade of oranges, originating in the southern EU member countries Spain, Italy, Greece, and Portugal, accounted for about 1.6 million tons, of which 74% originated in Spain. The non-EU countries exporting oranges to the EU can be divided into northern and southern-hemisphere suppliers, characterized by distinct orange export seasons. The major northern-hemisphere suppliers are the Mediterranean countries (MED),[1] which accounted for 88.4% of total EU orange imports from January to June in the period 1988-2004, and Cuba (Eurostat). In contrast, the orange export season of the primary southern-hemisphere suppliers, including South Africa, Brazil, Argentina, Uruguay, Zimbabwe, and Swaziland lasts from June to November (figure 1).

[1] The MED countries comprise Algeria, Cyprus, Egypt, Israel, Jordan, Lebanon, Malta, Morocco, Palestine Authority, Syria, Tunisia, and Turkey, the countries covered by the Euro-Mediterranean Partnership. Cyprus and Malta became EU members in 2004.



Major northern-hemisphere suppliers: Morocco, Israel, Tunisia, Turkey, Cyprus, Egypt, and Cuba; Major southern-hemisphere suppliers: South Africa, Brazil, Argentina, Uruguay, Zimbabwe, and Swaziland.
Source: Eurostat.

Figure 1. Seasonal pattern of extra-EU orange imports, 2002-2004.



Source: Eurostat.

Figure 2. EU orange imports from major northern-hemisphere suppliers, 1988-2004.

The most important MED countries exporting oranges to the EU are Morocco and Israel. Both countries' orange exports decreased markedly between 1988 and 2004 (figure 2). Additional MED countries exporting oranges to the EU are Egypt, Cyprus, Tunisia, and Turkey. Cypriot orange exports to the EU have decreased while Egyptian orange exports have recently increased. MED orange exports to the EU represented 72% of EU imports from non-EU countries during the EU harvest season lasting from November 1 to May 31 in the period 1988 to 2004.

EU ORANGE IMPORT POLICY

The EU MFN external-market regulation for oranges includes a seasonally varying *ad valorem* tariff, with the highest tariff (16%) applied from October 16 to March 31 during the EU orange harvest season (see table 1). In addition, an entry-price system is in effect from December 1 to May 31. In the event that the entry price is undercut, an additional specific tariff is levied; its size varies proportionately to the difference between the product's actual import price and the entry price. The maximum tariff equivalent (MTE) is the maximum specific tariff of 71 Euro that is levied if the minimum entry price is undercut by 8% or more.

The EU orange import system has been changed substantially in the course of the implementation of the results of the Uruguay Round. Applied *ad valorem* tariffs for oranges were reduced by 20% between 1995 and 2001, and the former reference-price system was replaced by the entry-price system as of December 1995. The MFN entry price for oranges, introduced on December 1995, was 34.3% higher than the former reference price, which was kept constant since 1975. This rise in the *de facto* minimum import price was designed to compensate EU orange growers, mainly in Italy, for the abolition of the market penetration premium[2] in the course of the EU accession of Spain and Portugal. Following its introduction in 1995, the MFN entry price for oranges was reduced slightly by 4% until 2001, due to the way in which the EU implemented its market access commitments resulting from the Uruguay Round Agreement.

Table 1. EU MFN Import Regime for Oranges

Time period	MFN ad valorem tariff (%)	MFN entry price (Euro/ton)	Specific tariff (Euro/ton)
01.01.-31.03.	16.0	354	≤ 71
01.04.-30.04.	10.4	354	≤ 71
01.05.-15.05.	4.8	354	≤ 71
16.05.-31.05.	3.2	354	≤ 71
01.06.-30.09.	3.2	NA	NA
01.10.-15.10.	3.2	NA	NA
16.10.-30.11.	16.0	NA	NA
01.12.-31.12.	16.0	354	≤ 71

Sources: European Commission (2005a), own calculations.

[2] Market penetration premiums, a policy instrument to subsidize orange production, were paid to orange growers on class I orange exports to other EU member countries prior to December 1995 (Swinbank and Ritson, 1995).

The substantial seasonal differences of the external market regulation for oranges imply that northern-hemisphere suppliers are confronted with stronger import restrictions than southern-hemisphere suppliers. Since 2001, northern-hemisphere suppliers are charged an average *ad valorem* tariff of 10.9% during their main export season from January to June, which is significantly higher than the average *ad valorem* tariff of 4.3% southern-hemisphere suppliers are confronted with throughout their export season from June to November. Southern-hemisphere suppliers are subject to a substantial *ad valorem* tariff only from October 16 to November 31, amounting to 16% since 2001. Also, northern-hemisphere suppliers have to comply with the entry-price system from January to May, thus during almost their complete export season, whereas the entry-price system is not at all effective during the southern-hemisphere suppliers' season.

EU trade preferences for oranges are mainly granted to the MED countries, the major northern-hemisphere orange suppliers to the EU. The primary southern-hemisphere suppliers, such as South Africa and Brazil, do not enjoy preferential orange market access. The only exception among the southern-hemisphere suppliers are Zimbabwe and Swaziland, which are offered an 80% reduction in *ad valorem* tariff since 2000.

The EU grants trade preferences for oranges using three kinds of instruments. A general tariff reduction lowers the MFN *ad valorem* tariff by a certain percentage for any amount of orange exports. A tariff rate quota (TRQ) and an entry price quota (EPQ) are both quantitative limits, i.e. the respective preference is applicable only up to a certain export quantity. Similarly to the general tariff reduction, the TRQ specifies a particular percentage of MFN tariff reduction. The EPQ includes a lowered entry price in addition to a 100% *ad valorem* tariff reduction (elimination).

In general, preferential access to the EU orange market might induce a competitive advantage for the preference receiving country's exporters against non-preference receiving countries' exporters. Also, trade preferences might diminish the competitive advantage of the protected EU domestic producers vis-à-vis non-EU suppliers in preference receiving countries. In particular, a preferential tariff may increase the non-EU exporters' profits by raising the export price. A preferential entry price might allow utilizing a cost advantage if the produce can profitably be supplied to the EU market at a price below the MFN entry price.

TRQs for oranges were first introduced for Morocco, Israel, Egypt, and Tunisia in 1991 to quantitatively limit the *ad valorem* tariff reductions granted analogously to the tariff reduction for Spain and Portugal in the context of EU market accession (table 2). In the ensuing years, TRQs increased slightly, and in January 1993 the *ad valorem* tariff within the TRQ was abolished completely to coincide with the tariff cancellation for Spanish and Portuguese orange exports. EPQs were introduced for Morocco and Israel concurrently with the transformation of the reference price into the entry-price system in December 1995. Thus, Morocco and Israel were not concerned by the large increase in the MFN entry price compared to the former reference price. Instead, the preferential entry price for oranges in 1995/96 was set equal to the former reference price, amounting to 74.6% of the MFN entry price. It was successively diminished by 4% until 2001, parallel to the reduction of the MFN entry price. For Egypt, an EPQ was established in December 1996.

Table 2. Development of EU Preferences for Primary Northern-hemisphere Orange Exporters, 1991-2004

	Morocco	Israel	Egypt	Tunisia	Cyprus	Turkey	MED
Thousand metric tons							
Preferential tariff-rate quota (TRQ)							
1991	265.0	293.0	7.0	28.0	0.0	0.0	593.0
1992	273.0	301.8	7.2	28.0	0.0	0.0	610.0
1993	280.9	310.6	7.4	28.0	0.0	0.0	626.9
1994	288.9	323.7	7.6	28.0	0.0	0.0	648.2
1995	292.8	328.1	7.7	30.9	0.0	0.0	659.5
1996	296.8	0.0	7.8	31.4	0.0	0.0	336.0
1997	296.8	0.0	7.8	32.3	0.0	0.0	336.9
1998	296.8	0.0	7.8	33.2	0.0	0.0	337.8
1999	296.8	0.0	7.8	34.2	0.0	0.0	338.8
2000	340.0	0.0	7.8	35.1	0.0	0.0	382.9
2001	340.0	0.0	7.8	35.1	0.0	0.0	382.9
2002	340.0	0.0	7.8	35.1	0.0	0.0	382.9
2003	340.0	0.0	7.8	35.1	0.0	0.0	382.9
2004	0.0	0.0	0.0	35.1	0.0	0.0	35.1
Entry price quota (EPQ)							
1996	300.0	200.0	0.0	0.0	0.0	0.0	500.0
1997	300.0	200.0	8.0	0.0	48.2	0.0	556.2
1998	300.0	200.0	8.0	0.0	48.2	0.0	556.2
1999	300.0	200.0	8.0	0.0	48.2	0.0	556.2
2000	300.0	200.0	8.0	0.0	48.2	0.0	556.2
2001	300.0	200.0	8.0	0.0	48.2	0.0	556.2
2002	300.0	200.0	8.0	0.0	48.2	0.0	556.2
2003	300.0	200.0	8.0	0.0	48.2	0.0	556.2
2004	300.0	201.5	50.0	0.0	48.2	0.0	599.7
Preferential intra-quota tariffs (% of MFN duty)							
1989-1992	20.0*	40.0*	40.0*	20.0*	60.0*	0.0	
1993-2004	0.0	0.0	0.0	0.0	24.0*	0.0	
Preferential extra-quota tariffs (% of MFN duty)							
1989-1992	20.0	40.0	40.0	20.0	0.0	0.0	
1993-2004	20.0	40.0	40.0	20.0	0.0	0.0	

Notes: *Further reduction of intra-quota tariffs in line with reductions for imports from Spain and Portugal. Malta, Algeria, Jordan, Lebanon, Syria and Palestine are no relevant orange exporters to the EU and are therefore not included in the table.

Source: European Union.

Spain and Portugal had to comply with the reference price until December 1993. In the second phase of EU accession transition (January 1990 to December 1993), oranges exported from Spain to the EU had to adhere with the reference price indirectly due to a compensation mechanism. In the event that the market price of Spanish oranges fell below the average EU supply price, which could not be lower than the reference price, Spanish exporters had to pay

a compensation, equivalent to the difference between the reference price and the EU market price (see European Union, OJ L302, 15.11.1985, Article 152).

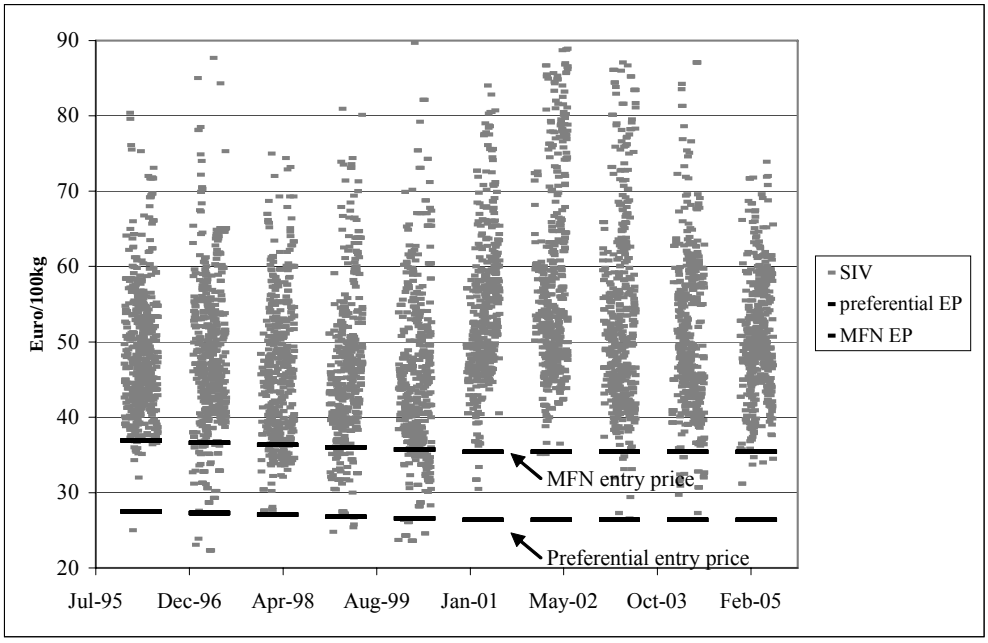
Between 1996 and 2004, TRQs were first increased for Morocco, Egypt, and Tunisia and were finally abolished for Morocco, Egypt, and Israel, which were granted EPQs in the meantime. In addition, the EPQ increased significantly for Egypt in 2004. For Cyprus, the tariff reduction rate gradually increased until the tariff was fully removed in December 1997. The tariff preference was supplemented by a preferential entry price, levied within an EPQ of 48,200 mt. With Cyprus' EU accession in 2004, trade barriers were completely eliminated. For Turkey, the *ad valorem* tariff for orange exports to the EU was removed completely in 1987. Overall, total orange quotas, including the TRQ and EPQ, granted by the EU to the MED orange suppliers amounted to 593,000 mt in 1991, increasing to about 939,000 mt in 2000, and contracting to about 635,000 mt in 2004, when the TRQ for Morocco was eliminated.

To sum up, the EU import regime for oranges is highly complex and evolved in a multitude of separate agreements and regulations. All MED countries may export oranges to the EU within the respective quotas tariff free since 1993. Also, orange exports enter the EU at preferential entry prices for Morocco and Israel since December 1995, Egypt since December 1996 and Cyprus since December 1997. Thus, the relatively high MFN entry price was at no time applied to Morocco and Israel, the largest MED orange exporters. Further, the MED trade preferences for oranges did not erode relative to those of Spain and Portugal until December 1993.

ANALYSIS OF THE EFFECTIVENESS OF THE EU IMPORT SYSTEM FOR ORANGES

To analyze whether and how the EU entry price impacts the EU import price for oranges, and thus the domestic orange market price, the standard import value (SIV) of oranges, an indicator for the import price, is compared to the entry price. The European Commission calculates the SIV daily as the weighted average of wholesale market prices surveyed by origin of the produce in all EU countries and less marketing and transportation margins and custom duties (for further details see European Union, OJ 1994, L337/66, Regulation 3223/94).

Our analysis is based on about 5,500 observations of the SIV for the orange exporting MED, including Morocco, Israel, Tunisia, Egypt, Cyprus, and Turkey, with about 600 to 1,100 observations for each individual country (figure 3). Each single dot corresponds to the SIV of oranges originating in a particular country at a given date. The data set includes SIV observations from December 1, 1995, when the entry-price system was first introduced, until May 31, 2005. The gaps in the data correspond to the SIVs surveyed exclusively when the entry-price system is in effect, i.e., from December 1 until May 31.



Sources: European Commission (2005a, 2005b).

Figure 3. SIV, MFN entry price and preferential entry price of MED orange exports to the EU, December 1995 to May 2005.

Figure 3 reveals directly that the vast majority of observations lies distinctively above the MFN entry price. Few SIV observations lie below the MFN entry price and even less are lower than the preferential entry price. In particular, the share of SIV observations that exceed the MFN entry price is highest for Israel with 99.9%, followed by Cyprus with 98.7%, Tunisia with 97.2%, and Morocco with 93% (table 3).

For Morocco and Israel, none of those observations lies below the applied entry price, which is the preferential entry price introduced on December 1, 1995. This means that the specific tariff was not at all imposed on Moroccan or Israeli oranges in this time period. Two observations for Cyprus and 24 observations for Tunisia lie below the respective entry price. The SIV was below the applied entry price most frequently for Egyptian oranges with 31 and Turkey with 90 observations, corresponding to 4.2% and 8.0% of all observations respectively. The average difference between the SIV and the MFN entry price is highest for Israel with the SIV amounting to 158.1% of the MFN entry price and 212% of the preferential entry price on average, followed by Turkey, Cyprus, and Tunisia. The differences are lowest for Egypt, with 124.1% and 166.5%, respectively. On average, the EU import price for oranges originating in the MEDs is 40% higher than the MFN entry price and about 90% higher than the preferential entry price. This indicates that the entry-price system for oranges is largely redundant.

Table 3. SIV in Relation to MFN Entry Price and Preferential Entry Price of MED Exports of Oranges to the EU, December 1995to May 2005

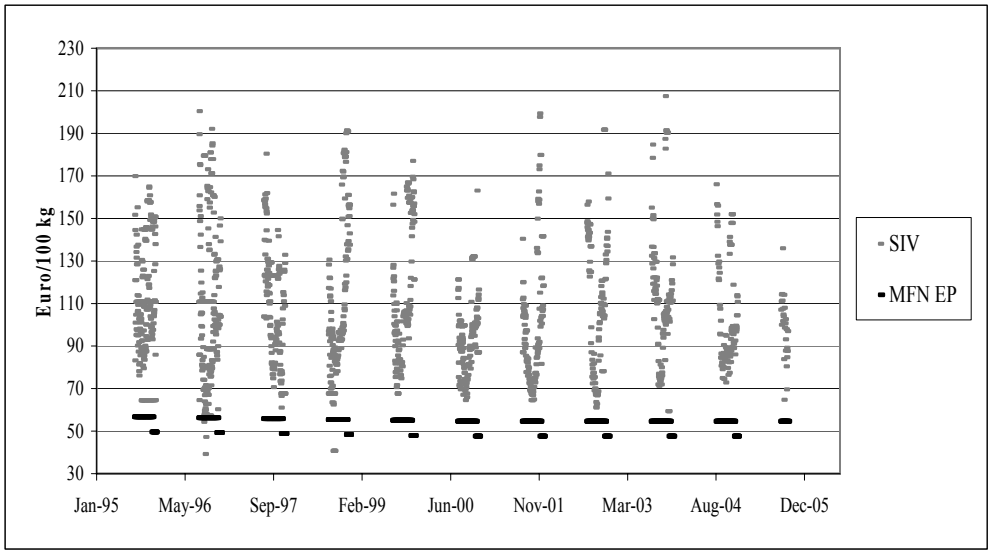
	Number of observations	SIV > MFN EP	SIV < Applied EP*		SIV as % of MFN EP	SIV as % of pref. EP
		% of observations	number of observations	% of observations	average	average
Israel	961	99.9%	0	0%	158.3%	212.4%
Tunisia	854	97.2%	24	2.8%	141.5%	185.8%
Turkey	1,132	92.0%	90	8.0%	144.5%	193.8%
Morocco	1,133	93.0%	0	0.0%	127.6%	171.1%
Egypt	746	79.1%	31	4.2%	124.1%	166.5%
Cyprus	613	98.7%	2	0.3%	144.4%	193.7%
Total	5439	93.3%	147	2.7%	140.1%	187.9%

Note: for Morocco and Israel: applied EP = pref. EP; for Turkey and Tunisia: applied EP = MFN EP; for Egypt: applied EP = MFN EP before Dec. 96 and pref. EP afterwards; for Cyprus: applied EP = MFN EP before Dec. 97; pref. EP afterwards.

Sources: European Commission (2005a, 2005b), own calculations.

Evidence from other Fruit Markets

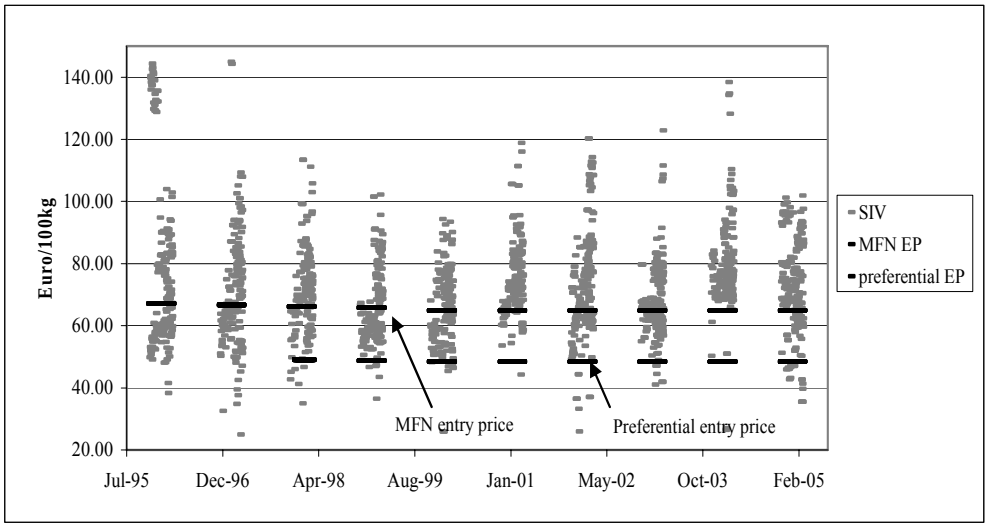
To check whether this result can be generalized, two other fruits are investigated. The size of the difference between the import price and the MFN entry price for oranges is exceeded by the corresponding difference for table grape exports from the MED countries to the EU (figure 4). On average, the SIV for table grapes amounts to 199.1% of the MFN entry price effective July 21 to November 20.



Sources: European Commission (2005a, 2005b).

Figure 4. SIV and MFN entry price of MED exports of table grapes to the EU, December 1995 to May 2005.

The situation for EU clementine imports from the MED countries differs considerably. The SIV is below the MFN entry price (operative November 1 to the end of February) for Turkey in 44%, Morocco in 31% and Israel in 23% of the surveyed cases for clementines, although a preferential entry price is granted to Morocco exclusively (figure 5). Morocco also benefits heavily from an EPQ granted by the EU for Moroccan tomatoes. For the period 2000 to 2003 about 58% of Moroccan tomato exports enter the EU at a price between the MFN and the preferential entry price (Chemnitz and Grethe, 2005). Thus, the EU entry-price system for oranges and grapes is by and large redundant for MED country exports. For clementines and tomatoes, however, import prices are much closer to entry prices, and the entry-price system seems to have an import restricting effect.



Sources: European Commission (2005a, 2005b).

Figure 5. SIV, MFN and preferential EP of MED exports of clementines to the EU, December 1995 to May 2005.

Development of Quota Fill Rates

The utilization of the preferential quotas for oranges is investigated by comparing the development of orange exports to the evolution of the total orange quota, comprising TRQ and EPQ. The corresponding quota fill rates, equal to the orange exports in percentage of the total orange quota, are given in Table 4 for the period 1991 to 2004. The only countries for which exports exceed the respective quota in some years are Morocco and Egypt. Morocco's orange exports exceed quotas in 1991 and 1992, but fall below afterwards. Since 1997, Morocco's fill rate has been below 50%. The removal of the TRQ in 2004 caused an increase in the fill rate in that year. Egypt exceeds its quota from 2002 to 2004 due to the rise of Egyptian orange exports to the EU in this period. Tunisia's quota fill rate varies between 48% and 75%. The rate for Cyprus is always below 50%. Israel exhibits the lowest fill rates,

declining from 32% in 1991 to 12% in 2004. The unweighted average fill rate fell from more than 100% in 1991 to 39% in 1999, but rose again to over 50% in 2002.

Table 4. Orange Quota Fill Rates (Orange Exports in % of Quota)

	Morocco	Israel	Cyprus	Egypt	Tunisia	Average
1991	132	32	-	279	75	130
1992	106	33	-	347	69	139
1993	91	23	-	264	72	113
1994	86	17	-	92	73	67
1995	59	28	-	184	73	86
1996	54	58	-	105	64	70
1997	39	57	38	61	45	48
1998	35	47	25	54	69	46
1999	33	35	18	50	61	39
2000	26	27	16	68	69	41
2001	26	27	19	95	61	46
2002	21	15	21	170	61	58
2003	25	12	19	195	48	60
2004	46	12	19	114	53	49

Sources: Eurostat, European Union, own calculations.

Overall, while TRQs and EPQs for oranges originating in the MED countries were increasing, the MED countries' orange exports to the EU were decreasing. Therefore, the quota fill rate has fallen for most MED countries, and the unweighted average quota fill rate has been 60% or less for all years since 1997.

DISCUSSION OF RESULTS AND IMPLICATIONS

Our analysis reveals that the import price of oranges originating in the MED countries is about 40% higher than the MFN entry price on average. In addition, the investigation on the EU trade preferences for oranges shows that about 70% of EU orange imports during the EU orange harvest season originate in the MED countries, and have entered the EU tariff-free since 1993 due to preferential tariff reductions. This suggests that the contribution of the external market regulation to the protection of EU orange growers is low. In particular, the entry-price system for oranges is of little effectiveness.

Low protectiveness of the EU reference-price system for oranges, the predecessor of the entry-price system until the implementation of the Uruguay Round results, was already detected by Swinbank and Ritson (1995). They find (p. 348) that countervailing charges were applied 500 times for all fruits and vegetables in the period August 1988 to August 1994, due to the shortfall of the import price under the reference price. For oranges, countervailing charges were induced altogether only 7 times, which may be interpreted as an indicator for a low protectiveness of the reference-price system for oranges or alternatively for a successful organization of the exporters concerned (Swinbank and Ritson 1995, p. 356). These results are in line with an earlier analysis of the EU external market regulations for oranges by Williams (1986).

Concordantly, Morocco, Israel, and Cyprus do not utilize the preferential entry price for oranges. Thus, MED countries do not compete with EU producers in this lower-price segment. Indeed, EU importers report that prices of Moroccan and Israeli orange imports are significantly higher than the import price of Spanish oranges. Egypt is the only MED country benefiting from the preferential entry price to some degree.

The analysis also reveals that although orange quotas increased from 1991 to 2004 for the MED countries as a whole, actual exports declined concurrently, and thus quota fill rates have decreased. A quota underfill can result from the method of quota administration and especially the red tape involved in importing under the quota (Skully, 2001). This, however, seems not to be relevant for the TRQs and EPQs granted by the EU for fresh fruit and vegetable imports. These quotas are administered according to the first-come-first-serve principle, and EU importers report that they do not involve significant red tape. Thus, the underfill reflects a market equilibrium, in which third country exporters' marginal cost equal the EU price.[3] As a conclusion, the quantitative limitations of tariff and entry price reductions within TRQs and EPQs are largely redundant.

Additionally, it is evident that the improvement of market access for Spain and Portugal due to their EU accession occurred almost parallel to the enhancement of preferences for the MED countries until 1993. This supports the conclusion that the development of trade preferences for the MED countries compared to market access conditions for Spain and Portugal was not decisive for the development of the MED's orange exports to the EU up to 1993. Furthermore, our results indicate that the erosion of orange trade preferences of Israel and Morocco relative to those of Spain and Portugal in the aftermath of 1993 did not cause the decline of orange exports from those countries. Both countries' orange exports enter the EU tariff free since 1993. Also, the preferential entry price is not utilized by the orange exporters in Israel and Morocco. Even, the average import price of oranges originating in Israel and Morocco is about 58% and 28% higher than the MFN entry price, respectively. Hence, any erosion of trade preferences compared to Spain, which is suggested by Cioffi and dell'Aquila (2004, p. 175), could not originate from EU trade policies. Also, we cannot find evidence for the assumption of Cioffi and dell'Aquila (2004, p. 178) that the large increase in the MFN entry price relative to the former reference price may have contributed to the decline of Moroccan and Israeli orange exports to the EU. Instead, we show that a preferential entry price for oranges originating in Israel and Morocco, which was equal to the former reference price, was introduced concurrently with the implementation of the entry-price system in December 1995. Thus, Morocco and Israel were never subject to the MFN entry price for oranges.

Hence, factors beyond EU trade policy would appear to have caused the decline of the MED's orange exports to the EU. For example, market distance and product variety are of particular importance for the decline of Israeli orange exports to Germany. German importers appreciate the high flexibility with orange imports from Spain. Due to Spain's proximity to the market, Spanish produce is packed directly in nets in Spain and transported by truck to retailers' distribution centers in Germany within 2 days. In contrast, Israeli produce is first packed in cardboard boxes in Israel, which are transported by ship within 4 days to Marseille (France). The produce is then carried by truck to packing stations in Germany where it is repacked in nets before it is brought to supermarkets. Of course, the resulting transportation

[3] See de Gorter and Kliauga (2005) for a detailed analysis of the economics of TRQs.

costs are lower for Spanish produce. Besides, Shamouti is the orange variety which still dominates Israeli orange production. In Spain, new orange varieties were introduced, e.g. the Navel varieties. German consumers prefer Navel over Shamouti oranges, but Israeli orange producers have not adapted to this change in consumer preferences.

It remains to determine the influence of EU internal agricultural policy as well as structural policy on the large increase in EU orange market share of Spanish produce. EU orange production is protected internally by processing aid and withdrawal compensation. Also, operational programs of producer organizations for improvement of product quality and market promotion activities are financially supported. Restructuring aids are granted to modernize marketing structure and to grub up old orange groves. Additional funds are provided by the EU Cohesion Fund, e.g. for enhancement of transport infrastructure.

Finally, all this implies that the liberalization of orange trade between the EU and the MED countries, which could be realized in the course of the ongoing Barcelona Process, would induce few, if any, trade effects. Theoretically, the entry-price system would prevent especially low qualities from entering the EU market. For oranges, however, interviews with trading companies did not reveal evidence of potential low-quality orange market segments below the entry price level. Existing regulatory standards for citrus fruits laid down in EC regulation 2200/96 specify minimum quality requirements regarding e.g. fruit size, external appearance and uniformity. Citrus produce which does not comply with those standards is not allowed to enter the EU market. Thus, inexpensive, low-quality produce is barred from the EU market, even if the EU entry-price system were removed. Recently, public standards are supplemented by even more restrictive private standards, in particular EUREPGAP, which evolves quickly and becomes a quasi-mandatory private sector quality assurance scheme for fresh fruits and vegetables in the EU (Codron, Giraud-Héraud, Soler, 2005).

Yet, as demonstrated for clementines, these results cannot be generalized, not even for citrus imported from the MED countries. It is highly probable that the removal of the entry price for clementines would result in a decrease of the average EU import price level. Table grapes, however, provide a second example for which the SIV of imports from the MED is far above the EU entry price, and thus the entry-price system is of little effect.

The conclusion that large parts of the EU external trade regime for oranges are redundant will potentially be amplified by the current round of trade negotiations in the WTO. Negotiations on market access will probably result in significant tariff reduction rates which would also apply to the specific tariffs which are part of the EU entry-price system. In implementing the results of the Uruguay Round, the EU reduced entry prices by the same monetary amount as specific tariffs—an approach which could be repeated and would thus further diminish the relevance of the EU entry-price system (Grethe 2005, p. 28-29).

In the light of the low effectiveness of the EU import regime for oranges along with high transaction costs involved in its administration and further development, the unlimited and free access by MED countries to the EU orange market could be considered as an alternative. This may be extended to grapes and possibly to other fruits and vegetables. In addition, the abolition of the entry-price system for some products would reduce the incidence of a clear non tariff barrier to market access which survived the Uruguay Round process of tariffication, but which is in clear conflict at least with its spirit.

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