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# Modeling the EU-US cereal trade - the post 'Agenda 2000' analysis

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# MODELING THE EU-US CEREAL TRADE – THE POST 'AGENDA 2000' ANALYSIS

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The dictionary defines graduation as the successful completion of a program of study, but for me it means a lot more. To me, graduation is an accomplishment of a cherished dream, a first step towards progressing onto a new threshold in life. I have no idea what the future may hold in store for me, but I do know that I have a lot of people to thank for getting me till here.

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## ABSTRACT

Significant changes in attitudes toward farm policy and trade have occurred within the European Union and the United States in the past decade. Trade negotiations under the General Agreement on Tariff and Trade (GATT) specifically the Agreement on Agriculture (AoA) and later under the Doha Round of the World Trade Organization (WTO) have bought about considerable changes in the market structure in the cereals trade. Bilateral trade has further been impacted by the cessation of concession treaties like the Blair House Accord that expired at the end of the 2004 marketing year (WTO).

Domestic budget pressures in the United States have lead to decreased support to farmers, making them more oriented to world market needs based on prevailing world prices (Daryll E. Ray). The European Union has introduced reforms in the Common Agricultural Policy as a consequence of high budgetary expenditure and the accession of the ten new central European nations into the European Union in the form of the Mac Sharry Reforms and the Agenda 2000 Reforms. These reforms are now aimed at decreasing the distortions caused due to the high amount of protection for farm income thus moving towards more targeted farm programs.

These economy wise changes internal to each of these major players in agricultural trade in the world, coupled with transformed bilateral trade relations under the auspices of the WTO have had vital effects on bilateral transactions and world markets. These reforms may have had compelling economy wise effects on consumption, production, trade and world prices and could subsequently provoke trade liberalization in other sectors based on the quantification and prediction of welfare effects of such measures by the two trading partners.

This study is aimed at reviewing policy changes in the European Union's Common Agricultural Policy and their effects on the cereal trade with the United States. The study contributes to estimating whether changes in the cereal policies of the EU have had a significant impact on the trade between the EU and the US. Further a forecast for the domestic prices for wheat in a free trade scenario is documented with an estimated trend for the exogenous variables.

Results obtained from the suggest that the re-instrumentation of the Common Agricultural Policy (CAP) by the Mac Sharry Reforms of 1992 and the Agenda 2000 Reforms have had significant effects on trade between the U.S. and the fifteen member countries. The forecast for domestic prices in wheat for the EU suggest a period of decreased prices followed by an increased amount of imports of wheat.

# CHAPTER 1

# INTRODUCTION

"*In matters of trade and investment conflicts, cooperation and convergence have all characterized relations between the United States and the European Union. Liberalization under the auspices of the GATT/WTO and the OECD promoted convergence over the past half century but the forces of markets, culture and language were far more important than policies emanating from Washington, Brussels or other European countries. If policy had been the driver of convergence, long ago Europe and the United States would have created the first NAFTA – the North Atlantic Free Trade Area*" (Gary Clyde Hufbauer, Reginald Jones, Federic Neumann 2002).

There are major limitations to free trade between the United States and the European Union. Policies influenced by national and regional political forces, imperfect information, and ideological conflicts have restricted trade between these two major countries. Agricultural trade has thus been influenced by domestic policy mechanisms that are aimed at protecting farmer interests while distorting the world market and trade.

Cereal trade between the United States and the European Union is one of the most complex matrices in world trade, characterized by policies aimed at supporting domestic producers while distorting the world prices as well as trade between these two dominant trading partners (characterizing the European Union as a single entity though it is more accurately an economic federation).

Graph 1.1 depicts the U.S. share of cereal imports to the European Union[1] imports of cereals. Total cereal exports by the United States have declined over the past

[1] The European Union considered here is the EU – 15 unless specified otherwise.

couple of decade. Though the United States cereal exports still account for 25.6 percent[2] of the net cereal exports to the European Union with respect to the rest of the world, there has been a decrease in the amount traded compared to the pre – 1992 era (64 percent in 1991). Wheat, Barley, Corn and Rice form the major cereals exported by the United States while Rye, Oats and Sorghum are minor cereals which collectively form a sizable amount of cereal trade.

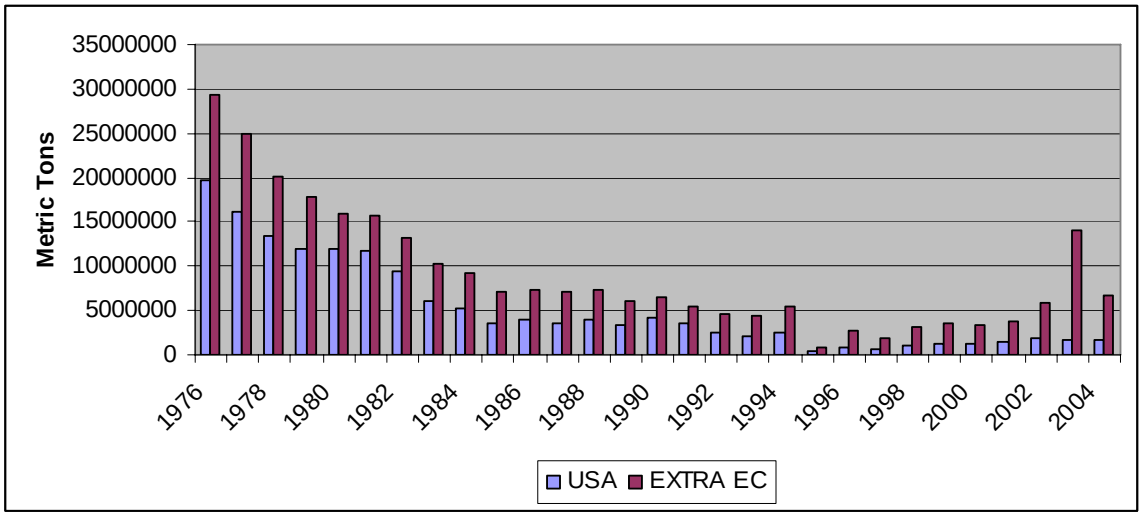


Figure 1.1: Cereal Imports by U.S. compared to the Rest of the world[3]

This decrease in trade between the United States and the European Union is mainly attributed to the policy changes in both these major cereal trading entities. The 1996 Federal Agriculture Improvement and Reform Act (FAIR 1996), the 2002 Farm Bill of the United States and the Common Agricultural Policy reforms of the European Union vis-à-vis the Mac Sharry Reforms (1992), the Agenda 2000 Reforms (1999) and the Mid Term Review (MTR) of Agenda 2000 aimed at being GATT/WTO compliance have had major welfare and trade effects on agricultural trade in general and cereals specifically. The Agreement on Agriculture (AoA) under the auspices of the GATT may have helped

[2] *Source:* National Agricultural Statistical Service, USDA.
[3] *Source:* Eurostat – Internal and External Trade of the European Union

increase trade flows between the European Union and the United States. Bilateral cereal policies under the Blair House Accord of the AoA which amended the Dunkel draft and broke the impasse between both these trading partners helped decrease price distorting policies (Sharma). The Accord signed in November 1993 included a shelter from challenges for major cereal policies of both the United States and the European Union. The protection was conditional to there being no increase in subsidy payment increase from the 1989 baseline levels (Josling, Tangerman. and Warley, T.K). This clause may have also provided an impetus for a larger and freer bilateral trade between these trading partners.

In light of domestic policy changes, modified economic forces such as exchange rates, and the evolution of bilateral trade agreements, cereal trade between the major importer (European Union) and the major exporter (United States) in the world could have many welfare effects apart from changes in the demand and supply elasticities and their effects on the world market of cereals. This thesis will construct a partial equilibrium model to determine such trade impacts and simulate alternate scenarios to predict trade flows between these two major agricultural trading entities.

### 1.1. Problem Statement

Significant changes in attitudes toward farm policy and trade have occurred in The United States and the European Union during the past decade. Trade negotiations under the General Agreement on Tariff and Trade (GATT), specifically the Agreement on Agriculture (AoA) and later under the Doha Round of the World Trade Organization (WTO), have brought about considerable changes in the market structure in agricultural trade in general and cereals in specific. Bilateral trade has further been impacted by the

cessation of concession treaties like the Blair House Accord that expired at the end of the 2004 marketing year (WTO).

Domestic budget pressures in the United States have lead to decreased support to farmers, making them more oriented to world market needs based on prevailing world prices (Ray). The European Union has introduced reforms in the Common Agricultural Policy as a consequence of budgetary pressures and the accession of ten central European nations into the European Union. These reforms are aimed at decreasing distortions resulting from the high levels of protection for farms income thus moving more towards targeted farm programs.

These economy wise changes internal to each of these major players in the world agricultural trade, coupled with transformed bilateral trade relations under the auspices of the WTO have had vital effects on bilateral transactions and world markets. Cereals are one of the major sectors that have undergone domestic and trade reforms in both these partner entities. These reforms may have had compelling economy wise effects on consumption, production, trade and world prices and could provoke trade liberalization in other sectors based on the quantification and prediction of welfare effects of such measures by the two trading partners.

Current issues of further liberalization in the agricultural sectors have created a demand from policy makers to quantify estimates of demand elasticities and forecasts for the future based on policy initiatives. The analysis of changes in elasticities of demand and forecasts based on policy changes and their significance could help make policy makers make better informed decisions on liberalizing other sectors of agriculture thus affecting better trade relations between the two trading entities. The analysis will also

help in determining if decoupled payments in cereals did have significant impacts on freer trade while providing price stabilities to both farmers and consumers.

### 1.2. Problem Justification

Previous quantitative assessments of the likely impacts of the recent reforms of the Common Agricultural Policy differ across empirical studies[4]. Differences in analytical results are mainly due to the way these policy instruments are taken into account vis-à-vis explicit modeling, implicit and ad valorem, the data used for analysis and the model used in explaining trade impacts due to these policy changes.

Many earlier studies either accentuate on the welfare impact of these policy changes on the member countries of the European Union, thus abstracting the world trade scenario or take the European Union as a bloc to illustrate trade distortions between the European Union and other non-member countries.

Since the United States is one of the largest exporters of cereals to the European Union, policy changes by the EU have significant effects on United States production, consumption and trade and vice versa. The termination of the Blair House Accord at the end of 2004 will have a huge impact on cereal trade between these two nations. In this background study of the effects of the changing agricultural policy of the European Union will find issues that are of vital significance for United States agriculture.

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[4] . (a). Medium term Forecast and Simulation Model (SPEL/EU-MFSS) is a partial equilibrium characterization of the EU agricultural sector.
(b). The Food and Agricultural Policy research Institute (FAPRI) model is a recursive dynamic PE econometric model.
(c). The CAP Modeling and Accounting (CAPMAT) is a EU focused dynamic computable General Equilibrium model with emphasis on Agriculture and food processing.
(d) Quest II is a macro econometric business cycle and growth model of the EU economy used to produce economy wide impact.

The thesis is aimed at predicting possible outcomes of these changes taking individual countries of the European Union into consideration rather than the European Union as a bloc. The study will analyze six commodities (Barley, Corn, Oats, Rye, and Wheat) and categorize trade among 16 regions (EU – 15 and the US), using a computable partial equilibrium model. Apart from these policy changes exchange rate effects have also been computed to determine their effects on the bilateral trade. Quantification and estimation of these policy changes and their impacts on trade will make policy makers make wiser decisions and understand domestic policy implications to both the consumers and producers in both the European Union and the United States.

### 1.3. Review of Literature

Benjamin; et al, (May 2003), evaluated the effect on the world cereal market under the new Common Agricultural reforms. They used the world econometric modeling of arable crop model (WEMAC) – an econometric, dynamic, multi product, non spatial[5], partial equilibrium commodity model. They studied the effect of the European reforms in three scenarios – with no CAP reforms. With the mid term review and finally a totally decoupled scenario and simulated their effects until 2008. The study identifies the United States as the highest exporter of wheat to the European Union with a share of 28.9% of the total cereal exports to the European Union. They estimated that exports by the U.S. actually increased by 5.3% while imports decreased to 1.1%. The study considered behavioral equations of production, consumption, price linkages (especially the price transmission equations) stocks and trade flows for each of these regions apart from the European Union's domestic policy instruments. The study also

[5] Does not identify trade flows between one specific country or region

assumed a specific severability structure in the CAP. Thus allocation decisions were made in three stages:

**i.** Producers split total available area between fodder and arable crops.

**ii.** Area under arable crops was allocated between industrial crops and cereals and oil seeds.

**iii.** Area under cereal and oil seed cultivation were demarcated among the crops

The study was restricted to the third stage and assumed that the total area under the oil seeds and cereals is fixed but allocatable across various grains and oil seeds. Cereal area in the European Union under the baseline projections were found to increase due to higher direct payments. World prices compared to the European Union prices for wheat showed a higher increase. Under the Mid term scenario the study concluded that the area harvested and production in the European Union decreased slightly, it also predicted that the prices would decrease and the amount of cereal imports increased. Finally, the total decoupled scenario showed that the harvested area decreased further and world prices for wheat increased. Imports to the European Union were estimated to increase by 12% through 2009. The study concluded that the United States would under the mid-term scenario and the decoupled scenario increase the amount of cereal production and exports to the European Union.

Thompson et al (November 2001) used a non-linear perfect substitutes, constant elasticities, one commodity, two region partial equilibrium market model for the European Union, rest of the world wheat market. The study was aimed at assessing the impact of reform of the CAP on wheat prices and the economic welfare in the European Union. The study took into consideration policy changes that included the 1992 Mac

Sharry reforms, the Uruguay Round of Agreement on Agriculture (URAA) and the first effects of the Agenda 2000. Aggregate welfare effects and the distribution of gains and losses among producers, consumers and the European Union's budget were evaluated. Offsetting effects of the reduced price supports and direct producer payments on producer welfare were also assessed. The study does not explicitly model individual agricultural policy instruments like the set-aside policy, intervention price, hectare and set- aside premia of direct payments, co-responsibility levies, variable import levies, import tariffs and export subsidies. Intra European Union trade was also excluded from this study. The EU-15[18] was only taken into consideration. The study used the USDA – Economic Research Service (ERS) data for world wheat market prices, production and supply. German producers served as a proxy for EU prices. A comparative study was done using pre and post 1992 data. The study estimated that consumers gain, producers lose without hectare premia payments while they gain when these payments are considered. Budgetary costs increase and the net welfare change are positive. Government expenditure was found to be less than welfare gains of producers and consumers and the study also observed that producers were over compensated with the direct payments for policy induced price reductions. The study finally concluded that the maximum impact of the post 1992 CAP reforms was on price levels and not on price stability.

Philippidis et al., studied the welfare effects of the Agenda 2000 reforms of the CAP on member countries. The study aggregated the database into two components – regions of developed countries and less developed countries along with the European Union's 15 member countries. They developed a 16 sector 17 region Global trade Analysis Project (GTAP) model to study the welfare effects and additional budgetary

allocation. They analyzed the welfare effects by employing the standard, multi-region GTAP comparative states framework with modifications to represent CAP interventions, Uruguay Round Agreement on Agriculture (URAA) and macro economic projections.

The study compared the full implementation of the URAA, comparing projections up to 2008 with simulations incorporating the Agenda 2000 reforms. Using these, they estimated the change in output, land use, retail prices, economic welfare and agricultural incomes in the EU apart from budgetary expenses due to implementation of the Agenda 2000 reforms.

The results of this study showed that welfare effects on individual member states differ considerably. The output of cereals, oil seeds and cattle falls, while output of pigs, poultry and milk increase. Oil seed production is replaced by cereal production due to the higher amount of compensatory payments done in cereals as compared to that of oil seeds. A switch in the use of pastures from cattle to milk was also observed. It was also found that cattle sector gains at the expense of cereal and milk.

As a result of these changes agricultural household income show gains and losses in various member countries with Finland, Ireland and Sweden gaining most while France, United Kingdom and Spain being the main losers. The Consumer Price Index (CPI) was also found to decrease in all member countries. The budgetary cost of the Agenda 2000 was estimated to be an additional € 3,203 million.

Betina Dimaranan et al, assessed the likely impact of 'decoupling' payments by OECD economies[6] on developing country welfare with a special attention on the impact of reforms on real farm income in the reforming OECD countries especially the European

[6] Organization for Economic Co-operation and Development of which the EU forms a major partner apart from the United States, Canada, Japan, Australia, Korea and Mexico.

Union, United States and Australia. The main focus of their study was to analyze the effects through terms of trade. They used the standard GTAP model and then provided central parameter values for the key elasticities of substitution and factor supply elasticities. The study found that these elasticities are less than one in contrast to the usual assumption of perfect factor mobility assumed in most studies.

The study observed that the EU and the U.S. show sizable cuts in the Producer Support Estimates (PSE) in periods from 1987 – 1997 though the 1996 FAIR Act of the U.S. reversed the trend. In contrast the EU showed a decisive shift in its composition of support with the share provided for market price support falling in favor of increased land and headage based payments. The U.S. recorded a moderate level of reduced PSE mostly due to the elimination of Market Price Supports (MPS) with historical entitlements becoming a more important technique of PSE in the U.S. for grains. The study observed that Argentina maintained its export specialization in program crops while the Middle East and North African (MENA) countries has been consistently a net importer of program crops[7].

The study also observed that while the USA and Canada's net export position strengthened over the period, the EU – 15 and the European Free Trade Area (EFTA) have substantially reduced their net imports as a share of total imports. They further conclude that increased domestic support for program crops has led to the improvements in the net trading position of the OECD countries at the expense of developing countries.

The study considered wheat as the chief agricultural commodity since it accounted for significant amount of trade as well as having high domestic support in the

[7] Program crops include cereals, oilseeds, raw sugar, processed rice and refined sugar.

OECD countries. It found that developing countries as a whole export 14% and import 54% of the total wheat traded. Further the U.S. and the EU each account for a quarter of total world wheat exports.

The study does not take a set world price for a commodity but computes it by analyzing bilateral trade thus domestic-world price gap is measured as a trade weighted combination of bilateral import and export prices. Also in order to compute the Market price support, the study took this price gap and applied it to output to compute the change in PSE associated with a policy change. The study assumes the trade elasticities using earlier studies which estimated this using the GTAP model. Import demand is estimated using the trade, tariff, and transport cost data for different countries.

The study observed that an output subsidy has a larger effect on the output, producer prices and farm income than does market price supports and hence substantiated to be more trade distorting. The study also found that EU production of wheat decreases while its consumption increases due to the decrease in export subsidies. It is estimated that total welfare gain due to this re-instrumentation of the policy will be $188 million. Most developing countries lose from higher wheat prices (total welfare estimated to be $65 million). Thus the study concludes that developing countries largely dependent on EU imports (MENA) lose with the decrease in domestic support in OECD countries while developing countries which compete with the OECD countries for the same products increase their share of exports since border support prices decrease giving greater access to these country markets.

Birgitte Gersfelt et al, provided a quantitative assessment of the impact of EU reforms namely the Agenda 2000 and the Mid Term Review of 2004 on non-EU

countries, focusing particularly on implications for trade, production and welfare. The analysis was conducted using the CAP specific version of the GTAP model. The analysis took into consideration 3 scenarios – the first simulation served as a benchmark against which the reforms were compared, it incorporated the effect of changes in CAP and the EU preferential market access from accession countries. Two scenarios are then compared and simulated till year 2013. The first illustrates the effect of enlarging the EU under the current CAP regime (Agenda 2000 scenario) and the second incorporates the effects of enlarging the EU and reforming the CAP in accordance of the Mid Term Review reforms (MTR scenario).

The implication of the Agenda 2000 scenario for the acceding 10 new countries is that the domestic support payments will be coupled to land use and livestock production. While the MTR – reform scenario illustrates that wheat intervention prices are reduced to € 285 per hectare in traditional areas and no payments in well established areas. For rice the intervention prices were decreased, coupled with an increase in direct payments. However since the MTR reforms stipulate that countries will have certain discretion in implementing the decoupled domestic price support the study assumed the MTR-reform implementation in each member country was based on options for decoupled direct payments in each member country.

The results of simulations conducted till 2013 showed that the joint effect of enlargement and the implementation of the MTR on all member countries would result in a 5.7% reduction in cereal production while under the Agenda 2000 scenario an increase in 1.5% of cereal production is seen for the same period.

The study also observed that under their assumption that there will be no restrictions on the use of agricultural land receiving single farm payments there will be a shift in production from cereals to other crops like vegetables, fruits and nuts. The study also concluded that there is a decline in the value of exports of cereals from the EU 25 in the MTR-Enlargement scenario while the net export value of cereals would have increased in the Agenda 2000-Enlargement scenario. Further, it estimates that the joint effect of the two reforms thus result in the net improvement in the agricultural trade balance by approximately $1 billion. Another notable observation that the study made was that the MTR-reform actually increases the value of EU exports and imports to the U.S. which is attributable to the increase in trade of fruits, vegetables and other non-program crops. Agricultural exports by the African countries to the EU 25 decrease by $660 million. Welfare effects illustrated that the total global welfare of almost $10 billion could be achieved with the implementation of the MTR-Enlargement scenario with the highest gain to the EU 25 and the highest losses to the African and Latin American countries.

Hans van Meijl et al examines the compatibility of the Agenda 2000 reforms of the CAP with GATT commitments of the EU. They also analyze the effects of alternative world market price changes on the fulfillments of these commitments.

The study used a eight region, 18 sector computable general equilibrium model – the GTAP version 5 to analyze the effects. Policy instruments taken into consideration were price transmission mechanism between market and the intervention price, lowering of intervention price for cereals, increased area payments for mandatory set-asides and intervention stock policy changes. The study deviates from the standard GTAP model by

including a multiple support price system of cereals. The variable import tariff which insulates the domestic cereal market is modeled along with variable export subsidy to dispose excess supply and the endogenous price transmission mechanism between the intervention price and market price.

The results show that there is a negative impact on output for feed grains while the opposite was observed for the food grain sector. The study also illustrates that within the cereal, oilseed and protein complex production shifts from oilseeds to cereals due to the fact that the drops in premiums for oilseeds outweigh the downward revenue effects in the cereal sector. Lower cereal price intervention price is partially compensated by higher area premiums. Exports were reported to effect negatively for feed grains and oil seeds. In contrast food grains export increases because of increased production.

The study concluded that the Agenda 2000 reforms had limited effects for producers outside the EU 15 with some positive output effects in oil seed trade of the U.S. and Australia. The study also observed that since intervention prices are kept equal for both food and feed grains which imply a higher export subsidy to feed grains as there is a positive differential between the two international markets. The paper also shows that even with the full implementation of the Agenda 2000 reforms successful reduction in export subsidies depend on the world market and exchange rate developments.

### 1.4. Project Objectives

The main objective of this thesis is to determine if policy re-instrumentation in the U.S. and the EU had any significant effects on bilateral trade and welfare of domestic producers in each of the countries. Future forecasts based on scenarios presented

considering policy reforms are analyzed to quantify whether these reforms were significantly affecting bilateral trade.

## 1.5. Specific Objectives

The specific objectives of the thesis are enumerated below. The thesis will address these objectives in a hierarchal manner.

### 1.5.1 Objective 1

Review major domestic policy changes and other treaties and agreements between in the United States and the European Union.

### 1.5.2 Objective 2

To analyze the country-wise effects of Agenda 2000 reforms on the U.S. and EU bilateral cereal trade taking into consideration policy re-instrumentation, the change in exchange rates affected by the dismantling of the Monetary Compensatory Amount (MCA) system of the European Union and affect of intervention stocks on trade..

### 1.5.3 Objective 3

To predict the consequences of the Agenda 2000 reforms in specific and other major EU – U.S. reforms on world prices, cereal imports from the EU and cereal exports to the EU with specific emphasis on the U.S. trade position.

### 1.5.4 Objective 4

To forecast the effect of free trade in wheat on U.S. exports of wheat to the EU, effect on world prices, change in welfare gains/losses to various agents in a general equilibrium setting.

## 1.6. Research Methods and Procedures

Demand and supply elasticities based on bilateral trade will be estimated using a system of equations in Statistical Analytical Software (SAS). Equations are derived and modified based on those applied in the Global Trade Analysis Project (GTAP) - a Computable General Equilibrium model (CGE) will be used to help us build our partial equilibrium model framework. Forecasts will be based on variables defined in the model some of the variables like GDP, population and world prices are exogenous and given in the International Financial Statistics (IFS) of the International Monetary Fund (IMF) while all others will be estimated based on elasticities derived from our equations. The model will use only cereals under the HS – 4 classifications[8] and will exclude processed cereals from the model. Impact of policy changes will be analyzed based on price movements and their significance to world price levels.

### 1.6.1. Objective 1

A thorough review of literature of the domestic policies in the European Union and the United States relating to cereals has been carried out. Treaties and sanctions have also been documented for a meticulous understanding of the variables that may affect trade between the trading entities. Legislations under the Official Journal (OJ) of the European Union sourced through the 'EUR-Lex' database have been studied for a better understanding of regulations concerning cereals in the European Union. Earlier research concerning the FAIR Act 1996 and other farm bills of the United States have given us insights as to how to model U.S. agricultural policies more efficiently.

[8] Harmonized Commodity Description and Coding System developed by the World Custom Organization.

### 1.6.2. Objective 2

To analyze country-wise effects of the Agenda 2000 reforms in specific and other reforms vis-à-vis FAIR Act 1996 of the United States and Mac Sharry Reforms of 1992 of the European Union we derive demand and supply elasticities based on the MODEL procedure in SAS. Data construction and modifications to the basic data for derived prices and policy instruments are documented. Country wise trade patterns are constructed using a system of equations and closing each model with the price variable. The entire model is then computed for world price to evaluate the impact of each country of the European Union on world price thus yielding a finer understanding the major players in bilateral trade between the United States and the European Union. Effect of change in exchange rates and the redesigning of the 'Green Money' concept to commercial Euro price on trade is also evaluated to observe whether they have significant consequences on trade.

### 1.6.3. Objective 3

A system of simultaneous equations model, modified for a partial equilibrium analysis are shocked for each of the scenarios created. Price variations are evaluated for significant changes from world price levels to quantify policy effects on bilateral trade. Welfare effects on producers, consumers and the government for each of the six cereals is analyzed based on results of the Non Linear three-stage Least Squares (N3SLS) estimation which are corrected for assumptions of the N3SLS procedure in SAS.

### 1.6.4. Objective 4

Based on the results from the econometric model constructed under objective 3 simulations will be carried out for wheat in a free trade scenario. Opening stocks will be

based on a trend variable while future demographic and macroeconomic variable data like population, Gross Domestic Product (GDP) and consumption will be taken from predicted values published by the IFS, the EUROSTAT and the National Agricultural Statistical Service (NASS) of the United States. Significance of change in price and production is evaluated for the most significant policy affecting trade. These scenarios could provide valuable information on trade trends that could take place based on policies followed by each of these countries. An important change in the database while constructing these simulations will be to aggregate the European Union as a single entity rather than a disaggregated group considering trade policies followed by each of the member countries are governed by the Common Agricultural Policy.

# CHAPTER 2

# EVOLUTION OF THE EUROPEAN UNION CAP AND OF THE U.S. AGRICULTURAL POLICY

## 2.1. Evolution of the Common Agricultural Policy (CAP) of the European Union

Article 38 of the Treaty of Rome that established the European Economic Commission in 1958 stated, "The Common Market shall extend to agriculture and trade in agricultural products." Though the objectives of the agricultural policy were detailed in the Treaty, the specific mechanisms by which they were to be achieved were not. Thus cooperation in agriculture was obscure at that time and formed a very insignificant part of the momentous Treaty. It was not until the Stresa Conference that a definitive policy framework for a common agricultural market and a Common Agricultural Policy was established which considered the central problem to be the disparity existing between the level of income in agriculture and other sectors of the economy. The development of trade within the community without threatening ties with third world countries, policies designed to manage markets and increase productivity, equilibrium between production and market outlets to stimulate efficiency and a high priority to increasing the efficiency of the family farm unit were some of the major factors that played an important role in the establishment of Common Agricultural Policy which came into existence on July 1st 1962 and thus "…. Agriculture ceased to be a subject of purely national administration[9] and control" (Linberg 1963). The five main objectives of the Common Agricultural Policy at that time were

a. To increase agricultural productivity by promoting technical progress and by ensuring the rational development of agricultural production and the optimum utilization of the factors of production, labor in particular.
b. Thus to ensure a fair standard of living for the agricultural community, in particular by increasing the individual earnings of persons engaged in agriculture.
c. To stabilize markets.
d. To assure the availability of supplies thus providing food safety.
e. To ensure that supplies reach consumers at reasonable prices.

An alternative way of characterizing the CAP is by its three principles which became the *de rigueur*, that any reform that the CAP may undergo, must not call into question these three principles (Christopher Ritson)

a. Free intra-Community trade: No barriers to trade in farm products between EC member states.
b. Community preference: Supplies from within the Community to be given preference in the market over those from outside the EC.
c. Common financing: Funding for the CAP would be through a European budget responsible for all revenues and expenditure generated by the Policy.

The CAP had two arms – a market arm and a structural arm. The market arm was responsible for all market stabilization mechanisms that were instituted by the structural arm which acted as the policy and guidance section. The policy is financed by a special section of the common budget known as the European Agricultural Guidance and Guarantee Fund (FEOGA).

### 2.1.1. Policy Mechanisms

Policy mechanisms play an important role in controlling the market for agricultural products. These vary significantly from product to product and have been subject to repeated modifications. The major features of these mechanisms can be broadly classified into three categories:

a. Import regulation: these were mainly designed to increase prices of imported goods thus making it less attractive for purchasers. Mechanisms included were variable import levies, import quotas, tariffs, countervailing duties, special trade arrangements, voluntary restraint agreements and supplementary levies.

b. Internal support: These were basically aimed at providing stability in income to farmers in the European Union as well as stabilizing prices for the consumers while keeping it in the CAP budget. Policies included were intervention purchases which formed a significant part of the Policy, production subsidies, production refunds, production quotas, input subsidies, co-responsibility levies[3], milling subsidies, market withdrawal compensations, private storage aids, headage premiums[10], subsidies for disposal and special sales schemes.

c. Export regulation: These were fundamentally aimed at helping the disposal of large stocks that accrued due to Governmental purchases over years. The major export regulation was export subsidies which were variable in nature for most of the products and cereals.

[10] Co-responsibility levies and hedge payments were not a part of the original CAP but was introduced during the Mac Sharry Reforms

### 2.1.2. Design of the CAP

The system of price support for cereals in specific and most of the other Agricultural products in general is depicted in figure 2.1.

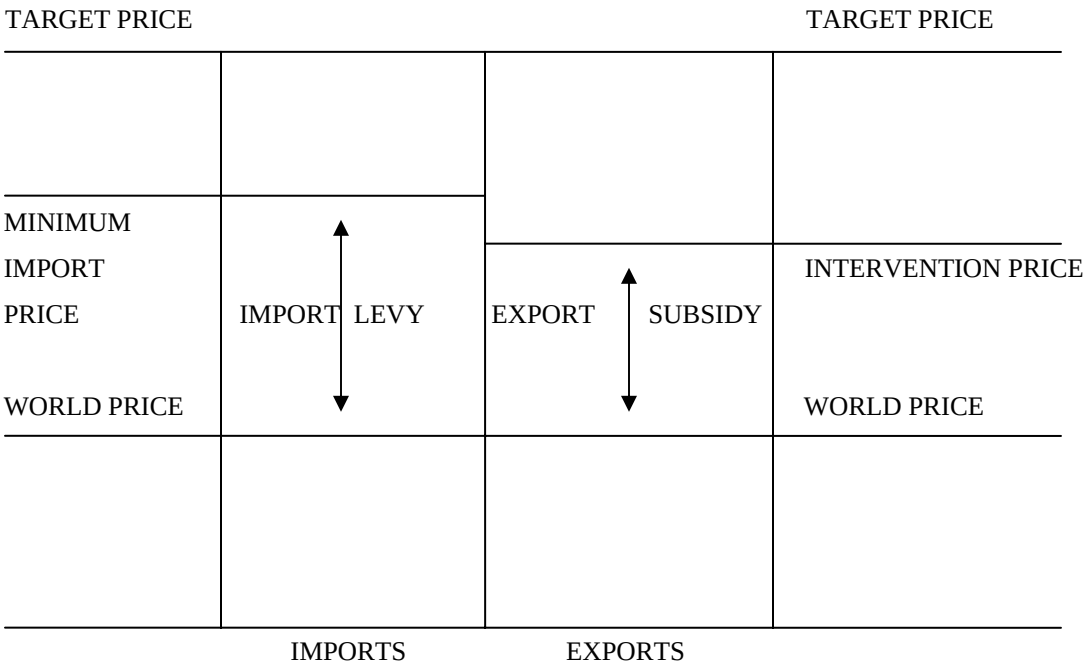


Figure 2.1: Model of a typical CAP system[11]

This elaborate system of price supports builds on three prices: the target price, the threshold price and the intervention price. The target price defines the indicative market price for the European Union producers and represents the upper limit in which the producer prices fluctuate. Imports enter the European Union at the minimum import price commonly called the threshold price. The intervention prices form the floor below which the market prices for agricultural commodities should not fall; intervention agencies buy agricultural commodities at the intervention price thus guaranteeing farmers a stable price for their produce much higher than the world price for the commodity. To limit the budgetary expenditure, co-responsibility and producer levies were introduced

[11] Reproduced from 'The Common Agricultural Policy' 2nd Edition Ritson. C.

for cereals and other agricultural goods most notably for that of milk. The European Union also offers voluntary and compulsory set-aside acreage scheme for this purpose.

Trade barriers were put in place to protect the European Union agricultural markets from the world markets. Variable import levies and quotas that bridge the gap between the threshold price and the world market were introduced. To dispose the excess production on the world markets, the European Union gave its farmers export subsidies which was the difference between the intervention prices and the world prices. Monetary compensatory amounts (MCA's)[12] were also applied to intra and extra European Union trade.

The most important non-price support mechanisms used were storage subsidies, deficiency payments and production premiums[13]. These measures were also applied to irrigation schemes, Research and Development, and reforestation projects.

### 2.1.3. Agricultural Conversion Rate – the Green Money Concept

The Common Agricultural Policy's agri-monetary system simply referred to as – its 'Green Money' is usually ignored or referred to only obliquely in most econometric analysis of the Common Agricultural Policy partly due to its complexity and partly due to the many changes that it had undergone during its existence. Yet this system had been of a major significance in the development of the Common Agricultural Policy until the common currency – the 'Euro' was introduced. The adjustments of the 'Green Money' to the valuations of the national currencies across the European Union gave rise to largely invisible upward creep in price supports and generated some interesting twists with respect to the European Union's implementation of the GATT Agreement.

[12] Differences in the national price levels could only be sustained if taxes and subsidies were applied on intra-community trade. These border taxes and subsidies were known as MCA's

[13] For beef and sheep only.

Since 1979 all support prices in the Common Agricultural Policy vis-à-vis intervention prices, production aids, export refunds, import levies, etc. were fixed in the European Currency Unit (ECU). However while applying these to farmers and traders the national intervention agencies paid them in national currencies. Consequently a conversion rate was required to convert the ECU into national currencies. This conversion rate fixed under the Common Agricultural Policy rules was called the Agricultural Conversion Rate more popularly known as the 'Green Money'. It was the rules that governed the Agricultural Conversion Rate that gave rise to the complexity in the 'Green Money' system (Swinbank, A.).

The European Currency Unit was basically a collection of European currencies as listed in column one of table 2.1. Thus the value can be determined by adding up the value of its constituent currency. These conversions were not necessary with the introduction of the 'Euro' which unlike the ECU which was only used as a reference currency for conversion to national currencies, had commercial and trade value. The European Union for the purpose of these conversions invented a notional currency called the Unit of Account (UA) and tied this to the United States dollar (USD). To calculate the exchange rate conversion the USD was preferred over the French Franc or the German Mark since all international commodity prices were usually quoted in this unit. One Unit of Account was then fixed to one USD since international currency markets were characterized by fixed exchange rates denominated in gold and since the European Union's Unit of Account had the same gold content as the United States both were kept at the same value

Table 2.1[14]: Currency basket and the specific weights they carried for the calculation of the ECU

| Currency | Quantity in collection | Value[15] | % Weight in value of ECU |
|---|---|---|---|
| Belgian/Luxemburg Franc | 3.431 | 39.3960 | 8.71 |
| Danish Kroner | 0.1976 | 7.2858 | 2.71 |
| German Mark | 0.6242 | 1.91007 | 32.68 |
| Greek Drachma | 1.44 | 292.867 | 0.49 |
| Spanish Peseta | 6.885 | 162.493 | 4.24 |
| French Franc | 1.332 | 6.40608 | 20.79 |
| Irish Punt | 0.008552 | 0.792214 | 1.08 |
| Italian Lire | 151.8 | 2106.15 | 7.21 |
| Dutch Florin | 0.2198 | 2.15214 | 10.21 |
| Portuguese Escudo | 1.393 | 195.792 | 0.71 |
| British Pound | 0.08784 | 0.786652 | 11.17 |

The ECU was also used to conduct transactions with farmers and traders and hence they incurred the currency conversion risk since national currencies fluctuated over a range. Thus a common price support and the law of one price could not be upheld with the concept of the agricultural conversion rate alone. This gave rise to the introduction of the Monetary Compensatory Amounts (MCA). Thus when there was an appreciation of a currency and its value decreased with respect to the Unit of Account the positive difference between these two currencies was adjusted by the Monetary Compensatory Amount essentially meaning that an additional payment was made for intra-European Union trade thus keeping the one price law in place. Consequently when there was a

[14]. The ECU and its value at the last adjustments of the central rates within the exchange rate mechanism (ERM) as given by the European Commission.
[15] As on March 1995 initial rate 1 ECU = $1.

depreciation of one of the member nation's currency an MCA tax was levied on exports of produce in that country to other member countries while a similar MCA subsidy was given to imports into that country. When trading with countries outside the Union, import levies and export subsidies also had to be adjusted to account for lower price support in the country where the currency fluctuates.

In August 1969 the French Franc was devalued while the German Mark was revalued and hence the MCA was created to maintain price stability. In 1973 the Unit of Account was tied to a 'joint float' (Christopher Ritson and Alan Swinbank) which consisted of the Benelux states[16], Germany and Denmark. These countries had agreed to restrict their exchange rates to a very narrow band of movement between their currencies but would allow their currencies to float freely collectively against their currencies. This resulted in the development of two types of MCA's the 'joint float' MCA and the 'variable float' MCA for those countries in the Union that did not participate in the 'joint float' system. The fixed green conversion rates kept the prices constant in the national currencies while the MCA's contracted or expanded to compensate for fluctuations in currency exchange rates. The fixed MCA was also subject to periodic revisions which were usually devaluations thus increasing the support prices. Another type of compensatory payments entered into account was called the Accession Compensatory Payment in 1973 due to the entry of the United Kingdom into the Union in order to accommodate its very low price supports to the grain producers.

In 1979 the MCA system was dismantled and the concept of the European Monetary System (EMS) was established. The Exchange Rate Mechanism (ERM) replaced the earlier 'joint float'. The key feature of the ERM was that certain countries in

[16] Benelux states consisted of the first three nations in the Union – Belgium, Luxemburg and Italy

the EU maintained fixed exchange rates between their currencies with narrow margins on either side of the fixed central rates for fluctuations. The commercial ECU replaced the Unit of Account and was worth commercially less than its predecessor. With the introduction of the 'Euro' this elaborate system for price stability and one price law was dismantled since the Euro had the same commercial value across the European Union.

## 2.2. Reforms in the Common Agricultural Policy

Since its inception CAP was mainly concerned with price stability for family farm units. It was argued that this would attract more labor and increase productivity thus making the European Union self sufficient in agriculture. Incidentally the European Union did not consider export subsidies as a major element at that time and expected that the revenues accrued from the import levies would exceed the cost of subsidies. It was not until later when the community that they began to expand their export of cereals that the cost of export refunds became a major policy issue (Tracy, 1994). By the mid eighties the European Union moved from being the main importing country to the second largest exporting country (Silvia Weyerbrock, 1996).

The common financing of the CAP was introduced in 1966, called the Guarantee and Guidance Fund (FEOGA). Allocation of national contribution was established on the basis of a fixed ceiling for each of the member countries. One issue that was of vital concern was the level of common prices. Too high a level would have upset the balance of payments in some member countries while extremely low prices would have adversely affected the farm income. Prices were finally set close to the higher price margin among the member states which subsequently increased the financial cost of the CAP but guaranteed price support to the farmers. This conflict resolution led to a

production surplus and thus influenced higher budgetary allocation to the FEOGA all throughout the 1970's and the 1980's.

The first reforms to check these surpluses were taken up in the mid 70's popularly known as the 'Agriculture 80'[17]. The main directives agreed upon were:

a. Modernization of farms
b. Encouraging cessation of farming and re-allocation of farms for the purposes of structural improvements.
c. Provision of socio-economic guidance for the acquisition of occupational skills by persons engaged in agriculture.

These directives fell short of their desired effects partly due to the reluctance of the member countries to follow them and partly because these directives were not specific and left a large amount of ambiguity that were exploited by the member countries.

The principle of producer co-responsibility came into effect in the mid 80's and was extended to cereals at the end of the decade after overcoming a great resistance by the farm lobbies of member countries bringing CAP's budgetary allocation back from the verge of bankruptcy.

With the starting of early GATT negotiations at the turn of the decade, the CAP underwent major policy changes shifting from its previous policy of supporting farm incomes at all costs to decreasing distortions while maintaining nearly the same amount of price support to its farmers. These radical changes were partly triggered by the need to decrease budgetary expenditures on Agriculture and partly to streamline Agriculture with early GATT objectives.

[17] Council Regulation (EEC) No 1418/76 'On the Common Organization of the Market for Cereals'.

This led to the application of stabilizers and hence to the adoption of Maximum Guarantee Quantities (MGQ)[18] for majority of the agricultural commodities with automatic price adjustment mechanisms should the MGQ be exceeded. In addition to the MGQ member countries agreed to include voluntary set-aside[19], extensification and diversification schemes aimed at adjusting supply and demand whilst compensating farmers for the loss of income. On the revenue side the Council agreed to increase the budget of the CAP by enlarging the resource base to include a proportion of the Gross National Product of each member state[20]. These reforms did have some short term effects with oil seed production drastically decreasing while the cereal production continued to increase. The stabilizer policy in the long run proved ineffective since they did not attack the underlying problem of supporting payments being linked to the quantity produced.

The Commissions 1991 paper 'Reflections' quoted "*the reforms of the years 85/88 have not been implemented and render themselves incomplete. It is not surprising that under these conditions the CAP finds itself once again confronted with a serious crisis. It appears under these conditions that the Community's agricultural policy cannot avoid a succession of increasingly serious crisis unless its mechanisms are fundamentally reviewed so as to adapt them to a situation different from that of the sixties. The Commission considers therefore that the time has come to stimulate a reflection on the objectives of the Community's Agricultural Policy and on the principles that should guide the future development of the CAP*" (Commission, 1991). The outcome was the so called radical reforms of 1992 referred popularly as the 'Mac Sharry Reforms'.

[18] Council Regulation (EEC) No: 1766/92 'On the Common Organization of Markets for Cereals'
[19] . Though they were proposed fifteen years before they were implemented.
[20] This was calculated as the difference between the standard 1.4% of the assessment basis of VAT and 1.3% of the GNP

### 2.2.1 The Mac Sharry Reforms

The Mac Sharry reforms were initiated in response to the weakening world prices for cereals and dairy products which substantially increased expenditure of export subsidies under the CAP. The mounting international pressure within the Uruguay round of the GATT Round also forced the Council to take drastic measures for a long run budgetary discipline to be incorporated into the CAP. For the first time these reforms combined substantial price reductions for major agricultural commodities with annual compensation payments modulated in favor of smaller farmers[21], this for the first time gave rise to the concept of decoupling payments which were at least partially imposed during these reforms.

Incidentally, the Mac Sharry reforms were focused only on cereals, oil seeds and protein crops apart from beef and sheep production together with an 'Agri-Environmental Action Program'.

The following were some of the major reform proposals submitted and approved by the Council

1. Reduction of cereal support prices by 35%.
2. Introduction of area payments to cereal producers to compensate the fall in farm revenues.
3. Compulsory set-asides were proposed which would then qualify for area payments.
4. A tradable bond scheme was introduced for the milk quota system.

[21] Though these modulations were later dropped with no consensus achieved by member countries.

### 2.2.1.1 Significance of the Mac Sharry Reforms on Cereal Production:

Three annual reductions were put in place for support prices for cereals instituted from 1993 to 1995. Figure 2.2 shows changes in cereal trade and support more accurately

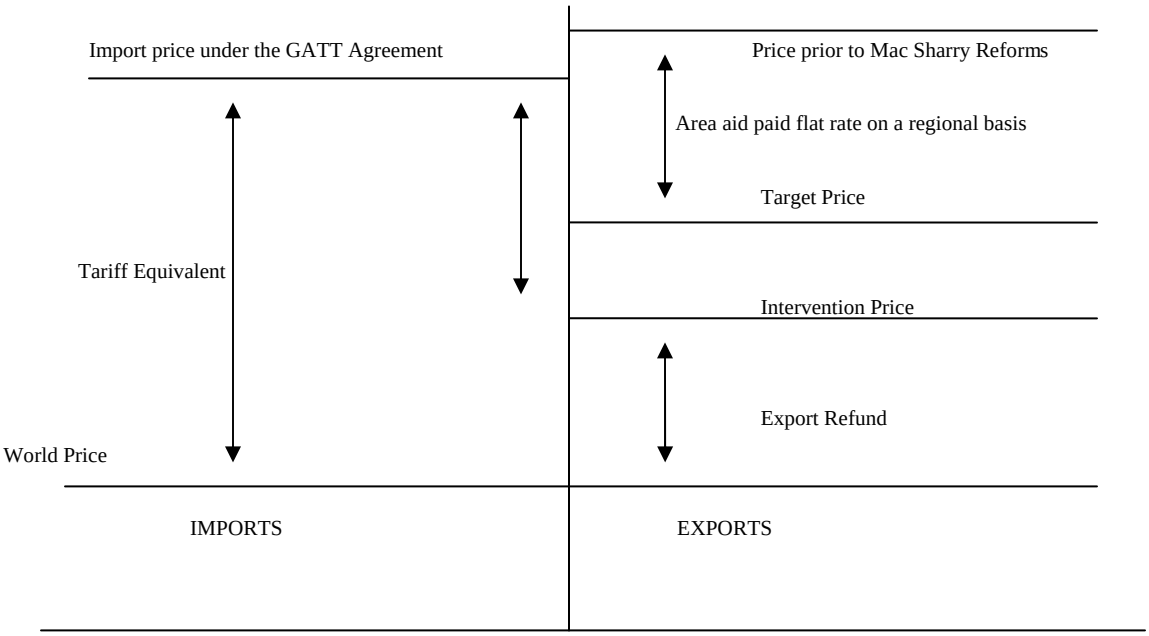


**Figure 2.2**[22]: Price Support for cereals from July 1995

- Target prices were significantly below and near the intervention prices. Graph 2.1 thus shows a downward trend for target price and intervention price with a relatively higher decrease in the target price.
- New intervention prices and target prices were kept nearly same for all cereals which can also be noticed in the graph.
- All cereals received same arable area aid – though additional area payments were paid on durum wheat in recognized production areas.

[22] Alan Swinbank, 1995

- On the import side as the figure shows the old system of threshold prices and variable import levies were abolished and were replaced by fixed tariffs. Since the U.S. under the GATT insisted that the community should limit itself to applying an import duty "at a level and in a manner so that the duty paid import price for such cereals will not be greater than the effective intervention price ….increased by 55%". In figure 2.2 this is shown as the maximum duty paid import price.
- In addition export refunds were still being paid though the GATT restricted on the volume of subsidized exports.
- The Integrated Administration and Control System was put in place to control supply and monitor the set-aside land.
- The system of MCA to calculate national currency system was abolished and a new EMS system was adopted.

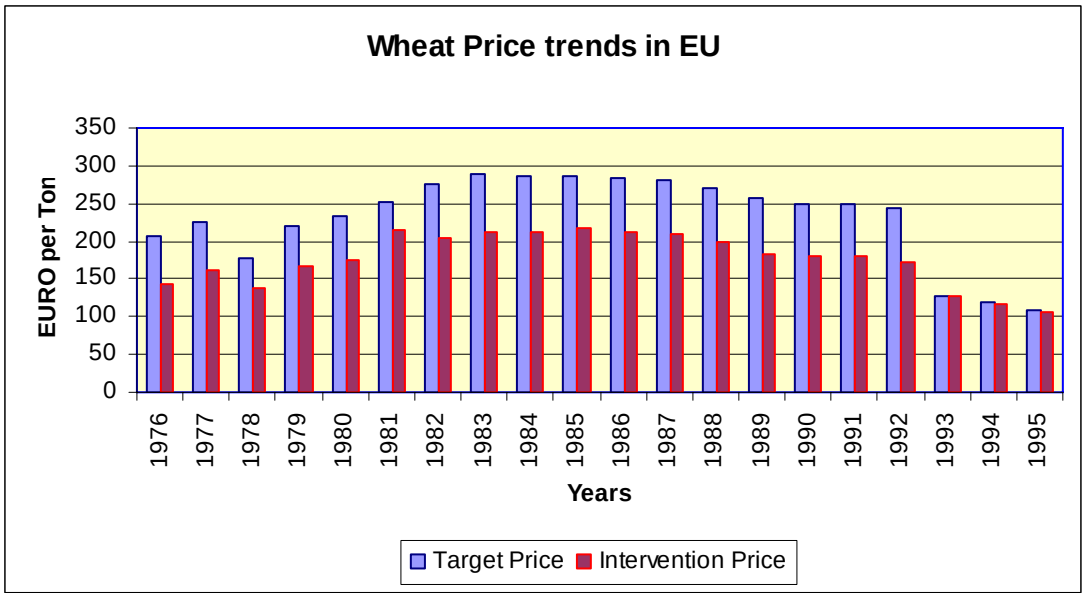


**Figure 2.3:** Wheat Intervention and target price trend from 1976 to 1995 (Data collected from various issues of the EURO-Lex)

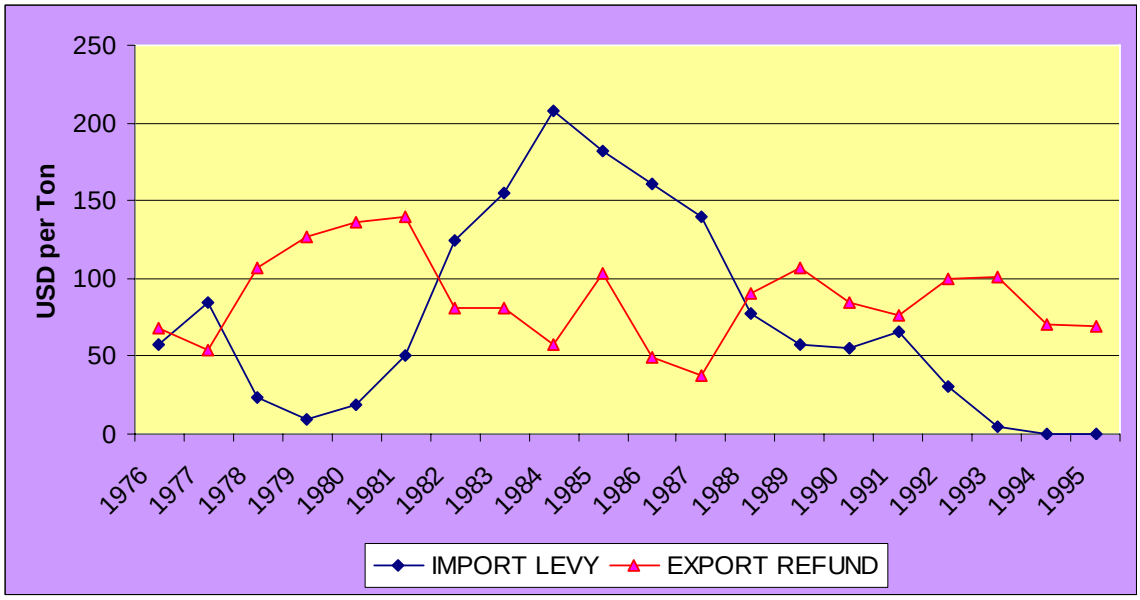


**Figure 2.4:** Import Levy and Export Refund trend Pre and Post Mac Sharry Reforms

### 2.2.1.2 Impact of the Mac Sharry Reforms on EU Cereal Market

The effects of the Mac Sharry reforms on cereal markets did achieve some financial responsibility of the CAP. A most comprehensive effect of these reforms are given below

- The immediate effect of these policy changes was an increase in the budgetary cost for implementation of these reforms though in the long run it was helpful in cutting CAP costs.
- Since Mac Sharry's proposal of modulated payments to the farmers was rejected by the member countries tax payer's cost escalated.
- Set-aside payments and land acreage payments paved the way for decoupling production and decreased distortions in trade.
- The Commission envisaged that these reforms would stabilize yields - "The reform of CAP is based on per hectare payments with fixed yields……there is

no longer an incentive for higher yields as there will be no payments beyond the fixed yields" (Commission, 1992, p 7)

### 2.2.2 The Agenda 2000 Reforms

The 1992 Mac Sharry Reforms though were the first radical steps to bring a certain amount of budget discipline; it did not bring the amount of reforms expected. This was due to various reasons

1. The tariffication conversion rates were fixed at the 1986/88 prices when the production was low and the world prices were close to the European Union prices.
2. Strong growth in the world agricultural markets with price offering a good rate of return.
3. Agricultural support was perceived to be unequally distributed between regions and producers.
4. The Mac Sharry reforms assumed that cereal production would increase at a rate of 1% and then stabilize, by 1999 cereal production rose steeply adding pressure on the already stressed budget of the CAP,
5. Set-aside payments introduced in the earlier reforms were minimum and farmers usually removed the most unproductive land from production.

These were some of the key factors that played an important part in the inception and implementation of the Agenda reforms.

The main objectives of the Agenda 2000 as stated in the Council Regulation were

1. To consolidate the support system for producers of certain arable crops established by the 1992 reform of the CAP with a view to boosting the competitiveness of the European agriculture by bringing European prices in line with world prices.
2. To continue the regionalization of the CAP so that the return leads to the development of sustainable, competitive and multifunctional agriculture in all regions, including those with specific problems.
3. To base payments to farmers on production as well as on their additional contribution to society, particularly from the point of view of the environment and countryside.

#### 2.2.2.1 Support System under Agenda 2000

The Council established a supports system for producers; the main elements were as follows[23]

1. Granting area payments.
2. A 15% reduction in the present intervention price of cereals in two equal stages of 7.5% (in 2000/2001 and 2001/2002 marketing years respectively). Consequently area payments were increased in two equal stages which was multiplied by the historical regional reference yields for cereals.
3. Progressive alignment of area-based aid for oilseed and non textile linseed to the level applied to cereals and set-asides.
4. A 10% set-aside requirement from the 2000/01 marketing year apart from the already 15% in place.

[23] Council Regulation (EC) No. 1251/1999.

#### 2.2.2.2 Area Support Payments

1. The support system for producers of cereals and other arable crops introduced regionally differentiated area payments**.**
2. Payments granted for the area of arable crops or subjected to set-aside should not exceed the regional base area.
3. Producers receiving area payments are subject to a compulsory set-aside part of their holding from production (10%) for which they received compensation amounting to the aid granted for cereals.
4. Small producers were exempted from any se-aside requirements.

#### 2.2.2.3 Regionalization Plan

To set average prices for calculating area payments a regionalization plan was established. Taking into account differentiated yield for both irrigated and non-irrigated land.

Apart from these measures producers were required to apply environmental measures appropriate to the specific situation of the land set-aside. An aid was also given up to 50% of costs for start up costs for growing multi annual crops intended for bio mass production.

## 2.3. Reforms of the United States Cereal Policy

The major changes in the U.S. agricultural support system were the implementation of two legislations the Food, Agriculture, Conservation and trade Act (FACT, 1990) and the Federal Agricultural Improvement Program (FAIR) Act in 1996. While the FACT was primarily perceived as a short term response to market conditions (Food and Agriculture Organization) prevailing at the time with depressed export prices

and higher production, the FAIR Act was targeted as a long term trend towards greater market orientation of the farmers by practically decoupling income support measures from farm prices. The U.S. cereal policy was based on a price support program, acreage controls and marketing quotas. The U.S. farm support program was a combination of target prices, acreage programs and the loan rate program. The government paid farmers of program crops[24] a deficiency payment multiplied by the eligible production. Deficiency payment was calculated as the difference between target price (set annually and revised periodically) and the market price or the loan rate whichever was the smaller (Micha Gisser). Acreage reduction program was introduced and combined with the deficiency payment by making farmers eligible to the payments only when they idled land as required by the acreage reduction program. To prevent external world price effects on the domestic markets, the government further developed programs for purchasing commodities for stocks at the loan rate when crops were exceptionally good and to sell the commodities when they failed. This, in the long run, led to a net accumulation of stocks which further increased government spending on storage costs.

### 2.3.1 The Food, Agriculture, Conservation and trade (FACT) Act 1990

The FACT Act of April 1990 represented a major shift in the U.S. farm policy and had significant impacts on cereals production, prices and trade in the U.S. It was perceived as a short term response to market conditions which were characterized by

- Depressed international agricultural prices.
- Strong consumption in export markets among the main exporters (including the U.S.)

[24] These included but not restricted to cereals, feed grains, cotton and rice.

- Expectations that the Uraguay Round of Multilateral Trade negotiations would lead to substantial reduction in the extent of protection.
- Budgetary costs that were increasing at a considerable rate.

The implications of the FACT Act[25] can be categorized under three major segments.

#### 2.3.1.1 Implications on Production

The system of target prices and deficiency payments were retained with certain modifications which included

- Freezing target prices for cereals at the 1990 price levels for the next five years which in real terms would represent an annual decrease in support.
- The Acreage Reserve Program (ARP) which is closely related to the deficiency payments under the Act, would be based on the stock to use ratio for cereals.
- The Act also introduced the "Triple Base Program" aimed at achieving considerable savings on budgetary costs. The program stipulated that cereal crop farmers may not be eligible to receive deficiency payments on a proportion of their base area which was mandated at 15 percent for the first year. The area would still be eligible for non recourse and marketing loans.
- The act also introduced the "Targeted option payment" where farmers were allowed a decrease or increase in their ARP in exchange for a percent increase or decrease in the target price for calculations of their deficiency payments.

[25] "Agricultural Food Policy Review: U.S. Policies in a changing world", ERS, USDA, 1989.

#### 2.3.1.2 Market and Government Stock Changes

Domestic market prices in the United States were fundamentally governed by the loan rate mechanism which also built up (or depleted) government held stocks. From 1985 to 1990 a lower loan rate had contributed to a depletion of the stocks in government held agencies and lead to modifications to the loan rate mechanism in the cereal sector. Under the Act, the loan rate was disaggregated into a basic and an actual loan rate system with the former being determined based a on five year moving average of prices received by the farmers with a minimum being set between 75 to 85 percent of the average. This average has been reduced by up to 20 percent over the five year period. The FACT Act provided provisions that included:

- A loan rate for cereals calculated at 85 percent of the average price with a maximum decline of 5 percent annually. Considering that actual loan rates were calculated as a percentage of the basic loan rate the FACT Act eventually lead to higher basic and actual loan rates while removing discretionary powers to reduce the basic loan rate below 5 percent per annum.
- The Farmer Owned Reserve (FOR) which provided price stability by encouraging grain storage by farmers until prices tended towards the target price was structurally modified. The price band was determined by the adjusted loan rate and the FOR release price (Allen, K.). Farmers received storage payments and loans for which interest was waived for the first year. The Act made the entry into the program more stringent by allowing only those farmers who had nine month Commodity Credit Corporation (CCC)

loans[26]. Prices that determined the initiation of the program (also called the "trigger prices") were drastically reduced. Table 2.2 below shows the significant changes that were adopted under the FACT Act.

Table 2.2: Trigger Price and quantity required for FOR to be initiated[27]:

| Cereal | Activated Quantity (Million Tons) | Market Price (Percent loan Rate) |
|---|---|---|
| Wheat | 8.2 | < 140 |
| Barley | 11.4 | < 120 |
| Oats | 11.4 | < 120 |
| Sorghum | 11.4 | < 120 |
| Rye | 11.4 | < 120 |
| Maize | 12.5 | < 120 + 22.5% of stock/use ratio |

#### 2.3.1.3 Trade Implications

Trade policy for cereals in specific and other agricultural products in general were unaffected with the Export Enhancement Program (EEP) being the main vehicle for providing export subsidies. The EEP was sub-divided under the Short Term Export Credit Program (GS-101) and the Intermediate Export Credit Program (GS – 103)

### 2.3.2 The Federal Agriculture Improvement and Reform Act 1996

The 1996 FAIR Act was aimed at reducing farm payments and decoupling support payments from farm prices[28]. The main features that affected the domestic and international price and production policies for cereals have been enumerated under three broad categories.

#### 2.3.2.1 Modifications to the Production Payments

- The FAIR Act suspended the two major farm income support payment programs vis-à-vis target prices and deficiency payments.

[26] "Agricultural Food Policy Review: U.S. Policies in a changing world", ERS, USDA, 1989.
[27] Cereal Policy Review, FAO, 1990.
[28] Provisions of the FAIR Act of 1996, ERS, USDA.

- In contrast to the FACT Act of 1990 which stipulated only 15 percent of the base area could be planted in non-program crops for being eligible for deficiency payments, the FAIR Act provided flexibility of planting decisions to the farmers, thus making them more market oriented[29].
- The loan rate system though retained was frozen to the 1995 levels for the next seven years. Farmers were required to follow conservation compliance obligations while keeping land in agriculture
- Production Flexibility Contract payments were introduced which were equal to 85 percent of the base area multiplied by the 'contract payment rate'. Program yields (which included all cereals) were frozen to the 1995 levels.
- The Area reduction Program (ARP) was eliminated but farmers eligible for support payments were required to set aside as fallow at least 15 percent of the base area.

#### 2.3.2.2 Marketing and Stock changes

The Market and stock situation was largely unchanged with the Market Loan Assistance (MLA) program and the non-recursive payments retained. The major shift under the market program included the suspension of the Farmer Ordered reserve (FOR).

#### 2.3.2.3 Trade Effects

Major changes in the export sector for cereals were introduced with the budget for the EEP was capped[30]. Considering that over 80 percent of the budget was utilized for export of cereals which mainly included wheat and corn, it had huge impacts on cereal trade and world prices.

[29] Agricultural outlook Supplement, ERs, USDA, April 1996.
[30] Cereal Policy Review, FAO, 1995-97.

# CHAPTER 3

# DATA, METHODOLOGY AND ECONOMETRIC MODEL

This chapter provides the basic framework of the economic model that governs the econometric model developed to analyze the various relationships between the variables and their effects on bilateral trade. Data collection procedures, data modifications and derivation of relations are documented for better understanding of quantifying policy initiatives in each of the member countries. The econometric model is used to calculate elasticities and evaluate variable significance.

## 3.1 Assembling the Raw Data

This section documents the main features of the empirical database that has been constructed for analyzing the policy-wise effects of the reforms in the Common Agriculture Policy (CAP) of the European Union and the Policy Reforms of the United States in an applied, partial equilibrium (PE) model.

The database considers five cereals: Wheat, Maize, Barley, Oats, and Rye and the fifteen European Union nations: Austria, Belgium Denmark, France, Finland, Germany, Greece, Ireland, Italy, The Netherlands, Portugal, Sweden, Spain, and United Kingdom. The database also includes the United States as a trading region while the rest of the world is considered as price takers in the world market for cereals. Data on Luxemburg has been merged with that of Belgium since data on some economic variables were not readily available for Luxemburg in disaggregated terms.

In assembling annual raw data from 1976 onwards for the variables in our analysis, we employed two major sources - The European Statistical Service (EUROSTAT) and the United States Department of Agriculture (USDA).

### 3.1.1 Assembling the European Union Data

The basic data for the European Union has been assembled by the five sectors, each representing a cereal crop, and fifteen country level. Annual data for production, consumption and crop yield for each of the fifteen countries of the European Union were collected from the 'AGRIS' Database of EUROSTAT while external trade data on the quantity exported from each of the member countries to the United States of America was collected from the 'COMEXT' database also known as the 'Internal and External Trade of the European Union.' It provides annual information on the quantities of total imports and exports for every pair of countries that we consider in our analysis. Demographic data such as Population, Gross Domestic Product (GDP) and Nominal Exchange Rates were collected from the International Financial Statistics database published by the International Monetary Foundation. Domestic Price data for the European Union (EU – 15) was made available to us by the office of the Director General (DG) of Agriculture for the European Union, Brussels, Belgium. Price support data for the five cereals was based on two acts if legislations: The Common Organization of the Market in Cereals[31] and Particular and Special Intervention Measures for Cereals[32]. Prior to 1995, three prices were defined by the European Commission namely – Target Price, Threshold Price and Intervention Price. Price supports which included import levies, export refunds and production refunds were derived from these three reference prices. Legislations from 1994 repealed such derived price measurements and replaced it with direct aid payments under each category[33].

[31] Council Regulation (EEC) No. 2727/75 enacted on 29th October 1975
[32] Council Regulation (EEC) No. 1146/76 enacted on 17th May 1976
[33] Council Regulation (EEC) No. 1866/94 enacted on 27th July 1994

#### 3.1.1.1 Modifications to the Raw Data

Several modifications to the raw data were made for the construction of the database and are described briefly below

#### 3.1.1.2 Calculating the Import Levies

Two components of the import levies were defined by the European Commission (EC); the fixed component derived from the prices defined by the EC and calculated as the difference between Threshold Price and World Price and a variable component defined as a factor of the fixed component and revised bi-monthly. Thus, annual data for import levies was calculated as a sum of the difference of Threshold Price and World Price and average of the monthly weighted import levy based on import quantity in that month to total imports in that year (Equation 3.1). World Price was calculated as an average of the weighted export price based on the quantity of the commodity exported by that country to the total exports for that commodity in a specific year (Equation 3.1). The world price was based on the major exporting country prices that made up to 80 percent of total export quantities in the world market.

**Equation 3.1**

$$\left.\begin{aligned} IL_{ij} &= \left(ThP_{ij} - WP_{ij}\right) + \overline{Z}_{ij} \\ K_{\alpha} &= \left[\frac{ILQ_{\alpha}}{\sum_{\alpha=1}^{12} K_{\alpha}/12} \times il_{\alpha}\right] \text{ where } (\alpha = 1 - 12) \\ \overline{Z} &= \left(\sum_{\alpha=1}^{12} K_{\alpha} \Big/ 12\right) \end{aligned}\right\} \text{ Import Levy for commodity } i \text{ in year } j$$

$$\left.\begin{aligned} WP_{ij} &= \overline{G_{ij}} \big/ N \ \text{(where } N \text{ = number of exporting countries)} \\ \overline{G}_{ij} &= \left[ \frac{ExQ_{lij}}{\sum_{k=1}^{n} ExQ_{kij}} \times P_{lij} \right] \ \text{(where } l \in k\text{)} \end{aligned} \right\} \text{where } k \text{ is exporting countries}$$

Where:

$$\left.\begin{aligned} IL &= \text{Import Levy} \\ ThP &= \text{Threshold Price} \\ WP &= \text{World Price} \end{aligned} \right\} \text{for country } i \text{ and commodity } j$$

$\overline{Z}$ = Yearly Average monthly weighted import levy

$K$ = Average monthly weighted import levy

$ILQ$ = Import quantity

#### 3.1.1.3 Calculating the Export Refunds

Export refunds were calculated as the difference between the intervention price and the world price for the specific commodity in that year[34]. Equation 2.3 below is the derived relation between the export refunds and the prices published by the European Commission.

**Equation .3.2**

$$ER_{ij} = \left( IP_{ij} - WP_{ij} \right)$$

Where:

$ER_{ij}$ = Export Refund for commodity $i$ in year $j$

$IP_{ij}$ = Intervention Price for commodity $i$ in year $j$

$WP_{ij}$ = World Price for commodity $i$ in year $j$

[34] Regulation (EEC) No 2746/75 of the Council of 29 October 1975 laying down general rules for granting export refunds on cereals and criteria for fixing the amount of such refunds

$$\left.\begin{aligned} WP_{ij} &= \overline{G_{ij}} \big/ N \ \text{(where } N \text{ = number of exporting countries)} \\ \overline{G}_{ij} &= \left[ \frac{ExQ_{lij}}{\sum_{k=1}^{n} ExQ_{kij}} \times P_{lij} \right] \ \text{(where } l \in k\text{)} \end{aligned} \right\} \text{where } k \text{ is exporting countries}$$

Where:

$ExQ$ = Export Quantity for country $k$, commodity $i$ in year $j$

$\overline{G}_{ij}$ = The average weighted price for commodity $i$ in year $j$

#### 3.1.1.4 Calculating Production Refunds

Production refunds for cereal commodities were calculated once every marketing year and were available from the 'EUROLEX' database which included all the legislations passed by the European Commission for cereals. This was calibrated to total domestic production for each of the fifteen European countries. While the Commission reviewed the amount of production refund each year it also passed legislations that governed the calculation of production refunds[35] (Equation 3.3). In estimating production refunds for years in which data was not available we used these calculations The Mac Sharry reforms[36] introduced the concepts of co-responsibility levies and voluntary set-asides. These instruments, which were mainly aimed at making producers more sensitive to the market, were incorporated in our database as a part of production refunds. Thus, production refunds were a derived value and a function of co-responsibility levy and set-aside payments (Equation 3.4).

[35] Council regulation (EEC) No: 1863/88

[36] Council regulation (EEC) No: 1766/92 'On the Common Organization of the market for Cereals'

**Equation 3.3**

$$PR_{ij} = K - IP_{ij}$$

*Where*:

$PR_{ij}$ = Production Refund for commodity $i$ and year $j$

$K$ = Average c.i.f price used for calculation of import levy

$IP_{ij}$ = Intervention Price for commodity $i$ and year $j$

**Equation 3.4**

$$PR_{ij} = K - \left[ SP_{ij} - CRL_{ij} \right]$$

Where:

$PR_{ij}$ = Production Refund for commodity $i$ and year $j$

$K$ = is a constant set by the European Commission

$SP_{ij}$ = Set Aside payment for commodity $i$ in year $j$

$CRL_{ij}$ = Co-responsibility levy for commodity $i$ in year $j$

### 3.1.1.5 Conversion Factor and Exchange Rates

For the purpose of constructing the database and to incorporate the effects of the Monetary Compensatory Amount (MCA) system that was followed until 1992, we used the Agri-Monetary System conversion rate (Swinbank, A., 1988). MCA's for the fixed and variable baskets were collected from the Economic Accounts for Agriculture (EAA) and various editions of the Handbook for EU price statistics. The conversion factor to U.S. dollars after 1992 was based on Nominal exchange rates given by the International Financial Statistics of the International Monetary Foundation (IMF).

### 3.1.1.6 Apparent Production and Consumption

Production for each of the country was derived as a function of area under a specific crop and yield per hectare (Equation 3.5).

**Equation 3.5**

$$PROD_{ijk} = YIELD_{ijk} \times AREA_{ijk}$$

Where:

$PROD$ = Production
$YIELD$ = Yield
$AREA$ = Area

} are defined for commodity $i$, year $j$ and country $k$

Consumption for each of the country was a function of domestic production, imports, opening stocks and total exports. Equation 3.6 below shows the relation for estimation of consumption of cereals in the two trading partners.

**Equation 3.6**

$$CONP_{ijk} = \left(DPROD + IMPQ + OPSTK\right)_{ijk} - EXPQ_{ijk}$$

Where:

$CONP$ = Consumption
$DPROD$ = Domestic Production
$IMPQ$ = Import Quantity
$OSTK$ = Opening Stocks
$EXPQ$ = Export Quantity

} Defined for comodity $i$ year $j$ and country $k$

## 3.2 Econometric Model Specification

To understand the effects of policy re-instrumentation in member countries of the European Union and the trade effects between each of these countries with the United States we developed a static, partial equilibrium, simultaneous equation model which solves for the demand side equations and the supply side equations simultaneously. The model thus incorporates the interdependence of both the supply and demand side equations on each other. An iterative, non-linear, three stage least square (N3SLS) system is developed. Two dummy variables are introduced in the system that account for the two major policy changes in the Common Agricultural Policy of the European Union.

Demand side equations are disaggregated into four equations Inventory demand, Domestic demand, Export demand and Import demand while the supply side equation is a single equation. The following sections describe the demand and supply side equation system.

### 3.2.1.5 Demand Side System

As mentioned earlier the demand side system includes four aspects, each of which helps us understand the specific effects of policy changes in the European Union and the United States. Each of these demand equations is further discussed in detail in the sub sections below

### 3.2.1.1 Inventory Demand

Iinventory demand denotes the demand of opening stocks and is a function of domestic price and the ratio of apparent production and apparent consumption. The econometric model is specified in Equation 3.7.

**Equation 3.7**

$$\ln opstk_{ijt} = \alpha_{ijt} + \beta_1 \ln dmpr_{ijt} + \beta_2 \left[ \left( \ln prod_{ijt} + \ln prod_{ij(t-1)} + \ln impq_{ijt} \right) \Big/ \ln conp_{ijt} \right] + e$$

*Where*:

$opstk =$ Opening Stocks
$dmpr =$ Domestic Price
$prod =$ Production
$impq =$ Import Quantity
$conp =$ Consumption

} Defined for comodity $i$ year $t$ and country $j$

### 3.2.1.2 Domestic Demand

The domestic demand function estimates the demand of the commodity in the specific country. An inverse demand function is used to estimate the effect on domestic prices as a function of other independent variables. Inverse demand functions have been

widely used in farm commodity market analysis (Westcott and Hull; Salathe, Price and Gadson; Subotnik and Houck; Meike and Young; Cromarty). The importance of a normalized simultaneous system of equation needs a causative specification for each variable including the price and thus justifies the use of an inverse demand function which otherwise would give erroneous results if none of the equations normalized on price. The domestic price is considered as a function of domestic consumption, opening stocks, income which is measured by the Gross Domestic Product (GDP) and two dummy variables each for the two major reforms of the CAP (Equation 3.8).

**Equation 3.8**

$$\ln dmpr_{ijt} = \alpha + \beta_1 \ln conp_{ijt} + \beta_2 \ln opstk_{ijt} + \beta_3 \ln gdp_{ijt} + \beta_4 mref_{ijt} + \beta_5 aref_{ijt} + e$$

*Where*:

$dmpr =$ domestic price
$conp =$ Consumption
$opstk =$ Opening Stock
$gdp =$ Gross Domestic Product

} Defined for commodity $i$ year $t$ and country $j$

$mref =$ Dummy for Mac Sharry Reforms
$aref =$ Dummy for Agenda 2000 Reforms

### 3.2.1.3 Export Demand

The export demand equation suggests the effect of policy changes on demand of exports for the specific country commodities. Policy effects causing huge changes in trade hence would yield insights about the impact on trade and world price effects. The demand for exports in the European Union thus depending on the two reform measures of the CAP, export refunds, domestic price, world price and exchange rates (Equation 3.9) which have undergone some drastic changes after the dismantling of the MCA in intra-EU trade.

**Equation 3.9**

$$\ln \exp q = \alpha + \beta_1 \ln dmpr + \beta_2 \ln worldp + \beta_3 \exp r + \beta_4 \ln exrt + \beta_5 \ln mref + \beta_6 \ln aref + e$$

*Where*:

$\exp q =$ Export Quantity

$dmpr =$ Domestic Price

$worldp =$ World Price

$\exp r =$ Export Refund

$exrt =$ Exchange Rate

$mref =$ Dummy Variable for MacSharry Reforms

$aref =$ Dummy Variable for Agenda 2000 Reforms

$e$ = Some error term not explained by the model

### 3.2.1.4 Import Demand

Import demand is modeled in the system of equations to understand the effect on quantities of cereals imported bought about by the two policy changes. We introduce a ratio of quantities imported from the United States to total imports of the commodity as a measure of significance. Significance of this ratio would suggest that imports from the U.S had considerable effect on demand of imports due to policy changes modeled as the two dummy variables. We introduce the equation with the log of the import quantities as a function of domestic price, exchange rate, import quantity, world price, import levies and the ratio of imports from the U.S. to total imports (Equation 3.10). Data for the import levies were collected from various issues of the Official Journal of the European Union which is maintained by the EURO-LEX (European Legislation).

**Equation 3.10**

$$\ln impq = \alpha + \beta_1 \ln dmpr + \beta_2 \ln worldp + \beta_3 impl + \beta_4 \ln exrt + \beta_5 \ln mref + \beta_6 \ln aref + \beta_7 (impqu / impq) + e$$

*Where*:

$impq =$ Import Quantity

$dmpr =$ Domestic Price

$worldp =$ World Price
$impl =$ Import Levy
$exrt =$ Exchange Rate
$mref =$ Dummy Variable for MacSharry Reforms
$aref =$ Dummy Variable for Agenda 2000 Reforms
$impqu =$ Import Quantity from U.S.
$e =$ Some error term not explained by the model

#### 3.2.1.5 Supply Equation

The supply equation tries to quantify the effect of these policies on the total domestic supply of commodities. Thus production is a function of total imports, production refunds, the two policy changes in the CAP and GDP of the country that accounts for income for that country. (Equation 3.11).

**Equation 3.11**

$$\ln prod_{ijt} = \alpha + \beta_1 \ln dmpr_{ijt} + \beta_2 \ln prodr_{ijt} + \beta_3 \ln gdp_{ijt} + \beta_4 mref_{ijt} + \beta_5 aref_{ijt} + e$$

*Where*:
$dmpr =$ domestic price
$prod =$ Production
$prodr =$ Production Refund
$gdp =$ Gross Domestic Product
$aref =$ Dummy for Agenda 2000 Reforms
$mref =$ Dummy for Mac Sharry Reforms
} for commodity $i$ in country $j$ for year $t$
$e =$ Some error term not explained by the model

### 3.3 Estimation Results

A non-linear, three stage least square method was used to solve for the system of equations for each of the countries. The simultaneous equation system helps us to understand the cross correlation effects of the independent variables across different equations. The coefficients of the independent variables give us the elasticities since we use a double log model for our estimation. We test for normality for the entire time series

data using the Shapiro-Wilk method where the null hypothesis considers that the distribution of the residuals is not normal. Heteroscedasticity for the residuals is tested to see if the residuals show any pattern using two tests – the Breusch-Pagan test and the White's test, where the null hypothesis that the error variance of the independent variables is not constant is rejected in the case where the p-value is greater than 0.05 for a 95 percent confidence interval. Furthermore, we use the Durbin Watson test to test for co-linearity in the independent variables. Results from these tests are cataloged in the appendix (Appendix 1). Elasticity results for the independent variables in the system are illustrated in table 3.1 to 3.6 for each of the cereal commodities. The standard error, t-value and the p-value for each of these elasticities are enumerated in the appendix (Appendix 1) for the reader. We do not find any correlation between the independent variables for each of the countries. The system was evaluated based on four main criteria which included the magnitude of the coefficient which suggested how elastic or inelastic it is to the dependent variable, the sign of the coefficient which illustrates if the dependent variable is positively related to the independent variable, the statistical significance of the coefficient at 90 percent significance level, the goodness of fit for each of the equation in the system.

#### 3.3.1.5 Elasticity Results for Wheat

The coefficients of the parameters for wheat are presented in table 3.1. Since the model is a log-log model where the independent and the dependent variables are in their natural log form the coefficients represent the associated elasticities. Significance of these elasticities is represented by an asterisk associated with the parameters that show

significance. We discuss the elasticity results and try to understand the coefficient effects and their signs in the following sections.

#### 3.3.1.1 Inventory Demand

The inventory demand which is a function of domestic price and the ratio of apparent production to apparent consumption showed acceptable statistical results across countries in the European Union. Economic theory would suggest that with an increase in domestic price there would be a decrease in the opening stocks of the commodity. Thus opening stocks and domestic price are inversely related ceteris paribus. Seven of the fourteen countries among the fourteen which includes France, Austria, Denmark, Spain, Greece, Portugal and Finland are consistent with economic theory while the rest show a positive sign suggesting that opening stocks increase with an increase in domestic price. This could be due to the fact that in most of these European countries the market price was governed by an intervention price below which the domestic price was not allowed to drop thus providing price stability to farmers. Figure 3.1 below further substantiates this perception. The average domestic price for these seven countries governed by the market demand is below the average intervention price for most of the period and hence the government in these countries had to buy all quantities offered by farmers in any given year which increased opening stocks into the next year. Eight of the fourteen countries in the European Union show that the relationship for inventory demand is significant at 90 percent significance level. The magnitudes of the parameters show the elasticities which suggest that, except for Belgium-Luxemburg, all other countries show that domestic prices are relatively inelastic to opening stocks.

**Table 3.1: Empirical Estimation of Elasticities for wheat in the European Union using Non-Linear Three Stage SLS:**

| WHEAT | | lndmpr | (lnprod+lnimpq)/lnconp | lnconp | mref | aref | lnopstk | lngdp | | lndmpr |
|---|---|---|---|---|---|---|---|---|---|---|
| | a1 | a2 | a3 | b1 | b2 | b3 | b4 | b5 | b6 | c1 | c2 |
| FRANCE | 1.12326 | -0.7451* | 5.426605* | 3.31563 | -0.909* | -0.1194 | -0.3590* | -0.1705* | 0.45361* | 2.98747 | 0.05424 |
| AUSTRIA | 1.69949 | -0.9321* | 10.24812* | 1.652265 | -0.368* | -0.2722* | -0.5507* | -0.05736 | 0.47936* | 4.61654* | 0.47738 |
| BELGIUM | 2.60806 | 1.11385* | 0.030716 | 1.247883 | -0.789* | -0.0962 | -0.1001 | 0.10783* | 0.43134* | 11.2907 | -2.30252 |
| GERMANY | 1.30101 | 0.85113* | 3.796* | -0.49773 | -0.520* | -0.3214* | -0.4755* | 0.06917 | 0.52732* | 18.0132 | -0.81615 |
| DENMARK | 3.77997 | -1.6596* | 4.272407* | -0.812 | -0.316* | -0.1659* | -0.3679* | -0.02086 | 0.56350* | 7.88735 | -0.29476 |
| IRELAND | -0.77523 | 1.02261* | -0.40622 | 4.102613 | -0.604* | -0.2923* | -0.7744* | 0.14553* | 0.40663* | -0.07253 | 3.35325* |
| ITALY | 9.92008 | 0.92996* | 9.690053* | 2.161606 | -0.7394 | -0.5169* | -0.6746* | 0.29343* | 0.06168 | 5.20351 | -1.7849* |
| N.LANDS | 0.02701 | 0.17144 | 0.434926 | -0.73357 | -0.392* | -0.1678* | -0.3991* | 0.2031* | 0.56778* | 0.00537 | 0.41981 |
| SPAIN | 0.19699 | -0.06223 | 5.920328* | 9.010716* | -1.197* | -0.2759* | -0.121* | 0.04055 | 0.11581 | 1.16292 | -1.00973 |
| UK | 10.0786 | 0.12576 | -5.67089* | 10.07368 | -1.063* | -0.4502* | -0.6023* | 0.04395 | 0.46745* | 3.02029 | 4.19456* |
| GREECE | 10.5130 | -0.25844 | -3.90531* | 11.39609* | 0.0421 | -0.34546 | -0.51395 | 0.04795 | -1.0333* | 10.0998 | 1.82932 |
| P.GAL | 3.59861* | -0.19024 | 0.741402 | 10.428349 | -1.665* | 0.26789 | 0.41204 | 0.08125 | -0.4954* | 11.5174 | -4.4853* |
| SWEDEN | 5.99929* | 0.174887 | -0.64284 | -0.10764 | -0.475* | -0.6760* | -0.9898* | 0.0908 | 0.54538* | 1.67627 | -0.9332 |
| FINLAND | 7.86957* | -1.0383* | 0.819484* | 2.083789 | -0.115* | -0.3820* | -0.6012* | -0.0996* | 0.21764* | 1.909344 | -1.4054 |

| WHEAT | lnworldp | lnexpr | lnexrt | mref | aref | | lndmpr | lnworldp | lnexrt | lnimpl | mref |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | c3 | c4 | c5 | c6 | c7 | d1 | d2 | d3 | d4 | d5 | d6 |
| FRANCE | 0.418281* | 0.00946* | 0.73804* | 0.239418 | 0.226732 | -0.1539 | -0.23414 | 0.515967 | 1.70204* | -12.390* | -0.25752 |
| AUSTRIA | 0.032159 | -0.1161* | 0.59962* | -0.3079* | -0.17176 | 16.40767 | -3.2595* | 0.123778 | -1.98264 | -0.13585 | -1.4410* |
| BELGIUM | -0.00871 | 0.190096 | -0.66647 | 0.23363 | -0.5928 | -9.30979 | 0.255669 | 0.98220* | 0.673451 | -0.08974 | 0.223388 |
| GERMANY | -0.26493 | 1.83117* | -1.9996* | 0.262911 | 0.72479* | -1.30603 | 0.341101 | -0.03407 | 1.104717 | 0.000986 | -0.20254 |
| DENMARK | -0.14698 | -0.01057 | 0.54142 | 0.63755* | 0.573726 | -8.69949 | 1.438219 | -0.74985 | 3.76372* | -0.10315 | 1.28012* |
| IRELAND | 0.309252 | 1.60619* | 2.71715* | 1.20172* | 1.77050* | 1.563265 | 0.096516 | -0.07751 | 0.262729 | 0.072969 | -0.12439 |
| ITALY | 0.418281* | 0.093364 | -1.1564* | 0.271463 | -0.31699 | 5.49337* | -0.03155 | -0.4570* | 0.82378* | -0.1793* | -0.07624 |
| N.LAND | 0.032159 | 8.66129* | -0.02184 | 0.29823* | 0.105821 | 3.95614 | -1.1176* | 0.38790* | -0.42838 | -3.7420* | 0.100146 |
| SPAIN | -0.00871 | 2.73017* | -2.443* | 0.539013 | 0.566459 | 13.79969 | 0.546431 | -1.8527* | -0.38911 | 0.093347 | 1.83110* |
| UK | -0.26493 | 7.6602* | 2.79932* | 1.56153* | 1.48621* | 13.7417* | -1.1496* | 0.15715 | -1.6542* | -1.6990* | 0.07871 |
| GREECE | -0.14698 | 2.9453* | -0.28923 | 2.07638* | 2.21500* | 8.986458 | -0.89616 | -1.6649* | 0.568849 | -0.1162 | -0.33917 |
| P.GAL | 0.309252 | -0.15687 | -3.8273* | -0.7843 | -0.02537 | 7.416288 | 0.908698 | -0.45924 | 1.16954* | -0.09712 | 0.97861* |
| SWEDEN | 0.747867 | 0.009852 | -0.8375 | -0.7504* | 0.196016 | -14.941 | -3.9644* | -0.69011 | -0.18167 | -0.0390 | -1.4301 |
| FINLAND | 0.874964 | -0.10526 | -0.2882 | -2.1031* | -3.0414* | 30.38712 | -2.4078 | -3.5736* | 5.431779 | -0.6460 | -2.4125 |

(Table Continued)

(Table Continued)

| WHEAT | aref | lngdp | lnimpqu/lnimpq | | lndmpr | lnprodr | mref | aref | lngdp |
|---|---|---|---|---|---|---|---|---|---|
| | d7 | d8 | d9 | e1 | e2 | e3 | e4 | e5 | e6 |
| **FRANCE** | -0.552 | 0.89094* | 3.08131* | 3.15469* | 0.6943* | 6.62572* | -0.1546* | -0.423* | 0.45014* |
| **AUSTRIA** | -1.65514 | 0.411929 | -0.29443 | 0.07481 | 0.2292 | 5.24173* | -0.17163 | -0.058 | 0.187085 |
| **BELGIUM** | -0.00299 | 0.259485 | 1.61453* | 0.03715 | 0.6928* | 1.59809* | -0.1794* | -0.356* | 0.589442* |
| **GERMANY** | -0.09448 | 0.404549 | 0.37384* | 1.013766 | 0.5546* | 2.10077* | 0.017256 | 0.09901 | 0.609937* |
| **DENMARK** | 1.45145* | 0.97542* | -0.16501 | -3.1629* | 2.3463* | 0.048707 | -0.3990* | -0.956* | 1.553344* |
| **IRELAND** | -0.04627 | 0.39093* | 4.79703* | 1.03262 | 0.5828* | 2.97349* | -0.2702* | -0.470* | 0.58861* |
| **ITALY** | -0.3507* | 0.37141* | 1.1901* | 1.013459 | 0.211506* | 1.57305* | 0.004054 | -0.1236 | -0.2149* |
| **N.LANDS** | 0.214689 | 0.32367 | -0.24269 | 4.60475* | 0.06739 | -0.04739 | -0.01202 | -0.0734 | 0.245791* |
| **SPAIN** | 2.14486* | 1.10939* | 0.53859* | 8.01806* | 0.41495* | -0.02041 | -0.4159* | -0.421* | 0.067798 |
| **UK** | 0.288189 | -0.5677* | 1.25176* | 2.004813 | 0.026057 | 5.14037* | -0.2434* | -0.455* | 0.678672* |
| **GREECE** | -0.34528 | 0.12551 | 0.56698* | 4.075386 | 0.589024* | 3.88089* | 0.214422 | -0.1537 | -0.17327 |
| **P.GAL** | 1.25330* | -0.0970* | 1.94095* | 3.964956 | 0.02684* | 0.190501 | -0.27138 | -1.523* | 0.000881 |
| **SWEDEN** | -1.9345 | 3.27466* | -0.0960 | 3.027776 | 0.6568* | 4.84347* | -0.4313* | -0.3496 | 0.380414* |
| **FINLAND** | -5.1470* | 2.13570* | 2.48023* | 8.37967* | 2.0822* | 0.31797* | -1.2797* | -1.725* | 0.775589* |

**Table 3.2: Variable Definition and Units:**

| Variable Name | Definition | Units |
|---|---|---|
| lndmpr | Log of Domestic Price | U.S. Dollars per Ton |
| (lnprod+lnimpq)/lnconp | Log of Ratio of Apparent production to Apparent consumption | 1000 Tons |
| lnconp | Log of Consumption | 1000 Tons |
| mref | Dummy Variable capturing the effect of Mac Sharry Reforms | |
| aref | Dummy Variable capturing the effect of Agenda 2000 Reforms | |
| lnopstk | Log of Opening Stocks | 1000 Tons |
| lngdp | Log of Gross Domestic Product | Million U.S. Dollars |
| lnworldp | Log of World Price | U.S. Dollars per Ton |
| lnexpr | Log of Export Refund | U.S. Dollars per Ton |
| lnexrt | Log of Exchange Rates | Domestic Currency per U.S. Dollar |
| lnimpl | Log of Import Levies | U.S. Dollars per Ton |
| lnimpqu/lnimpq | Log of Ratio of Imports from United States to Total Imports | 1000 Tons |
| lnprodr | Log of Production Refunds | U.S. Dollars per Ton |
| lnexpq | Log of Export Quantity | 1000 Tons |
| lnimpq | Log of Import Quantity | 1000 Tons |
| lnprod | Log of Domestic Production | 1000 Tons |

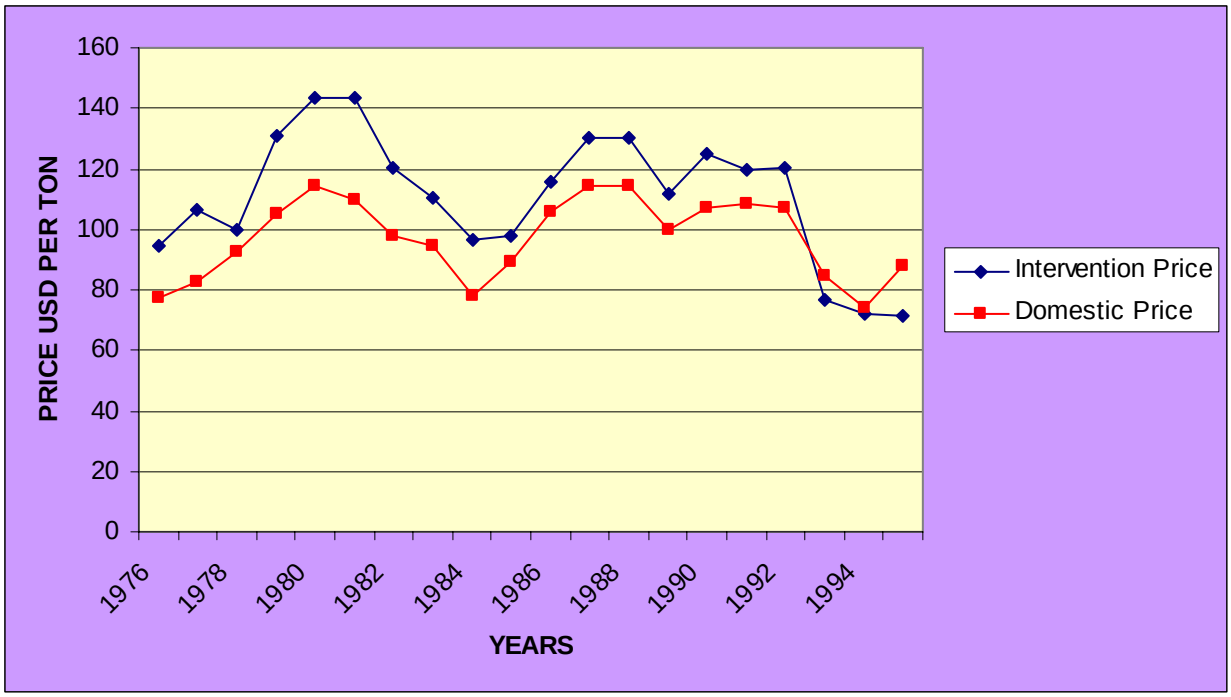


Figure 3.1: Average Domestic price and Average Intervention Price in seven countries which illustrates a positive relation to opening stock.

An increase in the ratio of apparent production to apparent consumption, should in ideal conditions, increase the opening stocks ceteris paribus. Except for four countries – Ireland, United Kingdom, Greece and Sweden, the rest of European Union members conformed to the economic theory. This exception could be due to the distortions caused by export refunds. Thus an increased production could have increased relative exports in these countries and subsequently could have had inverse effects on opening stocks of the country. Our intuition is further confirmed by observing the mean annual ratio of consumption to production in Figure 3.2 which suggests that Greece and Ireland are net exporters of wheat over the 29 year average. The magnitude of the elasticities suggests that the ratio of apparent production to apparent consumption is relatively elastic except for Belgium-Luxemburg, Ireland, Portugal, Finland and Sweden which exhibit fairly inelastic relationships to opening stocks of the country.

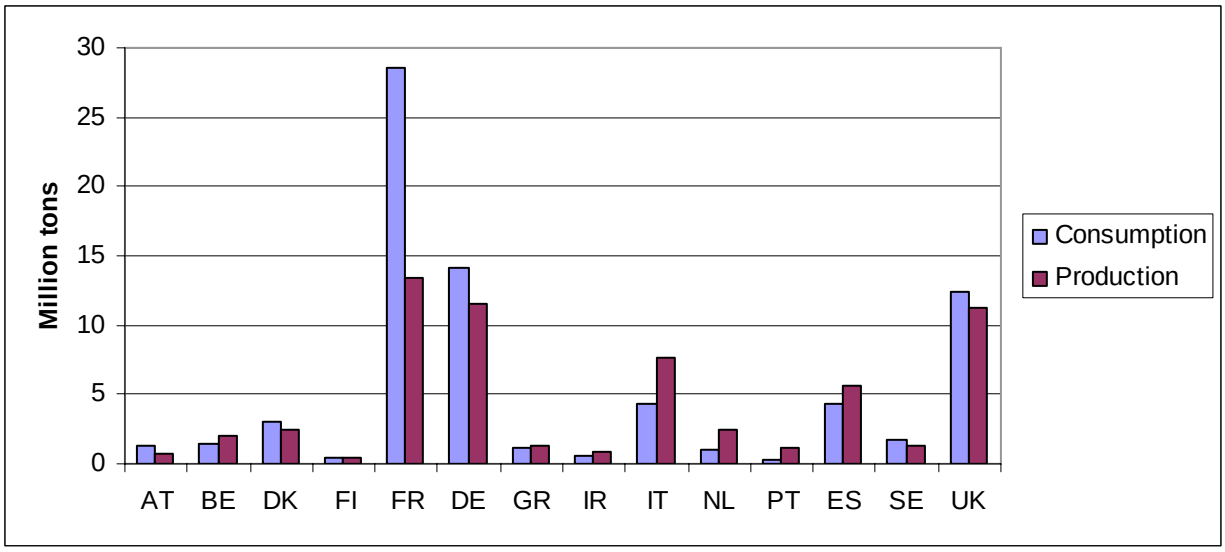

Figure 3.2: Average Ratio of Consumption and Production of wheat for the fifteen EU countries.

Nine countries which include France, Austria, Denmark Germany, Italy, Spain, United Kingdom, Greece and Finland show that this relationship is significant at 90% significance level.

#### 3.3.1.2 Domestic Demand

The inverse demand function for domestic price was modeled as a function of domestic consumption, opening stocks, the Gross Domestic Product of the country and the two policy dummy variables one representing the Mac Sharry reforms and the other for Agenda 2000 reforms. The coefficients in the log-log model for the equation thus represented the elasticities.

The results show statistical significance across all the countries of the European Union. Table 3.1 shows the estimated results for all variables (b1 – b6). Consumption shows a negative relation to domestic price which complies with economic theory that as prices increases the demand of the commodity decreases. Also all countries exhibit coefficients which are significant at the 90% significance level except for Italy which shows an inverse relationship with price. GDP shows a positive relation to dependent variable for all the countries which implies that as expendable income increases in an economy the prices increase and this could be due to the fact

that people tend to buy more with higher expendable income. Greece and Portugal show unexpected signs and show that as GDP increases prices tend to decrease. The results also suggest that the coefficients are significant at the 90% significance level except for Spain. Four countries France, Austria, Denmark and Finland show a negative relation of opening stocks to prices which suggests that as opening stocks increase prices tend to decrease on the consumer market. The other ten countries in the European Union showed that prices tended to increase with an increase in opening stocks. This could be due to the fact that stocks are also eligible for export refunds once exported. A higher opening stock would thus displace them on the world market due to the subsidy offered for these exports in the countries. Six of the countries showed significant effects on price at the 90 percent significance level. The elasticity estimates suggest they are inelastic in nature since all the elasticities are less than 1. The dummy variables ‘mref’ and ‘aref’ representing the effect of the Mac Sharry Reforms and Agenda 2000 reforms respectively showed a negative effect on domestic price across all the European countries, we can thus deduce that both these policies depressed domestic prices. Considering that these dummy variables were considered as intercept dummy variables the effect could be measured as a difference in the intercept and the coefficient of the equation (b1-b3 for mref and b1-b4 for aref). Ten out of the fourteen countries which included Austria, Germany, Denmark, Ireland, Italy, the Netherlands, Spain, the United Kingdom, Sweden and Finland showed that the coefficients were significant at 90 percent significance level and that they were relatively inelastic for the Mac Sharry Reforms. The Agenda 2000 Reforms further increased this negative impact on domestic price with the reforms showing significant negative effect on France at the 90 percent significance level while Belgium, Greece and Portugal were not affected by either of them.

#### 3.3.1.3 Export Demand

Export demand refers to the amount of wheat exported and the various parameters that influenced these exported quantities. Economic theory would suggest that the domestic price and world price, apart from exchange rate, would affect the amount of exports for any commodity. Higher domestic prices would relatively decrease exports while higher world prices would make exports more appealing. A relatively lower exchange rate would provide an incentive to exporting country providing it more domestic currency for every unit of export. The sub-model for exports in our system differed in many aspects to the economic theory mentioned above. Coefficients for France, Austria, the Netherlands and the United Kingdom showed a positive relation to that of export quantity suggesting that as domestic prices increased exports also showed an increase, though none of these showed statistical significance. Ireland, Italy, Sweden and Finland were the only countries whose coefficients were negative and significant at 90 percent significance level indicating that as the domestic prices increased exports to the world decreased. Eight countries – Belgium, Germany, Denmark, Spain, Portugal, Sweden and Finland showed that their elasticities are higher than 1 which is suggestive of a highly elastic export demand. Six countries which include Belgium Germany, Denmark, Spain United Kingdom and Greece show a negative effect of world price on exports. France and Italy are the only countries whose coefficients show statistical significance at alpha equal to 90 percent. These two variables which in normal situations drive exports thus show less or no effect on most of the member countries. This could be due to the fact that exports are primarily driven by domestic policies and the export refund regime. Also exports in terms of food aid to third world countries distort trade and world price effects. Our intuition is further justified by observing the behavior of export refund which shows a positive relation to the amount of exports in eleven of the fourteen

countries while Belgium, Portugal and Finland show a negative effect though not statistically significant and thus can be ignored. Eight of the countries show that the coefficients have a statistical significance and are mostly inelastic except for the Netherlands, Spain and Germany which show a very high elastic demand for exports.

Export countries tend to have a higher exchange rate which reinforces exports, thus theory would suggest that higher exchange rates would assist export growth. Our results show the contrary in nine countries – Belgium, Germany, Italy, The Netherlands, Spain, Greece Portugal, Sweden and Finland where the signs suggest that the two variables are inversely related to each other. We assume that this could be due to the elaborate structure of the Unit of Account system which was later replaced by the adjusted Monetary Compensatory Amount (MCA) system further modified by the European Monetary System (EMS). These regulations which were instituted to stabilize prices across nations in the European Union to uphold the law of single price across the member countries tended to increase domestic supports thus helping countries with surplus production with higher domestic support in terms of exports to non-member countries. Seven countries showed that the elasticities were significant at the 90 percent significance level and six countries – Germany, Ireland, Italy, Spain, United Kingdom and Portugal show that the export demand is highly elastic to changes in exchange rates while the rest suggest that exchange rate variations were inelastic to export demand.

The Mac Sharry Reforms dummy variable suggests that exports actually increased in ten of the fourteen European countries from 1992 onwards. This is illustrated by the positive sign for the coefficients. This could be due to strong world prices (Figure 3.3), and the fact that export refunds were frozen at the 1989 levels[37] which further assisted domestic farmers and trade.

[37] Council regulation (EEC) No: 1766/92 'On the Common Organization of the market for Cereals'

Austria, Portugal, Sweden and Finland showed a negative sign for the coefficient suggesting that these reforms were detrimental to wheat exports from the respective countries. Austria, Denmark, Ireland, the Netherlands, the UK, Greece, Sweden and Finland showed that the elasticity estimates are significant at 90 percent significance level. Coefficients for Greece, UK, Ireland and Finland indicate that export demand is highly elastic with the Mac Sharry reforms.

The dummy variable for Agenda 2000 reforms indicates that demand for export had a significant effect on exports due the reforms, in Germany, Ireland, UK and Finland while they were insignificant in the rest of the member countries. Germany, Ireland and Finland show a positive relation to the reforms while UK shows that the reforms had a negative effect on wheat export demand in the country. These results could be due to the fact that The EU was a net importer of wheat and thus exports would affect only few countries which were the major producers in the Union. The UK, Greece and Finland show that the demand for exports were elastic in relation to the reforms while the rest of the countries exhibited an inelastic demand.

#### 3.3.1.4 Import Demand

The import demand assesses the total domestic demand. Higher prices in the European market compared to that of world market would make exports by other countries attractive. Policies that restricted this entry thus would have an adverse effect on exporting countries since they tend to decrease incentive to import to the EU at a huge cost to domestic consumers and the government. The import demand is thus dependent on domestic price, exchange rates, world price, import levies, GDP, the two policy variables and the ratio of imports from the U.S to the total imports which helps us understand the effect of change in policies on U.S. exports.

Ten of the fourteen European countries show significant impact of GDP on imports. This suggests that higher expendable income led consumers to demand more of import quantities

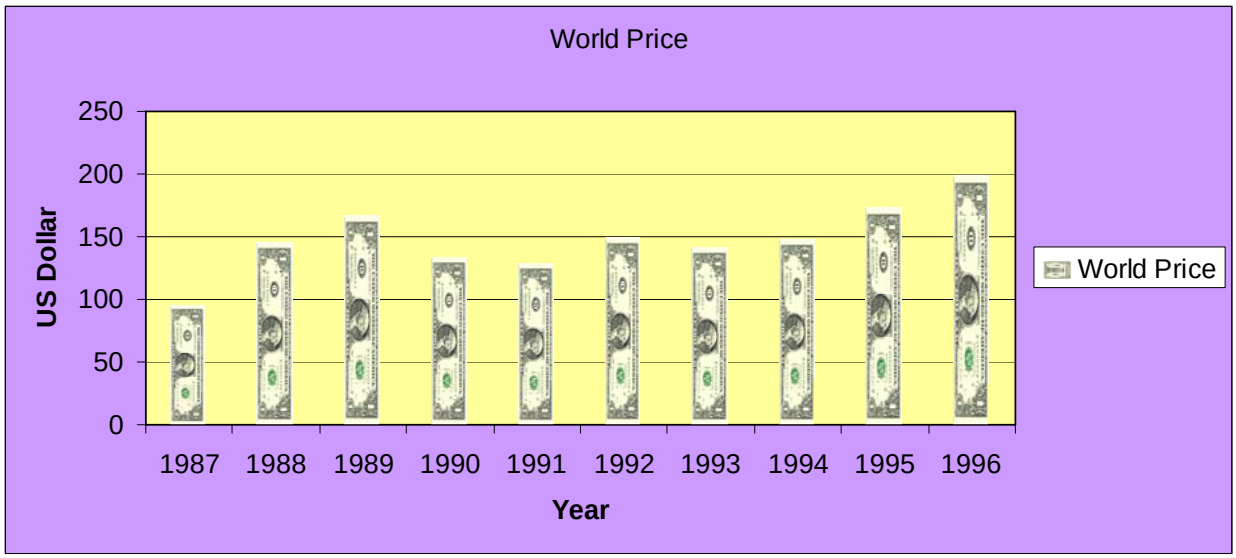

Figure 3.3: World Price for Wheat from 1987 to 1996

Portugal and the UK show unexpected signs and suggest that as consumer income increases the import demand is decreased and are inelastic. This may be due to the artificial effects of import levies in these major cereal producers in the European Union. Spain Sweden and Finland show that the import demand is highly elastic to GDP increase. Ten countries – France, Belgium, Germany, Ireland, Italy, Spain, the UK, Greece, Portugal and Finland show significant elasticity coefficients for the ratio of imports from the US compared to total imports from the world to the European Union. We also observe that all these results show a positive relation to import demand suggesting that U.S. imports have increased with an increase in import demand. Import levies comply with economic theory that it decreases the import demand. All the coefficients for the fourteen countries show a negative relationship with import demand. Four of the fourteen countries show significance at the 90 percent level and all these countries – France, Italy, Netherland and UK show that import demand is highly elastic to changes in to import

levies. Only five countries among the fourteen European countries show significant effects on imports due to world prices, which suggests that domestic policies have a major role in influencing amount of imports in the European Union. Nine of fourteen countries show a negative impact on import demand due to world prices which conform to economic theory that as prices increase the demand for the good decreases. Six countries – Belgium, Italy, The Netherlands, Spain, Greece and Finland show significant elasticity coefficients at 90 percent significance level levels. Exchange rates show mixed results for wheat in the import equation. As a major importer we expect that imports would increase with decrease in exchange rates. Five of the fourteen countries conform to this economic theory while the rest show a positive relation to amount of imports. This may be due to the internal market demand and the internal exchange rate system that governed trade between the member countries and the rest of the world. Belgium, Italy and Germany formed the joint float and restricted their exchange rate compared to the U.S. Dollar while the rest of the member countries adjusted their exchange rates and internal subsidies to these three country rates rather than the U.S dollar. Import demand is highly elastic to exchange rate in seven of the fourteen countries. Five countries which include France, Denmark, Italy, UK and Portugal show a significant impact of exchange rates on quantity imported at 90 percent significance level. An increase in domestic prices will increase the quantity imported. The estimates for domestic price effect for the member countries show that eight of the countries – France, Austria, Italy, The Netherlands, UK, Greece, Sweden and Finland have a inverse effect on import quantity. The import levies in place to restrict the amount of import could actually make imports unattractive and thus hamper trade in these countries. Domestic Prices in only three countries – Austria, Italy and UK show significant effect on the import quantity at 90 percent significant level. Four of the fourteen countries show significant

impact due to the Mac Sharry Reforms which include Denmark, Spain, Portugal and Austria. The Agenda 2000 Reforms apart from the four countries affect Finland. The Mac Sharry Reforms show a positive significant effect on import quantity in Portugal, Spain and Denmark while Austria shows a negative impact, implying that imports decreased as a result of the policy change. The Agenda 2000 reforms illustrate that Austria and Finland have a negative impact on quantities imported while the rest of the countries significantly affected by the reforms had positive impact on import quantities.

#### 3.3.1.5 Supply Equation

Supply of wheat was modeled as being a function of domestic price, the production refund, GDP which represented the expendable income and the policy re-instrumentations of the CAP. All member countries show a positive relation of production refunds to the quantity supplied except for The Netherlands and Spain whose coefficients are not significant at 90 percent significance level. Nine countries – France, Austria, Belgium, Demark, Ireland, Italy, the UK, Greece and Sweden show that supply is highly elastic and significant to production refunds. Finland shows that supply of wheat is inelastic to production refund and is significant at the 90 percent significance level. GDP shows a positive relation to the amount of supply in all countries except Italy and Greece which implies that as income increases the amount of supply increases. Ten of the fourteen countries show that this relation is significant at the 90 percent level. Estimates suggest that the Mac Sharry Reforms have had an overall negative impact on production of wheat in these countries. Eight of the EU nations show that production had been negatively affected significantly by the policy. The Agenda 2000 reforms also had similar negative impact on the production of wheat in all the fourteen countries and eight countries show significance at the 90 percent significance level. Domestic Price shows a positive relation to the

quantity supplied in the member countries implying that as prices increase in the domestic markets the supply of wheat increases. Four of the fourteen countries show that this relation is significant and elastic at the 90 percent significance level.

#### 3.3.1.5 Elasticity Results for Rye

Elasticity results for rye are presented in table 3.3, while the definition of the variables remains the same as in table 3.2. Due to lack of disaggregated data for all the cereals except wheat for imports by country and commodity, estimation of the ratio of imports by U.S compared to total imports was not possible. We assume that total imports thus form a good ratio measure of imports by U.S to the European Union. Data for six variables in our analysis which included domestic price, opening stocks, import quantity, export quantity and production refunds were unavailable for Ireland for analysis of results for rye and hence only fourteen countries were included in our analysis.

#### 3.3.2.1 Inventory Demand

The inventory demand equation depended on the ratio of apparent production to apparent consumption and domestic price. Domestic price across the thirteen countries show a negative relation to the quantity demanded which conforms to economic theory of an inverse relation between quantity demanded and price. Eight of the thirteen countries showed that these results were significant at the 90 percent significance level. The Netherlands and Spain showed a positive relation between quantities demanded and price though the relation was not statistically significant. The magnitudes of the parameters suggest that except for Greece prices in all other countries were highly elastic to quantity demanded. The increase in the ratio of apparent production to apparent consumption according to economic theory should increase opening stocks. All thirteen countries of the EU conform to this theory and are positively correlated to

**Table 3.3: Empirical Estimation of Elasticities for Rye in the European Union using Non-Linear Three Stage SLS**

| RYE | | lndmpr | (lnprod+lnimpq)/lnconp | lnconp | mref | aref | lnopstk | lngdp | | lndmpr |
|---|---|---|---|---|---|---|---|---|---|---|
| | a1 | A2 | a3 | b1 | b2 | b3 | b4 | b5 | b6 | c1 | c2 |
| AUSTRIA | *1.19332 | *-5.70332 | *2.71508 | 0.11921 | -0.1404 | 0.16084 | -0.1568 | *3.91042 | 0.05559 | -13.47740 | 0.7409 |
| BELGIUM | 0.07719 | *-1.36530 | *8.44446 | -0.09790 | 0.1614 | 0.02829 | *-0.3638 | -0.06875 | 0.09064 | 26.47895 | 0.9415 |
| DENMARK | *13.06195 | -1.51951 | 1.68536 | 2.47733 | -0.1928 | -0.09661 | *-0.4887 | -0.05872 | 0.16806 | 19.14495 | -1.8396 |
| FRANCE | -2.54917 | *-2.09617 | 0.40704 | -4.15982 | *-0.8772 | *0.37206 | *0.3419 | 0.05196 | 0.15408 | 0.16791 | *-3.4648 |
| GERMANY | *19.06222 | *-1.55969 | *0.49586 | -2.94265 | *-0.2142 | -0.18390 | *-0.3848 | -0.14515 | *0.25337 | *17.92232 | -0.5684 |
| GREECE | -0.18389 | *-0.48137 | *1.64825 | *11.52886 | *-0.5809 | 0.23824 | *-0.2126 | -0.02608 | *0.90702 | 0.10876 | *-7.4438 |
| ITALY | -0.45502 | *-1.40069 | *1.10072 | 0.29889 | *-0.2898 | *-0.21775 | *-0.5241 | -0.03694 | *0.44832 | *35.70048 | -1.3536 |
| N.LANDS | 0.20653 | -0.48316 | *0.89399 | 1.74532 | *-0.1514 | -0.03625 | -0.4624 | 0.07017 | 0.12855 | -1.28129 | -0.3744 |
| UK | -0.45741 | -0.43642 | *4.83589 | *7.33691 | *-0.2354 | -0.01569 | -0.1412 | -0.02281 | *0.17240 | -2.39083 | 0.5709 |
| SPAIN | *2.39660 | 0.42265 | 0.35087 | *2.53454 | -0.0228 | -0.09892 | *-0.3928 | 0.03185 | -0.17924 | 6.76210 | -2.9883 |
| PORTUGAL | *1.23411 | *-5.02050 | *1.58552 | -4.11184 | -0.2697 | 0.33525 | 0.4262 | *0.22809 | *1.42425 | *38.55650 | *-4.2751 |
| FINLAND | *2.88591 | -0.25297 | *1.49810 | 1.75872 | 0.0353 | *-0.22996 | *-0.5745 | -0.10817 | *0.40412 | 0.45958 | 0.25423 |
| SWEDEN | 1.38275 | *-1.10770 | *1.48462 | *7.11401 | *-0.3048 | *-0.19670 | *-0.508 | 0.02925 | *0.37995 | 0.99860 | -4.9318 |

| RYE | lnworldp | lnexpr | lnexrt | mref | aref | | lndmpr | lnworldp | lnexrt | lnimpl | mref |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | c3 | c4 | c5 | c6 | c7 | D1 | d2 | d3 | d4 | d5 | D6 |
| AUSTRIA | *1.37796 | 0.03029 | *-2.7321 | *-1.07788 | *-1.6267 | *15.44665 | 0.28045 | -0.78835 | *-1.3266 | -0.00201 | 1.71560 |
| BELGIUM | 0.10189 | 0.23164 | 5.0284 | -3.93243 | -0.3761 | 7.71027 | *2.24663 | -0.81984 | 0.4717 | -0.37275 | 0.16076 |
| DENMARK | 0.31789 | 0.25425 | 1.0627 | -1.17803 | -0.5823 | 2.14175 | 1.13811 | -0.59326 | -4.8332 | 0.10878 | 0.01527 |
| FRANCE | *1.54425 | *33.89145 | 2.1327 | *-1.06940 | -0.6530 | -19.99380 | 0.70002 | -0.84988 | *-1.9229 | -0.75940 | 0.05174 |
| GERMANY | *1.33001 | *17.92232 | *-2.5531 | -0.54181 | -0.7067 | *45.17485 | *2.06507 | -2.38284 | *-6.9786 | -0.41092 | *1.08113 |
| GREECE | *7.37959 | *37.61494 | *9.7823 | *-4.26537 | -1.7763 | -31.45570 | *1.86697 | -1.19842 | -1.8665 | *-0.89620 | 0.16830 |
| ITALY | 0.63193 | 0.34620 | -0.7084 | 0.84335 | -3.2296 | -6.00730 | 0.33921 | -1.74846 | -0.3707 | -0.10260 | *3.03501 |
| N.LANDS | *1.79958 | 0.68877 | 0.7636 | 0.22619 | -0.0115 | -7.82688 | 0.43829 | -0.70467 | -0.2591 | *-0.91190 | 0.21509 |
| UK | *3.10836 | *1.00474 | -4.2458 | *1.25275 | -1.1044 | *13.51014 | -0.53413 | -0.31611 | -0.4901 | -0.15460 | 0.98729 |
| SPAIN | -0.00400 | 2.43174 | -0.8226 | -0.24025 | 0.7929 | 18.78572 | 1.74080 | -3.97186 | -0.0608 | -1.64970 | 4.87248 |
| PORTUGAL | 1.67410 | 0.19288 | 1.6864 | -0.58357 | 1.6911 | -29.54230 | 0.43397 | 2.29046 | -2.3263 | -0.43790 | *3.62532 |
| FINLAND | 0.27299 | 0.01690 | -0.2970 | 0.24479 | -0.3034 | *25.19864 | 1.02789 | -0.67235 | -0.1288 | *-0.56400 | *0.91644 |
| SWEDEN | 0.50577 | 0.03668 | -0.0694 | -0.55190 | -0.2862 | 0.40255 | 0.32826 | -0.63520 | -0.9745 | *-0.84400 | 1.87336 |

(Table Continued)

(Table Continued)

| RYE | aref | lngdp | | lndmpr | lnprodr | mref | aref | Lngdp |
|---|---|---|---|---|---|---|---|---|
| | d7 | d8 | e1 | e2 | e3 | e4 | e5 | e6 |
| AUSTRIA | -0.50489 | -0.3720 | -0.0779 | 6.56390 | 0.0716 | *-0.24867 | *-0.5276 | -0.0927 |
| BELGIUM | 0.59509 | 0.6845 | 0.3029 | *17.67505 | *0.6006 | -0.07161 | *-0.4221 | *-0.9925 |
| DENMARK | 0.84627 | 0.4889 | *-1.3435 | *7.07593 | -0.0245 | -0.14063 | *-1.0906 | 0.2800 |
| FRANCE | *-2.26136 | *1.8125 | *-1.0344 | 0.25256 | *-0.1148 | *-0.37761 | *-0.6829 | *-0.2053 |
| GERMANY | 0.66587 | *-2.6388 | -0.1195 | *7.78826 | *0.4711 | *-0.31209 | -0.0663 | 0.0573 |
| GREECE | *2.15306 | *2.3710 | 4.0080 | *8.86270 | *0.0697 | *-0.35782 | *-1.1795 | -0.1171 |
| ITALY | -0.43459 | *0.6306 | *8.0395 | *0.29091 | 0.0096 | -0.05773 | *-0.5154 | *-0.3237 |
| N.LANDS | -0.66138 | *1.5325 | 5.7797 | *1.05393 | 0.1481 | -0.11640 | -0.0110 | *-0.4564 |
| UK | 30.06800 | *-0.4270 | *-0.4213 | *4.38502 | 0.0342 | -0.02636 | *-0.5203 | 0.2853 |
| SPAIN | 0.55886 | 1.7575 | -0.3063 | *4.42346 | *0.1608 | *-0.24489 | *-0.7297 | 0.1468 |
| PORTUGAL | *4.45105 | 1.5714 | 0.0727 | *7.32650 | -0.0017 | -0.37427 | *-0.7528 | *-0.2601 |
| FINLAND | 0.13659 | -1.0687 | -0.1597 | 5.99839 | -0.1002 | *-0.73088 | -0.2612 | 0.0008 |
| SWEDEN | -0.73580 | 0.1272 | -0.3112 | *11.73394 | 0.0017 | -0.11600 | -0.1979 | *-0.456 |

opening stocks. Ten of the countries which include Austria, Belgium-Luxemburg, Germany, Greece, Italy, the Netherlands, the UK, Portugal, Finland and Sweden show that this relation is significant at 90 percent significance level. The magnitudes of the log form variable show that the relation is elastic except for Germany and the Netherlands.

#### 3.3.2.2 Domestic Demand

The demand function which for the simultaneous equation model was modeled as an inverse demand function depended on consumption, opening stocks, GDP which represented the expendable income, opening stocks and the two policy variables vis-à-vis the Mac Sharry Reforms and the Agenda 2000 Reforms of the CAP. Results from the log form model show that as prices increased consumption decreased in all countries in the European Union except for Finland and Belgium-Luxemburg though the relation was not significant for these two countries at 90 percent significance levels. Al other countries which included Austria, Denmark, France, Germany, Greece, Italy, the Netherlands, the UK, Spain, Portugal and Sweden showed that the relation was significant at the 90 percent significance level. The magnitudes of the parameters suggest that the relation is inelastic for all the European countries. An increase in GDP which

represented the expendable income of the consumers in each of the countries should in ideal conditions increase simultaneously with an increase in prices as people tend to buy more with higher expendable incomes. All countries except Spain show this relation to be true while the negative relation for Spain is not significant at the 90 percent significance level. Seven of the countries – Germany, Greece, Italy, the UK, Portugal, Finland and Sweden show that this relation is significant at 90 percent significance level. An increase in opening stocks should in ideal conditions decrease prices. Empirical results for this relation show mixed results. Seven of the countries comply with economic theory which suggest that as opening stocks increase domestic prices should show a decrease as quantity in the market for supply increases, these include – Belgium-Luxemburg, Denmark, Germany, Greece, Italy, the UK and Finland. None of these countries showed a significant relation at the 90 percent significance levels. Austria and Portugal show that an increase in opening stocks actually increase domestic prices in each of these countries and is significant at the 90 percent significance level. Except for Austria, all other countries show that this relation is inelastic. The Agenda 2000 Reforms show that it has an overall negative impact on domestic price which suggests that the implementation of the policy depressed domestic prices. This was significant in nine of the thirteen countries which included Belgium-Luxemburg, Denmark, France, Germany, Greece, Italy, Spain, Finland and Sweden at the 90 percent significance level. The effect on domestic prices due to the Mac Sharry Reforms show mixed results with Portugal, Greece, Austria and Benelux countries showing a positive impact due to the implementation of the policy while the rest show a negative impact on prices due to the same policy. None of the four countries show significance at 90 percent significance level. France, Italy, Finland and Sweden show a significant negative impact due to the policy

implementation. It should be noted that Finland being one of the major exporters of rye to the world has a significant impact on world prices.

#### 3.3.2.3 Export Demand

Export demand accounts for the demand of exports and the various variables that influence quantities exported. Quantities exported is modeled as a function of Domestic Price, World Price, Export Refunds, Exchange Rates, and the two policy dummies which account for significance of the policies on exports (c1 – c7 in table 3.3). Higher world prices would make exports more attractive and thus have a positive effect on quantities exported. Coefficients for the world price variable showed acceptable statistical results with all of the European countries showing a positive correlation to the dependent variable (in this case quantity exported). Spain shows that world price is inversely related to that of quantity exported but this relation is not significant at 90 percent significance level. Austria, France, Germany, Greece, the Netherlands and the UK showed that this relation is significant at the 90 percent significance level. The magnitudes of the coefficients for all the above countries also suggest that this relation is elastic. An increase in domestic prices would under ideal conditions decrease the quantity exported to the world. Our empirical results suggest that this relation holds true for all the EU countries except Austria, Belgium-Luxemburg and Finland though they were not significant at the 90 percent significance level for these countries. Increase in export refunds would stimulate higher extra-EU exports. Results suggest that this positive relation is significant for only four of the thirteen countries which included France, Germany, Greece and UK at 90 percent significance level. These countries also show that exports are highly elastic to export refunds. A higher exchange rate strengthens export quantities and assists export growth. As seen in wheat, empirical results suggest the contrary with seven of the thirteen countries namely, Austria,

Germany, Italy, the Netherlands, the UK, Finland and Sweden. It is vital to observe that the Benelux countries and Denmark which represented the 'fixed floats' in the historical exchange rate regimes show that exchange rates are directly related to that of quantity exported. This provides an ample insight on the variation caused by an internal exchange rate system that used to be followed in the European Union before the Euro became the common currency. Austria, Germany and Greece showed significant effect of exchange rate on the exports of rye. The dummy variable for the Agenda 2000 Reforms of the CAP, which represents any significant impact of the policy on the exports of rye showed mostly negative impact on quantity exported except for Spain and Portugal. This relation was only significant in case of Austria at the 90 percent significance level. Mac Sharry Reforms showed a more significant impact on member countries though the results were not consistent across countries. Except for Italy, the Netherlands, the UK and Finland all other countries showed a negative impact on exports due to this policy reform. The relation was significant and elastic for Austria, France, Greece and the UK.

#### 3.3.2.4 Import Demand

The import demand equation in our model tries to captures the import quantity demanded. Higher domestic prices relative to the world prices in the European Union would make exports by other countries to the EU attractive. Restrictions to this natural flow of commodities until they adjust to the world price equilibrium which include import levies try to drag a wedge between actual domestic demands for imports to the artificial maintained prices. Thus import demand for rye is dependent on domestic prices, the world prices, exchange rate changes, import levies, GDP and the two policy dummies. Statistical results from the regression suggest that import demand decreased with an increase in import levies. The relation was

inelastic for all the countries except for Spain. Greece, Italy, Finland and Spain showed that this relation was significant at the 90 percent significance level. An increase in world price for rye decreases rye imports to the EU. Results from our empirical formulation suggests that this relation holds good for all the countries in the EU though none of them showed any significance at 90 percent significance level. This could be due to fact that imports form a very small part of total consumption of these countries as shown in Figure 3.3. The Mac Sharry Reforms and the Agenda 2000 Reforms have had a largely positive impact on import quantity demanded for rye. The Germany, Italy, Portugal and Finland have significant effect for the Mac Sharry Reforms at the 90 percent significance level. Except for Finland the other three countries shows that this relation is elastic. France shows a negative impact on import quantity demanded due to the Agenda 2000 Reforms and that the relation is significant at 90 percent significance. Greece and Protugal are the only other countries that show significant effect due to the Agenda 2000 Reforms on import quantity demanded. This also shows that imports do not have a major impact on internal prices and thus policies to reform these largely have minimal impact on prices. Exchange rate shows a negative effect to import quantity for all the countries in the EU. This follows theoretical assumptions that exchange rate adversely affect import quantity by the importing country. Austria, France and Germany show that this relation is significant at the 90 percent significance level. Higher domestic prices increase the demand for imports. This relation also holds true in our analysis for rye import demand. Belgium, Germany and Greece show that this relation is significant and elastic at 90 percent significance level.

#### 3.3.2.5 Supply Equation

The supply of rye was illustrated as a function of domestic prices, the production refund, GAP which represented the expendable income by the population and the two policy dummies which

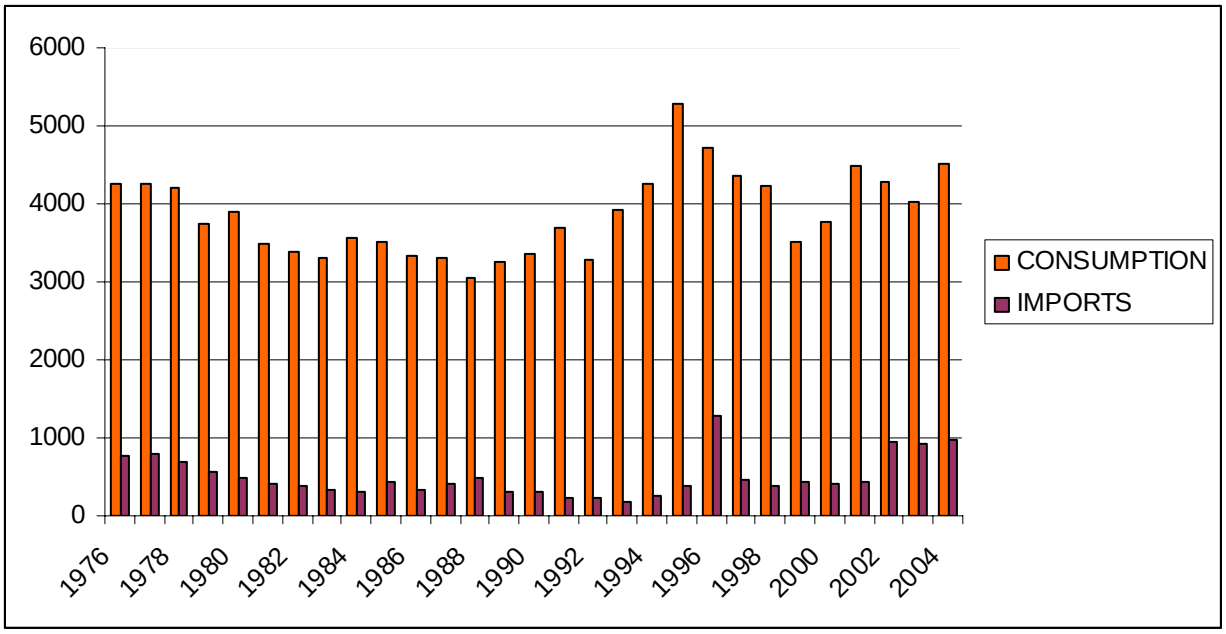


Figure 3.4: Imports as a percentage of total Consumption in the EU

captured if the change is supply was significant after the policies were implemented. All the EU countries show that supply was positively affected by the domestic price in each of the EU countries. This conforms to our economic reasoning that supply of rye should be positively related to the domestic price. Ten of the thirteen countries in our empirical model show that this relation is significant at the 90 percent significance level. These include Belgium, Denmark, Germany, Greece, Italy, the Netherlands, the UK, Spain, Portugal and Sweden. The magnitude of the elasticity results show that the relation is highly elastic, that is a slight change in price could have a large effect on the supply of rye. The Mac Sharry Reforms had significantly decreased the production refunds to nearly fifty percent in the post 1992 years. This made production of rye less attractive to farmers. Empirical results show that this relation holds for all the countries in the EU. The Mac Sharry Reforms had significant effect on the supply of rye in Austria, France, Germany, Greece, Spain and Finland at the 90 percent significance level. The Agenda 2000 Reforms further decreased the production refunds that farmers were eligible for. Thus supply was adversely affected by the introduction of the Agenda 2000 Reforms. This relation was

significant for Austria, Belgium, Denmark, France, Greece, Italy, the UK, Spain and Portugal among the thirteen EU nations. An increase in production refunds should increase the supply of rye. Empirical results show that except for France all other countries conformed to this economic theory interpretation. Belgium, Germany, Greece and Spain show that this relation is significant at the 90 percent significance level. The magnitude of the elasticities show that the relation is inelastic suggesting that a large increase in production refund show a small increase in the supply of rye.

#### 3.3.1.5 Elasticity Results for Corn

Results from the Non-linear Three Stage Least Squares (N3SLS) model for our simultaneous equation model are presented in table 3.4. Due to unavailability of trade data which included export quantity of corn, opening stocks and import quantity prior to 1995, analysis for Finland and Sweden were omitted. We thus presume that these countries would follow the general trend in trade along with the rest of the European nations considered in our analysis.

#### 3.3.3.1 Inventory Demand

Inventory demand which signifies the relation of the opening stocks, domestic price and the ratio of apparent production to apparent consumption showed statistically acceptable results. An increase in domestic prices influenced by the increased quantity demanded decreases opening stocks. This relation holds true in the case of corn in all European Union with all except the Netherlands showing that the domestic prices are directly related to the opening stocks. Eight of the twelve countries which included France, Austria, Belgium, Germany, Ireland, Italy, the UK and Greece showed that this relation was significant at the 90 percent significance level. The Netherland shows that the domestic prices are positively related to the opening stocks and that the relation is significant at the ninety percent significance level.

**Table 3.4: Empirical Estimation of Elasticities for Corn in the European Union using Non-Linear Three Stage SLS:**

| CORN | | lndmpr | (lnprod+lnimpq)/lnconp | lnconp | mref | aref | lnopstk | lngdp | | lndmpr |
|---|---|---|---|---|---|---|---|---|---|---|
| | a1 | a2 | a3 | b1 | b2 | b3 | b4 | b5 | b6 | c1 | c2 |
| FRANCE | 2.4291 | *-1.1308 | *6.8775 | 1.5864 | -0.9571 | *-0.2615 | *-0.5059 | *-0.3987 | *0.2841 | 0.0452 | -0.4647 |
| AUSTRIA | 0.4548 | *-1.4601 | *1.6391 | 0.1518 | *-0.2278 | *-0.3019 | *-0.4499 | *-0.1930 | *0.4211 | 0.8300 | *-24.0806 |
| BELGIUM | -0.1143 | *-1.3639 | *8.0129 | 0.0022 | -0.0280 | *-0.5493 | *-0.8450 | *-2.9499 | *0.4117 | 8.0153 | -2.6844 |
| GERMANY | -0.3687 | *-1.3698 | *10.2927 | 0.1125 | -0.1109 | *-0.3814 | *-0.5319 | *-0.1698 | *0.3985 | 0.0545 | -0.2497 |
| DENMARK | 1.1797 | -1.9071 | *7.9908 | 0.0782 | *0.1012 | *-0.3553 | *-0.7118 | *-1.3429 | *0.3548 | 3.7721 | -1.1454 |
| IRELAND | 2.4331 | *-15.4992 | *2.3128 | 5.1448 | -0.1078 | *-0.3198 | *-0.5977 | -5.5549 | 0.0961 | 0.9714 | -7.1385 |
| ITALY | 10.6049 | *-2.0666 | *0.3465 | 0.0823 | -0.0261 | *-0.5861 | *-0.8022 | 0.2306 | 0.2961 | -3.3167 | *-17.4387 |
| N.LANDS | 1.5919 | *0.7084 | 0.1787 | 0.0710 | -0.1623 | *-0.3966 | *-0.6705 | 0.2485 | *0.3608 | 0.0222 | *-1.2656 |
| SPAIN | -4.3926 | -0.7786 | *14.6784 | 1.5152 | -0.0354 | *-0.4130 | *-0.6469 | -0.0710 | 0.0448 | 50.9711 | -4.3452 |
| UK | -3.7344 | *-2.1782 | *2.0325 | 0.1052 | -0.2633 | *-0.3094 | *-0.4530 | -0.0095 | *7.3998 | 8.6676 | -0.6436 |
| GREECE | 0.1915 | *-5.2283 | *15.3625 | 12.4165 | -0.1141 | *-0.5759 | *-0.9699 | *-0.2662 | *-0.8370 | 2.4081 | -24.4435 |
| P.GAL | 1.5815 | -9.0079 | *7.4503 | 0.0387 | *-5.6676 | *-0.4179 | *-0.6859 | *-10.5490 | *0.3414 | 14.1762 | *-6.4258 |

| CORN | lnworldp | lnexpr | lnexrt | mref | aref | | lndmpr | lnworldp | lnexrt | lnimpl | mref |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | c3 | c4 | c5 | c6 | c7 | d1 | d2 | d3 | d4 | d5 | d6 |
| FRANCE | *1.1147 | *7.6408 | *1.2940 | -0.2933 | *0.9896 | 15.0454 | *0.7830 | -0.4174 | *-0.7218 | *-0.4535 | *-0.8040 |
| AUSTRIA | *3.7138 | *2.1208 | 1.8722 | -0.3158 | *-1.3599 | 13.8964 | *1.1894 | -0.0574 | -1.9580 | -0.3493 | -1.6638 |
| BELGIUM | 0.0760 | 0.0765 | 1.7163 | -0.5593 | *-3.1796 | 11.2358 | 0.6609 | 0.1947 | -0.0504 | *-0.6429 | 0.4353 |
| GERMANY | 0.2113 | *7.9629 | *2.0066 | *-4.4726 | *-0.3959 | 17.3134 | *1.3946 | 0.0535 | *-0.7015 | -0.0186 | 0.1646 |
| DENMARK | 0.1557 | 0.0938 | *5.1419 | 0.3526 | -0.6012 | 0.5115 | *27.1891 | -0.1565 | -0.3519 | -0.1378 | *-1.7848 |
| IRELAND | 0.2133 | *1.9822 | *3.2134 | 0.1019 | *3.2134 | 0.3791 | *5.2281 | -0.4390 | -0.4410 | 0.0425 | 0.1620 |
| ITALY | *0.9316 | 0.0147 | *3.8825 | -0.3245 | -0.1237 | 0.1686 | *19.2091 | 0.2489 | -1.1304 | 0.0173 | 0.0417 |
| N.LAND | *1.0173 | *17.2986 | *2.0703 | -0.2814 | -0.2945 | 0.1024 | *19.4245 | -0.1532 | *-0.8736 | *-0.4263 | -0.0831 |
| SPAIN | *1.8219 | 0.0107 | 0.9419 | -1.3810 | -0.2315 | 0.8354 | 1.1364 | -0.0855 | *-9.7622 | -0.0308 | 0.0971 |
| UK | 0.2514 | 0.0822 | *1.9472 | *-1.5781 | -0.5876 | 0.3043 | *9.2080 | *-0.4408 | *-0.7743 | -0.0252 | 0.1374 |
| GREECE | 0.2882 | *0.8527 | *5.7596 | *-2.2067 | *-3.4022 | 24.0424 | 1.3439 | -0.9687 | -0.1289 | *-0.5208 | *1.1264 |
| P.GAL | 1.4014 | *0.6455 | 0.0882 | -0.9874 | -1.5492 | 5.1399 | *1.5322 | -0.1289 | *-0.4067 | -0.0390 | *0.8615 |

(Table Continued)

(Table Continued)

| CORN | aref | Lngdp | | lndmpr | lnprodr | mref | aref | lngdp |
|---|---|---|---|---|---|---|---|---|
| | d7 | d8 | e1 | e2 | e3 | e4 | e5 | e6 |
| FRANCE | *-0.5426 | *0.5033 | 0.2410 | *6.4567 | 0.1071 | 0.1349 | -0.1632 | 0.1700 |
| AUSTRIA | -1.7132 | 1.7894 | 0.0800 | *3.9043 | 0.0641 | -0.1777 | -0.0311 | 0.2075 |
| BELGIUM | -0.0691 | 0.3382 | 0.0780 | *0.6805 | *1.2909 | *-0.8815 | *-5.2495 | *0.8355 |
| GERMANY | *-0.5660 | *0.3877 | -5.3971 | *0.5739 | *0.1148 | 0.1771 | -0.1192 | *0.8396 |
| DENMARK | -0.1218 | *0.8723 | 1.7870 | *12.5899 | 0.5839 | 1.2494 | *-1.8924 | 1.3409 |
| IRELAND | *-0.2423 | *0.7158 | -3.6055 | *30.1242 | *7.9685 | -1.2913 | -0.2696 | 0.1422 |
| ITALY | *-0.4851 | 0.4620 | -0.3413 | *29.4847 | *0.2101 | -0.0410 | *-0.5989 | 0.0729 |
| N.LANDS | -0.0551 | 0.0696 | -0.1300 | *6.2647 | *7.4018 | -0.4306 | -0.1530 | *5.5761 |
| SPAIN | 0.6342 | *1.8301 | -0.2747 | *0.4349 | 0.0446 | *-0.5627 | *-0.6438 | *0.4651 |
| UK | 0.2290 | 0.0789 | -38.4882 | 4.4465 | 1.0243 | -0.4703 | -1.4000 | 2.9793 |
| GREECE | -0.6342 | *1.9946 | 3.0158 | *0.2799 | 0.0136 | *-0.8465 | *-0.9805 | *0.4247 |
| P.GAL | *1.2825 | *1.1144 | -2.1576 | *3.8979 | 0.3632 | -0.0288 | -0.1186 | *0.1412 |

The magnitude of the parameters suggests that the relation is elastic except for the Netherlands. An increase in the ratio of apparent production to apparent consumption would increase the opening stocks according to economic theory. This relation holds true in all the twelve EU countries in out analysis. Empirical results also suggest that the relation is significant for nine of the twelve countries which included France, Austria, Belgium, Germany, Denmark, Ireland, Italy, Spain, the UK and Greece. The magnitude of the coefficients suggests that the relation is highly elastic.

#### 3.3.3.2 Domestic Demand

The domestic demand equation was modeled as a price dependent equation with the domestic price being a function of consumption, quantities of opening stocks, the GDP of the country as a proxy for expendable income of the population and the two dummy variables each for the specific policy regime change to the CAP. Empirical results showed that consumption decreased as domestic prices increased and thus was inversely related. This conforms to economic theory of an inverse relation to consumer demand of goods as prices of the good increased. Results show that this relation was significant at ninety percent significance for only

three of the twelve countries which included Austria, Denmark and Portugal. An increased quantity of opening stocks should decrease the domestic prices since the supply of the commodity increases. This relation holds true for ten of the twelve countries though Italy and the Netherlands suggest that the positive relation is not significant. Seven of the twelve countries show that the relation is significant at the 90 percent significance level, these included France, Austria, Belgium, Germany, Denmark, Greece and Portugal. Elasticity results also suggest that the relation is highly elastic for Portugal, Denmark, Germany and Ireland while it is inelastic for the rest of the EU nations. GDP shows a positive correlation to domestic prices suggesting that as expendable income increases the demand for good increases and hence prices tend to increase. This conforms to our knowledge of economic theory which suggests that increased income has a positive effect on prices. Eight of the twelve countries show that the relation is significant and negative for this relation and include France, Austria, Belgium, Germany, Denmark, the Netherlands, the UK and Portugal while Greece shows unexpected results for the same. Statistical results also show that the relation is inelastic for all the countries except the UK which shows a highly elastic relation suggesting that a small change in income could bring about a huge change in the domestic price of corn. The two dummy variable each for the policy regime change shows that they had a negative impact on domestic price. All the countries in the EU showed that the relation was significant for both the policy re-instrumentation of CAP. The relation also showed that it was significant for all the countries in the EU and were inelastic in nature.

#### 3.3.3.3 Export Demand

For the most part, the estimated parameters for export demand displayed signs consistent with economic expectations, and were significant. The quantity exported depended on domestic price, world price, export refund, the exchange rates and the dummy variables for each

of the reforms of the CAP. An increase in domestic price should decrease quantity exported as the domestic market seems more attractive for the sale of the commodities. This holds true for our empirical results for all the EU countries. Austria, Italy, the Netherlands and Greece showed that this relation was significant and elastic at the 90 percent significance level. An increase in world price should in ideal conditions increase quantity exported. All the EU countries conform to this economic theory with France, Austria, Italy, The Netherlands and Spain showing statistical significance at the 90 percent level. The magnitudes of the coefficients of the parameters suggest that except for Italy all the other countries which showed significance were elastic to export quantity suggesting that a slight change in world price would have a significant impact on quantity of corn exported by the EU. Export Refunds tend to increase the amount of quantity exported. All countries in the EU showed that export refunds were positively correlated to that of export quantities of corn. France, Austria, Germany, Ireland, The Netherlands, Greece and Portugal showed that the relation was significant at the 90 percent significance level. France, Austria, Germany and The Netherlands showed that the export quantities were elastic to changes in the export refunds. An increase in the exchange rate of an exporting country tends to increase the amount of exports to other countries. The relation holds true for all the EU nations with eight of the twelve countries showing significance. France, Germany, Denmark, Ireland, Italy, The Netherlands, the UK and Greece show that the relation is also export quantity is elastic to changes in the exchange rates. The policy re-instrumentation of the CAP showed mixed effects on the quantity exported with Denmark and Ireland showing an increase in the quantity exported due to the implementation of the Mac Sharry Reforms though these were not significant at the 90 percent significance level. Germany, the UK and Greece showed that the policy had a significantly negative effect on the quantity of exports. France showed a positive effect due to

the implementation of the Agenda 2000 Reforms of the CAP and was significant at the 90 percent significance level. The rest of the EU showed that the relation was negative suggesting that exports of corn to other countries declined considerably due to the implementation of the Agenda 2000 Reforms. Austria, Belgium, Germany and Greece showed that the relation was significant at the 90 percent significance level.

#### 3.3.3.4 Import Demand

Quantity of imports demanded of corn depended on the domestic prices of corn, the world prices, the exchange rate, the applied import levies which were a combination of fixed and variable levies, expendable income of the population measured by the change in GDP and the policy dummies to capture any significant change in the amount of imports due to their implementation. Statistically significant relations were observed for most of the variables in the sub model. An increase in domestic price should attract more imports, this relation held true for all the EU countries. Austria, France, Germany, Denmark, Ireland, Italy, The Netherlands, the UK and Portugal showed that the coefficients were significant at the 90 percent significance levels. The magnitudes of the coefficients suggest that the relation was elastic since all the coefficients were higher than 1 except for France which showed less elastic relation to import quantity. An increase in world price should in ideal conditions decrease the amount of imports since imports would become relatively costly. The relation holds true for all the EU countries in our analysis though only the UK showed statistical significance at the 90 percent significance level. The magnitude of the coefficient for the UK suggests that the relation is relatively inelastic. The less significance of the relation could be due to the fact that the domestic markets were kept insulated from the world market through a extensive system of price regimes controlled by the CAP policies. This is illustrated in figure 3.4 which shows that the domestic

prices in the UK, as an example, were kept relatively higher than the world price while imports were kept low through the presence of import levies and the internal exchange rate system. This is true for all the countries in the EU though the magnitude of the difference between the domestic and world prices differed.

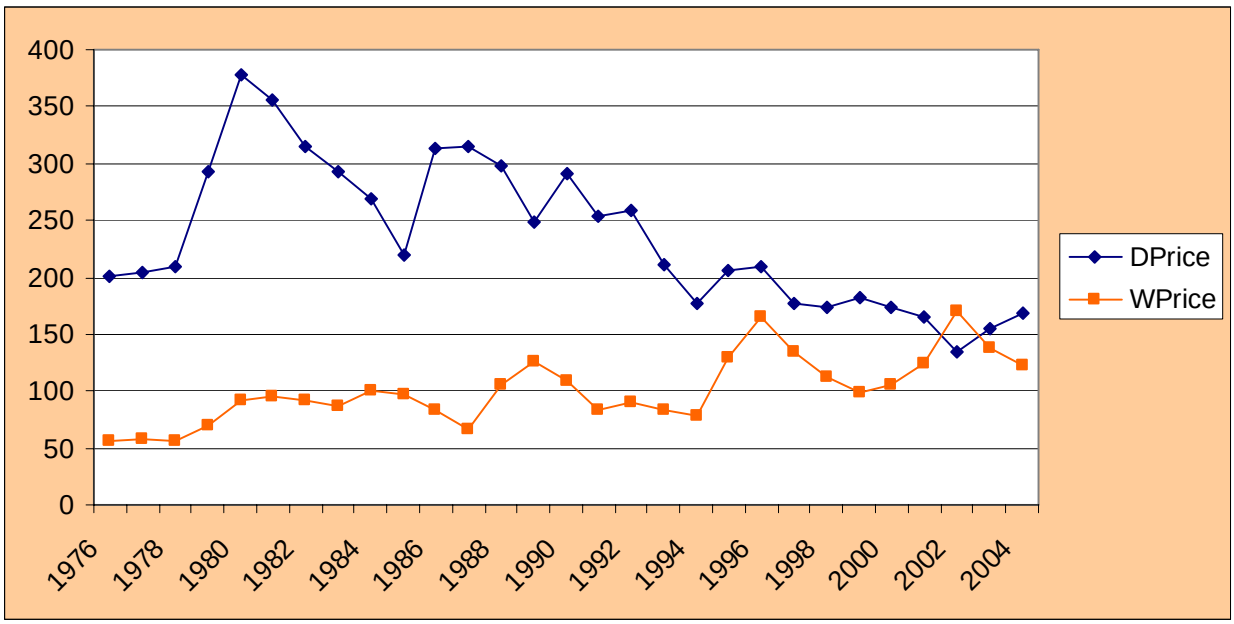


Figure 3.5: Domestic and World Prices of Corn for the United Kingdom

An increased exchange rate would decrease the amount of imports since commodities became relatively costly. This economic aspect held true for all the EU nations in our analysis. France, Germany, The Netherlands, Spain, the UK and Portugal showed that the relation was significant at the 90 percent significance level and was relatively inelastic to import quantity. Import levies acted as a deterrent to imports from other countries and hence an increase in the import levies decreased the quantity of corn imported to the EU. France, Belgium, The Netherlands and Greece showed that the relation is significant at the 90 percent significance level and negative as suggested by economic theory. An increase in the spending power of the population would effectively lead them to demand more of imports. This holds true for the demand of imports of corn by the EU. All the EU countries conform to this economic theory and show a positive sign

of the coefficient of the parameter in our sub model for import demand. France, Germany, Denmark, Ireland, Spain, Greece and Portugal show that this relation is significant at the 90 percent significance level. The magnitude of the coefficients suggests that except for Spain, Greece and Portugal the relation is inelastic. Changes in the CAP have had mixed impact on the imports of corn in the EU nations. Greece and Portugal had a positive and significant effect due to the implementation of the Mac Sharry reforms, France and Denmark showed a totally opposite effect suggesting a decrease in imports due to the implementation of the 1992 reforms. The Agenda 2000 Reforms have largely had a negative impact on imports with France, Germany, Ireland and Italy showing significance at the 90 percent level. Portugal showed that the implementation of the Agenda 2000 Reforms has increased the amount of imports to the country and the coefficient was significant at the 90 percent significance level.

#### 3.3.3.5 Supply Equation

Supply of corn depended on the domestic prices, the production refunds that farmers were paid, the expendable income and the two dummies to capture any significant effect of the policy changes in the CAP. An increase in domestic price should increase the amount of corn supplied since it is profitable for farmers to produce more. This is reflected in our empirical analysis since all the coefficients show a positive relation to quantities supplied. Except the UK the rest of the eleven countries show that this relation is significant at the 90 percent significance levels. Production refunds also create incentives for increased production and hence increase the amount of supply. Results from our analysis show that the production refunds have positive effects on production on corn in all the EU nations. Belgium, Germany, Ireland, Italy and The Netherlands show that this relation is significant at the 90 percent significance level. Increased household incomes would increase consumption of goods and this holds true for all the EU

countries corn supply. Belgium, Germany, Spain, The Netherlands, Greece and Portugal show that this relation is significant at the 90 percent significance level. Except for The Netherlands all other countries show that the relation is inelastic while the relation is elastic in case of The Netherlands suggesting a slight change in the income could increase the amount of supply by a significant amount. The two dummy variables which captured significant changes in supply due to the implementation of the policies showed mixed results. France, Germany and Denmark showed that the Mac Sharry Reforms actually help increase production in these countries though they were not statistically significant while the rest of the countries showed a negative effect on the production of corn due to its implementation. Belgium, Spain and Greece showed that the effect of the reforms was significant at the 90 percent significance level. All the EU countries showed a decrease in production of corn due to the reforms of the Agenda 2000 of the CAP. Belgium, Denmark, Italy, Spain and Greece showed that the result was significant at the 90 percent significance level.

#### 3.3.1.5 Elasticity Results for Barley

Table 3.4 shows the elasticity coefficients for Barley. The definition of the variables remains the same as that defined in table 3.2. The amount of trade in barley which includes both imports and exports formed a significantly small amount of total trade in cereals. Thus we expect that trade related variables have little or no significant effect on the prices, consumption and production of the commodity. The following sections discuss the results from each of the sub models in our N3SLS simultaneous equation model.

#### 3.3.4.1 Inventory Demand

Inventory demand which estimates the effect of variables on the opening stocks of a commodity are modeled as a function of domestic prices and the ratio of the apparent production

to apparent consumption. An increase in prices would in ideal conditions decrease the amount of opening stocks due to higher demand of barley by consumers. All the EU countries showed that this relation holds true. France, Germany, Ireland, Greece and Portugal showed that the relation is significant at the 90 percent significance level while the magnitudes of the coefficients showed that the relation is highly elastic. An increase in the ratio of apparent production and apparent consumption should increase the inventory added. This holds true for all the EU nations with all the fourteen countries except Spain showing that the relation is significant at the 90 percent significance level. The magnitudes of the coefficients which represent the elasticities suggest that except for The Netherlands all the other countries show that the relation is highly elastic.

#### 3.3.4.2 Domestic Demand

Domestic demand measures the effects on domestic consumption of barley and the variables that affect it. A price dependent domestic demand equation is generated for the model to normalize the simultaneous equation system. Thus domestic prices are a function of domestic consumption, the opening stocks or the inventory, the expendable income and the two dummies to account for any significant changes in domestic prices due to the implementation of policy reforms in the CAP. Economic theory suggests that consumption decrease with increase in the prices. This holds true in our analysis for all the fourteen EU nations. The relation is significant for France, Belgium, Ireland, Spain, Greece, Portugal and Sweden. The magnitudes of the elasticities suggest that except for Sweden the relation is highly elastic. Increased opening stocks suggest decreased prices in the domestic country. Mixed statistical results were observed for the relation with France, Austria, Belgium, the Netherlands and Spain showing a positive effect on domestic prices though none of the above countries showed that the relation is significant. Germany, the

**Table 3.5: Empirical Estimation of Elasticities for Barley in the European Union using Non-Linear Three Stage SLS**

| BARLEY | | lndmpr | (lnprod+lnimpq)/lnconp | | lnconp | mref | aref | lnopstk | lngdp | | lndmpr |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | a1 | a2 | a3 | b1 | b2 | b3 | b4 | b5 | b6 | c1 | c2 |
| FRANCE | 2.4244 | *-21.5909 | *12.1271 | 1.4090 | *-15.0248 | -0.0450 | *-0.3155 | 0.0212 | *0.4496 | 0.4440 | *-2.9029 |
| AUSTRIA | 1.2856 | *-9.5415 | *4.2187 | 0.0408 | -0.9160 | *-0.3668 | *-0.5306 | 0.0042 | *0.4387 | 10.6965 | -0.4939 |
| BELGIUM | 1.8098 | *-4.2306 | *11.1232 | 1.8884 | *-0.3935 | *-0.2853 | *-0.7304 | 0.0401 | 0.1743 | 8.6573 | -1.2476 |
| GERMANY | 0.9280 | *-20.7089 | *42.5574 | *0.1506 | -0.3370 | *-0.3569 | *-0.5641 | *-0.1275 | *0.5489 | 4.9556 | -0.0823 |
| DENMARK | -0.3137 | -0.5809 | *8.4644 | 1.1331 | -4.7174 | *-0.2654 | *-0.4183 | -0.0716 | 0.1884 | 2.3880 | -1.4188 |
| IRELAND | 1.2786 | *-0.3549 | *4.0302 | -0.0235 | *-12.2620 | -0.2382 | -0.4603 | -0.2265 | *1.3934 | 6.1446 | -0.1047 |
| ITALY | 7.4009 | -0.9110 | *0.8126 | 0.0716 | -0.9624 | *-0.3625 | *-0.4723 | -0.1500 | *0.1171 | -14.8390 | -3.3099 |
| N.LANDS | -0.0422 | -0.6958 | *0.4052 | 0.1405 | -0.7005 | *-0.2700 | *-0.4375 | 0.1071 | *0.2931 | 2.8321 | -0.2963 |
| SPAIN | -0.0176 | -0.2693 | 0.6394 | 0.1239 | *-0.7849 | *-0.4563 | *-0.5591 | 0.0488 | *5.5266 | 0.2609 | -0.8082 |
| UK | 1.1754 | -0.6264 | *8.4406 | -0.0401 | -0.2809 | *-0.4270 | *-0.5821 | *-0.2341 | 0.1333 | *1.2846 | -4.0365 |
| GREECE | 0.0309 | *-0.6133 | *8.5081 | 0.0399 | *-0.5452 | -0.0311 | -0.0483 | *-0.2433 | *1.8221 | *58.4581 | -6.0589 |
| P.GAL | -1.2653 | *-0.6994 | *3.6833 | 0.3017 | *-1.1910 | *-0.3181 | *-0.3856 | -0.0826 | *3.8334 | 34.9633 | -2.9941 |
| SWEDEN | 0.3516 | -0.1144 | *4.5200 | -0.0059 | *-0.6514 | *-0.7453 | *-1.5157 | *-0.2344 | *0.2358 | 0.9223 | *-0.8170 |
| FINLAND | -0.0173 | -0.0162 | *1.1155 | 1.2804 | -0.2243 | *-0.5091 | *-0.6448 | -1.0617 | *0.2671 | 0.0044 | *-0.6786 |

| BARLEY | lnworldp | lnexpr | lnexrt | mref | aref | | lndmpr | lnworldp | lnexrt | lnimpl | mref |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | c3 | c4 | c5 | c6 | c7 | d1 | d2 | d3 | d4 | d5 | d6 |
| FRANCE | 0.0602 | *6.9985 | 0.0526 | -0.7788 | -0.1494 | 12.4393 | 0.7453 | -0.4815 | -1.8652 | -0.4573 | -0.3419 |
| AUSTRIA | 0.1962 | 0.0570 | 0.0865 | -0.3900 | -0.6060 | 0.8134 | *11.7989 | -0.5748 | -0.4466 | *-0.5945 | 0.0160 |
| BELGIUM | 0.2649 | 0.0301 | 0.1225 | -0.0439 | -1.0570 | 5.2054 | 0.2670 | -0.0156 | 0.4751 | 0.1188 | 0.2636 |
| GERMANY | 0.2675 | *0.1503 | *1.5059 | -0.0732 | -1.0617 | *17.1080 | 0.3703 | 0.1950 | -0.6576 | -0.0336 | 0.1925 |
| DENMARK | 0.3166 | 0.0241 | 0.1351 | -0.3070 | -0.0281 | 1.7595 | *1.5787 | -2.5135 | 0.2254 | 0.1390 | *1.8182 |
| IRELAND | 0.0619 | *1.8059 | *2.8493 | *-0.7544 | *-0.9292 | 0.6633 | 0.3695 | 0.9011 | -6.3973 | -0.0500 | 0.6498 |
| ITALY | 0.6326 | *6.8514 | *4.9656 | -0.0645 | -0.0609 | *1.8938 | *1.5231 | -0.0907 | -0.9107 | -0.4983 | 0.0376 |
| N.LAND | 0.2177 | 0.1913 | *0.8652 | -1.9492 | -0.8644 | *0.2140 | 0.6279 | *0.5520 | 0.8994 | *-13.0704 | 0.0805 |
| SPAIN | 1.1193 | 0.1446 | 0.0626 | -0.4526 | -1.6981 | *53.0176 | 0.4843 | -0.6099 | -0.7676 | -1.3825 | -2.1126 |
| UK | 0.2360 | 0.2046 | 0.5694 | -0.0813 | -0.6749 | 8.3142 | *1.6590 | 0.4530 | *-9.3113 | *-6.2380 | *-1.2561 |
| GREECE | 0.1132 | 0.4054 | 1.9054 | -0.3891 | *-6.9692 | -3.3598 | *8.7245 | -0.7688 | -0.8010 | -0.1191 | *-0.8820 |
| P.GAL | 0.0918 | 1.1260 | 1.3449 | -0.4023 | *-4.1561 | *0.8276 | 0.4757 | -0.0886 | -3.2126 | -0.2591 | 0.2000 |
| SWEDEN | 0.5412 | 0.2055 | 0.7724 | -0.1581 | -0.5149 | 5.1793 | 1.5585 | -0.1556 | -1.4444 | -0.5308 | -0.8974 |
| FINLAND | 0.1572 | *9.8080 | *7.6993 | *-0.8037 | *-1.1552 | 1.2586 | *18.4782 | -0.1476 | -0.0567 | -0.6128 | *-2.0024 |

(Table Continued)

| BARLEY | aref | lngdp | | lndmpr | lnprodr | mref | aref | lngdp |
|---|---|---|---|---|---|---|---|---|
| | d7 | d8 | e1 | e2 | e3 | e4 | e5 | e6 |
| FRANCE | *-1.4062 | 0.6024 | -0.0262 | 0.1232 | -0.0216 | -0.0731 | *-0.0676 | *9.4044 |
| AUSTRIA | -0.3714 | 0.6100 | -0.0641 | *7.0111 | 0.0038 | *-0.1872 | *-0.4363 | 0.0395 |
| BELGIUM | -0.2077 | -0.1086 | -0.0708 | *8.8511 | *3.2071 | *-0.4068 | *-0.5931 | -0.1609 |
| GERMANY | 0.3438 | *-0.7858 | *-0.4412 | *4.8217 | *8.9584 | -0.1291 | -0.2288 | *0.4233 |
| DENMARK | *3.0714 | *-1.6708 | -0.0402 | *10.5102 | 0.0398 | *-0.3151 | *-0.2901 | -0.0992 |
| IRELAND | 0.3384 | -0.1264 | *-0.0495 | *0.1419 | *5.6559 | *-0.1623 | *-0.4518 | *0.1383 |
| ITALY | -0.2891 | *-0.4163 | *-0.5555 | 0.2164 | *7.2481 | *-0.4986 | *-0.8805 | *0.4582 |
| N.LANDS | 0.0362 | *0.6232 | 0.0631 | *5.2960 | -0.0127 | -0.1458 | -0.3446 | 0.1513 |
| SPAIN | 0.1793 | *-1.6604 | *-0.7028 | *5.5264 | *4.2626 | *-0.5163 | *-0.7022 | *0.3329 |
| UK | 0.0180 | 0.5680 | -0.0407 | *8.6708 | *0.2451 | -0.1402 | *-0.2276 | -0.0872 |
| GREECE | *-1.0649 | *2.0205 | -0.2011 | *0.3676 | 0.0483 | -0.0142 | *-0.3250 | *8.5611 |
| P.GAL | 0.0694 | *0.7094 | -0.2747 | 3.2908 | 0.0008 | -0.5746 | *-1.6406 | 0.1041 |
| SWEDEN | -1.9479 | 0.7093 | *-0.4128 | *8.5327 | *-0.0787 | *-0.4095 | *-0.6997 | 0.1136 |
| FINLAND | -1.9023 | -0.5558 | -0.3780 | *7.3706 | *3.0473 | -0.1760 | -0.2025 | 0.1398 |

UK, Greece and Sweden showed that the relation is significant at negative, thus conforming to economic theory of inverse relation. The magnitudes of the coefficients suggest that the relation is inelastic thus a very large change in opening stocks would signify a small change in domestic prices. Increased expendable incomes would increase domestic demand and hence increase the domestic prices of the commodity in our case Barley. All fourteen countries show that the relation holds true, further the relation seemed significant for France, Austria, Germany, Ireland, Italy, The Netherlands, Spain, Greece, Portugal, Sweden and Finland. Except for Portugal, Greece, Spain and Ireland the relation shows that it is inelastic. The two policy dummies which accounted for any significant changes in the domestic prices due to change in policy show negative effect on the prices for all the countries in the EU. The relation was significant for Austria, Belgium, Germany, Denmark, Italy, The Netherlands, Spain, the UK, Portugal Sweden and Finland for the Mac Sharry reforms of 1992. The Agenda 2000 Reforms of the CAP showed significant effect on all the EU countries except Ireland.

#### 3.3.4.3 Export demand

Export demand modeled the relation between the quantities exported of barley to the various other variables that influenced these exports. The quantity exported of barley depended on the domestic price of barley, the world price, the exchange rates, the export refunds that distorted trade and made exports viable for many of the EU countries and the dummy variables which accounted for the significance of policy re-instrumentation of the CAP. Increase in the domestic prices should in ideal conditions make exports less attractive and more quantities sold in the domestic market. This is signified by all the countries in the EU in our empirical results. The relation was significant for France, Sweden and Finland. An increase in world price should in ideal conditions increase the quantities of barley exported to the rest of the world. This holds true for all the EU nations in out analysis, though none of them showed significance at the 90 percent significance levels. Increased export refunds will increase exports of barley which can be seen to be true from the table France, Germany, Ireland, Italy, and Finland showed that the relation was significant. Except for Germany the other three EU countries showed that the relation was highly elastic suggesting that a small increase in export refunds could give rise to a relatively higher increase in exports of barley. Increased exchange rates of exporting countries would increase the amount of exports by the country since it brings relatively more units of foreign currency per unit of commodity sold. All the EU nations show that this positive relation of exchange rates to that of quantity of exports holds true. Germany, Ireland, Italy, The Netherlands and Finland show that this relation is significant and the magnitudes of the coefficients suggests that the relation is elastic. The CAP reforms had a negative impact on the quantities of barley exported to the world since they were aimed at decreasing the trade distortions caused by the controlled price regimes followed in the EU. The negative impact of the

Mac Sharry reforms of the CAP was observed to be significant for Ireland and Finland while it was significant for Ireland, Greece, Portugal and Finland due to the implementation of the Agenda 2000 Reforms.

#### 3.3.4.4 Import demand

The import demand sub-model in our simultaneous equation model specifies the effect on import quantity of barley due to factors like domestic prices, world prices, exchange rates, import levies, income and the two dummies which observe significant impact of the reforms of the CAP. An increase in domestic prices increases the amount of imports since it becomes more attractive for the rest of the world to export excess barley to higher priced markets. Our statistical results conform to this theory showing a significant relationship in four of the fourteen countries which included Austria, Denmark, the UK and Finland. The magnitudes of the coefficients suggest that the relation is highly elastic. Increased world prices should decrease the amount of imports by any importing country. This holds true for all the EU nations except The Netherlands none of them showed any significant at the 90 percent significance level. This may be due to the fact that the EU markets were highly insulated from the market fluctuations in the world markets. Importing countries import more of goods when the exchange rates decreases. This theory was statistically proven in our analysis with all fourteen countries showing the negative effect of exchange rates on the quantities of barley imported. The relation was significant for the UK and was also highly elastic. Import levies tend to decrease the amount of imports to the country thus differentiating the markets and keeping domestic prices higher than it would have normally been in their absence. The relation was significant for Austria, The Netherlands and the UK while the rest of the EU countries though showing a negative impact on the quantities of barley imported did not show any significance at the 90 percent significance level. This may also be due to the

fact that the quantities of barley imports were relatively insignificant compared to the rest of the cereals. Increased expendable income usually increases the demand for imports. We observe mixed results for this relation with France, Austria, the UK and Sweden showing that the imports was positively related to amount of imports while the rest of the countries showing the contrary. The two policy dummies which captured any significant effects of CAP reforms showed mixed impact on imports of barley. While the UK, Greece and Finland showed a significantly negative impact of the Mac Sharry Reforms on the imports of barley, Denmark showed a significant positive impact of imports due to the implementation of the 1992 reforms. France and Greece also showed a negative impact on imports of barley due to the implementation of the Agenda 2000 reforms while Denmark showed significantly positive effect on the quantity of barley imported into the country. These mixed results could be due to the fact that the implementation of the reforms also corrected for the increased domestic prices which over the years was realigned to the world prices thus export of barley became unattractive when the transportation and other costs were accounted for.

#### 3.3.4.5 Supply Equation

The supply of barley depended not only on the domestic prices but also on the production refunds, the consumer incomes and the effect of the policy reforms of the CAP. Theoretically, increased prices should increase the quantity of barley supplied to the market. The relation is statistically significant and positive for Austria, Denmark, The Netherlands, Spain, the UK, Greece and Finland. The magnitudes of the coefficients suggest that the relation is highly elastic to the domestic prices in the EU countries. Increased production refunds to farmers should in ideal conditions increase the amount of supply. This holds true for all the EU countries. The relation was observed to be significant for Belgium, Germany, Ireland, Italy, Spain, the UK,

Finland and Sweden. Increased incomes of the domestic population would ideally increase the demand for barley and hence increase the supply of the commodity. Six of the fourteen countries showed that the relation was significant and positive which included France, Germany, Ireland, Italy, Spain and Greece. The two policy variables had a negative effect on the supply of barley in all the countries of the EU. Seven of the EU countries which included Austria, Belgium, Denmark, Ireland, Italy, Spain and Sweden showed that the relation was significant at the 90 percent significance level for the reforms implemented in 1992. The Agenda 2000 reforms show that the relation was significant and negative for all countries except for Germany, the Netherlands and Finland.

#### 3.3.1.5 Elasticity Results for Oats

Results from the three-stage non linear least square simultaneous equation system has been documented in table 3.6. Due to non availability of import quantities, production quantities and the amount of consumption of oats in Finland and Sweden these countries were excluded from our analysis. We assume that these countries would follow the general trend of the regression results.

#### 3.3.5.1 Inventory Demand

The inventory demand which estimates the relation of the quantities of opening stocks and the variables that affect it was modeled as a function of the domestic prices and the ratio of apparent production to apparent consumption. An increase in the domestic prices would in ideal conditions decrease the quantities in opening stocks as the demand in the market increases. This holds true for all the EU nations in our model. Five countries which included Austria, Denmark, The Netherlands, Spain and Greece show that this relation is significant at the 90 percent significance level. The relation was elastic in case of Austria, Spain and The Netherlands while it

was inelastic for the rest of the countries. An increase in the ratio of apparent production to apparent consumption in ideal conditions should increase the amount of opening stocks. Thus the parameter has a positive effect on the quantities of opening stocks. This holds true for all the EU countries in our analysis. All the twelve countries show that the relation is significant at the 90 percent significance level. Except for Germany, the coefficients of the parameters suggest that the relation is elastic and that a slight change in the ratio could have a relatively higher change in the amount of opening stocks held by those countries.

#### 3.3.5.2 Domestic Demand

The total consumption by the population was modeled as a price dependent equation in the econometric model. Thus, prices depended on the amount of consumption, the opening stocks, GDP which accounted for the expendable income of the population and the two dummy variables which try to observe any significant changes in the domestic consumption and prices due to policy regime changes. An increase in the prices would in ideal conditions decrease the amount of consumption. Statistical results suggest that this theory of demand holds true for all the EU nations. The relation was significant at the 90 percent significance level for France, Germany, Denmark, Spain, UK, Greece and Portugal. The magnitudes of the coefficients suggest that except for Spain and Portugal the relation was elastic and hence a slight change in consumption behavior had a profound effect on the prices of oats in the country. Increased opening stocks tend to decrease domestic prices since the supply of oats for the market is higher. This relation is justified in our empirical model. Germany, Denmark, The Netherlands and The UK show that the relation was negative and significant at the 90 percent significance level. GDP which acts as a proxy for income changes in the country shows that an increase in the income of the population in the country tends to increase domestic prices of the commodity in our case oats

**Table 3.6: Empirical Estimation of Elasticities for Oats in the European Union using Non-Linear Three Stage SLS**

| OATS | | lndmpr | (lnprod+lnimpq)/lnconp | | lnconp | mref | aref | lnopstk | lngdp | | lndmpr |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | a1 | a2 | a3 | b1 | b2 | b3 | b4 | b5 | b6 | c1 | c2 |
| FRANCE | 1.9877 | -1.1906 | *9.6719 | -0.8782 | *-5.8762 | -0.0783 | *-0.3791 | -0.0445 | *0.4449 | 0.3181 | -0.3188 |
| AUSTRIA | -1.6999 | *-3.1821 | *2.6355 | -0.4302 | -0.0488 | -1.7113 | -0.2369 | -0.9654 | *0.4179 | 3.9365 | -1.0517 |
| BELGIUM | -2.0743 | -0.2865 | *7.8874 | 0.2300 | -4.0786 | -0.1767 | *-0.4207 | -0.0199 | *0.3728 | 46.9580 | *-4.1141 |
| GERMANY | -0.0173 | -0.7948 | *0.7157 | -0.3660 | *-8.0337 | *-0.2148 | *-0.3390 | *-1.3727 | *0.4969 | 14.7492 | *-2.2456 |
| DENMARK | -0.2808 | *-0.9084 | *8.0109 | 0.6979 | *-1.2299 | *-0.2216 | *-0.5909 | *-0.2778 | 0.1822 | -4.0734 | -0.5311 |
| IRELAND | 0.0365 | -1.1145 | *9.9807 | 5.4140 | -0.1486 | -0.1671 | *-0.4782 | -0.0882 | 0.0828 | -15.2515 | -0.0983 |
| ITALY | 0.2589 | -1.7054 | *6.2175 | -4.0502 | -0.1668 | *-0.3837 | *-0.6660 | -0.1330 | *0.7724 | 3.0687 | -0.3805 |
| N.LANDS | 0.2145 | *-15.9312 | *3.1657 | 0.9315 | -0.0560 | -0.0785 | -0.1428 | *-0.5318 | *0.2592 | 11.1351 | *-1.0206 |
| SPAIN | 0.0159 | *-1.1169 | *4.1696 | 3.2194 | *-0.6709 | *-0.4333 | *-0.3938 | -0.0096 | 0.1033 | 19.6960 | -1.4948 |
| UK | 0.0593 | -0.0386 | *3.4407 | 15.6731 | *-1.3804 | *-0.3813 | *-0.3901 | *-0.3468 | *0.2106 | -10.8812 | -1.3505 |
| GREECE | -0.1966 | *-0.9614 | *2.9207 | -0.5168 | *-1.0310 | *-0.6862 | *-0.8454 | -0.0736 | *0.9483 | 16.5341 | *-3.1597 |
| P.GAL | 0.0620 | -0.4927 | *2.1237 | 9.8313 | *-0.8252 | *-0.3983 | *-0.5553 | -0.0163 | *2.8188 | 28.2251 | *-2.0844 |

| OATS | lnworldp | lnexpr | lnexrt | mref | aref | | lndmpr | lnworldp | lnexrt | lnimpl | mref |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | c3 | c4 | C5 | c6 | c7 | d1 | d2 | d3 | d4 | d5 | d6 |
| FRANCE | 0.2964 | 0.1304 | 0.0109 | *-0.6450 | -0.7591 | 0.3351 | 0.8860 | -3.2030 | *-1.5583 | -0.4868 | 0.0571 |
| AUSTRIA | 0.5451 | 3.3320 | 0.2410 | *-4.0499 | *-4.0137 | 1.8582 | *1.7173 | -0.4551 | -0.0382 | -0.2694 | *-2.3382 |
| BELGIUM | *0.1589 | 0.0316 | 1.1029 | -0.7582 | -0.6917 | 7.2877 | 0.1701 | -0.9493 | -0.3360 | *-1.9529 | *-0.2636 |
| GERMANY | 0.0150 | *5.3220 | 0.2497 | -0.0734 | -0.3261 | 33.3707 | 0.0306 | 0.3492 | *-1.9697 | -0.0471 | 0.2218 |
| DENMARK | 0.4837 | 0.0191 | 0.7403 | -0.1181 | *-5.3771 | 6.6419 | 0.3090 | -0.2493 | -1.1596 | -0.2115 | 0.5115 |
| IRELAND | 0.4656 | 0.0877 | *4.2849 | -0.0045 | -1.4414 | 8.3077 | 0.6176 | -0.1841 | *-2.2781 | -0.1895 | -0.2392 |
| ITALY | 2.6987 | 0.2186 | 0.4574 | -1.4046 | 2.4779 | 10.4374 | 0.6024 | 0.0856 | *-0.6526 | -0.1235 | *-1.3740 |
| N.LAND | 1.0130 | 2.1813 | 1.3178 | *-0.6888 | *-1.0824 | -5.8437 | 0.9127 | -0.6361 | *-0.2091 | *-1.9669 | -0.4051 |
| SPAIN | 0.0475 | 0.0782 | *3.0215 | -0.2567 | -0.4275 | -54.4403 | *4.6718 | 1.7018 | *-0.4772 | -0.2624 | *-0.8083 |
| UK | *1.5507 | 0.1091 | *2.3622 | *-2.7603 | *-1.9669 | 19.8118 | *3.7146 | -0.4584 | -1.0453 | -0.2697 | *-1.4533 |
| GREECE | 0.1075 | 0.1651 | 0.4024 | *-1.8264 | *-2.9867 | -10.2463 | 0.3559 | 0.6922 | -1.6819 | -2.2121 | 0.1207 |
| P.GAL | 1.3191 | *1.9432 | 0.6056 | *-3.9480 | -1.6224 | -9.3685 | 1.6181 | 1.1160 | -0.9168 | -0.0269 | *-0.1628 |

(Table Continued)

(Table Continued)

| BARLEY | aref | lngdp | | lndmpr | lnprodr | mref | aref | lngdp |
|---|---|---|---|---|---|---|---|---|
| | d7 | d8 | e1 | e2 | e3 | e4 | e5 | e6 |
| FRANCE | -0.8843 | 0.0176 | 14.1717 | *0.3374 | 0.1057 | *-0.2353 | *-0.2473 | *7.8370 |
| AUSTRIA | *-2.1014 | 0.1209 | -0.0052 | *0.2344 | *8.1418 | *-0.3105 | *-0.5475 | 0.0266 |
| BELGIUM | *-0.3128 | *0.6728 | 15.2875 | 0.4035 | *3.7148 | -0.0102 | -0.1185 | *0.4465 |
| GERMANY | *-1.9278 | *0.8921 | 14.1457 | 0.2951 | 0.0012 | *-0.1123 | *-0.3342 | 0.1221 |
| DENMARK | -0.1255 | *1.1803 | 10.0113 | 0.2837 | *0.8241 | -9.3000 | -0.0860 | *0.4537 |
| IRELAND | *-0.7030 | 0.4600 | -0.0015 | 0.2480 | *5.0039 | -0.0243 | -0.0608 | 0.0480 |
| ITALY | *-0.4321 | 0.4663 | 6.4393 | *0.2474 | 0.0753 | *-0.0582 | -0.0749 | 0.0382 |
| N.LANDS | -0.1637 | 0.9647 | 20.1987 | 0.4730 | 1.1062 | -0.1030 | -0.0732 | 0.2367 |
| SPAIN | -0.1171 | *2.0950 | -0.9338 | *6.2110 | 0.0939 | *-0.4608 | -0.1776 | 0.0851 |
| UK | -1.0504 | 0.5826 | 10.5173 | 2.1946 | 0.1038 | -0.0044 | -0.0245 | 1.3293 |
| GREECE | 1.5069 | 0.6113 | -0.0790 | 0.1425 | *0.2878 | -0.0150 | *-0.0893 | 0.0617 |
| P.GAL | -0.0203 | 0.2079 | 10.8356 | *1.7876 | 0.0330 | -0.4100 | -0.4505 | 0.1693 |

The relation was significant in nine of the twelve countries which included France, Austria, Belgium, Germany Italy, The Netherlands UK, Greece and Portugal. Portugal shows that the relation was elastic while the rest of the countries suggest that it was highly inelastic to the income changes of the population. The changes in the policies had a largely negative impact on the prices suggesting that their implementation forced the domestic prices to decrease in member countries. While Germany, Denmark, Italy, UK Spain, Greece and Portugal showed that Mac Sharry Reforms of 1992 had significant negative impact on the domestic prices of oats, all the member countries except Austria and The Netherlands showed that the Agenda 2000 Reforms had significant effect on the domestic prices of oats in the respective countries.

#### 3.3.5.3 Export Demand

Quantities of oats exported were modeled as a function of the domestic prices, world prices, export refunds, exchange rates and the two policy variables which captured any significant impact on the quantities exported due to the implementation of the new policies in the CAP. Increased domestic prices would make exports unattractive. This relation holds true for all the countries in the EU. Belgium, Germany, The Netherlands, Greece and Portugal show that the

relation is significant and the magnitudes of the coefficients show that they are highly elastic in the log-log sub model. Increased world prices would in ideal conditions make quantities exported increase. All the EU member countries show that the relation holds true though only Belgium and UK show that the relation is significant at the 90 percent significance level. Increased export refunds would make exports to other countries more attractive and would give a premium for traders to export more oats over the world price. Only Germany and Portugal show that the relation was significant though all the countries show a positive sign of the coefficient for the parameter suggesting that though the relation holds true only two countries show any significant statistical results. This could be due to the fact that a relatively small amount of oats is traded when compared to other cereals between the EU and the rest of the world. Increased exchange rates would in ideal conditions make the exports attractive since relatively more national currency are bought in per unit of oats sold in the world market. The relation is significant for Ireland, Spain and UK at the 90 percent significance level. The Mac Sharry Reforms and the Agenda 2000 Reforms were implemented to decrease trade distortions caused by keeping domestic prices artificially higher than the world prices while adding trade instruments to prevent imports. Thus they have had a negative influence on the quantities exported since their implementation decreased the amount of export refunds to oat farmers and hence made exports less attractive. France, Austria, The Netherlands, UK, Greece and Portugal showed that the relation was negative and significant due to the implementation of the Mac Sharry Reforms. Austria, Denmark, The Netherlands, UK and Greece showed that the exports were significantly lowered due to the implementation of the Agenda 2000 Reforms.

#### 3.3.5.4 Import Demand

The quantities of oats imported was influenced by domestic prices, world prices, the exchange rates, the import levies implemented by the EU the income of the population and the implementation of new policies aimed at decreasing distortions to trade. Increased domestic prices made imports of oats more attractive as it would be cheaper to buy oats from the world market with higher demand in the domestic markets. This relation holds true for all the EU nations though only Austria, Spain and UK showed that the relation was significant at the 90 percent significance level. A decrease in world price would make imports cheaper and hence increase the quantities of oats imported. Though the sign of the coefficients suggests that the relation holds true none of the EU member countries showed that the relation was statistically significant at the 90 percent significance level. This could be due to the fact that very insignificant quantities of oats are being imported by the EU and that world prices have been relatively stable for the last three decades. A decreased exchange rate would make imports attractive since they can be bought at a relatively cheaper national currency. France, Germany, Ireland, Italy, The Netherlands and Spain show that the relation is statistically significant at the 90 percent significance level. Import levies are aimed at decreasing the amount of quantities imported into any country since it creates a wedge between world prices and domestic prices. Though the relation was negative for all the countries in the EU it was significant for Belgium and The Netherlands. Increased income of the population would generate higher demand for the commodity in our case oats. The relation was true for all the member countries in the EU though it showed significance at the 90 percent significance level for Belgium, Germany, Denmark and Spain. The reforms of the CAP which were in their earlier form more protective of domestic markets and tended to the world market influence on the EU markets showed that it had a mixed

effect on the imports. While quantities of imports increased due to the implementation of the Mac Sharry Reforms in France, Germany, Denmark, Ireland and Greece it had a negative impact for the rest of the EU countries. The Agenda 2000 Reforms had a largely negative impact on the quantities imported except for Greece which showed significantly increased imports of oats due to the implementation of the 2000 reforms.

#### 3.3.5.5 Supply Equation

Supply of oats in the EU was influenced by the domestic prices, the production refunds, the changes in the expendable income of the population and the policy change regimes of the CAP. We observed that increased domestic prices increased the quantities of oats supplied to the market. France, Italy, Spain and Portugal showed that the relation was significant at the 90 percent significance level. The relation was elastic for Spain and Portugal thus suggesting that a slight change in the prices had a significantly higher change in the quantities of oats supplied. The production refunds made production of oats more attractive since it gave an incentive to the farmer to produce oats though not economically viable. The relation showed significant effects on the quantities supplied for Austria, Belgium, Denmark, Ireland and Greece. The coefficients suggested that it was highly elastic for Austria, Belgium and Ireland. Increased income would in ideal conditions lead to higher demand and hence a higher supply of oats. This held true for all the EU nations. France, Belgium and Denmark showed that the relation was significant at the 90 percent significance level. The Mac Sharry Reforms of 1992 and the Agenda 2000 Reforms had a largely negative impact on the quantities of oats supplied since they decreased and in some cases removed all production refunds for oats. Mac Sharry reforms had significant impact on the supply of oats in France, Austria, Germany, Italy and Spain while the Agenda 2000 reforms had a significant negative impact on supplies in France, Austria, Germany and Greece.

# CHAPTER 4

# FORECASTING DOMESTIC PRICE EFFECTS EU

## 4.1 Introduction

Forecasting different scenarios based on the econometric framework developed in our model enables us to better understand the effects of different policy initiatives and their subsequent welfare effects on different agents in agricultural trade including the exporters, the importers, the governments and the farmers in each of the trading countries. We incorporate the estimation results from our econometric model to develop a free trade scenario between the EU and the U.S. for wheat. Theory would suggest that restrictions to trade tend to decrease imports, control market prices and increase the opening stocks in the country.

## 4.2 Modifications to the Data

Certain assumptions are made in order to forecast a free trade scenario for wheat which is documented in this section. To develop a forecasting framework for our existing econometric model we assume that the exogenous variables in our model which include the GDP of the country representing the expendable income, the population of the country and the consumption behavior of the consumers follow a logarithmic trend. Since in a free trade scenario there is no distortions to trade we assume that the export refunds, import levies and the production refunds will have no effect on imports and domestic prices. The simultaneous five equation system is solved for three variables that include the opening stocks, domestic prices and domestic production separately forming three reduced form equations in *Mathematica* each for one of the dependent variables.

### 4.2.1 Domestic Price

The reduced form equation for domestic price generated from *Mathematica* is presented in equation 4.1. Since the domestic price is seen in all the five equation (as described in equations 3.7 – 3.11), the reduced form equation needs only three of the five equations to solve for domestic prices. We select equation 3.7, 3.8 and 3.11 to generate the equation presented in equation 4.1. The definitions of the coefficients are defined in Appendix A2.

**Equation 4.1**

$$\text{lndmpr} = \left[ -\left( \frac{1}{(\text{a3 b5 * e2 - lnconp + a2 * b5 * lnconp})} \right) \right] \begin{pmatrix} \text{a3 * b5 * e1 + a3 * aref * b5 * e5} \\ \text{+ b1 * lnconp + aref * b4 * lnconp} \\ \text{+ a1 * b5 * lnconp + b2 * lnconp}^2 \\ \text{+ a3 * b5 * e6 * lngdp + b6 * lnconp} \\ \text{* lngdp + a3 * b5 * e4 * mref + b3 *} \\ \text{lnconp * mref + a3 * b5 * e3 * prodr} \end{pmatrix}$$

### 4.2.2 Opening Stocks

Changes in opening stocks would indicate the change in the amount of government procurement at higher prices than what the market dictates. Decreased opening stocks thus would signify lower procurement by government agencies. Equation 4.2 illustrates the reduced form equation for opening stocks derived from our econometric model and solved in *Mathematica*. The coefficients and the parameters are defined in Appendix 2 for the reference of the readers.

### 4.2.3 Production

The effect of free trade on the amount of domestic production is illustrated by the equation 4.3. An increased access to domestic markets of the EU would increase imports while supplies tend to increase. Domestic production could decrease while the total supply to the market may increase suggesting that a higher share of wheat consumed would be from imports.

**Equation 4.2**

$$\text{LnOPSTK} = \left[ -\left( \frac{1}{(a3 * b5 * e2 - \text{lnconp} + a2 * b5 * \text{lnconp})} \right) \right] \left( \begin{array}{l} a3 * e1 + a3 * b1 * e2 + a3 * aref * \\ b4 * e2 + a3 * aref * e5 + a1 * \text{lnconp} \\ + a2 * b1 * \text{lnconp} + a2 * aref * b4 * \\ \text{lnconp} + a3 * b2 * e2 * \text{lnconp} + a2 * b2 \\ * \text{lnconp}^2 + a3 * b6 * e2 * \text{lngdp} + a3 * \\ e6 * \text{lngdp} + a2 * b6 * \text{lnconp} * \text{lngdp} \\ + a3 * \text{lnimpq} + a3 * b3 * e2 * \text{mref} + a3 \\ * e4 * \text{mref} + a2 * b3 * \text{lnconp} * \text{mref} + \\ a3 * e3 * \text{prodr} \end{array} \right)$$

**Equation 4.3**

$$\text{LnPROD} = \left[ -\left( \frac{1}{(a3 * b5 * e2 - \text{lnconp} + a2 * b5 * \text{lnconp})} \right) \right] \left\{ \begin{array}{l} e1 * \text{lnconp} - a2 * b5 * e1 * \text{lnconp} + b1 * e2 * \\ \text{lnconp} + aref * b4 * e2 * \text{lnconp} + a1 * b5 * e2 \\ * \text{lnconp} + aref * e5 * \text{lnconp} - a2 * aref * b5 * \\ e5 * \text{lnconp} + b2 * e2 * \text{lnconp}^2 + b6 * e2 * \\ \text{lnconp} * \text{lngdp} + e6 * \text{lnconp} * \text{lngdp} - a2 * b5 * \\ e6 * \text{lnconp} * \text{lngdp} + a3 * b5 * e2 * \text{lnimpq} + \\ b3 * e2 * \text{lnconp} * \text{mref} + e4 * \text{lnconp} * \text{mref} - a2 \\ * b5 * e4 * \text{lnconp} * \text{mref} + e3 * \text{lnconp} * y - a2 \\ * b5 * e3 * \text{lnconp} * \text{prodr} \end{array} \right\}$$

## 4.3 Results

The results for the domestic prices are presented in table 4.1 which suggests that the domestic prices show a significant decrease in the domestic prices (figure 4.1). A free trade scenario which removes the distortions caused by the import levies and the production refunds tends to increase the amount of imports thus increasing supply and decreasing the domestic prices. This is further illustrated in figure 4.1.

Table 4.1: Forecasted Average Domestic Prices in the EU in a Free Trade Scenario

| YEAR | DOMESTIC PRICES ($/Ton) |
|---|---|
| 2005 | 224.3096 |
| 2006 | 224.1747 |
| 2007 | 224.0539 |
| 2008 | 223.9471 |
| 2009 | 223.8535 |
| 2010 | 223.7722 |
| 2011 | 223.704 |
| 2012 | 223.6481 |
| 2013 | 223.6037 |
| 2014 | 223.5712 |
| 2015 | 223.5496 |

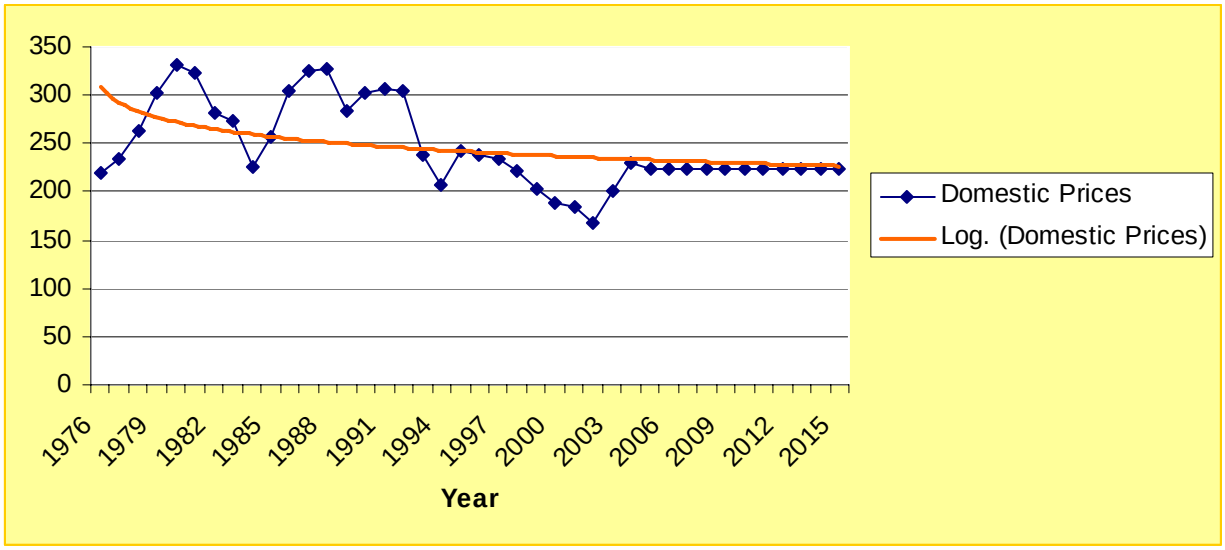


Figure 4.1: Change in Domestic Prices in the EU in a free trade scenario.

# CHAPTER 5

# SUMMARY AND CONCLUSIONS

## 5.1 Introduction

The cereal industry forms one of the largest parts of the U.S. export industry accounting for over $13 billion dollars in annual sales to the world market[38]. The major factors affecting U.S. cereal exports to the EU remains the stringent protective policies followed by the EU under the Common Agricultural Policy (CAP). Trade negotiations under the GATT and later the WTO have forced the EU to bring about reforms to the CAP. This study was aimed at quantifying the effects of these policy reforms on bilateral cereal trade between the fifteen EU nations and the U.S. at a disaggregated level. The decreasing trade distortion effects caused by the earlier CAP which included the export refunds, the import levies and the production refunds quantified to estimate if there were significant effects on trade and domestic prices in the EU.

Specifically, the objectives for this elaborate study were to (1) Understand the CAP and its effects on cereal production and trade, (2) Evaluate the effects of the change in policies of the CAP vis-à-vis the Mac Sharry Reforms and the Agenda 2000 Reforms on cereal trade with the U.S. and (3) Evaluate the effect of domestic prices in a free trade scenario for wheat. To accomplish these objectives data from various sources which included the European Statistical Division, International Grain Council, International Rice Research Institute, International Monetary Fund, Foreign Agricultural Service of the United States Department of Agriculture, Organization of Economic Co-operation and Development, Agriculture-Canada, the legislation division of the EU (EURO-LEX) was aggregated for each of the countries in the study.

A Non Linear three stage least squares (N3SLS) econometric model was developed and analyzed for understanding the effects of policy reforms on the bilateral trade with the U.S. of

[38] USDA – Foreign Agricultural Service 2004 report on Cereal exports to world.

the five cereals in each of the EU countries. The simultaneous equation model took into consideration any significant effects of the changes in the CAP with the introduction of two dummy variables in the model.

## 5.2 Results

Results from the model estimation showed a largely significant negative effect on the domestic prices and production in the EU countries while having a significant positive effect on the quantities of imports of cereals from other countries. In the case of the wheat model constructed for each of the EU nations a ratio of the exports by the U.S. to the total exports to the EU was estimated to understand if the change in policies in the EU had significant effect on the amount of wheat exported by the US. Results from the estimation showed that this was significant, suggesting that the decreasing trade distortion effects of the EU have had a significant positive effect on the U.S. exports of wheat. Further, the study was also able to estimate that changes in the government payments made production of cereals in some EU countries more costly than the world prices suggesting that opening up the EU markets would significantly decrease cereal production in these countries due to higher imports at cheaper prices. Elasticities obtained from this simultaneous equation model solving for the demand side equations and the supply side form a good approximation of the effect of policies and their implications on trade. The approximation that trade effects due to change in the domestic policies of the EU would affect the U.S. in the same manner as that of other exporting countries in case of cereals apart from wheat can be substantiated by the trend in the total exports and U.S. exports which follow similar patterns. Results from our estimation also showed that the domestic prices for cereals in most of the EU nations for all the five cereals have significantly decreased due to implementation of the policy reforms of the CAP. Opening stocks of these cereals have

decreased drastically in some cases due to lesser procurement of these cereals by the intervention agencies in member countries. Demand for imports which were restricted due to the implementation of a complex import levy system showed a drastic surge due to their partial removal in the case of wheat, maize, barley and rye and a total cessation of levies in case of oats. Production refunds which distorted the supplies of cereals in the EU showed a significant impact when restricted due to the implementation of the reforms. Export refunds largely decreased the amount of exports of wheat in case of France which forms one of the major exporters in the world for wheat. The exchange rate system which is abstracted in most studies since EU is considered as a single entity was better documented in our disaggregated study of the EU nations which showed varied intensity of the effects of trade in these countries. Monte Carlo simulation and forecasting of a free trade scenario model for wheat was developed to observe the effect on domestic prices in the EU nations. A significant decrease in the domestic prices followed by a decrease in production was observed when forecasted up to the year 2015. Further, this lead to a decrease in the welfare of domestic producers in the EU while consumers in each of these countries showed substantial positive effect. Producers in the U.S. would show gains in trade due to higher demand for exports of cereals.

## 5.3 Implications of Results

This study is the first of its kind to evaluate the country wise effects on bilateral trade with the U.S. due to the CAP re-instrumentation. We hope that this research forms a foundation to further investigate effect of policies not considered in our study on trade and welfare effects.

Results show that the losses incurred by the producers and exporters in the EU are relatively much lower than the gains to consumers and the Government of the EU, the producers in the U.S. and other exporting countries. If a total free trade area was created between one of the

world's largest importer and the one of the world's largest exporter of cereals the welfare effects could be huge and significant not only in these two trading partner entities but also on world prices and trade. Results from this model could be utilized to understand and include new policies that have lesser or no trade distorting effects and increase welfare among the partner countries. Hopefully this research would fuel research interest into the developing policies that aim for the highest welfare effects for every sector of the economy. The policy changes by the EU could augment further and more liberalizing changes in partner countries including the U.S. which while being WTO compliant could also bring about market orientation of the agriculture sector.

## 5.4 Limitations

While every effort was made to aggregate all the data and variables in our study, due to the complexity of the problem we did not consider the restrictions of trade put in place by the U.S. and assume that these restrictions were not binding. Assuming the U.S. as just a trading entity helped us focus on the effects on trade due to the policy changes in the CAP which would have been abstracted if effects of the FAIR Act of 1996 and the Farm Bill of 2002 were included in our study. The study was unable to estimate the elasticities of demand and supply for some countries due to the lack of availability of data for these countries. Further data for many countries in the EU was not available for trade in sorghum which forced us to remove sorghum from our study.

## 5.5 Future Research

This research was the first step in developing a disaggregated model to assess the impact of the two policies – the Mac Sharry Reforms of 1992 and the Agenda 2000 reforms in the EU 15 nations. Though this research was able to show that there were significant effects of

the policies on the EU – 15 nations, further study could be taken up to include the accession of the 10 new central European countries. Further a simultaneous dynamic model to include the effects of the trade distorting policies of the U.S. could show a comprehensive picture of the bilateral cereal trade between these two trading entities. Simulations and forecasts could be made that included different scenarios and policy regimes followed in these two countries and effects on the world markets. Better research could be possible through availability of data from government agencies in these trading partners. Policy makers could take wiser decisions while implementing trade policies based on the results of such elaborate research model.

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## APPENDIX 1: RESULTS FROM NON-LINEAR THREE STAGE LEAST SQUARE REGRESSION FOR CEREALS

**Table A1.1: Results from the Regression for Wheat:**

| WHEAT | | lndmpr | (lnprod+lnimpq)/lnconp | lnconp | mref | aref | lnopstk | lngdp | | lndmpr |
|---|---|---|---|---|---|---|---|---|---|---|
| | a1 | a2 | a3 | b1 | b2 | b3 | b4 | b5 | b6 | c1 | c2 |
| **FRANCE** | | | | | | | | | | | |
| | 1.12326 | -0.7451 | 5.426605 | 3.31563 | -0.9090 | -0.1194 | -0.3590 | -0.1705 | 0.45361 | 2.98747 | 0.05424 |
| **STD Err** | 2.8873 | 0.394 | 1.4251 | 0.3778 | 0.1784 | 0.0797 | 0.1062 | 0.0455 | 0.0945 | 2.8473 | 0.51 |
| **t value** | 0.39 | -1.89 | 3.81 | 0.84 | -5.1 | -1.5 | -3.38 | -3.74 | 4.8 | 1.05 | 0.11 |
| **P Value** | 0.7004 | 0.0698 | 0.0008 | 0.4134 | <.0001 | 0.1472 | 0.0026 | 0.0011 | <.0001 | 0.3055 | 0.9163 |
| **AUSTRIA** | | | | | | | | | | | |
| | 1.69949 | -0.93219 | 10.24812 | 1.652265 | -0.3684 | -0.2722 | -0.5507 | -0.05736 | 0.479362 | 4.616547 | 0.477384 |
| **STD Err** | 0.4828 | 0.341 | 1.8724 | 1.0881 | 0.1705 | 0.0876 | 0.108 | 0.0681 | 0.0807 | 2.3185 | 0.3186 |
| **t value** | -1.45 | -2.73 | 5.47 | 1.52 | -2.16 | -3.11 | -5.1 | -0.84 | 5.94 | 1.99 | 1.5 |
| **P Value** | 0.1593 | 0.0111 | <.0001 | 0.1425 | 0.0414 | 0.005 | <.0001 | 0.408 | <.0001 | 0.059 | 0.1482 |
| **BELGIUM** | | | | | | | | | | | |
| | 2.608067 | 1.11385 | 0.030716 | 1.247883 | -0.789 | -0.0962 | -0.1001 | 0.107835 | 0.43134 | 11.29073 | -2.30252 |
| **STD Err** | 1.947 | 0.3935 | 1.2028 | 0.9089 | 0.1169 | 0.0696 | 0.0975 | 0.0475 | 0.0681 | 11.9519 | 2.1485 |
| **t value** | 1.34 | 2.83 | 0.03 | 0.27 | -6.75 | -1.38 | -1.03 | 2.27 | 6.33 | 0.94 | -1.07 |
| **P Value** | 0.192 | 0.0088 | 0.9798 | 0.7879 | <.0001 | 0.1796 | 0.3148 | 0.0329 | <.0001 | 0.3551 | 0.2955 |
| **GERMANY** | | | | | | | | | | | |
| | 1.301017 | 0.851131 | 3.796 | -0.49773 | -0.5209 | -0.3214 | -0.4755 | 0.06917 | 0.52732 | 18.01321 | -0.81615 |
| **STD Err** | 3.5136 | 0.3521 | 2.05 | 1.0009 | 0.1595 | 0.0754 | 0.0923 | 0.0586 | 0.0916 | 0.0259 | 0.8681 |
| **t value** | 0.37 | 2.42 | 1.95 | -0.5 | -3.27 | -4.26 | -5.15 | 1.18 | 5.75 | 0.51 | -0.94 |
| **P Value** | 0.7142 | 0.0229 | 0.075 | 0.6237 | 0.0034 | 0.0003 | <.0001 | 0.25 | <.0001 | 0.6155 | 0.3573 |
| **DENMARK** | | | | | | | | | | | |
| | 3.779979 | -1.65968 | 4.272407 | -0.812 | -0.3162 | -0.1659 | -0.3679 | -0.02086 | 0.563506 | 7.887355 | -0.29476 |
| **STD Err** | 4.3833 | 0.7962 | 1.5935 | 0.6572 | 0.0499 | 0.0563 | 0.0668 | 0.0304 | 0.0716 | 6.833 | 1.5429 |
| **t value** | 0.86 | -2.08 | 2.68 | -1.24 | -6.33 | -2.95 | -5.51 | -0.69 | 7.87 | 1.15 | -0.19 |
| **P Value** | 0.3964 | 0.0471 | 0.0126 | 0.2291 | <.0001 | 0.0072 | <.0001 | 0.4991 | <.0001 | 0.2608 | 0.8502 |
| **IRELAND** | | | | | | | | | | | |
| | -0.77523 | 1.022619 | -0.40622 | 4.102613 | -0.6043 | -0.2923 | -0.7744 | 0.145539 | 0.406637 | -0.07253 | 3.353254 |
| **STD Err** | 4.3963 | 0.3724 | 1.9598 | 0.1361 | 0.1637 | 0.085 | 0.1078 | 0.0551 | 0.0824 | 0.1093 | 0.6754 |
| **t value** | -0.18 | 2.75 | -0.21 | 0.75 | -3.69 | -3.44 | -7.18 | 2.64 | 4.94 | -0.66 | 4.96 |
| **P Value** | 0.8614 | 0.0108 | 0.8374 | 0.4597 | 0.0012 | 0.0022 | <.0001 | 0.0145 | <.0001 | 0.5139 | <.0001 |

**(Table Continued)**

| WHEAT | lnworldp c3 | lnexpr c4 | lnexrt c5 | mref c6 | aref c7 | d1 | lndmpr d2 | lnworldp d3 | lnexrt d4 | lnimpl d5 | mref d6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **FRANCE** | | | | | | | | | | | |
| | 0.418281 | 0.009464 | 0.738048 | 0.239418 | 0.226732 | -0.1539 | -0.23414 | 0.515967 | 1.702043 | -12.3909 | -0.25752 |
| **STD Err** | 0.2474 | 0.0504 | 0.3944 | 0.1501 | 0.2913 | 0.1164 | 0.9234 | 0.479 | 0.9055 | 6.5828 | 0.3358 |
| **t value** | 1.69 | 0.19 | 1.87 | 1.6 | 0.78 | -1.32 | -0.25 | 1.08 | 1.88 | -1.88 | -0.77 |
| **P Value** | 0.105 | 0.0529 | 0.0746 | 0.1249 | 0.4446 | 0.2011 | 0.8024 | 0.2942 | 0.0748 | 0.0744 | 0.4521 |
| **AUSTRIA** | | | | | | | | | | | |
| | 0.032159 | -0.11617 | 0.599626 | -0.30793 | -0.17176 | 16.40767 | -3.25959 | 0.123778 | -1.98264 | -0.13585 | -1.44103 |
| **STD Err** | 0.2099 | 0.0396 | 0.3049 | 0.1242 | 0.21 | 13.2568 | 1.642 | 1.0594 | 2.2171 | 0.2191 | 0.7887 |
| **t value** | 0.15 | -2.93 | 1.97 | -2.48 | -0.82 | 1.24 | -1.99 | 0.12 | -0.89 | -0.62 | -1.83 |
| **P Value** | 0.8796 | 0.0077 | 0.062 | 0.0213 | 0.4222 | 0.2302 | 0.061 | 0.9082 | 0.3818 | 0.5422 | 0.0826 |
| **BELGIUM** | | | | | | | | | | | |
| | -0.00871 | 0.190096 | -0.66647 | 0.233633 | -0.5928 | -9.30979 | 0.255669 | 0.982207 | 0.673451 | -0.08974 | 0.223388 |
| **STD Err** | 0.8808 | 0.1911 | 1.9066 | 0.6133 | 0.981 | 6.8041 | 0.9768 | 0.4252 | 1.0656 | 0.1082 | 0.3384 |
| **t value** | -0.01 | 0.99 | -0.35 | 0.38 | -0.6 | -1.37 | 0.26 | 2.31 | 0.63 | -0.83 | 0.66 |
| **P Value** | 0.9922 | 0.3306 | 0.73 | 0.7069 | 0.5518 | 0.1864 | 0.7962 | 0.0317 | 0.5346 | 0.4167 | 0.5167 |
| **GERMANY** | | | | | | | | | | | |
| | -0.26493 | 1.83117 | -1.99968 | 0.262911 | 0.724791 | -1.30603 | 0.341101 | -0.03407 | 1.104717 | 0.000986 | -0.20254 |
| **STD Err** | 0.3837 | 4.5161 | 0.7382 | 0.2552 | 0.4087 | 5.7774 | 0.5743 | 0.2729 | 0.8263 | 0.0621 | 0.2194 |
| **t value** | -0.69 | 4.05 | -2.71 | 1.03 | 1.77 | -0.23 | 0.59 | -0.12 | 1.34 | 0.02 | -0.92 |
| **P Value** | 0.4972 | 0.0005 | 0.0128 | 0.314 | 0.09 | 0.8235 | 0.5592 | 0.9019 | 0.1962 | 0.9875 | 0.3669 |
| **DENMARK** | | | | | | | | | | | |
| | -0.14698 | -0.01057 | 0.54142 | 0.637554 | 0.573726 | -8.69949 | 1.438219 | -0.74985 | 3.763721 | -0.10315 | 1.280129 |
| **STD Err** | 0.5797 | 0.1168 | 1.0866 | 0.3873 | 0.637 | 8.0268 | 1.5228 | 0.6596 | 1.3503 | 0.1613 | 0.5188 |
| **t value** | -0.25 | -0.09 | 0.5 | 1.65 | 0.9 | -1.08 | 0.94 | -1.14 | 2.79 | -0.64 | 2.47 |
| **P Value** | 0.8022 | 0.9287 | 0.6232 | 0.1139 | 0.3775 | 0.2913 | 0.3562 | 0.2691 | 0.0114 | 0.5298 | 0.0228 |
| **IRELAND** | | | | | | | | | | | |
| | 0.309252 | 1.60619 | 2.717158 | 1.201726 | 1.770503 | 1.563265 | 0.096516 | -0.07751 | 0.262729 | 0.072969 | -0.12439 |
| **STD Err** | 0.4678 | 6.4397 | 0.6099 | 0.245 | 0.4999 | 3.6319 | 0.4051 | 0.2397 | 0.4638 | 0.0663 | 0.1982 |
| **t value** | 0.66 | 2.49 | 4.46 | 4.9 | 3.54 | 0.43 | 0.24 | -0.32 | 0.57 | 1.1 | -0.63 |
| **P Value** | 0.5155 | 0.0206 | 0.0002 | <.0001 | 0.0018 | 0.6715 | 0.8141 | 0.7498 | 0.5774 | 0.2841 | 0.5373 |

**(Table Continued)**

**(Table Continued)**

| WHEAT | aref d7 | Lngdp d8 | lnimpqu/lnimpq d9 | e1 | lndmpr e2 | lnprodr e3 | mref e4 | aref e5 | lngdp e6 |
|---|---|---|---|---|---|---|---|---|---|
| **FRANCE** | | | | | | | | | |
| | -0.552 | 0.89094 | 3.081319 | 3.15469 | -0.6943 | 6.625723 | -0.15469 | -0.4236 | 0.450149 |
| **STD Err** | 0.524 | 0.2981 | 1.5659 | 0.0783 | 0.1404 | 0.8887 | 0.0783 | 0.1507 | 0.0724 |
| **t value** | -1.05 | 2.99 | 4.52 | 1.98 | -4.95 | 7.46 | -1.98 | -2.81 | 6.22 |
| **P Value** | 0.3044 | 0.0073 | 0.0002 | 0.0604 | <.0001 | <.0001 | 0.0604 | 0.0099 | <.0001 |
| **AUSTRIA** | | | | | | | | | |
| | -1.65514 | 0.411929 | -0.29443 | 0.07481 | -0.2292 | 5.241738 | -0.17163 | -0.0581 | 0.187085 |
| **STD Err** | 1.1815 | 0.9246 | 0.4769 | 0.0536 | 0.2174 | 0.8769 | 0.1257 | 0.2121 | 0.1266 |
| **t value** | -1.4 | 0.45 | -0.62 | 1.4 | -1.05 | 5.98 | -1.37 | -0.27 | 1.48 |
| **P Value** | 0.1766 | 0.6607 | 0.5439 | 0.1761 | 0.3026 | <.0001 | 0.1852 | 0.7864 | 0.1531 |
| **BELGIUM** | | | | | | | | | |
| | -0.00299 | 0.259485 | 1.614537 | 0.03715 | -0.6928 | 1.598091 | -0.17945 | -0.3562 | 0.589442 |
| **STD Err** | 0.4885 | 0.2952 | 0.9304 | 0.0441 | 0.1503 | 0.8503 | 0.0954 | 0.1605 | 0.093 |
| **t value** | -0.01 | 0.88 | 1.74 | 0.84 | -4.61 | 1.88 | -1.88 | -2.22 | 6.34 |
| **P Value** | 0.9952 | 0.3898 | 0.0961 | 0.4083 | 0.0001 | 0.0729 | 0.0728 | 0.0366 | <.0001 |
| **GERMANY** | | | | | | | | | |
| | -0.09448 | 0.404549 | 0.37384 | 1.013766 | -0.5546 | 2.100771 | 0.017256 | 0.09901 | 0.609937 |
| **STD Err** | 0.3179 | 0.2914 | 0.1828 | 0.0419 | 0.1711 | 0.8328 | 0.1027 | 0.1627 | 0.0917 |
| **t value** | -0.3 | 1.39 | 2.05 | 0.33 | -3.24 | 2.52 | 0.17 | 0.61 | 6.65 |
| **P Value** | 0.7694 | 0.1803 | 0.0542 | 0.7458 | 0.0036 | 0.019 | 0.868 | 0.5489 | <.0001 |
| **DENMARK** | | | | | | | | | |
| | 1.451459 | 0.975423 | -0.16501 | -3.16298 | -2.3463 | 0.048707 | -0.39907 | -0.9569 | 1.553344 |
| **STD Err** | 0.7489 | 0.3932 | 0.2855 | 1.8482 | 0.332 | 0.0838 | 0.1906 | 0.3067 | 0.1801 |
| **t value** | 1.94 | 2.48 | -0.58 | -1.71 | -7.07 | 0.58 | -2.09 | -3.12 | 8.62 |
| **P Value** | 0.0669 | 0.0221 | 0.5697 | 0.1005 | <.0001 | 0.5667 | 0.0475 | 0.0048 | <.0001 |
| **IRELAND** | | | | | | | | | |
| | -0.04627 | 0.390937 | 4.797031 | 1.03262 | -0.5828 | 2.973492 | -0.27028 | -0.4704 | 0.58861 |
| **STD Err** | 0.3498 | 0.1134 | 0.7058 | 0.0761 | 0.2536 | 1.4543 | 0.1565 | 0.2928 | 0.1017 |
| **t value** | -0.13 | 3.45 | 6.8 | 0.43 | -2.3 | 2.04 | -1.73 | -1.61 | 5.79 |
| **P Value** | 0.8961 | 0.0025 | <.0001 | 0.6722 | 0.031 | 0.0525 | 0.0975 | 0.1218 | <.0001 |

**(Table Continued)**

**(Table Continued)**

| WHEAT | | lndmpr | (lnprod+lnimpq)/lnconp | lnconp | mref | aref | lnopstk | lngdp | | Lndmpr |
|---|---|---|---|---|---|---|---|---|---|---|
| | a1 | a2 | a3 | b1 | b2 | b3 | b4 | b5 | b6 | c1 | c2 |
| **ITALY** | | | | | | | | | | | |
| | 9.92008 | 0.929969 | 9.690053 | 2.161606 | -0.7394 | -0.51692 | -0.67461 | 0.293433 | 0.061685 | 5.203512 | -1.78495 |
| **STD Err** | 2.7804 | 0.2504 | 4.9932 | 4.4624 | 0.4734 | 0.0943 | 0.1045 | 0.0635 | 0.0858 | 4.2645 | 0.7223 |
| **t value** | -0.33 | 3.71 | 1.94 | 0.48 | -1.56 | -5.48 | -6.46 | 4.62 | 0.72 | 1.22 | -2.47 |
| **P Value** | 0.7434 | 0.001 | 0.0632 | 0.6327 | 0.132 | <.0001 | <.0001 | 0.0001 | 0.4792 | 0.2353 | 0.0217 |
| **NETHERLANDS** | | | | | | | | | | | |
| | 0.027018 | 0.171444 | 0.434926 | -0.73357 | -0.3920 | -0.16786 | -0.39911 | 0.203106 | 0.567788 | 0.00537 | 0.41981 |
| **STD Err** | 0.0566 | 0.2526 | 0.9208 | 1.1325 | 0.1453 | 0.0906 | 0.1214 | 0.1061 | 0.0986 | 0.0374 | 0.3685 |
| **t value** | 0.48 | 0.68 | 0.47 | -0.65 | -2.7 | -1.85 | -3.29 | 1.91 | 5.76 | 0.14 | 1.14 |
| **P Value** | 0.6386 | 0.5033 | 0.6406 | 0.5236 | 0.0128 | 0.0768 | 0.0032 | 0.0682 | <.0001 | 0.8872 | 0.2668 |
| **SPAIN** | | | | | | | | | | | |
| | 0.196992 | -0.06223 | 5.920328 | 9.010716 | -1.1971 | -0.27598 | -0.121 | 0.040558 | 0.115814 | 1.16292 | -1.00973 |
| **STD Err** | 0.9769 | 0.4355 | 1.7599 | 2.1939 | 0.2581 | 0.1089 | 0.1737 | 0.0509 | 0.0892 | 0.1744 | 1.1995 |
| **t value** | 0.2 | -0.14 | 3.36 | 4.11 | -4.64 | -2.53 | -0.7 | 0.8 | 1.3 | 0.93 | -0.84 |
| **P Value** | 0.8418 | 0.8875 | 0.0024 | 0.0004 | 0.0001 | 0.0186 | 0.4931 | 0.4337 | 0.207 | 0.3604 | 0.4089 |
| **UK** | | | | | | | | | | | |
| | 10.07868 | 0.125769 | -5.67089 | 10.07368 | -1.0637 | -0.45026 | -0.60238 | 0.043951 | 0.46745 | 3.020291 | 4.194562 |
| **STD Err** | 0.0789 | 0.3879 | 1.8356 | 0.5014 | 0.5958 | 0.0994 | 0.1267 | 0.0919 | 0.1475 | 0.138 | 0.7764 |
| **t value** | 1 | 0.32 | -3.09 | 0.15 | -1.79 | -4.53 | -4.75 | 0.48 | 3.17 | 0.15 | 5.4 |
| **P Value** | 0.3308 | 0.7484 | 0.0047 | 0.8846 | 0.0874 | 0.0001 | <.0001 | 0.6368 | 0.0043 | 0.8845 | <.0001 |
| **GREECE** | | | | | | | | | | | |
| | 10.51301 | -0.25844 | -3.90531 | 11.39609 | 0.0421 | -0.34546 | -0.51395 | 0.047951 | -1.03331 | 10.09985 | 1.829329 |
| **STD Err** | 0.6531 | 0.3266 | 2.038 | 4.4044 | 0.4603 | 0.2479 | 0.3321 | 0.087 | 0.2475 | 0.2003 | 1.8512 |
| **t value** | 0.79 | -0.79 | -1.92 | 2.59 | 0.09 | -1.39 | -1.55 | 0.55 | -4.18 | 0.5 | 0.99 |
| **P Value** | 0.4413 | 0.4359 | 0.0664 | 0.0165 | 0.9279 | 0.1767 | 0.1354 | 0.5868 | 0.0004 | 0.6231 | 0.3338 |
| **PORTUGAL** | | | | | | | | | | | |
| | 3.598615 | -0.19024 | 0.741402 | 10.428349 | -1.6659 | 0.267896 | 0.412049 | 0.081256 | -0.49542 | 11.51748 | -4.48538 |
| **STD Err** | 2.0483 | 0.1852 | 1.192 | 0.6977 | 0.7189 | 0.2871 | 0.3468 | 0.1074 | 0.1739 | 10.8995 | 1.7151 |
| **t value** | 1.76 | -1.03 | 0.62 | 0.61 | -2.32 | 0.93 | 1.19 | 0.76 | -2.85 | 1.06 | -2.62 |
| **P Value** | 0.0907 | 0.3137 | 0.5394 | 0.5462 | 0.0297 | 0.3605 | 0.2469 | 0.4568 | 0.0091 | 0.3021 | 0.0158 |

**(Table Continued)**

**(Table Continued)**

| WHEAT | lnworldpc3 | Lnexprc4 | lnexrtc5 | mrefc6 | arefc7 | d1 | lndmprd2 | lnworldpd3 | lnexrtd4 | lnimpld5 | mrefd6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **ITALY** | | | | | | | | | | | |
| | 0.418281 | 0.093364 | -1.15642 | 0.271463 | -0.31699 | 5.493373 | -0.03155 | -0.45702 | 0.823783 | -0.17934 | -0.07624 |
| **STD Err** | 0.2474 | 0.0751 | 0.5754 | 0.2715 | 0.3634 | 2.4573 | 0.3997 | 0.2156 | 0.4183 | 0.0534 | 0.16 |
| **t value** | 1.69 | 1.24 | -2.01 | 1 | -0.87 | 2.24 | -0.08 | -2.12 | 1.97 | -3.36 | -0.48 |
| **P Value** | 0.105 | 0.227 | 0.0569 | 0.3282 | 0.3925 | 0.0369 | 0.9379 | 0.0468 | 0.0629 | 0.0031 | 0.6389 |
| **NETHERLANDS** | | | | | | | | | | | |
| | 0.032159 | 8.661298 | -0.02184 | 0.298232 | 0.105821 | 3.95614 | -1.11765 | 0.387901 | -0.42838 | -3.74208 | 0.100146 |
| **STD Err** | 0.2099 | 2.1822 | 0.3283 | 0.1048 | 0.1708 | 3.7765 | 0.4628 | 0.2122 | 0.6208 | 1.8744 | 0.1605 |
| **t value** | 0.15 | 3.97 | -0.07 | 2.85 | 0.62 | 1.05 | -2.42 | 1.83 | -0.69 | -2 | 0.62 |
| **P Value** | 0.8796 | 0.0007 | 0.9476 | 0.0094 | 0.542 | 0.3073 | 0.0254 | 0.0825 | 0.4981 | 0.0565 | 0.5396 |
| **SPAIN** | | | | | | | | | | | |
| | -0.00871 | 2.730177 | -2.44302 | 0.539013 | 0.566459 | 13.79969 | 0.546431 | -1.85273 | -0.38911 | 0.093347 | 1.831107 |
| **STD Err** | 0.8808 | 9.5147 | 0.9469 | 0.4151 | 0.7722 | 9.897 | 1.1353 | 0.7802 | 1.1164 | 0.1927 | 0.5235 |
| **t value** | -0.01 | 2.87 | -2.58 | 1.3 | 0.73 | 1.39 | 0.48 | -2.37 | -0.35 | 0.48 | 3.5 |
| **P Value** | 0.9922 | 0.0089 | 0.0171 | 0.2075 | 0.471 | 0.1785 | 0.6355 | 0.0277 | 0.7311 | 0.6333 | 0.0023 |
| **UK** | | | | | | | | | | | |
| | -0.26493 | 7.6602 | 2.799324 | 1.561534 | 1.486212 | 13.74175 | -1.14963 | 0.157155 | -1.65422 | -1.69901 | 0.078716 |
| **STD Err** | 0.3837 | 7.3391 | 0.9039 | 0.332 | 0.6047 | 3.7617 | 0.4647 | 0.3172 | 0.7295 | 3.6752 | 0.2244 |
| **t value** | -0.69 | 2.41 | 3.1 | 4.7 | 2.46 | 3.65 | -2.47 | 0.5 | -2.27 | -4.62 | 0.35 |
| **P Value** | 0.4972 | 0.025 | 0.0053 | 0.0001 | 0.0223 | 0.0016 | 0.0224 | 0.6257 | 0.0346 | <.0001 | 0.7294 |
| **GREECE** | | | | | | | | | | | |
| | -0.14698 | 2.945302 | -0.28923 | 2.076387 | 2.215007 | 8.986458 | -0.89616 | -1.66493 | 0.568849 | -0.1162 | -0.33917 |
| **STD Err** | 0.5797 | 11.4374 | 1.5997 | 0.7934 | 1.2345 | 8.0307 | 1.2933 | 3.5568 | 1.1967 | 0.1496 | 0.4352 |
| **t value** | -0.25 | 2.58 | -0.18 | 2.62 | 1.79 | 1.12 | -0.69 | -3.28 | 0.48 | -0.78 | -0.78 |
| **P Value** | 0.8022 | 0.0173 | 0.8582 | 0.0157 | 0.0865 | 0.2764 | 0.4963 | 0.003 | 0.6397 | 0.4463 | 0.4449 |
| **PORTUGAL** | | | | | | | | | | | |
| | 0.309252 | -0.15687 | -3.82736 | -0.78437 | -0.02537 | 7.416288 | 0.908698 | -0.45924 | 1.169546 | -0.09712 | 0.978614 |
| **STD Err** | 0.4678 | 0.2123 | 1.3114 | 1.1409 | 1.3505 | 5.0444 | 0.7259 | 0.5006 | 0.593 | 0.0903 | 0.4242 |
| **t value** | 0.66 | -0.74 | -2.92 | -0.69 | -0.02 | 1.47 | 1.25 | -0.92 | 1.97 | -1.08 | 2.31 |
| **P Value** | 0.5155 | 0.4678 | 0.008 | 0.4989 | 0.9852 | 0.1571 | 0.2251 | 0.3699 | 0.0626 | 0.295 | 0.0319 |

**(Table Continued)**

**(Table Continued)**

| WHEAT | aref | lngdp | lnimpqu/lnimpq | | lndmpr | lnprodr | mref | aref | lngdp |
|---|---|---|---|---|---|---|---|---|---|
| | d7 | d8 | d9 | e1 | e2 | e3 | e4 | e5 | e6 |
| **ITALY** | | | | | | | | | |
| | -0.3507 | 0.371419 | 1.1901 | 1.013459 | 0.211506 | 1.57305 | 0.004054 | -0.1236 | -0.2149 |
| **STD Err** | 0.2259 | 0.0915 | 0.6493 | 0.0446 | 0.1127 | 0.6478 | 0.0839 | 0.132 | 0.0564 |
| **t value** | -1.55 | 4.06 | 1.83 | 0.3 | 1.88 | 17.86 | 0.05 | -0.94 | -3.81 |
| **P Value** | 0.1363 | 0.0006 | 0.0817 | 0.7657 | 0.0732 | <.0001 | 0.9619 | 0.3584 | 0.0009 |
| **NETHERLANDS** | | | | | | | | | |
| | 0.214689 | 0.323673 | -0.24269 | 4.604752 | -0.06739 | -0.04739 | -0.01202 | -0.0734 | 0.245791 |
| **STD Err** | 0.2718 | 0.2669 | 0.2906 | 1.1463 | 0.2309 | 0.0527 | 0.1224 | 0.2141 | 0.1402 |
| **t value** | 0.79 | 1.21 | -0.84 | 4.02 | -0.29 | -0.9 | -0.1 | -0.34 | 1.75 |
| **P Value** | 0.4389 | 0.2394 | 0.4134 | 0.0005 | 0.773 | 0.378 | 0.9226 | 0.7348 | 0.0928 |
| **SPAIN** | | | | | | | | | |
| | 2.144867 | 1.109397 | 0.538593 | 8.018061 | -0.41495 | -0.02041 | -0.41595 | -0.4214 | 0.067798 |
| **STD Err** | 0.8453 | 0.4451 | 0.3024 | 1.1728 | 0.1886 | 0.0823 | 0.1452 | 0.2574 | 0.1005 |
| **t value** | 2.54 | 2.49 | 1.78 | 6.84 | -2.2 | -0.25 | -2.86 | -1.64 | 0.67 |
| **P Value** | 0.0196 | 0.0216 | 0.09 | <.0001 | 0.0381 | 0.8064 | 0.0088 | 0.1152 | 0.5065 |
| **UK** | | | | | | | | | |
| | 0.288189 | -0.56779 | 1.251766 | 2.004813 | 0.026057 | 5.140374 | -0.24345 | -0.4550 | 0.678672 |
| **STD Err** | 0.3297 | 0.172 | 4.404 | 0.0606 | 0.1705 | 1.0018 | 0.1136 | 0.1877 | 0.0878 |
| **t value** | 0.87 | -3.3 | 2.84 | 0.08 | 0.15 | 5.13 | -2.14 | -2.42 | 7.73 |
| **P Value** | 0.3924 | 0.0036 | 0.0092 | 0.9374 | 0.8799 | <.0001 | 0.043 | 0.0236 | <.0001 |
| **GREECE** | | | | | | | | | |
| | -0.34528 | 0.125511 | 0.566985 | 4.075386 | 0.589024 | 3.880894 | 0.214422 | -0.1537 | -0.17327 |
| **STD Err** | 0.5963 | 0.5965 | 0.1787 | 0.0907 | 0.1398 | 2.3061 | 0.1563 | 0.2617 | 0.1659 |
| **t value** | -0.58 | 0.21 | 3.17 | 0.83 | 4.21 | 3.42 | 1.37 | -0.59 | -1.04 |
| **P Value** | 0.569 | 0.8355 | 0.0048 | 0.4145 | 0.0003 | 0.0024 | 0.1834 | 0.5624 | 0.307 |
| **PORTUGAL** | | | | | | | | | |
| | 1.253302 | -0.09707 | 1.94095 | 3.964956 | -0.02684 | 0.190501 | -0.27138 | -1.5233 | 0.000881 |
| **STD Err** | 0.4336 | 0.2149 | 4.2633 | 3.9771 | 0.3886 | 0.2393 | 0.3981 | 0.6307 | 0.2604 |
| **t value** | 2.89 | -0.45 | 3.97 | 1 | -0.07 | 0.8 | -0.68 | -2.42 | 0 |
| **P Value** | 0.009 | 0.6563 | 0.0006 | 0.3292 | 0.9455 | 0.4342 | 0.5022 | 0.0241 | 0.9973 |

**(Table Continued)**

**(Table Continued)**

| WHEAT | | lndmpr | (lnprod+lnimpq)/lnconp | | lnconp | mref | aref | lnopstk | lngdp | | lndmpr |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | a1 | a2 | a3 | b1 | b2 | b3 | b4 | b5 | b6 | c1 | c2 |
| **SWEDEN** | | | | | | | | | | | |
| | 5.999294 | 0.174887 | -0.64284 | -0.10764 | -0.4755 | -0.6760 | -0.9898 | 0.0908 | 0.54538 | 1.67627 | -0.9332 |
| **STD Err** | 1.6105 | 0.3271 | 0.4753 | 1.8156 | 0.1478 | 0.09 | 0.1093 | 0.1076 | 0.1351 | 7.1126 | 0.6914 |
| **t value** | 3.73 | 0.53 | -1.35 | -0.06 | -3.22 | -7.51 | -9.06 | 0.84 | 4.04 | 0.24 | -1.35 |
| **P Value** | 0.001 | 0.5974 | 0.1879 | 0.9532 | 0.0038 | <.0001 | <.0001 | 0.4071 | 0.0005 | 0.8159 | 0.1908 |
| **FINLAND** | | | | | | | | | | | |
| | 7.869577 | -1.03836 | 0.819484 | 2.083789 | -0.1152 | -0.3820 | -0.6012 | -0.0996 | 0.217641 | 1.909344 | -1.4054 |
| **STD Error** | 0.9842 | 0.282 | 0.2149 | 1.3171 | 0.0598 | 0.0575 | 0.074 | 0.0409 | 0.0481 | 9.2006 | 1.6255 |
| **t value** | 8 | -3.68 | 3.81 | 1.58 | -1.93 | -6.65 | -8.12 | -2.44 | 4.52 | 0.21 | -0.86 |
| **P Value** | <.0001 | 0.0011 | 0.0008 | 0.1293 | 0.0663 | <.0001 | <.0001 | 0.023 | 0.0002 | 0.8375 | 0.3966 |

| WHEAT | lnworldp | lnexpr | lnexrt | mref | aref | | lndmpr | lnworldp | lnexrt | lnimpl | mref |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | c3 | c4 | c5 | c6 | c7 | d1 | d2 | d3 | d4 | d5 | d6 |
| **SWEDEN** | | | | | | | | | | | |
| | 0.747867 | 0.009852 | -0.8375 | -0.7504 | 0.196016 | -14.941 | -3.9644 | -0.69011 | -0.18167 | -0.0390 | -1.4301 |
| **STD Err** | 0.566 | 0.1387 | 0.5491 | 0.4317 | 0.7271 | 22.9249 | 1.8114 | 1.4954 | 2.1705 | 0.4023 | 1.3344 |
| **t value** | 1.32 | 0.07 | -1.53 | -1.74 | 0.27 | -0.65 | -2.19 | -0.46 | -0.08 | -0.1 | -1.07 |
| **P Value** | 0.2 | 0.944 | 0.1414 | 0.0961 | 0.79 | 0.522 | 0.0407 | 0.6494 | 0.9341 | 0.9236 | 0.2966 |
| **FINLAND** | | | | | | | | | | | |
| | 0.874964 | -0.10526 | -0.2882 | -2.1031 | -3.0414 | 30.38712 | -2.4078 | -3.57365 | 5.431779 | -0.6460 | -2.4125 |
| **STD Err** | 0.6932 | 0.1554 | 1.139 | 0.5532 | 0.9091 | 24.9252 | 4.6637 | 1.9944 | 4.0441 | 0.4538 | 1.8052 |
| **t value** | 1.26 | -0.68 | -0.25 | -3.8 | -3.35 | 1.22 | -0.52 | -1.79 | 1.34 | -1.42 | -1.34 |
| **P Value** | 0.2201 | 0.5053 | 0.8026 | 0.001 | 0.0029 | 0.237 | 0.6113 | 0.0883 | 0.1943 | 0.17 | 0.1964 |

**Table A1.2: Results from the Regression for Rye:**

| RYE | | lndmpr | (lnprod+lnimpq)/lnconp | lnconp | mref | aref | lnopstk | lngdp | | lndmpr |
|---|---|---|---|---|---|---|---|---|---|---|
| | a1 | a2 | a3 | b1 | b2 | b3 | b4 | b5 | b6 | c1 | c2 |
| **AUSTRIA** | | | | | | | | | | | |
| | 1.193324 | -5.70332 | 2.715082 | 0.119209 | -0.14045 | 0.160844 | -0.15683 | 3.910419 | 0.055592 | -13.4774 | 0.740903 |
| **STD Error** | 0.4857 | 2.2489 | 0.408 | 0.0913 | 0.1516 | 0.1487 | 0.1637 | 2.0708 | 0.1148 | 8.1659 | 0.8913 |
| **t value** | 2.46 | -2.54 | 6.65 | 1.31 | -0.93 | 1.08 | -0.96 | 1.89 | 0.48 | -1.65 | 0.83 |
| **P Value** | 0.021 | 0.0176 | <.0001 | 0.2046 | 0.3638 | 0.2905 | 0.3479 | 0.0717 | 0.6327 | 0.1131 | 0.4147 |
| **BELGIUM** | | | | | | | | | | | |
| | 0.077192 | -1.3653 | 8.444456 | -0.0979 | 0.161446 | 0.02829 | -0.36386 | -0.06875 | 0.090636 | 26.47895 | 0.941499 |
| **STD Error** | 0.7661 | 0.7467 | 1.5649 | 1.4623 | 0.1008 | 0.127 | 0.1457 | 0.0709 | 0.1223 | 19.065 | 1.8008 |
| **t value** | 0.1 | -1.83 | 5.4 | -0.07 | 1.6 | 0.22 | -2.5 | -0.97 | 0.74 | 1.39 | 0.52 |
| **P Value** | 0.9205 | 0.079 | <.0001 | 0.9472 | 0.123 | 0.8256 | 0.0201 | 0.3424 | 0.4661 | 0.1788 | 0.6063 |
| **DENMARK** | | | | | | | | | | | |
| | 13.06195 | -1.51951 | 1.685359 | 2.477333 | -0.19285 | -0.09661 | -0.48877 | -0.05872 | 0.168062 | 19.14495 | -1.83961 |
| **STD Error** | 5.1588 | 1.1617 | 2.6622 | 1.6286 | 0.1867 | 0.1378 | 0.1816 | 0.0463 | 0.1512 | 18.7907 | 1.4094 |
| **t value** | 2.53 | -1.31 | 0.63 | 1.52 | -1.03 | -0.7 | -2.69 | -1.27 | 1.11 | 1.02 | -1.31 |
| **P Value** | 0.0177 | 0.2023 | 0.5322 | 0.1419 | 0.3123 | 0.4901 | 0.013 | 0.2175 | 0.2778 | 0.3193 | 0.2053 |
| **FRANCE** | | | | | | | | | | | |
| | -2.54917 | -2.09617 | 0.407042 | -4.15982 | -0.87724 | 0.372064 | 0.341983 | 0.051956 | 0.154078 | 0.167914 | -3.46486 |
| **STD Error** | 1.6388 | 0.5545 | 0.6398 | 2.6551 | 0.2562 | 0.1256 | 0.1886 | 0.041 | 0.1212 | 0.1156 | 1.3177 |
| **t value** | -1.56 | -3.78 | 0.64 | -1.57 | -3.42 | 2.96 | 1.81 | 1.27 | 1.27 | 1.45 | -2.63 |
| **P Value** | 0.1319 | 0.0008 | 0.5302 | 0.1308 | 0.0023 | 0.007 | 0.0828 | 0.2179 | 0.2164 | 0.1606 | 0.0153 |
| **GERMANY** | | | | | | | | | | | |
| | 19.06222 | -1.55969 | 0.495864 | -2.94265 | -0.2142 | -0.1839 | -0.38483 | -0.14515 | 0.25337 | 17.92232 | -0.56849 |
| **STD Error** | 3.2497 | 0.7458 | 0.1901 | 2.3639 | 0.1116 | 0.1491 | 0.1658 | 0.0916 | 0.1311 | 7.9884 | 0.9077 |
| **t value** | 5.87 | -2.09 | 2.61 | -1.24 | -1.92 | -1.23 | -2.32 | -1.58 | 1.93 | 2.24 | -0.63 |
| **P Value** | <.0001 | 0.0464 | 0.0149 | 0.2257 | 0.0674 | 0.2298 | 0.0295 | 0.1267 | 0.0657 | 0.0353 | 0.5376 |
| **GREECE** | | | | | | | | | | | |
| | -0.18389 | -0.48137 | 1.648248 | 11.52886 | -0.5809 | 0.238241 | -0.21262 | -0.02608 | 0.907023 | 0.108755 | -7.44386 |
| **STD Error** | 0.2793 | 0.1957 | 0.173 | 2.6403 | 0.1196 | 0.2433 | 0.2988 | 0.105 | 0.2477 | 0.4506 | 2.8162 |
| **t value** | -0.66 | -2.46 | 9.53 | 4.37 | -4.86 | 0.98 | -0.71 | -0.25 | 3.66 | 0.24 | -2.64 |
| **P Value** | 0.516 | 0.0209 | <.0001 | 0.0002 | <.0001 | 0.3376 | 0.4838 | 0.806 | 0.0013 | 0.8115 | 0.0148 |

**(Table Continued)**

**(Table Continued)**

| RYE | lnworldp | lnexpr | Lnexrt | mref | aref | | lndmpr | lnworldp | lnexrt | lnimpl | mref |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | c3 | c4 | c5 | c6 | c7 | d1 | d2 | d3 | d4 | d5 | d6 |
| **AUSTRIA** | | | | | | | | | | | |
| | 1.377961 | 0.030292 | -2.73212 | -1.07788 | -1.62676 | 15.44665 | 0.280449 | -0.78835 | -1.32668 | -0.00201 | 1.715595 |
| **STD Error** | 0.8022 | 0.1613 | 1.1279 | 0.3484 | 0.6752 | 8.6203 | 0.9953 | 1.3074 | 0.6308 | 0.3729 | 2.3883 |
| **t value** | 1.72 | 0.19 | -2.42 | -3.09 | -2.41 | 1.79 | 0.28 | -0.6 | -2.1 | -0.01 | 0.72 |
| **P Value** | 0.0999 | 0.8528 | 0.0241 | 0.0053 | 0.0248 | 0.0876 | 0.7809 | 0.553 | 0.0477 | 0.9958 | 0.4805 |
| **BELGIUM** | | | | | | | | | | | |
| | 0.101892 | 0.231641 | 5.028422 | -3.93243 | -0.3761 | 7.71027 | 2.246634 | -0.81984 | 0.471732 | -0.37275 | 0.16076 |
| **STD Error** | 0.6072 | 0.3167 | 3.214 | 2.4734 | 1.2867 | 7.6791 | 0.7001 | 0.9668 | 1.4512 | 0.2537 | 0.4024 |
| **t value** | 0.17 | 0.73 | 1.56 | -1.59 | -0.29 | 1 | 3.21 | -0.85 | 0.33 | -1.47 | 0.4 |
| **P Value** | 0.8683 | 0.4722 | 0.132 | 0.1261 | 0.7728 | 0.3268 | 0.004 | 0.406 | 0.7484 | 0.1566 | 0.6935 |
| **DENMARK** | | | | | | | | | | | |
| | 0.31789 | 0.254247 | 1.062695 | -1.17803 | -0.58238 | 2.141754 | 1.138109 | -0.59326 | -4.8332 | 0.108781 | 0.015268 |
| **STD Error** | 0.467 | 0.2064 | 2.7225 | 2.099 | 0.8795 | 1.9874 | 1.0556 | 1.4126 | 12.2954 | 0.3162 | 0.5013 |
| **t value** | 0.68 | 1.23 | 0.39 | -0.56 | -0.66 | 1.08 | 1.08 | -0.42 | -0.39 | 0.34 | 0.03 |
| **P Value** | 0.5031 | 0.2311 | 0.7 | 0.5803 | 0.5147 | 0.2934 | 0.2932 | 0.6788 | 0.6982 | 0.7342 | 0.976 |
| **FRANCE** | | | | | | | | | | | |
| | 1.544251 | 33.89145 | 2.132789 | -1.0694 | -0.65307 | -19.9938 | 0.700016 | -0.84988 | -1.92297 | -0.7594 | 0.051742 |
| **STD Error** | 0.872 | 11.1996 | 1.646 | 0.3288 | 0.5 | 27.1599 | 2.8961 | 1.9501 | 0.8876 | 0.5943 | 3.685 |
| **t value** | 1.77 | 3.03 | 1.3 | -3.25 | -1.31 | -0.74 | 0.24 | -0.44 | -2.17 | -1.28 | 0.01 |
| **P Value** | 0.0904 | 0.0062 | 0.2085 | 0.0037 | 0.205 | 0.4698 | 0.8114 | 0.6674 | 0.0419 | 0.2153 | 0.9889 |
| **GERMANY** | | | | | | | | | | | |
| | 1.330007 | 17.92232 | -2.55314 | -0.54181 | -0.70676 | 45.17485 | 2.065066 | -2.38284 | -6.97867 | -0.41092 | 1.08113 |
| **STD Error** | 0.3506 | 7.9884 | 1.0279 | 0.7541 | 0.7698 | 11.9902 | 0.934 | 0.846 | 2.0914 | 0.3176 | 0.575 |
| **t value** | 3.79 | 2.24 | -2.48 | -0.72 | -0.92 | 3.77 | 2.21 | -2.82 | -3.34 | -1.29 | 1.88 |
| **P Value** | 0.001 | 0.0353 | 0.0211 | 0.48 | 0.369 | 0.0011 | 0.0383 | 0.0103 | 0.0031 | 0.2097 | 0.074 |
| **GREECE** | | | | | | | | | | | |
| | 7.379593 | 37.61494 | 9.782343 | -4.26537 | -1.77637 | -31.4557 | 1.866968 | -1.19842 | -1.86655 | -0.8962 | 0.168299 |
| **STD Error** | 3.1049 | 20.5018 | 3.7173 | 1.6254 | 2.1233 | 19.9683 | 1.6648 | 1.6097 | 2.0742 | 0.5191 | 0.7768 |
| **t value** | 2.38 | 1.83 | 2.63 | -2.62 | -0.84 | -1.58 | 1.12 | -0.74 | -0.9 | -1.73 | 0.22 |
| **P Value** | 0.0266 | 0.0801 | 0.0152 | 0.0155 | 0.4118 | 0.1301 | 0.2748 | 0.4648 | 0.3784 | 0.099 | 0.8306 |

**(Table Continued)**

**(Table Continued)**

| RYE | aref | lngdp | | lndmpr | lnprodr | Mref | aref | lngdp |
|---|---|---|---|---|---|---|---|---|
| | d7 | d8 | e1 | e2 | e3 | e4 | e5 | e6 |
| **AUSTRIA** | | | | | | | | |
| | -0.50489 | -0.37202 | -0.07792 | 6.563901 | 0.071683 | -0.24867 | -0.52764 | -0.09275 |
| **STD Error** | 0.8546 | 0.8337 | 0.2563 | 1.4259 | 0.0574 | 0.1296 | 0.1967 | 0.129 |
| **t value** | -0.59 | -0.45 | -0.3 | 4.6 | 1.25 | -1.92 | -2.68 | -0.72 |
| **P Value** | 0.561 | 0.66 | 0.7638 | 0.0001 | 0.2244 | 0.0676 | 0.0133 | 0.4793 |
| **BELGIUM** | | | | | | | | |
| | 0.595094 | 0.684574 | 0.302982 | 17.67505 | 0.600693 | -0.07161 | -0.42212 | -0.9925 |
| **STD Error** | 0.526 | 0.4239 | 0.2767 | 1.7871 | 0.1821 | 0.1521 | 0.2239 | 0.1557 |
| **t value** | 1.13 | 1.61 | 1.1 | 9.89 | 3.3 | -0.47 | -1.89 | -6.37 |
| **P Value** | 0.2707 | 0.1213 | 0.2848 | <.0001 | 0.0031 | 0.6422 | 0.0721 | <.0001 |
| **DENMARK** | | | | | | | | |
| | 0.84627 | 0.488906 | -1.34356 | 7.075928 | -0.02459 | -0.14063 | -1.09067 | 0.280077 |
| **STD Error** | 0.624 | 0.4345 | 0.382 | 2.4516 | 0.0786 | 0.1877 | 0.265 | 0.1781 |
| **t value** | 1.36 | 1.13 | -3.52 | 2.89 | -0.31 | -0.75 | -4.12 | 1.57 |
| **P Value** | 0.1894 | 0.2732 | 0.0019 | 0.0083 | 0.7571 | 0.4614 | 0.0004 | 0.1294 |
| **FRANCE** | | | | | | | | |
| | -2.26136 | 1.812511 | -1.03448 | 0.252564 | -0.11482 | -0.37761 | -0.68297 | -0.20532 |
| **STD Error** | 1.042 | 0.6951 | 0.1373 | 0.1603 | 0.0345 | 0.0785 | 0.112 | 0.0756 |
| **t value** | -2.17 | 2.61 | -7.54 | 1.58 | -3.33 | -4.81 | -6.1 | -2.72 |
| **P Value** | 0.0416 | 0.0164 | <.0001 | 0.1287 | 0.0029 | <.0001 | <.0001 | 0.0123 |
| **GERMANY** | | | | | | | | |
| | 0.665874 | -2.63884 | -0.11957 | 7.788255 | 0.471137 | -0.31209 | -0.06633 | 0.057365 |
| **STD Error** | 0.7464 | 0.8122 | 0.349 | 2.0621 | 0.2674 | 0.066 | 0.0787 | 0.1665 |
| **t value** | 0.89 | -3.25 | -0.34 | 3.78 | 1.76 | -4.73 | -0.84 | 0.34 |
| **P Value** | 0.3825 | 0.0038 | 0.735 | 0.001 | 0.0914 | <.0001 | 0.4081 | 0.7335 |
| **GREECE** | | | | | | | | |
| | 2.153063 | 2.371072 | 4.008039 | 8.862704 | 0.069749 | -0.35782 | -1.17957 | -0.11714 |
| **STD Error** | 0.8713 | 0.9785 | 2.7387 | 1.1338 | 0.074 | 0.1597 | 0.2289 | 0.2158 |
| **t value** | 2.47 | 2.42 | 1.46 | 7.82 | 0.94 | -2.24 | -5.15 | -0.54 |
| **P Value** | 0.0221 | 0.0245 | 0.1569 | <.0001 | 0.3557 | 0.035 | <.0001 | 0.5925 |

**(Table Continued)**

**(Table Continued)**

| RYE | | lndmpr | (lnprod+lnimpq)/lnconp | | lnconp | mref | aref | lnopstk | Lngdp | | lndmpr |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | a1 | a2 | a3 | b1 | b2 | b3 | b4 | b5 | b6 | c1 | c2 |
| **ITALY** | | | | | | | | | | | |
| | -0.45502 | -1.40069 | 1.100723 | 0.298893 | -0.28988 | -0.21775 | -0.52419 | -0.03694 | 0.44832 | 35.70048 | -1.35365 |
| **STD Error** | 0.2796 | 0.5588 | 0.4924 | 1.8158 | 0.1142 | 0.1242 | 0.1456 | 0.0905 | 0.2009 | 11.5002 | 1.2678 |
| **t value** | -1.63 | -2.51 | 2.24 | 0.16 | -2.54 | -1.75 | -3.6 | -0.41 | 2.23 | 3.1 | -1.07 |
| **P Value** | 0.1157 | 0.0188 | 0.0342 | 0.8707 | 0.0183 | 0.093 | 0.0015 | 0.6868 | 0.0357 | 0.0052 | 0.2972 |
| **NETHERLANDS** | | | | | | | | | | | |
| | 0.206533 | -0.48316 | 0.893988 | 1.745316 | -0.15142 | -0.03625 | -0.46247 | 0.070172 | 0.128553 | -1.28129 | -0.37449 |
| **STD Error** | 0.357 | 1.5794 | 0.4788 | 1.4025 | 0.0861 | 0.1303 | 0.1659 | 0.1142 | 0.1259 | 7.6267 | 0.6785 |
| **t value** | 0.58 | -0.31 | 1.87 | 1.24 | -1.76 | -0.28 | -2.79 | 0.61 | 1.02 | -0.17 | -0.55 |
| **P Value** | 0.5679 | 0.7621 | 0.0732 | 0.2259 | 0.0919 | 0.7833 | 0.0105 | 0.545 | 0.3178 | 0.8681 | 0.5866 |
| **UK** | | | | | | | | | | | |
| | -0.45741 | -0.43642 | 4.835893 | 7.336909 | -0.23547 | -0.01569 | -0.14129 | -0.02281 | 0.172395 | -2.39083 | 0.570971 |
| **STD Error** | 0.5099 | 0.3825 | 1.9754 | 0.5344 | 0.1236 | 0.1025 | 0.1378 | 0.0848 | 0.085 | 17.4434 | 1.518 |
| **t value** | -0.9 | -1.14 | 2.45 | 13.73 | -1.9 | -0.15 | -1.03 | -0.27 | 2.03 | -0.14 | 0.38 |
| **P Value** | 0.3779 | 0.2642 | 0.0214 | <.0001 | 0.0694 | 0.8796 | 0.3157 | 0.7903 | 0.0543 | 0.8922 | 0.7104 |
| **SPAIN** | | | | | | | | | | | |
| | 2.396596 | 0.422648 | 0.350866 | 2.534538 | -0.02285 | -0.09892 | -0.39285 | 0.031853 | -0.17924 | 6.762101 | -2.9883 |
| **STD Error** | 0.6397 | 0.7314 | 0.5283 | 1.6071 | 0.1644 | 0.15 | 0.2004 | 0.0514 | 0.1357 | 29.2045 | 3.552 |
| **t value** | 3.75 | 0.58 | 0.66 | 1.58 | -0.14 | -0.66 | -1.96 | 0.62 | -1.32 | 0.23 | -0.84 |
| **P Value** | 0.0009 | 0.5683 | 0.5124 | 0.1284 | 0.8906 | 0.5161 | 0.0622 | 0.5414 | 0.1997 | 0.819 | 0.4092 |
| **PORTUGAL** | | | | | | | | | | | |
| | 1.234108 | -5.0205 | 1.585523 | -4.11184 | -0.26978 | 0.335249 | 0.426215 | 0.228085 | 1.424249 | 38.5565 | -4.27512 |
| **STD Error** | 0.2908 | 1.6532 | 0.2383 | 4.3698 | 0.2507 | 0.326 | 0.4216 | 0.1086 | 0.436 | 14.3835 | 1.9329 |
| **t value** | 4.24 | -3.04 | 6.65 | -0.94 | -1.08 | 1.03 | 1.01 | 2.1 | 3.27 | 2.68 | -2.21 |
| **P Value** | 0.0002 | 0.0054 | <.0001 | 0.3565 | 0.293 | 0.3144 | 0.3225 | 0.0468 | 0.0034 | 0.0137 | 0.0377 |
| **FINLAND** | | | | | | | | | | | |
| | 2.88591 | -0.25297 | 1.498096 | 1.758717 | 0.035305 | -0.22996 | -0.57457 | -0.10817 | 0.404124 | 0.45958 | 0.254231 |
| **STD Error** | 1.2739 | 0.3923 | 0.453 | 1.8592 | 0.1045 | 0.0938 | 0.1178 | 0.081 | 0.2101 | 14.4288 | 1.2654 |
| **t value** | 2.27 | -0.64 | 3.31 | 0.95 | 0.34 | -2.45 | -4.88 | -1.33 | 1.92 | 0.03 | 0.2 |
| **P Value** | 0.032 | 0.5247 | 0.0028 | 0.354 | 0.7384 | 0.0223 | <.0001 | 0.195 | 0.0669 | 0.9749 | 0.8426 |

**(Table Continued)**

**(Table Continued)**

| RYE | lnworldp | lnexpr | lnexrt | mref | Aref | | lndmpr | lnworldp | lnexrt | lnimpl | mref |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | c3 | c4 | c5 | c6 | c7 | d1 | d2 | d3 | d4 | d5 | d6 |
| **ITALY** | | | | | | | | | | | |
| | 0.631926 | 0.346198 | -0.70842 | 0.843354 | -3.22965 | -6.0073 | 0.339213 | -1.74846 | -0.37075 | -0.1026 | 3.035014 |
| **STD Error** | 1.207 | 0.2462 | 2.697 | 0.9708 | 2.2158 | 8.2838 | 0.8062 | 1.1891 | 0.5813 | 0.3111 | 1.502 |
| **t value** | 0.52 | 1.41 | -0.26 | 0.87 | -1.46 | -0.73 | 0.42 | -1.47 | -0.64 | -0.33 | 2.02 |
| **P Value** | 0.6058 | 0.1737 | 0.7952 | 0.3944 | 0.1591 | 0.4763 | 0.6782 | 0.1563 | 0.5305 | 0.7447 | 0.0563 |
| **NETHERLANDS** | | | | | | | | | | | |
| | 1.799579 | 0.688771 | 0.763661 | 0.226193 | -0.01157 | -7.82688 | 0.438288 | -0.70467 | -0.25912 | -0.9119 | 0.215093 |
| **STD Error** | 0.8225 | 0.5597 | 0.9913 | 0.2782 | 0.1354 | 6.3226 | 0.7159 | 0.6628 | 0.3985 | 0.2181 | 0.352 |
| **t value** | 2.19 | 1.23 | 0.77 | 0.81 | -0.09 | -1.24 | 0.61 | -1.06 | -0.65 | -4.18 | 0.61 |
| **P Value** | 0.0396 | 0.2315 | 0.4493 | 0.4249 | 0.9327 | 0.2294 | 0.547 | 0.2998 | 0.5226 | 0.0004 | 0.5477 |
| **UK** | | | | | | | | | | | |
| | 3.108363 | 1.004744 | -4.24581 | 1.252753 | -1.10444 | 13.51014 | -0.53413 | -0.31611 | -0.49013 | -0.1546 | 0.98729 |
| **STD Error** | 1.0077 | 0.2445 | 3.114 | 0.6467 | 1.7396 | 7.0649 | 0.7608 | 0.809 | 1.3999 | 0.2373 | 1.3574 |
| **t value** | 3.08 | 4.11 | -1.36 | 1.94 | -0.63 | 1.91 | -0.7 | -0.39 | -0.35 | -0.65 | 0.73 |
| **P Value** | 0.0054 | 0.0005 | 0.1865 | 0.0657 | 0.5321 | 0.0696 | 0.4904 | 0.6999 | 0.7297 | 0.5217 | 0.475 |
| **SPAIN** | | | | | | | | | | | |
| | -0.004 | 2.431744 | -0.82263 | -0.24025 | 0.792942 | 18.78572 | 1.740799 | -3.97186 | -0.06088 | -1.6497 | 4.872475 |
| **STD Error** | 4.3281 | 1.7382 | 5.1491 | 0.4909 | 2.2203 | 39.8098 | 3.9091 | 4.8273 | 1.8989 | 1.145 | 5.7043 |
| **t value** | 0 | 1.4 | -0.16 | -0.49 | 0.36 | 0.47 | 0.45 | -0.82 | -0.03 | -1.44 | 0.85 |
| **P Value** | 0.9993 | 0.1758 | 0.8745 | 0.6294 | 0.7244 | 0.6419 | 0.6606 | 0.4199 | 0.9747 | 0.1644 | 0.4026 |
| **PORTUGAL** | | | | | | | | | | | |
| | 1.674099 | 0.192875 | 1.686404 | -0.58357 | 1.69115 | -29.5423 | 0.433967 | 2.290456 | -2.32632 | -0.4379 | 3.625323 |
| **STD Error** | 1.4327 | 0.2879 | 1.8871 | 0.748 | 1.1039 | 32.2531 | 1.6185 | 2.7496 | 2.3786 | 0.7166 | 1.0083 |
| **t value** | 1.17 | 0.67 | 0.89 | -0.78 | 1.53 | -0.92 | 0.27 | 0.83 | -0.98 | -0.61 | 3.6 |
| **P Value** | 0.2551 | 0.5099 | 0.3812 | 0.4436 | 0.1398 | 0.3701 | 0.7912 | 0.4142 | 0.3392 | 0.5477 | 0.0017 |
| **FINLAND** | | | | | | | | | | | |
| | 0.272989 | 0.016895 | -0.29702 | 0.244791 | -0.30342 | 25.19864 | 1.027888 | -0.67235 | -0.12889 | -0.5640 | 0.916444 |
| **STD Error** | 1.5645 | 1.1191 | 2.3338 | 0.6904 | 0.2215 | 9.0453 | 0.9812 | 1.1596 | 0.6326 | 0.3368 | 1.8748 |
| **t value** | 0.17 | 0.02 | -0.13 | 0.35 | -1.37 | 2.79 | 1.05 | -0.58 | -0.2 | -1.67 | 0.49 |
| **P Value** | 0.8631 | 0.9881 | 0.8999 | 0.7263 | 0.1845 | 0.0111 | 0.3067 | 0.5682 | 0.8405 | 0.1088 | 0.63 |

**(Table Continued)**

**(Table Continued)**

| RYE | aref | lngdp | | lndmpr | lnprodr | mref | aref | lngdp |
|---|---|---|---|---|---|---|---|---|
| | d7 | d8 | e1 | e2 | e3 | e4 | e5 | e6 |
| **ITALY** | | | | | | | | |
| | -0.43459 | 0.63066 | 8.039542 | 0.29091 | 0.009627 | -0.05773 | -0.5154 | -0.32377 |
| **STD Error** | 0.6971 | 0.3272 | 0.7685 | 0.1129 | 0.0362 | 0.0709 | 0.1102 | 0.0639 |
| **t value** | -0.62 | 1.93 | 10.46 | 2.58 | 0.27 | -0.81 | -4.68 | -5.06 |
| **P Value** | 0.5397 | 0.0676 | <.0001 | 0.0169 | 0.7926 | 0.4238 | 0.0001 | <.0001 |
| **NETHERLANDS** | | | | | | | | |
| | -0.66138 | 1.532525 | 5.779721 | 1.053928 | 0.148128 | -0.1164 | -0.0110 | -0.45645 |
| **STD Error** | 0.5142 | 0.5163 | 3.3902 | 0.5403 | 0.2493 | 0.1076 | 0.4006 | 0.2824 |
| **t value** | -1.29 | 2.97 | 1.7 | 1.95 | 0.59 | -1.08 | -0.03 | -1.62 |
| **P Value** | 0.2124 | 0.0073 | 0.1017 | 0.0634 | 0.5582 | 0.2908 | 0.9782 | 0.1197 |
| **UK** | | | | | | | | |
| | 0.068004 | -0.42704 | -0.42135 | 4.385015 | 0.034221 | -0.02636 | -0.5203 | 0.285387 |
| **STD Error** | 0.4303 | 0.2508 | 0.2331 | 1.6899 | 0.1166 | 0.0573 | 0.1848 | 0.1081 |
| **t value** | 0.16 | -1.7 | -1.81 | 2.59 | 0.29 | -0.46 | -2.82 | 2.64 |
| **P Value** | 0.8759 | 0.1034 | 0.0838 | 0.0162 | 0.7717 | 0.6496 | 0.0098 | 0.0146 |
| **SPAIN** | | | | | | | | |
| | 0.558857 | 1.757576 | -0.30631 | 4.423459 | 0.1608 | -0.24489 | -0.7297 | 0.146865 |
| **STD Error** | 2.1558 | 1.1222 | 0.2248 | 1.4792 | 0.0675 | 0.1477 | 0.2421 | 0.119 |
| **t value** | 0.26 | 1.57 | -1.36 | 2.99 | 2.38 | -1.66 | -3.01 | 1.23 |
| **P Value** | 0.798 | 0.1322 | 0.1862 | 0.0065 | 0.0259 | 0.1109 | 0.0062 | 0.2296 |
| **PORTUGAL** | | | | | | | | |
| | 4.451046 | 1.571455 | 0.07278 | 7.326503 | -0.00175 | -0.37427 | -0.7528 | -0.26018 |
| **STD Error** | 1.2166 | 1.1666 | 0.1308 | 1.6388 | 0.0628 | 0.1536 | 0.1983 | 0.137 |
| **t value** | 3.66 | 1.35 | 0.56 | 4.47 | -0.03 | -2.44 | -3.8 | -1.9 |
| **P Value** | 0.0015 | 0.1923 | 0.5834 | 0.0002 | 0.978 | 0.023 | 0.0009 | 0.0702 |
| **FINLAND** | | | | | | | | |
| | 0.136587 | -1.06872 | -0.1597 | 5.998392 | -0.10023 | -0.73088 | -0.2612 | 0.000799 |
| **STD Error** | 0.8311 | 0.3611 | 0.7627 | 4.5665 | 0.1734 | 0.3129 | 0.5929 | 0.305 |
| **t value** | 0.16 | -2.96 | -0.21 | 1.31 | -0.58 | -2.34 | -0.44 | 0 |
| **P Value** | 0.871 | 0.0075 | 0.836 | 0.2019 | 0.5689 | 0.0286 | 0.6636 | 0.9979 |

**(Table Continued)**

**(Table Continued)**

| RYE | | lndmpr | (lnprod+lnimpq)/lnconp | | lnconp | mref | aref | lnopstk | lngdp | | lndmpr |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | a1 | a2 | a3 | b1 | b2 | b3 | b4 | b5 | b6 | C1 | c2 |
| **SWEDEN** | | | | | | | | | | | |
| | 1.382752 | -1.1077 | 1.484615 | 7.114013 | -0.3048 | -0.1967 | -0.5089 | 0.029254 | 0.379954 | 0.998596 | -4.9318 |
| **STD Error** | 1.0529 | 0.4904 | 0.3402 | 1.5228 | 0.0988 | 0.1022 | 0.1645 | 0.0774 | 0.2112 | 1.1428 | 11.4786 |
| **t value** | 1.31 | -2.26 | 4.36 | 4.67 | -3.09 | -1.93 | -3.09 | 0.38 | 1.8 | 0.87 | -0.43 |
| **P Value** | 0.2005 | 0.0325 | 0.0002 | 0.0001 | 0.0052 | 0.0666 | 0.0051 | 0.7088 | 0.0852 | 0.3917 | 0.6716 |

| RYE | lnworldp | lnexpr | lnexrt | Mref | aref | | lndmpr | lnworldp | lnexrt | lnimpl | mref |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | C3 | c4 | c5 | c6 | c7 | d1 | d2 | d3 | d4 | d5 | d6 |
| **SWEDEN** | | | | | | | | | | | |
| | 0.505766 | 0.036682 | -0.0694 | -0.5519 | -0.2862 | 0.402548 | 0.328256 | -0.6352 | -0.9745 | -0.8440 | 1.87336 |
| **STD Error** | 1.4617 | 0.1584 | 1.9246 | 0.59 | 0.7184 | 2.052 | 1.7846 | 19.7823 | 0.9115 | 0.5237 | 2.8508 |
| **t value** | 0.35 | 0.23 | -0.04 | -0.94 | -0.4 | 0.2 | 0.18 | -0.03 | -1.07 | -1.61 | 0.66 |
| **P Value** | 0.7326 | 0.819 | 0.9715 | 0.3597 | 0.6942 | 0.8464 | 0.8558 | 0.9747 | 0.2971 | 0.1219 | 0.5182 |

| RYE | aref | Lngdp | | lndmpr | lnprodr | mref | aref | lngdp |
|---|---|---|---|---|---|---|---|---|
| | d7 | d8 | e1 | e2 | e3 | e4 | e5 | e6 |
| **SWEDEN** | | | | | | | | |
| | -0.7358 | 0.127261 | -0.3112 | 11.73394 | 0.001776 | -0.1160 | -0.1979 | -0.4565 |
| **STD Error** | 1.1513 | 0.6276 | 0.3208 | 2.7249 | 0.0799 | 0.1856 | 0.2913 | 0.1938 |
| **t value** | -0.64 | 0.2 | -0.97 | 4.31 | 0.02 | -0.63 | -0.68 | -2.36 |
| **P Value** | 0.5297 | 0.8413 | 0.342 | 0.0003 | 0.9825 | 0.538 | 0.5035 | 0.0274 |

**Table A1.3: Results from the Regression for Barley:**

| BARLEY | | lndmpr | (lnprod+lnimpq)/lnconp | lnconp | mref | aref | lnopstk | lngdp | | lndmpr |
|---|---|---|---|---|---|---|---|---|---|---|
| | a1 | a2 | a3 | b1 | b2 | b3 | b4 | b5 | b6 | c1 | c2 |
| **AUSTRIA** | | | | | | | | | | | |
| | 1.285619 | -9.54153 | 4.218654 | 0.040819 | -0.91599 | -0.3668 | -0.5306 | 0.004246 | 0.438673 | 10.69653 | -0.4939 |
| **Std.Error** | 0.9352 | 5.2827 | 2.1131 | 0.2055 | 2.0484 | 0.0951 | 0.1014 | 0.0307 | 0.093 | 8.8497 | 0.6313 |
| **t value** | 1.37 | -1.81 | 2 | 0.2 | -0.45 | -3.86 | -5.23 | 0.14 | 4.72 | 1.21 | -0.78 |
| **P value** | 0.1809 | 0.0825 | 0.0565 | 0.8443 | 0.6589 | 0.0008 | <.0001 | 0.8911 | <.0001 | 0.2396 | 0.4423 |
| **BELGIUM** | | | | | | | | | | | |
| | 1.80977 | -4.23059 | 11.12321 | 1.888412 | -0.39352 | -0.2853 | -0.7304 | 0.040067 | 0.174261 | 8.657272 | -1.24763 |
| **Std.Error** | 1.3023 | 2.2493 | 5.0627 | 2.3109 | 0.1795 | 0.1027 | 0.1776 | 0.0272 | 0.1213 | 13.2682 | 2.1192 |
| **t value** | 1.39 | -1.88 | 2.2 | 0.82 | -2.19 | -2.78 | -4.11 | 1.47 | 1.44 | 0.65 | -0.59 |
| **P value** | 0.1764 | 0.0712 | 0.0371 | 0.4222 | 0.0388 | 0.0107 | 0.0004 | 0.1548 | 0.1641 | 0.5209 | 0.562 |
| **DENMARK** | | | | | | | | | | | |
| | -0.31365 | -0.58089 | 8.464395 | 1.133063 | -4.71736 | -0.2654 | -0.4183 | -0.07164 | 0.188392 | 2.387982 | -1.41877 |
| **Std.Error** | 0.3925 | 0.4332 | 1.5814 | 1.0659 | 3.6544 | 0.103 | 0.1162 | 0.0891 | 0.1117 | 4.9777 | 1.3823 |
| **t value** | -0.8 | -1.34 | 5.35 | 1.06 | -1.29 | -2.58 | -3.6 | -0.8 | 1.69 | 0.48 | -1.03 |
| **P value** | 0.4315 | 0.1916 | <.0001 | 0.2988 | 0.2096 | 0.0168 | 0.0015 | 0.4295 | 0.1052 | 0.6362 | 0.3159 |
| **FINLAND** | | | | | | | | | | | |
| | -0.0173 | -0.01617 | 1.115542 | 1.280414 | -0.22434 | -0.5091 | -0.6448 | -1.06172 | 0.267071 | 0.004357 | -0.6786 |
| **Std.Error** | 0.0454 | 0.6111 | 0.3599 | 1.2017 | 0.2241 | 0.077 | 0.0937 | 4.7117 | 0.0874 | 0.054 | 0.405 |
| **t value** | -0.38 | -0.03 | 3.1 | 1.07 | -1 | -6.61 | -6.88 | -0.23 | 3.06 | 0.08 | -1.68 |
| **P value** | 0.7061 | 0.9791 | 0.0046 | 0.2977 | 0.3272 | <.0001 | <.0001 | 0.8237 | 0.0056 | 0.9364 | 0.1079 |
| **FRANCE** | | | | | | | | | | | |
| | 2.424437 | -21.5909 | 12.12706 | 1.408981 | -15.0248 | -0.0450 | -0.3155 | 0.021167 | 0.449566 | 0.444008 | -2.9029 |
| **Std.Error** | 1.7995 | 11.0406 | 4.1142 | 0.3074 | 3.6205 | 0.1037 | 0.1074 | 0.0239 | 0.124 | 0.2848 | 1.4327 |
| **t value** | 1.35 | -1.96 | 2.95 | 4.58 | -4.15 | -0.43 | -2.94 | 0.89 | 3.63 | 1.56 | -2.03 |
| **P value** | 0.1895 | 0.0613 | 0.0067 | 0.0001 | 0.0004 | 0.6678 | 0.0074 | 0.3847 | 0.0014 | 0.1332 | 0.0531 |
| **GERMANY** | | | | | | | | | | | |
| | 0.927956 | -20.7089 | 42.55744 | 0.150583 | -0.33696 | -0.3569 | -0.5641 | -0.12745 | 0.548922 | 4.955551 | -0.08232 |
| **Std.Error** | 0.7515 | 5.0049 | 9.0345 | 0.0604 | 0.5604 | 0.0899 | 0.1026 | 0.0569 | 0.1124 | 6.4081 | 0.2506 |
| **t value** | 1.23 | -4.14 | 4.71 | 2.49 | -0.6 | -3.97 | -5.5 | -2.24 | 4.88 | 0.77 | -0.33 |
| **P value** | 0.2279 | 0.0003 | <.0001 | 0.0203 | 0.5535 | 0.0006 | <.0001 | 0.0351 | <.0001 | 0.4476 | 0.7456 |

(Table Continued)

(Table Continued)

| BARLEY | lnworldp c3 | lnexpr c4 | lnexrt c5 | mref c6 | aref c7 | d1 | lndmpr d2 | lnworldp d3 | lnexrt d4 | lnimpl d5 | mref d6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **AUSTRIA** | | | | | | | | | | | |
| | 0.196192 | 0.056955 | 0.08647 | -0.38999 | -0.60601 | 0.813441 | 11.79889 | -0.5748 | -0.44658 | -0.59453 | 0.015993 |
| **Std.Error** | 1.2481 | 0.1288 | 0.843 | 0.4651 | 0.8026 | 1.3153 | 5.8152 | 0.4443 | 0.7817 | 0.2934 | 0.3719 |
| **t value** | 0.16 | 0.44 | 0.1 | -0.84 | -0.76 | 0.62 | 2.03 | -1.29 | -0.57 | -2.03 | 0.04 |
| **P value** | 0.8765 | 0.6627 | 0.9192 | 0.4108 | 0.4582 | 0.5429 | 0.0553 | 0.2098 | 0.5739 | 0.0556 | 0.9661 |
| **BELGIUM** | | | | | | | | | | | |
| | 0.264924 | 0.030132 | 0.122481 | -0.0439 | -1.05699 | 5.205436 | 0.266981 | -0.01559 | 0.475066 | 0.118819 | 0.26357 |
| **Std.Error** | 0.6338 | 0.0858 | 1.9262 | 0.7731 | 0.8409 | 6.9672 | 1.095 | 0.4155 | 1.0492 | 0.1691 | 0.3389 |
| **t value** | 0.42 | 0.35 | 0.06 | -0.06 | -1.26 | 0.75 | 0.24 | -0.04 | 0.45 | 0.7 | 0.78 |
| **P value** | 0.68 | 0.7288 | 0.9499 | 0.9552 | 0.2219 | 0.4633 | 0.8097 | 0.9704 | 0.6554 | 0.49 | 0.4454 |
| **DENMARK** | | | | | | | | | | | |
| | 0.316597 | 0.024098 | 0.135118 | -0.30703 | -0.02813 | 1.759472 | 1.578654 | -2.51348 | 0.225419 | 0.138968 | 1.818183 |
| **Std.Error** | 0.3243 | 0.0734 | 0.6565 | 0.2777 | 0.5128 | 1.9812 | 0.9155 | 14.8702 | 1.9988 | 0.7165 | 0.7637 |
| **t value** | 0.98 | 0.33 | 0.21 | -1.11 | -0.05 | 0.89 | 1.72 | -0.17 | 0.11 | 0.19 | 2.38 |
| **P value** | 0.3396 | 0.7457 | 0.8388 | 0.2808 | 0.9567 | 0.3846 | 0.0993 | 0.8674 | 0.9113 | 0.8481 | 0.0268 |
| **FINLAND** | | | | | | | | | | | |
| | 0.157192 | 9.808029 | 7.699251 | -0.80367 | -1.15516 | 1.258591 | 18.47824 | -0.14763 | -0.05673 | -0.61276 | -2.00243 |
| **Std.Error** | 0.8557 | 3.2903 | 2.1562 | 0.2351 | 0.4542 | 1.8696 | 9.7962 | 0.8104 | 1.1596 | 0.5397 | 0.7411 |
| **t value** | 0.18 | 2.98 | 3.57 | -3.42 | -2.54 | 0.67 | 1.89 | -0.18 | -0.05 | -1.14 | -2.7 |
| **P value** | 0.8559 | 0.0069 | 0.0017 | 0.0025 | 0.0185 | 0.5082 | 0.0732 | 0.8572 | 0.9614 | 0.269 | 0.0134 |
| **FRANCE** | | | | | | | | | | | |
| | 0.060204 | 6.998538 | 0.052618 | -0.77881 | -0.14939 | 12.43933 | 0.745349 | -0.48146 | -1.86516 | -0.45733 | -0.34193 |
| **Std.Error** | 0.1444 | 3.4979 | 0.2872 | 1.0653 | 0.6951 | 8.2846 | 1.1825 | 0.5065 | 1.1956 | 0.3918 | 0.45 |
| **t value** | 0.42 | 2 | 0.18 | -0.73 | -0.21 | 1.5 | 0.63 | -0.95 | -1.56 | -1.17 | -0.76 |
| **P value** | 0.6807 | 0.0574 | 0.8563 | 0.4724 | 0.8318 | 0.1481 | 0.5353 | 0.3527 | 0.1337 | 0.2562 | 0.4558 |
| **GERMANY** | | | | | | | | | | | |
| | 0.267498 | 0.150347 | 1.50594 | -0.07321 | -1.06165 | 17.10799 | 0.370322 | 0.194958 | -0.65761 | -0.03358 | 0.192499 |
| **Std.Error** | 0.388 | 0.08 | 0.5059 | 0.4434 | 0.8748 | 3.2509 | 0.2717 | 0.1443 | 0.5009 | 0.0917 | 0.1276 |
| **t value** | 0.69 | 1.88 | 2.98 | -0.17 | -1.21 | 5.26 | 1.36 | 1.35 | -1.31 | -0.37 | 1.51 |
| **P value** | 0.4978 | 0.0734 | 0.007 | 0.8704 | 0.2378 | <.0001 | 0.1873 | 0.1911 | 0.2034 | 0.718 | 0.1464 |

(Table Continued)

(Table Continued)

| BARLEY | aref d7 | lngdp d8 | e1 | lndmpr e2 | lnprodr e3 | mref e4 | aref e5 | lngdp e6 |
|---|---|---|---|---|---|---|---|---|
| **AUSTRIA** | | | | | | | | |
| | -0.37142 | 0.610011 | -0.0641 | 7.01113 | 0.00379 | -0.1872 | -0.43632 | 0.039529 |
| **Std.Error** | 0.732 | 0.5132 | 0.1576 | 0.6098 | 0.0272 | 0.0866 | 0.1242 | 0.093 |
| **t value** | -0.51 | 1.19 | -0.41 | 11.5 | 0.14 | -2.16 | -3.51 | 0.42 |
| **P value** | 0.6172 | 0.2479 | 0.6879 | <.0001 | 0.8904 | 0.0413 | 0.0019 | 0.6748 |
| **BELGIUM** | | | | | | | | |
| | -0.20765 | -0.10857 | -0.0708 | 8.851073 | 3.20714 | -0.4068 | -0.59306 | -0.16092 |
| **Std.Error** | 0.4756 | 0.1509 | 0.1647 | 0.9919 | 0.7652 | 0.1 | 0.1424 | 0.1058 |
| **t value** | -0.44 | -0.72 | -0.43 | 8.92 | 4.19 | -4.07 | -4.16 | -1.52 |
| **P value** | 0.6668 | 0.4797 | 0.671 | <.0001 | 0.0003 | 0.0005 | 0.0004 | 0.1419 |
| **DENMARK** | | | | | | | | |
| | 3.071425 | -1.67083 | -0.0402 | 10.51023 | 0.039803 | -0.3151 | -0.29006 | -0.09922 |
| **Std.Error** | 1.4345 | 0.6573 | 0.1585 | 0.7802 | 0.1018 | 0.0864 | 0.1226 | 0.085 |
| **t value** | 2.14 | -2.54 | -0.25 | 13.47 | 0.39 | -3.65 | -2.37 | -1.17 |
| **P value** | 0.0442 | 0.019 | 0.8019 | <.0001 | 0.6995 | 0.0013 | 0.0267 | 0.2552 |
| **FINLAND** | | | | | | | | |
| | -1.90225 | -0.55582 | -0.3780 | 7.370558 | 3.047345 | -0.1760 | -0.20247 | 0.139837 |
| **Std.Error** | 1.5067 | 0.5009 | 0.2292 | 0.9178 | 1.1605 | 0.1447 | 0.2097 | 0.1011 |
| **t value** | -1.26 | -1.11 | -1.65 | 8.03 | 2.63 | -1.22 | -0.97 | 1.38 |
| **P value** | 0.2206 | 0.2797 | 0.1127 | <.0001 | 0.0143 | 0.236 | 0.3444 | 0.1799 |
| **FRANCE** | | | | | | | | |
| | -1.4062 | 0.602387 | -0.02618 | 0.12323 | -0.0216 | -0.0731 | -0.0676 | 9.404404 |
| **Std.Error** | 0.7665 | 0.3921 | 0.0668 | 0.1386 | 0.0247 | 0.0704 | 0.032 | 0.7796 |
| **t value** | -1.83 | 1.54 | -0.39 | 0.89 | -0.88 | -1.04 | -2.11 | 12.06 |
| **P value** | 0.0808 | 0.1394 | 0.6989 | 0.3832 | 0.3901 | 0.3095 | 0.0459 | <.0001 |
| **GERMANY** | | | | | | | | |
| | 0.343831 | -0.78582 | -0.4412 | 4.821702 | 8.958379 | -0.1291 | -0.22878 | 0.423285 |
| **Std.Error** | 0.2493 | 0.1958 | 0.1791 | 0.9855 | 4.6175 | 0.1055 | 0.1422 | 0.1036 |
| **t value** | 1.38 | -4.01 | -2.46 | 4.89 | 1.94 | -1.22 | -1.61 | 4.09 |
| **P value** | 0.1824 | 0.0006 | 0.0217 | <.0001 | 0.0647 | 0.2335 | 0.1213 | 0.0005 |

(Table Continued)

(Table Continued)

| BARLEY | a1 | lndmpr a2 | (lnprod+lnimpq)/lnconp a3 | b1 | lnconp b2 | mref b3 | aref b4 | lnopstk b5 | lngdp b6 | c1 | lndmpr c2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **GREECE** | | | | | | | | | | | |
| | 0.030881 | -0.6133 | 8.5081 | 0.039946 | -0.5452 | -0.0311 | -0.0483 | -0.24325 | 1.82211 | 58.4581 | -6.0589 |
| **Std.Error** | 0.4012 | 0.2101 | 2.4184 | 0.024 | 0.1814 | 0.1805 | 0.2313 | 0.0598 | 0.3635 | 23.8104 | 3.8889 |
| **t value** | 0.08 | -2.92 | 3.52 | 1.67 | -3.01 | -0.17 | -0.21 | -4.07 | 5.01 | 2.46 | -1.56 |
| **P value** | 0.9393 | 0.0072 | 0.0016 | 0.1091 | 0.0063 | 0.8647 | 0.8364 | 0.0005 | <.0001 | 0.0225 | 0.1335 |
| **IRELAND** | | | | | | | | | | | |
| | 1.27861 | -0.3549 | 4.03023 | -0.0235 | -12.262 | -0.2382 | -0.4603 | -0.22652 | 1.3934 | 6.14455 | -0.1047 |
| **Std.Error** | 1.0946 | 0.1155 | 1.6991 | 0.0342 | 6.5391 | 0.4225 | 0.2897 | 0.1714 | 0.5752 | 4.3653 | 0.1187 |
| **t value** | 1.17 | -3.07 | 2.37 | -0.69 | -1.88 | -0.56 | -1.59 | -1.32 | 2.42 | 1.41 | -0.88 |
| **P value** | 0.2534 | 0.0049 | 0.0254 | 0.4983 | 0.0735 | 0.5783 | 0.1258 | 0.1994 | 0.0237 | 0.1732 | 0.3871 |
| **ITALY** | | | | | | | | | | | |
| | 7.40085 | -0.911 | 0.81264 | 0.07160 | -0.9624 | -0.3625 | -0.4723 | -0.14999 | 0.11714 | -14.839 | -3.3099 |
| **Std.Error** | 6.8493 | 3.7033 | 0.3182 | 0.4859 | 3.2442 | 0.1361 | 0.1536 | 0.0983 | 0.0583 | 10.4328 | 25.5605 |
| **t value** | 1.08 | -0.25 | 2.55 | 0.15 | -0.3 | -2.66 | -3.07 | -1.53 | 2.01 | -1.42 | -0.13 |
| **P value** | 0.2898 | 0.8076 | 0.0169 | 0.8841 | 0.7694 | 0.0139 | 0.0054 | 0.1406 | 0.0566 | 0.1689 | 0.8981 |
| **NETHERLAND** | | | | | | | | | | | |
| | -0.04216 | -0.6958 | 0.40520 | 0.14047 | -0.7005 | -0.2700 | -0.4375 | 0.10707 | 0.29308 | 2.83211 | -0.2963 |
| **Std.Error** | 0.0689 | 0.5819 | 0.227 | 0.1291 | 0.887 | 0.0723 | 0.0935 | 0.1833 | 0.1111 | 6.4757 | 1.1115 |
| **t value** | -0.61 | -1.2 | 1.79 | 1.09 | -0.79 | -3.74 | -4.68 | 0.58 | 2.64 | 0.44 | -0.27 |
| **P value** | 0.5468 | 0.2426 | 0.0859 | 0.2879 | 0.4378 | 0.0011 | 0.0001 | 0.5647 | 0.0147 | 0.6661 | 0.7922 |
| **PORTUGAL** | | | | | | | | | | | |
| | -1.26529 | -0.6994 | 3.68331 | 0.30173 | -1.1910 | -0.3181 | -0.3856 | -0.08261 | 3.83337 | 34.9633 | -2.9941 |
| **Std.Error** | 1.4994 | 0.1829 | 0.9204 | 0.1895 | 0.2287 | 0.1479 | 0.1945 | 0.0752 | 1.0823 | 15.3472 | 2.1932 |
| **t value** | -0.84 | -3.82 | 4 | 1.59 | -5.21 | -2.15 | -1.98 | -1.1 | 3.54 | 2.28 | -1.37 |
| **P value** | 0.4064 | 0.0007 | 0.0005 | 0.125 | <.0001 | 0.0422 | 0.0595 | 0.2832 | 0.0017 | 0.0328 | 0.186 |
| **SPAIN** | | | | | | | | | | | |
| | -0.01762 | -0.2693 | 0.63943 | 0.123854 | -0.7849 | -0.4563 | -0.5591 | 0.048767 | 5.526637 | 0.260911 | -0.8082 |
| **Std.Error** | 0.0464 | 1.1008 | 0.6114 | 0.0932 | 0.2599 | 0.1117 | 0.136 | 0.0335 | 2.2299 | 0.2712 | 3.2138 |
| **t value** | -0.38 | -0.24 | 1.05 | 1.33 | -3.02 | -4.09 | -4.11 | 1.46 | 2.48 | 0.96 | -0.25 |
| **P value** | 0.7075 | 0.8086 | 0.3052 | 0.1969 | 0.0061 | 0.0005 | 0.0004 | 0.1591 | 0.021 | 0.3465 | 0.8038 |

(Table Continued)

(Table Continued)

| BARLEY | lnworldp c3 | lnexpr c4 | lnexrt c5 | mref c6 | aref c7 | d1 | lndmpr d2 | lnworldp d3 | lnexrt d4 | lnimpl d5 | mref d6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **GREECE** | | | | | | | | | | | |
| | 0.113201 | 0.405421 | 1.905376 | -0.38909 | -6.96919 | -3.35983 | 8.724489 | -0.76882 | -0.80102 | -0.11909 | -0.882 |
| **Std.Error** | 0.2948 | 0.2563 | 2.2709 | 1.3478 | 3.4005 | 10.8728 | 3.0559 | 0.5198 | 1.2054 | 0.3931 | 0.4073 |
| **t value** | 0.38 | 1.58 | 0.84 | -0.29 | -2.05 | -0.31 | 2.86 | -1.48 | -0.66 | -0.3 | -2.17 |
| **P value** | 0.7046 | 0.128 | 0.4105 | 0.7755 | 0.0525 | 0.7604 | 0.0095 | 0.1539 | 0.5136 | 0.7649 | 0.042 |
| **IRELAND** | | | | | | | | | | | |
| | 0.061872 | 1.805927 | 2.849256 | -0.75441 | -0.92916 | 0.66334 | 0.369497 | 0.901059 | -6.39726 | -0.05002 | 0.649848 |
| **Std.Error** | 0.3311 | 0.7411 | 1.2054 | 0.2435 | 0.4823 | 1.717 | 0.2176 | 0.8022 | 14.5114 | 0.6233 | 0.5167 |
| **t value** | 0.19 | 2.44 | 2.36 | -3.1 | -1.93 | 0.39 | 1.7 | 1.12 | -0.44 | -0.08 | 1.26 |
| **P value** | 0.8535 | 0.0234 | 0.0273 | 0.0052 | 0.0671 | 0.7031 | 0.1043 | 0.274 | 0.6638 | 0.9368 | 0.2223 |
| **ITALY** | | | | | | | | | | | |
| | 0.632627 | 6.8514 | 4.965642 | -0.06446 | -0.06093 | 1.893847 | 1.523125 | -0.09071 | -0.91068 | -0.4983 | 0.037587 |
| **Std.Error** | 0.4462 | 1.9841 | 1.6967 | 0.1049 | 0.4599 | 0.566 | 0.5036 | 0.2289 | 1.1966 | 0.1937 | 0.2026 |
| **t value** | 1.42 | 3.45 | 2.93 | -0.61 | -0.13 | 3.35 | 3.02 | -0.4 | -0.76 | -2.57 | 0.19 |
| **P value** | 0.1703 | 0.0023 | 0.0078 | 0.5452 | 0.8958 | 0.0031 | 0.0064 | 0.6959 | 0.4551 | 0.0178 | 0.8546 |
| **N.LAND** | | | | | | | | | | | |
| | 0.217688 | 0.191344 | 0.865173 | -1.94923 | -0.86443 | 0.213972 | 0.627926 | 0.552032 | 0.89936 | -13.0704 | 0.080479 |
| **Std.Error** | 0.4016 | 0.1367 | 0.4979 | 1.5265 | 1.0815 | 0.1137 | 0.4463 | 0.1776 | 0.5576 | 2.9761 | 0.1597 |
| **t value** | 0.54 | 1.4 | 1.74 | -1.28 | -0.8 | 1.88 | 1.41 | 3.11 | 1.61 | -4.39 | 0.5 |
| **P value** | 0.5932 | 0.1755 | 0.0963 | 0.2149 | 0.4327 | 0.0739 | 0.1741 | 0.0053 | 0.1217 | 0.0003 | 0.6195 |
| **PORTUGAL** | | | | | | | | | | | |
| | 0.091803 | 1.126006 | 1.344853 | -0.40229 | -4.15606 | 0.827595 | 0.475715 | -0.08864 | -3.21257 | -0.25911 | 0.199995 |
| **Std.Error** | 0.1246 | 0.9919 | 1.5699 | 0.3335 | 1.6671 | 0.4232 | 0.568 | 0.2946 | 5.6615 | 0.209 | 0.2541 |
| **t value** | 0.74 | 1.14 | 0.86 | -1.21 | -2.49 | 1.96 | 0.84 | -0.3 | -0.57 | -1.24 | 0.79 |
| **P value** | 0.4689 | 0.2685 | 0.4009 | 0.2406 | 0.0207 | 0.064 | 0.4117 | 0.7665 | 0.5764 | 0.2288 | 0.44 |
| **SPAIN** | | | | | | | | | | | |
| | 1.119345 | 0.144566 | 0.06257 | -0.45256 | -1.69814 | 53.0176 | 0.484259 | -0.60993 | -0.76764 | -1.38253 | -2.11257 |
| **Std.Error** | 2.0595 | 0.231 | 1.6031 | 2.5 | 3.2895 | 19.4943 | 1.02 | 1.4191 | 2.2213 | 1.083 | 1.8803 |
| **t value** | 0.54 | 0.63 | 0.04 | -0.18 | -0.52 | 2.72 | 0.47 | -0.43 | -0.35 | -1.28 | -1.12 |
| **P value** | 0.5923 | 0.5379 | 0.9692 | 0.858 | 0.6108 | 0.0128 | 0.6399 | 0.6717 | 0.7331 | 0.2157 | 0.2739 |

(Table Continued)

(Table Continued)

| BARLEY | aref<br>d7 | lngdp<br>d8 | e1 | lndmpr<br>e2 | lnprodr<br>e3 | mref<br>e4 | aref<br>e5 | lngdp<br>e6 |
|---|---|---|---|---|---|---|---|---|
| **GREECE** | | | | | | | | |
| | -1.06488 | 2.02049 | -0.20107 | 0.367623 | 0.048331 | -0.0142 | -0.32497 | 8.561123 |
| **Std.Error** | 0.6002 | 0.6762 | 0.148 | 0.1069 | 0.1233 | 0.047 | 0.1764 | 1.7594 |
| **t value** | -1.77 | 2.99 | -1.36 | 3.44 | 0.39 | -0.3 | -1.84 | 4.87 |
| **P value** | 0.0905 | 0.007 | 0.1874 | 0.0022 | 0.6986 | 0.7651 | 0.0783 | <.0001 |
| **IRELAND** | | | | | | | | |
| | 0.338414 | -0.12636 | -0.04945 | 0.141918 | 5.655948 | -0.16231 | -0.45181 | 0.138311 |
| **Std.Error** | 1.1857 | 0.3976 | 0.0281 | 0.0342 | 0.6382 | 0.0915 | 0.1326 | 0.06 |
| **t value** | 0.29 | -0.32 | -1.76 | 4.15 | 8.86 | -1.77 | -3.41 | 2.3 |
| **P value** | 0.7781 | 0.7538 | 0.092 | 0.0004 | <.0001 | 0.0893 | 0.0024 | 0.0305 |
| **ITALY** | | | | | | | | |
| | -0.28911 | -0.41626 | -0.55548 | 0.216356 | 7.248124 | -0.49856 | -0.88047 | 0.458208 |
| **Std.Error** | 0.4083 | 0.1418 | 0.1956 | 0.9454 | 1.7836 | 0.1229 | 0.1775 | 0.0828 |
| **t value** | -0.71 | -2.94 | -2.84 | 0.23 | 4.06 | -4.06 | -4.96 | 5.54 |
| **P value** | 0.4867 | 0.0079 | 0.0093 | 0.821 | 0.0004 | 0.0005 | <.0001 | <.0001 |
| **NETHERLAND** | | | | | | | | |
| | 0.036207 | 0.623232 | 0.063143 | 5.295975 | -0.01268 | -0.14577 | -0.34461 | 0.151267 |
| **Std.Error** | 0.3036 | 0.2282 | 0.2914 | 1.6615 | 0.0577 | 0.1846 | 0.4015 | 0.2311 |
| **t value** | 0.12 | 2.73 | 0.22 | 3.19 | -0.22 | -0.79 | -0.86 | 0.65 |
| **P value** | 0.9062 | 0.0125 | 0.8304 | 0.0041 | 0.828 | 0.4377 | 0.3996 | 0.5192 |
| **PORTUGAL** | | | | | | | | |
| | 0.06935 | 0.709413 | -0.27466 | 3.290815 | 0.000838 | -0.57458 | -1.64057 | 0.104054 |
| **Std.Error** | 0.3756 | 0.2818 | 0.3636 | 3.294 | 0.1418 | 0.3536 | 0.4992 | 0.2966 |
| **t value** | 0.18 | 2.52 | -0.76 | 1 | 0.01 | -1.62 | -3.29 | 0.35 |
| **P value** | 0.8553 | 0.02 | 0.4577 | 0.3282 | 0.9953 | 0.1178 | 0.0032 | 0.7289 |
| **SPAIN** | | | | | | | | |
| | 0.179343 | -1.6604 | -0.7028 | 5.526383 | 4.26258 | -0.5163 | -0.70221 | 0.332862 |
| **Std.Error** | 2.1637 | 0.8935 | 0.2617 | 1.4864 | 1.6728 | 0.1887 | 0.2865 | 0.1349 |
| **t value** | 0.08 | -1.86 | -2.69 | 3.72 | 2.55 | -2.74 | -2.45 | 2.47 |
| **P value** | 0.9347 | 0.0772 | 0.0132 | 0.0011 | 0.0171 | 0.0118 | 0.0223 | 0.0215 |

(Table Continued)

(Table Continued)

| BARLEY | a1 | lndmpr a2 | (lnprod+lnimpq)/lnconp a3 | b1 | lnconp b2 | mref b3 | aref b4 | lnopstk b5 | lngdp b6 | c1 | lndmpr c2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWEDEN** | | | | | | | | | | | |
| | 0.351644 | -0.11438 | 4.520039 | -0.00592 | -0.6514 | -0.7453 | -1.5157 | -0.2344 | 0.23578 | 0.922291 | -0.817 |
| **Std.Error** | 0.3613 | 0.9141 | 2.2954 | 0.0313 | 0.3376 | 0.1555 | 0.2503 | 0.1155 | 0.1157 | 5.1517 | 0.4514 |
| **t value** | 0.97 | -0.13 | 1.97 | -0.19 | -1.93 | -4.79 | -6.06 | -2.03 | 2.04 | 0.18 | -1.81 |
| **P value** | 0.3394 | 0.9014 | 0.0597 | 0.8518 | 0.0661 | <.0001 | <.0001 | 0.0541 | 0.0531 | 0.8596 | 0.084 |
| **UK** | | | | | | | | | | | |
| | 1.175374 | -0.62639 | 8.44064 | -0.0401 | -0.2809 | -0.427 | -0.5821 | -0.2341 | 0.133258 | 1.284587 | -4.03651 |
| **Std.Error** | 0.8737 | 0.3832 | 2.9754 | 0.0337 | 0.4307 | 0.0975 | 0.1418 | 0.0933 | 0.1425 | 0.6106 | 4.5594 |
| **t value** | 1.35 | -1.63 | 2.84 | -1.19 | -0.65 | -4.38 | -4.11 | -2.51 | 0.93 | 2.1 | -0.89 |
| **P value** | 0.1902 | 0.1142 | 0.0087 | 0.2452 | 0.5208 | 0.0002 | 0.0004 | 0.0196 | 0.3595 | 0.047 | 0.3856 |

| BARLEY | lnworldp c3 | lnexpr c4 | lnexrt c5 | mref c6 | aref c7 | d1 | lndmpr d2 | lnworldp d3 | lnexrt d4 | lnimpl d5 | mref d6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWEDEN** | | | | | | | | | | | |
| | 0.541173 | 0.205537 | 0.77236 | -0.15813 | -0.51487 | 5.179318 | 1.558499 | -0.15559 | -1.4444 | -0.53081 | -0.8974 |
| **Std.Error** | 0.3911 | 0.1311 | 0.6835 | 0.3241 | 0.4952 | 12.3008 | 1.4645 | 0.8238 | 0.923 | 0.5915 | 0.6748 |
| **t value** | 1.38 | 1.57 | 1.13 | -0.49 | -1.04 | 0.42 | 1.06 | -0.19 | -1.56 | -0.9 | -1.33 |
| **P value** | 0.1803 | 0.1312 | 0.2707 | 0.6304 | 0.3097 | 0.678 | 0.2993 | 0.852 | 0.1325 | 0.3797 | 0.1978 |
| **UK** | | | | | | | | | | | |
| | 0.235995 | 0.204641 | 0.569414 | -0.08133 | -0.67493 | 8.314154 | 1.659006 | 0.452986 | -9.31126 | -6.238 | -1.2561 |
| **Std.Error** | 0.3338 | 0.1203 | 0.7718 | 0.3355 | 0.7122 | 10.7089 | 0.4889 | 0.6969 | 2.0332 | 1.1035 | 0.5517 |
| **t value** | 0.71 | 1.7 | 0.74 | -0.24 | -0.95 | 0.78 | 3.39 | 0.65 | -4.58 | -5.65 | -2.28 |
| **P value** | 0.487 | 0.103 | 0.4685 | 0.8107 | 0.3536 | 0.4462 | 0.0027 | 0.5228 | 0.0002 | <.0001 | 0.0334 |

**Table A1.4: Results from the Regression for Oats:**

| OATS | | lndmpr | (lnprod+lnimpq)/lnconp | lnconp | mref | aref | lnopstk | lngdp | | lndmpr |
|---|---|---|---|---|---|---|---|---|---|---|
| | a1 | a2 | a3 | b1 | b2 | b3 | b4 | b5 | b6 | c1 | c2 |
| **AUSTRIA** | | | | | | | | | | | |
| | -1.69989 | -3.18212 | 2.635512 | -0.43024 | -0.04876 | -1.71133 | -0.2369 | -0.9654 | 0.417915 | 3.936483 | -1.05165 |
| **Std.Error** | 1.3357 | 1.8677 | 0.1896 | 0.0996 | 0.1035 | 1.27 | 0.1842 | 1.3308 | 0.0949 | 10.3218 | 1.3844 |
| **t value** | -1.27 | -1.7 | 13.9 | -4.32 | -0.47 | -1.35 | -1.29 | -0.73 | 4.41 | 0.38 | -0.76 |
| **P value** | 0.2164 | 0.1004 | <.0001 | 0.0003 | 0.642 | 0.1894 | 0.211 | 0.4755 | 0.0002 | 0.7066 | 0.4555 |
| **BELGIUM** | | | | | | | | | | | |
| | -2.07426 | -0.28649 | 7.887401 | 0.230006 | -4.07858 | -0.17671 | -0.4207 | -0.01992 | 0.372807 | 46.95799 | -4.1141 |
| **Std.Error** | 1.4442 | 0.7049 | 2.9017 | 0.1758 | 2.8709 | 0.1208 | 0.1376 | 0.0512 | 0.1776 | 10.446 | 1.69 |
| **t value** | -1.44 | -0.41 | 2.72 | 1.31 | -1.42 | -1.46 | -3.06 | -0.39 | 2.1 | 4.5 | -2.43 |
| **P value** | 0.1629 | 0.6877 | 0.0115 | 0.2036 | 0.1688 | 0.1571 | 0.0056 | 0.7008 | 0.0469 | 0.0002 | 0.0235 |
| **DENMARK** | | | | | | | | | | | |
| | -0.28084 | -0.90837 | 8.010851 | 0.69787 | -1.22985 | -0.22159 | -0.5909 | -0.27775 | 0.182224 | -4.07335 | -0.53111 |
| **Std.Error** | 0.061 | 0.3198 | 1.485 | 1.8516 | 0.6616 | 0.12 | 0.1741 | 0.116 | 0.127 | 11.8647 | 1.5508 |
| **t value** | -4.6 | -2.84 | 5.39 | 0.38 | -1.86 | -1.85 | -3.4 | -2.39 | 1.43 | -0.34 | -0.34 |
| **P value** | 0.0001 | 0.0086 | <.0001 | 0.7097 | 0.0744 | 0.0778 | 0.0025 | 0.0252 | 0.1648 | 0.7346 | 0.7352 |
| **FRANCE** | | | | | | | | | | | |
| | 1.987687 | -1.19064 | 9.671903 | -0.87816 | -5.87622 | -0.07825 | -0.3791 | -0.04452 | 0.444918 | 0.318085 | -0.31876 |
| **Std.Error** | 1.3461 | 0.8048 | 2.9751 | 0.1473 | 2.7746 | 0.0976 | 0.1085 | 0.0306 | 0.13 | 0.7386 | 4.7751 |
| **t value** | 1.48 | -1.48 | 3.25 | -5.96 | -2.12 | -0.8 | -3.49 | -1.45 | 3.42 | 0.43 | -0.07 |
| **P value** | 0.1546 | 0.151 | 0.0032 | <.0001 | 0.0452 | 0.4307 | 0.002 | 0.1592 | 0.0023 | 0.6709 | 0.9474 |
| **GERMANY** | | | | | | | | | | | |
| | -0.01725 | -0.79481 | 0.715687 | -0.36601 | -8.0337 | -0.21482 | -0.3390 | -1.37268 | 0.496873 | 14.74924 | -2.24562 |
| **Std.Error** | 0.076 | 0.819 | 0.2849 | 0.2004 | 3.0542 | 0.1103 | 0.1538 | 0.6519 | 0.1301 | 3.4736 | 0.5528 |
| **t value** | -0.23 | -0.97 | 2.51 | -1.83 | -2.63 | -1.95 | -2.2 | -2.11 | 3.82 | 4.25 | -4.06 |
| **P value** | 0.8225 | 0.3408 | 0.0186 | 0.0808 | 0.015 | 0.0638 | 0.0378 | 0.045 | 0.0009 | 0.0003 | 0.0005 |
| **GREECE** | | | | | | | | | | | |
| | -0.19664 | -0.96138 | 2.920659 | -0.51682 | -1.03104 | -0.68624 | -0.8454 | -0.07364 | 0.948322 | 16.53406 | -3.15974 |
| **Std.Error** | 0.5673 | 0.3007 | 0.7336 | 0.0815 | 0.2051 | 0.231 | 0.2783 | 0.0534 | 0.2998 | 10.0413 | 1.4088 |
| **t value** | -0.35 | -3.2 | 3.98 | -6.34 | -5.03 | -2.97 | -3.04 | -1.38 | 3.16 | 1.65 | -2.24 |
| **P value** | 0.7322 | 0.0036 | 0.0005 | <.0001 | <.0001 | 0.0068 | 0.0058 | 0.1812 | 0.0043 | 0.1139 | 0.0353 |

(Table Continued)

(Table Continued)

| OATS | lnworldp c3 | lnexpr c4 | lnexrt c5 | mref c6 | aref c7 | d1 | lndmpr d2 | lnworldp d3 | lnexrt d4 | lnimpl d5 | mref d6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **AUSTRIA** | | | | | | | | | | | |
| | 0.545059 | 3.331959 | 0.24101 | -4.04989 | -4.01374 | 1.858215 | 1.717312 | -0.45505 | -0.03822 | -0.26941 | -2.33818 |
| **Std.Error** | 0.7734 | 7.5566 | 1.728 | 0.5747 | 0.9531 | 1.5491 | 0.9747 | 0.6041 | 0.2114 | 0.2827 | 0.4793 |
| **t value** | 0.7 | 0.44 | 0.14 | -7.05 | -4.21 | 1.2 | 1.76 | -0.75 | -0.18 | -0.95 | -4.88 |
| **P value** | 0.4884 | 0.6638 | 0.8903 | <.0001 | 0.0004 | 0.2437 | 0.0926 | 0.4596 | 0.8582 | 0.3514 | <.0001 |
| **BELGIUM** | | | | | | | | | | | |
| | 0.158905 | 0.031606 | 1.102912 | -0.75817 | -0.69173 | 7.287716 | 0.170065 | -0.94932 | -0.33597 | -1.95294 | -0.2636 |
| **Std.Error** | 0.058 | 0.521 | 1.0107 | 0.5527 | 0.9669 | 2.5528 | 0.3081 | 0.7817 | 0.381 | 0.5901 | 0.1355 |
| **t value** | 2.74 | 0.06 | 1.09 | -1.37 | -0.72 | 2.85 | 0.55 | -1.21 | -0.88 | -3.31 | -1.95 |
| **P value** | 0.0116 | 0.9522 | 0.287 | 0.184 | 0.4819 | 0.0095 | 0.5867 | 0.2374 | 0.3879 | 0.0032 | 0.0653 |
| **DENMARK** | | | | | | | | | | | |
| | 0.483697 | 0.019141 | 0.740263 | -0.11809 | -5.37706 | 6.641861 | 0.309019 | -0.24932 | -1.15958 | -0.21148 | 0.511467 |
| **Std.Error** | 0.824 | 0.2291 | 1.5444 | 0.2447 | 1.748 | 6.5776 | 0.2544 | 0.513 | 0.9908 | 0.9087 | 0.3742 |
| **t value** | 0.59 | 0.08 | 0.48 | -0.48 | -3.08 | 1.01 | 1.21 | -0.49 | -1.17 | -0.23 | 1.37 |
| **P value** | 0.5632 | 0.9342 | 0.6364 | 0.6342 | 0.0055 | 0.3241 | 0.238 | 0.632 | 0.255 | 0.8182 | 0.1861 |
| **FRANCE** | | | | | | | | | | | |
| | 0.296429 | 0.130415 | 0.01093 | -0.64495 | -0.75907 | 0.335074 | 0.886038 | -3.20295 | -1.55826 | -0.48675 | 0.057101 |
| **Std.Error** | 0.3657 | 0.0991 | 0.1136 | 0.2514 | 0.486 | 0.8244 | 1.4851 | 9.3577 | 0.7943 | 0.4371 | 0.6174 |
| **t value** | 0.81 | 1.32 | 0.1 | -2.57 | -1.56 | 0.41 | 0.6 | -0.34 | -1.96 | -1.11 | 0.09 |
| **P value** | 0.4263 | 0.2016 | 0.9242 | 0.0177 | 0.1326 | 0.6885 | 0.5571 | 0.7355 | 0.0626 | 0.278 | 0.9272 |
| **GERMANY** | | | | | | | | | | | |
| | 0.015036 | 5.321969 | 0.249684 | -0.07343 | -0.32606 | 33.37069 | 0.030616 | 0.349185 | -1.96968 | -0.04706 | 0.221755 |
| **Std.Error** | 0.2365 | 1.6635 | 0.1671 | 0.1792 | 0.2892 | 6.5826 | 0.5783 | 0.2903 | 0.9253 | 0.1423 | 0.2693 |
| **t value** | 0.06 | 3.2 | 1.49 | -0.41 | -1.13 | 5.07 | 0.05 | 1.2 | -2.13 | -0.33 | 0.82 |
| **P value** | 0.9499 | 0.0036 | 0.1487 | 0.6859 | 0.2717 | <.0001 | 0.9583 | 0.2425 | 0.0453 | 0.744 | 0.4195 |
| **GREECE** | | | | | | | | | | | |
| | 0.107544 | 0.165082 | 0.402443 | -1.82636 | -2.98668 | -10.2463 | 0.355851 | 0.692221 | -1.68185 | -2.21206 | 0.120659 |
| **Std.Error** | 0.1756 | 0.1971 | 0.4382 | 0.6577 | 0.9919 | 21.5259 | 0.6659 | 1.2985 | 2.4679 | 2.7191 | 1.0922 |
| **t value** | 0.61 | 0.84 | 0.92 | -2.78 | -3.01 | -0.48 | 0.53 | 0.53 | -0.68 | -0.81 | 0.11 |
| **P value** | 0.5468 | 0.4112 | 0.3668 | 0.011 | 0.0064 | 0.639 | 0.5987 | 0.5996 | 0.503 | 0.425 | 0.9131 |

(Table Continued)

(Table Continued)

| OATS | aref d7 | lngdp d8 | e1 | lndmpr e2 | Lnprodr e3 | mref e4 | aref e5 | lngdp e6 |
|---|---|---|---|---|---|---|---|---|
| **AUSTRIA** | | | | | | | | |
| | -2.10143 | 0.12086 | -0.0052 | 0.234415 | 8.14184 | -0.31045 | -0.54747 | 0.026587 |
| **Std.Error** | 0.7792 | 0.6527 | 0.018 | 0.0921 | 0.4797 | 0.0545 | 0.0876 | 0.0887 |
| **t value** | -2.7 | 0.19 | -0.29 | 2.55 | 16.97 | -5.69 | -6.25 | 0.3 |
| **P value** | 0.0135 | 0.8549 | 0.7724 | 0.018 | <.0001 | <.0001 | <.0001 | 0.7674 |
| **BELGIUM** | | | | | | | | |
| | -0.31277 | 0.672849 | 15.28749 | 0.403549 | 3.714839 | -0.01024 | -0.11853 | 0.446546 |
| **Std.Error** | 0.1786 | 0.2235 | 1.4654 | 0.2358 | 1.6048 | 0.1351 | 0.1949 | 0.1649 |
| **t value** | -1.75 | 3.01 | 10.43 | 1.71 | 2.31 | -0.08 | -0.61 | 2.71 |
| **P value** | 0.0945 | 0.0067 | <.0001 | 0.1004 | 0.0299 | 0.9402 | 0.5491 | 0.0126 |
| **DENMARK** | | | | | | | | |
| | -0.1255 | 1.180291 | 10.01129 | 0.283671 | 0.824126 | -9.30E06 | -0.086 | 0.45372 |
| **Std.Error** | 0.4085 | 0.6145 | 2.0807 | 0.1892 | 0.2934 | 0.3548 | 0.0632 | 0.2027 |
| **t value** | -0.31 | 1.92 | 4.81 | 1.5 | 2.81 | 0 | -1.36 | 2.24 |
| **P value** | 0.7617 | 0.0684 | <.0001 | 0.1474 | 0.01 | 1 | 0.186 | 0.0352 |
| **FRANCE** | | | | | | | | |
| | -0.88427 | 0.017631 | 14.17165 | 0.337402 | 0.10569 | -0.23531 | -0.24725 | 7.837047 |
| **Std.Error** | 1.0169 | 0.6782 | 0.9794 | 0.1857 | 0.156 | 0.0816 | 0.1293 | 2.5584 |
| **t value** | -0.87 | 0.03 | 14.47 | 1.82 | 0.68 | -2.88 | -1.91 | 3.06 |
| **P value** | 0.3943 | 0.9795 | <.0001 | 0.0823 | 0.5047 | 0.0084 | 0.0685 | 0.0055 |
| **GERMANY** | | | | | | | | |
| | -1.92778 | 0.892139 | 14.14569 | 0.295054 | 0.001198 | -0.1123 | -0.33421 | 0.122121 |
| **Std.Error** | 0.4148 | 0.4172 | 1.0532 | 0.1769 | 0.099 | 0.0288 | 0.138 | 0.1756 |
| **t value** | -4.65 | 2.14 | 13.43 | 1.67 | 0.01 | -3.9 | -2.42 | 0.7 |
| **P value** | 0.0001 | 0.0444 | <.0001 | 0.1088 | 0.9905 | 0.0007 | 0.0237 | 0.4938 |
| **GREECE** | | | | | | | | |
| | 1.506867 | 0.611305 | -0.079 | 0.142544 | 0.287824 | -0.015 | -0.0893 | 0.061719 |
| **Std.Error** | 1.5792 | 1.4108 | 0.0425 | 0.0999 | 0.1082 | 0.0379 | 0.0251 | 0.1348 |
| **t value** | 0.95 | 0.43 | -1.86 | 1.43 | 2.66 | -0.4 | -3.56 | 0.46 |
| **P value** | 0.3508 | 0.6692 | 0.0754 | 0.167 | 0.014 | 0.6948 | 0.0017 | 0.6514 |

(Table Continued)

(Table Continued)

| OATS | | lndmpr | (lnprod+lnimpq)/lnconp | lnconp | mref | aref | lnopstk | lngdp | | lndmpr |
|---|---|---|---|---|---|---|---|---|---|---|
| | a1 | a2 | a3 | b1 | b2 | b3 | b4 | b5 | b6 | c1 | c2 |
| **IRELAND** | | | | | | | | | | | |
| | 0.036487 | -1.11447 | 9.980733 | 5.413997 | -0.14862 | -0.1671 | -0.4782 | -0.08823 | 0.08281 | -15.2515 | -0.09833 |
| **Std.Error** | 0.2194 | 0.7743 | 3.6089 | 1.7069 | 0.2082 | 0.1257 | 0.181 | 0.0585 | 0.106 | 14.5343 | 0.1438 |
| **t value** | 0.17 | -1.44 | 2.77 | 3.17 | -0.71 | -1.33 | -2.64 | -1.51 | 0.78 | -1.05 | -0.68 |
| **P value** | 0.8695 | 0.162 | 0.0103 | 0.0043 | 0.4825 | 0.1967 | 0.0146 | 0.1449 | 0.4425 | 0.3054 | 0.5011 |
| **ITALY** | | | | | | | | | | | |
| | 0.258897 | -1.70538 | 6.217453 | -4.05023 | -0.16679 | -0.3837 | -0.6660 | -0.13297 | 0.772416 | 3.068685 | -0.38052 |
| **Std.Error** | 0.1915 | 1.353 | 2.4284 | 3.0243 | 0.1057 | 0.1014 | 0.1182 | 0.0842 | 0.3365 | 12.1542 | 1.1703 |
| **t value** | 1.35 | -1.26 | 2.56 | -1.34 | -1.58 | -3.79 | -5.63 | -1.58 | 2.3 | 0.25 | -0.33 |
| **P value** | 0.188 | 0.2187 | 0.0166 | 0.1936 | 0.1282 | 0.001 | <.0001 | 0.1278 | 0.0311 | 0.803 | 0.7481 |
| **NETHERLANDS** | | | | | | | | | | | |
| | 0.214548 | -15.9312 | 3.165688 | 0.931465 | -0.05602 | -0.0785 | -0.1428 | -0.53181 | 0.259202 | 11.13514 | -1.02063 |
| **Std.Error** | 0.0399 | 2.2364 | 0.7148 | 1.70E+00 | 0.1482 | 0.125 | 0.1652 | 0.1106 | 0.1159 | 6.1282 | 0.4546 |
| **t value** | 5.37 | -7.12 | 4.43 | 0.55 | -0.38 | -0.63 | -0.86 | -4.81 | 2.24 | 1.82 | -2.25 |
| **P value** | <.0001 | <.0001 | 0.0002 | 0.5893 | 0.7088 | 0.5359 | 0.3962 | <.0001 | 0.0353 | 0.0829 | 0.0351 |
| **PORTUGAL** | | | | | | | | | | | |
| | 0.061974 | -0.49267 | 2.123735 | 9.831342 | -0.82518 | -0.3983 | -0.5553 | -0.0163 | 2.818814 | 28.22511 | -2.08436 |
| **Std.Error** | 0.3752 | 0.6929 | 0.9216 | 1.1539 | 0.1411 | 0.1859 | 0.22 | 0.0439 | 0.5341 | 13.1882 | 0.9531 |
| **t value** | 0.17 | -0.71 | 2.3 | 8.52 | -5.85 | -2.14 | -2.52 | -0.37 | 5.28 | 2.14 | -2.19 |
| **P value** | 0.8701 | 0.4834 | 0.0294 | <.0001 | <.0001 | 0.043 | 0.0189 | 0.7139 | <.0001 | 0.0437 | 0.0397 |
| **SPAIN** | | | | | | | | | | | |
| | 0.01593 | -1.11688 | 4.16961 | 3.219435 | -0.67085 | -0.4333 | -0.3938 | -0.00958 | 0.103305 | 19.696 | -1.49476 |
| **Std.Error** | 0.6847 | 0.6556 | 0.7718 | 1.205 | 0.132 | 0.0976 | 0.1426 | 0.0231 | 0.0795 | 16.9074 | 2.3797 |
| **t value** | 0.02 | -1.7 | 5.4 | 2.67 | -5.08 | -4.44 | -2.76 | -0.41 | 1.3 | 1.16 | -0.63 |
| **P value** | 0.9816 | 0.1004 | <.0001 | 0.0136 | <.0001 | 0.0002 | 0.0111 | 0.6825 | 0.2066 | 0.2565 | 0.5364 |
| **UK** | | | | | | | | | | | |
| | 0.059278 | -0.03864 | 3.440705 | 15.67308 | -1.38035 | -0.3813 | -0.3901 | -0.34676 | 0.210594 | -10.8812 | -1.3505 |
| **Std.Error** | 0.1553 | 0.3072 | 0.9749 | 2.4679 | 0.2941 | 0.0878 | 0.1327 | 0.1251 | 0.1091 | 8.1664 | 1.0152 |
| **t value** | 0.38 | -0.13 | 3.53 | 6.35 | -4.69 | -4.34 | -2.94 | -2.77 | 1.93 | -1.33 | -1.33 |
| **P value** | 0.7058 | 0.9009 | 0.0016 | <.0001 | 0.0001 | 0.0002 | 0.0074 | 0.0109 | 0.066 | 0.1964 | 0.1971 |

(Table Continued)

(Table Continued)

| OATS | lnworldp c3 | lnexpr c4 | lnexrt c5 | mref c6 | aref c7 | d1 | lndmpr d2 | lnworldp d3 | lnexrt d4 | lnimpl d5 | mref d6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **IRELAND** | | | | | | | | | | | |
| | 0.465648 | 0.087711 | 4.284882 | -0.00452 | -1.44135 | 8.307715 | 0.617634 | -0.18412 | -2.2781 | -0.18949 | -0.23916 |
| **Std.Error** | 0.9181 | 0.2612 | 1.7198 | 0.2301 | 1.9892 | 6.8628 | 0.8096 | 0.5127 | 0.9011 | 0.2515 | 0.3931 |
| **t value** | 0.51 | 0.34 | 2.49 | -0.02 | -0.72 | 1.21 | 0.76 | -0.36 | -2.53 | -0.75 | -0.61 |
| **P value** | 0.6171 | 0.7402 | 0.0208 | 0.9845 | 0.4767 | 0.2395 | 0.454 | 0.7231 | 0.0196 | 0.4595 | 0.5494 |
| **ITALY** | | | | | | | | | | | |
| | 2.69872 | 0.218631 | 0.457386 | -1.40456 | 2.4779 | 10.43738 | 0.602435 | 0.085568 | -0.65259 | -0.12354 | -1.37396 |
| **Std.Error** | 1.6377 | 0.2919 | 1.7444 | 1.4043 | 1.5069 | 3.8819 | 0.5617 | 0.3539 | 0.2187 | 0.1762 | 0.3287 |
| **t value** | 1.65 | 0.75 | 0.26 | -1 | 1.64 | 2.69 | 1.07 | 0.24 | -2.98 | -0.7 | -4.18 |
| **P value** | 0.1136 | 0.4618 | 0.7956 | 0.3281 | 0.1143 | 0.0137 | 0.2957 | 0.8113 | 0.0066 | 0.491 | 0.0004 |
| **NETHERLANDS** | | | | | | | | | | | |
| | 1.012971 | 2.181332 | 1.317752 | -0.68877 | -1.08235 | -5.84373 | 0.912665 | -0.63613 | -0.20905 | -1.96687 | -0.40511 |
| **Std.Error** | 0.6479 | 1.6037 | 0.9798 | 0.3388 | 0.5605 | 6.6088 | 0.5642 | 0.4302 | 0.0546 | 0.8217 | 0.36 |
| **t value** | 1.56 | 1.36 | 1.34 | -2.03 | -1.93 | -0.88 | 1.62 | -1.48 | -3.83 | -2.39 | -1.13 |
| **P value** | 0.1322 | 0.1876 | 0.1923 | 0.0543 | 0.0665 | 0.3866 | 0.1207 | 0.1541 | 0.0009 | 0.0242 | 0.2732 |
| **PORTUGAL** | | | | | | | | | | | |
| | 1.319086 | 1.9432 | 0.605606 | -3.94796 | -1.62236 | -9.3685 | 1.618094 | 1.116026 | -0.91681 | -0.02687 | -0.1628 |
| **Std.Error** | 1.6704 | 0.565 | 0.9128 | 2.0741 | 0.9603 | 16.2817 | 1.1702 | 0.9099 | 1.6005 | 0.4969 | 0.0874 |
| **t value** | 0.79 | 3.44 | 0.66 | -1.9 | -1.69 | -0.58 | 1.38 | 1.23 | -0.57 | -0.05 | -1.86 |
| **P value** | 0.4381 | 0.0023 | 0.5139 | 0.0701 | 0.1059 | 0.5711 | 0.1806 | 0.2336 | 0.5728 | 0.9574 | 0.0755 |
| **SPAIN** | | | | | | | | | | | |
| | 0.047527 | 0.078249 | 3.021536 | -0.2567 | -0.42748 | -54.4403 | 4.671755 | 1.70179 | -0.47718 | -0.26237 | -0.80833 |
| **Std.Error** | 1.5511 | 0.3888 | 0.7008 | 1.0161 | 1.9923 | 11.0617 | 1.7229 | 1.0327 | 0.0992 | 0.5176 | 0.2214 |
| **t value** | 0.03 | 0.2 | 4.31 | -0.25 | -0.21 | -4.92 | 2.71 | 1.65 | -4.81 | -0.51 | -3.65 |
| **P value** | 0.9758 | 0.8424 | 0.0003 | 0.8029 | 0.8321 | <.0001 | 0.0131 | 0.1142 | <.0001 | 0.6175 | 0.0013 |
| **UK** | | | | | | | | | | | |
| | 1.550737 | 0.109121 | 2.362155 | -2.76026 | -1.96687 | 19.81181 | 3.714641 | -0.45836 | -1.04525 | -0.26967 | -1.45326 |
| **Std.Error** | 0.6521 | 0.1734 | 0.4783 | 1.344 | 0.8217 | 8.6312 | 1.122 | 0.7142 | 1.5059 | 0.3615 | 0.5881 |
| **t value** | 2.38 | 0.63 | 4.94 | -2.05 | -2.39 | 2.3 | 3.31 | -0.64 | -0.69 | -0.75 | -2.47 |
| **P value** | 0.0265 | 0.5356 | <.0001 | 0.0521 | 0.0242 | 0.0321 | 0.0032 | 0.5279 | 0.4952 | 0.4639 | 0.0221 |

(Table Continued)

(Table Continued)

| OATS | aref d7 | lngdp d8 | e1 | lndmpr e2 | Lnprodr e3 | mref e4 | aref e5 | lngdp e6 |
|---|---|---|---|---|---|---|---|---|
| **IRELAND** | | | | | | | | |
| | -0.70297 | 0.45997 | -0.00154 | 0.247983 | 5.003864 | -0.0243 | -0.06082 | 0.047954 |
| **Std.Error** | 0.2884 | 0.7044 | 0.0307 | 1.424 | 0.9547 | 0.0905 | 0.1615 | 0.0653 |
| **t value** | -2.44 | 0.65 | -0.05 | 0.17 | 5.24 | -0.27 | -0.38 | 0.73 |
| **P value** | 0.0237 | 0.5209 | 0.9606 | 0.8634 | <.0001 | 0.7908 | 0.71 | 0.4699 |
| **ITALY** | | | | | | | | |
| | -0.43212 | 0.466346 | 6.43926 | 0.247355 | 0.075311 | -0.05823 | -0.07492 | 0.038176 |
| **Std.Error** | 0.1967 | 0.4467 | 0.6092 | 0.1112 | 0.073 | 0.0255 | 0.0515 | 0.055 |
| **t value** | -2.2 | 1.04 | 10.57 | 2.22 | 1.03 | -2.29 | -1.46 | 0.69 |
| **P value** | 0.0394 | 0.3083 | <.0001 | 0.0362 | 0.3127 | 0.0319 | 0.159 | 0.4948 |
| **NETHERLANDS** | | | | | | | | |
| | -0.16372 | 0.964693 | 20.19869 | 0.473042 | 1.106177 | -0.10301 | -0.0732 | 0.236665 |
| **Std.Error** | 0.6224 | 0.6313 | 3.2775 | 0.3737 | 0.7232 | 0.2859 | 0.4235 | 0.2855 |
| **t value** | -0.26 | 1.53 | 6.16 | 1.27 | 1.53 | -0.36 | -0.17 | 0.83 |
| **P value** | 0.7951 | 0.1414 | <.0001 | 0.2183 | 0.141 | 0.7219 | 0.8643 | 0.4165 |
| **PORTUGAL** | | | | | | | | |
| | -0.0203 | 0.20785 | 10.83555 | 1.787617 | 0.032972 | -0.41004 | -0.45047 | 0.169258 |
| **Std.Error** | 0.4605 | 0.6834 | 2.2453 | 0.8652 | 0.1137 | 0.2515 | 0.3338 | 0.573 |
| **t value** | -0.04 | 0.3 | 4.83 | 2.07 | 0.29 | -1.63 | -1.35 | 0.3 |
| **P value** | 0.9653 | 0.764 | <.0001 | 0.0514 | 0.7744 | 0.1166 | 0.1903 | 0.7706 |
| **SPAIN** | | | | | | | | |
| | -0.11712 | 2.094984 | -0.93379 | 6.210954 | 0.093927 | -0.46083 | -0.17761 | 0.085065 |
| **Std.Error** | 0.1591 | 0.6206 | 0.2351 | 1.4234 | 0.0785 | 0.1739 | 0.2784 | 0.1299 |
| **t value** | -0.74 | 3.38 | -3.97 | 4.36 | 1.2 | -2.65 | -0.64 | 0.66 |
| **P value** | 0.469 | 0.0029 | 0.0006 | 0.0002 | 0.2436 | 0.0143 | 0.5298 | 0.5189 |
| **UK** | | | | | | | | |
| | -1.0504 | 0.582596 | 10.51731 | 2.194572 | 0.103835 | -0.00443 | -0.02452 | 1.329345 |
| **Std.Error** | 0.9356 | 1.0333 | 0.5609 | 1.5442 | 0.104 | 0.0684 | 0.0221 | 1.1696 |
| **t value** | -1.12 | 0.56 | 18.75 | 1.42 | 1 | -0.06 | -1.11 | 1.14 |
| **P value** | 0.2742 | 0.5789 | <.0001 | 0.1699 | 0.3285 | 0.9489 | 0.2779 | 0.2685 |

**Table A1.5: Results from the Regression for Maize:**

| CORN | | lndmpr | (lnprod+lnimpq)/lnconp | lnconp | mref | aref | lnopstk | lngdp | | lndmpr |
|---|---|---|---|---|---|---|---|---|---|---|
| | a1 | a2 | a3 | b1 | b2 | b3 | b4 | b5 | b6 | c1 | c2 |
| **AUSTRIA** | | | | | | | | | | | |
| | 0.45482 | -1.46007 | 1.639112 | 0.151771 | -0.22783 | -0.3019 | -0.4499 | -0.19304 | 0.421112 | 0.830021 | -24.0806 |
| **Std.Error** | 0.2727 | 0.3706 | 0.5857 | 0.1288 | 0.0933 | 0.0831 | 0.1102 | 0.038 | 0.0622 | 0.9625 | 10.6263 |
| **t value** | 1.67 | -3.94 | 2.8 | 1.18 | -2.44 | -3.63 | -4.08 | -5.08 | 6.77 | 0.86 | -2.27 |
| **P value** | 0.1073 | 0.0005 | 0.0095 | 0.2511 | 0.0227 | 0.0014 | 0.0005 | <.0001 | <.0001 | 0.3978 | 0.0336 |
| **BELGIUM** | | | | | | | | | | | |
| | -0.11433 | -1.36387 | 8.012914 | 0.00221 | -0.02803 | -0.5493 | -0.845 | -2.94985 | 0.411703 | 8.015275 | -2.68435 |
| **Std.Error** | 0.6736 | 0.461 | 1.6028 | 0.0655 | 0.0604 | 0.1084 | 0.1582 | 1.4227 | 0.1068 | 22.9148 | 2.1052 |
| **t value** | -0.17 | -2.96 | 5 | 0.03 | -0.46 | -5.07 | -5.34 | -2.07 | 3.85 | 0.35 | -1.28 |
| **P value** | 0.8665 | 0.0065 | <.0001 | 0.9734 | 0.6469 | <.0001 | <.0001 | 0.0495 | 0.0008 | 0.7298 | 0.2156 |
| **DENMARK** | | | | | | | | | | | |
| | 1.179724 | -1.90705 | 7.990778 | 0.078179 | 0.101166 | -0.3553 | -0.7118 | -1.34285 | 0.354751 | 3.772068 | -1.14537 |
| **Std.Error** | 0.4985 | 1.5344 | 2.2227 | 0.0504 | 0.0522 | 0.0976 | 0.1296 | 1.5958 | 0.1238 | 17.5295 | 1.5051 |
| **t value** | 2.37 | -1.24 | 3.6 | 1.55 | 1.94 | -3.64 | -5.49 | -0.84 | 2.86 | 0.22 | -0.76 |
| **P value** | 0.0257 | 0.225 | 0.0013 | 0.1346 | 0.065 | 0.0014 | <.0001 | 0.4087 | 0.0088 | 0.8316 | 0.4547 |
| **FRANCE** | | | | | | | | | | | |
| | 2.429117 | -1.13075 | 6.877499 | 1.586381 | -0.95706 | -0.2615 | -0.5059 | -0.39867 | 0.284123 | 0.045189 | -0.46473 |
| **Std.Error** | 1.5772 | 0.2628 | 3.0696 | 3.2669 | 1.7961 | 0.0993 | 0.1185 | 0.0908 | 0.1071 | 0.0564 | 0.38 |
| **t value** | 1.54 | -4.3 | 2.24 | 0.49 | -0.53 | -2.63 | -4.27 | -4.39 | 2.65 | 0.8 | -1.22 |
| **P value** | 0.1356 | 0.0002 | 0.0338 | 0.6319 | 0.5993 | 0.0148 | 0.0003 | 0.0002 | 0.0142 | 0.4319 | 0.2343 |
| **GERMANY** | | | | | | | | | | | |
| | -0.36872 | -1.36983 | 10.29274 | 0.112514 | -0.11088 | -0.3814 | -0.5319 | -0.16984 | 0.398472 | 0.054517 | -0.24966 |
| **Std.Error** | 1.4792 | 0.3186 | 2.7461 | 0.3144 | 0.2259 | 0.1086 | 0.1395 | 0.0808 | 0.0916 | 0.0407 | 0.434 |
| **t value** | -0.25 | -4.3 | 3.75 | 0.36 | -0.49 | -3.51 | -3.81 | -2.1 | 4.35 | 1.34 | -0.58 |
| **P value** | 0.8051 | 0.0002 | 0.0009 | 0.7237 | 0.6281 | 0.0019 | 0.0009 | 0.0466 | 0.0002 | 0.194 | 0.571 |
| **GREECE** | | | | | | | | | | | |
| | 0.191539 | -5.22831 | 15.36247 | 12.41648 | -0.11411 | -0.5759 | -0.9699 | -0.26624 | -0.837 | 2.408056 | -24.4435 |
| **Std.Error** | 0.1249 | 1.1744 | 2.0644 | 3.1912 | 0.4746 | 0.2565 | 0.3731 | 0.1331 | 0.2801 | 2.2205 | 18.1396 |
| **t value** | 1.53 | -4.45 | 7.44 | 3.89 | -0.24 | -2.25 | -2.6 | -2 | -2.99 | 1.08 | -1.35 |
| **P value** | 0.1372 | 0.0001 | <.0001 | 0.0007 | 0.8121 | 0.0347 | 0.016 | 0.0574 | 0.0066 | 0.2899 | 0.1915 |

(Table Continued)

(Table Continued)

| CORN | lnworldp c3 | lnexpr c4 | lnexrt c5 | mref c6 | aref c7 | d1 | lndmpr d2 | lnworldp d3 | lnexrt d4 | lnimpl d5 | mref d6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **AUSTRIA** | | | | | | | | | | | |
| | 3.713757 | 2.120771 | 1.872163 | -0.31575 | -1.35986 | 13.89638 | 1.189414 | -0.0574 | -1.95797 | -0.34926 | -1.66383 |
| **Std.Error** | 1.2788 | 1.0719 | 1.7623 | 1.9303 | 0.5576 | 20.9259 | 0.2645 | 0.0438 | 4.0298 | 0.5135 | 1.1795 |
| **t value** | 2.9 | 1.98 | 1.06 | -0.16 | -2.44 | 0.66 | 4.5 | -1.31 | -0.49 | -0.68 | -1.41 |
| **P value** | 0.0082 | 0.06 | 0.2996 | 0.8716 | 0.0233 | 0.5139 | 0.0002 | 0.2039 | 0.6321 | 0.5039 | 0.173 |
| **BELGIUM** | | | | | | | | | | | |
| | 0.075993 | 0.076547 | 1.716316 | -0.55934 | -3.17964 | 11.23575 | 0.660918 | 0.194696 | -0.0504 | -0.64293 | 0.435283 |
| **Std.Error** | 0.6628 | 0.3016 | 2.8989 | 1.1086 | 1.1844 | 7.2161 | 0.5376 | 0.4446 | 0.0487 | 0.3732 | 0.3803 |
| **t value** | 0.11 | 0.25 | 0.59 | -0.5 | -2.68 | 1.56 | 1.23 | 0.44 | -1.03 | -1.72 | 1.14 |
| **P value** | 0.9098 | 0.802 | 0.5598 | 0.6189 | 0.0135 | 0.1344 | 0.2325 | 0.6659 | 0.3118 | 0.0996 | 0.2653 |
| **DENMARK** | | | | | | | | | | | |
| | 0.155678 | 0.093781 | 5.141906 | 0.352617 | -0.60122 | 0.511526 | 27.1891 | -0.15652 | -0.35187 | -0.1378 | -1.78482 |
| **Std.Error** | 2.1048 | 0.2261 | 2.2716 | 0.7822 | 1.1358 | 0.6298 | 5.7184 | 0.4327 | 0.7842 | 0.1526 | 0.2886 |
| **t value** | 0.07 | 0.41 | 2.26 | 0.45 | -0.53 | 0.81 | 4.75 | -0.36 | -0.45 | -0.9 | -6.18 |
| **P value** | 0.9417 | 0.6823 | 0.0338 | 0.6565 | 0.6019 | 0.4258 | 0.0001 | 0.7211 | 0.6583 | 0.3767 | <.0001 |
| **FRANCE** | | | | | | | | | | | |
| | 1.114727 | 7.640804 | 1.294038 | -0.29331 | 0.989621 | 15.04535 | 0.782961 | -0.41738 | -0.72177 | -0.4535 | -0.80395 |
| **Std.Error** | 0.2911 | 4.2761 | 0.6238 | 0.2074 | 0.5938 | 3.5955 | 0.4307 | 0.2839 | 0.1778 | 0.0735 | 0.2265 |
| **t value** | 3.83 | 1.79 | 2.07 | -1.41 | 1.67 | 4.18 | 1.82 | -1.47 | -4.06 | -6.17 | -3.55 |
| **P value** | 0.0009 | 0.0877 | 0.0499 | 0.1713 | 0.1098 | 0.0004 | 0.0834 | 0.1564 | 0.0006 | <.0001 | 0.0017 |
| **GERMANY** | | | | | | | | | | | |
| | 0.21129 | 7.962898 | 2.006617 | -4.4726 | -0.39591 | 17.31335 | 1.394562 | 0.053498 | -0.70145 | -0.01861 | 0.164604 |
| **Std.Error** | 0.334 | 3.5135 | 0.6401 | 1.8309 | 0.1707 | 3.1958 | 0.4734 | 0.1593 | 0.4061 | 0.0448 | 0.1271 |
| **t value** | 0.63 | 2.27 | 3.13 | -2.44 | -2.32 | 5.42 | 2.95 | 0.34 | -1.73 | -0.42 | 1.29 |
| **P value** | 0.5335 | 0.0336 | 0.0048 | 0.0231 | 0.0301 | <.0001 | 0.0077 | 0.7403 | 0.0988 | 0.6821 | 0.2095 |
| **GREECE** | | | | | | | | | | | |
| | 0.288242 | 0.852742 | 5.759646 | -2.20667 | -3.40223 | 24.04244 | 1.343863 | -0.9687 | -0.1289 | -0.52076 | 1.126379 |
| **Std.Error** | 1.5545 | 0.1982 | 2.1238 | 1.0554 | 1.427 | 9.4427 | 1.0024 | 0.7217 | 0.0949 | 0.2408 | 0.5001 |
| **t value** | 0.19 | 4.3 | 2.71 | -2.09 | -2.38 | 2.55 | 1.34 | -1.34 | -1.36 | -2.16 | 2.25 |
| **P value** | 0.8546 | 0.0003 | 0.0127 | 0.0483 | 0.0262 | 0.0188 | 0.1943 | 0.1939 | 0.1873 | 0.0423 | 0.0351 |

(Table Continued)

(Table Continued)

| CORN | aref d7 | lngdp d8 | e1 | lndmpr e2 | lnprodr e3 | mref e4 | aref e5 | lngdp e6 |
|---|---|---|---|---|---|---|---|---|
| **AUSTRIA** | | | | | | | | |
| | -1.71324 | 1.789368 | 0.079989 | 3.904274 | 0.064059 | -0.17772 | -0.03105 | 0.207522 |
| **Std.Error** | 1.671 | 1.5883 | 0.1727 | 0.8351 | 0.05 | 0.1277 | 0.2014 | 0.1256 |
| **t value** | -1.03 | 1.13 | 0.46 | 4.68 | 1.28 | -1.39 | -0.15 | 1.65 |
| **P value** | 0.3169 | 0.2726 | 0.6476 | 0.0001 | 0.2125 | 0.1773 | 0.8788 | 0.112 |
| **BELGIUM** | | | | | | | | |
| | -0.06905 | 0.338171 | 0.078007 | 0.680482 | 1.29086 | -0.88149 | -5.24946 | 0.835511 |
| **Std.Error** | 0.1751 | 0.4859 | 0.0916 | 0.2574 | 0.3734 | 0.3284 | 2.2161 | 0.2353 |
| **t value** | -0.39 | 0.7 | 0.85 | 2.64 | 3.46 | -2.68 | -2.37 | 3.55 |
| **P value** | 0.6972 | 0.494 | 0.403 | 0.0145 | 0.0021 | 0.0132 | 0.0266 | 0.0017 |
| **DENMARK** | | | | | | | | |
| | -0.12178 | 0.872342 | 1.787003 | 12.58987 | 0.583886 | 1.249356 | -1.8924 | 1.340928 |
| **Std.Error** | 0.2069 | 0.3246 | 1.3213 | 6.436 | 0.3626 | 0.7647 | 0.7318 | 1.3432 |
| **t value** | -0.59 | 2.69 | 1.35 | 1.96 | 1.61 | 1.63 | -2.59 | 1 |
| **P value** | 0.5623 | 0.0138 | 0.1894 | 0.0627 | 0.121 | 0.1159 | 0.0165 | 0.3285 |
| **FRANCE** | | | | | | | | |
| | -0.54263 | 0.503286 | 0.241038 | 6.456707 | 0.107133 | 0.134887 | -0.16324 | 0.170022 |
| **Std.Error** | 0.1432 | 0.2562 | 0.2017 | 1.2342 | 0.0665 | 0.1128 | 0.1936 | 0.1118 |
| **t value** | -3.79 | 1.96 | 1.2 | 5.23 | 1.61 | 1.2 | -0.84 | 1.52 |
| **P value** | 0.0011 | 0.0628 | 0.2442 | <.0001 | 0.1209 | 0.2438 | 0.4077 | 0.142 |
| **GERMANY** | | | | | | | | |
| | -0.56598 | 0.38768 | -5.39714 | 0.573861 | 0.114752 | 0.17708 | -0.11915 | 0.839598 |
| **Std.Error** | 0.1743 | 0.1726 | 1.7194 | 0.2597 | 0.0653 | 0.1826 | 0.2562 | 0.1732 |
| **t value** | -3.25 | 2.25 | -3.14 | 2.21 | 1.76 | 0.97 | -0.47 | 4.85 |
| **P value** | 0.0039 | 0.0356 | 0.0046 | 0.0373 | 0.0923 | 0.3422 | 0.6463 | <.0001 |
| **GREECE** | | | | | | | | |
| | -0.63416 | 1.99455 | 3.015843 | 0.279933 | 0.013574 | -0.84646 | -0.98047 | 0.424655 |
| **Std.Error** | 0.6204 | 0.6307 | 3.232 | 0.1412 | 0.1329 | 0.2234 | 0.3691 | 0.2349 |
| **t value** | -1.02 | 3.16 | 0.93 | 1.98 | 0.1 | -3.79 | -2.66 | 1.81 |
| **P value** | 0.3183 | 0.0047 | 0.3605 | 0.0595 | 0.9196 | 0.0009 | 0.0141 | 0.0838 |

(Table Continued)

(Table Continued)

| CORN | | lndmpr | (lnprod+lnimpq)/lnconp | lnconp | mref | aref | lnopstk | lngdp | | lndmpr |
|---|---|---|---|---|---|---|---|---|---|---|
| | a1 | a2 | a3 | b1 | b2 | b3 | b4 | b5 | b6 | c1 | c2 |
| **IRELAND** | | | | | | | | | | | |
| | 2.433091 | -15.4992 | 2.312826 | 5.144763 | -0.10783 | -0.3198 | -0.5977 | -5.55487 | 0.096067 | 0.971375 | -7.13851 |
| **Std.Error** | 0.5672 | 3.7963 | 0.8221 | 1.2314 | 0.113 | 0.1256 | 0.2318 | 4.1784 | 0.0904 | 1.3331 | 13.1199 |
| **t value** | 4.29 | -4.08 | 2.81 | 4.18 | -0.95 | -2.55 | -2.58 | -1.33 | 1.06 | 0.73 | -0.54 |
| **P value** | 0.0002 | 0.0004 | 0.0092 | 0.0004 | 0.3501 | 0.018 | 0.0168 | 0.1967 | 0.2988 | 0.4739 | 0.5918 |
| **ITALY** | | | | | | | | | | | |
| | 10.60493 | -2.06657 | 0.346475 | 0.082304 | -0.0261 | -0.5861 | -0.8022 | 0.230625 | 0.296123 | -3.31669 | -17.4387 |
| **Std.Error** | 2.1569 | 1.0701 | 0.1558 | 0.0615 | 0.1219 | 0.1444 | 0.212 | 0.19 | 0.3321 | 1.9324 | 5.476 |
| **t value** | 4.92 | -1.93 | 2.22 | 1.34 | -0.21 | -4.06 | -3.78 | 1.21 | 0.89 | -1.72 | -3.18 |
| **P value** | <.0001 | 0.0644 | 0.035 | 0.1941 | 0.8323 | 0.0005 | 0.001 | 0.2372 | 0.3818 | 0.1002 | 0.0043 |
| **N.LANDS** | | | | | | | | | | | |
| | 1.59193 | 0.708372 | 0.178698 | 0.071047 | -0.16227 | -0.3966 | -0.6705 | 0.248513 | 0.360779 | 0.022232 | -1.26558 |
| **Std.Error** | 0.8603 | 0.1772 | 0.1125 | 2.7305 | 0.1517 | 0.0994 | 0.1504 | 0.1899 | 0.126 | 0.0444 | 0.4037 |
| **t value** | 1.85 | 4 | 1.59 | 0.03 | -1.07 | -3.99 | -4.46 | 1.31 | 2.86 | 0.5 | -3.13 |
| **P value** | 0.0757 | 0.0005 | 0.1243 | 0.9795 | 0.2958 | 0.0006 | 0.0002 | 0.2037 | 0.0088 | 0.6213 | 0.0048 |
| **PORTUGAL** | | | | | | | | | | | |
| | 1.581518 | -9.00786 | 7.450312 | 0.038688 | -5.6676 | -0.4179 | -0.6859 | -10.549 | 0.341407 | 14.17618 | -6.42583 |
| **Std.Error** | 0.2341 | 6.3279 | 3.4927 | 0.1686 | 1.9494 | 0.2018 | 0.2569 | 3.6788 | 0.0789 | 14.753 | 2.0889 |
| **t value** | 6.76 | -1.42 | 2.13 | 0.23 | -2.91 | -2.07 | -2.67 | -2.87 | 4.33 | 0.96 | -3.08 |
| **P value** | <.0001 | 0.1665 | 0.0425 | 0.8205 | 0.0084 | 0.0497 | 0.0137 | 0.0087 | 0.0002 | 0.347 | 0.0055 |
| **SPAIN** | | | | | | | | | | | |
| | -4.39258 | -0.77857 | 14.67837 | 1.515186 | -0.03541 | -0.4130 | -0.6469 | -0.07104 | 0.044751 | 50.97114 | -4.34519 |
| **Std.Error** | 3.77 | 0.5227 | 6.9973 | 2.7502 | 0.2362 | 0.1545 | 0.2245 | 0.1149 | 0.0526 | 20.8273 | 2.7085 |
| **t value** | -1.17 | -1.49 | 2.1 | 0.55 | -0.15 | -2.67 | -2.88 | -0.62 | 0.85 | 2.45 | -1.6 |
| **P value** | 0.2545 | 0.1484 | 0.0458 | 0.587 | 0.8821 | 0.0135 | 0.0084 | 0.5426 | 0.4035 | 0.0228 | 0.1229 |
| **UK** | | | | | | | | | | | |
| | -3.73438 | -2.17817 | 2.032482 | 0.10521 | -0.26332 | -0.3094 | -0.4530 | -0.00946 | 7.399764 | 8.667626 | -0.64358 |
| **Std.Error** | 2.526 | 0.461 | 0.4409 | 0.0629 | 0.225 | 0.1176 | 0.1761 | 0.1722 | 2.5794 | 11.1045 | 0.9214 |
| **t value** | -1.48 | -4.72 | 4.61 | 1.67 | -1.17 | -2.63 | -2.57 | -0.05 | 2.87 | 0.78 | -0.7 |
| **P value** | 0.1513 | <.0001 | <.0001 | 0.1081 | 0.2539 | 0.0149 | 0.017 | 0.9567 | 0.0087 | 0.4434 | 0.4922 |

(Table Continued)

(Table Continued)

| CORN | lnworldp c3 | lnexpr c4 | lnexrt c5 | mref c6 | aref c7 | d1 | lndmpr d2 | lnworldp d3 | lnexrt d4 | lnimpl d5 | mref d6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **IRELAND** | | | | | | | | | | | |
| | 0.213339 | 1.982231 | 3.213364 | 0.101872 | 3.213364 | 0.379125 | 5.228131 | -0.43902 | -0.44097 | 0.042503 | 0.162026 |
| **Std.Error** | 1.0608 | 0.5651 | 0.9547 | 0.1828 | 0.9547 | 0.2271 | 3.0039 | 0.3121 | 0.4183 | 0.0818 | 0.1855 |
| **t value** | 0.2 | 3.51 | 3.37 | 0.56 | 3.37 | 1.67 | 1.74 | -1.41 | -1.05 | 0.52 | 0.87 |
| **P value** | 0.8425 | 0.002 | 0.0028 | 0.583 | 0.0028 | 0.1099 | 0.0964 | 0.1741 | 0.3038 | 0.6089 | 0.3924 |
| **ITALY** | | | | | | | | | | | |
| | 0.931623 | 0.014718 | 3.882495 | -0.32454 | -0.12366 | 0.16858 | 19.20911 | 0.248919 | -1.13039 | 0.017269 | 0.041681 |
| **Std.Error** | 0.4554 | 0.0758 | 0.6641 | 0.3238 | 0.4488 | 0.6341 | 5.7957 | 0.4699 | 0.82 | 0.1703 | 0.3646 |
| **t value** | 2.05 | 0.19 | 5.85 | -1 | -0.28 | 0.27 | 3.31 | 0.53 | -1.38 | 0.1 | 0.11 |
| **P value** | 0.0529 | 0.8478 | <.0001 | 0.3271 | 0.7855 | 0.7929 | 0.0033 | 0.6019 | 0.1826 | 0.9202 | 0.9101 |
| **N.LANDS** | | | | | | | | | | | |
| | 1.017284 | 17.2986 | 2.070262 | -0.28141 | -0.29452 | 0.102364 | 19.42448 | -0.15321 | -0.87358 | -0.4263 | -0.0831 |
| **Std.Error** | 0.2916 | 3.9419 | 0.4851 | 0.1911 | 0.1979 | 0.517 | 2.3503 | 0.1371 | 0.3427 | 0.1631 | 0.1061 |
| **t value** | 3.49 | 4.39 | 4.27 | -1.47 | -1.49 | 0.2 | 8.26 | -1.12 | -2.55 | -2.61 | -0.78 |
| **P value** | 0.0021 | 0.0002 | 0.0003 | 0.1551 | 0.1509 | 0.845 | <.0001 | 0.2764 | 0.0187 | 0.0162 | 0.4423 |
| **PORTUGAL** | | | | | | | | | | | |
| | 1.401376 | 0.645514 | 0.088209 | -0.98736 | -1.54918 | 5.139921 | 1.532221 | -0.1289 | -0.4067 | -0.03896 | 0.86146 |
| **Std.Error** | 1.3472 | 0.1763 | 0.1974 | 0.9343 | 1.1286 | 3.6309 | 0.4638 | 0.0949 | 0.1414 | 0.0763 | 0.2175 |
| **t value** | 1.04 | 3.66 | 0.45 | -1.06 | -1.37 | 1.42 | 3.3 | -1.36 | -2.88 | -0.51 | 3.96 |
| **P value** | 0.3095 | 0.0014 | 0.6593 | 0.3021 | 0.1837 | 0.1715 | 0.0034 | 0.1873 | 0.009 | 0.6148 | 0.0007 |
| **SPAIN** | | | | | | | | | | | |
| | 1.821929 | 0.010698 | 0.941858 | -1.38095 | -0.23152 | 0.835441 | 1.136444 | -0.0855 | -9.76222 | -0.03082 | 0.097134 |
| **Std.Error** | 0.5983 | 0.2863 | 1.0168 | 2.6557 | 1.6408 | 0.4993 | 0.6944 | 0.1738 | 5.8321 | 0.1578 | 0.3086 |
| **t value** | 3.05 | 0.04 | 0.93 | -0.52 | -0.14 | 1.67 | 1.64 | -0.49 | -1.67 | -0.2 | 0.31 |
| **P value** | 0.0059 | 0.9705 | 0.3643 | 0.6083 | 0.8891 | 0.1091 | 0.1166 | 0.6277 | 0.109 | 0.8471 | 0.7561 |
| **UK** | | | | | | | | | | | |
| | 0.25137 | 0.082211 | 1.947218 | -1.57805 | -0.58762 | 0.304337 | 9.208027 | -0.4408 | -0.77426 | -0.0252 | 0.137433 |
| **Std.Error** | 1.1989 | 0.1523 | 0.676 | 0.5355 | 1.9303 | 0.1435 | 1.7974 | 0.1977 | 0.3593 | 0.0563 | 0.1077 |
| **t value** | 0.21 | 0.54 | 2.88 | -2.95 | -0.3 | 2.12 | 5.12 | -2.23 | -2.16 | -0.45 | 1.28 |
| **P value** | 0.8359 | 0.5946 | 0.0087 | 0.0075 | 0.7637 | 0.046 | <.0001 | 0.0368 | 0.0429 | 0.6587 | 0.2157 |

(Table Continued)

(Table Continued)

| CORN | aref d7 | lngdp d8 | e1 | lndmpr e2 | lnprodr e3 | mref e4 | aref e5 | lngdp e6 |
|---|---|---|---|---|---|---|---|---|
| **IRELAND** | | | | | | | | |
| | -0.2423 | 0.715801 | -3.60547 | 30.12424 | 7.968518 | -1.29127 | -0.2696 | 0.142194 |
| **Std.Error** | 0.0984 | 0.295 | 1.2055 | 7.778 | 0.6088 | 0.777 | 0.3314 | 1.4287 |
| **t value** | -2.46 | 2.43 | -2.99 | 3.87 | 13.09 | -1.66 | -0.81 | 0.1 |
| **P value** | 0.0225 | 0.0243 | 0.0065 | 0.0008 | <.0001 | 0.1101 | 0.4241 | 0.9216 |
| **ITALY** | | | | | | | | |
| | -0.4851 | 0.461984 | -0.3413 | 29.48467 | 0.210127 | -0.041 | -0.59887 | 0.072866 |
| **Std.Error** | 0.1914 | 0.4822 | 0.4611 | 5.7788 | 0.0885 | 0.0437 | 0.201 | 0.055 |
| **t value** | -2.53 | 0.96 | -0.74 | 5.1 | 2.37 | -0.94 | -2.98 | 1.32 |
| **P value** | 0.0193 | 0.3489 | 0.4666 | <.0001 | 0.0264 | 0.3567 | 0.0067 | 0.1983 |
| **N.LANDS** | | | | | | | | |
| | -0.05508 | 0.069647 | -0.12996 | 6.264693 | 7.401843 | -0.4306 | -0.153 | 5.576106 |
| **Std.Error** | 0.1736 | 1.4573 | 0.111 | 0.615 | 1.0167 | 0.9183 | 0.2385 | 0.8166 |
| **t value** | -0.32 | 0.05 | -1.17 | 10.19 | 7.28 | -0.47 | -0.64 | 6.83 |
| **P value** | 0.7542 | 0.9623 | 0.2538 | <.0001 | <.0001 | 0.6435 | 0.5275 | <.0001 |
| **PORTUGAL** | | | | | | | | |
| | 1.282534 | 1.114379 | -2.15756 | 3.897915 | 0.363224 | -0.0288 | -0.11861 | 0.141159 |
| **Std.Error** | 0.2434 | 0.4005 | 0.6929 | 1.2682 | 0.9634 | 0.075 | 0.1207 | 0.0583 |
| **t value** | 5.27 | 2.78 | -3.11 | 3.07 | 0.38 | -0.38 | -0.98 | 2.42 |
| **P value** | <.0001 | 0.0112 | 0.0049 | 0.0054 | 0.7099 | 0.7044 | 0.3361 | 0.0238 |
| **SPAIN** | | | | | | | | |
| | 0.634218 | 1.830064 | -0.27465 | 0.434903 | 0.044615 | -0.56272 | -0.64378 | 0.465059 |
| **Std.Error** | 0.4359 | 0.7522 | 0.0818 | 0.1904 | 0.2809 | 0.1635 | 0.2972 | 0.111 |
| **t value** | 1.46 | 2.43 | -3.36 | 2.28 | 0.16 | -3.44 | -2.17 | 4.19 |
| **P value** | 0.1604 | 0.024 | 0.0027 | 0.0329 | 0.8753 | 0.0022 | 0.0409 | 0.0004 |
| **UK** | | | | | | | | |
| | 0.229 | 0.078859 | -38.4882 | 4.446464 | 1.024293 | -0.47034 | -1.40002 | 2.979343 |
| **Std.Error** | 0.1523 | 0.0954 | 9.3696 | 1.49 | 1.0898 | 0.937 | 1.5633 | 0.7289 |
| **t value** | 1.5 | 0.83 | -4.11 | 2.98 | 0.94 | -0.5 | -0.9 | 4.09 |
| **P value** | 0.1475 | 0.4176 | 0.0004 | 0.0066 | 0.358 | 0.6205 | 0.3798 | 0.0005 |

## APPENDIX 2: DEFINITIONS OF COEFFICIENTS AND VARIABLES

| Coefficient | Variable | Definition |
|---|---|---|
| a1 | Intercept | |
| a2 | Lndmpr | Domestic Price |
| a3 | (lnprod+lnimpq)/lnconp | Ratio of Apparent production to Apparent consumption |
| b1 | Intercept | |
| b2 | Lnconp | Consumption |
| b3 | Mref | Dummy Variable capturing the effect of Mac Sharry Reforms |
| b4 | Aref | Dummy Variable capturing the effect of Agenda 2000 Reforms |
| b5 | Lnopstk | Opening Stocks |
| b6 | Lngdp | Gross Domestic Product |
| c1 | Intercept | |
| c2 | Lndmpr | Domestic Price |
| c3 | Lnworldp | World Price |
| c4 | Lnexpr | Export Refund |
| c5 | Lnexrt | Exchange Rates |
| c6 | Mref | Dummy Variable capturing the effect of Mac Sharry Reforms |
| c7 | Aref | Dummy Variable capturing the effect of Agenda 2000 Reforms |
| d1 | Intercept | |
| d2 | Lndmpr | Domestic Price |
| d3 | Lnworldp | World Price |
| d4 | Lnexrt | Exchange Rates |
| d5 | Lnimpl | Import Levies |
| d6 | Mref | Dummy Variable capturing the effect of Mac Sharry Reforms |
| d7 | Aref | Dummy Variable capturing the effect of Agenda 2000 Reforms |
| d8 | Lngdp | Gross Domestic Product |
| e1 | Intercept | |
| e2 | Lndmpr | Domestic Price |
| e3 | Lnprodr | Production Refunds |
| e4 | Mref | Dummy Variable capturing the effect of Mac Sharry Reforms |
| e5 | Aref | Dummy Variable capturing the effect of Agenda 2000 Reforms |
| e6 | Lngdp | Gross Domestic Product |

## VITA

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