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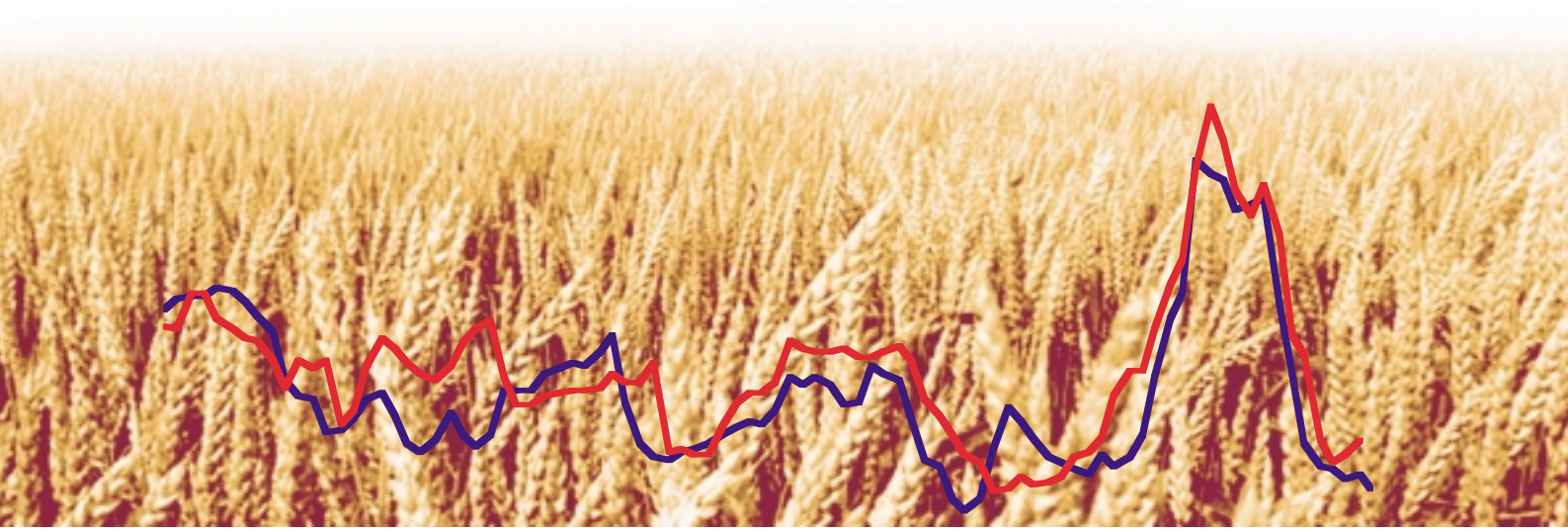
Agricultural Reforms and the Use of Market Mechanisms for Risk Management



A study commissioned by the Futures and Options Association

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Amir Alizadeh PhD and Nikos Nomikos PhD
Centre for Shipping, Trade & Finance
Cass Business School

Foreword

In July 2004, the Members of the World Trade Organisation (WTO) unanimously agreed on a framework for liberalising farm trade under the Doha Development Agenda with a view to establishing a fair and market-orientated trading system. The ultimate objective is to promote living standards, employment and sustainable development around the world, particularly in developing countries, through a process of fundamental reform. The key ingredients of this process are substantial reductions in trade-distorting domestic support, the elimination of all forms of export subsidisation by an agreed date, and a further opening-up of agricultural markets.

The European Community has already taken important unilateral steps in that direction, most recently through the introduction of the Single Farm Payment scheme agreed under the 2003 Mid-term Review of the Common Agricultural Policy. This policy change coupled with the reforms that will result from the WTO negotiations will expose European farmers, like farmers in other countries, more prominently to market forces.

The present report provides an important analysis of the opportunities and challenges ahead for the European farm community in adapting to the new policy environment. It also provides guidance for farmers, agro-industries and policy markets with respect to effective risk management strategies designed to facilitate smooth adjustment and a soft landing as these reforms are being implemented. Finally, the report highlights a few important areas which need to be further explored in the quest for instruments to facilitate a successful liberalisation of agricultural markets in Europe.

Dr Supachai Panitchpakdi
Director-General
World Trade Organisation

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Members of the Working Group

ABN AMRO Bank NV

AgWorld Risk Management

Banks Cargill Agriculture

Calyon

Cass Business School

Country Land and Business Association

Euronext.liffe

Futures and Options Association

Home Grown Cereals Authority

HM Treasury

HSBC Bank plc

E.M. Jesch Commodity Consulting

KPMG

National Australia Bank

National Economic Research Associates

NFU Policy Unit

Rabobank

SAFEX

Executive Summary

The support and subsidies provided to European farmers through the Common Agricultural Policy (CAP) has been the main reason for the limited participation of producers in risk management activities and, in particular, the use of derivative markets as a means for controlling price or yield risk. Over recent years, however, agricultural price support in the EU has been reduced and further reforms are ongoing; this is in part, a result of the necessity to change the policies of the internal market due to: the increasing cost to the taxpayers and consumers in supporting the agricultural sector, the cost of supporting the accession of the ten new member states, as well as pressures from WTO to liberalise and open the agricultural markets, particularly following the August 2004 WTO Agreement. Although the level of market price support is still very considerable, there has been a shift in support to the agricultural sector from trade distorting measures to decoupled direct payment to farmers and payments connected to rural development strategies. This implies that, where intervention prices previously offered a security net at a relatively high level below which prices would not fall, farmers' revenue is now becoming more volatile and linked to the world prices.

Preliminary investigation and statistical analysis of wheat prices suggests that, overall, the volatility of farm gate prices in EU member states has increased significantly, as a result of cuts in intervention prices and a reduction of other price support measures, following both the 1992 MacSharry and the AGENDA 2000 reforms. The ongoing reforms will result in further cuts in market price support measures which, combined with the commitment under WTO to improve market access, should increase the volatility of agricultural prices even further. Given this, the best way forward for farmers to cope with high price volatility and market uncertainty is to use market based instruments (derivatives and insurance products) in order to reduce income variability associated with price risk, provided that such instruments can be readily accessed and are economically affordable and properly understood. This report considers and outlines the opportunities and challenges related to the effective use of market based risk management products, particularly derivatives, in the European agricultural sector.

Currently, the extent of use of the risk management instruments by European producers appears to vary across the EU member states and also by the type of instrument. Production and marketing contracts, particularly those with downstream participants in the supply chain, appear to be fairly common instruments adopted in a number of markets by some producers. Diversification of production and income from non-farming activities, such as rental businesses and off-farm work, are other popular risk management strategies. Insurance policies are also particularly popular in member states where insurance premia are subsidised by the government.

Consistent with the trend in European agricultural policy towards reduced market intervention, in recent years, several commodity exchanges have launched new contracts on agricultural products such as milling wheat, corn, live hogs and rapeseed. As is shown in the report, derivative contracts offered by European Exchanges provide a fairly effective method for agricultural price risk management, and European producers can get the same level of risk protection as can the US farmers, using the "more established" US derivatives markets. Despite this, however, the uptake of derivative contracts by EU producers is rather limited. For instance, in the UK, it is estimated that only 11% of producers actively use derivatives for the purposes of risk management, and the level of futures trading activity is no more than

equal to the level of physical production; whereas in the US, not only a higher proportion of farmers actively use derivatives, but also the volume of futures trading is, on average, 10 times higher than the level of the physical market. The main reasons for the low uptake of market-based risk management tools in the EU, identified in the report, include:

- **Availability of Price Support through CAP**

  Perhaps the most important reason for the limited use of market based risk management products for agricultural price risk management by farmers and producers is the security that has been provided by CAP and the inbred expectation that the consequences of price volatility will be borne by the taxpayers. In ensuring stable farm prices, the CAP has meant that producers have had little or no incentives to resort to market-based price risk management instruments. However, the ongoing reforms in CAP will result in greater variability in production prices and, hence, will make farmers more aware of the need to use risk management tools.

- **Training and Market Information**

  The second most important cause of the low participation in derivatives markets is lack of familiarity or understanding of risk management products due to inadequate information and training. Only a small number of European farmers and farming consultants have the knowledge, training and resources, to participate in agricultural derivatives markets and to use them for price risk management purposes.

- **Structure of Existing Derivative Instruments**

  The affordability of derivative instruments can sometimes be a dissuasive factor in the uptake of these products by farmers. Examples of this include the cost of buying option contracts, and the access to funds required to cover initial margins (in the case of futures contracts) and variation margins (in the case of futures and options contracts). Issues such as: quality and location mismatches between the physical production and the futures contracts; liquidity risk, due to the low trading volume in these markets; and the mixed perception of derivatives, are also reasons for the low uptake of derivatives by European producers.

- **Regulatory Restrictions**

  Financial regulators such as the Financial Services Authority (FSA) in the UK and the Autorité des Marchés Financiers (AMF) in France, classify private farms (i.e. non-limited companies) as retail investors rather than professional hedgers. This means that non-limited company farms, despite seeking to use financial instruments for hedging purposes, have to be recognised by both Futures Exchanges and their member companies in the same way as would an individual speculator. Due to regulatory requirements, the treatment of this category of financial instrument user is more complex, time consuming, and costly, and hence less attractive to all parties involved.

- **Availability of Alternative Risk Management Tools**

  Finally, the availability of alternative risk management methods such as, land and product diversification, crop insurance and production contracts, is another contributing factor to the low uptake of market-based price risk management instruments. Although farmers may perceive these methods to be more readily understandable and simpler to use, they may not be as efficient as other risk management techniques - such as derivative instruments and insurance policies.

One of the major challenges to providers of risk management products is the diversity of the European agricultural sector due to differences in agricultural products, production levels and the structure of farm sectors across the member states. Taking these parameters into consideration, along with the reasons for the low uptake of derivatives by producers, as well as experiences from other less "protected" agricultural markets (most notably South Africa and Australia), this report proposes a number of measures to encourage and enable farmers/producers to use more efficient and effective market risk management tools to control their price, yield and income risk, i.e.

- **Establishing an Educational and Training Programme for Agricultural Risk Management**

  It is essential for producers to better understand the benefits of using market instruments (particularly derivatives and insurance) to manage their risk, and to be able to use such instruments confidently and effectively. The challenge is to motivate all producers to learn and eventually use these instruments in order to help them to focus on their core business activities. Training should not only be targeted at producers but also at those consultants, banks, trading houses and other organisations, to whom farmers turn for assistance in managing their risk. For instance, in the UK, Farmcare has been sponsored by the Department for Environment, Food and Rural Affairs (DEFRA) to undertake a major risk management training and registration programme for all farming consultants ("The Risk Management Network"). It would also be beneficial to align such initiatives with the activities of other organisations actively involved in the promotion of derivative instruments in the agricultural sector, such as the Agricultural Working Group of the Futures and Options Association. Similar educational programmes have also been established by the Home-Grown Cereals Association (HGCA) in the UK, as well as in other member states, such as France and Greece. The objective of these educational programmes is to improve growers' understanding of the basic mechanics of the grain market and the need to adopt a more strategic approach to grain marketing. These developments have been very well received by market participants and have also influenced their attitudes and perceptions towards the use of risk management tools. Delegate responses have shown that attending workshops has greatly improved their understanding and willingness to use risk management techniques including options and forward selling, based on the futures markets. This further illustrates how effective and properly implemented training schemes can affect farmer's goals and attitudes towards risk management. Therefore, more comprehensive training programmes, co-ordinated by the appropriate authorities at European level, would greatly increase the awareness of risk in agricultural business and enhance the uptake of risk management instruments and techniques across the industry.

- **Channelling Market Based Risk Management Products through Farmer-focused Organisations**

  Any new scheme for the education and promotion of market mechanisms for agricultural risk management should invest and build relationships with farmer-focused organisations such as Co-operatives, Farmer Controlled Businesses and Merchants. These organisations are ideal vehicles for training farmers, advising on and taking collective action in risk management activities on behalf of their members; and training schemes should enhance their ability to efficiently distribute information to the critical mass. They can also play an important role in creating economies of scale for farmers, by reducing the cost of using market risk management instruments. For instance, the World Bank Project on Commodity Risk Management presents an interesting case of how agricultural risk management projects can be tailored to meet the needs of small-scale producers. A similar approach could also be applied to promote and implement risk management projects for farmers in the EU.

- **Development and Marketing of Flexible Derivative Instruments**

  The diversity of the agriculture industry and business in the EU in terms of, number of products, quality differentials, regional disparities, and production cycles, indicates that more flexible risk management instruments are needed. Therefore, the success of new market-based risk management schemes and products greatly depends on their flexibility in terms of fulfilling the needs of users, simplicity in terms of trading and regulation, liquidity, efficiency and cost effectiveness. The use of flexible and tailor made Over-The-Counter products, which can be used along with exchange traded products seem to be the best way to address the need for product diversity in the agricultural sector. Such instruments can be designed to manage not only price risk but also crop yield risk, as well as weather risk, across a wide range of applications in the agricultural sector.

- **Proactive Involvement of Exchanges, Banks and Financial Institutions**

  The role of exchanges, banks and financial institutions working with the agricultural sector is of utmost importance because they finance farming and agricultural ventures. Experience from other agricultural economies (South Africa, Australia and the US) indicates that such institutions can have a vital role in providing appropriate infrastructure, training, and instruments, for market-based risk trading.

- **Agricultural Policy Management**

  The Commission and Member States need to be sensitive to the impact that the CAP, and in particular, market management activities under the CAP have on the liquidity of existing derivative markets and the development of new ones. The experience in South Africa was that during the transitional period where the Maize Board and the nascent SAFEX Agricultural Markets Division coexisted, the development of SAFEX AMD and its liquidity were threatened by the ongoing attempts by the Maize Board to continue managing the market, and in particular maize exports

Overall it seems that there are opportunities for farmers and producers in different member states to make wider and more effective use of derivatives, and other risk management instruments, to stabilise their income, and that these instruments are capable of providing a viable and effective form of income protection for agricultural farmers – as they do in other sectors of the economy. It is also interesting to note that the concept of risk management is not new to the European Agricultural sector given that, prior to the post-war government policy of subsidising agricultural production, producers traditionally relied on forward dealings as a means of managing price risk, often in the form of rudimentary "to arrive" contracts.

There are however, a number of issues that need to be investigated further, prior to the development of an effective action plan for making the use of market-based risk management instruments more attractive to EU producers, particularly:

1. a detailed review and assessment of the different risks which EU farmers face and of the extent to which farmers, in different regions and engaged in farming different crops, etc. are likely to use risk management products. This is an important step as very little is known about the individual goals and attitudes of farmers towards risk in different regions and member states. Understanding the producers' needs across the different member states can also assist in appropriately channelling risk management products to the end users more efficiently;

2. the cost and effectiveness of alternative risk management tools in reducing risks associated with farming activities needs to be assessed and measured against the cost and effectiveness of the use of central subsidy under the CAP, in order to identify the economic impact of transition;

3. the need for financial service suppliers, i.e. exchanges, banks and brokers to engage more closely with the farming community. Understanding producers' needs across the different member states will help to ensure the development of appropriate derivative and insurance products;

4. further investigation on the issue of how CAP reforms are going to affect all EU farmers and producers and, most importantly, how risk management tools can alleviate the problem of higher volatility of prices in different sectors, and across agricultural products, since this study is necessarily concentrated only on arable crops, most notably wheat, as it is the single most important agricultural produce of the EU and receives the largest share of subsidies under CAP.

1 CHAPTER ONE

Review of Common Agricultural Policy and Structure of the European Agricultural Market

1.1 Introduction

European agri-businesses, historically, have limited participation in risk management activities and, in particular, seldom use derivative markets as a means for controlling price, yield and other risks. However, given the current reforms in the Common Agricultural Policy (CAP) and the reduction in the level of support and subsidies available to the agricultural sector under the August 2004 WTO agreement, it is expected that soon market participants, and farmers in particular, will be exposed to greater price volatility which, in turn, will result in greater income uncertainty. Given these circumstances, the use of market based mechanisms for managing agricultural risk may be the best available solution for market participants and farmers. Therefore, the main purpose of this report is to consider the potential role of derivatives in the European agricultural sector and the challenges related to promoting and encouraging their use. In so doing, we also examine the causes behind the slow uptake of derivative products among farmers and agribusinesses in Europe, and assess whether the experience from similar agricultural "transitions" in other countries, most notably South Africa and Australia, could provide European farmers and policy makers with valuable lessons in risk management. Based on our findings and evidence from other countries, the study suggests a number of ways to make agricultural derivative products more accessible to agri-businesses in Europe.

The structure of this report is as follows. This chapter presents an overview of the CAP and the changes that will take place under the 2003/04 review and the WTO agreement; in addition, it also presents a summary of the structure and composition of the EU agricultural

sector, which may be one factor contributing to the slow uptake of risk management instruments. Chapter 2 presents different types of agricultural risks and their impact on agriculture business along with statistical evidence on how the volatility of EU wheat prices has been affected by changes and reforms in CAP. Chapter 3 presents an overview of the different risk management tools which are available in agriculture; and Chapter 4 describes the process of deregulating the agricultural sector in South Africa and Australia. Chapter 5 discusses different measures for establishing a more effective market mechanism for agricultural risk management, including increasing the uptake of derivatives. Finally, Chapter 6 concludes this report and proposes areas for future research.

1.2 Overview of the Common Agricultural Policy Reforms

Under the Common Agricultural Policy (CAP), European farmers currently receive around 40 percent of their total revenue through subsidies at an annual cost of around €100 bn to European taxpayers and shoppers.[1] Escalation of costs, pressure from WTO, the cost of supporting the accession of the 10 new member states, increasing food surpluses, and concerns about the environment, have increased the pressure on the European Union to reform the CAP. The reformed CAP is likely to make European farmers more competitive and influenced by world commodity markets.

Prior to 1992, the CAP operated through a combination of agricultural prices fixed above prevailing world prices, tariff and quota barriers on imports, and subsidies for EU exporters. The 1992 (MacSharry) Reform was followed up by the Agenda 2000 reforms, both of which addressed pressure from the World Trade Organization (WTO) to remove trade distorting subsidies and structural food surpluses. Direct payments to farmers replaced parts of price support, making farmers more responsive to market signals rather than policy interventions, and also induced more environmentally sound farming. The more recent 2003-04 Reform represents the most radical change in CAP's history with the introduction of 'decoupling' and 'cross compliance'. The majority of subsidies will now be paid independently of production volume or area planted and linked rather to environmental, food safety, and animal welfare standards. As a result, commodity price volatility is expected to increase and move more into line with world prices. These changes in CAP policy entail new challenges in risk management for European producers and a need to carefully review the price protection methods that could be suitable for their risk profiles.

1.2.1 CAP Reforms of 2003-04

On 26 June 2003, EU farm ministers agreed to a fundamental reform to the CAP. The key policy changes include decoupling of direct payments and their organisation into a Single Farm Payment (SFP), strengthening of rural development, and budgetary discipline in the CAP budget. The vast majority of subsidies in the form of SFPs are to be paid independently

[1] According to the UK Department for Environment, Food and Rural Affairs (DEFRA), this is equivalent to an annual cost of 1,000 euros for a family of 4 in the EU. Because food takes up a larger share of the budget of poorer families, the burden imposed by higher prices falls disproportionately on them.

of volume of production (known as decoupling). This will make farmers more market orientated and competitive in their production decisions, while, at the same time, providing the necessary income safety net. The farmer must, however, abide by minimum standards in food safety, environmental and plant health and animal welfare (known as cross-compliance) to receive the full amount of the SFP. The different elements of the reform will come into force in 2004 and 2005. The single farm payment will come into force between 2005 and 2007; however, if a member state needs a transitional period due to its specific agricultural conditions, it may defer implementation of the single farm payment until 2007.

It is important to recognise that, when fully implemented, these reforms should be contributing to a reduction in export subsidies of around 70% compared to their level in 1992, to around 3 bn euros, and a reduction in trade-distorting domestic subsidy as defined by the WTO of around 70%. In the same period US support has actually increased, with the 2002 Farm Bill (The Farm Security and Rural Investment Act) reversing many of the trends of its 1996 predecessor (the FAIR Act), and increasing agricultural expenditure by some $83 bn over the 10 years to 2011.

Key elements of the 2003-04 reform include:

- a single farm payment for EU farmers, independent from production (“decoupling”), although linkage to certain limited coupled elements may be maintained to avoid abandonment of production;
- the SFP will be linked to environmental, food safety, animal and plant health and animal welfare standards, as well as to the requirement to keep all farmland in good agricultural and environmental condition ("cross-compliance");
- a strengthened rural development policy with more EU money, new measures to preserve the environment, promote quality and animal welfare, and to help farmers to meet the EU production standards starting in 2005;
- a reduction in direct payments ("modulation") to enable bigger farms to finance the new rural development policy; and
- a mechanism for financial discipline to ensure that the farm budget is not overshot.

Overall, it is expected that the introduction of the SFP is going to have an impact on the use of agricultural land since the use of marginal land, which was only possible due to high subsidies and tariffs, is going to be reduced. In addition, as subsidies will become disconnected from production, there may be further consolidation where farms are becoming larger. Even so, it is still the case, that even after the 2003-4 reforms, very substantial levels of market price support (import tariffs, export subsidies, set-aside and production quotas) will remain. For example, the Most Favoured Nation import tariffs on low/medium quality wheat, lamb and butter are 60% , 58%, and 143% respectively (source: DEFRA).

EU Enlargement and the 2003-04 reforms

The expansion of the EU from 15 to 25 member states required changes in internal EU policies and the common finances. On 1st May 2004, the enlargement welcomed 75 million new consumers and 4 million new farmers to the EU. As Poland and other candidate countries were far more dependent on revenue from the agricultural sector than the EU-15, the accession of the 10 states to the internal market meant that the trade policy needed amendments.

The 2003-04 reforms will also apply to the 10 new member states but with differential treatment as dictated by negotiated agreements prior to their accession. SFPs will be phased in starting at 25% with increments of 5% or more per annum until payments to farmers in new member states are aligned with those to the existing member states, by 2013. New member states are also allowed to "top up" these payments by a maximum of 30% per annum from national funds. The single farm payment will be based on yield and area cropped in the reference period 1995-1999. During this period the new member states experienced market disruptions in the transition from central planning to market based economy, which reduced yields significantly. Therefore, new member states will receive a significantly lower single farm payment (per hectare payment) than the EU-15, even in 2013.

1.2.2 WTO and CAP Reforms

In July 2004, members of the World Trade Organisation (WTO) unanimously agreed on a framework for liberalising farm trade within the Doha Development Agenda (DDA). The most important aspects of the agreement and its implications for EU are:

Reducing trade distorting agricultural support

- The level of the domestic support subsidies will have to be substantially reduced. A down payment of 20% of this reduction will be made in year 1 of the implementation period and since these reductions will be linked to the level of the subsidy, the bigger subsidisers will have to make the deepest cuts.
- It should be noted that the decoupling of payments under the 2003-04 reforms means that a major share of EU support to agriculture is moved from the trade distorting classification under WTO rules (Amber Box) towards the minimal or non-trade distorting category (Green Box). Consequently, these reforms are in line with the WTO agreement and should not be called into question [2].
- The agreement also ensures that other developed countries will have to undertake reforms.

Eliminating trade distorting export practices

- EU export subsidies, export credits, credit guarantees and insurance programmes will either be eliminated by a date to be agreed, if the repayment period is greater than 180 days, or will be subject to stricter regulations and disciplines if the repayment period is less than 180 days
- Trade distorting practices with respect to export State Trading Enterprises will also be eliminated.

[2] For WTO purposes domestic agricultural support is divided into coloured 'boxes': The Amber box refers to policies that directly influence production decisions. The Blue box refers to the exemptions from the Amber box. These include coupled payments such as the compensatory payments to farmers in the EU. The Green box refers to policies that have minimal or no effect on production or trade, such as e.g. research, domestic food aid, decoupled payments and rural development schemes.

Opening-up of agricultural markets

The agreement will substantially improve market access. Farm tariffs will be cut according to a single, tiered approach: the higher the tariff, the greater the tariff cut will be. However, countries can self-select an appropriate number of sensitive products which will be treated in a more lenient way. In addition, tariff rate quotas will have to be opened in order to ensure better market access. Overall, this is expected to have an impact on the EU market, particularly if tariff rate quotas for Black Sea wheat are relaxed.

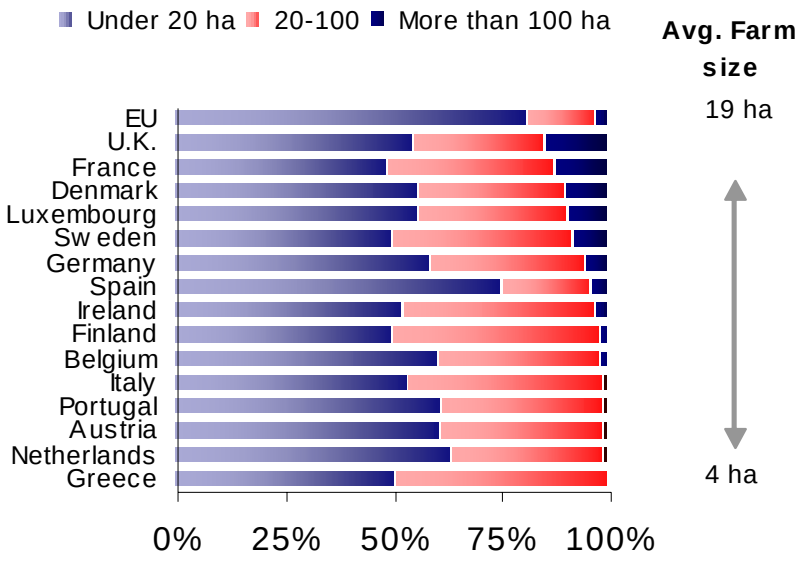
1.3 Structure of the European Union Agricultural Sector

The agricultural sector in the European Union differs in many aspects across member states and, as a result, agricultural producers in some countries have more incentives to make use of risk management strategies, than in others. Many EU farmers are small scale producers with low production levels and significant levels of off farm-income. In addition, many farmers are ageing and receive pensions and social security payments as well as farm income. Overall, this implies that a large proportion of EU farmers are not exclusively dependent on income from agricultural activities and so less exposed to agriculture-related risks. Targeting agricultural risk management methods including derivatives to appropriate groups of producers could, however, help in overcoming some of these challenges.

Agriculture and its activities contribute to no more than 1.6 percent of the total GDP in the European Union; however, its importance to the economy varies greatly across member states. In South Europe, for instance, agriculture contributes a significant proportion to the economy, with countries like Greece (6.5 percent), Spain (3.4 percent) and Portugal (2.5 percent) relying relatively more on the sector (see Annex 1). In these countries, agriculture employs also a great share of the civilian labour force, reflecting the more concentrated character of agricultural production and the small farm holdings, with the Greek, Spanish and Portuguese agricultural sectors employing the largest number of workers - nearly one third of the total European agriculture employment.

Regarding the distribution of the average farm size, the European agricultural sector is made up of a large number of small farm operators. About 6.7 million farms are located in the European Union, of which more than two third are less than 20 hectares, and only 3 percent are larger than 100 hectares (Figure 1.1). Small-scale producers are mostly located in South Europe with about 50 percent of the farms with less than 20 hectares being in Greece, Italy, and Portugal. At the other end of the scale, UK (17 percent), France (15 percent), Denmark (11 percent), and Luxembourg (10 percent) have the highest share of large farm operators. It is also worth noting that, due to farm consolidation, the share of the labour force engaged in production and the number of farm holdings have been shrinking in recent years, yet the total agricultural area has been maintained roughly at the same level over the same period (European Commission for Agriculture, 1999-2003).

Figure 1.1: EU farm size distribution



Source: Eurostat, Agriculture and Fisheries, 2000

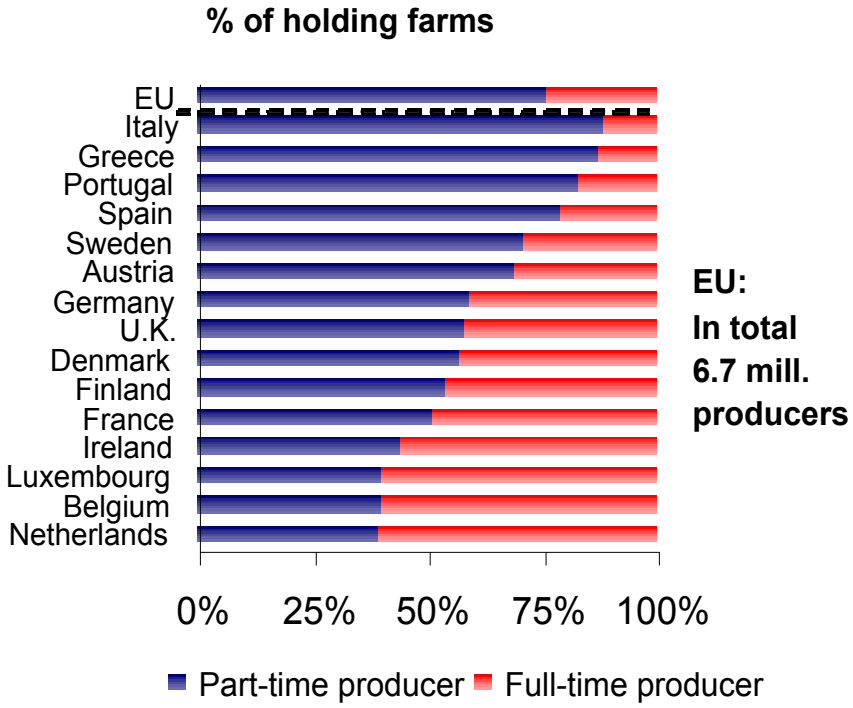
In addition, a large proportion of farmers in the European Union consider farming as a part-time occupation[3]. More than 5 million producers work part-time i.e. only one in four work full-time. The importance of part-time work varies widely across member states where most part-time producers are located in South Europe; from 90 percent in Greece, Italy, and Portugal to less than 50 percent in the Netherlands, Belgium, and Luxembourg (Figure 1.2). Additionally, there seems to be correlation between off farm-work and scale of production. Highest share of off-farm work is expected to be found in South Europe because these are generally small-scale producers, whereas in the U.K. part-time work is low as the average farm size is much higher (see Annex 1). The higher share of part-time farmers in South Europe is the result of the small natural resource base of many farms in the region and the high degree of seasonality of agricultural production, which suggests that part-time farming makes more economic sense (European Commission, 1999).

Regarding their age distribution, European farmers have a high average age, 53 percent of the total farmers are over 55 years (of whom more than half are over 65 years old) and only 8 percent under 36 years of age. Older farmers tend to rely more on off-farm work than their younger counterparts and the percentage of producers in every age group is higher for part-time than for full-time producers and this difference increases with age. The ageing of the "average" EU producer has been cited as a cause either for concern, i.e. too few younger people are taking up farming, or reassurance, i.e. the problem of surplus production will be solved by demographics as older farmers exit the sector. The EU has allowed member states to institute policies that encourage the intergenerational transfer of farms through early retirement incentives for older farmers, while providing aid for establishing younger farmers.

[3] Full-time farmers are defined as those whose work on the farm is equivalent to the annual time of a full-time worker (Eurostat, 2000)

Finally, regarding agricultural production, one of the major produce of the European Union is cereals which accounts for 12.3 percent of the total agricultural production. In 2001 EU produced about 200 million tonnes of cereals (including wheat, oat, barley, rye and maize); however, only a few member states account for a large proportion (more than two thirds) of that production. France (30 percent), Germany (25 percent), and the U.K. (9 percent) who together produce up to 130 million tonnes of cereals. About one-tenth is made up by other small producing member states: Belgium, Greece, Ireland, Luxembourg, The Netherlands, Austria, Portugal, Finland, and Sweden.

Figure 1.2: EU part-time and full-time producers



Source: Eurostat, Agriculture and Fisheries.

1.4 Conclusions

Over the recent years, agricultural price support in the EU has been reduced and reforms for further reductions are ongoing; this is, in part, a result of the necessity to change the policies of the internal market to accommodate the accession of the ten new member states, as well as a result of pressures from WTO to liberalise and open the agricultural markets. Support to the agricultural sector is shifting from trade distorting measures to decoupled direct payment to farmers, and more indirect support through rural development strategies. The consequence of the reduction in intervention purchase at guaranteed prices is that the farmers' income is increasingly reliant on market pricing. As the level of the safety net resulting from intervention prices falls, farmers' revenue is now becoming more volatile. The volatility of prices will also increase as farm gate prices and market prices in the EU converge to

international levels, particularly following the implementation of WTO agreement. Consequently, it is important that risk management tools to control income and revenue risk develop into an integral part of farm operations and agribusiness, in the future. If they do not, farmers who would otherwise be viable may be pushed out of business as a result of adverse price movements.

Nevertheless, the complexities and diversity of the European agriculture sector due to varying production levels and the size of farm holdings, present several challenges to risk product providers. Thus, producers in some member states may make more use of derivatives than others. For example, France, Germany, and the U.K., as the largest cereal producers, are more likely to take part in promoting and using derivatives markets to cover price and production risk than, say, in Greece, Spain, and Portugal where they may perceive the derivatives market as not worthwhile to hedge against adverse price movements. In addition, an ageing farm population can further slow down the uptake of derivatives in agri-businesses in the future.

2 CHAPTER TWO

Risk and Risk Analysis in EU Agriculture

2.1 Introduction

Risks are inherent in all farming businesses, and producers have numerous ways to protect their production, revenue and income against such risks. These range from state supports and subsidies to production diversification, private insurance policies and derivatives markets. Depending on what type of risk the producer is exposed to and to what extent it has to be covered, the producer can choose which risk management instrument to use. Generally, the existence of different forms of government support provisioned by CAP has made European farmers very dependent on government intervention and has directed them away from market risk management instruments. As argued before, recent reforms in CAP - decoupling of direct payments for producers, the modest reduction in market price support for some commodities, and the consequent increase in the volatility and uncertainty of their income - call for a closer look at the capacity of risk management instruments that could be offered to the industry to manage agricultural risk more comprehensively. In this section we first review the different types of risks to which European farmers are exposed. Next, we analyse the impact of recent CAP reforms on the level and volatility of EU agricultural prices. The inevitable conclusion is that as CAP reforms are implemented, European agricultural prices tend to follow world prices more closely, both in terms of volatility and levels.

2.2 Different Types of Risk in Agricultural Industry

All businesses are subject to a great variety of risks. Some of those risks are of a domestic nature (e.g. risks linked to personal and family situations, health and personal accidents), whereas others originate from the macroeconomic environment (changes in economic conditions, interest rates etc.) or the business environment (such as credit risk and institutional risk). In addition, some types of risk are more specific to agriculture or affect it to a greater extent than other sectors such as environmental or weather risks. According to Hardaker et al. (1997), USDA (1999) and European Commission (2001), the major types of risk in the agricultural sector are:

- **Asset Risks** which are associated with theft, fire and other loss or damage of equipment, buildings and other agricultural assets used for production. Losses are normally covered by insurance or, in the case of catastrophic events, public disaster aid may contribute to reduce asset losses;

- **Production or Yield Risks** which are often related to extreme weather events (such as excessive or insufficient rainfall, hail, extreme temperatures), but also include risks like plant and animal diseases. Yield risk is measured by yield variability, i.e. fluctuations relative to the mean in a historical series of production yields. Yield variability for a given crop differs considerably from region to region depending on climate, soil type and production methods. It can be measured at farm, regional or country level. Aggregate data can, to a considerable extent, mask variability at lower levels of aggregation or at the individual farm level;

- **Price Risk** which arises from falling output prices and/or rising input prices after a production decision has taken place. Price risk is measured by the volatility of commodity prices and can be mitigated by measures of price support or through the use of derivatives. In open markets, prices are generally more highly correlated across different regions than yields

- **Financial Risks** which are related to fluctuations in the cost of borrowing, insufficient liquidity and loss of equity;

- **Institutional and Legal Risks** which can be due to changes in the regulatory and legal environments that producers operate. For instance, the introduction of Single Farm Payments in CAP and the reduction in the level of import tariffs under the WTO agreement constitute such risks. Institutional risks are also interrelated with other types of risk. For instance, the institutional risk of a change in price support has an influence on price risk. Likewise, imposing environmental restrictions on production has an impact on yield risk;

- **Ecological risks** that are related to pollution and climate change, or the result of the management of natural resources such as water. These natural risks can be considered as ordinary or extraordinary depending on their frequency and the extent of losses, and they vary according to natural conditions, farm structures and production practices;

- **Market risks** which depend on output and input price variability. They can also concern the demand side and relate, for example, to quality requirements and the emergence of new products;

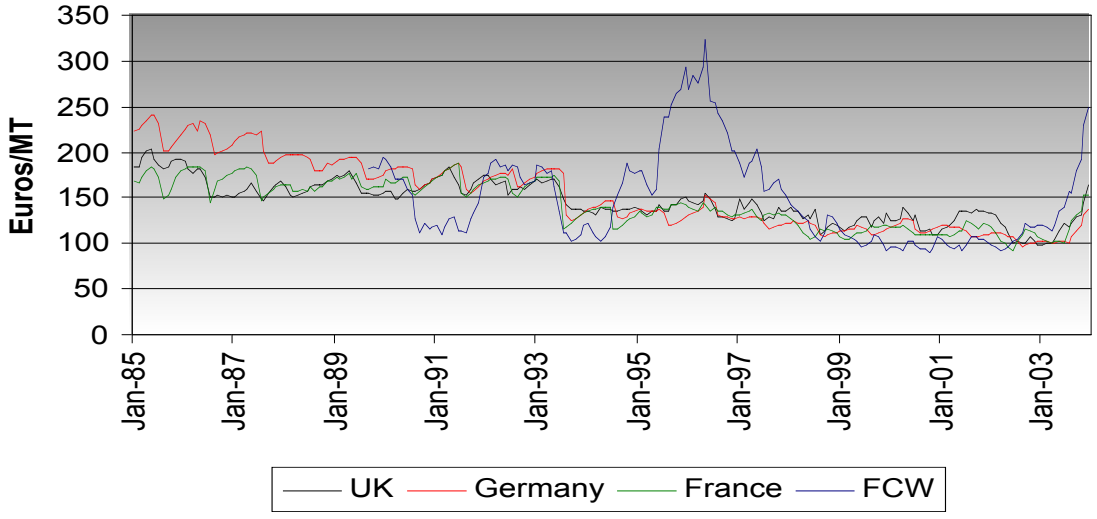
- **Currency risk** that arises from fluctuations in exchange rates when costs and revenues in agricultural business are in different currencies. Currency risk is more important for those producers who rely on export and their revenue determined by the exchange rate at the time of harvest or sale of the product. In general, European farmers are exposed to currency risk if their exports are denominated in US dollars.

2.3 Analysis of Volatility

Having identified the different types of agricultural risks, the next step is to analyse the impact of changes in the institutional framework of CAP on the pattern or price volatilities. Investigation of this issue is important as it helps identify whether farmers are exposed to greater volatility following reductions in the level of subsidies and, hence, provides support for the use of price risk management tools. The analysis focuses on the performance of EU soft wheat prices at farm gate level and export prices for the global wheat market because (a) the cereals market has been undergoing the most radical CAP reforms to date; and (b) wheat is the most important of all arable crops/cereals in terms of tonnage produced and monetary value of production, as well as the amount of subsidies being transferred to the producers.

In order to measure the impact of CAP reforms on EU farm gate prices, we examine whether price volatilities, before and after the MacSharry (1992) CAP reform, show any significant differences. EU farm gate prices in the five largest soft wheat producing countries in the EU; and the f.o.b. export prices for wheat from the EU (French Common Wheat, FCW) and the US (Soft Red Winter, US SRW) are compared and tested for changes in volatility before and after the 1992 reform. The data series for the EU agricultural sector has been extracted by the authors from the NewCronos database provided by Eurostat. The world market prices for wheat were provided by the International Grains Council. The advantage of using absolute selling prices at farm gate level when testing the hypothesis is that they include the price support element but exclude any direct payments. This means that any reductions in market support measures should directly transmit to the prices at farm gate.

Figure 2.1: Development of EU Wheat farm gate and FCW Prices



Source: New Cronos, International Grains Council

Figure 2.1 shows the development of wheat farm-gate prices from 1985 to 2003 for the three largest producing countries in the EU. It is clear that price levels across different member states follow each other closely while, since 1993, there has been a declining trend in EU farmgate prices. It can also be noted that EU farm-gate prices have been higher than French Common Wheat prices except for approximately three years, from 1995 to 1998.

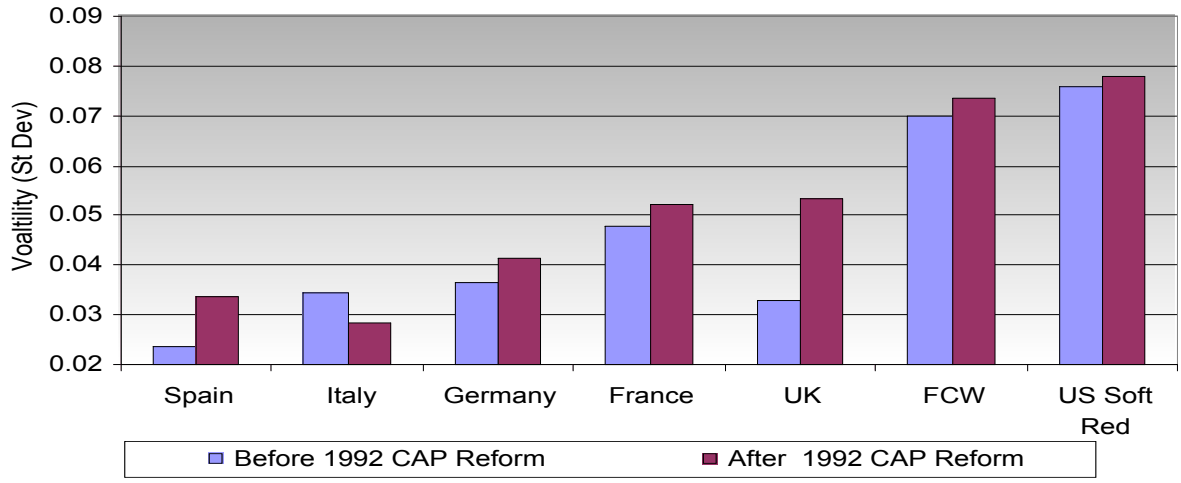
In order to identify any significant changes in volatility before and after the 1992 reform, the series were divided into two sub periods: January 1985 to May 1993 and July 1993 to December 2003. Price volatilities for each sub-period were then estimated for the five larger EU producers of wheat, along with two other world benchmark prices for wheat, namely, FCW and US SRW; subsequently the volatilities, before and after reform, were compared on the basis of hypothesis testing on variances (F tests) (see Annex 2). Results from these tests, in Figure 2.2 indicate that, following the 1992 CAP reform, price volatilities have significantly increased in three out of the five countries under investigation. Also, it can be observed that there is no significant change in the volatility of FCW and US Soft Red price after the 1992 reform which indicates that the observed increase in the volatility of EU prices cannot be attributed to an increase in the volatility of international prices. It is also clear that on average the volatility of European prices is well below the volatility of world prices (FCW and US Soft Red); however, these seem to be converging after the reform[4].

The impact of MacSharry's 1992 CAP reform on the volatility of wheat prices in major European countries, is also assessed by using an Exponential Generalised Autoregressive Conditional Heteroscedasticity (EGARCH) model which can accommodate structural changes in the volatility of wheat prices by incorporating a binary dummy variable taking a value of zero prior to May 1993 and a value of one after that, as shown in Annex 2. Results indicate that the volatility of farm gate wheat prices in four European countries, as well as the volatility of world reference prices, are all time-varying. This is in line with findings in other commodity markets such as oil, metals and other agricultural products, and suggests that volatility depends on market conditions and the volatility clustering effects due to the nature of any news or shocks to the market. Furthermore, the statistical significance of the coefficient of dummy variable in the model for Spain, France and UK, indicates that there has been a statistically significant increase in conditional volatilities of farm-gate price in these countries.

The purpose of these tests was to assess to what extent the reforms have had an impact on the volatility of prices received by farmers, as high price volatility may be translated into instability and uncertainty in farmers' income. As suggested by the results, the 1992 CAP reform resulted in higher volatility in wheat prices in European countries. On that basis, the gradual removal of much of the market price support, the introduction of decoupled single farm payments under the 2003-04 reforms and the implementation of the WTO agreement, are expected to have an even greater impact on the volatility of agricultural prices.

[4] The same exercise was also carried out in order to identify whether the implementation of reforms under the AGENDA 2000 had a significant impact on the volatility of EU grain prices. Results show that farm gate price volatilities increased in Spain and the UK after the reform, but decreased in Germany with no significant change observed in the volatility of French prices. The reason for these mixed results can be attributed to the partial implementation of AGENDA 2000 as well as the very short sample period available after the reform, for such statistical analysis.

Figure 2.2: Volatility before and after the 1992 CAP reform



Note: FCW and SRW abbreviate French Common Soft wheat (EU reference price) and Soft Red Winter (US Gulf reference price). The farm gate prices are reported in ECU for comparison across member states with euro. The UK prices are in Pounds Sterling and the reference prices are reported in US dollars. Sample includes January 1985 – May 1993, July 1993 – December 2003. *Source: Authors compilation from New Cronos. International Grains Council and own calculations*

2.3.1 Analysis of Correlation

Another impact of MacSharry's Reform could be the convergence in co-movement of European farm gate prices and international reference prices such as FCW and US SRW. In order to examine such convergence in correlation, we analyse the correlation coefficient between European prices and reference prices before and after the implementation of reform in mid-1993.

Results of correlation analysis (Annex 2) indicate that prior to the MacSharry reform, the correlation between the farm-gate prices in major European countries and world reference prices is very low and, in some cases, negative (ranging from -0.392 between French farm gate prices and FCW to 0.233 between Italian farm gate prices and FCW). This result is mainly due to the price divergence caused by CAP subsidies and supports prior to the 1992 reform. On the other hand, after the 1992 reform, results reveal that the correlation between European farm-gate prices and world reference price has increased significantly. For example, the coefficient of correlation between farm-gate prices in France and FCW or US Soft Red is about 59%. Similarly the correlation between UK farm-gate prices and world reference prices (FCW) is 76.1%, and the correlation between German farm-gate prices and world reference prices (FCW) has increased to 43.1%. This increase in correlation can be explained by the strengthened linkages between the EU export reference price at the farm gate and the World reference prices, as a consequence of the 1992 reform.

2.4 Conclusions

Overall, it seems that the volatility of farm-gate prices in EU member states has become significantly higher as a result of radical changes to the CAP, through both the MacSharry and the AGENDA 2000 reforms. The policy measures which were affected in the reforms, included all price supporting measures such as intervention, tariffs and export subsidies.

Price support is a form of subsidy that distorts the market and generates artificially high domestic prices. Reductions in intervention prices of 20 percent after the 1992 reform and a further 15 percent reduction in the AGENDA 2000 reform, have significantly increased the volatility of farm gate prices in the EU. Reductions of import tariffs and export subsidies of 36 percent also improved market access to the EU, which resulted in an overall reduction in the prices of imported wheat[5]. At the same time, the reduction in export subsidies also had an indirect effect in that farmers had less scope to sell any surplus production in the international market at artificially high prices, so as to reduce domestic supply. Consequently, fluctuating production levels also became a contributing factor to higher volatility in agricultural prices.

To summarise, whilst intervention price cuts and a reduction of other price support instruments are beneficial in efficiency terms and reduce the level of welfare transfers from consumers to producers, they have increased the volatility of EU prices. The levels of volatility of the EU prices have not yet reached volatility levels seen on the international markets, but they are converging. However, the response and adjustment at farm-gate has been slow and the direct payments may have postponed the impact of price volatility on farm income volatility. The 2003 reform will result in further cuts in guaranteed finances (market price support) to the agricultural sector and introduce decoupled single farm payments. Combined with the commitment under WTO to improve market access, this should increase the volatility of agricultural prices even further but, at the same time, will improve the dissemination of price signals to the farmers and speed up farmers' responses to price signals in the near future. This should lead to an increase among farmers in demand for risk management products, such as derivatives, to reduce income variability associated with price risk.

[5] The EU committed to these reductions under the negotiations (1986-1993) to revise the GATT in the Uruguay Round on the Agreement on Agriculture (URAA), signed in April 1994. The reductions were implemented over a six year period until 2000.

3 CHAPTER THREE

Managing Risk in the Agriculture Industry

3.1 Risk Management Strategies

The uncertainties of global markets, prices, government policies, yields, weather, and other factors can cause significant variability in farm yield, revenue or income. As a result, risk management has become an integral part of farming and agri-businesses all over the world. Risk management essentially involves choosing among different strategies and instruments which can reduce the financial effects of such uncertainties on the yield and the revenue of producers. The strategies that are accessible to European producers are categorised as on-farm risk management activities and risk sharing policies (Hardaker et al., 1997, and Bascou 2003). On-farm strategies, or risk management at farm level, are concerned with income diversification through growing a portfolio of products, selecting and growing low-risk products or products where there is a low or negative correlation of price risk, choosing products with short production cycles, holding sufficient liquidity, part-time farming and diversifying of income sources beyond agriculture. Risk-sharing strategies, on the other hand, include insurance schemes, hedging using derivative markets, vertical integration and contracting. The aim of this chapter is to discuss different risk management strategies available to European farmers and producers and to highlight the pros and cons of such risk management tools. The structure of this chapter is as follows: the following section presents the use of insurance instruments in agricultural risk management. Section 3.3 discusses the use of derivatives as well as the factors affecting the uptake of derivative instruments. Section 3.4 presents general risk management strategies, other than insurance and derivatives, used in agriculture. Finally, section 3.5 presents a summary of the use of risk management instruments in the EU.

3.2 Use of Insurance in Agricultural Risk Management

The principal idea behind insurance is *Risk pooling*, where participants pay a premium to a common fund to cover the losses incurred by any individual in the pool. According to the European Commission (2001) and Meuwissen et al. (1999) the following insurance product schemes are identified for risk management purposes in the EU agricultural sector:

Yield Insurance

In the agriculture and farming industry, *Yield Insurance* is defined as compensation (indemnity) paid by the insurer to the farmer/producer in the event of the yield falling below a certain pre-specified level due to named peril(s) such as hail, frost, etc. Yield Insurance can be based on individual yields or area yields. In the first case, indemnities are paid, if the individual loss falls below a pre-determined trigger yield, whereas in the latter case a farmer would only receive a payment if the area yield falls below a trigger yield. When the yield insured is based on individual production then problems such as *moral hazard* and *adverse selection* may arise. Use of area-based solutions overcomes these problems; however such a policy is only attractive to farmers if individual yields are well correlated with the area yield, otherwise the degree of risk reduction for an individual farmer might not be sufficient to make participation attractive.

For pricing purposes, insurers normally calculate the probability distribution of a loss occurring, due to named (known) perils, such as hail, storm, fire, etc. based on historic data. Then, using statistical models, insurers calculate the premium according to the risk and probability distribution of the occurrence of such events. As a result, the premium of insurance products increases with the number of perils named and cover against them.

Price Insurance

Price insurance can be defined as indemnity against adverse price movements of farming products. In this case, the insurer indemnifies the farmer if price levels fall below a pre-specified level over a certain period (e.g. harvest) in return for a premium. Price insurance policies are more effective for those products for which objective price data are available. To avoid moral hazard and adverse selection problems, loss assessment should be based on a reference price (futures price, spot market price) which cannot be influenced by the farmer. The major drawback of price insurance is the high correlation of prices which is associated with a high degree of systemic (i.e. non-diversifiable) risk. Generally, systemic risks can be dealt with more effectively using derivatives products such as options, futures and swaps (essentially, any price insurance policy can be replicated with a long put option strategy, the strike price of the option being the trigger level of the insurance). Thus, the availability of price insurance may also depend on the availability of derivatives markets where the insurer can dispose of the excess risk due to high correlation of prices or on the availability of sufficient re-insurance capacity.

According to Meuwissen et al. (1999) and the EC 2001 report on Risk Management, price insurance provides less protection for the farmer if losses resulting from a loss of quality are excluded from coverage. On the other hand, including loss of quality may involve significant moral hazard problems, as quality depends to a certain extent on farmer's good practice and commitment.

Revenue Insurance

Revenue insurance can be defined as protection against adverse movements in farmer's/producer's revenue due to changes in the market and production level. Therefore, revenue insurance can be viewed as a combination of price and yield insurance with the potential advantage of being cheaper than either price or yield insurance because the risk of a bad outcome is smaller since low yields may be offset by high prices and vice versa.

Revenue insurance can be set up on a commodity-per-commodity basis or for a portfolio of commodities. The latter could, again, be cheaper for the farmer, because low revenues from one enterprise are likely to be partly offset by higher revenues from another where revenues are not positively correlated. However, such insurance may not be feasible when the correlation between the different commodities and farm yields is high. In addition, access to objective (reference) price and yield measures is necessary for accurate and fair pricing of policies as well as for determining payoffs when claims are put forward. The availability of transparent market information also minimises the instances of problems associated with moral hazard and adverse selection.

Income Insurance

Income insurance is defined as the cover for losses affecting the farmer's income or welfare due to changes in both total revenue as well as total variable costs, such as production input costs, rent, interest payments, taxes, depreciation and employees' compensations. There is always some degree of moral hazard and adverse selection problems involved in a farm's income insurance as potential income losses may not only depend on perils but they are related to large extent on the good will of the farmer and how well he/she manages the business. Furthermore, certain factors influencing the income (e.g. compensation to employees, operating costs, inventories) can easily be manipulated and tampered with to show losses for which the insurance cover is purchased. These two factors could make it even harder for insurance companies to calculate the probability distribution of occurrence of loss making events and setting appropriate and fair premia.

Mutual Funds

Mutual funds can also be considered as a special insurance scheme in which participants (owners of the fund) share the risk amongst themselves in a form of association or club. In the case of a member incurring a loss, the loss will be fully or partially compensated through the collected money already available in the fund and an additional collection among participants. The participation premium is set to cover administrative costs and possible re-insurance costs. Many mutual funds operate on a regional or local basis. Regional mutual funds have the advantage that participants (farmers) know each other and there is a possibility for social control, reducing problems of moral hazard and adverse selection. The disadvantage is the fact that many of the risks they face are highly correlated and, consequently, there is a danger that many or even all farmers may incur losses at the same time. This could mean an extra burden in that a farmer who has already incurred losses must contribute to the fund to cover other farmers' losses. Solutions to this problem include re-insurance or the teaming up with mutual funds in other regions which would cover a share of the loss.

From the point of view of the insurer, the risk of underwriting covers, such as revenue, income or yield in the agricultural sector, could be very high due to high correlation between

the yield (revenue or income) across all farms in one region. This means that potential losses could be substantial in any single year and go beyond the capacity of any single insurer. In such cases, re-insurance policies are purchased by primary insurers who are willing to share or pass on part or whole of the risk to other underwriters. The benefit of re-insurance for farmers is that premia can be lowered substantially, as the risk is shared amongst several underwriters with diversified portfolios. In addition to re-insurance, the formation of insurance pools is another solution for insurers to pass on or spread the risk. In other words, a pool or syndicate is set up by insurers to jointly provide insurance for certain risks which an individual company alone could not cover. [6]

3.2.1 Comparison of Use of Insurance across the EU Members

For many years the most common risk management tools for producers in Europe have been diversification and crop insurance. According to the EC 2001 Risk Management Report and Meuwissen et al. (2003) the extent to which these products are used varies across different member states and depends mainly on government policies.[7]

The involvement of governments in the EU member states in providing subsidies and insurance cover for producers varies substantially across member states. On the one extreme, for example, Greece operates a system which through its public insurance organisation, collects contributions, administers the programme and guarantees coverage of losses. By virtue of this, the role of the private sector is limited – it only covers products not insured by the public system, or provides only top-up coverage.

In the intermediate, Spain and Portugal have "public-private partnership" systems, where the state provides premium subsidies and is involved in reinsurance while the private insurance industry is integrated into the system, administering the whole programme and covering a share of the risk. The high level of insurance cover in Spain is mainly because of the heavy involvement of the Spanish government in providing subsidies on all types of insurance covers used by producers for all types of insurable agricultural risks. This means that all insurable agricultural risks which are covered by the private sector and all types of policies, are subsidised by the state. However, it is also worth nothing that the proportion of high-value weather dependent products (such as banana, tobacco, fruit, rice and winter wheat) which are covered by agricultural insurance cover in Spain, is much higher than the proportion of insurance cover for low-value all weather products (such as cattle, olives, vegetables).

On the other extreme, Italy, France, Austria and Germany have systems of agricultural insurance schemes, which are predominantly private. However, these four countries differ considerably in terms of the role the government plays in providing insurance subsidies for

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[6] Sometimes re-insurance is done using other market instruments such as Mutual Funds and Catastrophic Bonds and options. Catastrophic Bonds and Options are a relatively new instrument and are designed to provide capital contingent on the occurrence of a disaster, which is used as cover for the insured. Investors on such bonds receive a high yield if there are no catastrophes but lose some or all of their investment in the occurrence of a catastrophe. With catastrophic insurance options, an insurance company can share risk with market speculators.

[7] According to Munich Re and Österreichische Hagelversicherung (1999) total public expenditure in Italy, Spain, Austria, France and Germany for disaster aids and insurance subsidies between 1988 and 1997 was about 6.335 billion Euros. Among these member States, Italy spent the highest amount (2.740 billion Euros) to compensate producers for crop losses in the form of disaster aid. A considerable amount of disaster aid was also paid by France (595 million Euros), while Spain paid close to four times more money for insurance subsidies than for disaster aid (1.153 billion and 314 million Euros, respectively).

insurance premia. For example, Germany does not provide any premium subsidies, while Italy grants considerable amounts of premium subsidies to the farming sector (see tables 4.3 in section 4.3.2 of the EC 2001 report). Bascou (2003) argues that, overall, introducing and supporting insurance schemes which cover a wide range of perils at the level which could be of interest to farmers and producers, such as those offered in Spain and the US, seems to involve a considerable amount of state and local government involvement. This may in turn question the efficiency of such insurance programmes, social and regional equity, and consistency with WTO requirements in providing support.

3.3 Use of Derivatives in Agricultural Risk Management

Derivative contracts are also widely used for the purposes of price risk management. The most popular derivative contracts are futures, options and swaps.[8] Market agents, confronted with price risk which arises mainly from supply and demand imbalance in the market, can use derivatives instruments to control price (and perhaps yield) risk by transferring it to other individuals who are willing to bear it. The activity of trading derivatives contracts with the objective of reducing or controlling future spot price risk and revenue is called "hedging". Hedging essentially involves taking a position in the derivatives market which can offset any gains or losses made in the physical market, by locking into a fixed price, or buying a price floor or price ceiling.

Organised trading in agricultural derivatives markets dates back to the mid 1860s with the opening of the Chicago Board of Trade in the US. Since then, the trading volume as well as the variety of futures contracts available for trading has increased dramatically. In the European markets, agricultural derivatives have been traded since 1929 with the establishment of the London Commodity Exchange (LCE) [9]. A list of the major exchanges offering agricultural futures contracts word-wide is presented in Table 3.1.

3.3.1 Economic Benefits of Derivatives Trading

The growth in derivatives trading over the recent years reflects the increased economic benefits which futures markets provide to market agents. These benefits are mainly price discovery, market transparency and risk management through hedging. Price discovery is the process of revealing information about current and expected spot prices through the futures and forward markets. Risk management refers to hedgers using derivatives contracts to

[8] A *futures contract* is an agreement to trade at a specified future time and price a specified commodity or other asset. The principal idea behind futures contracts is to protect the holder against adverse price movements prior to a cash sale or purchase of commodity in the future. Futures hedging is effective in eliminating price risk, but leads to other risks including basis risk. An *option contract* gives its holder the right, but not the obligation, to buy (call option) or sell (put option) an underlying asset (e.g. wheat) at certain price, known as the strike price, and at a certain point in time, known as the expiration date or the maturity. Finally, a *swap contract* is an agreement whereby a floating price for a commodity is exchanged for a fixed price for the same commodity over a specified period for a defined volume. The floating price is normally the prevailing market (spot) price for the asset and the fixed price is the price which is negotiated and agreed before the initiation of the swap contract.

[9] The London International Financial Futures Exchange (LIFFE) merged with London Commodity Exchange (LCE) in 1996. Later in 2001, Euronext acquired LIFFE and was renamed to Euronext.liffe.

control their spot price risk. The dual roles of price discovery and hedging provide benefits that cannot be offered in the spot market alone and are often presented as the justification for futures trading (see e.g. Garbade and Silber, 1983).

Table 3.1: World futures and options markets in agricultural commodities

Exchanges	Location & Date of Establishment	Agricultural Products Offered
Euronext.liffe	London, Paris, Amsterdam, Lisbon & Brussels; 2000	Cocoa, Robusta coffee, white sugar, feed wheat, milling wheat, rapeseed, corn, potatoes
Warenterminborse Hanover AG (WTB).	Hanover; 1998	Hogs, piglets, potatoes, wheat, brewing barley
Budapest Commodity Exchange (BCE)	Budapest; 1989	Corn, wheat, feed barley, rapeseed, soybean, sunflower seed.
Poznan Commodity Exchange	Poznan, Poland; 1991	Corn, wheat, sugar.
Chicago Board of Trade (CBOT)	Chicago; 1848	Corn, soybeans, soybean oil, soybean meal, wheat, oats, rough rice, mini corn, mini soybeans, mini wheat, Dow AIG Index*
Chicago Mercantile Exchange (CME)	Chicago; 1874	Beef, dairy, e-livestock, fertilizer, hogs, lumber
New York Board of Trade (NYBOT)	New York;	Cocoa, coffee, cotton, FCOJ, sugar
Kansas City Board of Trade (KCBOT)	Kansas; 1856	Wheat
Minneapolis Grain Exchange (MGE)	Minneapolis; 1881	Wheat, three classes of wheat Indices**, national corn index (NCI), national soybean index (NSI)
South African Futures Exchange (SAFEX)	Sandown; 1988	White maize, yellow maize, wheat, sunflower seed, soybeans
Sydney Futures Exchange (SFE)	Sydney; 1960	Wool, New Zealand Broad Wool, MLA/SFE cattle.
Winnipeg Commodities Exchange	Winnipeg; 1972	Canola, Barley, Flaxseed, Feed Wheat

*Dow Jones AIG Commodity Index Futures (AI)
**Hard winter wheat index (HWI), Soft red winter wheat index (SRI) and Spring wheat index (SWI).
Source: Battley, Nick (1999) The world's futures and options markets, Second Edition, John Wiley & Sons, LTD.

The Price Discovery Role of Derivatives Markets

Derivatives markets provide a mechanism through which the supply and demand for an asset are brought into alignment, both in the present and over time. According to Edwards and Ma (1992), derivative prices reflect the current expectations of the market regarding the level of spot prices that will prevail in the future. Therefore, through derivatives trading, information about the expectations of market participants regarding the future supply and demand balance

for a commodity is assimilated to produce the price of the derivatives instrument for a later date. As a result, derivatives trading and contracts contribute to a more transparent market.

By reflecting expectations about future spot prices, derivative prices trigger production and consumption decisions that reallocate the temporal supply and demand for a commodity in a way that promotes an efficient allocation of economic resources. In particular, expected future shortages of a commodity could be alleviated by increased future production, while current shortages are alleviated by the deferral of current consumption to a later period, when spot prices will be lower. In addition, due to their liquidity and price transparency, derivative prices are also used for determining the underlying spot prices in many agricultural markets.

In summary, the existence and functioning of derivatives markets determines and makes visible both current and expected spot prices. This availability of information contributes to market transparency, reduces search costs and provides signals that guide production and consumption decisions, and result in a more efficient allocation of economic resources. Moreover, the benefits of price discovery accrue not only to the futures markets participants, but also to anyone else with an interest in the future value of the underlying asset.

The Risk Management Function of Derivatives Markets

In general, using agricultural derivative products presents several benefits to society (Kolb, 1997). First, derivative markets give producers the opportunity to participate in risky activities which they would not otherwise undertake. Second, trading away price risk using agricultural derivatives results in a more efficient allocation of resources compared to using on-farm methods for avoiding risk (Myers, 1991 and Hardaker et al. 1997). Third, use of price risk management strategies is likely to stabilise farmers' income, which in turn implies more stable expenditure on farm inputs and family consumption, thereby providing greater security for rural businesses and society as a whole through increased rural employment. A downturn in farm incomes and in spending by farm families could lead to the closure of some local businesses and to a withdrawal of services, yet these lost facilities may not be fully replaced when farmer's incomes recover later (Hardaker et al. 1997). Finally, if farmers can manage market risks effectively there will be less pressure for taxpayer-funded support prices or emergency aid packages and a corresponding reduction in the business resilience of the farming industry.

3.3.2 Hedging using Derivatives – An Example

To illustrate the benefits of derivative contracts for the purposes of risk management, we present a simple hypothetical hedging exercise. Consider the case of a UK wheat producer who wants to secure his revenue from fluctuations in wheat prices. For this he considers using a hedging strategy with options and futures on wheat. More specifically the following strategies are considered:

> **Strategy A:** Hedging wheat price risk three months forward using wheat put options contracts with a strike price which is 3% below the current spot price;
> **Strategy B:** Same as A but strike price is 1% below current spot price;
> **Strategy C:** Hedging using 3-month futures contracts by establishing a short futures position.

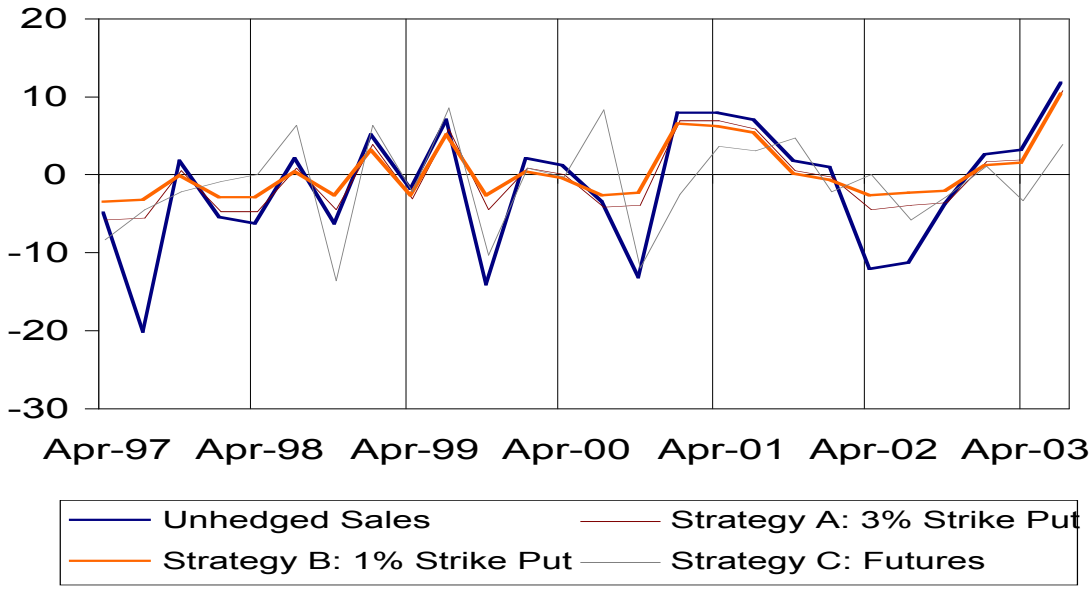
These positions are then kept open for a period of three months at the end of which the positions are closed and new positions are established for the subsequent three months. This exercise is repeated for subsequent three month periods from January 1997 to December 2003. The performance of these strategies is then compared to the case where the producer simply decides to "take his chances" and leave his position open i.e. selling the crops at the market price without using any risk management tools [10].

Table 3.2: Variability of the Payoffs for the four strategies for the period 1997-2003

	Average (£/ton)	Standard Deviation (£/ton)	Variance Reduction
Sales only strategy (Unhedged)	-1.66	7.93	
Put 3% Strike (Strategy A)	-0.23	4.66	65.4%
Put 1% Strike (Strategy B)	0.13	3.73	77.9%
Short Futures (Strategy C)	-0.95	5.85	45.5%

Notes: Average and Standard deviation are for the four series presented in Figure 3.1. Variance Reduction measures the reduction in the variances (i.e. standard deviation squared) of the payoffs from the different strategies over the unhedged strategy.

Figure 3.1 : Payoffs for the four strategies for the period 1997-2003



The descriptive statistics and payoffs from these strategies are presented in Table 3.2 and Figure 3.1, respectively. The best strategy is the strategy that provides the lowest possible variability of the hedged position. We can see that the "leave open" position results in the largest variation in payoff which implies that, if producers do not take any hedging actions, then they will be exposed to substantial price risk. Both option strategies provide good risk protection. Overall strategy B (1% put) is superior to A (3% put) reflecting the fact that buying put options with strikes which are 1% below the spot market represents a good

[10] Futures price series are collected from Datastream, and Department for Environment Food and Rural Affairs (DEFRA) provides producer price series. The put options are priced using the Black-Scholes option valuation model (see Hull, 2002 for more details). As inputs in the Black-Scholes model we use the realised annualised volatility of producer prices and interest rates are assumed to be 4% over the period examined.

balance between cost of options premia (1% puts are more expensive that 3% puts) and frequency of exercise; in other words, over a three month period, the spot market is more likely to drop by 1%, as opposed to 3%, and, as a result, 1% puts will be exercised more frequently than 3% puts thus providing superior risk protection. It should also be mentioned that the choice of 1% and 3% strike price intervals should differ across different contracts and primarily reflects the volatility of the underlying market. Finally, the futures strategy also performs well by reducing the risk of the unhedged position by as much as 45.5%. Overall, this example further illustrates the usefulness of using derivative contracts for the purposes of price risk management.

3.3.3 Factors Affecting the Uptake of Derivative Contracts

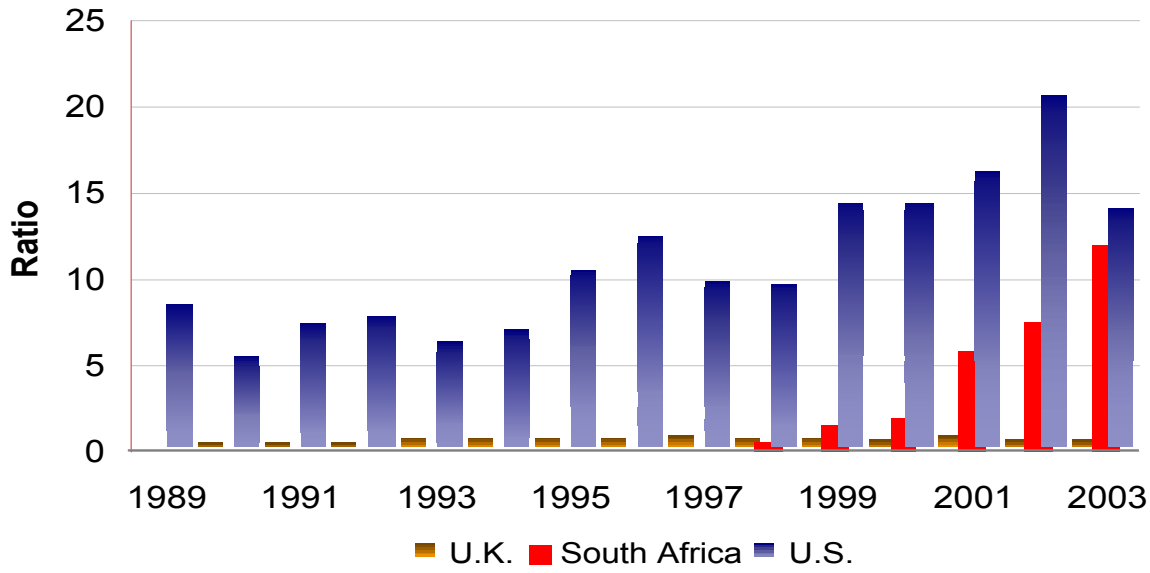
Derivative markets could provide a theoretically sound agricultural risk management method for farmers (as well as processor, merchandiser or others). Yet European agri-businesses were slow in the uptake of derivative products; for instance, only as much as 11 percent of UK grain producers has been reported to employ agricultural derivative products.[11] The low participation in the market can also by judged by the number of futures contracts traded relative to the physical base, in Figure 3.2. In the UK for instance, the volume in the futures market is equivalent to the level of physical activity. In contrast, in the US, futures volume is on average 10 times the level of physical activity while, in South Africa, the ratio in 2003 was at about the same level as in the US. Lack of correlation and basis risk, the presence of Common Agricultural Policy, inadequate information and training, liquidity risk, transaction costs and affordability and availability of other risk management tools may have contributed to the low participation of agricultural producers in the European derivative markets. These reasons are explained in more detail next.

Common Agricultural Policy

The Common Agricultural Policy provides income stability through price support and direct subsidies. Having ensured a stable farm income, European producers have had little or no incentives to conduct hedging, whether on an individual basis or through co-operatives. Unless the European Union initiates market measures in the agricultural sector, farmers will not perceive these products as a feasible risk management tool. However, reforms in CAP under the 2003-04 review and the reduction in trade distorting support measures under the WTO agreement will result in greater variability in production prices and, hence, will make farmers more aware of the need to use risk management tools.

[11] National Farmers' Union (NFU) Report on Farm Risk Management, 2000.

Figure 3.2: Ratio of Wheat Futures Volume over physical production in the UK, US and South Africa for the period 1989-2003



Source: DataStream, FAO Agricultural statistics. Unit of trading differs between the exchanges. On Euronext.liffe and SAFEX the futures contract size is one hundred metric tonnes whilst on CBOT the futures contract is 5,000 bushels or 136 metric tonnes. Contracts presented in this graph are adjusted to reflect the different sizes. SAFEX contract is for White Maize.

Training and Market Information

Another frequently cited cause for the low participation in derivatives markets is lack of understanding of the products due to inadequate information and training. Risk management activities require considerable knowledge of financial instruments and it seems that only a minority of European farmers has the knowledge and training to understand and make use of agricultural derivatives. In addition, the larger participants in the market tend to be food industry processors, merchants, and (to a lesser extent) co-operatives as they posses the necessary resources and know-how to engage in agricultural derivative transactions. To that extent national organisations take initiatives to train and educate market participants about the use of derivative products. In the UK for instance, the Home Grown Cereals Association (HGCA) recently ran numerous one-day seminars on options on grains and currency, to assist the UK cereals sector in risk management. The HGCA also allows registered customers to view market reports, market intelligence, and the latest future and currency prices, on its website. In addition, other UK organisations like the National Farmers' Union (NFU), National Pig Association (NPA), and Meat and Livestock Commission (MLC) are currently involved in the distribution of information to their members and in training in risk management tools including derivatives.

Correlation and Basis Risk

Hedging in futures markets does not come without risk. Variation in basis or basis risk could cause futures prices to deviate from cash prices and, as a consequence, the hedger's harvested

production would not be covered completely and effectively using futures contracts [12]. This is because an effective hedge also requires a high correlation between price changes in cash price and the futures price. A high correlation in price changes results in a better euro for euro offset between cash and futures position; if this were not the case, the production would not be sufficiently covered by the futures market and extra gains or losses would arise.

To assess the performance of agricultural futures contracts, we examine the effectiveness of the wheat futures contracts traded at Euronext.liffe, in reducing physical price risk for European producers.[13] Hedge ratios and measures of hedging effectiveness are therefore estimated for producer prices for feed and milling wheat in the UK, Ireland, Germany, Spain, Portugal and France. These results are then compared with similar wheat futures contracts offered in three main exchanges in the US (CBOT, KCBOT and MGE) and extensively used by US farmers/producers for price risk management purposes. The examination is carried out from July 1999 through December 2004 resulting in 66 monthly time series observations. Futures and US wheat prices are collected from DataStream while European wheat prices are from HGCA.

Results of effectiveness of wheat futures contracts offered by Euronext.liffe as risk management tools for different European feeding and milling wheat products are presented in Table 3.3. Similarly Table 3.4 reports the hedging effectiveness of three US traded wheat contract in managing the price risk of three different grades of wheat produced in the US. Plot of price levels are also presented in Annex 4.

Starting with the results for the UK market (Table 3.3) it can be seen that a producer would have reduced the variability of the selling price of his product by as much as 52.1% (degree of risk reduction) using the Euronext.liffe feed wheat futures contract.[14] Similarly, for French milling wheat, a 65.7% reduction in volatility of farmers' selling price can be achieved using the Euronext.liffe milling wheat futures contracts. However, farmers and producers in other regions (Germany, Spain, Portugal and Ireland) achieve considerably lower hedging effectiveness, ranging from 16.7% to 44.2%, when they use wheat futures contracts offered by Euronext.liffe. This lower hedging performance in other European countries is mainly due to basis risk. This means that, although Euronext.liffe futures contracts are good hedging instruments for UK and French market players (farmers, cooperatives, merchants, traders and consumers), they provide less effective risk protection across other types of European wheat.

Results of hedging effectiveness of US traded futures contracts (CBOT, KCBOT and MGE) for managing price risk of three different grades of wheat produced in the US are quite comparable to those traded in Europe. Results reveal that the best instrument to hedge Number 2 Soft Red Wheat is CBOT futures with 64.3% effectiveness, the best contract to hedge Number 2 Hard Red Wheat is KCBE futures with 57.9% effectiveness, and the best contract to use for hedging Hard Red Spring Wheat is MGE futures with 76% risk reduction ability. It can also be noted that cross hedging these wheat futures results in lower hedging

[12] Basis is the difference between local cash price and the relevant futures contract price for a specific location at a particular time. Basis risk typically arises when there is imperfect correlation between spot prices and futures prices.
[13] To assess the hedging effectiveness we use the minimum variance hedge ratio methodology. In other words, hedge ratios (number of futures contracts a hedger must buy and sell for a given physical position) are estimated in such a way so that the risk of the physical position is minimised. This methodology is described in Annex 3.
[14] Note that the hedging effectiveness of 52.1% is achieved using a "hedge ratio" of 0.8. In other words, for every £1 of physical production, the hedger needs to buy 80p worth of futures contracts

effectiveness because of the increased basis risk due to quality, location and stock level differences.

Table 3.3: Hedging Effectiveness for EU wheat prices against corresponding exchange traded wheat futures contracts

Panel A: European Wheat Prices vs Euronext.liffe Feed Wheat Futures

UK Feed	Ireland Feed	German Feed	German Mill	Spain Feed	Portugal Feed	France Mill
52.1%	44.4%	22.5%	19.6%	22.5%	42.6%	44.6%

Panel B: European Wheat Prices vs Euronext.liffe Milling Wheat Futures

UK Feed	Ireland Feed	German Feed	German Mill	Spain Feed	Portugal Feed	France Mill
17.9%	29.4%	16.7%	36.6%	23.6%	38.9%	**65.7%**

- Figures presented are measures of hedging effectiveness; i.e. they reflect the percentage reduction in the variance of the physical position.

Table 3.4: Hedging Effectiveness for US wheat prices against corresponding exchange traded wheat futures contracts

Panel C: US Wheat Prices vs US Wheat Futures

	CBOT Futures	KCBOT Futures	MGE Futures
Number 2 Soft Red	**64.3%**	34.7%	61.3%
Number 2 Hard Red	46.6%	**57.9%**	54.0%
Hard Red Spring	53.5%	45.2%	**76.0%**

- CBOT, KCBT and MGE are the Chicago Board of Trade, the Kansas City Board Trade and the Minneapolis Grain Exchange, respectively.
- The underlying for CBOT, KCBOT and MGE are Number 2 Soft Red, Number 2 Hard Red and Hard Red Spring wheat, respectively.
- Figures presented are measures of hedging effectiveness; i.e. they reflect the percentage reduction in the variance of the physical position.

One possible solution to the problem of basis risk is the use of a certain type of OTC derivatives instruments known as "Contracts for Difference" (CFD). These contracts can be used to reduce basis risk and help farmers to lock in Euronext.liffe prices in order to increase the performance of their hedging exercise. CFDs, which are essentially swaps contracts, are extensively used by Australian farmers, producers and other market participants, who are interested in locking their prices into futures contracts traded in the US or other world benchmark prices (see section 5.4.1 for more details on CFDs).

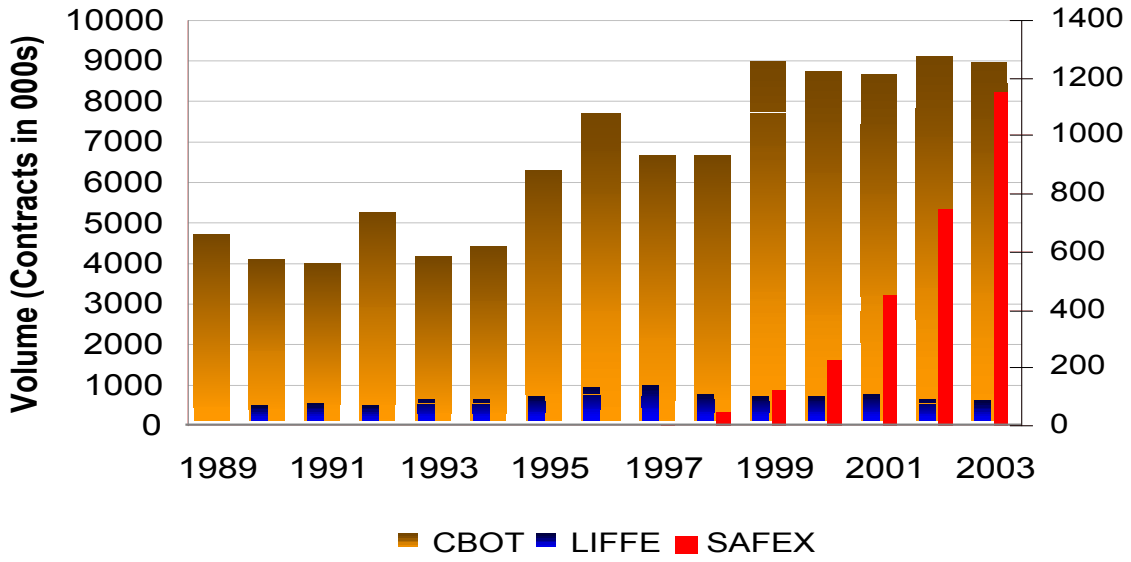
Liquidity Risk

Futures contracts on feed wheat have been traded at Euronext.liffe since 1964. Yet the contract has so far not attracted participation by all market participants (such as cooperatives, merchants, traders and manufacturers) and does not have the involvement of the majority of UK producers and, as a result, trading volume has remained at relatively low levels. In contrast, the agricultural derivative markets in the United States and South Africa have been more successful in attracting sufficient liquidity for hedgers and traders alike. Figure 3.3 presents the liquidity – measured as number of traded contracts – of the wheat contract at CBOT, the white maize contract at SAFEX and the feed wheat contract at Euronext.liffe. We can see that for every feed wheat contract traded at Euronext.liffe there are 14 white maize contracts traded at SAFEX. However, CBOT is the most liquid of the two markets with the annual volume in 2003 representing the equivalent of 900 m tonnes of physical trade.

Liquidity is an important parameter in attracting participation in derivative markets. Participants need to know that there is adequate depth in the market so that they can buy or sell a contract without the market moving significantly and also that they will be able to move out of the market (i.e. close a position) quickly and efficiently.

A key factor affecting liquidity relates to the involvement of the international trade. If exports are managed administratively (or could be managed administratively), as is currently the case in the EU, traders hedging international risks on EU derivative markets are exposed to EU policy risk. In South Africa, volumes and liquidity only rose significantly once the Maize Board had withdrawn from its role of managing the export market.

Figure 3.3 :Volume of wheat futures contract traded in Chicago (left axis), London (right axis) and South Africa (right axis) for the period 1989-2003



Note: Unit of trading differs between the exchanges. On Euronext.liffe and SAFEX the futures contract size is one hundred metric tonnes whilst on CBOT the futures contract is 5,000 bushels or 136 metric tonnes. Contracts presented in this graph are adjusted to reflect the different sizes. SAFEX contract is for White Maize. *Source: DataStream*

Affordability and Accessibility

Several organisations have reported that the costs of trading derivatives privately, i.e. *transaction costs*, outweigh the gains, or the products are insufficient in meeting producers' needs (EC Report on Risk Management, 2001). For large producers, the cost issue is less of a problem;[15] however, cost issues could have a larger impact on small-scale producers with limited resources and time available to manage derivative products. Transaction costs and the prices of financial products are also affected by whether the market is liquid enough. For instance, the greater the liquidity in a market, the lower the level of transaction costs. Similarly, purchasing a financial product (e.g. option or insurance) in an illiquid market will command a higher price due to a "liquidity premium" embedded in the price.

[15] Grant (1989) finds that costs from futures trading such as commissions and opportunity costs in placing margin deposit have little effect on overall hedging performance.

Accessibility refers to whether a market participant can access information about derivatives instruments (such as contract price, contract specification, historical information, etc.) with no restrictions, and whether they are able to correspond with their brokers, counterparties and advisors with no impediments. The technological advances in recent years in information dissemination, use of internet and introduction of electronic trading provide a great opportunity for making different risk management products more accessible to small and medium-size European farmers and producers, both in terms of training and trading.

Financial regulation also plays an important role in the sense that it provides the institutional framework within which risk management activities may be carried out. Changes in financial regulations may affect the ability and capacity of a financial services provider to offer, say, agricultural derivative products to producers.

3.4 Other Risk Management Methods

Common risk management tools for producers in Europe are diversification and crop insurance. In the UK for instance, producers traditionally consider diversification as a sound strategy because it can take a number of forms like varying product mix to reduce variability of returns, or earning income from non-farming activities. The majority of producers, nearly 65 percent, derive some income from working off farm. Overall, it seems that the practicalities and availability of other risk management tools can pose a trade-off situation to farmers. These risk management methods are discussed next:

Diversification is intended to reduce the variation of overall returns from farming activities that have net returns with low or negative correlation. For instance, higher income from some farming activities can potentially offset low income from other activities which have seasonal irregularities. Diversification can be applied to income sources and off-farm income; a crop farmer may choose to become an income spreader, which involves producing different kinds of crops or both crops and livestock, so that localised or crop-specific weather disasters are less likely to reduce yields for all crops simultaneously. Off-farm income is simply when the farmer obtains his income from other non-farm activities, for example taking work at the local shop or operating hostels.

Vertical Integration includes all of the ways the output from one stage of production and distribution is transferred to another stage, so that a firm's ownership or control of a commodity can move across from production to marketing. Vertical Integration can then be used to reduce risks arising from variation in the quantity and quality of agricultural inputs or outputs. However, it may not be very effective against price risk as the overall profitability of the vertically integrated entity depends on the fluctuation of input and output prices. An example of a vertically integrated agricultural business can be a medium-size cattle or hog producer who is involved in other parts of the supply chain such as processing, distribution and sales of the meat products. Here the farmer can at least control part of the price, production and quality risks (Mills, 2003)

Marketing Contracts or Contracting involves a seller and buyer who enter into a contract whereby a specified price is agreed on a commodity for delivery in the future; that is, harvest, or when the commodity is ready to be marketed. Marketing contracts determine price, quality

and amount of product to be delivered. In marketing contracts, the producer usually remains fully responsible for the management decisions during the production process. In the US, marketing contracts are more widely used than production contracts: in 1998, 21 percent of the total value of US production was sold under marketing contracts. Topping the list of crops under marketing contracts were fruits and vegetables (with US $10 billion, or 45 percent of total production, sold under a marketing contract), followed by cotton, corn, soybeans and sugar. For cattle, just under 10 percent of the value of production was sold under marketing contracts whereas, for dairy products, this was more than 60 percent. In order to stimulate the use of futures and options markets for livestock products, the US has started pilot programmes for dairy, cattle and pig farmers, involving training in the use of these tools and, in some cases, subsidisation of premia payments.

Production Contracts specify the quantity and quality of input and output to deliver a commodity at a specified price at the time of harvest. Production contracts are made between producers and economic agents downstream in the supply chain. Processors commonly enter into production contracts with producers to ensure timeliness and quality of commodity deliveries and to gain control over the methods used in the production process. In the US, in 1998, 14 percent of the total value of production was produced under production contracts. These contracts are mostly used for livestock: poultry and poultry products accounted for over 50 percent of the total value of commodities under production contracts, and cattle and pigs for another 41 percent.

Safety Net Programmes are schemes promoted by governments to stabilise farmers' income by regularly contributing to an account in a high-income year and withdrawing from it in a low-income year. These accounts are normally topped-up by government support. Several such schemes exist in European countries that allow farmers to smooth their income over a longer time period. In the UK for instance, under the Corporation Taxes Act, farmers can set trading losses forward against future profits of the same trade, against other income of the same or previous year, or against capital gains of the same or previous year.

Financial Leverage means borrowing capital to help finance the farm business. Generally, high levels of debt relative to net worth are considered risky. The optimal amount of leverage depends on several factors including farm profitability, the cost of credit, tolerance for risk, and the degree of uncertainty in income. Increasing the level of debt, increases the capital available for production allowing expansion of the business, but also entails incurring a repayment obligation and creates the possibility of loan default because of the risks inherent in farming operation.

Liquidity is defined as having cash or commodities at hand which the farmer can easily turn into cash in order to meet her short-term financial obligations or to provide protection against adverse market movements. For example, farmers can enhance *liquidity* by having cash available and storing commodities, or other assets, which can efficiently be converted to cash without incurring a major loss. Liquidity is also crucial for highly leveraged operations. The more leveraged the farm, the greater the need for careful liquidity management in order to make timely payments on loans and other obligations.

3.5 Use of Risk Management Instruments in the EU

The extent of the use of insurance policies and financial risk management instruments by European producers appears to vary by the type of instrument. Production contracts and some types of marketing contracts, particularly contracts with downstream participants in the supply chain, appear to be fairly common instruments adopted by some types of producers in respect of some commodities. It seems likely, however, that larger and possibly more specialised producers are in the best position to adopt this form of risk management.

According to the European Commission (2001) in the UK for instance, producers consider diversification as a sound strategy because they rely on product mix diversification and income from non-farming activities such as rental businesses and off-farm work. The majority of producers, nearly 65 percent, derive some income from working off-farm. In the EU, the share of farmers diversifying their activities outside agriculture is also considerable. In fact, the average level reached 29 % in 1997, with some differences among Member States. According to statistics available the highest proportion of part-time farmers with off-farm income sources can be found in Sweden (54 %), Finland (49 %), Germany (45 %), and Austria (39 %), whereas Belgium and Luxembourg (17 %) are at the lower end of the scale. In the south of Europe the share of off-farm activities is relatively moderate with Spain (28 %), Greece (27 %), Portugal (33 %), and Italy (24 %).

Crop insurance is also widely used and is particularly popular in Spain, where insurance companies offer coverage for most natural agricultural risks and premia are subsidised by the government. In fact, farmers have the option to choose the level of coverage and it is estimated that as much as 70 percent of the cereal plantation area in Spain is insured. Also, in the Netherlands, mutual insurance schemes have been used widely for contagious disease outbreaks both in crops (horticulture and potatoes) and livestock (poultry). The Commission has recently proposed the setting up of similar funds in Member States intended to stabilise revenue in the pig sector. These regulatory funds would be financed by producers and would enable them to stabilise revenue through a system of levies to be collected during periods when their economic situation is satisfactory. In exchange, payments would be made during periods of a difficult market situation (EC Report on Risk Management, 2001).

Finally, recently, there have been considerable efforts in Europe to develop agricultural futures and option markets**.** At least four new commodity exchanges that offer futures and options based on agricultural commodities have been established since 1988. Although many of the new European agricultural futures and option markets are not actively traded, changes in economic and agricultural policies over the last 10 to 15 years appear to have created more favourable conditions for the development of futures and option markets. In particular, many of the new agricultural derivative markets were introduced after the implementation of reductions in price supports for major commodities due to the 1992 and AGENDA 2000 reforms, as well as implementation of the 1995 WTO Agreement on Agriculture. This has resulted in the launch of a number of new commodity and agricultural exchanges in Central and Eastern Europe as well as the introduction of at least 38 new agricultural futures and options contracts. These new contracts include futures and/or options for wheat, corn, live hogs, rapeseed, rapeseed meal, and rapeseed oil. On the whole, it seems that, consistent with the trends in European agricultural policy towards reduced market intervention, most new European agricultural futures contracts have been designed to reflect the needs of producers and are more in line with agricultural commodities produced and consumed within Europe.

4 CHAPTER FOUR

Deregulation and Derivatives Markets: Experience of Other Countries

4.1 Introduction

The ongoing 2003-04 reform in CAP, combined with the commitment under WTO to improve market access, is expected to increase the volatility of EU agricultural product prices. As a result, where intervention prices previously offered a floor below which prices would not fall, farmers' prices are now becoming more volatile and linked to the world market. This is expected to lead to an increase among farmers in the demand for risk management products, such as derivatives, to reduce downside income risk associated with price risk. It is interesting, therefore, to compare the case of the EU with other countries where there is little or no government intervention in the agricultural sector, and market participants actively use the derivatives markets for the purposes of risk management. Two such markets are the South African and the Australian. The South African example is worthwhile looking at because, following the deregulation of the maize market, producers and other participants have learned how to deal with price risk by using the local futures and options market. The Australian market is also interesting because, despite the absence of organised derivatives markets for key agricultural commodities, there is widespread use of OTC options and price swaps and, nowadays, the Australian market is considered as the single most advanced market in the world for agricultural risk management.

4.2 The South African Experience

In the mid 1990s, the agricultural marketing system in South Africa underwent significant changes. Government controls and the level of market price support were considerably reduced, the domestic maize market was gradually liberalised and the Maize Board, the statutory authority responsible for determining every aspect of the production and marketing process of maize in South Africa, was closed. Although South African producers were faced with a dramatic change in their risk environment, they managed to readjust their risk management activities. Operating in a largely deregulated environment, they now participate extensively in the agricultural derivatives market in which 20 to 30 percent of producers trade directly on the exchange and through co-operatives [16]. In addition to being members and hedging actively on the exchange, co-ops and financial institutions also provide a number of ancillary services to farmers and participants such as production credit and the provision of credit for futures margins.

4.2.1 White Maize and Deregulation

The South African agricultural sector, and in particular maize production, was initially based on a free market system in which maize was marketed, bought and sold, without intervention from the government. In the mid 1930s, the government established an increasingly strict grip over the supply chain of maize. In 1937, the Maize Board was set-up with the purpose of controlling and regulating the maize market. The Board was a statutory body controlled by farmers (who had the majority of board members) and had all the legal powers necessary for determining which persons should produce, handle, process and trade maize. The Maize Board dictated almost every aspect of the marketing process including the price the producer was paid, the financing of storage facilities, the purchases for millers, the shipment of production abroad, and even information and inspection services. The maize marketing system was financially unsustainable, and a series of reforms in the 1980s and early 1990s, sought to reduce the fiscal burden for the South African Government and to make the system more market oriented. But even as late as 1994, the Maize Board was still running a very interventionist and distorting maize marketing scheme. The political reforms of the early 1990s provided the necessary political impetus for the move to full liberalisation of the domestic market and maize imports. Eventually, in 1997, the Maize Board was closed.

Nowadays, the South African agricultural sector and its activities bring 17.4 billion US dollars to the economy or account for 3.8 percent of the GDP. At the same time the sector employs as much as 6 percent of the civilian workforce. Much of the value produced comes from maize, contributing to the fact that South Africa is one of the world's major producers. White and yellow maize make up 35 percent of the area planted in the country with almost 65 percent of the maize grown being white and the remaining 35 percent yellow. In order to provide effective risk management for Maize producers, the Agricultural Markets Division (AMD) of the South African Futures Exchange (SAFEX) introduced the white and yellow maize futures contract in 1996 [17]. Figure 4.1 presents the trading volume of the white maize futures contract. Starting from very low levels initially, this has grown at a steady rate of as

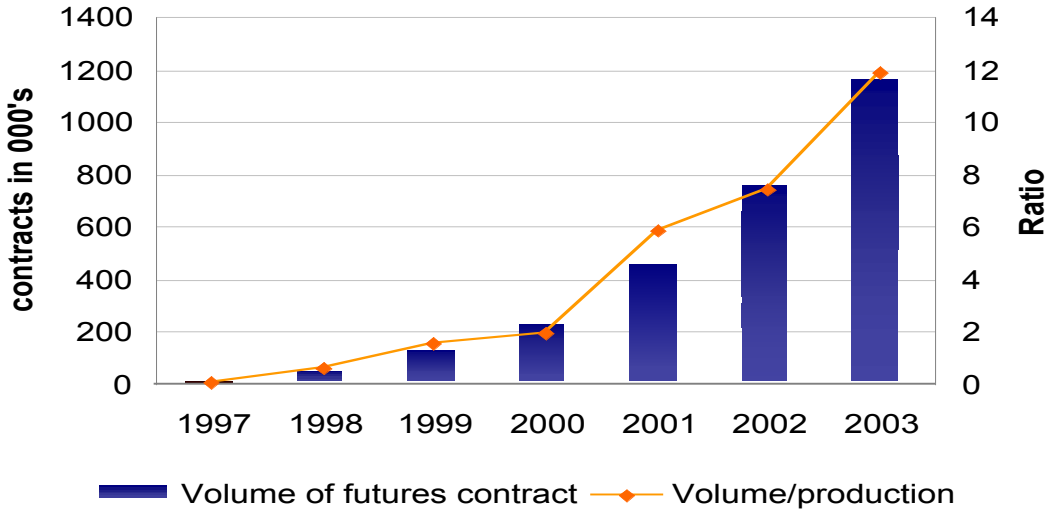
[16] Interview with Chris Sturgess from SAFEX. It is estimated though that these are primarily large scale producers since small scale farmers are primarily involved in subsistence farming and are predominantly net purchasers of maize (Bayley, 2000)

[17] SAFEX AMD was set-up in 1995. In 2001, SAFEX was bought by the JSE Securities Exchange and since then trading of agricultural derivatives takes place in the Agricultural Derivatives Division of JSE.

much as 150 percent annually. In addition, over the same period of time, the ratio of futures volume to physical production has risen from 0.04 to about 12 times the level of production, indicating larger uptake of derivatives among producers and agri-businesses as well as active participation by speculators. A liquid market like SAFEX attracts participants such as processors, producers and co-operatives. Co-operatives and financiers also assist producers with the provision of credit for margin requirements and other costs, related to the trading of derivatives.

At the same time SAFEX AMD also established an options market. Volumes in the maize options market also grew rapidly. The advantages of the options market for farmers and millers, compared to the futures market, was that there were no margin calls for the buyers of options, and secondly that buyers of options were effectively buying a price floor (farmers) or a price ceiling (millers) limiting their downside risk without limiting the upside potential in the market.

Figure 4.1 : Futures volume and Production Cover for the White Maize contract in SAFEX



Source: SAFEX

4.2.2 Marketing through Building Relationships

New products can be versatile and effective, but that does not in itself guarantee success. There need to be expressed commitment and effective strategy, to ensure that an understanding exists of the benefits and costs of these products. In many cases, this will include accommodating the farmers' needs, particularly those with small- and medium-sized operations. The experience in South Africa has shown that the larger farms are quite familiar with, and frequently trade, futures, options, and other types of derivative products.

Members of the Exchange provided valuable services in marketing the concept of derivatives trading to the market. In the early days, they spent many days on the road training and marketing, first the concept of futures and then later on options, to the entire agricultural community. This was not easy as they had to persuade farmers and processors, who had been used to regulation and single-channel sourcing of their products, about the benefits of the free

market. A number of seminars were also arranged by SAFEX together with broker firms to assist broking members to source clients or to build relationships with farmers.

4.2.3 The Role of Co-operatives in South Africa

In 1995, there were 238 primary co-operatives and 37 central co-operatives throughout South Africa. Co-operatives play an important role and provide a number of value-added services to their members. More specifically, some co-operatives are members of the Exchange and employ risk managers on a full-time basis, to make trading decisions on behalf of their members. This is beneficial to farmers since trading decisions are based on extensive research and informed judgement. In addition, co-operatives pool together various production levels to match minimum requirement size for futures contracts and margin requirements, which allows small and medium size producers to indirectly hedge with futures contracts, without being obliged to provide minimum production levels and/or capital for initial and variation margins. Also many of the co-operatives enter into forward contracts with producers and then subsequently hedge these forward contracts into the Exchange, thus enhancing market liquidity. More recently, there has been a change in the structure of the co-operatives since a number of them have become companies. Overall, they have given small farmers leverage which they would not have otherwise, and have also improved their cost structure.

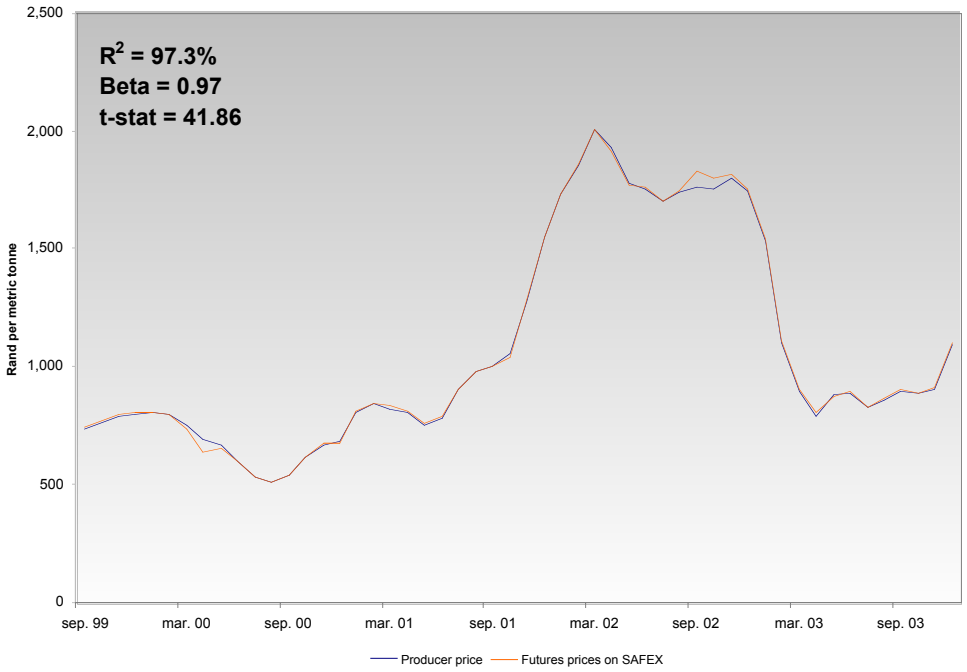
4.2.4 Hedging Performance of the White Maize Contract

Market participants consider that SAFEX provides transparent and competitive information which accurately reflects commodity prices in the region. Producers are familiar with what the price on the Exchange represents and often use the futures price in their contract pricing. The approach toward risk management by the part of producers and processors, has moved a long way since the initial stages of deregulation. At that time, some market participants believed that they could manage their price risk through the corresponding derivative contracts in the US. However, this implied that market participants were exposed to three different types of price risk instead of just one. First, price risk arising from fluctuations in the supply and demand for maize in South Africa; second, exchange rate risk arising from fluctuations in the Rand / US Dollar exchange rate; and finally, basis risk, since the futures contract is different from the underlying commodity to be hedged and the relationship between US and South African prices changes markedly depending on whether South African production is in surplus or deficit in any given year. The latter point is particularly important for white maize producers and processors since there is no futures market for white maize anywhere else in the world. As expected, this approach failed to provide satisfactory risk reduction benefits to market participants, and resulted in both sides of the market having to use the SAFEX contract for risk management purposes. As is also suggested by Bayley (2000) this was perhaps the crucial factor behind SAFEX's growing liquidity, since both farmers and processors needed urgently to manage their price risk.

As noted earlier, an effective hedge requires low basis risk and a high correlation between cash and futures price changes which is the case for the white maize contract, as is evidenced in Figure 4.2. Overall, hedgers in the market can reduce price risk in their physical positions by as much as 97% which is very effective by any standard, and also outperforms the risk

reduction evidenced in other exchanges in the EU and the US. This further emphasises the importance of the SAFEX contract in providing effective risk protection for producers in a deregulated market.

Figure 4.2 : South Africa white maize cash price versus SAFEX futures price



4.2.5 Regulatory Environment and Price Transparency

As the market has grown, SAFEX has shifted its focus from educating market participants about the benefits of futures trading (which is now primarily undertaken by brokers) to ensuring that investors are aware what their rights are within the rules of the Exchange. SAFEX also has the usual processes in place for distributing information and, to date, they supply as much information as possible free of charge, by daily updates on the web page, distribution by email, or even by SMS. They continually strive to supply price information to the market as efficiently as possible.

As noted earlier one of the reasons behind the success of SAFEX's contract is the fact that producers and processors urgently needed a market to manage their risk and the only viable method for achieving this was the contract offered by SAFEX. Bayley (2000) also identified a number of other factors that may have contributed to the establishment and subsequent growth in the agricultural derivatives market. First, prior to the introduction of the maize contracts, there existed a critical mass of expertise in trading and using derivative instruments among market participants. In the mid 1990s, SAFEX was already trading financial derivative contracts and had an established position as a provider of risk management services in the financial markets. In addition, financial institutions were already familiar with the concept of financial derivatives and their use for risk management purposes. Second, there was physical infrastructure available to facilitate the delivery of the futures contracts. Third, the deregulation of the domestic agricultural market resulted in market uncertainty and price

volatility [18]; this was perhaps the major contributing factor since price stability does not provide an environment conducive to derivatives trading and risk management. Finally, the liberalisation of agricultural trade also had the impact of facilitating the involvement of international trading houses in the South African market. International trading houses were already familiar with the use of derivative contracts in other markets, most notably in the US, and hence were able to migrate their expertise and know how in the newly established SAFEX AMD.

Overall, The effects of the growth of SAFEX AMD have given rise to some significant benefits to the government and the wider economy, the most important being the efficiency benefits of a liberalised market and the transfer of agricultural risk (that was both difficult and costly to manage) from the Government to the private sector. Agricultural risk can be "off-loaded" to the financial sector through the use of derivative contracts. This results in greater stability in agricultural income, price stability in agricultural products and more efficient allocation of resources in the agricultural economy. Availability of derivative prices also results in a transparent and competitive price formation process. In line with other established futures markets, the level of nearby futures provides an indication for the level of prices in the spot market and is also used as a reference price which market participants take into account when pricing their contracts.

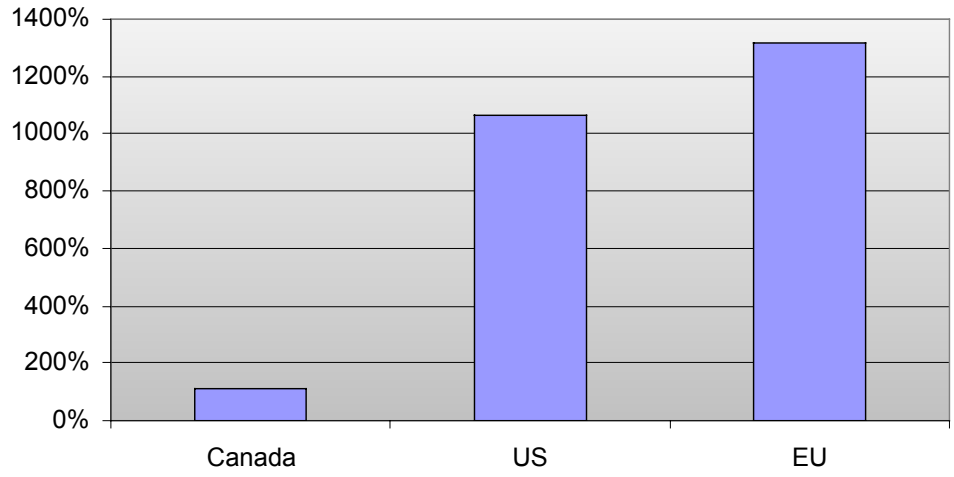
4.3 The Australian Agricultural Risk Management Experience

Australia is a country with a relatively large agriculture industry, producing many products ranging from grain, seeds and fruits, to cotton, wool and livestock. Australian grain producers, in particular, face unique difficulties in the highly competitive global wheat market. For example, compared to growers in other countries, Australian wheat growers are highly exposed to fluctuations in exchange rates and world wheat prices. This is because around 79% of the Australian wheat crop is exported, while only 45% of US wheat and 13% of wheat produced in the EU goes to international markets. In addition, as illustrated in Figure 4.3, the outside support provided to Australian growers is less than one-tenth of that provided to their competitors in the US and the EU, and under half that provided to Canadian growers. Income support, price support and other implicit subsidies provide Canadian growers with the equivalent of an extra AU$25 per tonne, US growers with over AU$140 per tonne and EU growers with over AU$170 per tonne. Wheat growers in these heavily subsidised markets have expanded their production and export volumes, thus depressing average world wheat prices, and causing severe world price distortions as well as volatility.

The Australian agricultural sector has always been very dynamic and progressive in risk management activities. This is partly due to the nature of their agricultural and farming businesses, which are exposed to extreme weather uncertainties as well as price risk, and partly due to the limited support provided by the government for farmers and producers. This environment has helped Australian farmers realise the benefits of derivatives and risk management and, nowadays, Australian farmers are considered as the largest and most sophisticated agricultural hedgers in the world.

[18] Most production and consumption of maize takes place a long way from the coast which, combined with high transport costs, and tendency for climatic factors to affect yields so that the region oscillates between surplus and deficit production, results in prices moving between import and export parity prices that are a long way apart.

Figure 4.3: Comparison of Income Support Offered to Major Grain Growers as Percentage of the Support to Australian Growers



Source: AWB publication

Australian farmers and other participants in the agricultural business have learned how to deal with the different risks they face, by extensively using market-based risk management instruments from insurance policies to derivatives. Despite the absence of organised derivatives markets for key commodities such as wheat, canola, cotton and sugar, there is widespread use of OTC options and price swaps indexed to international markets, usually CBOT or Winnipeg, at the farmer, co-operative and end-user levels of the business chain. In this respect, financial institutions, such as investment banks, play a major role not only in training and consulting, but also in providing farmers, producers and other participants with innovative and flexible financial and risk management products. In Australia, financial institutions such as Rabobank and National Australian Bank (NAB) have been focusing on providing products that can meet the unique needs of farmers and growers as well as *'middle market'* clients, such as businesses operating beyond the farm gate in the food and agribusiness. These financial institutions have special divisions with particular expertise in providing finance and risk management solutions for farming and agri-businesses in all key Australian markets, from grain to livestock products. As a result these institution can successfully utilise their network of expertise and services, to provide innovative financial solutions customised for each customer - whether a farmer/producer or other middle market clients such as processing and distribution businesses.

In addition to financial institutions, other agricultural organisations in Australia also provide services to farmers and growers, such as advisory services with regard to logistics, sales and marketing issues, as well as risk management activities. One such organisation is the Australian Wheat Board (AWB) whose purpose is to maximise net pool returns for growers delivering wheat into the national export wheat pool. The AWB offers delicate risk management products to its clients using agricultural derivatives traded in international and US exchanges by “repackaging” them, to take into account currency risk and quality differential risk. One such product is the Fixed Basis Wheat Contract, which provides the farmer with control of wheat price risk. A basis contract allows producers to lock in or

capture an attractive basis for a specific delivery period without being locked into the futures price at that time. The basis contract is in fact a package combining CBOT wheat futures, Currency Risk Cover, Fixed Basis Cover and Varital Grade Cover. Using a Fixed Basis contract the farmer can hedge the price of his wheat production with great efficiency without having to participate in several contracts to manage each type of risk involved.

An Example of a Fixed Basis Contract

It is January 2004 and a wheat farmer with a May 2004 harvest decides to use a basis contract to lock into a fixed basis for that harvest. Since there is no exchange traded wheat futures contract in Australia the closest futures contract available to the farmer, in terms of limited basis risk and quality differential, is the CBOT wheat futures which is traded in terms of USc/bu. This also implies that the farmer has to hedge the exchange rate risk exposure using an US$/AU$ forward contract. The Fixed Basis contract provided by AWB is a simple combination of the wheat and currency futures contracts but offered as a simple package which can be quite convenient for the farmer.

Assume the following information is available in January 2004:

- CBOT May 2004 wheat futures is trading at 325 USc/bu;
- CBOT May 2004 wheat futures basis is 15 USc/bu ;
- AU$/US$ forward exchange rate for May 2004 is 0.5800;
- Farmer expects harvest of 1000 tonnes of wheat in May 2004;
- Bushel to tonne conversion =36.7437.

The fixed basis contract is constructed by selling CBOT futures and entering into a forward AU$/US$ contract proportionate to the size of the futures contract. The farmer can then fix his wheat basis at 9.5 AU$/tonne to US wheat prices, as follows:

$$\text{Basis in } US\$/tonne = \frac{15\ USc/bu}{100} * 36.7437 = 5.512\, US\$/tonne$$

$$\text{Basis in } AU\$/tonne = \frac{5.512\, US\$/tonne}{0.58} = 9.5\ AU\$/tonne$$

Having locked the price with a fixed basis of 9.5 AU$/tonne, assuming zero commission, the farmer can be sure that he will be getting the futures price less the fixed basis in May 2004. For instance, if the expected futures price in May 2004 is 325 USc/bu, the farmer will be getting 196.40 AU$/tonne for his wheat:

$$\text{Price in } AU\$ = \frac{(325\, USc/bu - 15\, USc/bu)}{100 * 0.58} * 36.7437 = 196.40\ AU\$/\text{tonne}$$

An Example of Collar Option Hedging

An alternative method for managing price risk for the wheat farmer is to use a collar option contract for hedging. This strategy is formed by combining a call and a put option contracts

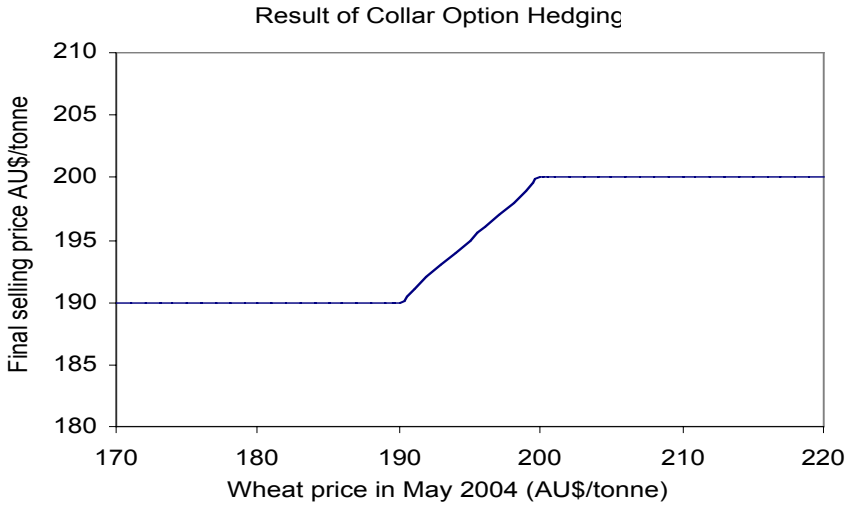
both of which have the same maturity, i.e. May 2004. More specifically, it involves selling a call option and then, buying a put option with the proceeds. In this way the cost of hedging can be significantly lower and the farmer can lock his final selling price within a reasonable band. In other words, a collar provides both a floor and a cap for the selling price of wheat in May 2004.

Assume the following information is available in January 2004

- Farmer expects harvest of 1000 tonnes of wheat in May 2004;
- Put price (premium) for 1000 tonnes wheat with strike price of 190 AU$/tonne expiring in May 2004 is 10 AU$/tonne;
- Call price (premium) for 1000 tonnes wheat with strike price of 200 AU$/tonne expiring in May 2004 is 10 AU$/tonne;

By selling the call option and simultaneously buying the put, the farmer can be sure that whatever the price of wheat in May 2004, he will be receiving no less than 190 AU$/tonne and no more than 200 AU$/tonne for his wheat, as shown in Figure 4.4.

Figure 4.4: Result of hedging with a zero cost collar option



It can be observed that, by using a zero cost collar with no initial cost (apart from commissions), the farmer can control the price risk within a reasonable margin (approximately 5% of the price), which is normally above his breakeven price. An additional benefit of using this type of risk control instrument is the enhanced credibility and ability of the farmer to fulfil any borrowing and loan obligations from the point of view of the financier. Banks and other creditors are generally interested to see a sound and secure stream of income before providing cheaper financial arrangements. This has been one of the main drives for using risk management instruments in Australia, because major financiers offer competitive financing packages once they see that their client has taken the necessary steps to protect against market risk.

5 CHAPTER FIVE

Challenges and Prospects for Agricultural Risk Management in the EU

5.1 Introduction

The reforms to the Common Agricultural Policy pose new opportunities as well as challenges for providers of risk management products. The preceding analyses and case studies highlighted a number of possibilities that can improve producers' and agri-businesses' uptake of derivative products. Looking at the structure of the EU agricultural sector, the institutional framework provided by CAP, the limited degree of participation by European producers in the derivatives markets, the availability of risk management products and the deregulation models in other countries, there are clear opportunities to facilitate new ways of delivering price, yield and income stability for producers and agri-businesses through wider use of derivatives. However, this will require, among other things, an extensive programme of education and training of participants. More specifically, the measures which are identified in this report are:

- Strengthening Education and Training
- Building Relationships through Co-operatives and Farmed Controlled Businesses
- Promote the use of flexible and Over-the-Counter Derivative Instruments
- Promote and strengthen the liquidity of agricultural futures markets

These measures are discussed next:

5.2 Strengthening Education and Training

Before choosing a risk management strategy, it is essential for producers to understand, at a basic level, the nature of the risks posed by their business, which of those risks they are prepared to run and which of them they wish to manage and how they should be managed. The role of education is particularly important in the agricultural sector because farmers, like other economic actors, perceive the risks they face as being smaller than they actually are. This phenomenon is called "cognitive failure" and is often the result of insufficient information or misjudgement[19].

Training should not only focus on risk management tools, but also on how it is being delivered. As previously mentioned, European farmers are becoming older and spend less time on farming activities which may indicate that they have less motivation to learn new methodologies for managing risk or are more concerned with other issues like retirement and securing their income sources. The challenge is to align these groups of farmers to pay more attention to the risk posed by their businesses, so that they are motivated to learn and eventually use derivatives and/or insurance in ways which, in turn, can help them remain focused on their core activities. This will not only benefit the agricultural community but also society as a whole.

Finally, training should not only be targeted at producers but also at those consultants and other organisations to whom farmers turn for assistance in managing their risk. For instance, in the UK, Farmcare is currently leading a major training and registration programme, called the "The Risk Management Network", for all farming consultants. The programme is sponsored by a number of organisations, both producers' associations and commodity trading houses, and its purpose is to train farming consultants and raise their awareness of the wide variety of mechanisms and strategies for managing farming risk in all its different forms, including the use of derivatives and insurance. Consultants who have completed the training course can then gain a professional accreditation and become members of a professional register of risk management consultants, established for that purpose.

Examples of Effective Training Schemes

In the US, the Economic Research Service of the U.S. Department of Agriculture, provides users on its webpage with access to a myriad of University educational resources which cover the topic of risk management extensively. They seem to have a more pro-active approach in terms of derivatives training and appear to understand that the complex features of derivatives demand a wide range of services, supported by adequate financial investment, people with know-how, and a clear strategy on how to reach the critical mass.

In Europe, the UK's Department for Environment, Food and Rural Affairs (DEFRA) has implemented a wide range of information and educational services which have served a broad customer base including small- and medium-size producers. Similarly, the Home-Grown Cereals Association (HGCA) has been running, since 2003, a series of regional workshops in the UK on risk management and the use of financial instrument for producers. The objective of these workshops is to improve growers' understanding of the basic mechanics of the grain market and the need to adopt a more strategic approach to grain marketing. These courses,

[19] Dirk Ahner (2004): "How can the EU help farmers on Risk management" in Agriculture Perspectives for the EU 25, Speech on European Commission DG Agriculture.

provide a hands on intensive approach on the use of risk management tools for the agricultural industry and are organised in different locations across the UK. HGCA is also active in organising industry risk management conferences jointly with Euronext.liffe, CBOT and National Australia Bank for participants from all the sectors of the grain and feed industry – growers, traders, processors (milling, malting) and feed buyers. The objective of these conferences is to bring all participants in the grain chain together, so as to understand the mechanisms and also the benefits of greater use of risk management tools.

These events have been very well received by market participants and have also influenced the attitudes and perceptions of participants towards the use of risk management tools. Delegate responses have shown that attending the workshops has greatly improved their understanding and willingness to use risk management techniques including options and forward selling, based on the futures markets. Overall, around 93% of delegates considered these courses to be highly relevant for their activities and stated that attending would result in changing their business practices. This further illustrates how effective and properly implemented training schemes can affect farmer's goals and attitudes towards risk management. Therefore, more comprehensive training programmes, co-ordinated by the appropriate authorities at the European level, would greatly increase the uptake of risk management techniques across the industry.

5.3 Building Relationships through Co-operatives

Co-operatives, are a substantial part of the European agricultural industry since, according to the Confédération Générale des Coopératives Agricoles de l'Union Européenne (COGECA), they handle about 210 bn euros turnover, over 50% of shares in the supply of agricultural inputs, and over 60% of shares in the collection, processing and marketing of agricultural products. Despite their significance however, co-operatives play a limited role in risk management especially for small scale producers, but this is gradually changing as new models of co-operatives management structure are emerging.

A co-operative is an enterprise which exists primarily to serve the interests of its stakeholder groups - normally farmers, who also own and control it - rather than to provide return on investment (Commission of the European Communities, 2001). Modern agricultural co-operatives, for marketing and for purchasing supplies, have become an integral part of the European Union agriculture industry. Local supply co-operatives have a proud tradition of providing farmers with a wide range of offerings from seeds to crop-inspection services. Local marketing co-operatives help farmers to attain the best price for their crops as well as to provide services such as commodity storage. Local co-operatives and regional co-operatives have, further, pooled these supplies and marketing activities and have made larger investments up- or downstream from farms. Currently, new models in co-op organisations are evolving where co-operatives are increasingly owned by shareholders and are gradually becoming more like businesses where a minor proportion of shareholders are outside investors (usually customers rather than farmers) and are run by highly qualified management (see Table 5.1, Annex 5 for an overview of the different structures of co-operatives).

Co-operatives can create a number of opportunities which would otherwise be unachievable by an individual producer. Providers of risk management tools should leverage these centralised organisations - currently there are ten times more farm holdings than co-operatives

in the EU - to efficiently distribute information to the critical mass. Co-operatives have traditionally offered members valuable services in exchange for commitment and trust. If co-operatives are convinced that, in the future, derivatives and insurance can play an essential role in risk management, their members will need to be able to access affordable risk management instruments and providers of risk management products can look forward to acquiring new customers and developing new products.

Co-operatives can also assist in reducing the gap between small and part-time farmers on the one hand and derivatives markets on the other. First, they can offer assistance through professional managers who have access to market information and understand the concept of trading derivatives and, hence, can develop and implement effective risk management strategies. This step is important since producers, irrespective of age, are not always familiar with the structure and functioning of derivative markets. Second, co-operatives may pool together production from small-scale farmers in order to realize minimum size requirements for derivative contracts; they can also get better pricing and much lower transaction costs than hedging on an individual basis. The latter is important since many farmers, on their own, may not be able to afford the level of transaction costs or the margin requirements. It is also interesting to note that a survey of the risk attitudes of producers in the UK, conducted by NFU, identified lack of understanding and transaction costs as the main barriers for the adoption of futures contracts, options contracts and cost insurance by the farming community. Finally, another important benefit of letting co-operatives service the hedging needs of their members is that it will enable farmers to spend more time on farming than managing their use of risk management products.

Today, co-operatives have become more independent as their activities can rely on external shareholders, while the use of professional managers to run them provides safeguards against any agency problems which may arise. With a strong plan and use of alternative governance, co-operatives can be more involved in risk management to satisfy demanding producers who face volatile commodity prices. Funding from external sources will enable these organisations to better assist agri-businesses by identifying their members' price risk management areas and creating customised risk management products and also by providing finance for margin deposits, margin calls, and other costs associated with trading in derivatives markets. It seems therefore that in a deregulated European agricultural sector, co-operatives can play a pivotal role in the provision of risk management services and, hence, should be the prime target of providers of such products such as trading houses, commodity brokers and investment banks.

5.3.1 Targeting Small Scale Producers via Local Co-operatives: the Case of the International Task Force on Commodity Risk Management

The International Task Force on Commodity Risk Management also presents an interesting example of how agricultural risk management projects can be tailored to meet the needs of small-scale producers. In 1999, the World Bank convened an International Task Force (ITF) on Commodity Risk Management in Developing Countries to explore new, market-based approaches to assist developing countries better manage their vulnerability to commodity risks, including price risk and weather risk. Managing risks in highly volatile commodity markets remains one of the major challenges for developing countries, since, according to the World Bank, more than 50 developing countries depend on three or fewer leading commodities for more than one half of their export earnings. In many of these countries,

commodity production and trade affect the livelihood of millions of people, the government's fiscal revenue and public expenditure, as well as the government's ability to maintain a conducive and stable environment for domestic business and to implement policies and programmes to reduce poverty.

The Commodity Risk Management (CRM) Group is the implementing agency for the work of the ITF at the World Bank. The CRM team is comprised of commodities experts, financial analysts, training personnel, and derivatives specialists working to make market-based price risk and weather risk management instruments available to developing country producers, and works in conjunction with supporting governments, international organisations and the private sector. The CRM team also carries out research and provides training on using innovative tools for risk management.

For instance, one such pilot transaction implemented by CRM in conjunction with Rabobank, was the purchase of price insurance (i.e. put options) for coffee co-operatives in Uganda and Tanzania. This resulted in price stability for local producers who were then free to market their physical product knowing they have a floor price in place. It is estimated that this particular transaction benefited several thousands of small coffee farmers in these countries. Other innovative tools proposed by CRM include the implementation of rainfall-index insurance in Morocco and rainfall insurance policies in India. These examples also highlight the broader role that co-operatives can play in the provision of risk management services, by acting as intermediaries between local farmers and providers of risk management services.

The issue that arises is whether a similar approach towards risk management could also be applied to small-sized farmers in developed countries and in particular in the EU. One expects that what works for developing countries must work much more efficiently in developed countries for a number of reasons: first, in developed countries the physical infrastructure is already in place; second, there are established capital and financial markets which provide price transparency and a mechanism for transferring risk; and, third, there will be significant reductions in the levels of credit risk and sovereign risk for financial service suppliers, compared to those operating in developing countries.

5.4 Introduction of Flexible Derivative Instruments

The success of relying on new risk management schemes and products depends greatly on their ability to meet the needs of users, to provide simplicity in terms of trading and regulation and to be liquid and affordable. The diversity of the agricultural industry and business in the EU in terms of the number of products, quality differentials, regional disparities and production cycles, suggests that the existing range of standardised exchange-traded derivative products may not be suitable for everyone. In this respect, it is anticipated that exchanges will need to develop new products. At the same time, more flexible over-the-counter (OTC) products can be used on their own or along with exchange-traded products to help ensure that there is an appropriate match between the underlying risk and the risk management product.

OTC instruments are traded outside organised Exchanges through a network of dealers and brokers. The major advantage of OTC instruments over exchange-traded derivatives is that they provide a great degree of *flexibility* to their users, as they can be tailored to cover specific risk exposures, very efficiently. For instance, OTC derivatives can be structured in such a way

so as to manage risks which cannot be managed by Exchange traded derivatives or to cover long-dated exposures which exceed the maturities of exchange traded instruments. In addition, OTC derivatives may not involve physical delivery of the underlying commodity, and, consequently, the hedger does not have to commit the physical crop. Furthermore, it has been observed in other industries that when exchange-traded instruments are not effective in providing risk reduction, OTC derivatives are introduced and gradually dominate the market with the active participation of financial institutions[20]. On the other hand, the major disadvantage of OTC instruments is the existence of *credit* or *default risk*. This is the risk when a counterparty does not honour its obligation with respect to meeting the derivatives contract in full and on time. This is not an issue in contracts traded in organised exchanges since the performance of exchange traded contracts is guaranteed by a clearing house. This also implies that the OTC market may be better suited to individuals or corporations with solid credit standing and/or large capital base. However, there are now instruments available which can be used to control credit risk.

The successful implementation of OTC products requires careful planning and substantial investment both in training and education, as well as infrastructure. More specifically, the necessary requirements are:

1- **Availability of Transparent Market Indicators.** This step is very important as pricing, trading and settlement of derivative instruments are normally based on such indicators. For example, in order to use derivatives for yield risk management, there must exist an independent yield reporting system to produce frequent and reliable assessments on yield and production across different regions. Once the yield assessment is available, market participants - such as farmers, elevators, insurance companies and financial institutions - would be able to trade, hedge or speculate on the expected yield in each region. The existence of a reliable regional yield assessment will also eliminate issues, such as moral hazard and adverse selection. In the US, such assessments are produced by USDA for different regions on regular basis.[21] In the EU, the Agriculture Department of the European Commission could be active in producing independent yield assessments for different regions. Such a scheme could also improve market transparency in relation to price and production yield, which is absolutely necessary for the efficient operation of the market for agricultural products in the EU.

2- **Active Participation by Financial Institutions.** For derivative markets to be successful in their risk management and price discovery roles, they should be liquid enough to a) reduce transaction cost; and b) enhance pricing and risk management efficiency. Therefore, the introduction of new derivative products should be done with careful consideration to offer the best and most flexible product. To that extent, providers of agricultural risk management services should put more emphasis on the research, development, pricing, marketing and trading of these products.

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[20] Two main examples here are the shipping freight and fuel oil markets where exchange traded derivative instruments were not successful and gradually OTC derivatives took over due to their flexibility and better performance in terms of risk management.

[21] In other industries there are similar reporting mechanisms in place. For instance, in shipping, assessments are made on the level of freight rates in different shipping routes by the Baltic Exchange in London. Forward Freight contracts are then traded in the market based on these assessments. In the oil industry, Platt's is publishing assessments on prices of oil and products across different parts of the world. Major oil traders, consumers and other parties use these assessments to price and trade numerous derivative instruments.

3- **Availability of Know-How through Training.** The significance of training as a factor conducive to the successful launch and operation of derivatives markets has already been discussed. Any new derivative product must be promoted first to its end users (producers), who must be familiar with the way derivative markets operate.

4- **Support by Local Governments to Promote the Use of these Instruments.** The role of the EC and governments not only in channelling funds to educating and training producers, but also to support them in using such market mechanism for risk management, is quite important.

5.4.1 Major Types of Agricultural OTC Instruments

OTC instruments vary in their specification and characteristics. They include simple put and call options with different specifications than those offered in organised exchanges. For instance, the contract size may be smaller than the contract size at organised exchanges so as to facilitate smaller users. Other products can be more sophisticated and include combinations of other more simple instruments or simply new instruments that are used to cover specific risks such as weather. Some of those products include:

CFDs

Contracts for Difference (CFDs) are contracts to exchange the difference between two prices for a notional volume at certain time in the future. CFDs are offered by financial institutions for a number of products and are successfully used for agricultural price risk management by Australian farmers and producers. An example of a typical CFD is the exchange of Australian wheat prices with CBOT futures prices for a notional amount, say 5,000 bushels, at a certain date in the future. By using such contracts farmers can eliminate any basis risk which exists between their products and those for which exchange-traded futures contracts are available. Another example is a CFD on the quality differential between two different types of wheat which can be used by producers to manage the quality risk of their product.

Zero Cost Collars

It is sometimes argued that options can be expensive risk management tools especially in the case of agricultural price risk management. This is because if a producer wants to buy price insurance (i.e. put options), he must pay the option premium upfront and in addition, the higher the trigger level (strike price) of the option, the more expensive the option will be. A way round this is for the producer to "sacrifice" some of the upside gains for protection against downside risk. This can be achieved through the use of zero-cost collars (cylinder options). A zero cost collar is in fact a combination of a put and a call, and can be constructed by selling a call option at strike price X_1 and for maturity at time T, and then by using the proceeds from the sale of the call to buy a put at strike price X_2 and the same maturity. Normally X_1 is greater than X_2, and, as a result, the farmer can be guaranteed that the selling price of his product will not be lower than X_2 and higher than X_1. The main advantage of collars is that the cost of managing price (or yield) risk is substantially lower than when a put or a forward contract is used (see as well section 4.3 for an example on zero cost collars).

Weather Derivatives and Risk Management

One most important risk factor that farmers are exposed to is weather and its impact on farmers' production and income. Bad weather conditions such as hail, frost, flood, drought and storm may partially or totally destroy the crop and leave farmers with no protection in a very difficult situation. These adverse weather conditions are considered as correlated risk which can affect farming in an entire region and, as a result, farmers might find it expensive to insure against them.

Although governments, especially in the US and the EU, have established provisions such as "catastrophic aid" and other safety net helps, in recent years there has been a growth in weather derivatives which can be used by farmers and insurers, in order to control their income and revenue risk due to adverse weather. Weather derivatives can be used to hedge yield-related risks caused by extreme variations in environmental conditions over defined future time periods. These are mainly OTC contracts contingent on specific weather conditions such as amount of precipitation, hot degree-days or cold degree-days. For instance, a farmer can use the rainfall index in his region to hedge against excess rainfall which is harmful to the crop. In this case, the farmer can buy a call option on the rainfall index which pays off if the rainfall exceeds a certain level, which is the strike price of the option. The payoff from the option should then be enough to compensate the farmer for the loss due to excess precipitation. Similarly, the protection cover for a drought or lack of precipitation can be designed using a put option on the rainfall index which pays off when the precipitation is less than an agreed level, i.e. the strike price of the put.

Currently weather derivatives for agribusiness are traded in Australia, the US and the UK to a limited extent, and are more applicable to large corporate grain and cotton growers and suppliers of agrochemicals. Because the impact of weather conditions affects an entire region, as opposed to an individual farm, farmers could participate in the weather derivatives markets through regional co-operatives which can create the necessary economies of scale to make these products accessible to smaller farmers. In addition, implementation of successful weather derivatives instruments requires a reliable and fairly assessed index of weather conditions (such as rain, cold degree-days, hot degree-days, etc.), on which derivative contracts can be priced, traded and settled. It is also worth noting that currently, projects involving the use of weather derivatives are implemented in developing countries through the CRM group of World Bank (see also section 5.3.1)

Forward Yield Agreements

Forward Yield Agreements (FYA) are contracts which allow farmers, elevators, insurance companies and others to hedge agricultural production risk. The idea behind FYAs is to trade forward contracts on an average yield index for different regions. For instance a farmer who is concerned about the effect of natural disasters on his crop will sell an appropriate FYA contract to a counterparty (e.g. a bank), to hedge his future crop yield.

Swing Contracts

Swing contracts are forward or option contracts on the price of an underlying asset, where one party has the option to change the notional volume of the underlying asset within a pre-specified range. Consider the case of a farmer who is uncertain about his production yield. He

can enter into a swing contract where the forward price is fixed while the notional volume can be anything from, say 1,000 to 5,000 bushels, with the exact amount being determined at the maturity of the contract. By using this contract, the farmer eliminates any uncertainty regarding the amount of crop to hedge.

Other Exotic Options and Risk Management Products

In addition to the aforementioned instruments, there are numerous other types of derivative instruments which financial services providers can develop and offer to farmers for the purposes of agricultural price and yield risk management. Such instruments are used extensively in the financial OTC derivative markets, and their migration to the agricultural derivatives markets could be done relatively easily. Such instruments include, for instance, forward start options, knock-in and knock-out options etc.

5.5 Enhancing Liquidity in Agricultural Derivatives Exchanges

Liquidity is another essential parameter when introducing new contracts in derivatives markets. For a futures market to attract market participants, whether hedgers or speculators, they have to be assured to some degree that futures trades will compel them only to deliver the underlying commodity on the basis of their own initiative. European Exchanges are constantly taking measures to offer high liquidity and sufficient market depth, which enables speedy execution of small as well large orders with minimum price changes and maintaining a fair price movement. In addition, as noted elsewhere in this report, liquidity is also linked to the prevailing agricultural policy framework, and in particular the extent and nature of administrative controls over exports.

6 CHAPTER SIX

Summary and Conclusions

6.1 Summary and Conclusions

The European agricultural sector has gone through three major reforms of the Common Agricultural Policy in the last decade. These include the MacSharry reform (1992), the AGENDA 2000 reform (1999) and, more recently, the 2003-04 reform. These reforms were meant to improve the competitiveness of the agricultural sector in an increasingly competitive global market by restructuring the financial transfers to the sector. The restructuring was also critical because the financial transfers system would not have been financially viable after the inclusion of the ten new accession countries to the EU. The major issues that are examined in this report include:

The extent to which reforms in CAP have an impact on the volatility of EU wheat prices and the likely outcome once further reforms are implemented

Statistical analysis of EU wheat prices, presented in this report, indicates that, overall, the volatility of farm gate prices in EU member states has become significantly higher, as a result of both the 1992 and AGENDA 2000 reforms. The ongoing 2003-04 reforms will result in further cuts in market price support measures which, combined with the commitment under WTO to improve market access, should increase the volatility of agricultural prices even further. Consequently, the use of market-based mechanisms for managing agricultural risk may be the best available solution for market participants and farmers to reduce income variability associated with price risk.

The extent to which farmers and producers in the EU, use risk management instruments

Currently, there is a limited degree of participation of producers in risk management activities, and derivatives in particular, for which a number of reasons are put forward in this report: first, the income stability provided by CAP implies that producers have little or no incentive to conduct hedging; second, lack of understanding of risk management products by producers, since only a small number of European farmers has the knowledge, training and resources to understand and make use of agricultural derivatives; third, the availability of other risk management tools such as product diversification and income from non-farming activities.

The experience of other countries that have undergone agricultural liberalisation

Overall, it seems that there are opportunities for farmers and producers in different member states to make wider and more effective use of derivatives and other risk management instruments, to stabilise their income. Consequently, derivatives can provide a viable and effective form of income protection for agricultural farmers. To that extent, valuable lessons can be learned from the case of South Africa, where there was a gradual transition from complete government control of the maize market, to a free market, where the Futures Exchange plays a major role in the provision of risk management services. Five main causes were behind the success of the maize contract on the Exchange: first, SAFEX AMD benefited from the reputation of the SAFEX financial futures market, the number of financial institutions prepared to participate in the nascent market and provide it with liquidity, as well as the critical mass of experienced derivative market brokers and traders that already existed as a result of SAFEX; second, the good quality physical infrastructure that allowed SAFEX AMD to establish a system of physical delivery that ensured that near-dated futures did closely relate to the spot market; third, the high level of price risk arising from the specific characteristics of the South African maize market; fourth, the degree of commitment expressed by market participants to educate and train the agricultural community; and finally, the Government managed the transition to a liberalised market in a way that was sensitive to the needs of the nascent SAFEX AMD, in particular by restricting the Maize Board's powers to manage exports administratively.

Proposed measures to raise awareness and enhance the of derivatives

One of the major challenges to providers of risk products is the diversity of the European agricultural sector due to differences in produce, production levels and farm holdings across the member states. In addition, an ageing farm population and an increase in the number of part-time farmers can further slow down the uptake of derivatives by the sector in the future.

Taking these parameters into consideration, the measures, proposed in this report, to promote the uptake of derivatives by market participants, are:

- **Promotion of derivatives through education and training**, since this will help producers to understand the benefits of derivatives trading. Training should also be targeted at those consultants and other organisations to whom farmers turn for assistance

in managing their risk, as in the "The Risk Management Network" established by Farmcare in the UK

- **Channelling risk management products through farmer-focused organisations:** these could provide a very useful framework, through which the use of derivatives might be channelled to small producers. To this extent, valuable lessons could also be learned by the World Bank Project on commodity risk management

- **Development and marketing of flexible instruments:** the diversity of the agriculture industry and business in the EU in terms of, number of products, quality differentials, regional disparities, and production cycles, also calls for the development of more flexible, OTC derivative products that can provide a good fit to the requirements of market participants in the physical market

- **Proactive involvement of exchanges, banks and financial institutions** involved in the agricultural sector, since these organisations provide risk management services and finance farming and agricultural ventures. Experience from other agricultural economies (South Africa, Australia and the US) indicates that financial institutions, exchanges and banks can play a vital role in providing appropriate infrastructure, training and instruments, for market-based risk trading.

6.2 Areas for Further Research

The 6.7 million farm holdings in the European Union and the regional differences in the structure of the agricultural sector, between relatively larger farms in Northern Europe and small farm holdings with predominantly part-time farmers in the South, present the providers of risk management services with some unique challenges. In order to ensure that derivative markets are more transparent, more efficient and ultimately attractive to European producers and agri-businesses, a number of issues need to be investigated further:

Comprehensive analysis of risk and attitudes towards risk in the European agricultural sector

A detailed assessment is required of the different risks EU farmers face, their use of alternative risk management strategies and the changes they would have to make if faced with financial difficulty, since very little is known about their individual goals and attitudes towards risk. For instance, USDA's Agricultural Resource Management Study (ARMS), in the US, has conducted a thorough and extensive examination of the risks that US farmers are facing which are also ranked according to crops harvested, farm type and regional characteristics. In the EU, only two similar surveys, by NFU in the UK and in the Netherlands, have been carried out, which have shown that producers are resolute in using risk management strategies suitable for the types of risk they face. However, the diversity of the agricultural sector in the EU and the regional differences between North and South Europe call for a more thorough investigation of the issue. Issues such as scale of production, types of crops being produced and time spent on farm activities, present challenges to the providers of risk management services. Understanding the producers' needs across the different member

states can assist in channelling derivative products more efficiently and in producers perceiving derivative markets as more viable risk management tools.

Investigation and comparison of different risk management tools in terms of effectiveness, costs and benefits

Further investigation is required on the effectiveness of alternative risk management tools in reducing risks associated with farming activities. European producers can adopt a range of strategies like diversification, flexibility, production contracts, marketing contracts and insurance. Particularly insurance, diversification, and off-farm work are widely used, sometimes depending on the type of crops being harvested, and government support in the form of subsidies. Not only are surveys needed to identify the use of such risk management strategies, but also are studies to consider the value of these strategies with respect to farmers as well as to society in general. Along the same lines, it would also be informative to evaluate the cost of central subsidies under the CAP, compared to the cost of privatising risk management in the context of the impact on the taxpayer, the farming community and retail consumers.

Further research on the development of new products for agricultural risk management

Further investigation is also required on how to improve existing products and how to offer more innovative derivative products which can provide a better fit to the requirements of market participants. For instance, combining market-based risk management methods with lower levels of leverage can improve the credit facilities offered to producers by financial services providers. In addition, providers of risk management products can use structured contracts in conjunction with Exchange traded instruments to deliver tailor-made risk tools. This would not only fit better with the needs of producers in terms of risk protection, but also enhance the liquidity of exchange traded contracts through increasing the trading volume of the latter instruments. Further studies in this area can assist European risk providers to understand the potential of this market and eventually to offer new products with high liquidity and low access cost in the markets to suit both large and small farmers.

Extend the current analysis to different agricultural products in Europe

This study necessarily concentrated only on arable crops, and in particular wheat, as it is the single most important agricultural produce of the EU and receives the largest share of subsidies under CAP. However, EU countries produce a multitude of agricultural products which are also covered by CAP and producers of such goods are going to be affected, both by the impending CAP reforms as well as by the reforms under the WTO agreement. Consequently, further study is needed on the issue of how CAP reforms are going to affect all EU farmers and producers and, most importantly, how risk management tools can alleviate the problem of higher volatility in agricultural prices. Livestock, for instance, is one sector which will be affected substantially by the ongoing liberalisation of CAP.

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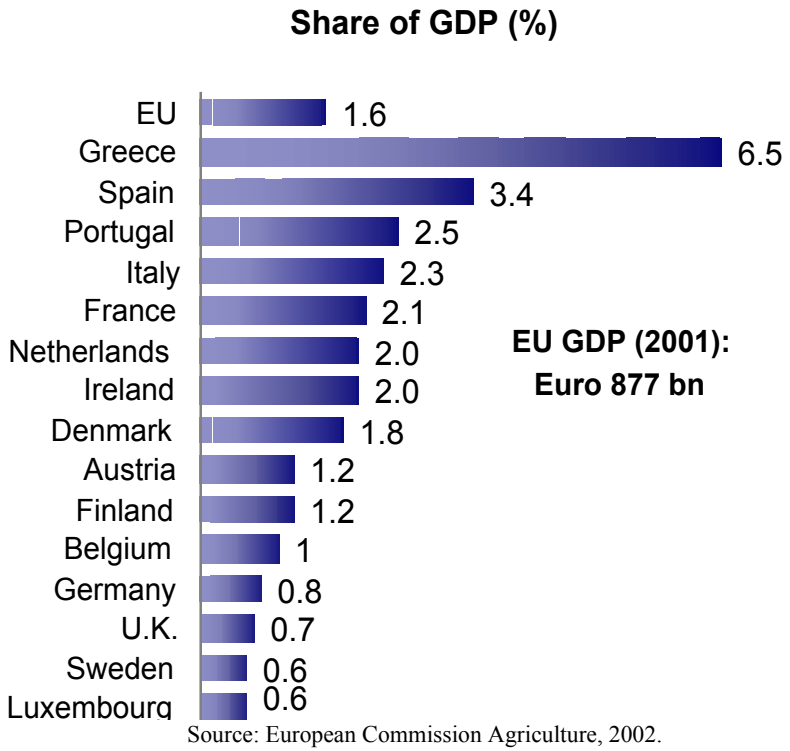
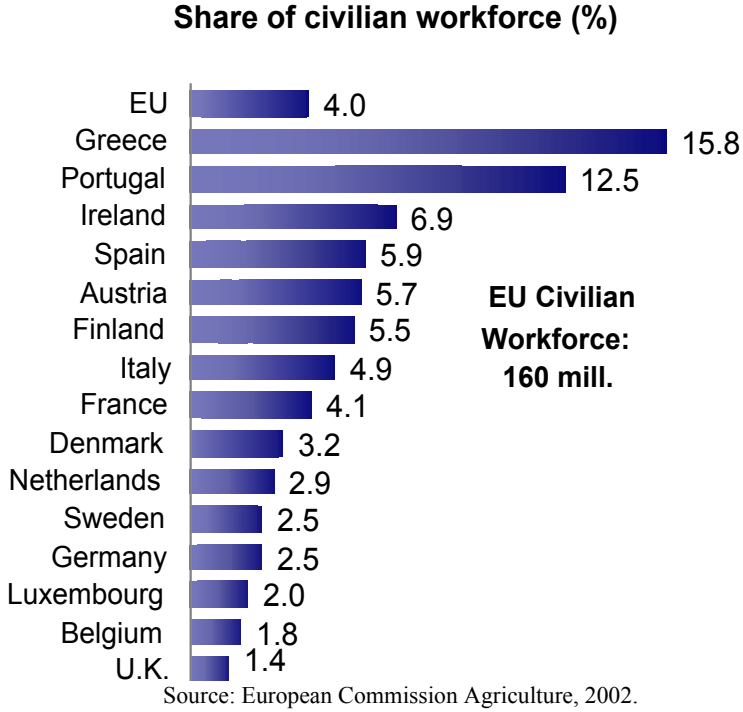
Annex 1: Structure and characteristics of EU Agriculture

Figure A1.1: Agriculture sector and the European economy: Share of GDP



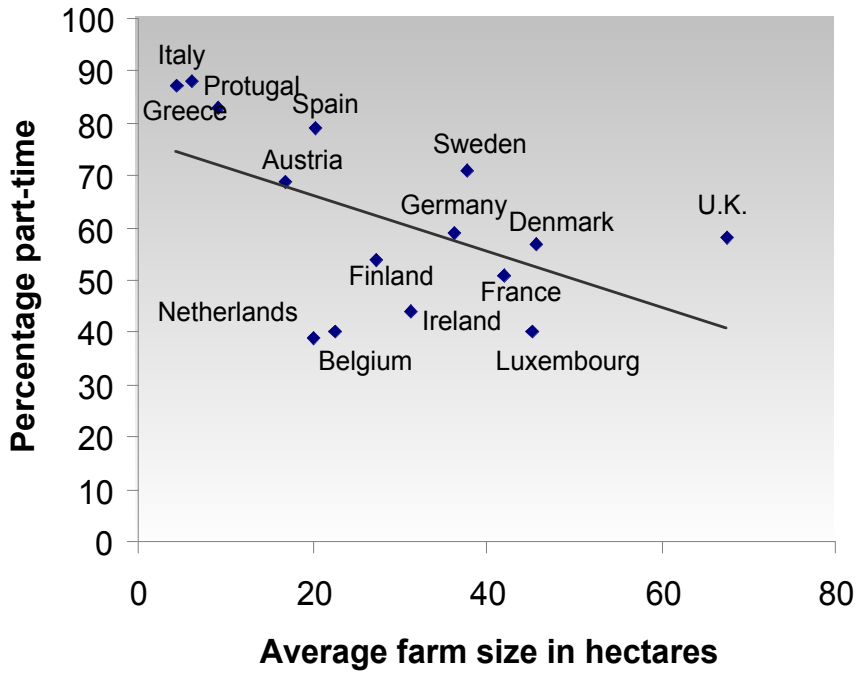
Source: European Commission Agriculture, 2002.

Figure A1.2: Agriculture sector and the European economy: Share of civilian Workforce



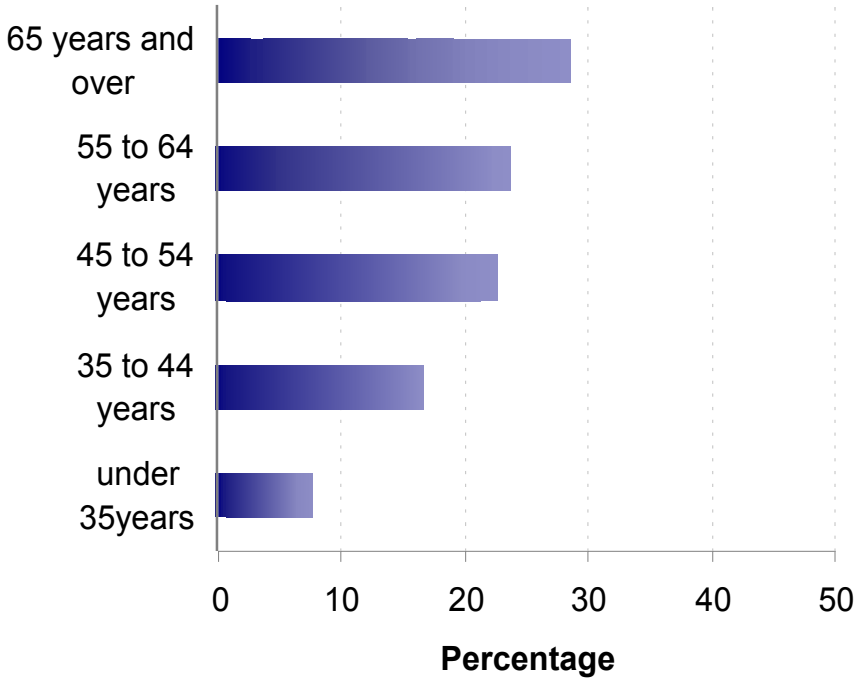
Source: European Commission Agriculture, 2002.

Figure A1.3: Relation between farm size and off-farm work



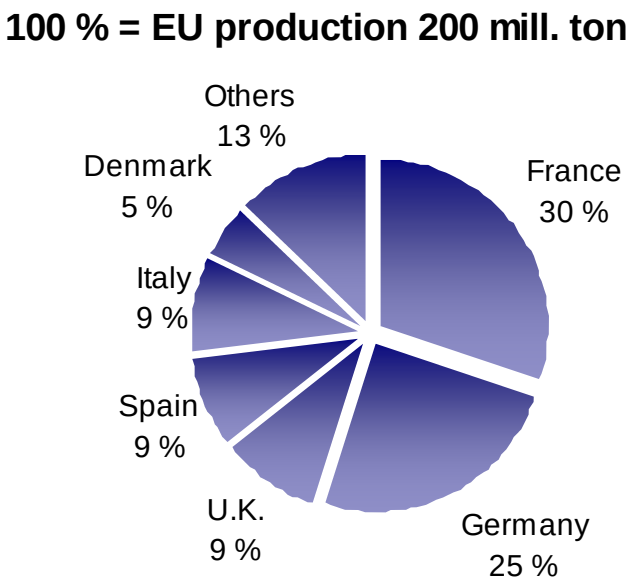
Source: Eurostat, Agriculture and Fisheries.

Figure A1.4: Share of age in EU agricultural sector



Source: Eurostat, Agriculture and Fisheries.

Figure A1.5: Composition of EU cereal output, 2001



Source: European Commission Agriculture 2001

Annex 2: Analysis of Volatility of Wheat Prices

F-Tests on Volatility

It is believed that the MacSharry reform has increased the volatility of common soft wheat prices in the EU. This hypothesis is tested statistically using an F test which is formulated as follows:

$$H_0: \sigma^2_{\text{Jan85–May93}} = \sigma^2_{\text{July93-Dec03}}$$
$$H_1: \sigma^2_{\text{Jan85–May93}} \neq \sigma^2_{\text{July93- Dec03}}$$

where $\sigma^2_{\text{Jan85–May93}}$ and $\sigma^2_{\text{July93- Dec03}}$ are unconditional variances of farm gate prices over the period January 1985 to May 1993, and July 1993 to December 2003, respectively. The above hypothesis can be tested using the ratio of variances as follows:

$$F^{obs} = \frac{\sigma_1^2}{\sigma_2^2} \quad , \quad F^{\text{obs}} \sim F_{(n1,n2)} \tag{A2.1}$$

Results from the tests are presented in Table A2.5 below

Table A2.5 Volatility (Variance) of Grain Prices before and after the 1992 CAP reform

	σ^2_{before}	σ^2_{after}	F-test	Prob.	Change
Spain	0.0006	0.0011	2.0739	**0.0001*** **	**Increase**
Italy	0.0012	0.0008	1.4792	**0.0352** **	**Decrease**
Germany	0.0013	0.0017	1.2930	**0.0907***	**Increase**
France	0.0023	0.0027	1.2050	0.1670	Unchanged
UK	0.0011	0.0029	2.5649	**0.0000*** **	**Increase**
US Soft Red	0.0058	0.0061	1.0499	0.3961	Unchanged
FCW	0.0049	0.0054	1.1099	0.3219	Unchanged

Note: Sample includes January 1985 – May 1993, July 1993 – December 2003 (July 1993 – July 2000 for Italy). *, ** and *** indicate significance at the 1%, 5% and 10% level, respectively. FCW is French Common Wheat, which is the European bench mark export price.

Exponential GARCH models

As a second and more robust approach for testing change in price volatility before and after the 1992 CAP reform, we use the Exponential Generalised Autoregressive Conditional Heteroscedasticity (EGARCH) model of Nelson (1991). This model is modified to include a binary dummy variable, D_t, in the conditional variance equation which takes values of zero prior July 1993 and one after. The mean model for price changes is defined as an autoregressive model while the variance equation is specified as an EGARCH model in the following form:

$$\Delta P_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta P_{t-i} + \sum_{i=1}^{q} \beta_i \varepsilon_{t-i} + \varepsilon_t \quad , \quad \varepsilon_t \sim \text{IN}(0, \sigma_t^2)$$

$$\sigma_t^2 = \exp[\gamma_0 + \gamma_1(\varepsilon_{t-1} / \sigma_{t-1}) + \gamma_2 \log(\sigma_{t-1}^2) + \delta D_t] \tag{A2.2}$$

The main advantage of the EGARCH model is that it takes into account the evolution of price levels, and the mean and volatility equations are both estimated in a simultaneous framework. In the above setting, the hypothesis of whether there has been an increase in volatility of EU farm gate prices can be tested through the significance of the estimated coefficient for δ. Results from this model are presented in Table A2.6.

Table A2.6: Estimation Result of Dynamic Volatility Models

$$\Delta P_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta P_{t-i} + \sum_{i=1}^{q} \beta_i \varepsilon_{t-i} + \varepsilon_t \qquad , \quad \varepsilon_t \sim IN(0, \sigma_t^2)$$

$$\sigma_t^2 = \exp[\gamma_0 + \gamma_1(\varepsilon_{t-1} / \sigma_{t-1}) + \gamma_2 \log(\sigma_{t-1}^2) + \delta D_t]$$

	Spain	France	Germany	UK	FCW	US Soft Red
Mean						
α_0	0.0015 (0.0017)	0.0055 (0.0069)	0.0087*** (0.0019)	0.0054 (0.0037)	-0.0007 (0.0079)	0.0013 (0.0038)
α_1	0.4079*** (0.0634)	0.1597** (0.0811)		0.2454*** (0.0697)	0.3056*** (0.0764)	
α_2	-0.2078*** (0.0538)					
α_6						-0.2239*** (0.0692)
α_7						-0.1638** (0.0750)
α_{12}		0.4730*** (0.0406)	0.5305*** (0.0209)	0.1564*** (0.0487)		
β_1			0.3945*** (0.0155)			
Variance						
γ_0	-8.0191*** (0.3430)	-7.2027*** (0.1205)	-8.3274*** (0.3394)	-7.4282*** (0.2722)	-5.4867*** (0.2942)	-5.3229*** (0.1789)
γ_1	0.4411* (0.2393)	0.4389*** (0.1076)	0.9780*** (0.1612)	0.6410*** (0.1823)	0.2053 (0.2722)	-0.0599 (0.1605)
δ	0.7686** (0.3282)	0.4676*** (0.1365)	-0.1133 (0.4027)	0.9630*** (0.3195)	-0.0174 (0.3017)	0.2484 (0.1853)
R-bar squared	0.0874	0.193	0.5024	0.000	0.0773	0.0551

Sample period is from 1985:1 to 2003:12. The dummy variable which measures the impact of 1992 CAP reform on volatility take value of zero prior to May 1993 and one after June 1993. ***, **, and * indicate significance at the 1%, 5% and 10% level, respectively.

Correlation tests

Table A2.7 Correlation between farm gate and international price levels

Panel A Sample Period: 1985:1 - 1993:5							
	France	**Germany**	**Italy**	**Spain**	**UK**	**FCW**	**US SRW**
France	1.000						
Germany	0.402	1.000					
Italy [a]	0.073	0.669	1.000				
Spain	0.452	0.654	0.448	1.000			
UK	0.191	-0.008	-0.248	0.415	1.000		
FCW	-0.392	-0.139	0.233	-0.035	0.117	1.000	
US Soft Red	-0.160	-0.050	-0.146	0.152	0.185	0.891	1.000
Panel B Sample Period: 1993:7 – 2003:12							
	France	**Germany**	**Italy**	**Spain**	**UK**	**FCW**	**US SRW**
France	1.000						
Germany	0.873	1.000					
Italy [a]	0.773	0.725	1.000				
Spain	0.727	0.695	0.661	1.000			
UK	0.895	0.811	0.799	0.817	1.000		
FCW	0.591	0.431	0.461	0.723	0.761	1.000	
US Soft Red	0.595	0.654	0.435	0.678	0.696	0.890	1.000

Note: Italian farm gate prices are not available after July 2000. Source: International Grain Council, New Cronos

Annex 3: Hedge Ratio Estimation Methodology

The primary purpose of hedging is to reduce or control the risk of adverse price changes in the spot market. To achieve this objective, the hedger has to determine a hedge ratio, i.e. the number of futures contracts to buy or sell for each unit of spot commodity on which he bears price risk. Johnson (1960), Stein (1961) and Ederington (1979) apply the principles of portfolio theory to show that the hedge ratio that minimises the risk of the spot position is given by the ratio of the unconditional covariance between spot and futures price changes over the unconditional variance of futures price changes. This is derived as follows.

Consider the case of a producer who wants to secure his production revenue using agricultural futures. The change on his portfolio of spot and futures positions, ΔP_t, is given by

$$\Delta P_t = \Delta S_t - \gamma \Delta F_t \qquad \text{(A3.1)}$$

where, $\Delta S_t = S_t - S_{t-1}$ is the change in the spot position between t-1 and t; $\Delta F_t = F_t - F_{t-1}$ is the change in the futures position between t-1 and t; and γ is the hedge ratio [22]. The optimum hedge ratio is the one that minimises the variability or risk of the position in the spot market. Ederington (1979) showed that this is equivalent to the slope coefficient, β (beta), in the following linear regression

$$\Delta S_t = \alpha + \beta \Delta F_t + u_t \quad ; u_t \sim \text{iid}(0, \sigma^2) \qquad \text{(A3.2)}$$

In this model, the degree of variance reduction in the hedged portfolio achieved through hedging is given by the R^2 of the regression, since it represents the proportion of risk in the spot market that is eliminated through hedging; the higher the R^2 the greater the effectiveness of the minimum variance hedge.

[22] Spot and futures prices are measured in natural logarithms. Hence, ΔS_t and ΔF_t approximate the continuously compounded spot and futures returns, respectively.

Annex 4: Historical Spot and Futures Prices of Wheat in Different European Countries

Figure A4. 1: Plot of Euronext.liffe nearby Feed Wheat Contract against UK Feed Wheat

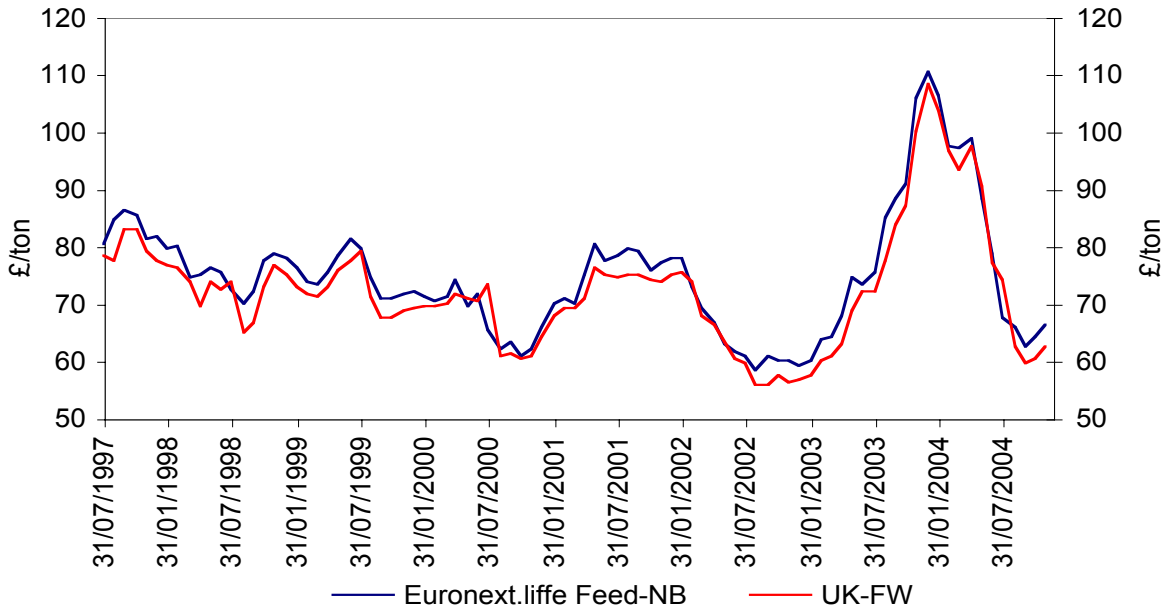


Figure A4. 2: Plot of Euronext.liffe nearby Feed Wheat Contract against Irish Feed Wheat

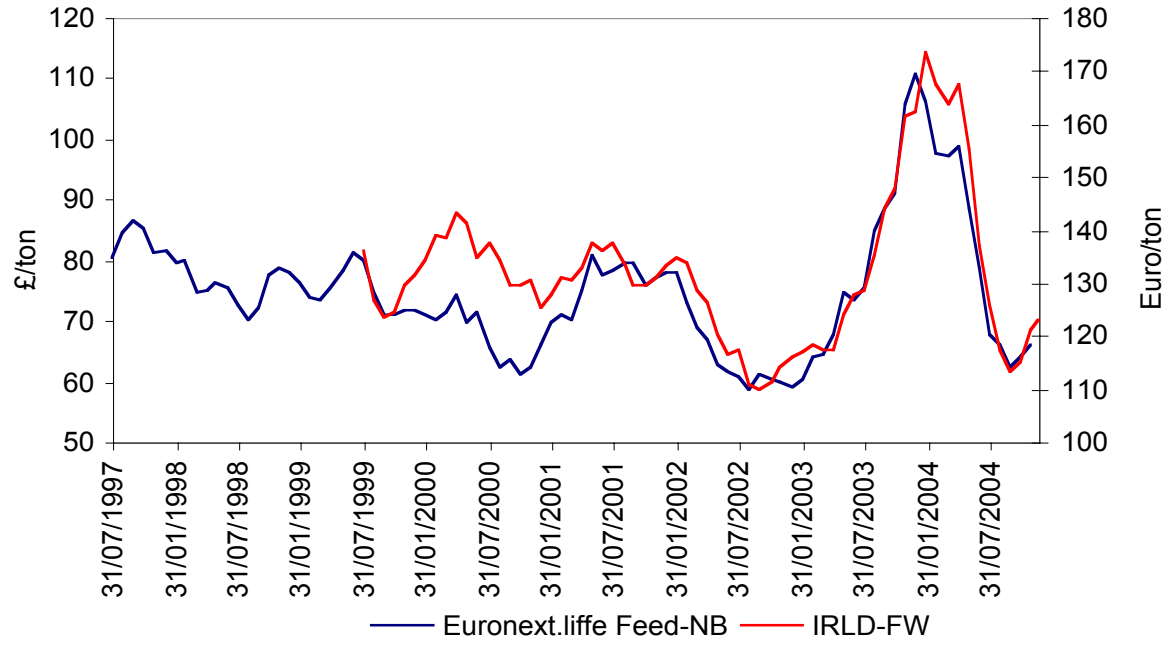


Figure A4. 3: Plot of Euronext.liffe nearby Feed Wheat Contract against German Feed Wheat

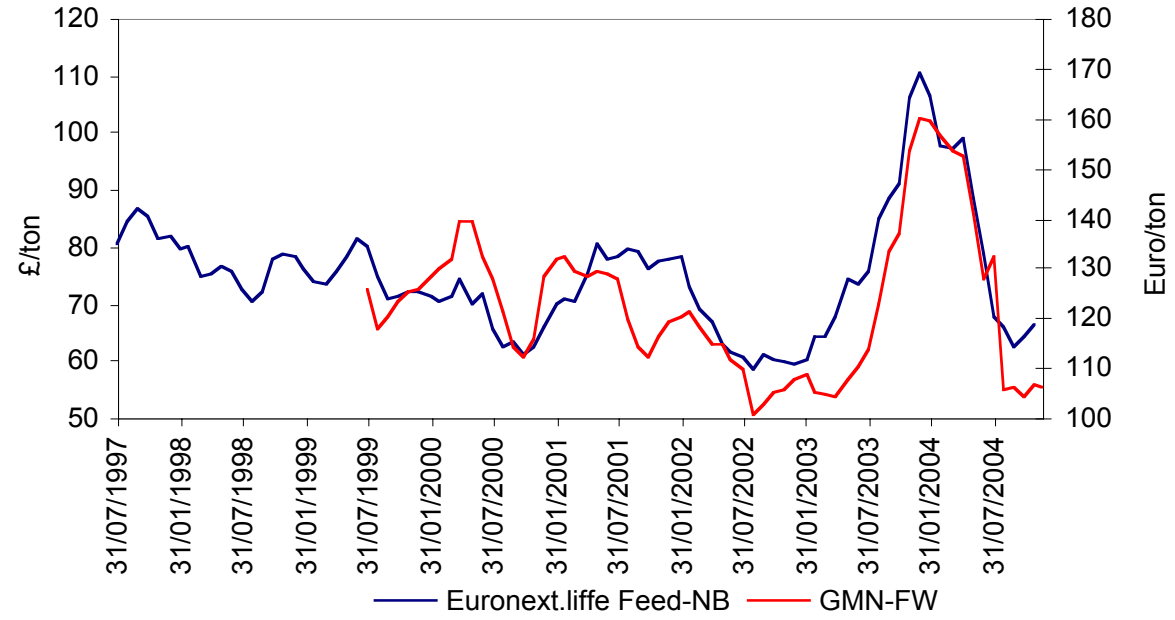


Figure A4. 4: Plot of Euronext.liffe nearby Feed Wheat Contract against Spanish Feed Wheat

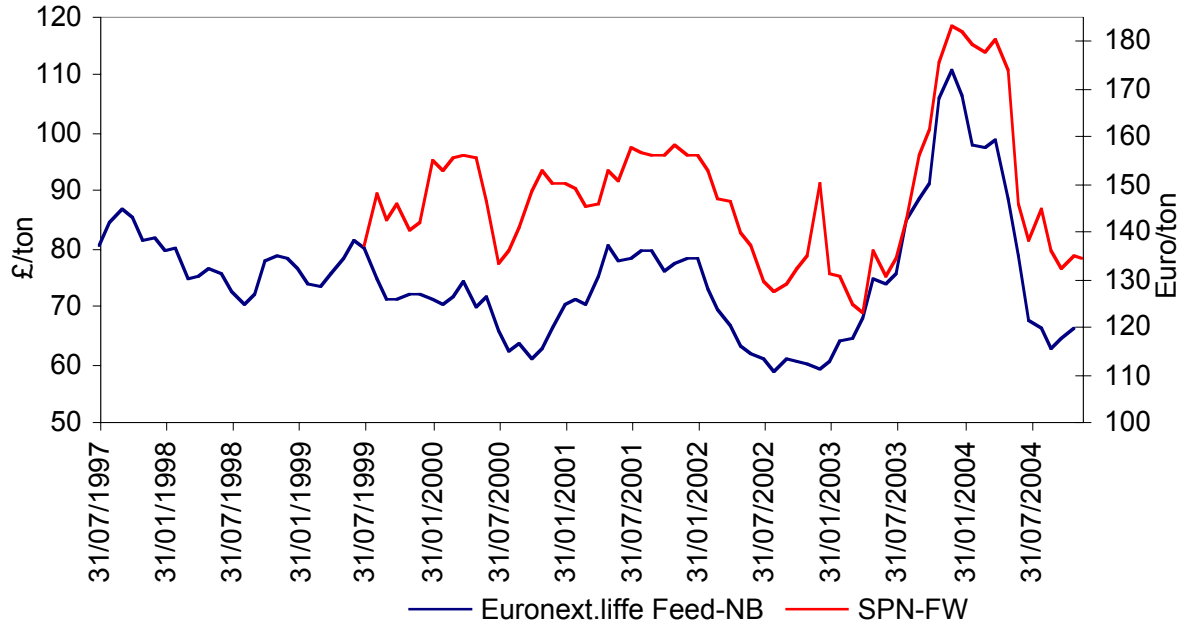


Figure A4.5: Plot of Euronext.liffe nearby Feed Wheat Contract against Portuguese Feed Wheat

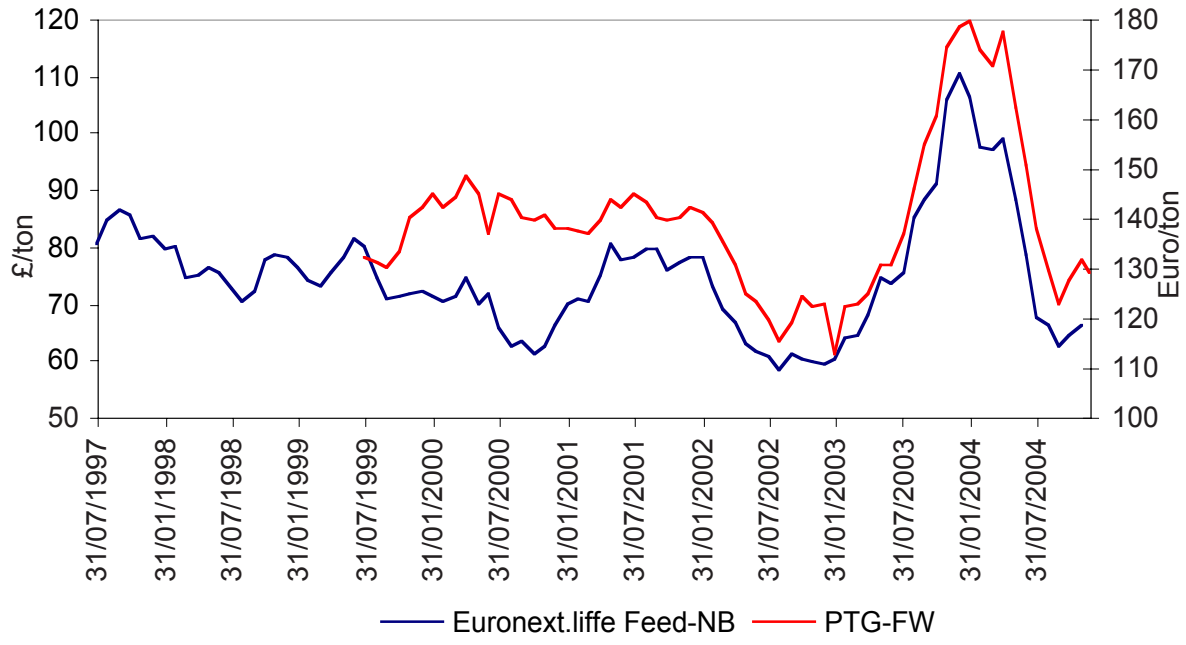


Figure A4. 6: Plot of Euronext.liffe nearby Milling Wheat Contract against German Milling Wheat

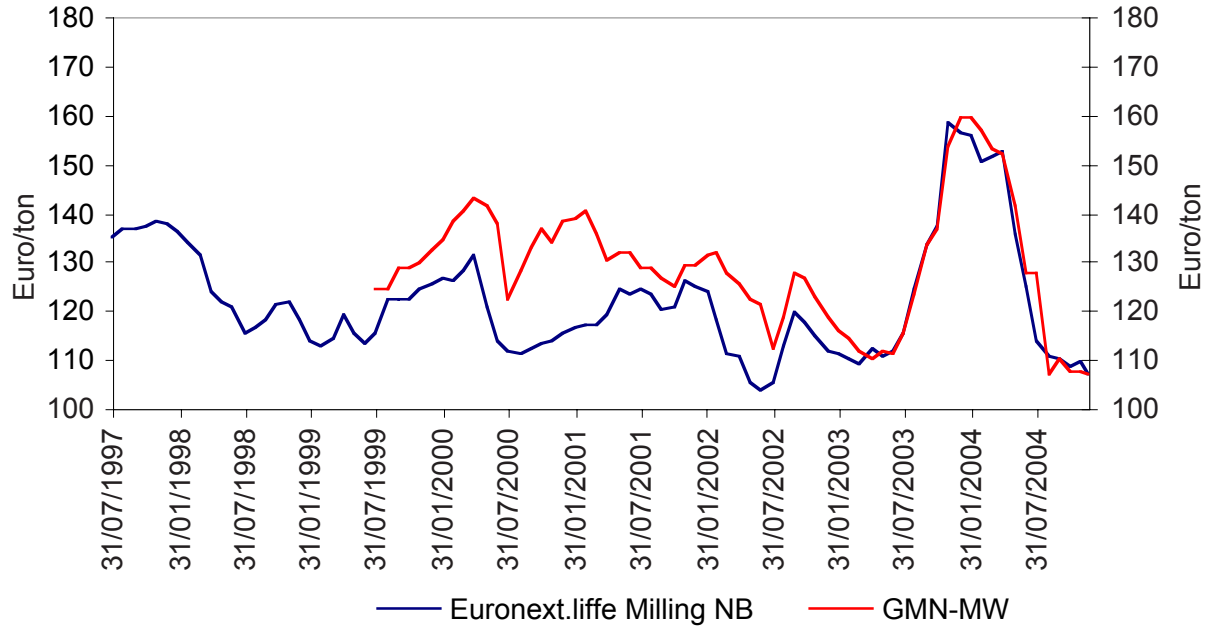
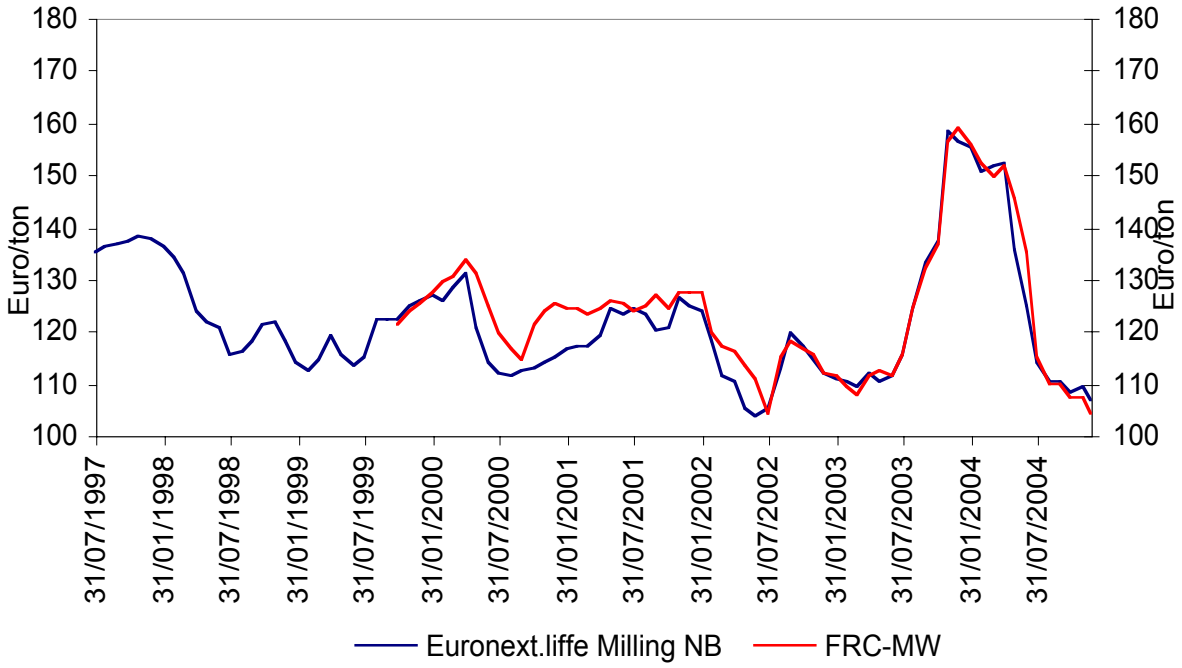


Figure A4.7: Plot of Euronext.liffe nearby Milling Wheat Contract against French Milling Wheat



Annex 5: Models of Co-Operatives

Table A5.1: Co-operative models in the EU

	Traditional co-ops	Share co-ops	Daughter co-ops	Tradable shares co-ops (NGC)	Limited liability co-ops (PLC)
Membership	Free	Free	Changing	Limited	Changing
Personal liability	No	For investors	For investors	Yes	Yes
Voting scheme	Equal right	Members: yield	Members: yield	Based on yields, investments	Based on shares
Decisive control	Members	Members	Members through co-op	Members	Investors
External shares	No	Yes	Yes	Limited	Yes
Membership shares	Equal	Equal	Equal	Based on yield	Shares
Returns	Based on yields	Members: yield Investors: shares	Members: yield Investors: shares	Members: yield Investors: shares	Members: yield Investors: shares
Professional manager	No	Not always	Yes	Yes	Yes

Source: Bouckova, B. (2002) Agricultural co-operatives: perspective for the 21st century, AGRIC. ECON. 48, (4): 166–170

Cass Business School
106 Bunhill Row
London EC1Y 8TZ

www.cass.city.ac.uk
E-mail: info@city.ac.uk
Tel: +44 (0)20 7040 0104
Fax: +44 (0)20 7040 8881

Futures and Options Association
2nd Floor, 36-38 Botolph Lane
London EC3R 8DE

www.foa.co.uk
E-mail: info@foa.co.uk
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Fax: +44 (0)20 7621 0223