ALLIANCE ENVIRONNEMENT

Groupement Européen d'Intérêt Economique

EVALUATION OF THE ENVIRONMENTAL IMPACT OF MILK QUOTAS

FINAL DELIVERABLE REPORT

Deliverable prepared for DG Agriculture

July 2008

This study has been conducted by *Alliance Environnement* and financed by the European Commission. *Alliance Environnement* takes full responsibility for the content of the study. The conclusions, recommendations and opinions presented in the study reflect those of *Alliance Envionnnement* and do not necessarily reflect the opinion of the European Commission.

Alliance Environnement comprises the following partners:

Institute for European Environmental Policy (IEEP)
David Baldock, Executive Director
15 Queen Anne's Gate, London,
SW1H 9BU, UK
Tel: + 44 20 7799 2244
Fax: + 44 20 7799 2600
kparrott@ieep.eu

Oréade-Brèche Sarl

Thierry Clément, Gérant
64 Chemin del Prat,
31320 Auzeville, FRANCE
Tel.: + 33 5 61 73 62 62
Fax: + 33 5 61 73 62 90
oreade-breche@oreade-breche.fr

ACKNOWLEDGEMENTS

This report was compiled by David Baldock (IEEP), Justin Bartley (IEEP), Professor Alison Burrell (University of Wageningen), Professor David Colman (University of Manchester), Kaley Hart (IEEP), Philippe Pointereau (Solagro), and Paul Silcock (Cumulus Consultants Ltd).

The corresponding author for this report is Justin Bartley (jbartley@ieep.eu).

Alliance Environnement recognises the contribution of the national experts listed below in undertaking the case studies in seven Member States.

Clément, T., Latruberce, M., Lavrilleux, Y., Nocentini, L. *Oréade-Brèche*	France
Kleinhanß, W., Offermann, F., Ehrmann, M. *Johann Heinrich von Thünen Institute (vTI)*	Germany
Silcock, P. *Cumulus Consultants Ltd*	Ireland
Borri, I., Borsotto, P., Cagliero, R., Henke, R., Macrì, M.C., Marseglia, F., Torighelli, B., Vanni, F. *Istituto Nazionale di Economia Agraria (INEA)*	Italy
Daatselaar, C. *Agricultural Economics Research Institute (LEI)*	The Netherlands
Beaufoy, G. Salguero, C. *Instituto de Desarrollo Rural Sostenible (IDRiSi)*	Spain
Bartley, J. *Institute for European Environmental Policy (IEEP)*	UK

MEMBER STATE ABBREVIATIONS (EU 25)

AT	= AUSTRIA
BE	= BELGIUM
CY	= CYPRUS
CZ	= CZECH REPUBLIC
DE	= GERMANY
DK	= DENMARK
EE	= ESTONIA
EL	= GREECE
ES	= SPAIN
FI	= FINLAND
FR	= FRANCE
HU	= HUNGARY
IE	= IRELAND
IT	= ITALY
LT	= LITHUANIA
LU	= LUXEMBOURG
LV	= LATVIA
MT	= MALTA
NL	= NETHERLANDS
PL	= POLAND
PT	= PORTUGAL
SV	= SWEDEN
SK	= SLOVAKIA
SI	= SLOVENIA
UK	= UNITED KINGDOM

GLOSSARY OF TERMS AND ACRONYMS

ACAL	Aide à la Cessation de l'Activité Laitière – a type of 'abandonment programme' (see Section 3.2) operated in France
Agenda 2000	Agreement reached in 1999 as part of CAP reforms with specific reference to the period 2000-2006
CAP	Common Agricultural Policy
CH_4	Methane
CO_2	Carbon Dioxide
Cross compliance	Compliance with a set of standards linked to the receipt of direct payments as set out in Chapter 2 of Council Regulation (EC) No 1782/2003
EQ	Evaluation Question (this study is focused on two EQs)
EU	European Union (prior to the Maastricht Treaty in 1991 known as the European Community)
EU 12	12 Member States of the European Community prior to the accession of Austria, Finland and Sweden in 1995
EU 15	15 Member States of the European Union prior to 2004
EU 25	25 Member States of the European Union prior to the accession of Bulgaria and Romania in 2007
FADN	Farm Accountancy Data Network
FSS	Farm Structure Survey
GAEC	Good Agricultural and Environmental Condition as defined to in Article 5 & Annex IV of Council Regulation (EC) No 1782/2003
GDR	German Democratic Republic – former East Germany (DDR)
GHG	Greenhouse gas
GWP	Global Warming Potential
HNV	High Nature Value
LCA	Life Cycle Assessment

LFA	Less Favoured Area as defined under Articles 18, 19, 20 & 16 of Council Regulation (EC) No 1257/1999
LU	Livestock unit
Milk quota	For an overview of rules for the transfer and allocation of milk quotas please refer to Section 3.2
MTR	Mid-Term Review (of the CAP in 2003)
NMS 10	10 New Member States which acceded to the European Union in 2004
N_2O	Nitrous Oxide
NPQR	Non-producing quota holder
NVZ	Nitrate Vulnerable Zone
OECD	Organisation for Economic Co-operation and Development
PDO	Protected Designation of Origin
PGI	Protected Geographical Indication
SMR	Statutory Management Requirements relating to public, animal and plant health, environment, and animal welfare, as defined in Article 4 & Annex III of. Council Regulation (EC) No 1782/2003
SO_2	Sulphur Dioxide
UAA	Utilised Agricultural Area

TABLE OF CONTENTS

LIST OF ANNEXES

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

1.1 Aim of the study

The aim of this study is to examine the environmental impacts of the different systems for allocation and transfer of milk quota under the Common Agricultural Policy (CAP) in individual Member States of the European Union (EU). In particular, it seeks to identify the ways in which differences in the implementation of milk quota regimes can impact on various sectoral and farm management trends and the environmental implications of these. This report is intended to complement a previous study[1], henceforth referred to as the *main* study, which evaluated the impact of market support measures in the EU dairy sector as well as the effect of applying reference quantities of milk quota at national level. In contrast, the main policy impacts considered in this study arise from national implementation of the following aspects of milk quota policy within Member States:

- Transfers of quota with land (including rural leases);
- Permanent transfers of quota without land (via market or administrative mechanisms);
- Temporary transfers of quota without land;
- Temporary redistribution of unused quota; and
- Management of the National Reserve.

The study has sought to assess the environmental effects of milk quota implementation at national level following a two-step approach. Firstly, there is an analysis of the causal link, leading from implementation of the milk quotas regime to likely impacts on farmers' decisions, including effects on both farm structures and management practices. Second is consideration of the effects that these outcomes are likely to have had on the environment.

The linkages between milk quota implementation and environmental impacts are not straightforward. The environmental effects are various and can be either positive or negative, or both. For example, some structural changes linked to milk quota implementation may be beneficial in terms of greenhouse gas (GHG) emissions but negative in terms of water pollution or vice versa. The impact of some structural changes will also vary significantly depending both on local agro-climatic conditions and the extent to which production is concentrated in a particular region. Furthermore, in order to consider the overall environmental impact of milk quota implementation at farm level and regionally, it is necessary to take into account both increases and decreases in dairy production. Finally, since a number of other policy measures and market trends will influence structural and environmental impacts of dairying, isolating the impact of the quota regime is quite difficult.

[1] Evaluation of the environmental impacts of CAP measures related to the beef and veal sector and the milk sector (Alliance Environnement, 2007)

1.2 Scope of the evaluation

Within the overall evaluation exercise specific consideration is given to the effects of different quota regimes on the regional distribution of milk production. Since there has been no possibility of transferring milk quota *between* Member States, each Member State is treated as a self-contained unit and regional quota movements are analysed *within* national boundaries.

In terms of geographical scope the main focus of the evaluation is on the EU 15. In addition, it also provides a provisional overview of the implementation of milk quotas in the 10 new Member States which acceded to the EU in 2004 (henceforth referred to as the NMS 10). Detailed analysis based on data provided through case studies is provided in relation to seven Member States which account for nearly 85 per cent of milk production in the EU 15 distributed over a range of production systems and agro-climatic zones. Case studies were conducted in France, Germany, Ireland, Italy, the Netherlands, Spain and the United Kingdom. Analysis of the remaining EU 15 Member States is based on supplementary data sources.

The evaluation covers the same period as the *main* study, namely from 1988[2] until the present day, taking into account data availability. The analysis focuses on the medium to long term impacts of milk quota implementation throughout the period. Particular attention is given to changes in national implementation resulting from the 1992 and Agenda 2000 reforms of the CAP.

1.3 Structure of the report

The report consists of nine main chapters, a number of supplementary Annexes as well as an Executive Summary and a Short Summary. These are:

- Chapter 1: Introduction to the Evaluation giving an overview of the objectives and the structure of the report evaluation and the approach set out in subsequent sections of the study;
- Chapter 2: The EU Dairy Sector. This chapter gives a summary of structural developments during the evaluation period, including the regional distributions of milk production, dairy cows and dairy holdings;
- Chapter 3: Implementation of Milk Quotas in the EU. This chapter sets out an overview of the EU milk quota regime, its intervention logic and the different approaches adopted by Member States in respect to the transfer and allocation of milk quotas within their territory;
- Chapter 4: Farm Level and Environmental Impacts. This chapter identifies aspects of dairy production which may be affected by national milk quota implementation. The subsequent potential for environmental impacts on soils, water, biodiversity, landscape, air and climate change is then outlined;
- Chapter 5: Methodology. This chapter outlines the methodological approach used to address the two key evaluation questions addressed in the study including data considerations, an outline of the counterfactual and an

[2] In some cases, where data are available, the analysis dates back to 1984 when EU milk quotas were first introduced.

assessment of the degree of market orientation of Member State milk quota regimes;

- Chapter 6: Hypotheses linking milk quota implementation and environmental consequences. This chapter outlines the key hypotheses to be examined in the study;
- Chapter 7: Environmental Impact of Milk Quota Implementation at Member State Level. This chapter provides a detailed analysis of available evidence relevant to a series of hypotheses in order to evaluate the overall environmental impact of national milk quota implementations. This is the first major evaluation question;
- Chapter 8: Effectiveness of national Measures with Environmental Objectives. This Chapter provides a detailed analysis of the effectiveness of aspects of national milk quota regimes where an environmental objective has been specified either explicitly or implicitly. This is the second major evaluation question;
- Chapter 9: Conclusions and Recommendations. This chapter identifies the main findings of the evaluation and sets out some recommendations in relation to future dairy policy based on the study's conclusions;

A number of annexes are also included, mostly comprising detailed tables of Member State implementation in relation to transfers and allocations of milk quotas.

2 THE EU DAIRY SECTOR

2.1 Introduction

Milk production in the EU has been subject to the CAP milk quota regime throughout the period covered by this study. As a result, production levels have been characterised by relative stability at national level, particularly in the largest producing Member States, but with significant fluctuations in some regions. Cows' milk production in the EU 15 Member States was 129.6 million tons[3] in 1984 falling to around 121 million tons in the 1990s due to cuts in milk quota (DG Agri, 1997). Milk production in the EU 15 remained at around this level until 2003, but had declined to 120 million tons by 2005. Production at EU 25 level was 143 million tons in 2005, with the 10 new Member States (NMS 10)[4] accounting for just over 15 per cent of total EU production.

In 2005 the largest producers in the EU 25 were Germany (20.0 per cent), France (17.3 per cent), the UK (10.2 per cent), Poland (8.4 per cent), Italy (7.7 per cent), the Netherlands (7.6 per cent), Spain (4.6 per cent), and Ireland (3.6 per cent). Together, these eight Member States account for 79 per cent of total EU production. Excluding Poland, the seven EU 15 Member States account for 71 per cent of production in the EU 25 and 84 per cent of production in the EU 15. For a breakdown of production in all Member States please refer to Annex 1. Deliveries of cows' milk to dairies accounted for more than 95 per cent of milk production in the EU 15 in 2005, with direct sales and on-farm use accounting for the rest. In the EU 25 direct sales accounted for 8 per cent of total production, reflecting the relative importance of this form of sales in the NMS 10.

Whilst overall production of cows' milk has remained relatively stable during the evaluation period, the EU dairy sector has been subject to a great deal of structural change. The number of dairy cows has decreased, compensated to a large degree by increases in average milk yields per cow as a result of increased efficiencies of scale linked to increasing herd sizes in all Member States. Some of the principle trends in the EU-15 are considered in the next section. The history in the NMS 10 has been rather different and is the subject of the final section of this chapter.

[3] 1984 figures are the EU 12 plus Austria, Finland and Sweden.

[4] Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia. Bulgaria and Romania acceded to the EU in 2007 and are therefore not included within the scope of this evaluation study.

2.2 Developments in the EU 15 dairy sector

2.2.1 Milk Production in the EU 15 Member States

Between 1983/84 and 1993/94[5] milk production declined in the majority of Member States by between 10 and 16 per cent as a result of cuts in milk quota. The period between 1993/94 and 2003/04 was, in contrast, subject to much greater stability with most Member States experiencing only minor changes to their national levels of milk production. There were, however, exceptions to this pattern in a few mainly Mediterranean Member States where significant increases in production occurred, namely Austria (+16 per cent), Greece (+12 per cent), Italy (+9 per cent), Portugal (+23 per cent), and Spain (+10 per cent). Relatively small decreases in production occurred in a few Member States during this period, including Belgium (-5 per cent), Finland (-2 per cent) and Sweden (-1 per cent).

In recent years (2003/04 to 2006/07) milk production has remained relatively stable with no more than a one per cent change in the majority of EU 15 Member States. Exceptions include Greece (+10 per cent), the UK (-6 per cent), Finland (-3 per cent), and Germany, Spain and Sweden (all -2 per cent). For further details please refer to Table 2.1 below.

Table 2.1 Milk deliveries in the EU 15 between 1983/84 and 2006/07 (1,000 t)

Member State	**1983/84**	**1993/94**	**2003/04**	**2006/07**	**Percentage change (%) 1983/84 - 1993/94**	**Percentage change (%) 1993/94 - 2003/04**	**Percentage change (%) 2003/04 - 2006/07**
Austria[1]		2,290	2,645	2,672		15.5	1.0
Belgium	3,821	3,329	3,176	3,155	-12.9	-4.6	-0.7
Denmark	5,280	4,433	4,489	4,506	-16.0	1.3	0.4
Finland	3,229	2,457	2,408	2,343	-23.9	-2.0	-2.7
France	25,320	22,188	22,449	22,229	-12.4	1.2	-1.0
Germany[2]	32,338	28,098	28,533	27,995	-13.1	1.5	-1.9
Greece		601	672	739		11.8	10.0
Ireland	5,341	5,213	5,418	5,393	-2.4	3.9	-0.5
Italy[6]		10,119	11,018	11,141		8.9	1.1
Luxembourg	293	258	257	258	-11.9	-0.4	0.4
Netherlands[3]	12,181	10,997	11,065	11,123	-9.7	0.6	0.5
Portugal		1,501	1,841	1,838		22.7	-0.2
Spain[4]		5,352	5,893	5,759		10.1	-2.3
Sweden[1]		3,241	3,203	3,123		-1.2	-2.5
United Kingdom	15,957	13,986	14,658	13,839	-12.4	4.8	-5.6

Source: Member State responses to DG Agriculture questionnaire (2007)
[1] Data correspond to following years: 1995, 2003, & 2006 (Eurostat)
[2] Data correspond to following years: 1983/84, 1993, 2003 & 2006. 1983/84 figures include former GDR figures from 1990/01.
[3] Data for 1983/84 based on year 1984/85.
[4] Data correspond to following years: 1993, 2003, & 2006 (Eurostat)
[5] Data for 1993/94 is based on year 1995 (Eurostat).
[6] Deliveries and direct sales production. No data provided for 1983/84.

[5] All figures in this section were obtained in response to a questionnaire sent by DG Agriculture to Member State administrations in 2007.

2.2.2 *Scale of production*

Increased scale of production at the level of the farm holding has been observed in all Member States[6]. This can be observed through a decline in the number of dairy holdings at Member State level, with those holdings which remain in production increasing in size and milk output. Between 1983/84 and 1993/94 the number of dairy holdings declined by between 40 and 60 per cent in the majority of Member States, but by around 30 per cent or less in the Netherlands, and the UK. Between 1993/94 and 2003/04 average declines were typically in the region of 30 to 50 per cent. However, rates of decline in the number of holdings in Mediterranean countries were significantly greater, particularly in Greece (-69 per cent), Portugal (-80 per cent) and Spain (-70 per cent). Between 2003/04 and 2006/07 rates of decline were typically between 10 and 20 per cent with the exception of the Mediterranean countries as well as the Netherlands and Denmark, where higher rates of decline were observed (see Table 2.2 for more details).

Table 2.2 Number of dairy holdings in the EU 15 (1983/94-2006/07)

Member State	1983/84	1993/94	2003/04	2006/07	Percentage change (%) 1983/84 - 1993/94	Percentage change (%) 1993/94 - 2003/04	Percentage change (%) 2003/04 - 2006/07
Austria[1]		78,441	54,344	45,847		-30.7	-15.6
Belgium	47,053	24,272	15,817	14,311	-48.4	-34.8	-9.5
Denmark	32,679	16,390	7,332	5,364	-49.8	-55.3	-26.8
Finland	73,766	36,187	18,401	14,897	-50.9	-49.2	-19.0
France	384,945	162,384	107,971	94,332	-57.8	-33.5	-12.6
Germany[2]	383,369	220,679	121,524	105,800	-42.4	-44.9	-12.9
Greece		27,805	8,669	6,294		-68.8	-27.4
Ireland	67,981	41,390	25,212	21,872	-39.1	-39.1	-13.2
Italy		140,878	60,198	48,020		-57.3	-20.2
Luxembourg	2,226	1,524	1,022	923	-31.5	-32.9	-9.7
Netherlands[3]	54,013	43,928	28,389	21,172	-18.7	-35.4	-25.4
Portugal		87,254	17,616	12,461		-79.8	-29.3
Spain[4]		137,330	41,612	29,341		-69.7	-29.5
Sweden[5]		17,640	10,030	8,369		-43.1	-16.6
United Kingdom	50,625	36,709	21,553	18,499	-27.5	-41.3	-14.2

Source: Member State responses to DG Agriculture questionnaire (2007)
[1] Data for 1993/94 is based on year 1995/96. Figures from presentation on Austrian Milk Sector (Lebensministerium 2007).
[2] Data correspond to following years: 1983, 1993, 2003 & 2006.
[3] Data for 1983/84 based on year 1984/85.
[4] Data for 2006/07 based on year 22005/06. Figures from Spanish case study report (COAG, 2006 based on data from MAPA)
[5] Data for 1993/94 is based on year 1995 (Eurostat).

Trends in the number of dairy cows and average number of dairy cows per holding are shown below in Table 2.3. Figures are based on Eurostat data and presented at

[6] Similar trends in terms of number of cows, dairy holdings and their size distributions have been reported throughout the OECD. Please refer to their 2004 report on 'The Dairy Sector' for more details.

Member State, EU 15 and EC 12[7] level between 1990 and 2005. The figures indicate that between 1995 and 2005 the average annual decline in the number of dairy cows per Member State was 1.8 per cent for the EU 15. Four Member States experienced declines below the EU average including France (-1.6 per cent), Greece (-0.9 per cent), Italy (-1.4 per cent) and the Netherlands (-1.6 per cent). In contrast, nine Member States experienced declines above the EU average, including Austria (-2.4 per cent), Germany (-2.0 per cent), Portugal (-2.5 per cent), Spain (-2.6 per cent), the UK (-1.9 per cent).

In terms of the average number of dairy cows per holding, the largest holdings in the EU 15 are located in Denmark, the Netherlands and the UK, whilst the smallest holdings can be found in Austria, Finland, Greece, Portugal and Spain. The greatest average annual increases in dairy cows per holding between 1995 and 2005 have occurred in Denmark (9.3 per cent), Greece (16.1 per cent), Italy (6.0 per cent), Portugal (17.7 per cent), and Spain (11.4 per cent). In contrast, the lowest annual increases have occurred in Austria (2.5 per cent), Belgium (1.5 per cent), France (3.1 per cent), Luxembourg (1.7 per cent), the Netherlands (3.4 per cent), and the UK (1.8 per cent).

Table 2.3 Number of dairy cows and average number of cows per holding in the EU 15 (1990-2005)

Member State	Number of dairy cows				Annual Change (%) 1995-2005	Average number of dairy cows per holding				Annual Change (%) 1995-2005
	1990	1995	2000	2005		1990	1995	2000	2005	
Austria		705,680	697,310	535,790	-2.4		7.8	9.0	9.8	2.5
Belgium	841,860	688,380	615,860	549,330	-2.0	26.9	31.5	33.9	36.2	1.5
Denmark	761,930	702,470	640,190	564,270	-2.0	32.9	44.0	57.4	85.1	9.3
Finland		396,050	364,120	318,760	-2.0		12.1	15.2	18.8	5.6
France	5,304,390	4,624,350	4,193,270	3,877,620	-1.6	23.4	28.7	32.7	37.5	3.1
Germany		5,271,000	4,765,140	4,235,960	-2.0		25.2	31.2	38.4	5.2
Greece	204,760	183,600	153,790	167,920	-0.9	5.4	6.6	12.8	17.2	16.1
Ireland	1,330,810	1,312,080	1,177,450	1,081,960	-1.8	27.1	30.9	37.0	45.4	4.7
Italy	2,641,760	2,173,310	1,896,050	1,860,180	-1.4	12.8	18.9	23.2	30.5	6.1
Luxembourg	60,530	48,600	45,140	39,340	-1.9	32.0	34.7	36.7	40.6	1.7
Netherlands	1,877,870	1,707,880	1,649,730	1,433,200	-1.6	39.9	45.6	47.1	60.9	3.4
Portugal	405,600	381,760	355,730	287,290	-2.5	4.1	6.5	10.8	18.1	17.7
Spain	1,597,840	1,356,840	1,242,310	1,001,920	-2.6	7.7	11.1	16.0	23.6	11.4
Sweden		481,390	448,520	393,260	-1.8		27.3	32.1	46.0	6.9
United Kingdom	2,844,910	2,555,370	2,334,840	2,065,070	-1.9	63.5	66.6	73.3	78.5	1.8
EC 12		21,005,640	19,069,500	17,164,060	-1.8		24.7	31.0	39.1	5.8
EU 15		22,588,760	20,579,450	18,411,870	-1.8		22.8	28.2	35.4	5.6

Source: Eurostat
Note: Average number of cows per holding based on own calculations using Eurostat data. Data for the former West Germany prior to reunification with the ex-GDR are not publicly available for 1990.

[7] The 12 Member States of the European Community, as the EU was known prior to the Maastricht agreement in 1991 and the accession of Austria, Finland and Sweden to the Union in 1995.

Although the national average number of dairy cows per holding can be a useful indicator of the scale of production, the figures can hide potentially significant variations in the size of holdings. Therefore it can be useful to examine the extent to which dairy production takes place on larger holdings. Table 2.4 presents data for the EU 15 on the proportion of dairy holdings with more than dairy 100 cows as well as the proportion of dairy cows kept on these holdings. The data indicates that in both categories the percentage distributions have increased in all Member States. The Member States with the largest proportion of herds with at least 100 dairy cows in 2005 are Denmark (38 per cent) and the UK (28 per cent) followed the Netherlands (11 per cent). The increase is Denmark is notable for having risen from 2 per cent in 1990 (the same as Ireland) to 38 per cent in 2005 (compared with 5 per cent in Ireland). The Member States with the fewest holdings of this scale in 2005 include Austria (<1 per cent), Finland (<1 per cent), France (1 per cent), Greece (2 per cent), Luxembourg (2 per cent), Portugal (2 per cent), and Spain (3 per cent). Austria and Finland are notable for having had no holdings with more than 100 dairy cows in 1995, whilst in Luxembourg the same was true in 1990.

Table 2.4 Share of dairy holdings and dairy cows on holdings with more than 100 cows in the EU 15 (1990-2005)

Member State	Share of dairy holdings with > 100 cows (%)				Share of dairy cows on holdings with > 100 cows (%)			
	1990	1995	2000	2005	1990	1995	2000	2005
Austria		0	<1	<1		0	<1	<1
Belgium	<1	1	2	2	3	5	6	7
Denmark	2	4	12	38	7	13	27	66
Finland		0	<1	<1		0	<1	1
France	<1	<1	<1	1	1	3	3	4
Germany	1	2	3	4	22	19	21	26
Greece	<1	<1	1	2	4	5	14	18
Ireland	2	2	3	5	8	11	11	13
Italy	1	3	4	7	17	26	31	39
Luxembourg	0	<1	2	2	0	2	4	7
Netherlands	3	4	6	11	10	13	16	25
Portugal	<1	<1	<1	2	6	8	14	21
Spain	<1	<1	2	3	7	12	15	22
Sweden		1	2	7		7	11	25
United Kingdom	18	20	25	28	42	45	53	58

Source: Adapted and updated from OECD (2004) using data from Eurostat.

2.2.3 Regional distribution of dairy cows and holdings

Nearly 85 per cent of the EU 15's milk production and dairy cows can be found in the seven Member States[8] in which case studies were conducted as part of this study. A detailed summary of data indicating regional structural changes within these Member States in relation to average number of dairy cows, number of dairy holdings, and

[8] Case studies were conducted as part of this study in France, Germany, Ireland, Italy, the Netherlands, Spain, and the UK with regional analysis in Auvergne and Brittany, Bavaria, Emilia-Romagna, Galicia and the Southwest of England.

number of dairy cows per holding is included in Annex 2. Data are for selected regions within these Member States and cover the period between 1990 and 2005. A brief summary of the keys points is highlighted below.

In France the regional distribution of dairy cows does not appear to have changed significantly between 1990 and 1995. In terms of regional shares of dairy holdings there are some differences though, with some regions gaining slightly (Pays de la Loire, Auvergne) and some losing slightly (Lower Normandy, Rhône-Alpes). The largest region, in terms of dairy production (Brittany), appears to have maintained both its share of dairy cows and dairy holdings during this period. Average herd sizes in the more extensive dairy regions (Auvergne and Rhône-Alpes) are consistently below those found in regions typically associated with more intensive production methods.

In Ireland there is a clear difference between the relatively productive areas in the South and East, and the rest of country where the majority of the LFA is located. No changes in the distribution of dairy cow numbers occurred between 2000 and 2005, although the rate of increase in herd sizes was quicker in the Border, Midlands and Western regions (albeit from a lower base) resulting in a decreased share of national holdings.

In Germany the distribution of dairy cows between the main production regions does not change much between 1990 and 2005. However, variations between regions in the structure of dairy holdings alter over this period, notably with respect to Bavaria where the rate of increase in herd size is significantly slower than in other regions. Subsequently, the divergence between regions with larger average herd sizes, such as Lower Saxony, and those with smaller average herd sizes, such as Bavaria, has become more pronounced.

In Italy significant changes in the regional distribution of dairy cows have taken place in Lombardy (mainly before and after 1995), Veneto (-2 per cent), and Campania (+6 per cent). Regional shares of both dairy cows and holdings have remained stable in Emilia Romagna. In terms of share of holdings, Lombardy gained significantly (+4 per cent), whilst Veneto lost regional share (-4 per cent). The largest holdings on average are located in Lombardy and all regions have experienced significant increases in herd size, but have been particularly pronounced in regions where herd sizes were relatively low in 1990 i.e. Campania and to a lesser extent Veneto.

In Spain the national share of dairy cows in Galicia increased from 30 per cent in 1990 to 39 per cent in 2005. Average holding sizes in Galicia remained below the national average during this period and are amongst the lowest in the seven case study Member States.

In the Netherlands the dairy herd is relatively evenly distributed between the four regions, with the highest regional share of dairy cows in the East and the lowest in the South and the West. Between 1990 and 2005 the North experienced significant (3 per cent) increases in both the share of dairy cow and holding numbers, mainly at the expense of the South and to a lesser extent the East. The largest herd sizes are located in the North.

In the UK the main dairy production is the South West of England accounting for nearly a quarter of the UK dairy herd and number of holdings. Dairy production in the UK has consistently moved to west with increases in the proportion of dairy cow numbers between 1990 and 2005 in Scotland (+1 per cent), Wales (+2 per cent) and most noticeably Northern Ireland (+4 per cent), but not in the South West of England (- 2 per cent). Dairy holdings in Northern Ireland are significant smaller on average than in the rest of the UK. The largest holdings on average can be found in Scotland followed by England.

2.2.4 Regional distribution of dairy production systems

There is a significant amount of variation in dairy production systems in the EU 15 from predominantly grass based systems to systems where cereals and maize account for a significant proportion of feed produced on the holding or bought in. CEAS *et al* (2000) identify ten types of dairy production (summarised in Table 2.5), classified according to their geographical location, input intensity (high/low input/output) and feed resources (such as semi-natural pastures, permanent and temporary grassland, crops and grain mixed, crops and grain maize, and relative importance of grazing). The types of dairy production identified by CEAS *et al* (2000) can be grouped as follows:

- grassland (temporary and permanent) based systems ('intensive grassland', 'permanent grassland lowland', and 'permanent grassland mountain');
- production based on grazing of semi-natural pastures ('transhumant');
- mixed cropping systems ('conventional mixed', 'low-input and organic mixed', and 'Mediterranean mixed');
- maize based production systems ('intensive maize silage'); and
- limited-grazing systems ('industrial' and 'Mediterranean commercial').

At the end of the 1990s, CEAS *et al* (2000) estimated that three types of dairy production were responsible for about 77 per cent of milk production in the EU 15 – 'intensive grassland' (64 per cent), 'conventional mixed' (10 per cent) and 'intensive maize silage' (7 per cent). However, they noted that some of the smaller categories of production, such as permanent grassland (lowland and mountain), low-input and organic mixed and Mediterranean mixed, although responsible for only about 5 per cent, 4 per cent, 3 per cent and 1 per cent of milk production respectively, were potentially important for their environmental value. Table 2.5 summarises the main features of these production systems, and indicates the EU regions where they predominate.

It was not possible to update the CEAS *et al* figures for this study due to the complex data requirements needed to do so. However, it is clear that the three main production categories outlined above, namely 'intensive grassland', 'conventional mixed' and 'intensive maize silage', will still account for the majority of milk production in the EU 15, possibly with an increased share since 2000. 'Industrial' and 'Mediterranean commercial' are also likely to have retained or increased their share of milk production. Share of milk production attributed to more extensive systems such as 'transhumant', 'permanent grassland mountain' and 'Mediterranean mixed' (see Table 2.5) is likely to have declined or, at best, been maintained since 2000.

Table 2.5 CEAS *et al* typology of dairy production systems in the EU 15 based on the situation in 2000

Production system	Location (main regions)	Forage and Feed system	Comments
Intensive grassland Estimated share of milk production: 64%	Netherlands, SW England and SW Scotland, Western France (e.g., La Mayenne), Sweden and Finland, North Spain, parts of the Azores.	*Main winter fodder*: grass silage/cereals/ beet/maize silage *Feeding system*: more than 60% of the farmland is grass and crops. Concentrate use can exceed 1,500kg/cow/year.	Relatively high input/output Wetter and cooler parts of the Continental and Atlantic regions where conditions are poor for maize cultivation, and in the Boreal (Scandinavian) zone, Holstein-Friesian breeds;
Permanent grassland lowland Estimated share of milk production: 5%	Northern and eastern France, Ireland, north and west of UK, parts of the Azores	*Main winter fodder*: grass silage/hay/cereals/ maize silage *Feeding system*: mostly permanent grassland. Cereals occupy less than 30% of UAA often in rotation with maize, wheat and brassicas. Some concentrate use.	Relatively low input/output Summer grazing. in Atlantic regions, Holstein-Friesian breeds; .
Permanent grassland mountain Estimated share of milk production: 4%	In uplands, high plateaux and mountain foothills in the Atlantic, Continental and Alpine regions, for example, the Massif Central, Auvergne, the Black Forest and the foothills of the Alps, Pyrenees and Cantabrian mountains	*Main winter fodder*: hay/grass silage *Feeding system*: virtually all grassland. Concentrate use on more intensive farms.	Low input/output Alpine, Atlantic, Continental and Boreal regions. Red & White, regional and dual purpose breeds.
Transhumant Estimated share of milk production: 1%	Mountain regions including Alps, Pyrenees, and Cantabrian mountains	*Main winter fodder*: hay, restricted use of concentrate feeds and silage *Feeding system*: spring and autumn grazing in valley and mid altitude meadows, summer grazing of pasture on rotation.	Very low input/output. Grazing in higher Alpine pastures in summer and housed in lower valleys in winter. Very low mineral and manure inputs, regional breeds.
Conventional mixed Estimated share of milk production: 10%	Throughout the lowlands of the Atlantic and Continental regions including Denmark, UK, Western Germany.	*Main winter fodder:* grass and arable silage/cereals/beet *Feeding system*: rotational arable cropping with cereals, fodder beets and cash crops in combination with temporary grassland but limited area of permanent pasture. Variable use of concentrates.	Relatively high input/output Throughout the lowlands of the Atlantic and Continental regions where soils make crop cultivation viable but where temperature restricts intensive maize cultivation. Holstein-Friesian breeds.

Production system	Location (main regions)	Forage and Feed system	Comments
Low-input and organic mixed Estimated share of milk production: 3%	Throughout the lowlands of the Atlantic and Continental regions including Denmark, UK, Western Germany.	*Main winter fodder*: grass and arable silage/cereals/beet. *Feeding system*: based on rotational arable cropping system with similar areas of permanent and temporary grassland. Greater use of rapeseed cake and grain due to concentrate restrictions.	Relatively low input/output Throughout the lowlands of the Atlantic and Continental regions wherever conventional mixed cropping systems occur. No mineral inputs; Jersey, Guernsey, Red & White, breeds in addition to Holstein-Friesian.
Mediterranean mixed Estimated share of milk production: 1%	Wetter parts of northern Portugal, the less fertile and arid areas of Spain, southern Italy and Greece.	Main winter fodder: cereals (rye, maize, oats, triticale, lucerne)/dryland rye grass silage and hay. *Feeding system*: grazed on poor pastures and stubbles, low concentrate use (300-600kgs/cow/year) combined with supplementary green fodder.	Small-scale, low input/output. Occurs where irrigated maize cultivation is not possible. Wide variety of breeds.
Intensive maize silage Estimated share of milk production: 7%	Includes parts of western France, south-west France, northern Italy, the Rhine valley and some areas of southern England. More than 45% of French output from this system (mostly in western France including Bretagne).	*Main winter fodder*: maize silage. *Feeding system*: maize represents 25-60% UAA (sometimes more). Arable land not under maize is usually under rotational grass based on rye grass. Concentrate use typically 1,300-1,800kg/cow/year.	High input/output Lowland parts of the Atlantic and Continental regions where climate and soils favour the growing of early to semi-early maize. Farms where over 80% of the UAA is normally suitable for cultivation. Holstein-Friesian breeds.
Industrial Estimated share of milk production: 3%	Germany (new Länder), North European lowlands (e.g. Netherlands and UK)	*Main winter fodder*: maize silage and bi-products. *Feeding system*: Zero grazing. Fed ration of concentrates, roughage and minerals.	High input/output Housed units, detached from land with high concentrate use. Holstein-Friesian breeds;
Mediterranean commercial Estimated share of milk production: 4%	Throughout the Mediterranean region: central and northern Greece, northern Italy, Spain and Portugal.	*Main winter fodder:* maize silage/rye grass silage. *Feeding system*: grazed for less than 3 months (if at all). Irrigated maize silage and dry-land ryegrass. Large amounts of concentrates (over 2,000kg/cow/year).	High input/output Zero grazing, housed units with high concentrate use. Holstein-Friesian breeds.

Source: Based on CEAS *et al*. (2000). Note: Figures for share of milk production are for indicative purposes only.

2.2.5 Production in Less Favoured Areas (LFAs)

A significant amount of dairy production in the EU 15 takes place in less favoured areas (LFAs) both within mountain areas (Article 18) and 'Other' LFAs (Article 19)[9]. Criteria for designating LFAs vary between Member States (IEEP 2006) with areas designated as mountain LFAs typically, but not exclusively, being subject to the greatest level of handicap (natural and socio-economic). In some Member States, areas with mountainous characteristics have been designated under Article 19 as 'Other' LFAs (e.g. Germany and the UK).

Member States characterised as having a high proportion of Mountain LFAs (Article 18) include Greece, Italy, and Austria. Members States which have predominantly designated 'other' LFAs (Article 19) include Belgium, Germany, Ireland, Luxembourg, and the UK. The Netherlands and Denmark and Finland (partially) have designated their LFAs in relation to 'specific handicaps' (Article 20).

In terms of proportion of utilised agricultural area (UAA) designated as LFA (under all four Articles), then the Member States with the highest designations of LFA[10], not necessarily an indicator of greatest natural handicap, are Finland, Luxembourg, Portugal, Greece, Spain, and Austria. Other Member States with significant areas of LFA linked to dairy production include France, Germany, Ireland, Italy, and the UK (in Northern Ireland, Scotland and Wales but not England). Denmark and the Netherlands are notable for having small proportions of UAA designated as LFA.

It is worth noting that degrees of handicap may vary significantly within LFAs, with dairy holdings often located in the least marginal areas. In some Member States, such as the UK, dairy production is explicitly excluded from the eligibility criteria for LFA payments, with preference given to more extensive forms of production such as suckler cows or sheep rearing.

Dairy production systems likely to occur in LFAs (as defined by CEAS *et al*; see Table 2.5) are 'transhumant' and 'permanent grassland mountain' and 'Mediterranean mixed'. Localised environmental impacts (e.g. to soil and water resources and farm biodiversity) are likely to be positive where such systems result in the maintenance of traditional extensive grazing or cropping practices. However, where dairy production has become increasingly intensive over time, the potential for negative environmental impacts is likely to increase linked to the degree of natural handicap (i.e. fragility) of the LFA in question - more likely to be an issue for 'permanent grassland mountain' rather than 'transhumant' and 'Mediterranean mixed' systems (where LFA production remains consistent with criteria set out in Table 2.5).

---

[9] Articles 18 and 19 as defined in Council Regulation 1257/1999. Classifications are also possible under Article 16 (areas subject to environmental restrictions) and 20 (areas affected by specific handicaps) are also possible but account for a much smaller proportion of LFA in the EU as a whole. This applies particularly to designations under Article 16 (IEEP 2006).

[10] Based on figures in 'Evaluation Of The Less Favoured Area Measure In The 25 Member States Of The European Union' (IEEP 2006).

In general, more intensive forms of production are unlikely to be associated with LFAs and this is reinforced by an EU wide trend for migration of dairy production from marginal to more productive areas both within regions and between regions (where permitted by national milk quota administration). Such migration is likely to contribute to an on-going decline in the share of milk production taking place in the LFAs, particular the most marginal parts.

2.2.6 Trends in intensity

In addition to significant variations in the scale of production between Member States there is also a great deal of variation in the intensity of production between Member States, between regions within Member States and sometimes even within regions. Milk yield per cow is a common indicator of production intensity with a generally positive correlation between inputs (i.e. feedstuffs, concentrates, etc), milk yield, and nitrogen excretions per cow (OECD 2004). Other potential indicators include number of dairy cows per forage hectare and milk production per forage hectare.

Table 2.6 shows trends in milk yield per cow between 1990 and 2005. Increasing milk yields per cow have been observed in all EU 15 Member States over this period, with the highest annual increases observed in Spain (5.6 per cent), Austria (4.1 per cent), Greece (3.1 per cent), Portugal (3.1 per cent) and Italy (3.0 per cent). The lowest rates of annual increase have occurred in France (1.8 per cent), the UK (1 .7 per cent), the Netherlands (1.5 per cent) and Ireland (1.3 per cent). The highest milk yields per cow on average are found in Denmark, Finland, Netherlands and Sweden. In recent years average milk yields per cow have been lowest in Ireland followed by Greece and then Austria. In 1990 milk yields in Spain were the lowest in the EU but have increased rapidly since then.

Table 2.6 Average milk yields per cow in the EU 15 (1990-2005)

Member State	milk yield per cow (kg/cow)				Annual percentage change (%) 1990-2005
	1990	1995	2000	2005	
Austria		4,178	4,785	5,871	4.1
Belgium	4,288	4,903	5,465	5,692	2.2
Denmark	6,224	6,652	6,927	8,187	2.1
Finland		6,231	6,749	7,825	2.6
France	4,949	5,495	5,600	6,277	1.8
Germany	4,787	5,483	6,034	6,784	2.8
Greece	3,498	4,158	4,583	5,120	3.1
Ireland	4,054	4,075	4,175	4,820	1.3
Italy	4,036	4,830	5,349	5,824	3.0
Luxembourg	4,795	5,527	5,933	6,761	2.7
Netherlands	6,009	6,613	7,105	7,338	1.5
Portugal	4,177	4,610	5,440	6,090	3.1
Spain	3,600	4,532	5,010	6,607	5.6
Sweden		6,863	7,494	8,383	2.2
United Kingdom	5,366	5,746	5,933	6,719	1.7

Source: Adapted and updated from OECD (2004) using data from Eurostat.
Percentage annual change for Austria, Finland and Sweden is calculated for the period 1995-2005.

Table 2.7 give an indication of trends which have taken place in terms of the number of dairy cows per forage hectare between 1990 and 2000[11]. The figures indicate a mixed picture, with increases in some Member States (for example Greece, Ireland, Italy and Spain) and declines in others (for example Austria, Denmark, Germany, Luxembourg and the Netherlands). The highest numbers of dairy cows per forage hectare are found in Greece followed by Belgium and the Netherlands. The lowest stocking rates can be found in Austria, Finland, and Sweden.

Table 2.7 Dairy cows per forage hectare in the EU 15 (1990-2000)

Member State	Cows per forage hectare (cows/ha)			Annual percentage change 1990-2000
	1990	1995	2000	
Austria		1.57	1.47	-1.3
Belgium	4.06	4.05	3.89	-0.4
Denmark	3.47	3.08	3.12	-1.0
Finland		1.28	1.31	0.5
France	1.71	1.76	1.77	0.4
Germany	2.32	2.21	2.20	-0.5
Greece	7.25	6.93	8.68	2.0
Ireland	1.90	1.99	2.15	1.3
Italy	2.61	3.13	3.10	1.9
Luxembourg	2.01	1.88	1.83	-0.9
Netherlands	3.98	3.79	3.44	-1.4
Portugal	2.51	2.47	2.52	0.0
Spain	2.37	2.38	2.79	1.8
Sweden		1.38	1.40	0.3
United Kingdom	2.11	2.10	2.16	0.2

Source OECD (2004) using data from Eurostat.
Annual percentage change for Austria, Finland and Sweden is calculated for the period 1995-2000.
Note: Comparable data for a more a more recent year requested from Eurostat but unavailable.

Table 2.8 provides a rough estimate of milk production per forage hectare between 1990 and 2000[12]. Increases can be observed in all Member States, albeit slight in Denmark and the Netherlands[13] where average yields per forage hectare were already

[11] Data from OECD (2004) provided for 1990-2000 based on multiplication of average milk yield per cow by the average number of dairy cows per forage hectare. Equivalent data from Eurostat on forage area not available for more recent years.

[12] Data from OECD (2004) provided for 1990-2000. Equivalent data from Eurostat on forage area not available for more recent years.

[13] The figures in Table 2.8 are shown in this report to provide an indicative picture of the relative intensity of production between Member States only. The figures provided for the Netherlands, Denmark and Belgium in particular have been disputed by national case study experts as being too high (as result of the method of calculation) and are not thought to represent the actual situation on the ground. The issue of national measures relating to milk production per hectare is discussed in Chapter 8.

high. Yields per forage hectare in Greece[14] have consistently been the highest in the EU. The lowest yields per forage hectare can be observed in Austria, Finland, France, and Ireland.

Table 2.8 Milk per forage hectare in the EU 15 (1990-2000)

Member State	Milk per forage hectare (kg/ha)			Annual percentage change (%) 1990-2000
	1990	1995	2000	
Austria		6,559	7,034	1.4
Belgium	17,409	19,857	21,259	2.2
Denmark	21,597	20,488	21,612	0.0
Finland		7,976	8,841	2.2
France	8,463	9,671	9,912	1.7
Germany	11,106	12,117	13,275	2.0
Greece	25,361	28,815	39,780	5.7
Ireland	7,703	8,109	8,976	1.7
Italy	10,534	15,118	16,582	5.7
Luxembourg	9,638	10,391	10,857	1.3
Netherlands	23,916	25,063	24,441	0.2
Portugal	10,484	11,387	13,709	3.1
Spain	8,532	10,786	13,978	6.4
Sweden		9,471	10,492	2.2
United Kingdom	11,322	12,067	12,815	1.3

Source: Adapted and updated from OECD (2004) using data from Eurostat.
Percentage annual change for Austria, Finland and Sweden is calculated for the period 1995-2000.
Note: Comparable data for a more a more recent year requested from Eurostat but unavailable.

2.3 Dairy production in the 10 New Member States (NMS 10)

With the generally liberal approach taken by the New Member States (NMS 10) to the implementation of milk quotas, and the opening up of these countries to free trade and market forces, one might expect relatively unimpeded dairy sector restructuring to take place including:

- Concentration of milk production with fewer, very small dairy farms and more, larger dairy farms;
- Intensification of milk production, including fewer dairy cows and higher average yields;
- Geographic concentration of milk production to the most competitive dairying areas (in terms of productivity, skills and markets).

[14] This likely to be due to the prevalence of 'Mediterranean commercial' production systems as outlined in Table 2.5. The issue of whether common land is included within a farm's forage area may also be relevant in some areas including 'Mediterranean mixed' production systems.

These changes are also likely to be supported by other key influences such as EU dairy hygiene regulation requirements, EU financial support for modernisation, the loss of labour from rural areas and increasing fuel and labour costs.

Preliminary evidence gathered from DG Agriculture's recent survey supports some of these trends for the two year period 2004/05 to 2006/07 (see Table 2.9). There has been an average 20 per cent reduction in the number of dairy farms in the NMS 10 (excluding Malta) and an 8 per cent increase in milk production. The Baltic States all experienced a 20-30 per cent reduction in the number of dairy producers, although other countries experienced lesser decreases. The greatest increases in milk production occurred in Latvia and Lithuania.

Table 2.9 Milk producers and production structure in the NMS 10

Member States	Milk producers		Percentage change (%)2004/5-2006/7	Milk Production (tons)		Percentage change (%) 2004/5-2006/7
	2004/5	2006/7		2004/5	2006/7	
Cyprus	241	224	-7.1	150,198	150,519	0.2
Czech Rep.	2,982	2,727	-8.6	2,609,951	2,684,069	2.8
Estonia	2,147	1,494	-30.4	529,651	600,427	13.4
Hungary	6,422	8,014	24.8	1,480,625	1,597,994	7.9
Latvia	31,269	23,756	-24.0	455,300	620,791	36.3
Lithuania	119,949	85,096	-29.1	1,153,234	1,369,379	18.7
Malta	150	152	1.3	41,872	41,237	-1.5
Poland	311,113	255,786	-17.8	8,269,434	8,899,613	7.6
Slovakia	814	729	-10.4	944,044	970,943	2.8
Slovenia	10,060	9,598	-4.6	528,999	536,150	1.4
Total	**485,147**	**387,576**	-20.1	**16,163,308**	**17,471,122**	8.1

* Slovenia figures relate to 2005/6
Na = data not available
Source: EC Survey of Member States 2007

The restructuring of production can also be seen from trends in quota size[15]. In 2004/5, 89 per cent of milk producers in the NMS 10 (excluding Malta) held quota of under 50 tons, 6.7 per cent had 50-100 tons, and 2.6 per cent had 100-200 tons. Two years later, in 2006/7, 84 per cent of milk producers in the EU 10 (excluding Malta) held quota of under 50 tons, 9.5 per cent had 50-100 tons, and 4.2 per cent had 100-200 tons. These averages hide considerable variation. Over 95 per cent of dairy farms in Lithuania have under 50 tons of milk quota, compared to 6.4 per cent in Slovakia and 81 per cent in Poland (the NMS 10's largest milk producer). By contrast, almost 50 per cent of Slovakia's dairy farms and 30 per cent of the Czech Republic's dairy farms have quotas of over 1,000 tons (with some having 10,000 tons and more); the proportions in this largest size category have increased over the past three years.

Despite recent changes, the structure of milk producing farms in many of the NMS 10 countries is very fragmented, with a large proportion of small farms which individually produce insignificant amounts of milk. Most national authorities are

[15] Figures based on data obtained from Member State responses to a questionnaire submitted by DG Agri.

seeking improvements in economic efficiency and expect that a number of costs, including feed and energy, will continue to grow. Strong co-operation between milk producers is starting to address the problem of fragmentation (which affects both production volumes and quality). Feedback from DG Agriculture's survey also suggests that amalgamations between milk purchasers and processors are taking place on a significant scale, altering the structure of the sector.

Dairy cow numbers in 2005 based on Eurostat data for the NMS 10 are shown in Table 2.10. Poland dominates with 60 per cent of dairy cows and 70 per cent of holdings. Lithuania is the next largest producer with 10 per cent of the NMS 10's dairy herd and 17 per cent of holdings.

Table 2.10 Dairy farm characteristics in the 10 New Member States (2005)

Member State	milk yield per cow	number of dairy cows	Number of dairy holdings	Average number of dairy cows per holding	Percentage of dairy holdings with > 100 cows (%)	Percentage of dairy cows on holdings with > 100 cows (%)
Cyprus	6,151	24,250	240	101.0	38	65
Czech Republic	6,120	440,500	6,780	65.0	16	88
Estonia	5,764	115,230	9,210	12.5	3	67
Hungary	6,648	286,830	16,250	17.7	3	69
Latvia	4,233	172,360	50,900	3.4	>1	17
Lithuania	4,422	493,890	170,790	2.9	>1	9
Malta	5,361	7,270	180	40.4	6	26
Poland	4,291	2853,740	727,100	3.9	>1	6
Slovakia	5,434	193,200	13,460	14.4	4	87
Slovenia	5,408	130,680	19,710	6.6	>1	3
EU 10		4,717,950	1,014,620	4.6		

Source: Eurostat
Note: Average number of dairy cows per holding based on own calculations using Eurostat data.

In terms of average herd size the largest herds are found in Cyprus (101) followed by Czech Republic (65), whilst the smallest in Lithuania (2.9) and Poland (3.9). The picture changes somewhat through, when looking at the percentage share of dairy cows held on holdings with more than 100 cows. In Slovakia, for example, 87 per cent of dairy cows are held on holdings with more than 100 dairy cows even though the average is less than 15 cows per holding. This reflects the relatively small number of very large holdings at one end of the scale and a large number of very small holdings at the other end. Other Member States where at least 65 per cent of dairy cows are kept on large holdings are Cyprus, Czech Republic, Estonia, and Hungary.

Average milk yields in the NMS 10 vary with three Member States exceeding 6,000 kg per cow (Cyprus, Czech Republic, and Hungary). Member States with average milk yields of less than 4,500 kg per cow are Latvia, Lithuania and Poland.

Summary for the NMS 10

- Milk production has increased since accession in 2004.
- Concentration of production is occurring with a 20 per cent decrease in the total number of dairy farms over the short period of 2004/05 to 2006/07. Many of these will have been the smallest dairy farms.
- Restructuring is resulting in fewer very small farms and more larger farms, or fewer of both types
- Even so, 89 per cent of all dairy farms still produce less than 50 tons milk per year and the structure of dairy farming is still fragmented. Slovakia and the Czech Republic are unusual in having a significant proportion of very large farms.
- The number of dairy cows has decreased by an average of 5 per cent over the period 2004-06.
- Average milk yields are expected to have improved over 2004/06, although they are still likely to be well below EU averages.
- Geographic concentration of production is likely to be occurring, particularly given readily available quota and relatively unrestricted national quota markets. Polish data provides some evidence of this.
- However the quota system is only one influence on the development of dairy farming in the NMS 10. Other factors include free trade within the EU, new markets, the need to secure economic efficiencies, EU support for modernisation, EU dairy hygiene regulations, changing consumer requirement, loss of labour from the sector and increasing costs.

3 IMPLEMENTATION OF MILK QUOTAS IN THE EU

3.1 The development of the milk quota system at EU level

The EU milk quota system was introduced in 1984 and has been in operation by Member States ever since. Under the terms of the 2003 Mid-Term Review, the milk quota regime was extended until 2015. The main objective of the regime, in combination with price support measures to the dairy sector, is to regulate milk production below a specified reference quantity. In particular, milk quotas were intended to limit the substantial and increasing surplus of milk production which had existed prior to their introduction. For a summary of the events which led up to the introduction of milk quotas, please refer to the text box on the next page.

Originally established for a five year period starting from 1984, the milk quota system was extended until 1992 as part of the 'agricultural stabilisers' package in April 1988, and extended further until the year 2000 as part of the 1992 CAP Reform. Under the Agenda 2000 reforms the system was extended until 2008 with a further extension granted under the 2003 Mid-Term Review until 2015.

As part of the milk quota regime Member States are allocated national reference quantities which are set out in the Council Regulations. No transfers of quota can take place across national borders. The reference quantity is fixed for each Member State at a determined milk fat content. The national quota is then divided between deliveries and direct sales quota, although these can be converted on the basis of duly justified producer requests. For deliveries the fat content of actual deliveries is compared with the reference fat content and if a difference is observed then the producer's delivery volume is adjusted to take account of this.

Deliveries are measured against deliveries quota for the quota year which runs from 1 April until 31 March during the following year. If milk deliveries in a Member State exceed national quota in a given quota 12 month period, taking into account adjustments made for fat content, then those individual producers who have overrun their individual quota are liable for a punitive levy (or superlevy). A similar process is operated in respect of direct sales, except there is no adjustment in respect of fat content. Calculation of the levy is made separately for deliveries and direct sales quota.

The system of milk quotas has been reformed on several occasions since it was introduced in 1984. In particular a number of measures have been introduced in order to permit structural development and adjustment to take place within the dairy sector. Notably, rules permitting permanent transfers of milk quota with land to take place between producers were introduced shortly after the regime's introduction. This was followed by the introduction of temporary transfers of quota between producers which were optional at Member State level. During the late 1980s a number of permanent cuts in national quota levels were introduced across the board. A major outcome of the 1992 CAP reforms was the potential for Member States to specify rules permitting the permanent transfer of milk quota without land. An overview of key developments is provided

Table 3.1.

Issues and proposals leading to the introduction of milk quotas in 1984

Rising surpluses of EEC dairy products and budgetary costs first became evident in the late 1960s. In 1968 Sicco Mansholt, European Commissioner for Agriculture, first published proposals for CAP policy reform in what is commonly known as the Mansholt Plan. The main aim of this plan was to achieve a reduction in price support, accompanied by assistance to a large number of small farmers in what was still at that time the EEC-6 to leave the industry. Following opposition, the initial proposals in the Mansholt Plan were scaled down resulting in the implementation of three Directives in 1972 concerning the modernisation of agricultural holdings, the abandonment of farming and the training of farmers.

Various steps were taken in the early 1980s to introduce measures to curb surpluses, such as co-responsibility levies and guarantee thresholds. In 1981 the EC introduced a system of maximum guarantee thresholds intended to operate in such a way that, should milk deliveries in any year exceed the (pre fixed) quantitative threshold, action would be triggered to offset the additional costs of the regime caused by the excess production. As early as 1983 the guarantee threshold was exceeded by 6.5 per cent. The reduction in intervention price for dairy products which should have been triggered by this surplus was estimated by the Commission to have been in the order of 12 per cent - too large to be politically feasible (Colman in Artis and Nixson, 2007).

There was debate in Member States about the use of quotas to curb milk production, as an alternative to reducing price support. At the end of March 1984, the decision was made to maintain the level of price support at its existing level and adopt a system of marketing quotas made effective by charging a very high tax, or super levy, on excess deliveries beyond the quota (Colman in Artis and Nixson, 2007).

Initially, each Member State was allocated a national quota or ‘reference quantity’, set equal to its 1983 milk sales (deliveries and direct sales), plus 1 per cent. However, it possible for Member States to receive dispensation to use a different reference year’s milk sales, as happened in the UK where quota was based on 1981 milk sales on the basis that its 1983 production had been unusually low due to very poor weather conditions. Quotas were then allocated to individual farmers, again on the basis of their historical production levels (Colman in Artis and Nixson, 2007).

Table 3.1 Developments of the EU Milk Quota System

Period	**Measures:**
Milk quotas introduced[16]	– The milk quota system was introduced in 1984, initially for 5 years and then extended to 1992 – Permanent transfer of milk quota with land introduced in 1985 – Temporary transfer of quota permitted at Member State level from 1986/87 – 1988: 2% permanent cut in milk quota – 1989: 1% permanent cut in milk quota
CAP Reform 1992[17]	– Milk quotas extended until March 2000 – Permanent transfer of quota without land (‘special transfers’) permitted at Member State level
Agenda 2000 Reform[18]	– Milk quotas extended until 2008 – Increased milk quotas (IT, EL, ES, IE, NI for 2000/1 and 2001/2, other Member States by 1.5% from 2005/6 to 2007/8).
2003 CAP Mid term Review[19]	– Milk quotas extended until 2015; – Increases in milk quota scheduled for 2005 deferred to 2006. – Inactive producers no longer able to continue holding quota (Thomsen case) – Strict limits on temporary transfers

Arrangements and rules for quota transfer vary considerably from one Member State to another. Figure 3.1 below shows a diagram of the intervention logic for the milk quota system.

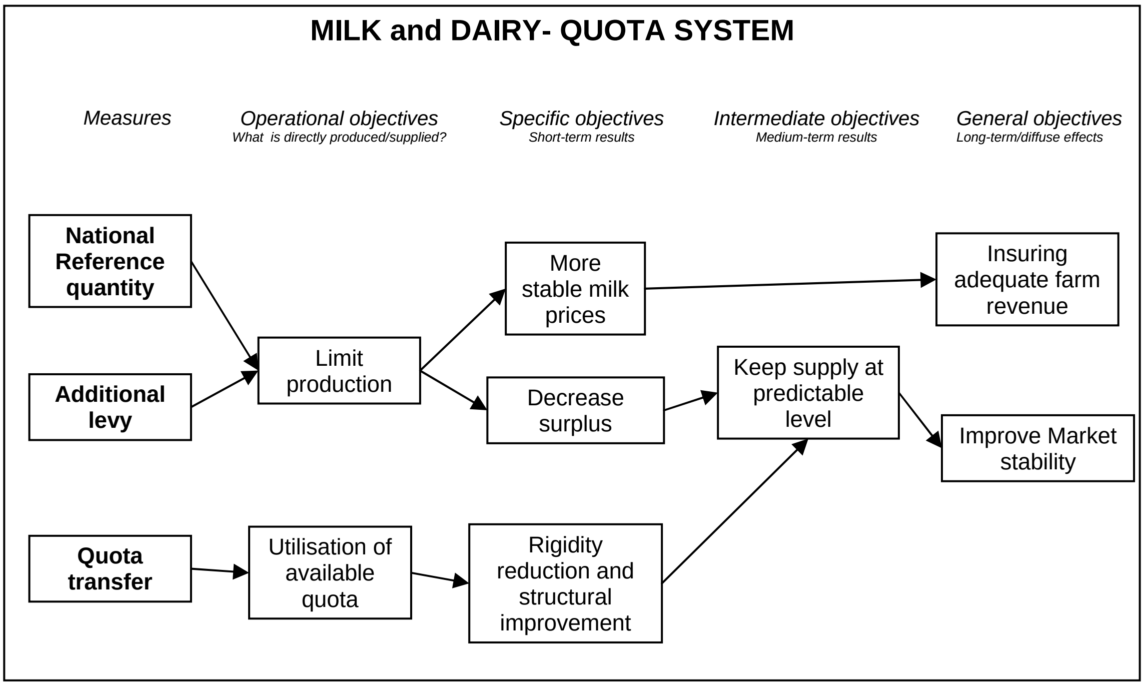
[16] Council Regulation (EEC) No 856/84 of 31 March 1984 amending Regulation (EEC) No 804/68 on the common organisation of the market in milk and milk products

[17] Council Regulation (EEC) No 3950/92 of 28 December 1992 establishing an additional levy in the milk and milk products sector

[18] Council Regulation (EC) No 1256/1999 of 17 May 1999 amending Regulation (EEC) No 3950/92 establishing an additional levy in the milk and milk products sector

[19] Council Regulation (EC) No 1788/2003 of 29 September 2003 establishing a levy in the milk and milk products sector

Figure 3.1 Intervention logic for milk quota system



3.2 Overview of rules for allocation and transfer of milk quota

Member States are able to determine rules for the allocation and transfer of milk quota according to the framework set out in EU legislation. The current system is defined by Council Regulation (EC) Regulation 1234/2007[20] which recently replaced Regulation 1788/2003. A brief summary of the main aspects of the legislation relevant to this evaluation study is provided below.

Transfers of quota with land

Permanent transfers of milk quota with land have been permitted since the early days of the milk quota system. Under current legislation permanent transfers of quota are permitted under Article 74 of Council Regulation (EC) No 1234/2007 (previously Article 17 of Council Regulation (EC) No 1788/2003 and Article 7 of Council Regulation (EEC) No 3950/92). Transfers take place between producers when land, to which quota is attached, is sold, leased, or inherited in accordance with detailed rules determined at Member State level. Under Article 74(2) Member States may decide that quota transferred by means of a rural lease is not transferred with the holding in order to ensure that reference quantities are solely attributed to producers.

Permanent transfers of quota without land

Permanent transfers of quota without land (referred to as '*Special Transfers' in the legislation*) were first permitted at Member State level in 1987 and subsequently expanded in 1993 under Article 8 of Council Regulation (EEC) No 3950/92 and Article 18 of Council Regulation (EC) No 1788/2003. Under current legislation such transfers are permitted under Article 75 of Council Regulation (EC) No 1234/2007.

[20] Council Regulation (EC) No 1234/2007 of 22 October 2007 establishing a common organisation of agricultural markets and on specific provisions for certain agricultural products (Single CMO Regulation).

Member States are able to determine detailed rules aimed at 'successfully restructuring milk production or improving the environment'. The following possibilities are permitted:

- **Abandonment programmes** whereby producers, who abandon milk production permanently, receive financial compensation for their quota, which is then redistributed to other producers via the national reserve;
- **Reallocation of quota to specific producers** in return for payment by them equal to compensation to those producers who have released the quota; objective criteria for such reallocations may be determined by national administrations;
- **Centralised transfers** of reference quantities without land e.g. via a quota exchange (national or regional);
- Permanent transfer of quota without land with the aim of **improving the structure of milk production** within regions or collection areas;
- Permanent transfer of quota without land with the aim of **improving the structure of milk production at the level of the holding** or to allow for **extensification of production**; and
- Permanent transfers without land with a view to **improving the environment**.

Such transfers may take place via a variety of administrative and market-based mechanisms including private sales and quota exchanges. Member States are able to determine whether transfers take place at national, regional or purchaser level and whether transfers are continuous or periodic.

Temporary transfers of quota without land
Temporary transfers of quota without associated land are permitted under Article 73 of Council Regulation (EC) No 1234/2007 (previously Article 16 of Council Regulation (EC) No 1788/2003 and Article 6 of Council Regulation (EEC) No 3950/92). Member States have been able to authorise temporary transfers of part of an individual producer's unused reference quantity in a given quota year since at least 1987. Members States are able to regulate transfers to certain groups of producers, and can limit transfers to the level of the purchaser or within regions and can determine to what extent the transferor can repeat transfer operations. Transfers may take place via an administrative or a market based mechanism (e.g. leasing).

A Member State may decide not to permit temporary transfers of quota in order to facilitate structural changes and adjustments, or on the basis of overriding administrative needs. The extent to which quota holders can transfer their quotas to other producers has changed over the duration of the regime. Between 1993 and 2003 it was possible for Member States to allow quota holders to repeatedly transfer their entire quota, whereas the changes introduced in 2003 limit such transfers to part of a producer's quota, although entire quotas can be temporarily transferred without land in circumstances of *force majeure*.

Accordingly in some Member States, the use of the National Reserve both in the acquisition and allocation of quota is central to the quota mobility and restructuring process.

National Reserve

Member States are obliged to set up a national reserve and determine rules for the allocation of milk quota to producers according to objective criteria under Articles 71 and 68 of Council Regulation (EC) No 1234/2007 respectively (previously Articles 7 and 14 of Council Regulation (EC) 1788/2003). National reserves are fed by:

- National allocations from the EU, such as those linked to the Agenda 2000 reforms; and subsequently to 2003 reform
- Confiscation of quota from inactive producers (complete inactivity).

In addition, Member States can add quota to the reserve through the application of discretionary powers relating to:

- Quota purchased through abandonment or buying programmes;
- The application of an across-the-board linear reduction to all producers' individual reference quantities;
- The application of a siphon or 'clawback' to permanent transfers with or without land; and
- Confiscation of quota from inactive producers (partial inactivity);

Member States have significant discretion available to them as regards the way in which they manage quota in the national reserve. In some Member States, quota in the national reserve is kept to a minimum, and allocated in very limited situations. In other Member States a policy of actively acquiring quota for redistribution through the national reserve is pursued (through the optional methods referred to above). The quota is then reallocated to producers on the basis of specified objective criteria. Quota is not sold from the reserve, but such allocations result in an indirect transfer of quota without land.

Siphons or 'clawback'

Member States are able to retain part of a quota transfer (with or without land), on the basis of objective criteria, under Article 76 of Council Regulation (EC) No 1234/2007 (previously Article 19 of Council Regulation (EC) 1788/2003). Quota which is 'siphoned off' in this way is permanently lost by both parties to the transfer and is transferred to the national reserve. Member States can vary siphon rates in order to encourage or discourage certain types of quota mobility. For example, higher rates can be applied to transfers out of regions, whilst lower rates might be applied to transfers to certain groups of producers, such as young producers, etc.

Inactive producers

As referred to in the previous section quota can be confiscated from producers on the basis of inactivity. Under Article 72 (1) of Council Regulation (EC) No 1234/2007 (previously Article 15 (1) of Council Regulation (EC) 1788/2003), when a quota holder ceases production during a twelve-month period, the quota is transferred to the national reserve. However, if the quota holder restarts production within a certain period (up to two years following confiscation of the quota), then all or part of the confiscated quota is returned. Quota may not be confiscated in recognised cases of *force majeure*. Following the Thomsen ruling at the European Court of Justice in 2002, it has not been possible for Member States to allow non-producing quota holders (NPQHs) to retain quota and lease it indefinitely to active producers.

In addition, Member States have the option of applying Article 72 (2) of Council Regulation (EC) No 1234/2007 which relates to partial inactivity (previously Article 15 (2) of Council Regulation (EC) 1788/2003). If a quota holder's production is less than 70 per cent, relative to quota held in a given a year, then a Member State may decide to confiscate unused quota to the national reserve. Member States may then determine on what conditions a reference quantity shall be reallocated to the producer concerned should they resume production.

There can be an important relationship between choices made by producers in relation to national rules for quota inactivity and temporary transfers (see above). The temporary transfer of a substantial proportion of a producer's quota can reduce the lessor's delivery rate to the level at which they may be designated as partially inactive and thus risk the loss of quota to the national reserve.

Reallocation of unused quota
In the event that an individual producer exceeds their quota then a levy will be paid, unless a Member State chooses to temporarily reallocate unused quota under Article 80 (3) of Council Regulation (EC) No 1234/2007 (previously Article 10 (3) of Council Regulation (EC) 1788/2003). In the event that national production exceeds quota in a given reference year, then those individual producers who exceed their quota will be subject to a levy, although this may be offset to a degree, on the basis of objective criteria, by temporary reallocations of unused quota originating from individual producers whose production did not exceed their reference quantity. Temporary reallocations may take place either at national level or at producer group level and then subsequently at national level.

Furthermore, when the contribution collected is higher than the total levy due, Member States are able to temporarily redistribute the excess quota in respect of that quota year to producers who fall within specified priority categories or to producers who are affected by an exceptional situation unconnected to the milk quota regime according to Article 84 of Council Regulation (EC) No 1234/2007. Alternatively Member States may use some, or all, of the levy to finance abandonment programmes, where these have been implemented.

3.3 Implementation of milk quotas at Member State level

The following sections set out the ways in which Member States have applied the various options for the transfer and allocation of milk quota as set out in the previous section. An overall summary of application can be found at the end of this chapter. Detailed tables of milk quota implementation for the EU 25 are included in Annex 3 - Annex 7 of this report.

Information on the implementation of milk quotas in different Member States is provided from two primary sources. Firstly, from national reports undertaken in seven case study Member States[21], and secondly, from responses to a questionnaire sent to administrations by DG Agriculture in 2007.

[21] France, Germany, Ireland, Italy, the Netherlands, Spain, and the UK.

3.3.1 Transfers of quota with land (including rural leases)

Several Member States specify limits to the amount of quota which may be transferred per hectare of land including Belgium (20,000 kg per forage hectare), Denmark (10,000 kg until 2002), Finland (12,000 litres per hectare including transfer of arable land), and the Netherlands (20,000 kg).

Rules favouring certain priority groups of producers, such as transfers between relatives and married couples, are specified in Belgium, Finland, France, Germany, Greece, and Ireland. In the Netherlands transfers to family members are not subject to the 20,000 kg per hectare limit. In the remaining eight EU 15 Member States there do not appear to be rules to prioritise transfers with land between specific groups.

In a number of Member States, a siphon has been used to deduct a fixed proportion of quota when transferred permanently with land, with the siphoned quota being made available to the national reserve for administrative redistribution. Siphons have been applied at rates ranging from 5 per cent in Greece to 50 per cent in France[22]. In Denmark a 50 per cent siphon applies to transfers with land, whilst in Portugal a 7.5 per cent siphon, is applied except to transfers out of Nitrate Vulnerable Zones (NVZs), in which case no siphon is applied. In Germany a 30 per cent siphon was operated on transfers greater than 350,000 tons until 1993, whilst in Ireland a clawback of up to 20 per cent was in operation until 2000. It should be noted, however, that in Ireland various exemptions existed such as transfers between family members, transfers to young producers or producers in the LFA.

In several Member States reference is made regional restrictions which prevent transfers of quota with land between producers based in different regions. In Belgium, for example, no transfers can take place between holdings more than 30 km apart or between Wallonia and Flanders. In Germany transfers were not possible between producers based in different Länder or *Regierungsbezirke*[23] until 2007, whilst in Finland seven trading regions are specified. In Ireland producers in the LFA have not been able to transfer quota with land to holdings located more than 48 km away since 1995. In Portugal, preference is given to transfers out of Nitrate Vulnerable Zones (NVZs). In the UK ring-fenced quota transfer areas in the Scottish Islands have been in operation since 1994. Prior to this quota transfers with land were not permitted between five large regions[24], based on the now disbanded Milk Marketing Boards.

Rural leasing arrangements of quota with land have been a common feature of transfers with land in some Member States. Specific arrangements include: minimum six year leases for arable land attached to quota (Finland), long term land and lease arrangements (common in the late 1980s and 1990s in Ireland), leasing of land for one year before purchase (since 1989 until 2007 in the Netherlands), whilst in the UK a stipulation exists that quota must be transferred to the new occupiers unless the lease

[22] 10% clawback is normal, although regional rules apply. An additional siphon of up to 40% may be applied to larger producers.

[23] A *Regierungsbezirk* is a type of government region in Germany which occurs within certain Länder.

[24] One region covering the whole of England and Wales; one region covering Northern Ireland; and three in Scotland.

is less than a specified period of time[25]. In Germany 'old land lease contracts' entered into before 1984 have implications for quota ownership and transfers.

Situation in the 10 New Member States

- No permanent transfers of milk quota with land are permitted in Cyprus, the Czech Republic or Latvia (subject to likely future rules in respect of early retirement);
- Permanent transfers of milk quota with land are permitted in Estonia, Hungary, Lithuania, Slovenia and Slovakia, subject to various conditions. These include retention of quota for a specified period prior to transfer (Estonia, Hungary and Lithuania), limits on the amount of quota transferred per hectare (Lithuania (10 tons per hectare) and Slovenia (15 tons per hectare), and transfer only to new producer/owner with land (Slovakia);
- Land and quota leasing is permitted in Estonia, Hungary and Slovakia.

3.3.2 Permanent transfer of quota without land

Member States first had the option of introducing permanent transfers without land under Council Regulations in 1987. Direct transfers without land between producers at a market price, determined via negotiations between buyers and sellers, have been permitted during at least a part of the evaluation period of this study in a number of Member States including: Austria, Belgium (Flanders), Germany[26], Greece, Spain, Italy, Luxembourg, the Netherlands, Portugal, Sweden and the UK.

Permanent transfers of quota without land via centralised quota exchanges have been operated in Denmark (since 1997), Germany (since 2000), and Ireland (since 2007/08). Sales at quota exchanges usually take place by auction with bids being made on fixed dates.

Some Member States operate hybrid systems which allow part of the quota to be sold at a market price, and the other part to be sold at an administratively determined price. In Finland, 50 per cent of available quota is transferred directly between producers at market prices and 50 per cent via the administration at a nationally determined price. In Ireland the quota exchange is administered through the Milk Quota Trading Scheme which allows producers to sell 70 per cent of quota via the quota exchange at market prices, provided the other 30 per cent is sold at an administratively determined price to priority groups. In Belgium, 40 per cent of the quota is sold into a quota fund for sale at the same price to producers according to their priority status and the remaining 60 per cent of the quota is sold at a price negotiated between the buyer and seller. Some transfers are exempt from the 40 per cent condition. In Flanders free market transfers were permitted until 1996.

Administrative mechanisms which facilitate permanent transfers of quota without land have been operated in a number of Member States including Belgium, Denmark, Finland (see above) France, Germany, Italy, Ireland, and Spain. Restructuring

[25] 8 months (Scotland), 10 months (England and Wales), or 12 months (Northern Ireland).

[26] Direct transfers of quota without land have been very limited since the introduction of quota exchanges in 2000 and are only allowed in cases of transfers of whole farms or parts thereof, between direct relatives, and by inheritance.

programmes have been operated in Denmark (1989-1997), Germany (early 1990s with the objective of reducing the amount of national excess quota) and Ireland (1988-2006).

Abandonment programmes, whereby producers abandoning milk production are compensated by the administration were EU financed between 1986 and 1992, primarily to reduce total quota but with part made available for reallocation to other priority producers via the national reserve. Other abandonment programmes have been operated in France (throughout the evaluation period via ACAL[27] programmes), Italy and Spain (since the 1990s with distribution via the national Quota Fund and National Quota Bank since 2003). In France an administrative mechanism allowing resale of quota to other producers within the same *Département* has been in place alongside the ACAL programmes since 2006.

Geographical restrictions
In several Member States, no or minimal, restrictions have been applied on the regional movement of permanent transfers of quota with land. These include Austria (with the exception of alpine pastures) Denmark, Greece, the Netherlands, and Portugal (except for transfers into Nitrate Vulnerable Zones) and the UK (with the exception of ring-fenced regions in the Scottish Islands which account for a very small proportion of UK milk production).

In contrast, restrictions preventing the mobility of quota between regions have been implemented in Belgium, France, Finland, Germany, Ireland, Italy, Spain and Sweden. In Belgium no transfers are permitted between Flanders and Wallonia or more than 30 km zone from a holding. In France transfers between *Départements* are not permitted, although in principle up to 20 per cent of the national reserve allocations may be managed at national level. In Germany transfers were not permitted between Länder[28] until 2007, when two trading zones were established (‘East’ and ‘West’). In Finland and Sweden transfers are restricted to seven and two trading areas respectively.

In Ireland, permanent transfers of quota without land can only take place within individual milk purchaser pools. Restrictions at purchaser level also apply in Luxembourg. In Italy transfers between regions or autonomous provinces were not permitted until 2003. Since then transfers of quota out of mountain regions and LFAs have been ring-fenced, whilst transfers between lowland holdings are subject to a limit of 70 per cent of a holding’s quota. In Spain, there has been a requirement since 1998 for producers to demonstrate that the transfers between regions will improve production structures or extensify production[29]. Between 1998 and 2003 transfers out of the LFA into another administrative region were subject to restrictions.

[27] Aide à la Cessation de l'Activité Laitière.

[28] Regierungsbezirke in Lower Saxony (1993-96), Bavaria and Baden-Württemberg.

[29] Extensification of production required a stocking density of less than two livestock units per forage hectare. The requirement was dropped in 2003.

Other conditions relating to quota transfers

Per hectare limits of quota applying to the recipient holding have been specified in Belgium (20,000 litres[30]), Finland (12,000 litres), Italy (30 tons per hectare of UAA), Luxembourg (12,000kg per forage hectare), the Netherlands (20,000kg), Sweden (16,000kg per arable hectare for large holdings, previously 12,000kg). In the UK a recommended limit of 20,000 litres per hectare has been set.

Several Member States or regions have applied minimum or maximum limits to the amount of quota which can be transferred including: Denmark (the maximum of 300,000 kg per one man farm was lifted in 2005), Greece (minimum of five tons), Spain (minimum of 50,000 kg), Finland (minimum of 15,000 litres for administrative transfers, maximum of 78,000-117,000 litres for private transfers), and Ireland (maximum of 60,000 litres from 2007). A maximum limit of 800,000 kg is set on the buying producer's new total quota in the Flanders region of Belgium. In the Netherlands a producer may only acquire an additional 10 per cent of quota, unless he can prove that the holding will remain within the 20,000 kg per hectare limit.

Deductions to the national reserve through siphon mechanisms have been applied to permanent transfers without land in the following Member States: Denmark (1 per cent); Germany (5-15 per cent deduction for unsuccessful quota exchange bids 2000-2002), Greece (5 per cent deduction), France (10 per cent, higher rate for larger holdings), Luxembourg (15 per cent deduction except to relatives or other certain transfers), and Portugal (7.5 per cent except to relatives or other specific transfers).

In several Member States, priority groups have been specified in terms of quota transfers without land including: Belgium, Finland, Ireland, and Spain. In Belgium, young farmers receive up to 50 per cent of quota allocations. In Finland, producers with spare capacity and 'other' producers, including organic or rare breeds, are guaranteed up to 50 per cent of administrative allocations at the expense of investing producers. In France, criteria for allocations of quota to specified groups are determined regionally but include young producers, small producers, producers with investment plans and producers undergoing financial difficulties. In Ireland, priority groups include young farmers, successors, small producers, and producers who have lost land and quota leases. In Spain these include young farmers, LFA holdings, and full-time producers.

Situation in the 10 New Member States

- The majority of the NMS 10 operates a market based system for permanent transfers of quota without land, with prices fixed privately between buyer and seller (Cyprus, Czech Republic, Hungary, Latvia and Slovenia). Lithuania has recently launched a centralised quota auction. Latvia also permits the sale of quota directly back into the national reserve.
- Permanent transfers without land are also permitted on a market basis in Estonia (from 2006/7) and Slovakia, but only where cows are also being transferred from one producer to another. In Lithuania, quota may now only be transferred with cows, land and buildings.

[30] Variation in units between litres, tons and kilograms are expressed in the original format provided in Member State responses to the questionnaire submitted by DG Agri.

- Permanent transfers of quota without land are subject to various conditions. These include a deduction to national reserves (Cyprus, Czech Republic, Estonia, Lithuania), limits on the amount transferred based on cow numbers/yields (Estonia, Hungary and Slovakia), limits on the amount of quota transferred per hectare (Lithuania (10 tons per hectare).

3.3.3 Temporary transfer of quota without land

A number of Member States have chosen not to implement temporary transfers between producers during the evaluation period, including: Denmark, Greece, France, Luxembourg and Sweden. A number of other Member States do not currently permit temporary transfers but have allowed them during the evaluation period. For example, temporary transfers have not been permitted in Flanders since 2007, whilst in Germany temporary transfers have been limited to certain specific circumstances since 2000, having been first introduced with land in 1990 and without land in 1993.

In some Member States temporary transfers have been in operation throughout the evaluation including Austria, the Netherlands, and the UK. Other Member States which currently operate temporary transfers include Spain (since 1994), Finland (since 2006), Ireland (since at least 1990), and Italy (since 1993). Temporary transfers are negotiated directly between producers in all Member States except Ireland where transfers take place via the administrative Temporary Leasing Scheme.

Geographical restrictions
Member States which have implemented restrictions on the regional movement of temporary transfers of quota include Belgium, Germany, Spain (1994-1998), Finland, and Italy (between non-'homogeneous' areas since 2003). In Ireland temporary transfers of quota operate at purchaser level and were of particular importance prior to the introduction of geographical restrictions linked to the LFAs in 1995. In the UK temporary transfers of quota were operated within five large Milk Marketing Board regions[31] until 1994 but have been permitted throughout the UK since then (with the exception of minor 'ring-fencing' in the Scottish Islands). In the Netherlands there have never been any regional restrictions.

Other conditions relating to temporary transfer of quotas
A number of Member States have specified rules for minimum quantities of unused quota per transaction including Finland (10,000 litres), Spain (5,000 kg since 1998) and the Netherlands (10,000 kg). Limits on the maximum amount of quota transferred have been specified in Austria (up to 100,000 kg per holding in 2005; less in subsequent years), Belgium (20,000 litres) and Finland (12,000 litres per hectare of arable land).

In some Member States limits have been specified on the percentage of quota which may be leased out by a holding. For example, in Spain a producer cannot lease out more than 25 per cent of quota for more than two consecutive years. Since 2004 producers in the Netherlands have been unable to lease out more than 30 per cent of their quota in a given quota year. In Portugal, producers on the mainland cannot lease out more than 10 per cent of their quota or more than 30 per cent in the Azores. In

[31] One region consisted of the whole of England and Wales.

Austria, producers are limited may lease out quota for up to two consecutive years with a limit of 30 per cent of a holding's quota in the second year.

Rules limiting the number of consecutive years in which a holding may lease out quota have been specified in Austria, Spain, Finland, and Italy. In the UK, a producer may lease out some (but not all) of their quota on consecutive years not to the same lessee. Prior to 2002, it was possible for non-producing quota holders to lease out their entire quota. During the 1990s leasing arrangements between producers could be renewed annually.

Situation in the 10 New Member States

- No temporary transfers of milk quota are permitted in the majority of NMS 10 countries (Cyprus, Czech Republic, Estonia, Latvia (since 2006), Slovenia and Slovakia).
- Temporary transfers are permitted as private transactions in Hungary, Latvia (prior to 2006) and Lithuania. Conditions relate to the percentage of total quota being leased (30 per cent in Hungary and Lithuania) and minimum amounts being leased (Latvia, prior to 2006).

3.3.4 Temporary redistribution of unused quota

Member States are able to temporarily redistribute unused quota to producers who have exceeded their quota level in order to offset the application of the levy. In the majority of EU 15 Member States this is done at the end of the quota year at a national level (Austria, Belgium, Denmark, Greece, Spain since 2005, Finland, Italy, Portugal, Sweden and the UK). In the remaining EU 15 Member States, temporary redistributions are undertaken at purchaser level first, then remaining quota are allocated at national level (Germany, Spain until 2005, Ireland, Luxembourg and the Netherlands). In France unused quota is redistributed at purchaser level during the year with allocations at the end of the quota year taking place at national level.

Allocations are generally in line with either the producer's quota size or related to their share of the total surplus production. However limits on the maximum amount of unused quota which an individual holding may receive in the event of exceeding their quota have been specified in Belgium (15,000 litres), Germany (10 per cent of a holding's quota since 2006), France (typically 10 per cent but up to 20 per cent in recent years), and Italy (holdings which exceed 100 per cent of quota held are excluded from certain redistribution categories). In some Member States preference is given to certain types of producers such as small producers in Ireland, and producers in mountain areas and LFAs in Italy.

3.3.5 Management of the national reserve

Member States have discretion over a number of aspects of national reserve management relating to transfer of quota into the national reserve and allocation of national reserve quota to producers. The main options for transferring quota into the national reserve are through quota holder inactivity, the application of siphons to transfers of quota between producers, and through the administrative purchase of quota through abandonment programmes. Member State approaches to these aspects are outlined below. Some Member States have actively used the national reserve as an integral component of their quota allocation and transfer strategy, whereas others (notably the Netherlands and the United Kingdom) have aimed to keep the size and role of the national reserve to a minimum.

Quota holder inactivity
While Article 72(1) on inactivity is mandatory for all Member States, Article 72(2) in relation to partial (less than 70 per cent) quota inactivity is not and a number of Member States have chosen not to implement it. These include Belgium (Flanders), Germany, Denmark, Finland, Luxembourg, Sweden and the UK.

Quota may be confiscated from producers in relation to partial inactivity in the following Member States: Austria, Belgium (Wallonia), Greece, France, Ireland, Italy, the Netherlands, Portugal and Spain.

Application of siphons
A number of Member States do not apply siphons to milk quota transfers either with or without land. These include Finland, Netherlands, Sweden and the UK. In Germany no siphons are currently operated, although a 30 per cent siphon was applicable on large transfers with land until 1993, whilst unsuccessful bids on the regional quota exchanges were subject to incremental siphons of 5 per cent up to a total of 15 per cent. In Denmark a 50 per cent siphon is applied to permanent transfers of quota with land between producers. However, the majority of transfers in Denmark are undertaken via the national quota exchange, to which a siphon of only 1 per cent is applied.

In Greece a 5 per cent siphon applies to all permanent transfers. In Ireland ‘clawback’ of up to 20 per cent was applied to permanent transfers with land until the 1990s, although transactions between family members and certain other groups were exempt. In Luxembourg a 15 per cent siphon is applied to transfer with land. In Italy quota transfers until 2003 were subject to a siphon of 10 per cent for amounts under 60,000 kg and 15 per cent for larger transfers. In Portugal a 7.5 per cent siphon is applied to transfers except when quota is transferred out of a Nitrate Vulnerable Zone or certain business or family transfers.

In France, a 10 per cent siphon can be applied on transfers between producers. An additional siphon (up to 40 per cent) based on quota size can also be applied. In Belgium accumulation transfers are subject to a siphon of 40 per cent. In Spain a siphon has applied to transfers between regions since 2003, initially at 20 per cent but reduced to 15 per cent since 2004.

Abandonment programmes
The purchase of quota through abandonment or restructuring programmes has been a feature of quota management in a number of Member States. In addition to the EU-financed schemes which were in place in the 1980s and early 1990s, nationally financed schemes have been operated in France (ACAL), Belgium, Denmark restructuring scheme 1989-1997), Germany (restructuring schemes in the late 1980s and early 1990s), Greece (early retirement schemes), Ireland (restructuring scheme 1994-1996), Italy and Spain (since 1991).

Quota transfers via abandonment programmes have been the main mechanism for quota transfer without land in France throughout the evaluation period. In Ireland and Denmark, producer self financing rather than nationally financed restructuring programmes have been the primary mechanism used to enable the redistribution of quota between producers. In Spain quota allocations, resulting from abandonment programmes, have become increasingly significant since 2005 as a result of new restrictions on private transactions.

Allocation of quota from the national reserve
Several Member States make linear allocations to all producers based on quota size including Belgium (up to 500,000 litres per holding), the Netherlands, Sweden and the UK[32]. Quota allocations from the national reserve are linked to production in the current or previous quota years in Italy (prioritising young producers and limiting overproduction are also specified). In Germany national reserve has been reallocated in proportion to the number of successful bids at the quota auctions since their introduction in 2000.

In other Member States, a number of priority groups are specified. For example, in Ireland priority is given to small scale farmers with a high rate of dependency on dairy farming, whilst in Portugal a producer's age, current quota size and location (priority given to holdings not located in Nitrate Vulnerable Zones) are all taken into account. In France quota allocations at departmental level prioritise young farmers, farmers in financial difficulties, and small producers. In Spain quota is allocated to producers according to a points system agreed in each region based on objective criteria. In Denmark young farmers are prioritised for administrative redistributions of quota through the national reserve. In Greece quota allocations are determined according to objective criteria determined in view of the current market situation. In Finland priority is given to producers with free capacity and 'other' producers (e.g. organic or rare breed producers). In Luxembourg allocation criteria include young producers, structural improvements, development plans and hardship cases where these have been proposed or have taken place.

New producers receive quota allocations from the national reserve in a number of Member States including Denmark, Greece, Italy, Portugal, and Sweden. Restrictions on future transfers of quota allocated from the national reserve exist in Austria, Denmark, Ireland, Greece, Portugal and Spain.

Situation in the 10 New Member States
- In the majority of the NMS 10, unused quota is distributed at national level either on the basis of a common allocation to all producers (Czech Republic, Lithuania, Latvia) or in proportion to the size of eligible producers' excess production (Cyprus, Estonia, Hungary, Slovenia) or quota (Slovakia). In Cyprus, unused quota is distributed at purchaser level initially.
- Unused quota is confiscated to the national reserve if production is less than 70 per cent of quota in most NMS 10 countries.
- Allocations from the national reserve are distributed on the basis of 'objective criteria'. The main one is the producer's supply record in the current or previous

[32] Currently based on net quota held at end of year, previously permanent quota held.

year relative to quota. Other criteria include the producer's age, the producer's existing quota and recent quota transfers out. New producers also receive allocations from the national reserve.

- The national reserve benefits from siphons in most NMS 10 countries. Siphons are generally based on a percentage of quota transferred (mainly 5-10 per cent of quota transferred, although the percentage is as much as 30 per cent in Slovenia for transfers between regions and as low as 1 per cent in Latvia) but also on quota transferred in excess average dairy cow yield when cows are also sold (Estonia, Slovakia).

3.3.6 Overall summary of Member State application

The main points relating to milk quota application in the EU 15 during the evaluation period can be summarised as follows[33]:

- Transfers with land (including rural leases): *siphons* applied in 7 Member States (BE, DE, DK, EL, FR, IE, PT); *regional restrictions* on location of holding in 7 Member States (BE; DE; FI; FR, IE, PT, UK);
- Permanent transfers without land; *direct transfers between producers* in 11 Member States (AT, DE, EL, ES, FI, IT, LU, NL, PT, SV, UK); *quota exchanges* in 3 Member States (DK, DE, IE); *administrative transfers* in 7 Member States (BE, DK, ES, FI, FR, IE, IT); *geographical restrictions* on movement of quota in 12 Member States (AT, BE, DE, ES, FI, FR, IE, IT, LU, PT, SV, UK); *siphons* applied in 6 Member States (DE, DK, EL, ES, LU, PT); *priority groups* in 5 Member States (BE, ES, FR, IE, PT)
- Temporary transfers without land in 10 Member States (AT, BE, DE, ES, FI, IE, IT, NL, PT, UK);
- Temporary redistribution of unused quota at *national level* in 11 Member States (AT, BE, DK, EL, ES, FI, FR, IT, PT, SV, UK), at *purchaser level* in 6 Member States (DE, ES, FR, IE, LU, NL)[34];
- National reserve management: *partial quota inactivity* enforced in 9 Member States (AT, BE, EL, ES, FR, IE, IT, NL, PT); *siphons* to feed the national reserve applied in 10 Member States (BE, DE, DK, El, ES, FR, IE, IT, LU, PT); *abandonment or restructuring programmes* in 8 Member States (BE, DE, DK, EL, ES, FR, IE, IT); *priority groups for national reserve allocations* including new producers in 11 Member States (BE, DK, EL, ES, FI, FR, IE, IT, LU, PT, SV).

A synthetic summary of Member State milk quota regimes is set out Table 3.2 with more detailed tables in Annex 3 to Annex 7. A visual representation of Member State application in regards to quota mobility and transfer mechanism is set out in Figure 3.2.

---

[33] The points listed are for indicative purposes only and do not provide an indication of how the various aspects of milk quota allocation and transfer have been operated.

[34] Spain is listed in both categories due to a change from purchaser to national level, whilst in France purchaser level redistributions occur during the quota year with national level reallocations taking place at the end of the quota year.

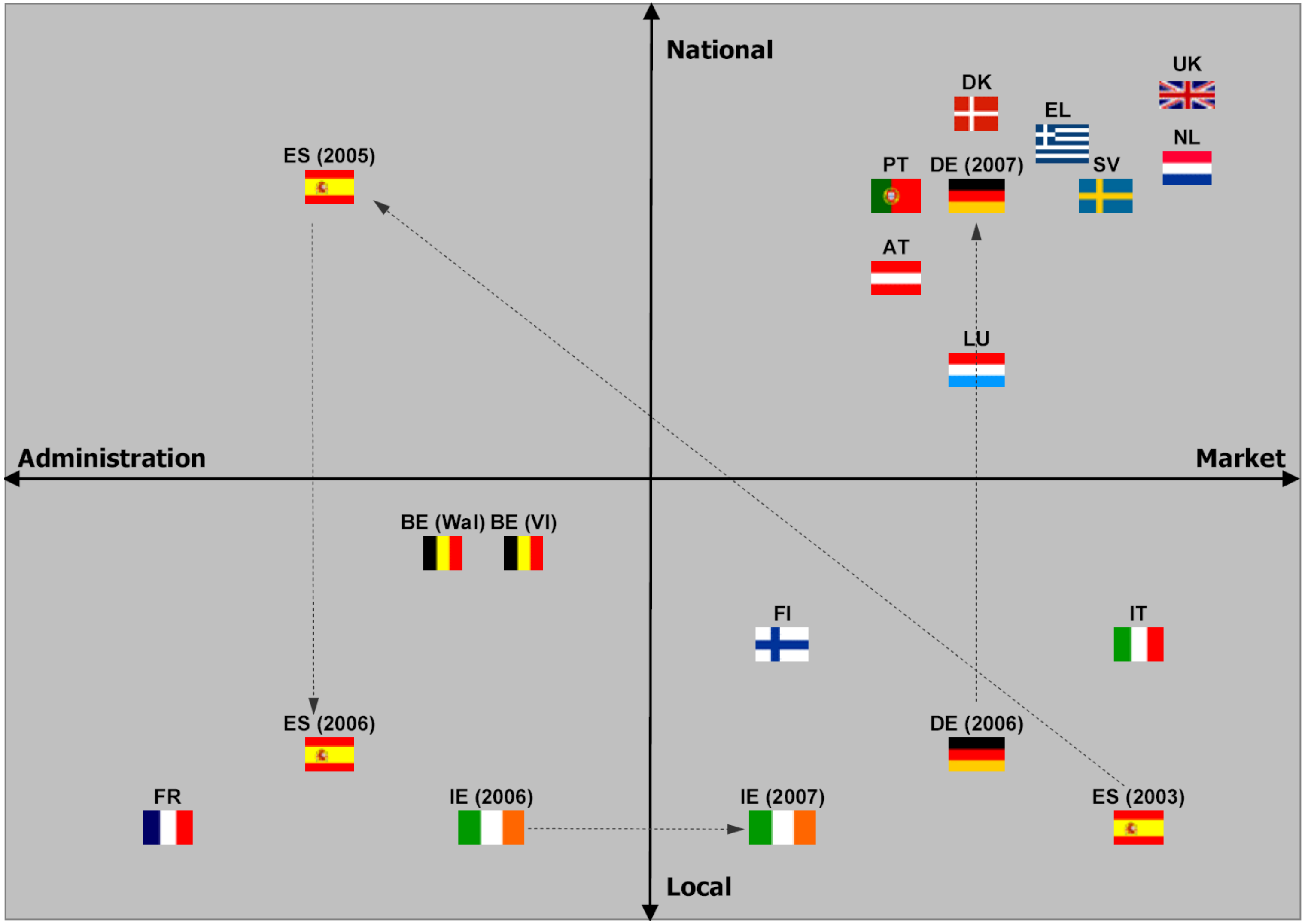
In the NMS 10, milk quota regimes are generally based on the essential requirements of the EU regulations without adding many further requirements. Quota transfers tend to be conducted privately between buyers and sellers and are not subject to geographical restrictions within the Member States concerned. Unused quota tends to be distributed at a national level.

Table 3.2 Synthetic summary of key aspects of recent milk quota implementation in the EU 15[35]

Member State	Quota mobility between regions	Market transactions (without land)	Administrative reallocations	Comments
AT	Yes	Yes	No	Transfers without land since 1996. Geographical restrictions on alpine pasture quota.
BE	No	Yes for 60%	Yes for 40%	Hybrid (market and administrative) system. 40% of quota sold at administrative price (strong preference for young farmers). Private sale of 60% for transfers with land and without land. 1st installations & family exempt from 40% siphon. 30km restriction.
DE	No (Yes since 2007)	Yes (quota exchange since 2000)	No	Most transfers without land via regional quota exchanges since 2000. Market transfers and temporary transfers before 2000. 2 trading regions since 2007.
DK	Yes	Yes (quota exchange since 1997)	Yes until 1997	Most transfers without land via the national quota exchange since 1997. Restructuring schemes before 1997. Transfers with land subject to 50% siphon.
EL	Yes	Yes	Some	Most transfers *without land*. Limited transfers *with land* since at least 2004/05. 5% siphon.
ES	Yes since 1998 (some restrictions)	Yes (until 2005)	Yes (main transfer mechanism from 2005)	Milk quota regime not applied in Spain until 1992. Only transfers with land until 1994. LFA restrictions 1998-2003. Administrative reallocations at regional level. 15-20% siphon between regions since 2003.
FI	No	Yes (50%)	Yes (50%)	Majority of transfers *without land*. 7 Trading regions.
FR	No	No	Yes	Main transfer mechanism is national reserve allocations (up to 20% managed at national level) from abandonment (ACAL) programmes. Administrative transfers since 2006. Siphon (10% + additional 0-40% possible).
IE	Not since 1995 (LFA ring fencing)	Yes (70% quota exchange since 2007)	Yes	Long term 'land and quota' leases common in late 1980s and 1990s. Land and quota transfers subject to ring fencing within LFA. Most transfers without land since 2000 (via restructuring programmes and quota exchange). These are restricted to milk purchaser. Siphon until 2000 (up to 20%)
IT	Yes since 2003 (some restrictions)	Yes	Yes	Regional restrictions on transfers without land 1992-2003. Restrictions on LFA transfers since 2003. Siphon until 2003.
LU	Yes (at purchaser level)	Yes (since 2000)	Yes	Most transfers without land since 2000. 15% siphon.
NL	Yes	Yes	No	Liberal approach to quota transfers with land (leasing arrangements) and temporary transfers. Most transfers *without land* since 2006
PT	Yes (some restrictions)	Yes	No	Generally liberal approach to quota transfer. Restrictions on transfers into NVZs. (7.5% siphon)
SV	No (within 2 regions)	Yes	No	Most transfers without land until 2006. Leasing arrangements with land also significant. More than 80% of milk production in one region.
UK	Yes (except Scottish Islands)	Yes	No	Liberal approach to quota transfers with land (leasing arrangements) and temporary transfers. Most transfers without land since 2002. Minimal regional restrictions.

35 Details in the table for the most part represent current implementation and do not necessarily reflect the conditions prevailing throughout the evaluation period of this study.

Figure 3.2 Visual summary of Member State milk quota mobility vs. transfer mechanism



Source: Modified and adapted from data provided by DG Agriculture (2007)

4 FARM LEVEL AND ENVIRONMENTAL IMPACTS

4.1 Introduction

This chapter seeks to identify the farm structural issues, farm systems and farm management practices associated with dairy production that are most likely to be affected by the milk quota regimes operated in different Member States and their potential environmental effects. It informs the development of the environmental hypotheses for this study and the subsequent evaluation of environmental impacts.

The analysis here is derived from the literature, data assembled for the project, the case studies and experience of the project team.

4.2 Farm management structures, systems and practices of relevance to the environment

The potential impacts on farm structures of the operation of milk quota regimes, which are of particular relevance to the study, are summarised here, along with those relating to farming systems and practices. The environmental implications of these potential impacts are explored in the following sections.

4.2.1 Farm management structures

Four structural parameters are of particular interest to an analysis of environmental outcomes. These are:

a) Scale of production;
b) Regional distribution / concentration of production;
c) Intensity of production; and
d) Specialisation of production

a) Scale of production

The scale of dairy production can be measured in different ways, several of which have environmental implications. These include

- Total volume of milk production, measured in kilograms of milk produced per cow in a year, broadly indicates the level of resources deployed in production (i.e. feed, energy, etc). In environmental terms, output of milk is also an indicator of the volume of livestock wastes that are generated in the course of production and hence of overall nutrient levels associated with the sector.
- The size of dairy herd is also an indicator of certain environmental pressures. While cattle breeds will vary in size and other attributes, there is a strong relationship between the number of animals, methane emissions from enteric fermentation and the volume of livestock manure that enters the environment. Other pollutants, such as ammonia, are also related to the number of cattle kept for production, although the housing conditions and technologies employed for indoor production will also play a role here.
- The area of land devoted to dairy production is also significant environmentally. It is more difficult to establish precisely however, since this needs to take account of the area of land under different types of fodder

production, including temporary and permanent grass. Both the area grazed by cattle and the area devoted to fodder crops, such as silage maize, are of environmental interest with respect to landscape management, biodiversity, nutrient management and other inputs on cropped land. Different patterns of fodder production affect the greenhouse gas (GHG) emissions from the milk production process. The use of imported feed can also have environmental impacts depending on type, origin, etc. (Garnett 2007).

- Average farm size is also of interest, although its relationship with environmental outcomes is less direct. On-going trends of increasing area of land within individual dairy holdings leading to fewer farm holdings will result in fewer potential point sources for pollution of fresh water i.e. slurry stores and dairy washings. However, increased farm size may result in greater concentrations of potential pollutants (although this will depend on the relative intensity of production) which will require careful management as well as investment in appropriate infrastructure in order to reduce the potential for point source and diffuse pollution.

b) Regional distribution/concentration of production

The change in spatial distribution of dairy production is also potentially important in determining environmental outcomes. This is relevant in at least three respects:

- The regional concentration of production, as measured by the number of cattle in a watershed, can indicate the amount of land needed, or other measures required to absorb nutrients. Hence it points to potential environmental pressures, which may be managed successfully or otherwise, depending on the farming practices adopted.
- The distribution of dairy farms in relation to land with different environmental characteristics is also of relevance. For example, the presence of dairy farms on land that is designated as a Nitrate Vulnerable Zone (NVZ) could be a major factor in determining water quality.
- Regional distribution also has implications for patterns of land use and landscape diversity in different areas.

c) *Intensity of production*

This can be measured in different ways, for example in relation to total output per hectare, taking into account:

- outputs per hectare (volume of milk and the forage and feed crops produced);
- stocking density (the number of cattle per hectare); and
- inputs per hectare (feedstuffs, organic and inorganic fertilisers and energy consumption).

Stocking densities are a useful indicator as they are a measure of overall intensity at the farm management level, reflecting a combination of management choice and limitations that may be imposed by the land itself. It can be measured in different ways, however, and care must be taken to avoid comparing data calculated on different bases. For this evaluation we take stocking density to be calculated by taking all the ruminant livestock units (LU) on the farm (including sheep and goats where these occur) and dividing the resulting sum by the total forage area in hectares.

There are, however, shortcomings to stocking density as an indicator of intensity, which are particularly important to recognise in terms of making judgements relating to environmental impacts. For example:

- The measurement of livestock units (LU) does not differentiate between the size and productivity of stock, for example between cattle with different milk production levels or different feed requirements.
- The fodder area in hectares is not differentiated according to productivity or inputs - rough grassland is treated the same as silage maize, for example.
- There can be significant inaccuracies in the measurement of forage area. Common or community land is not included in the conventional measurement of forage area although it is an important grazing resource for some farms. This can distort stocking density figures at the farm, regional or even national level.

According to FADN, in 2004, the average stocking density on specialist dairy farms was around 1.7 LU/hectare in the EU 15[36]. Based on these data, only 22-30 per cent of dairy farms have an average of less than 1.4 LU/hectare. In particular, on specialist dairy farms average stocking density decreased from 1.92 LU/ha in 1989 to 1.77 in 2004. These changes appear to be linked more to a decrease in the number of animals than an increase in forage area on dairy farms.

An indicator of production intensity that does take into account milk production levels is the amount of milk produced per hectare. This measure, to a certain extent, captures changes in intensity arising from both increases in stocking density, but also in milk yield per cow due to genetic, diet and management changes. It is also closely and positively correlated with nitrogen surplus per hectare (Bos *et al*. 2005). Milk production per hectare is one of the measures used by the OECD (2004) as previously outlined in Section 2.2.6 of this report.

d) Specialisation of production

Specialisation involves the focus of production on a single or small number of outputs and a move away from multiple enterprises on a farm. Mixed farms traditionally were widespread in the EU. On mixed farms it was common to pursue a mixture of livestock and cropping systems and there was a variety in the management practices adopted. Specialised farms can concentrate resources and management effort on a line of production but there may be implications for the environment. For example, specialist dairy enterprises will tend to be comprised of highly stocked and intensively managed, predominantly temporary, grassland in rotation with an area of forage crops. However, specialised dairy farms have the potential to be more efficient in

[36] In FADN Stocking density is calculated at farm level as the sum of total livestock units (Dairy cows, Other cattle and Sheep and goats) divided by total forage area (Fodder roots and brassicas, Other fodder plants, Fallow land, Temporary grass, Permanent grassland, Rough grazing). The following data limitation has to be considered during interpretation of results: mountain pasture and other pasture outside the UAA of the holding it is not included in the calculation of stocking density. As a consequence farms with small forage crop area and uses common pastures are classified with intensive farms.

their use of resources, due to economies of scale, which may reduce pollution (e.g. nutrient runoff, GHG emissions, etc) per unit of output at farm level. The role of specialised management practices and investment in appropriate infrastructure and equipment at farm level is clearly important in this respect.

Information on the changes in relation to these four structural characteristics as a result of the application of the milk quota regime within different Member States, alongside trends emerging from more specific indicators provide a useful foundation for examining the potential environmental impacts and risks in greater detail. They do not provide a conclusive indicator of environmental damage or benefit but they point to possible impacts. At farm level these will differ depending on the different agro-climatic and topographic conditions of any given area.

4.2.2 Farming systems and practices

In addition to changes in structural characteristics, such as scale and intensity of production, both farm systems and practices are also important in any assessment of the environmental impacts of any shift or change in dairy production. Land management practices are of relevance on all those farms that remain in milk production whether or not they gain or lose quota. They are also of relevance on farm land that continues to be managed for other purposes where dairying has ceased.

It should be noted that geographic and agronomic conditions have a considerable influence on the choice of system and farming practice open to individual farmers. Factors such as climate, altitude, soil fertility and water availability influence the choice of fodder crop, the period of grazing and other husbandry considerations.

Farming *systems* can be classified in different ways:

- By primary types of production on the farm (specialist dairy, suckler cows, etc). For example, changes from intensive dairy to beef production on a farm may result in environmental benefits, principally in relation to reduced slurry storage requirements, but also through subsequent changes to feed and housing regimes. Changes are likely to be less noticeable when changes between extensive dairy and beef production occur.
- Within the dairy sector there are a range of systems based mainly on fodder supply (for example, outdoor grazing systems through to indoor, concentrate based feeding regimes). Each is associated with certain management practices, with differing environmental implications [c.f. CEAS *et al* (2000) typology set out in section 2.2.4].
- Similarly, farms can be classified according to stocking density (i.e. relative intensity of management).
- According to whether the farm is managed organically or conventionally.

In terms of farming *practices*, it is clear that a range of decisions linked to farm management have implications for the environmental impact of dairy farming. These impacts can often be both positive and negative. The sensitivity of the practice to local environmental conditions is a central issue. In many cases the impact of a practice can be assessed only in relation to farm circumstances. Farm practices will change over time in response to technology, labour costs, policy interventions and other drivers.

4.2.3 Other drivers

There are a number of other factors which have the potential to influence dairy farming practices and management in addition to national milk quota regimes. These include environmental legislation (primarily the Nitrates Directive at EU level), price support measures and the more recent introduction of cross compliance requirements (see '*main*' study). In addition, factors such as outbreaks of animal diseases and the structure of the dairy processing industry and purchaser groups can also be important.

Environmental legislation impacting on producer behaviour

The progressive implementation of the Nitrates Directive (91/676/EC)[37] during the evaluation period of this study will have had a significant influence on the behaviour of dairy farmers located within areas designated as Nitrate Vulnerable Zones (NVZs). First adopted in 1991, 35.5 per cent of territory in the EU 15 had been designated as NVZs by 1999, increasing to 44 per cent by 2003 with further designations thereafter[38]. By 2003 seven Member States (Austria, Denmark, Finland, Germany, Luxembourg, the Netherlands and Ireland) had applied NVZ action programmes throughout their territories. In the UK the area designated as NVZs increased from 2.4 per cent to 32.8 per cent, whilst other Member States (Spain, Italy, Sweden, and Belgium) experienced more modest increases during this period. From 2003 onwards further designations were made resulting in the whole of Northern Ireland being designated an NVZ as well additional designations in Italy, Spain, Portugal and Belgium.

Agriculture, with dairy production making a significant contribution, accounts for approximately 62 per cent of the nitrogen load to surface water across the EU 15, ranging from 18 per cent in Portugal to 97 per cent in Denmark. Member States are obliged to develop an NVZ Action Programme which specifies farm level rules in regards to per hectare limits for nitrate applications, storage requirements for livestock manures and slurries, and dates restricting when these can be spread and in what circumstances. A number of Member States have successfully obtained derogations for their NVZ Action Programmes which allow nitrate applications in relation to livestock manure on cattle farms (principally dairy) to be higher than otherwise would have been the case[39]. Such Member States include Denmark, the Netherlands, Austria and Germany. Figure 4.1 provides a visual overview of NVZ designations in the EU from 2000 until 2006 as well as an assessment by the Commission of additional areas which may require designation.

[37] Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources.

[38] Report from the Commission (COM(2007) 120 final) on implementation of Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources for the period 2000-2003

[39]Up to 250 kg nitrogen per hectare per year rather than the standard limit of 170 kg nitrogen per hectare per year

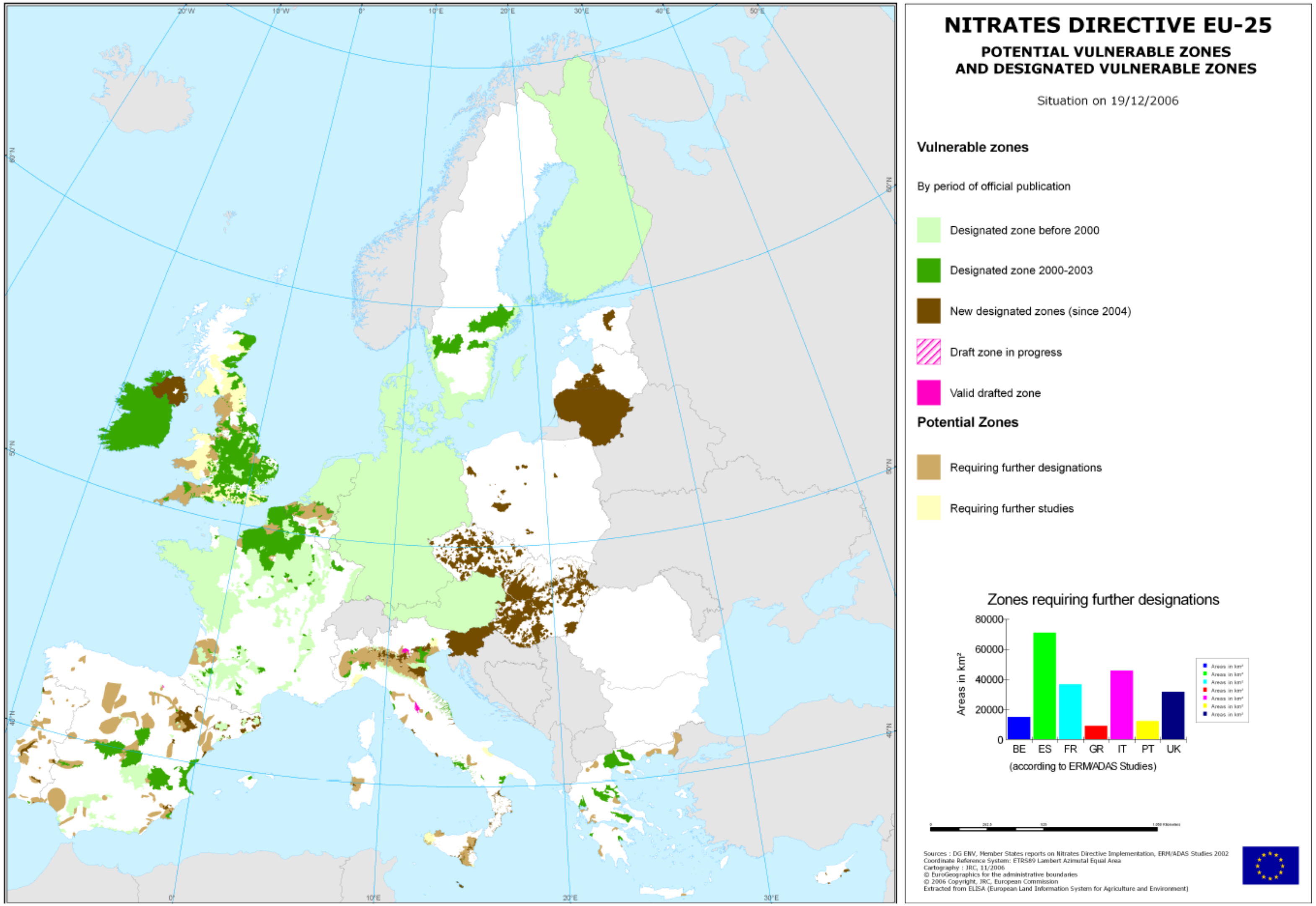
The Nitrates Directive has been a Statutory Management Requirement (SMR) as part of cross compliance requirements in the EU 15 (plus Malta and Slovenia) since 2005. As a result, if farmers located within an NVZ fail to comply with the Nitrates Directive, then cross compliance sanctions, usually a deduction from their Single Payment, will be applied. This is in addition to possible legal sanctions, which remain in place alongside cross compliance. In the Member States which currently apply full cross compliance, breaches of the Nitrates Directive accounted for 10 per cent of all breaches in 2005, after breaches of cattle identification and registration (71 per cent) and all Good Agricultural and Environmental Condition (GAEC) standards combined (13 per cent)[40].

Other environmental legislation included as SMRs within the cross compliance with potential relevance to the dairy sector includes the Groundwater Directive, the Birds and Habitats Directives and the Sewage Sludge Directive. Standards related to animal identification and registration (cattle), and the control of animal diseases (including BSE[41], Foot and Mouth Disease and Bluetongue) will also be relevant. The Water Framework Directive (2000/60/EC) is also of interest and will likely be a key environmental legislative driver for reducing inputs at farm level in future, given that its objective to achieve 'good ecological and chemical status' for all EU surface waters by 2015.

[40] Report on the application of the system of cross-compliance, COM(2007)147 http://ec.europa.eu/agriculture/simplification/crosscom/com147_en.pdf

[41] Bovine Spongiform Encephalopathy.

Figure 4.1 Nitrate Vulnerable Zone designation EU 25 (year 2006) and area requiring designation according to Commission assessment



Source: Annexes to (SEC (2007) 339) Commission report on implementation of Council Directive 91/676/EEC.
*Designated nitrates vulnerable zones after 2003 are based on information made available to the Commission in digital form. The estimate of designated area does not include some designations communicated in paper form only.

Direct payments and price support

Another factor which will have influenced farm management decisions and practices during the evaluation period is EU support for the dairy sector through price support measures. An assessment of the environmental impact of these measures is included in the '*main*' study which evaluates CAP measures related to the beef and dairy sectors. Price support measures such as intervention purchasing of dairy products such as butter and skimmed milk powder (SMP) and export refunds will have affected dairy producers indirectly by impacting on the farmgate milk price.

Structure of the dairy processing industry

In some regions the structure of the dairy processing industry and purchaser groups may have been a factor in farm level management decisions and practices during the evaluation period. For example, rules of origin or denomination for specific products including in the EU's food labelling systems known as PDO (Protected Designation of Origin) and PGI (Protected Geographical Indication). These rules restrict the location of production and in some cases the practices permitted (for example, relating to forage crops used and input applications) for those foods granted the label and may underpin a significant price premium. This in turn, can influence the location of production and the viability of more traditional systems in some cases. These rules were cited in the '*main*' study as a factor influencing dairy production patterns in parts of France and Italy, given the range of designated regional cheeses. Another issue, particular to milk production in Northern Ireland, is the structure of the processing industry in the Republic of Ireland, where demand for milk linked to the export of dairy products has resulted in a noticeable migration of milk production (and quota) from other parts of the UK to Northern Ireland.

4.2.4 Summary of farm practices and environmental implications

Some of the practices of greatest significance to the environment are shown in Table 4.1 below and some of the impacts that these practices can have on particular aspects of the environment are set out in Section 4.3.

Table 4.1 Types of practices and environmental implications

Type of Practice	Environmental Issues
Breed of Cattle Used in Production and size of herd	• Feed requirements in relation to farm resources • Conservation of genetic resources (rare breeds) • Capacity to graze • Adaptation to specific conditions (alpine pastures, wetlands, rough grasslands)
Grassland Management	• Grazing at an appropriate stocking density and time • Grass conservation method for example, hay or silage making • Use of inputs including manure and inorganic fertilisers, herbicides • Carbon sequestration on unploughed permanent pasture • Continuous management of permanent pasture or ploughing and reseeding • Water level, drainage, irrigation • Exploitation of common land, transhumance (seasonal alpine grazing of semi-natural pastures), maintenance of pastures, etc.
Other Crop Management	• Choice of forage crop; particular issues with forage maize which has displaced grass in sizable areas • Crop rotation and soil management including cover on arable soils in winter • Use of inputs, including fertilisers and agrichemicals • Disposal of slurry and other livestock manure – quantity, timing, technology for spreading • Crop storage and conservation (for example, silage, a potential pollution source) • Management of water, landscape features etc, as above
Manure Management	• Design of livestock housing • Method and frequency of collecting livestock manure • Method of manure storage, design and capacity of storage facility • Location of manure storage and handling in relation to hazards, for example, water courses • Timing, frequency, quantity and methods of spreading or other disposal route • Management of manure other than from livestock, including silage effluent, milk
Landscape Management	• Field size • Retention and management of field boundaries and other landscape / ecological features

Type of Practice	**Environmental Issues**
	• Management of semi-natural vegetation, including scrub clearance • Management of stock in woodland and agro-forestry systems such as ‘dehesa’ or ‘pré-verger’ • Maintenance of drovers’ roads • Management of streams and rivers • Maintenance of seasonal grazing (transhumance)
Soil Management	• Appropriate stocking densities for example, on slopes, dry areas, wet patches etc. • Management of grazing and feeding to avoid poaching on heavily used areas • Appropriate management of crops and grass (see above) • Appropriate spreading and management of livestock manure (see above) • Management of nutrients, including phosphates • Management leading to soil contamination for example, from heavy metals
Biodiversity Management	• Habitat and landscape management (c.f. sections above) • Management practices affecting species on cropped area, for example, timing of mowing • Control of wild species, for example, badgers, hunting, etc.
Other	• Veterinary medicine use • Management of noise and odours, especially from housed livestock • Energy efficiency • Bio-energy production from livestock manure , crops and crop residues for example, biogas generators • Use of renewables, for example, solar energy use (for fodder drying, or water heating) • Reductions in greenhouse gas emissions in addition to those accounted for above, for example, through changes in stock feeding regimes • Disposal of carcases

4.3 Environmental issues in relation to livestock production

In this section the environmental pressures and impacts that arise from dairy farming are considered. European dairy systems span many different types of management practices and levels of intensity: from extensive mountain dairy systems, through pastoral systems of varying intensity to zero-grazing indoor systems. The environmental impacts associated with each type of system vary considerably in both type and magnitude. The key environmental issues associated with dairy farming are greenhouse gas (GHG) and ammonia emissions, impacts of the sector on water quality (i.e. pollution), water quantity, soils (principally erosion), biodiversity and landscape. This section has been structured according to environmental themes, addressing both positive and negative impacts, and considers findings of recent Life Cycle Assessment studies.

Greenhouse Gas emissions

Dairy production systems contribute to emissions of three greenhouse gasses through a variety of different pathways. These are:

- Carbon dioxide (CO_2) arises from energy use on the farm, including crop cultivation and the operation of livestock specific machinery, such as milking machines, refrigeration, slurry handling etc. Poor soil management can also result in the release of CO_2. Off-farm factors such as nitrogen fertiliser production, overseas production of fodder crops and transport of milk should also be counted in a full analysis.
- Methane (CH_4) is a potent greenhouse gas with 23 times the direct global warming potential (GWP) of CO_2. This arises from enteric fermentation in the digestive systems of cattle and other ruminants. Emissions are also linked to manure and/or slurry management (more of an issue for indoor housing systems), particularly where storage or spreading of manure or slurry is poorly managed.
- Nitrous Oxide (N_2O) is more potent still, with a GWP 296 times that of CO_2. Emissions are linked to manure and slurry storage and spreading, transport and use of machinery, the application of nitrogen fertilisers and from the cultivation of leguminous crops, such as alfalfa.

At a global scale livestock production is responsible for 80 per cent of the emissions of these three greenhouse gases (GHG) from agriculture according to the FAO (LEAD 2006). In the EU 15, agriculture accounts for about 9 per cent of all GHG emissions (EEA 2007), although the sector's share of emissions has fallen slightly over time from more than 10 per cent between 1990 and 2005. Cattle represent a significant share of this total, with methane emissions from cattle alone amounting to 26 per cent of all EU 15 agriculture sector emissions in 2005 (EEA, 2007), representing 121,830Gg[42] of CO_2 equivalents. Emissions associated solely with dairy production are more difficult to isolate.

[42] One gigagram (Gg) is equal to 1,000,000 kilograms (kg).

While emissions are closely related to the number of dairy livestock, there is not a simple linear relationship because the size and breed of cow, the feeding and management regime, and the way in which wastes are handled and disposed of, will affect the level of emissions. For example, while more extensive dairy production systems may give rise to lower emissions of some greenhouse gases per cow, as a result of lower inputs and less energy intensive production methods, ruminants fed on fibrous diets associated with more extensive systems often have a higher output of methane than those from more intensive systems that use feed supplements (OECD 2004).

Substantial greenhouse gas emissions are produced as a result of the collection, storage and transport of milk. Estimates of the emissions created during the transport of milk from farm to processors range from 9-12 kg CO_2 equivalents per 1,000 litres of milk. Whilst undeniably a significant source of greenhouse gases, the emissions associated with transport of 1,000 litres of milk are estimated to be significantly less than those associated with its production (Defra 2007).

Another important cause of greenhouse gas emissions associated with the dairy industry is the production of fodder crops principally, but not exclusively, from outside the EU. Currently a significant proportion of the soya used for feeding dairy cattle is produced outside the EU, particularly in Brazil, the world’s second largest producer of soya. One estimate suggests that the production of crops such as soya and maize to feed dairy cattle accounts for as much as 15 per cent of the primary energy used in milk production in the UK (Defra 2007). Not only does this fodder crop production give rise to all the greenhouse gas emissions normally associated with crop cultivation and transport, but where forest, savannah and other natural habitats have been cleared to provide land, fodder crop production can be accompanied by the release of vast quantities of carbon previously stored in the habitats and their soils. Few studies have attempted to quantify the carbon emissions associated with clearance of natural habitats for soya cultivation in the tropics, but for areas like Brazil, where 27 per cent of the country’s soya crop area is located in Amazonia, the emissions are likely to be considerable (Garnett 2007).

Since greenhouse gas emissions have the same impact on global warming wherever they take place, environmental benefits can be secured only if overall emissions fall. Changes in the location of production within the EU are relevant only if they are associated with a change in production characteristics that affect emissions of greenhouse gases per litre of milk. In this sense the efficiency (in terms of inputs per unit of output i.e. inputs per litre of milk) of production systems is of particular concern for agricultural policy and not simply the number of animals maintained in one production area.

Ammonia emissions

Ammonia (NH_3) can also have serious environmental implications for localised air and water pollution and is emitted in large quantities by the dairy sector. From the information available at a global level, agricultural emissions account for 90 per cent of ammonia emissions from all sources. Ammonia emissions into the air depend on farm level management in relation to housing, and storage and spreading of manures and slurries produced by the dairy sector. Much of the ammonia will be deposited locally which can cause soil acidification and eutrophication resulting in a decline in biodiversity as nitrophilic and acid tolerant species become dominant (Bobbink *et al*. 1998). Ammonia emissions from dairy systems are a particular issue as emissions from manure applied to grassland are 1.5 times higher than for manure applied to arable[43] land (Marschiner *et al* (1995) in CEAS *et al* 2000).

Water Quality

Pollution of ground water by nitrates, phosphates and sedimentation resulting in eutrophication of surface water is an issue associated with the dairy sector. The main sources of nitrogen and phosphates are inorganic fertilisers, organic manures and slurries, livestock feed and silage effluent. Other potential pollutants include fertilisers and pesticides used for feedcrops, veterinary medicines and pathogens associated with cattle. The degree to which water quality is affected will depend on a range of factors including soil and weather characteristics, the intensity, frequency and period of grazing, the timing and the rate at which manure is applied. Water pollution can be divided into two main types: point source (emanating from a specific, observable source) and diffuse (where pollutants are being dispersed over a wide area). Dairy livestock, therefore, have a complex relationship with water pollution as not only are they direct and indirect contributors through the production of pollutants but they also influence the natural processes that can control and mitigate pollution loads.

The livestock sector in general has been a major contributor to the increase in fertiliser use over the past 50 years. Figures from the FAO from 2006[44] show that, within Europe, (particularly France, Germany and the UK), livestock and associated production of feed are responsible for more than 50 per cent of mineral nitrogen and phosphorous applied on agricultural land. Losses to freshwater ecosystems are also high within these Member States.

The risk of point source pollution from intensive dairy systems is particularly high due to the large volumes of slurry and silage stored on the average unit and the large number of housed cattle. For example, in England and Wales, dairy systems were responsible for between 37 and 59 per cent of all serious water pollution incidents[45] from agriculture recorded annually by the Environment Agency between 2002 and 2006. In 2002 the dairy industry was responsible for more than four times more serious water pollution incidents than any other agricultural sector in England and Wales (Defra 2007). Data from other Member States is not readily available but the large volumes of slurry generated on dairy farms are a characteristic of all systems where housing is involved.

---

[43] The source does not indicate whether maize production would be classified as 'arable' in this context.

[44] The contribution of livestock to agricultural N and P consumption in the form of mineral fertiliser for France, Germany and the UK was as follows: France N: 52%, P: 52%; Germany N:62%, P: 51% and UK N: 70%, P: 58%.

[45] Category 1 and 2 water pollution incidents. Category 1 is defined by the Environment Agency as resulting in 'persistent and extensive effects on water quality' and 'major damage to the ecosystem'. Category 2 incidents are defined as resulting in 'significant effects on quality' and 'significant damage to the ecosystem'.

In general, the risk of nitrate pollution is higher where cattle production systems have intensified, whilst extensive and low intensity production systems are at lower risk. However, whilst large intensive cattle units can increase the severity of pollution incidents, farm management practices are crucial when determining the environmental impact of an individual farm.

The storage and application of organic manures and slurries is of particular significance for water quality. For example, the likelihood of a pollution incident from a point source can be minimised by appropriate management and investment in infrastructure – anecdotally more widespread on larger farms, particularly where significant financial investment is required. Diffuse pollution can also be reduced by appropriate management practices. Phosphate pollution is closely linked to soil erosion and sedimentation. Overgrazing and unsuitable supplementary feeding practices can have a negative impact on water quality, as can cropping practices. In some areas, fodder maize crops, involving higher risks of soil erosion than grass can cause pollution through soil movement, transporting phosphate into water courses. The trend towards increased silage production also has implications for water quality as silage effluent is a potential pollutant.

The risk of nitrate pollution from dairy systems for different countries has been assessed by the OECD (2004), using indicators of the level of dairy cow nitrogen manure production, the share of this in total nitrogen input and the overall nitrogen soil balance for the country. This assessment classified Belgium, Czech Republic, Denmark, Germany, Ireland, the Netherlands, Portugal, and the United Kingdom as high risk (nitrogen balance ≥ 50kg N/ha and more than 10 per cent of the nitrogen from the dairy industry) and Spain and Italy as low risk (nitrogen balance ≤50kgN/ha and less than 10 per cent of nitrogen from the dairy industry), although this hides significant regional variations within Member States.

Water resources

The management of grassland and land used to grow forage crops for cattle can have a significant impact on water resources. In some areas irrigation is used to grow forage crops such as maize. This can put pressure on the availability of water in drier regions where water is a scarce resource. The use of water for irrigation can also have negative implications for natural watercourses and groundwater systems.

Drainage is also an important issue in terms of water resource management. Historically, large areas of natural and semi-natural habitats have been drained in order to 'improve' grassland for cattle production or to convert it to forage crop production although this is a less common practice now. Natural and semi-natural habitats such as wetlands and marshes can mitigate the effect of high rainfall events and maintain a more constant supply of water. Drainage of such areas for cattle production can have negative implications for the soil's water storage capacity, whilst maintenance of these systems through extensive grazing practices can be beneficial in terms of water resource management.

Soils

Dairy production systems can have a variety of impacts on soils. Intensive production systems are often associated with negative impacts in terms of soil erosion, compaction, which can increase susceptibility of the land to flooding, and nutrient contamination. High stocking rates can result in negative impacts on soil quality as a result of increased poaching, although this will clearly not apply to cattle in indoor housed units.

The production of forage crops for cattle also has implications for soil management. Land growing maize is particularly vulnerable to soil erosion due to the extended period with low ground cover and late harvesting (often in wet conditions) leaving bare and potentially compacted soil at times of high rainfall. Practices such as unsuitable supplementary feeding and over wintering of cattle outdoors can have negative impacts on soil quality, although negative impacts are largely dependent on stocking densities. Management practices as well as soil type and rainfall are also critical determinants of the likely environmental impact.

Some of the management practices associated with dairy production can cause high levels of heavy metals to build up in agricultural soils. Feed supplements can cause manure from intensive dairy systems to be high in heavy metals such as copper, zinc and cadmium. Application of such manure to land can result in the accumulation of these metals in soils, which can in turn lead to impaired soil function and contaminated crops, with implications for human health (OECD 2004).

Biodiversity

Many practices associated with dairy production systems have resulted in long-term declines in biodiversity. These include:

- The effects of intensification resulting in higher inputs of fertilisers, organic manure and pesticides and leading to a loss of grassland diversity, both flora and fauna – high yield ryegrass swards, for example, are of little benefit to biodiversity, in contrast to more botanically diverse permanent pasture;
- Higher stocking rates, leading to overgrazing and an increased risk of trampling of the nests of ground-nesting birds;
- An increase in the cultivation of forage maize;
- Early cutting dates for silage, leading to a loss of grassland diversity and potential disturbance to ground nesting birds;
- Loss of permanent pasture to temporary grassland, with resulting losses of species diversity;
- A general decline from mixed livestock farming systems towards more specialised systems;
- Cattle breeds can also have an impact on biodiversity depending on their suitability for a particular regime. Feed regimes may also have negative environmental impacts such as habitat damage caused by unsuitable supplementary feeding;
- Intensive and specialist housed cattle production systems, in particular, are likely to have an adverse impact on biodiversity as a result of increased forage crop production, whilst more extensive cattle grazing is often associated with positive impacts on biodiversity;

- Diffuse water pollution can have a deleterious effect on aquatic flora and fauna; and
- Abandonment or undergrazing of semi-natural habitats will result in scrub encroachment which will reduce species diversity.

Some extensive dairy systems maintain habitats and landscapes of high biodiversity value. This is particularly true of extensive mountain dairy systems, such as those found in Italy, Austria and France. A study in Switzerland (Schmid 2001) found a wider range of flora and fauna species on extensive dairy cattle grazing areas compared to extensively managed conservation areas where the grass is cut. Permanent grassland has higher associated biodiversity and carbon sequestration potential than temporary leys or arable cultivation, and associated boundary features such as hedgerows form important refuge habitats in agricultural landscapes and provide corridors for the movement of mammals, birds, reptiles and invertebrates.

Cattle grazing can be an important management tool particularly in natural and semi-natural habitats where extensive grazing has traditionally taken place. However, the implications of cattle grazing on biodiversity are complex and much will depend on the habitat being grazed, stocking density and relative proportion of grazing by cattle compared with other types of livestock. Many grazed habitats with a high nature value will require a specific management regime in order to maintain biodiversity.

Cattle graze in a distinct way in comparison to other livestock, such as sheep and goats. Mixed grazing is usually the most beneficial system to conserve and improve biodiversity, although this not commonly associated with dairy systems. Cattle do not graze vegetation too close to the ground, often leaving tussocks of grass which are used by insects and small mammals and do not graze selectively which is important for botanically diverse habitats. Trampling by cattle can also be an important means of controlling scrub, although high stocking levels can result in overgrazing.

In some cases biodiversity benefits could result from increasing the proportion of livestock grazing by cattle, although this does not tend to be the case in dairy systems. In other habitats, biodiversity benefits could result from reductions in cattle grazing relative to other livestock. Undergrazing, or the withdrawal of grazing, can have negative implications for biodiversity, although limited scrub development may be beneficial in some areas.

Soil erosion related to overgrazing, including the trampling of stream banks, can have an adverse impact on aquatic biodiversity, including damage to or destruction of invertebrate habitats and fish spawning areas.

Landscape

Dairy production systems can have a significant impact on landscape. Dairy systems which maintain permanent grassland and hedged landscapes such as the pastoral landscapes of South West England or the bocage landscapes of North West France, help to safeguard the benefits associated with these landscapes. Larger scale intensive management in productive areas, as well as abandonment in marginal areas, can both lead to increasing homogeneity and loss of landscape distinctiveness. In particular, scrub encroachment and afforestation as a result of the cessation of dairying will displace the traditional open mosaic landscape created by traditional livestock production systems. Intensive production systems or insensitive management can have negative impacts on landscape character, for example, through increasing field sizes by removing landscape features such as boundary features or small areas of woodland or wetland. Where production is becoming more intensive and stock are housed indoors, the erection of additional buildings and associated infrastructure can have significant negative impacts on the landscape by giving it a more 'industrial' character. The shift from grass-based systems to the use of maize as a fodder crop can also detract from the traditional character of the landscape. Increased soil compaction and erosion resulting from intensive grassland management may adversely affect below ground archaeological features.

Life Cycle Assessment of Environmental Burden from Dairy Systems
Life Cycle Assessment[46] (LCA) of dairy production systems explores the total environmental burden arising from the whole milk production process, not just impacts directly associated with the management of livestock and land. It gives a more representative reflection of the total environmental burdens arising from production systems by taking into account emissions and energy use associated with each part of the production process and those embodied in the machinery and inputs used by a system.

A recent Swedish LCA study (Cederberg and Mattsson 2000, cited in Defra 2007) compared the environmental burdens associated with organic and conventional dairy systems. Organic systems were found to have lower global warming potential, as they produce 13.6 per cent less CO_2 equivalent per ton of milk than conventional systems. They also have lower acidification potential as they produce 12 per cent less sulphur dioxide (SO_2) equivalent per ton of milk than conventional systems. However, in eutrophication and land use terms, the study found organic systems to be worse, due to the types of feed used and greater reliance on grazing, leading to increased nitrate leaching, and greater land requirements per unit of milk produced. Another study, Williams *et al*. (2006) (cited in Defra 2007) found that organic systems in relation to all the above measures, scored less well than conventional ones.

As discussed above, there are not only differences in the types and magnitude of environmental impacts arising from different types of dairy systems, but differences can also arise from relatively simple changes in management. An LCA model of UK dairy systems developed by Cranfield University (summarised in Defra 2007) estimated that changing from autumn to spring calving can reduce primary energy consumption by 354 MJ and global warming potential by 42 kg CO_2 equivalent, per 1,000 litres of milk produced. It also estimated that cows producing 10,000 litres of milk a year required 236 MJ more primary energy per 1,000 litres than cows producing 6,500 litres per year, but had lower nitrogen emissions and global warming potential and used less land. Environmental burden was estimated to be greater on all counts for cows producing 3,500 litres of milk per year than those producing 6,500, implying that on the criteria based score, environmental benefits can be gained by using moderately high yielding cows (at least 6,500 but not more than 10,000 litres per year).

[46] Life Cycle Assessment analyses production systems systematically to account for all inputs and outputs that cross the boundaries of the product systems. (Defra 2007)

LCA analysis, which attempts to rank options using a single consistent unit, expressed in energy terms, must be treated with some caution, however. The performance of the systems in relation to energy demand and greenhouse gas emissions is easier to measure than impacts on land use or biodiversity. Relatively small differences in the performance of systems in relation to quantifiable impacts (themselves quite sensitive to the assumptions made) can obscure quite large differences in other respects, especially where site specific impacts, such as landscape management, are important.

Against the background of the interrelationships between dairy production and the environment as set out in this chapter, the challenge is to establish the precise impact of national milk quota regimes on the environment - the main focus of this study (see Chapters 7 and 8).

5 METHODOLOGY

5.1 General methodological considerations

The methodology used in this study has been designed specifically for the questions addressed, and is constrained by difficulties encountered in translating certain conceptual elements of the research question into empirically verifiable hypotheses. The short duration of the research project, relative to the complexity of the issues to be addressed, has also been a determining factor in the design of the methodology. This section describes the main decisions that have shaped the methodological approach taken in the study.

5.1.1 Articulation of the Evaluation Questions

The objective of this study is to go beyond an evaluation of the environmental effects of the milk quota regime *per se* (i.e. the effects of limiting the volume of milk production in the EU) in order to examine the environmental effects of *the different ways in which successive milk quota regulations have been applied in individual Member States*. Differences in implementation rules relate to aspects such as quota transfer between producers, distribution of the superlevy burden over producers, and priority treatment given to particular producer groups or certain regions regarding quota allocations from the national reserve.

These implementation characteristics can impact on the environment in two distinct ways:

- The mechanisms set up to implement milk quotas influence structural change in the sector (including location of milk production and size structure of dairy herds), producers' decisions regarding the type of farming system used and, for any given farming system, the degree of intensity of input use. These impacts on structure and production systems will in turn have environmental implications. Thus, the causal chain between implementation rules and environmental effects is broken down into two stages: the effect of implementation rules on *where* and *how* milk is produced (direct effects on the sector), and the consequences for these changes on the environment (indirect effects on the environment). These effects are analysed under Evaluation Question 1 (Chapter 7).
- A provision exists in EU milk quota legislation[47] for an environmental protection or enhancement objective to be incorporated into the national implementation legislation. The extent to which measures with explicit environmental objectives have been implemented by Member States and the evidence for any resulting environmental effects is explored in Evaluation Question 2 (Chapter 8). Measures with implicit environmental objectives are also examined, notably where Member State milk quota allocation and transfer rules distinguish between LFAs and non-LFAs.

[47] Council Regulation (EC) No 1788/2003 (Article 18) and the preceding Council Regulation (EC) No 3950/92 (Article 8).

5.2 Methodology for addressing Evaluation Questions

5.2.1 Types of evidence used and conclusions obtained

A considerable quantity of data exists on the first stage of the causal chain. It is analysed in order to discover whether the different outcomes for quota mobility, production methods and structure of dairy farms that are hypothesised to follow from the differences in implementation have actually occurred. It is much more difficult to obtain relevant data on the second of the two linkages, since environmental effects are often site-specific or associated with particular local conditions. Moreover, the time lags between a changed farming practice or type of land use and discernible environmental effects are often uncertain and difficult to pin down empirically. Detailed studies of particular regions are often needed to establish empirically the causal links between particular ways of farming or changes in farming practices, and environmental effects. Therefore, the empirical treatment in this study of the second order environmental effects is inevitably more impressionistic and less conclusive than the first.

It follows that the degree of support and the strength of evidence in favour of various hypotheses is variable. At one extreme, both stages of the causal link can be examined using appropriate empirical evidence for a number of countries, and the conclusions derived can be treated as relatively robust. At the other extreme, only the first stage of the causal link can be checked against relevant empirical evidence (and even then the relevant data may not exist for more than a few Member States), whilst empirical support for the second stage of the link is entirely missing. This could be due either to the non-availability of data or to the inherent difficulty of measuring the hypothesised effect in a scientifically rigorous way (for example effects relating to landscape quality or biodiversity). In these cases, our conclusions, if any, are much more speculative, and do not go much beyond a restatement of the original hypothesis. However, even in the worst case, the exercise is still a useful one in that it articulates and highlights questions that would be worthwhile examining in more targeted micro-oriented research.

Data sources

The evaluation has drawn a on a wide range of available evidence and sources of data. This includes publicly available literature both at EU and national level and pan-European databases including Eurostat FSS[48] data and FADN[49]. In addition the evaluation has drawn on national information and data gathered from case studies conducted in major producing Member States and regions as the *main* study[50]. Another significant source of information and data was provided by Member State responses to a questionnaire prepared by DG Agriculture in 2007. Questionnaire

[48] Farm Structure Survey data available at Eurostat website

[49] Farm Accountancy Data Network. Public databases used and data request made to DG Agri.

[50] Case studies conducted in France, Germany, Ireland, Italy, Netherlands, Spain and the UK. Regional analysis in Bavaria, Emilia Romagna, Galicia, Brittany and Auvergne, and the South West of England.

responses contained information on milk production, size structures and details of milk quota implementation[51]

5.2.2 Member State coverage

Since Member States have taken different approaches to milk quota implementation, our analytical framework inevitably involves a *comparison* across Member States.

The choice of Member States for which detailed information has been analysed in order to perform the study has been influenced by several considerations. First, the environmental effects that are hypothesised to result from different implementation decisions require a number of years to become manifest empirically. Therefore, it is inappropriate to extend the empirical investigation of environmental effects to countries that entered the EU recently in 2004 or 2007. Consequently, empirical evidence has been analysed for countries comprising EU 15 only. Second, although milk is produced in all Member States, 87 per cent of EU 25 milk output is produced in 11 Member States[52], and 85 per cent of EU 15 output is produced in just seven countries[53], each of which accounts for at least 4 per cent of EU 15 production. It was decided therefore to focus on these most important milk producing countries: Germany, Spain, France, Ireland, Italy, the Netherlands and the United Kingdom. Together, these seven Member States provide nearly 71 per cent of total EU 25 milk output (see Annex 1). Case studies were commissioned for these seven Member States, and we draw heavily on these sources for much of the detailed information used in the empirical assessment. Information for other Member States is also used, but less often and less systematically.

5.2.3 Counterfactual scenario

In order to assess the effects of any policy intervention, a counterfactual scenario has to be specified. Typically, the effects of a policy are assessed by comparing outcomes under the policy with what would have happened in a no-policy situation. In this case, however, the alternative scenario of ‘no quotas on milk production’ is not an appropriate counterfactual since the aim is not to evaluate the effects of milk quotas *per se*.

For this study, we have used the fact that Member States have differed in their philosophy regarding quota implementation. This has enabled individual Member States to be positioned along a continuum ranging from the most interventionist (or ‘restrictive’) approach to the most liberal or market-oriented (hereafter ‘unrestrictive’) approach. An interventionist approach to implementing milk quotas involves the tightest administrative control over quota allocation and transfer, together with a

[51] The analysis and interpretation of data and information from questionnaire responses comes from the research team and does not necessarily represent the views of the Commission.

[52] Denmark, Germany, Spain, France, Ireland, Italy, Netherlands, Austria, Poland, Sweden and United Kingdom. The remaining countries each account for less than 2% of total output, and of these, 7 Member States each account for less than 1% of total output.

[53] Germany, Spain, France, Ireland, Italy, Netherlands, and United Kingdom.

willingness to go beyond 'supply control' *per se* in order to use quota administration as a means of targeting additional national structural, socio-economic or territorial objectives. By contrast, a market-oriented approach involves implementing the policy as explicitly required by the relevant EU regulations in order to limit national milk production effectively, whilst allowing other decisions and developments pertaining to quotas that are not explicitly fixed by the regulations to be governed by market forces.

The underlying assumption is that, at the most market-oriented end of the spectrum, trends in location of production and in the structure of the sector are the least distorted from what they would have been in a situation without the quota scheme at all.

Therefore, trends in Member States that are characterised as unrestrictive serve as a **'minimum intervention' counterfactual** with which Member States situated at other points of the continuum can be compared. The more interventionist the implementation approach is, the more it is expected that trends will diverge from this benchmark.

This approach has the advantage that exogenous trends affecting *all* Member States regardless of whether or not milk quotas were applied (such as increasing yields due to continuing genetic improvements) are partly controlled for. We look for *differences* in the rate or incidence of these trends that we can attribute to differences in quota implementation features. A risk is that some differences that are due to other Member State specificities, unrelated to differences in quota implementation, might be wrongly attributed to quota implementation rules. Therefore, some caution is needed in interpreting the conclusions drawn from these comparisons.

It must be stressed that the use of trends in Member States that are characterised as market-oriented as a counterfactual for more interventionist Member States relates only to the first stage of the two-stage causal chain. It does not extend to the environmental consequences of these trends, which are specific to each Member State, depending on its agro-climatic conditions and other factors such as the level of environmental stress already being caused by dairying at the start of the quota period. For example, a particular market-driven trend, which was given free rein in a market-oriented Member State and turned out to have beneficial environmental effects in that Member State, may have had negative environmental consequences if it had been allowed to develop in another more interventionist Member State with different agri-environment pre-conditions.

Table 5.1 describes the features of national quota implementation rules that we consider relevant for classifying Member States according to their degree of market orientation. The period up to 2006 only is considered. More recent changes to national quota regimes are described in Chapter 3. On the basis of these features as they were implemented over all or most of the period of analysis, the Member States of EU 15 have been ranked on five levels, from 'most interventionist' (France and Ireland) to 'most market-oriented' (UK and the Netherlands).

In Evaluation Question 2, an additional counterfactual is considered, that is the situation *without* quota allocation and transfer measures with explicit or implicit environmental objectives.

Table 5.1 Member States characterised according to the degree of market orientation of their quota implementation regulations over the evaluation period (1984-2006)

Member State	Quota transfer without land between regions?	Quota transfer between producers	Operation of National Reserve (NR)	Restructuring programmes
Level 1 – Least market-oriented				
France	No transfers without land between *Départements* throughout evaluation period.	By farm sale only. Since 2006 producers can sell quota to Administration which is sold on to other producers within same region. No quota leasing.	Administrative reallocation to priority groups *within* regions. 20% of NR managed at national level since mid 1990s. Potentially results in transfers between regions, but limited in practice.	Continuous operation since 1984, first the EU-funded buyout programmes, then nationally funded programmes
Ireland	No transfers without land except within milk purchasing pools. Pools vary in size and geographic extent.	Land and quota leases up to 2000 (LFA ring fencing after 1995). Now transfers within milk purchasing pools, priority groups favoured. Temporary leasing on similar basis, but national pool option.	1995-2000: NR fed by a 10% siphon on land and quota leases. Allocated to hardship cases.	Restructuring schemes since early 1990s. Main method of acquiring quota 2000-6. Administrative purchase for allocation to priority groups.
Level 2 – Weak market orientation				
Belgium	Two trading regions.	Upper limit on quantity transferred, distance limit, siphon. Administrative transfers (Free market transfers in Flanders until 1996)	Young farmers have priority.	Yes. Also confiscation of unused quota under certain conditions.
Finland	Seven trading regions.	Mixed market-oriented/ administrative transactions. Upper limit on size of transfer.	Distributed to regions in proportion to existing quota. Allocated to producers in priority groups.	None.

Table 5.1 (continued) Member States characterised according to the degree of market orientation of their quota implementation regulations over the evaluation period (1984-2006)

Level 3 – Moderate market orientation				
Germany	No transfers between trading regions. Until 2007, 27 trading regions defined at level of Länder or *Regierungsbezirke*.	Since 1993, transfer without land within the same trading region (since 2000 in the new Länder). Quota exchange since 2000. Temporary transfers without land within trading zones 1993-2000.	Until 1993 siphons used at different times for different types of transfer. Until 2002, siphon on unsuccessful offers on the quota exchange. NR quota mainly used to 'equilibrate' regional quota markets – some movement of quota between regions possible.	National restructuring schemes during 1980s and early 1990s with the aim of reducing the volume of national excess quota.
Italy	National market since 2003. Ring-fencing of LFAs, mountain areas. 1993-2003 Temporary leasing for max 2 consecutive years (also between regions). Since 2004, limited to transfers within 'homogeneous regions'.	Market transactions since 1992.	Siphon until 2003. Inactive quota redistributed to priority groups (incl. LFAs and mountain areas). Since 2003 NR divided among regions in proportion to excess production during previous 2 quota years. Distributed at regional level to priority groups.	Since 1993 payments to encourage farmers to quit dairying. Payment diversified according to location of holding.
Luxembourg	Transfers permitted only between producers selling milk to the same dairy.	Private transactions since 2000.	Priority groups.	None.
Spain	Since 1998 transfers between regions if they improve production structures of recipient holding or extensify production (<2LU/forage ha). Ring fencing of quota in LFAs 1998-2003. Leasing of quota for up to 2 years between regions since 1998.	Market transfers until 2005. Transfers within regions to priority groups. Since 2006 easier for producer to transfer only part of quota	NR quota allocated to producers on points system for each region. Since 2003, 15-20% siphon on transfers between regions (optional within regions). Bias towards smaller farms.	Since 1991 abandonment programmes purchased quota which is then redistributed from NR to active producers
Level 4 – Stronger market orientation				
Austria	Alpine LFAs ring-fenced.	Market transactions of permanent quota. Restrictions on temporary transfers.	Confiscation of unused quota. Priority groups	Unknown.

Table 5.1 (continued) Member States characterised according to the degree of market orientation of their quota implementation regulations over the evaluation period (1984-2006)

Denmark	National market.	Quota exchange since 1997, 1% siphon. National restructuring scheme 1989-1997. No temporary leasing.	Priority groups young farmers and new entrants.	None.
Greece	National market.	Market transactions. Siphon. Minimum size of transfer. No transfers in last quarter of year.	Allocations according to objective criteria according to circumstances. Some allocations to new producers.	None.
Portugal	National market. Restrictions on transfers to Nitrate Vulnerable Zones.	Market transactions. Siphon.	Allocation to priority groups. Restrictions on sale after allocation.	None.
Sweden	Two regions.	Market transfers since 2000. Upper limit on size of transfer. No temporary leasing.	Allocations to producers based on quota holding.	None.
Level 5 – Most market-oriented				
The Netherlands	National market.	Market transfers with land from the start of the quota regime but with liberal rural leasing arrangements. Permanent transfers without land introduced in 2006. Initially some restrictions on amounts transferred in relation to land. Temporary leasing.	The aim has been to keep the NR as small as possible.	Only the early EU schemes. Low uptake.
United Kingdom	Until 1993, transfers only within 5 large regions (including whole of England and Wales). Since 1993 only minor ring-fencing for Scottish Islands.	Initially, permanent transfer of quota with land coupled with liberal rural leasing arrangement led to permanent transfer of quota without land after specified time. Official permanent transfers without land since 1993 (most common form of transfer since 2002). Quota leasing possible since 1986. Temporary leasing.	The aim has been to keep the NR as small as possible. No priority groups except producers affected by movement restrictions for temporary allocation of unused quota.	Only the early EU schemes. Low uptake.

5.2.4 Time horizon, treatment of time

Both links in the causal chain involve medium- or long-term developments. Many of the changes to trends in structure and location induced by quota management rules required some time before becoming well established. First, milk producers had to undergo a learning process during which they adapted their operation to the changed policy environment and became more aware of optimal strategies under the new conditions. Second, decisions to quit dairying, or to buy more land or more quota to expand operations, are usually not taken in a hurry and their timing can be influenced by other factors such as family situation, credit availability or interest rates, and uncertainty about further policy changes. As for the second link in the causal chain, some environmental effects are cumulative and a number of years are required before they become apparent.

Our methodology therefore takes a long-term perspective, and ignores short-term, year-to-year changes. Where data permit, the start of the quota regime is taken as the benchmark situation, and trends are measured in terms of changes over subsequent periods of circa 10 years. This means quantifying changes between the mid 1980s and the mid 1990s, and again between the mid 1990s and the mid 2000s, and for the whole period from the mid 1980s until 2005/06 or 2006/07.

5.2.5 Level of disaggregation

Many of the hypotheses put forward in Chapter 6 can only be effectively examined at a level of aggregation *below* national level. For example, for those hypotheses based on the degree of quota mobility between regions, regional rather than national data are needed. Ideally, regional data on dairying would be associated with an environmental profile of each region, although this is usually not available. Where the effects of prioritising particular regions (such as LFAs or mountainous areas) are concerned, disaggregation to NUTS III would be required (under current definitions) but information on milk production and quota allocation is generally absent at this level of disaggregation. Therefore, use has to be made of data that have been produced by existing special studies, if any. For hypotheses relating to the effects of different degrees of restriction on quota mobility between producers (even if only within the same regions), simple averages of herd sizes, stocking rates and input use are insufficient. What is needed are data on herd size distributions and input rates for different herd sizes. Lack of data at the appropriate level of disaggregation for certain hypotheses has severely limited the kind of empirical results that could be obtained for this study.

5.2.6 Summary of methodological considerations

- The causal chain implicit in the research question has been decomposed into two stages, quota administration → economic, technical and structural effects → environmental effects.

- The strength of the empirical evidence available on these causal links is variable over hypotheses, and is relatively sparse for the second order environmental effects. Consistent EU data sets including FADN have been used where available.

Data on milk production and quota allocations has been drawn from several sources, including recent information supplied to DG Agriculture by national authorities.

- Evidence from the 12 most recent EU members has not been examined because their time frame is too short to provide useful evidence on the causal links implied by the research question. Seven Member States, representing 71 per cent of milk production in EU 25 and 85 per cent in EU 15 were selected for more detailed treatment, and the empirical investigation focuses mainly (but not exclusively) on these countries.

- The counterfactual scenario adopted consists of trends in the Member State(s) with the least interventionist philosophy towards quota implementation. An additional counterfactual scenario is considered in Evaluation Question 2, the situation without quota measures with explicit or implicit environmental objectives.

- A long time perspective is taken where possible (circa 20 years), as the effects under study are medium- or long-term phenomena. Therefore, year-to-year changes are not studied.

- The appropriate level of disaggregation is sub-national, and data showing distributions (spatial or by farm size) are preferred, given the inadequacy of simple (national, ‘all farm’) averages.

6 HYPOTHESES LINKING MILK QUOTA IMPLEMENTATION AND ENVIRONMENTAL CONSEQUENCES

There is no simple relationship between the rules governing national quota regimes and environmental outcomes on the ground. This is because both the quota implementation rules and the possible environmental impacts are multi-dimensional and complex, and because the causal pathway is not a direct one. Therefore, a number of hypotheses have been developed as a means of analysing the relationship. These are explained in this chapter.

When constructing the hypotheses that link differences in Member States' quota implementation approaches to environmental consequences, two different kinds of causal pathway can be envisaged. On the one hand, the implementation rules based on objective criteria may explicitly seek to target a *non-economic* objective (such as equity, transparency or administrative efficiency). Where this objective is environmental maintenance or enhancement, then the causal pathway between the implementation rule and environmental effect is relatively straightforward as the intention is clear. These cases where an environmental effect is explicitly targeted are explored in Chapter 8 under Evaluation Question 2 (EQ2).

More often, however, the environmental outcome will be an unintended, indirect consequence of the implementation rule. In this case, the causal pathway will consist of two stages. First, national differences in quota implementation will create different incentives and constraints for dairy producers, leading to differences in the outcomes of economic decisions taken by individual producers and markets. These economic decisions may in turn have their own environmental consequences, although these consequences will be unintended by the policy maker. In Chapter 7, under Evaluation Question 1 (EQ1), we consider the environmental effects that occur as indirect, second order, impacts of the reactions and adjustments of producers and markets to changed economic incentives

6.1 Environmental impact of national milk quota implementation (Evaluation Question 1)

Five hypotheses have been formulated about possible causal pathways linking implementation features of the quota regulation and environmental impacts. A necessary condition for the existence of different indirect environmental effects resulting from the way Member States have implemented the milk quota regime, is that their approaches have triggered identifiable, perhaps different trends in variables like regional mobility or the size distribution of dairy herds. For this reason, there is little value in looking for differences in environmental outcomes that might be attributed to differences in quota implementation rules in Member States, if there are no identifiable impacts of these rules on variables related to production decisions, structural change etc. This reasoning implies the need for a sequential procedure both for presenting the hypotheses, and for examining them empirically.

Each hypothesis distinguishes between these two elements of the causal chain. Each hypothesis first states how differences in quota implementation are expected directly to effect outcomes such as structural change, regional location of milk production, farm size and producers' choice of production methods (first order effects), followed by hypotheses about the consequences of each of these outcomes for the environment (second order environmental effects).

Differences in the pattern of structural change and concentration (first order effects) are likely to have differing environmental impacts in respect of landscape, water quality/pollution, biodiversity, soils, greenhouse gases, air pollution, and ammonia pollution *inter alia*.

The hypotheses relating to the second order environmental effects are necessarily more difficult to formulate because local environmental factors may determine whether a specific management decision or structural development impacts positively or negatively on the environment over time. This means that some of the hypotheses specified for the second order effects, are dependent on location specific factors for their analysis, with potentially differing outcomes in different areas. Such analysis is beyond the scope of this evaluation. It follows, therefore, that, regardless of the problem of data availability, empirically supported conclusions will be for the most part unavailable regarding environmental consequences. While some region-specific conclusions may be possible, it would be dangerous to extrapolate to general conclusions. Nevertheless, the hypotheses relating to the second order environmental effects are valuable in that they articulate explicitly the kind of environmental effects that could be investigated by more detailed, micro-oriented research, and because they provide policy makers with a wider view of possible outcomes.

The following general considerations and assumptions underlie the hypotheses that are specified about the link between economic decisions and environmental effects:

- There is the potential for both environmental damage and benefit to arise from the keeping and management of dairy cows and followers;
- These impacts arise from fodder production wherever it occurs as well as from the cows themselves and the areas where they are kept;
- A range of factors needs to be considered, including the total number of dairy cows, (which will affect manure production and methane emissions, for example) their breed, the systems and forms of management employed, the sources of feed and fodder, the management of fodder crops, manure handling facilities and management, and many other variables;
- It is also relevant to take account of the known or likely alternative management of the land in cases where the economic decision is to cease dairy production.

Hypotheses about the consequences of different quota implementation approaches are presented below, under three main headings. Each heading specifies a particular way in which differences in quota implementation might manifest themselves with respect to the first-round decision. Differences might show up in terms of:

- Degrees of quota mobility
    - between regions (affecting regional quota shares)
    - between producers (affecting size distribution of herds)
- Decisions to cease milk production (affecting producer exit rates, the number of dairy farms and land use).
- Specific production decisions (affecting timing of production or input use)

In each case, the hypothesis concerning direct first order effects is linked to a hypothesis specifying the potential *indirect* second order environmental effect of the direct impacts.

It should be pointed out that the 'least restrictive' (most market-oriented) case is taken as the base case and is in effect the counterfactual. Each hypothesis concerns how outcomes are expected to be different, relative to this base case, when implementation rules incorporate a particular kind of restriction or constraint. This follows from our choice of the 'least restrictive' case as the counterfactual – see section 5.2.3.

Table 6.1 summarises the six hypotheses developed for evaluation; four in relation to the environmental impact of national milk quota regimes (EQ1) and two in relation to the effectiveness of environmental objectives associated with national quota implementation (EQ2).

Table 6.1 Summary of hypotheses

	Type of Restriction	Characteristic of the 'least restrictive' model	First order effects (relative to the 'least restrictive' model)	Second order environmental effects	Comment
1	**Quota trading confined within regions**, or administrative transfers only within regions	Unified national market for quota, no impediments to transactions between regions or zones	Limited shifts in regional shares of quota, as the only inter-regional mobility is via the national reserve	Potential environmental effects (positive or negative) of long-term trends in location of milk production are slowed down or stopped. May be positive or negative. To the extent that regional concentration is avoided, certain environmental effects will always be positive	The same degree of inter-regional quota mobility may be environmentally beneficial in one country, but harmful in another, depending on conditions in the regions of outflow and inflow
2	**No quota trading between producers** even within regions; administrative transfers only between producers	Unified national market for quota, no impediments to transactions between regions or zones	Slower upward shift in herd size distribution, slower growth in average herd size $\rightarrow$ weaker tendency towards scale induced intensification of production method	Various environmental consequences of greater intensification, nearly all unambiguously negative, are avoided or slowed down	If herd sizes were already relatively large at the start of the quota period, the intensification effect will be smaller. No strong difference in environmental effects compared with the 'no mobility' situation
3	**Exiting producers cannot obtain 'market value'** for their quota separate from other assets (farm, land)	Exiting producers can sell quota detached from land at the 'market rate', and without giving up their farm	Slower exit rate, slower decline in number of herd and slower growth in remaining herd sizes, quota more likely to stay on the farm, land less likely to go to alternative use or be abandoned	Potential environmental effects vary depending on (a) what would have been the alternative land use when dairying ceases, or (b) the local circumstances if the land is abandoned	Faster rate of dairy cessations means that quota is being absorbed elsewhere; the net environmental effect depends on where this freed quota is going, and whether or not it is environmentally neutral
4	**Transfers/ allocations of new quota** linked to constraints or incentives regarding input use	No input-related constraints or preferences govern who can buy, sell or receive quota	Substitution amongst inputs will occur, against (in favour of) inputs linked to constraints (incentives)	Potential environmental impact may be positive or negative, according to the particular input concerned, and whether it is constrained or favoured	Will apply only to those producers transferring quota or receiving new allocations. Would require a micro study to verify these effects empirically

	Type of Restriction	Characteristic of the 'least restrictive' model	First order effects (relative to the 'least restrictive' model)	Second order environmental effects	Comment
5	Milk quota regimes with **explicit environmental objectives**	Not applicable	Less dairying or more extensive dairying is expected to occur in certain regions relative to counterfactual.	Range of environmental benefits (e.g. biodiversity, landscape, water quality etc) is expected where explicit objective is achieved.	Member States allowed to specific 'improving the environment' as a possible objective for restructuring programmes. Few examples in practice though.
6	Milk quota regimes with **implicit environmental objectives** (e.g. retention of production in the LFA)	Not applicable	Depends on objective of measure. Maintenance of dairy production in LFA or other targeted areas expected at higher level than counterfactual (where this is the objective).	Range of environmental benefits (e.g. biodiversity, landscape, water quality etc) expected depending on nature of implicit objective.	Significant variation in environmental impact of dairy production in LFA – not all beneficial. Most potential for environmental benefits associated with traditional low input/output systems in mountain regions.

Two aspects of the structure of the milk-producing sector in Europe are of particular relevance to this study. These are the spatial distribution and the size distribution of dairy production units. This section elaborates hypotheses relating to these two dimensions.

6.1.1 Quota mobility between regions

Hypothesis 1: Regional quota mobility

First order effects
Member States that *either* permit market transfers only within regions *or* that allow only administrative transfers of quota under the control of local administrations are subject to less mobility of quota between regions than Member States that permit national markets in transferable quota to operate (with environmental implications – see below).

Second order environmental effects
The environmental impact of constraining or preventing regional quota mobility will vary, depending on the consequences avoided by not allowing regional transfer relative to the environmental consequences of keeping quota in its original region.

This is an important hypothesis for two reasons. First, there has been considerable variation in Member States' rules for relating to the mobility of quota, over the entire period, both in their underlying philosophy and the detailed operation of their quota transfer mechanisms. Second, the extent of regional quota mobility is potentially significant in terms of indirect environmental consequences arising from varying situations. For example, the dominant production system may differ between regions gaining and losing quota, and if these differences between systems apply to those farms affected by production transfers, they could have environmental consequences. Additionally, in regions gaining quota, the density of dairy farms may become concentrated to such a point that it causes an excessive environmental load. Conversely, 'de-concentration' may occur in other regions.

For Member States that for many years have allowed national quota markets to operate, it is likely that the current regional distribution of milk production differs little from what it would have been in the absence of the quota regime, although the level of production will be different. Therefore, if national quota markets and higher regional quota mobility have led to a change in environmental conditions in certain regions, the decision to allow a national quota market cannot be considered the prime cause of this result. However, Member States that have not allowed a free market at national level in transferable quota, thereby reducing the degree of regional mobility, may have avoided harmful effects by keeping quota in its original region, or indeed may have foregone a net environmental improvement by doing so.

One of the key environmental issues relating to the regional mobility of quota is the extent to which this leads to a decline of dairying in marginal areas. Dairying within marginal areas, generally at higher altitudes, including LFAs, tends to be predominantly grass-based, using permanent pasture and usually operating with relatively low stocking densities. In many, but not all, cases these systems support more biodiversity-rich habitats than found on lowland dairy farms. The loss of dairy production from these areas brings with it a risk of these semi-natural habitats being lost and replaced by other land uses which are often of lesser environmental quality.

When considering this hypothesis, it is useful to bear in mind that the larger regional shifts or the scaling-up of farm size that are expected for Member States with a free quota market are not *caused* by the quota market. However, because of the costs of acquiring quota these trends can be assumed to occur more slowly than would be the case without quotas at all. On the other hand, regional shifts that are small relative to the pre-quota period, or slower rates of growth in average herd sizes, hypothesised for Member States with restrictions on transfers, *can* be attributed to these restrictive features of their quota regime.

6.1.2 Quota mobility between producers

Hypothesis 2: Scale increases and intensification

First order effects
Restrictions on quota mobility between producers will slow down increases in average herd sizes. Since intensification tends to increase with herd size, this is likely to slow down intensification of production methods (including higher input use and stocking densities). There may also be implications for the degree of specialisation in dairying.

Second order environmental effects
In general, more intensive production systems are associated with greater negative environmental impacts. Therefore, adverse environmental effects that are mitigated by regimes that restrict quota mobility between producers include:

- **Greater use of concentrated feeds/silage maize will often have negative impacts on the environment, particularly in relation to water quality/biodiversity/landscape.**
- **More production within indoor systems although the relative environmental impacts of indoor versus outdoor systems depend significantly on specific features such as provisions for manure management and stocking densities.**
- **Changes in breed of dairy cows – from local varieties to more input-demanding breeds or dual purpose breeds – are likely to have negative environmental impacts on soil, air and water and possibly on traditional landscape values although they may be beneficial in terms of greenhouse gas emissions.**
- **Higher stocking densities associated with greater aggregate negative environmental impacts unless offset by better management.**

Even when quota regions are ring-fenced (regardless of whether quota transfer involves market transactions or administrative reallocation), the extent to which quota transfer is permitted between producers is likely to have consequences for the distribution of milk production by size of herd (scale effects). Total herd numbers will decline, average herd size will increase and the ‘typical litre’ of milk will come from a larger-sized herd.

There are two reasons why such scale increases might not be neutral for the environment. *First*, if the same volume of milk production is concentrated on fewer agricultural holdings, it is likely to be less dispersed around the countryside. If so, the environmental load in specific local sites will be affected. *Second*, regardless of spatial concentration of milk production or regional production shifts, increases in scale of production can have environmental effects through changes in production methods. This is the focus of this hypothesis.

As set out in Chapter 4, more intensive systems generally have higher inputs and outputs per hectare and higher stocking densities and as a result tend to be more harmful for the environment than the minority of genuinely extensive systems, particularly in relation to biodiversity and landscape. The position with greenhouse gas emissions is much less clear.

It is also important to recognise, however, that increasing scale may also have environmentally positive aspects. For example, more efficient waste management technologies may become economically viable with larger herd sizes, and greenhouse gas emissions may be reduced in some intensive systems.

6.1.3 Incentives to cease milk production

Hypothesis 3: Cessation of production

First order effects
In Member States where producers cannot sell their quota separately at a price equal to its 'true economic value' or where quota can only be sold in the context of a farm sale, it is expected that the exit rate from the dairy sector will be lower than in Member States where a 'market price' for giving up quota can be earned without having to sell the farm.

Second order environmental effects
- **Cessation of intensive dairying systems will generally be environmentally beneficial in most cases.**
- **Cessation of extensive dairying systems in marginal areas where milk production based on grazing is the sole economically viable land use, is likely to be environmentally negative, leading potentially to land abandonment, scrub encroachment, loss of biodiversity, and so on.**

Where quota markets do not exist, the only way of 'selling' quota is as one of the farm's fixed assets when the whole farm is sold. The extra value the quota adds to the total price of the farm will be diluted by other characteristics of the farm, and will not be as high as if the farmer had been able to offer the quota separately from the farm on an open market. If producers can cash in the value of their quota on a quota market, there is a greater incentive for producers with marginal herds who cannot earn sufficient income, or those who wish to exit from dairy production for other reasons, to do so. If they stay in farming, the cash obtained from selling their quota can act as start-up money to invest in a new farming enterprise. Alternatively, it can assist their re-establishment outside farming or contribute to their retirement pension. Where the value of quota can only be realised by selling the farm, or at an administrative price that does not reflect what is thought to be its true value, then the incentive to quit will be reduced. Even in these cases, however, a decline in producer numbers will still be observed since many other factors contribute to the exodus of farmers from dairying.

The environmental effects of slowing down the rate of cessation are not clear cut. Differences in the rate of disappearance of dairy farms are likely to have environmental impacts. However, these will be location-specific. If the land remains in agriculture and is used in a more environmentally friendly way, the results will be beneficial. If the land is reassigned to other uses such as forestry, tourist facilities, urban construction or road developments, the environmental effects will depend on the relative environmental impact of these other uses.

6.1.4 Incentives to alter production decisions

Hypothesis 4: Constraints and incentives with respect to input use

First order effects
Where constraints or incentives regarding inputs are attached to rules for quota allocation or transfer, producers' decisions regarding input use will be influenced against or in favour of these inputs, *or* producers already using little or more of these inputs will gain quota share relative to others.

Second order environmental effects
The relative levels and proportions of various inputs used, and substitution between inputs, are not environmentally neutral, and have a variety of potential environmental impacts.

This hypothesis groups together the various constraints and incentives that Member States have attached to their rules for quota allocation and transfer. For example, where administrative transfers of quota favour producers with investment plans, this may create positive incentives to upgrade fixed investment on the farm. By contrast, when quota expansion has relied on the quota market, on-farm investment competes for financial resources with market purchases of quota, which may lead indirectly to a lower level of on-farm investment in more environmentally oriented fixed equipment or infrastructure. Other examples involve attaching conditions on stocking densities to farms buying quota, fixing a quota/land maximum ratio for transfers of quota with land or favouring the acquisition of quota by particular groups of farmers.

The environmental effects of quota-induced biases against or towards the use of particular inputs will depend on the nature of the inputs concerned (and those with which they are substituted)

6.2 Effectiveness of quota measures with environmental objectives (Evaluation Question 2)

The final two hypotheses concern those parts of Member States' implementation rules that, as well as specifying a mechanism or a constraint relevant to the operation of the milk quota scheme, also have either an explicit or an implicit environmental objective.

6.2.1 Explicit environmental objectives

Hypothesis 5: Milk quota regimes with explicit environmental objectives

First order effects
Where Member State milk quota regimes have *explicit* environmental objectives, then less dairying or more extensive dairying is expected to occur in certain regions of those Member States, relative to the counterfactual.

Second order environmental effects
Where Member State milk quota regimes with *explicit* environmental objectives have led to less dairying or more extensive dairying, then a range of environmental benefits (e.g. biodiversity, landscape, water quality etc) is expected to have been provided.

This hypothesis is related to Hypothesis 4 above. It assumes that any *explicit* environmental objectives address key issues relating to the dairy sector in the Member State concerned. Measures relating to the allocation and transfer of milk quota, with *explicit* environmental protection or enhancement objectives, could be expected to have contributed, on certain farms and in certain areas, to the continuation of milk production where land has been released for the purposes of improving the environment, the extensification of milk production, and the abandonment of milk production. In practice, this would equate to some, or all, of the following impacts, in certain areas: a reduction in milk production; a decrease in the number of dairy cows; a decrease in stocking density; and a change in the type, extent and management of forage crops and inputs such as fertilisers, concentrates and feedstuffs. The nature of environmental impacts is very dependent on the location of the dairying affected and the management systems used.

6.2.2 Implicit environmental objectives

Hypothesis 6: Milk quota regimes with *implicit* environmental objectives

First order effects
Where Member States have milk quota measures with *implicit* environmental objectives relating to the LFA, then milk production, dairy cows and dairy farms are expected to have been maintained in LFAs and/or other priority areas at a higher level than otherwise. Where these objectives relate to limits on milk production, levels of production are expected to be maintained or reduced.

Second order environmental effects
Where milk quota measures with *implicit* environmental objectives have led to reduced production or the maintenance of dairying in LFAs and/or other priority areas, then a range of environmental benefits (e.g. biodiversity, landscape etc) is expected to have been maintained.

This hypothesis is related to Hypothesis 1 above, which deals with regional quota mobility. Milk quota regimes with *implicit* environmental objectives in the form of geographic or other priorities/rules for the allocation or transfer of milk quota can be expected to have sustained milk production, dairy cows and dairy farms in LFAs and other priority areas at a higher level than under the counterfactual.

The nature of environmental impacts is dependent on the nature on the target areas and management systems involved. However more extensive grass-based dairying systems are likely to have been maintained in LFAs potentially with biodiversity, landscape and other benefits.

7 THE ENVIRONMENTAL IMPACT OF MILK QUOTA IMPLEMENTATION AT MEMBER STATE LEVEL

Evaluation Question 1
To what extent are the **different systems of application of the milk quota regime in the individual Member States relating to allocation and transfer of milk quota** in coherence with the obligation of integrating the environmental protection requirements into the CAP (Article 6 of the EC Treaty[54]) over the evaluation period?

7.1 Introduction

This chapter considers the extent to which the different ways of implementing the milk quota regime in Member States have impacted on various aspects of producer behaviour and, when this has occurred, the potential environmental implications of these behavioural changes.

As discussed in Chapter 6 (Hypotheses), the mechanisms set up to implement milk quotas may influence structural change in the sector (including location of milk production and size structure of dairy herds), producers' decisions regarding the type of farming system used and, for any given farming system, the degree of intensity of input use. These impacts on structure and production systems will in turn have environmental implications. Thus, the causal chain between implementation rules and environmental effects is broken down into two stages: the effect of implementation rules on *where* and *how* milk is produced (direct effects on the sector), and the consequences for these changes on the environment (indirect second order effects on the environment).

In this chapter, the evidence relating to each of our hypotheses is examined, beginning in each case with the direct effect of different quota implementation approaches on producers' decisions, followed by an analysis of the potential *indirect* environmental impacts.

7.2 Hypotheses 1: Regional quota mobility

First order effects

Member States that *either* permit market transfers only within regions *or* that allow only administrative transfers of quota under the control of local administrations experience less mobility of quota between regions than Member States that permit national markets in transferable quota to operate.

Second order environmental effects

The environmental impact of constraining or preventing regional quota mobility will vary, depending on the consequences avoided by not allowing regional transfer relative to the environmental consequences of keeping quota in its original region.

[54] Consolidated EC Treaty, Article 6: "*Environmental protection requirements must be integrated into the definition and implementation of the Community policies and activities referred to in Article 3, in particular with a view to promoting sustainable development.*"

Spatial mobility of quota can occur between sites that are rather close to each other, or between distinct regions. Our analysis focuses on mobility of quota between regions because (a) data are not available on spatial transfers within regions, and (b) transfers between regions generally have greater policy relevance (in terms of regional employment and income levels, rural depopulation and so on). Clearly, transfers *within* regions may also involve spatial relocation that is environmentally significant as appears in some case studies. However, the European data available to this study do not permit us to develop this aspect.

A basic assumption of this study is that, when quota is transferred in a free market, and especially when that market can operate without barriers at national level, there will be greater mobility of quota between regions than when transfers are geographically restricted or when they occur by local non-market reallocation. A second basic assumption is that quota will flow to areas with greater comparative advantage in dairying. This often means that quota moves to areas that are intrinsically more productive for dairying and that, consequently, dairying in more marginal areas will decline. However, it is possible that in areas that are very productive for dairying, production of other higher-value commodities is even more profitable. In this case, an outflow of quota from areas of high productivity towards areas where there is less competition from alternative land uses might be observed, even though the latter do not offer the highest rates of technical productivity.

The environmental effects of the movements in milk production will depend considerably on the location of new or expanded dairy enterprises and the management systems used. For example, if milk production moves from an area vulnerable to the leaching of nitrates and heavy metals to an area where there was greater buffering capacity, then this would be likely to have a positive environmental effect depending, of course, on farm management. However, the type of production that takes over from dairying in the area from which it has moved, as well as the systems that dairying has replaced within the region it has moved to, also need to be taken into account to assess the overall environmental impact. Although it is difficult to generalise as to the environmental impacts of quota mobility, it is likely that quota will be attracted to regions where combinations of agro-climatic, topographic and structural conditions favour higher-performance production systems, and the intensive nature of such systems tends to create environment pressures, the severity of which depends partly on farm management.

Where dairy production moves from marginal areas to more fertile, productive land, the nature of the production system is likely to change from one characterised by extensive grazing, predominantly on permanent grassland, with low inputs to one that is more intensive, with higher levels of inputs, higher stocking densities, use of more intensive, often temporary, grassland and an increased area devoted to forage crops. This shift from predominantly extensive to intensive systems often will have an overall negative effect on the environment, although the nature and extent of these impacts will vary from location to location.

Where dairy production becomes more concentrated in those areas that are most suited to high productivity, this is likely to increase the degree of environmental pressure on these areas, particularly in relation to water quality and quantity, air quality and landscape character. For example, higher levels of nutrient loading will be likely within a catchment as a result of increasing volumes of manure, higher applications of fertilisers across an increased area of temporary grass or forage maize (at the expense of permanent grassland). There will also be greater potential for increased losses to air through greater slurry production and higher levels of nitrogen fertiliser use. At the same time restrictions on farm management linked to implementation of national or regional NVZ Action Programmes have the potential to mitigate such impacts, at least in areas that have been designated as Nitrate Vulnerable Zones under the Nitrates Directive and where implementation of the Directive has been pursued effectively (see Section 4.2.3 for an overview of NVZ implementation). Particularly in drier regions, the concentration of cattle will increase the competition for water resources with other agricultural and non-agricultural uses, adding pressure to the water table, with implications for the broader environment in relation to species and habitat diversity.

The effects of regional deconcentration depend on the initial density of dairying before outflows of quota took place. If the density was high, and congestion problems were present, then relieving the environmental pressures by reducing density would be beneficial. At the other extreme, if milk production was providing positive environmental services in a particular region with low dairying density and, because of quota outflow, its density falls below the minimum level at which these services can be provided, then the environmental impact is negative.

Quota mobility is particularly pertinent to dairy activity in marginal LFAs where it tends to use predominantly grass-based systems, mainly permanent pasture, with low stocking densities. In some cases, these systems support valuable biodiversity-rich habitats such as alpine pasture. The loss of dairy production from these areas brings with it a risk of these habitats being lost and being replaced by other land uses which may be of lesser environmental quality, particularly if farms are abandoned and pasture is replaced by scrub.

Given these considerations, when examining regional mobility of quota, special attention has to be paid to any differential treatment applied to transfers in and out of LFAs, or otherwise specified vulnerable and protected areas. A liberal market-oriented regime that ring-fences such areas could offer a good solution for balancing economic and environmental objectives or at least preventing one of the more negative potential effects of totally unrestricted market transactions in quota. Member States that have operated such ring-fencing have tended to use barriers that are permeable in one direction: that is, quota can flow into these protected areas but not out of them.

Comparing the extent of regional quota mobility between Member States ideally requires long time series of quota holdings based on regional classifications at approximately the same level of disaggregation. Three types of data problems have arisen in this context. First, where regional information on quota holdings was not available, we have had to use regional data on milk production or deliveries. As long as quotas are binding, these three variables – quota, production and deliveries, or at least their changes over time – are reasonably good proxies for each other. Second, it has been impossible to obtain data on regional changes in quota distribution for all Member States since the start of the quota regime. Where these data have not been available for the early years of the period, we have taken the longest period available. Third, levels of regional disaggregation are not always comparable. Clearly, the higher the level of regional aggregation (i.e. fewer, larger regions), the fewer transfers will show up as shifts between regions. For comparisons where this might be misleading, a comment has been included.

This section begins with a detailed comparison of mobility in the UK (England and Wales), which offers the longest running example of a highly market-oriented approach (which is less true of the UK as a whole due to regional restrictions on quota mobility in place prior to the abolition of the Milk Marketing Boards in 1994), and France, where market mechanisms have not been used and administrative reallocation has favoured local producers. Environmental consequences, attributable to inter-regional mobility, are also evaluated for these two countries. In the second part of the section, there is a more general discussion of quota mobility and its effects in a number of other Member States.

7.2.1 Comparison of France with the UK (England and Wales)

General developments in France and in the UK (England and Wales)
Table 7.1 below provides some basic comparative data on the developments under milk quotas in France and England and Wales.

Table 7.1 France, and England and Wales: basic data

	France	**England & Wales**
Period covered	**1983/4 – 2006/7**	**1984/5 – 2006/7**
Number of milk producers at start of period	384,945	37,815
Reduction in number of milk producers (%)	75.5	65.6
Reduction in national production (quota) over the period (%)	12.2	12.5
Largest regional production outflow[1] (%)	17.8 (Centre)	56.9 (South East)
Largest regional production gain[1] (%)	2.9 (Massif Central)	18.1 (North)
Average output per herd at start of period[2]	66	333
Increase in output per herd (%)	158.0	54.7
Largest regional average scale, 2006[2]	375 (South West)	1162 (South East)
Smallest regional average scale, 2006[2]	183 (North)	687 (Wales)
Ratio largest : smallest average scale, 2006	2.0	1.7

1. Based on regional breakdowns consisting of 7 regions in France, and 10 regions in the UK (England and Wales).
2. Output measured in tons per herd for France, thousand litres per herd for the UK (England and Wales).

These figures indicate that:

- Producer buy-out schemes in France and the possibility for producers to cash in on quota value via the market in the UK (England and Wales) achieved comparable rates of reduction in producer numbers (and one must bear in mind that the UK had fewer very small dairy farms than France at the start of the period).

- Regional inflows and outflows of quota are substantially higher in the UK (England and Wales) than in France. It may be tempting to think that this result occurs because there are fewer regions in the classification for France, but this statistical feature cannot account for the large differences in maximum inflow and outflow. In fact, even when France is broken down into 22 regions, the greatest regional loss is only 22.9 per cent (from Poitou-Charentes) and the greatest regional gain is 15.3 per cent (in Languedoc-Roussillon). These changes are still considerably smaller than those observed for England and Wales with 11 regions.
- Scale increases have been far greater in France than in the UK (England and Wales), although the much lower starting point in France must explain at least part of this.
- The ratio of average scale in the regions with largest and smallest average scale of production is comparable in the two countries.

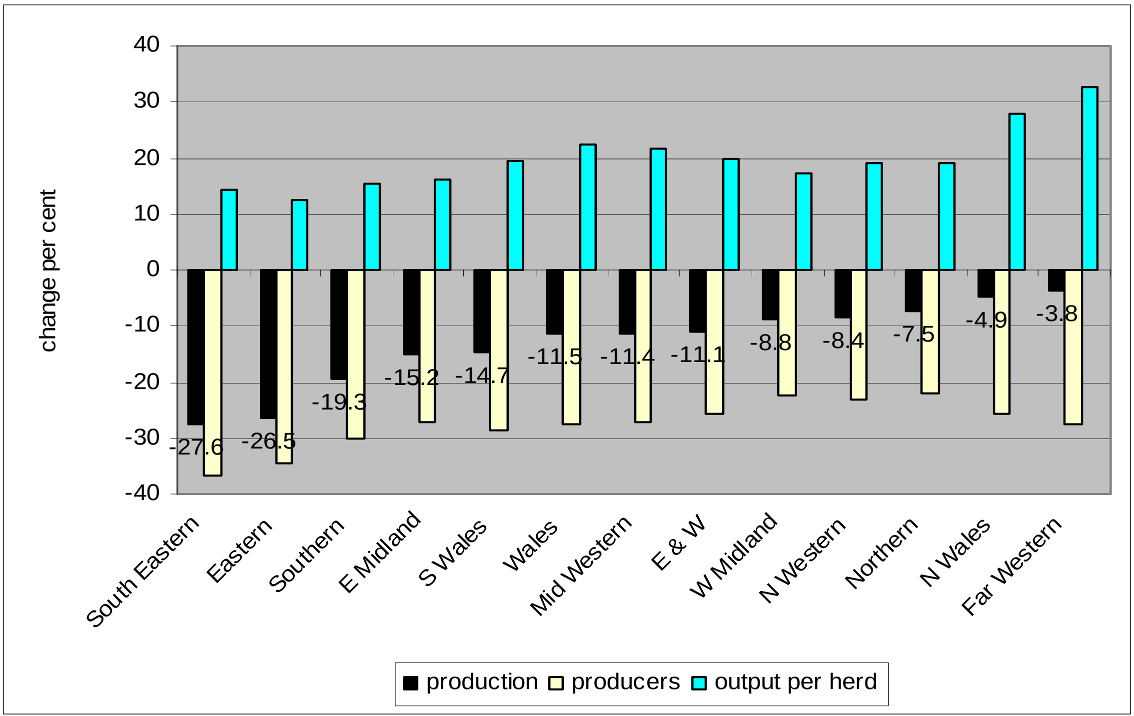
Quota mobility in the UK

For the first nine years of the milk quota regime, trading in permanent quota was permitted only within Milk Marketing Board areas, resulting in one integrated market for England and Wales, four separate markets in Scotland and one in Northern Ireland. From 1993 on, sales of permanent quota between parties anywhere the UK were permitted. A year later, the temporary leasing market was also freed from restrictions on movements within the UK.[55] It is therefore interesting to consider the first nine years separately from the whole period.

Figure 7.1 shows the regional changes in production in percentage terms during the first nine years of the scheme. Falls in production occurred everywhere but in percentage terms reductions were much higher than the England and Wales average in southern and eastern parts of England and relatively small in the South West, West and Wales. Production in the South Eastern region fell by nearly 28 per cent, but by only just over 3 per cent in the Far Western region which is a more important production region. There was less heterogeneity in the rate of reduction in the number of producers, which varied between 22 per cent and 37 per cent. Percentage scale increases are relatively large in North Wales and the Far West regions, which started the period with the smallest herd sizes. The greater rate of decline in producer numbers than in quota in every region indicates that exiting producers tended to have below average size quota holdings. This resulted in an increase in scale in all regions.

[55] Ring-fencing was retained only for the Scottish Islands, more for economic than environmental reasons.

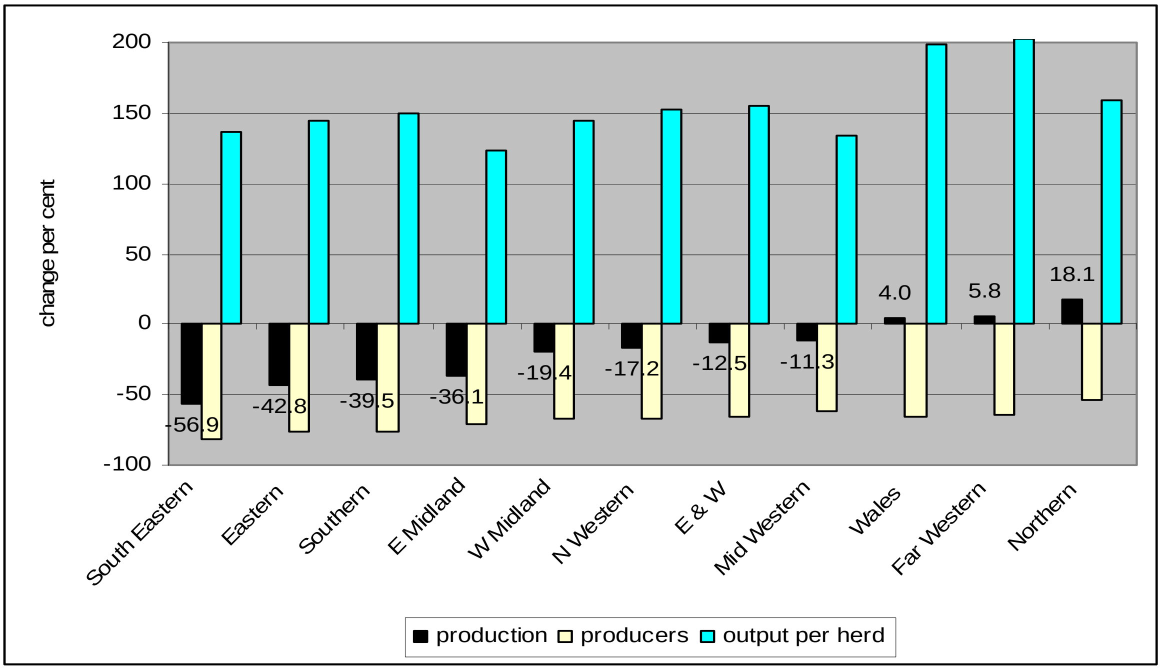
Figure 7.1 Regional changes in milk production, milk producers and milk output per herd: 1984/5-1993/4, for the UK (England and Wales)[56]



Source: Based on figures from the MMB (England and Wales) and the Milk Development Council.
Note: The figures shown in this diagram relate to the percentage change in production over the period.

[56] In the mid-1990s, the definition and composition of regions in England and Wales changed. In order to allow regional trends to be quantified over the long term, regional production levels for 2006/7 have been recalculated from county data according to the old regional boundary definitions. In particular, what is currently the English region 'South West' was in the old classification broken down into 'Far Western' and 'Mid Western'.

Figure 7.2 Regional changes milk production, milk producers and milk output per herd: 1984/5-2006/7, England and Wales



Source: Based on figures from the MMB (England and Wales) and the Milk Development Council. Note: The figures shown in this diagram relate to the percentage change in production over the period.

Over the evaluation period as a whole (see Figure 7.2), regional changes in producer numbers and average output per herd are relatively close in percentage terms to the national average changes. The fall in producer numbers ranged from 54 to 82 per cent, whilst the growth in output per head was between 124 per cent and 158 per cent (except for the outliers Wales and the Far West). However, there is considerable divergence concerning changes in quota. The pattern of gaining and losing regions is very strong: milk production fell steeply in the eastern and southern parts of England, and increased in the North, Wales and the Far Western regions. These regions have comparative advantage in milk production, and by 2006/7 they were producing 42 per cent of milk output in the UK (England and Wales). However, they are still characterised by average herd sizes (measured in terms of milk output per holding) that are below the national average. The largest herd sizes (on average over one million litres per holding) are found in the three regions that have experienced the greatest outflow of production: East, South East and South. None of these are major production regions.

The greater part of agricultural land in England is in Nitrate Vulnerable Zones (NVZs). Exceptions are in the North East and North West of England, part of the West Midlands near the Welsh border and large parts of the Mid West and Far West. Less than 3 per cent of Wales is designated as a NVZ[57]. At a regional level there therefore seems to have been some movement towards parts of the country with fewer designated NVZs. However, dairying may be expanding on the best land within these regions and within more nitrate sensitive catchments. Moreover, increasing concentration in Wales and the South West may well have had negative effects on a

[57] There is current discussion about extending NVZ designations in the UK.

variety of other environmental indicators, for which hard empirical evidence is not readily available. The crucial question concerns the totality of environmental impacts of moving some milk production from the eastern side of the country, where it is likely to have been replaced predominantly by arable cropping, to the western side of the country where dairy cattle numbers are still falling despite the larger share of national milk production found there. Given the location-specific nature of some environmental impacts, the 'total environmental impact', which involves many diverse consequences in different locations, some of which will be positive and others negative, remains an attractive concept but empirically very complex to measure.

It should be stressed that the structural *and* environmental consequences of allowing maximum quota mobility would almost certainly have happened without a quota scheme at all, and are largely the unintended by-product of economic decisions taken by profit-oriented agricultural producers. Therefore, all that can be said is that the market-oriented approach did not strongly impede these movements. Whether it allowed them to happen slightly more quickly or more slowly than would have happened without quotas in place depends on the balance of two opposing factors. On the one hand, allowing producers to sell quota without having to sell their farm and with some start-up capital for establishing other enterprises, could have accelerated the decision to quit dairying. On the other hand, quota buyers needed to find the capital not only to finance the on-farm start-up or expansion of their dairy enterprise, but also to purchase quota, and this could have slowed down these structural trends relative to the no-quota situation.

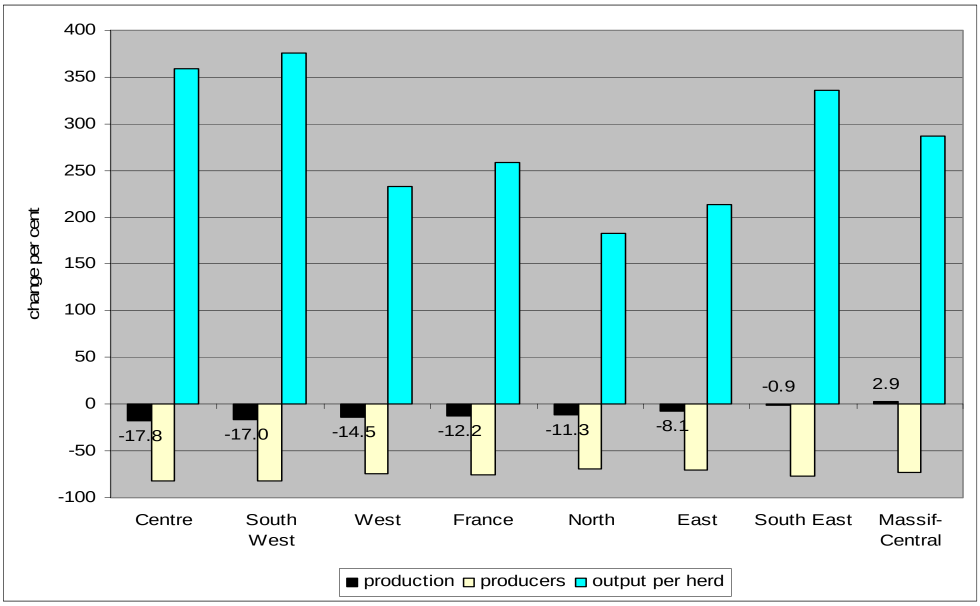
Based on the evidence to hand, regional mobility is likely to have had mixed impacts on the environment with some areas losing a significant share of dairy in the land use mix, and others gaining their share of production without necessarily more dairy cattle. It should be borne in mind that water pollution is still a significant environmental issue in many areas that are not designated as NVZ, and any increase in pressure, whether in terms of stocking density or input use, is likely to increase adverse environmental effects.

Quota mobility in France

Figure 7.3 shows the regional rates of quota loss and gain in percentage terms, ranging between a loss of nearly 18 per cent in the Centre to a gain of about 3 per cent in the Massif Central. These rates are significant but the range is much narrower than for the UK (England and Wales), indicating less regional mobility of quota in France. The reduction in the number of milk producers shows less regional variation. At national level, the reduction was over 75 per cent. The smallest reduction (North) was 7 per cent points lower, and the largest (South West) was 7 per cent points above the national average. In all regions, producers left the sector at a faster rate than the decline in quota, increasing the average scale of operation everywhere.

Four cases can be identified. First, in the East, North and Massif Central, the decline in both quota and producers was smaller than the corresponding national average, however, average output per head increased faster than the national average in the Massif Central. Second, in the South West, Centre and West, production and producer numbers both fell more steeply than the national average and yet the average scale of production also rose more sharply than the national rate in the first two regions, because of the substantially faster decline in herd numbers. Third, in the South East, production hardly changed but producers left the sector at a faster rate than for France as a whole, leading to above-average scale increases in percentage terms. Fourth, in the West the greater production fall and smaller producer exodus relative to the national picture reinforced each other to produce smaller changes in average scale.

Figure 7.3 Regional change in milk production, milk producers and milk output per herd: 1983/4-2006/7, France



Source: Based on data provided by the French Authorities in response to DG Agri's questionnaire.
Note: The figures shown in this diagram relate to the percentage change in production over the period.

At national level, output per holding increased by 258 per cent between 1983/4 and 2006/7. Percentage increases in scale were largest in the two regions (South-west and Centre) with the greatest percentage reductions in total production. This was also true at sub-regional level, where the largest increases in average scale were in areas with the greatest reduction in production. The smallest increase in average scale occurred in the North, where the scale of milk production was already relatively high at the start of the period. For the most part, the regions with the greatest scale increases started the period with below-average levels of output per herd. This means that differential rates of increase in scale have had the result of reducing regional and sub-regional scale differences. Average scale at regional and sub-regional level is now much more homogeneous across France than in 1983/4. However, production scale is still much smaller than the national average in Mediterranean areas (Rhône-Alpes, Provence, Alpes and Côte d'Azur), and in Auvergne.

The regional changes shown in Figure 7.3 mask movements towards greater concentration that are discernible in the data at sub-regional level. For example, within the South East region, production in Languedoc-Roussillon grew by over 15 per cent during the period, largely at the expense of production in Provence, Alpes and Côte d'Azur. Within the relatively small Massif Central area, production grew by about 5 per cent in Auvergne, which already produced the greater part of the region's milk, but it fell by 8 per cent in Limousin. We have not been able to ascertain whether these trends within regions produced concentration to a point where it was likely to have a significant environmental impact.

A first impression from this analysis of developments in France is that the lack of a free quota market has not prevented substantial regional quota mobility. However, the three regions responsible for over 70 per cent of France's milk production (West, North and East) experienced percentage changes quite close to the national average. The larger changes relate to less important regions. In contrast, the Massif Central, South and East regions, which gained or maintained production over the period, together account for only about 12 per cent of national production. At the same time, changes for the sub-regions *within* the most important milk-producing region (the West, with over 46 per cent of production) show similar individual rates of loss as the whole region, indicating that the net quota flows between these sub-regions were small. Therefore, in terms of the total volume of quota shifting between regions, mobility has been quite low in France.

The environmental consequences of this relatively stable pattern are hard to assess. A crucial question is whether, in a more market-oriented setting, milk production would have fallen *more* quickly in the West. Within this region, Brittany alone produces 20 per cent of French milk output. Thus, there is a high density of dairy cows. There is also strong competition from intensive livestock rearing. Nearly all of Brittany is designated as a Nitrate Vulnerable Zone (NVZ). The fall in milk production in Brittany was four percentage points higher than the national average, suggesting some lessening of interest in milk production. The question is whether, with a free quota market and presumably strong quota prices during at least part of the period, producers in the East and North regions (where quota fell less than the national average) would not have captured a greater share of Breton quota.

Chatellier (2003) believes that because administrative reallocation of the national reserve at departmental level has kept milk production dispersed widely across the territory of France, this has acted to *prevent further concentration* of pollution and other environmental stress. This may well be true for some regions but must be assessed against the background of falling dairy cattle numbers and so reduced pressures in many areas, even those gaining a higher share of national production. It can also be argued that, in other regions, the French system of local administrative management may have impeded some environmentally desirable *deconcentration*; that is, it may have prevented quota movements out of areas already subject to high levels of environmental stress towards areas with greater capacity for environmentally sustainable dairy production.

In order to highlight the consequences of the redistribution that has occurred, Table 7.2 provides evidence comparing farming systems in the Auvergne (a low-intensity LFA that gained quota) and Brittany (a high-intensity, environmentally stressed area with an above-average loss of quota). On average, stocking densities are 60 per cent higher in Brittany, farming systems use very little pasture and the use of maize silage is well above the national average. Fertiliser use by dairy farmers is also much higher in Brittany. The production system in Auvergne, typical of LFAs, is more extensive, smaller scale structures prevail and there is above average potential for positive environmental benefits from dairying. In addition, the largely positive landscape and biodiversity effects of dairying in this location should be taken into account.

Table 7.2 Comparison of farming systems in Auvergne and Brittany, averages per dairy farm

	Auvergne	Brittany	France
Total production (thousand tons), 1983/4	1031	5556	25,320
Total production (thousand tons), 2006/7	1082	4664	22,229
Percentage change 1983/4-2006/7	+4.9	-16.2	-12.2
Dairy cows per holding 1990	28.7	29.0	31.0
Dairy cows per holding 2005	39.6	42.7	42.2
Percentage increase 1990-2005	38	47	36
Quota (litres per holding), 1984	43,913	87,669	
Quota (litres per holding) (Au: 2007; Br: 2005)	151,000	260,000	
Percentage increase 1990-2007 (1990-2005)	244	197	
Stocking density 1990	1.1	1.7	1.5
Stocking density 2005	1.0	1.6	1.3
Milk yield per forage hectare (litres/ha), 2007	3,304	6,174	4,612
Land use 2005: percentage of farm area as			
Cereals	15	23	21
Forage (excluding grass)	40	68	41
Grass	45	9	38
Maize forage per dairy farm (ha), 2005	2.9	15.9	11.4
UAA on dairy specialist holdings (1990)	43.0	31.3	40.3
UAA on dairy specialist holdings (2005)	69.8	62.5	69.7
Maize forage as percent of farm area, 2005	4.2	25.4	16.3
	Massif Central	**West**	
Fertiliser cost (€/ha UAA), 1995	56	112	
Fertiliser cost (€/ha UAA), 2004	60	91	

Source: France case study based on FADN, Commission questionnaire.

This evidence suggests that France's non-market approach, which takes account of objectives other than those driving market exchanges, has helped to maintain milk production in LFAs[58] although other factors also will have played a role. Nearly one-fifth of total milk output is produced in the most marginal areas. In an unrestricted quota market, without any ring-fencing, quota probably would have been sucked out of these relatively less profitable areas with potentially negative environmental effects.

The policy of favouring or protecting LFAs in terms of quota reallocation alongside other policies (such as LFA support) and market factors like the high value of some

[58] The issue of LFA milk production in relation to implicit environmental objectives of national milk quota regimes is discussed further in Section 8.4.

cheeses made in the uplands and mountains has helped to keep one third of milk producers in these areas, which contributes to the sustainability of the local economy.

At the same time, if France's non-market approach has also restrained market forces that would have drawn quota out of Brittany towards regions with production systems closer to the national average, then some environmental improvements may have been foregone. Thus, it is not possible to reach an overall conclusion at national level regarding the environmental consequences of the constraints and incentives imposed on quota mobility by France's implementation rules.

7.2.2 Quota mobility in other Member States

Having compared regional mobility of quota between two countries at opposite ends of the 'market-orientation' spectrum, we now examine evidence from the five other case study Member States, most of which occupy intermediate positions in the ranking of Member States by restrictiveness that is presented in Chapter 5, Table 5.1. In each case, the questions addressed are:

- Is the degree of regional mobility found in line with predictions based on the relative restrictiveness of their implementation rules?
- Are there country-specific characteristics of mobility patterns that provide additional insights into the way implementation rules have influenced mobility?
- What are the observable, or potential, environmental effects of the shifts that have occurred?

The Member States analysed are, in increasing order of market orientation, Ireland, Germany, Spain, Italy, and the Netherlands.

Ireland

Regional data for studying mobility of quota from 1984 until recent years are not available for Ireland. This is because restrictions on quota movement apply to the milk purchaser rather than the general location of the individual farmer. However, it is widely thought that allowing landless quota transfers only between producers who supply to the same purchaser, and the ring-fencing of all disadvantaged areas in Ireland in respect of land transfers, have prevented strong shifts towards the South and East, where farms are larger and more intensive, and have lower unit costs. This suggests that, by preventing the flow of quota to these regions, quota implementation rules have helped to prevent some level of negative environmental impacts that would otherwise have occurred.

Some data are available for the sub-period 1993/4 to 2000/1, and they are presented in Table 7.3. It is striking that, despite the lapse of some years and the increase of national quota in 2000/1 due to Agenda 2000, the regional shares have remained constant. This confirms the expectation that Ireland's implementation rules have worked very effectively against mobility of quota between regions.

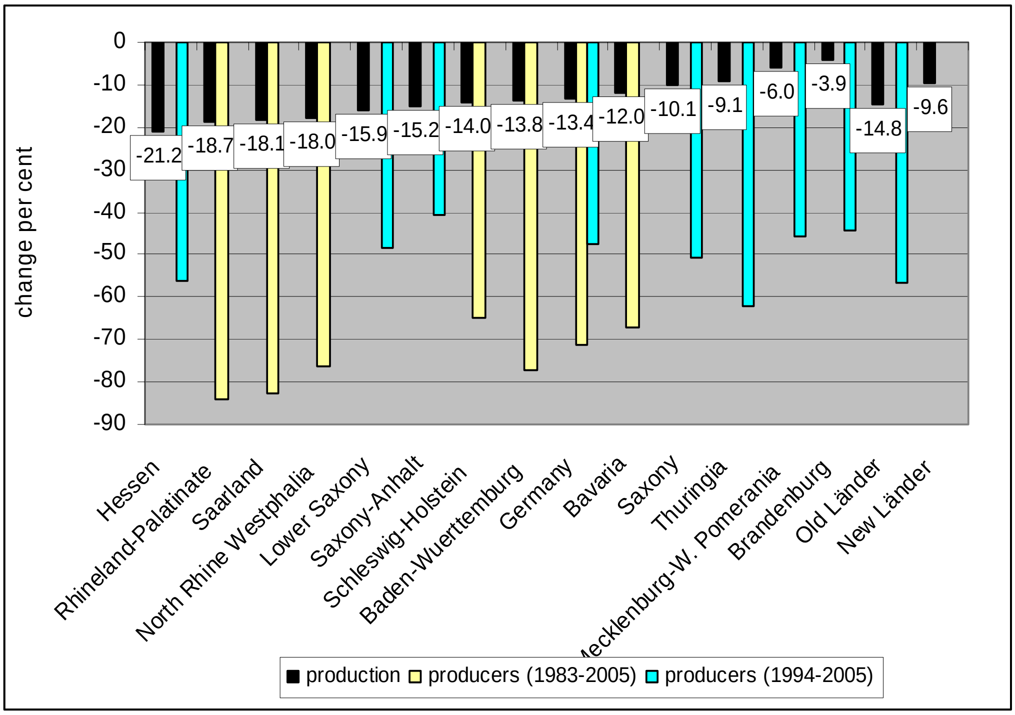
Table 7.3 Regional shares of quota, 1993/4 to 2000/1, Ireland

Quota held (thousand tons)	1993/4	1996/7	1999/2000	2000/1	Percentage Shares (%)	
					1993/4	2000/1
Connaught	136.4	134.3	134.0	137.3	2.61	2.58
Ulster	650.5	638.1	635.5	644.6	12.44	12.13
Leinster	1,531.0	1,533.5	1,531.9	1,554.4	29.28	29.26
Munster	2,910.3	2,926.2	2,922.4	2,975.6	55.66	56.02
Total	5,228.2	5,229.9	5,223.9	5,311.9	100.00	100.00

Source: DAF (2007)

Germany
In Germany, quota trading has been constrained to take place within regions. Until 2006, there were 27 quota regions, creating substantial restrictions on geographical movement of quota. Any discernible inter-regional shifts prior to 2007 will be due to reallocations from the national reserve. In mid 2007 these regions were amalgamated to form two large regions (consisting of the old and the new Länder, respectively), with trading by auction within each region.

Figure 7.4 Regional changes in milk production and milk producers, 1983/4-2006/7, Germany



Source: Based on data provided by the German Authorities in response to DG Agri's questionnaire.

Regional production data are available for the whole of Germany from 1983/84 and different rates of change in production up to 2006/07 are shown in Figure 7.4. However, data on the change in producer numbers were available only for the last 13 years of that period for the new Länder and several of the old Länder. The figure indicates which period the change in producer numbers relates to.

Among the old Länder, most quota changes have been within 3-4 percentage points of the 14.8 per cent average reduction for the old Länder as a whole. The three central western Länder with the greatest reductions (Hessen, Rhineland-Palatinate, and Saarland) are relatively unimportant for agriculture with a modest share of milk production. Here, the net rate of decline in producer numbers was steep, which freed up a relatively larger share of a limited quota volume for redistribution via the national reserve. Otherwise, as expected, the shifts of quota between regions have been relatively modest. The rates of decline in production between the old and new Länder are not comparable, as quota limits were fixed for the new Länder only at reunification in 1990, with the allocation depending on a number of factors. Among the old Länder, only Schleswig-Holstein and Bavaria have increased their share of total production, whereas among the new Länder, only Saxony and Saxony Anhalt have seen their shares of the new Länder total decline.

Compared with the pattern observed in France, it is striking that no regions actually gained or maintained quota. This suggests that the policy of quota redistribution from the national reserve in France was more proactive in terms of regional policy objectives like prioritising demands from less favoured areas than in Germany.

The environmental impacts of the restrictions on quota movement in Germany are not clear cut. In some areas of Schleswig-Holstein and Lower Saxony, milk production in the early 2000s was taking place at the highest rates seen in Germany (greater than four tons per hectare of agricultural land in areas north of Bremen, and between three and four tons per hectare in other parts of Lower Saxony and southern Schleswig-Holstein) (Isermeyer *et al*., 2006). Moreover, within the old Länder, these two northern regions have the largest average herd sizes and are ranked at, or near the top, in terms of milk yields, suggesting the use of more intensive farming systems. These regions have a low incidence of LFAs (where production methods are generally more extensive), and a lower concentration of organic milk production than in Baden-Württemberg, Bavaria, Hessen and some parts of the new Länder. Elsewhere in Germany, the very intensive systems observed in Lower Saxony and Schleswig-Holstein are found only in parts of southern and south western Bavaria, several areas in North Rhine Westphalia and the easternmost part of Baden-Württemberg.

According to the case study expert, while milk production has declined in alpine areas in Bavaria (largely LFA-designated), this has not necessarily led to a decline in the environmental value of these habitats. Alpine pastures are increasingly used for grazing young livestock that have been moved from the valleys to avoid stocking density restrictions. This type of grazing is specifically targeted by agri-environment support (Bavaria's KULAP programme for cultivated landscape). There is also, however, some anecdotal evidence of both abandonment and the introduction of cereal crops in certain areas, particularly where beef production is unprofitable, but it has not been possible to obtain empirical evidence to support this as part of this evaluation.

During the second part of 2007, when quota trading by auction across all regions of the old Länder was introduced, some quota flowed out of the south (Baden-

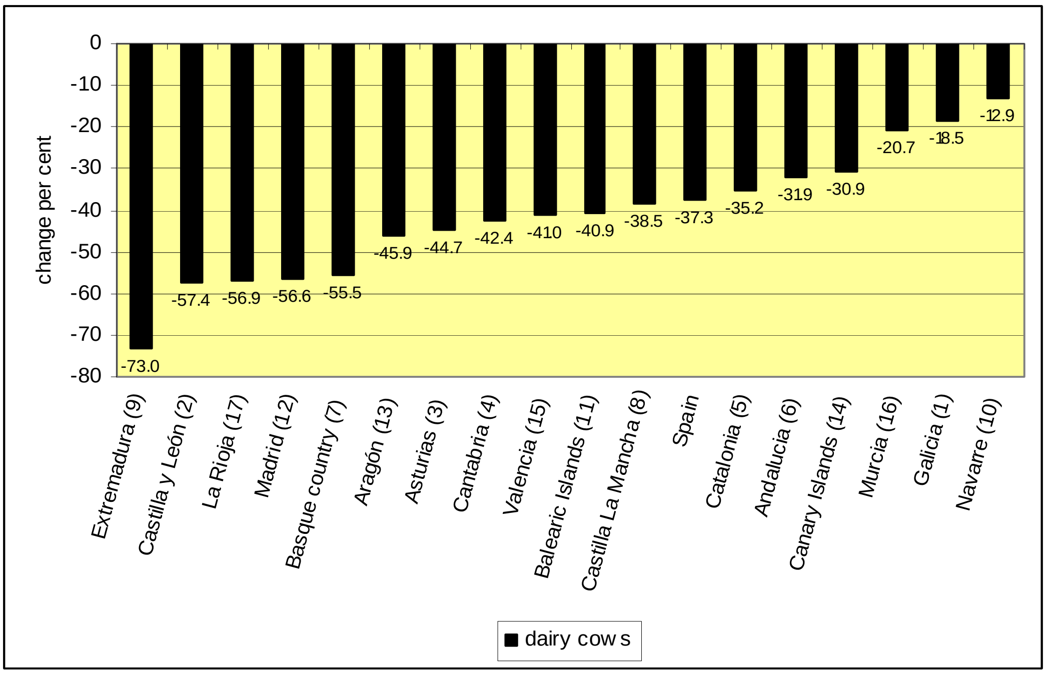
Württemberg and Bavaria lost 37,161 and 22,900 tons, respectively) whilst Lower Saxony and Schleswig-Holstein together gained 88,898 tons. These initial market forces suggest that, at least in the years immediately preceding 2007, regionalisation of quota trade had been preventing a relocation of production from the southern to the northern old Länder. However, more recently milk quota has started to flow back towards the southern Länder. However, since both areas contain pockets of high density and highly intensive dairying, it is impossible to identify any potential environmental consequences without a detailed analysis of the source and destination of these flows at a much lower level of disaggregation.

Spain

In 2005/6, four North Western regions – Galicia, Castilla y León, Asturias and Cantabria – produced two-thirds of the total milk produced in Spain. Galicia alone was responsible for 35 per cent. With Catalonia in the North East and Andalucía in the South, these six regions supplied over 84 per cent of Spain's national production.

Regional data on allocated quota, production or deliveries were not available for Spain over a long time period. Therefore, we have looked at regional data on changes in dairy cow numbers for 1990 to 2005. Percentage changes in dairy cow numbers over this 15-year period are shown in Figure 7.5. There are strong regional differences relative to the national average reduction of 37.3 per cent. Note that the number in parentheses after the name of the region shows its ranking in terms of dairy cow population in 1990. Among high-ranked regions, several have lost relatively fewer cows (Galicia, Catalonia, Andalucía) whilst others have lost relatively more cows (Castilla y Léon, Asturias, Cantabria).

Figure 7.5 Change in dairy cows, 1990-2005, Spain



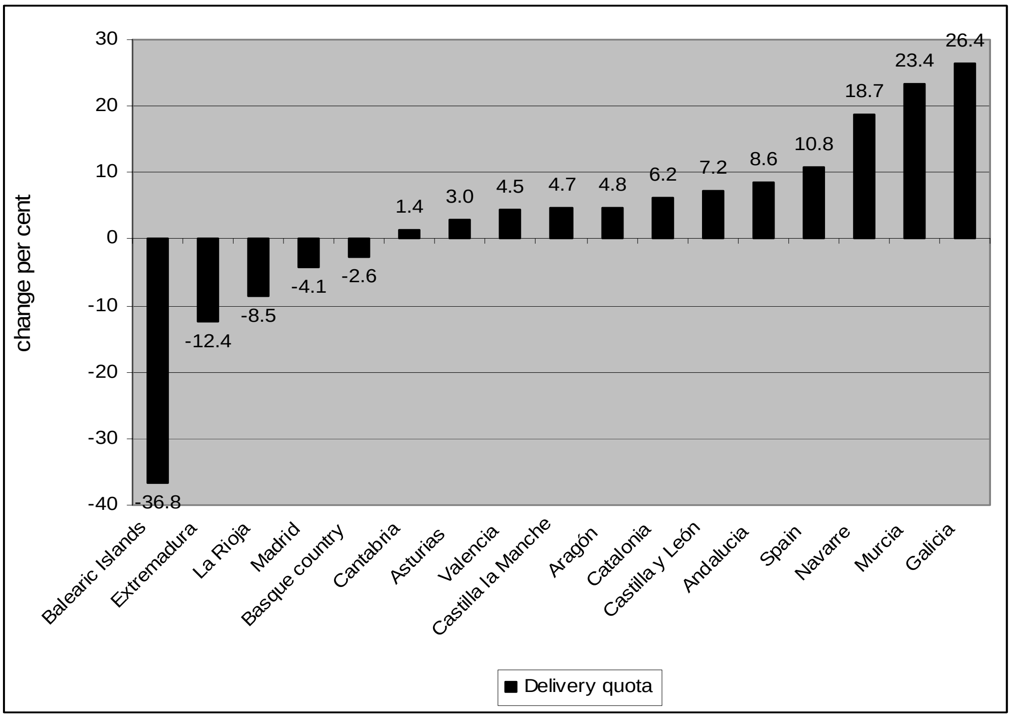
Source: Farm Structure Survey.

Unfortunately, these data are not a perfect substitute for data on changes in allocated quota or deliveries, because of possible regional differences in the rate of growth of milk yield per cow. If yields had been growing at the same rate in each region over time, and quota allocations remained fixed, then all regions would have had the same percentage reduction in cow numbers. However, if yields were growing faster in some regions, then cow numbers in those regions would be declining faster even with unchanged quota shares. Thus, two phenomena – changes in quota and differential yield growth – are confounded in Figure 7.5.

Regional data for both production and cow numbers are available for 2005, from which yields in 2005 have been calculated. There is considerable yield variation over regions. Extremadura had the lowest average yield (about 4.5 tons per cow), suggesting slow yield growth since 1990. It is likely that most of the reduction in dairy cow numbers in that region over the period was due to falling production. However, Castilla y León and La Rioja had very high average yields (about 3 tons above the national average of 6.5 tons per cow), raising the question as to whether their sharp loss in dairy cow numbers over the 20-year period was due to rapidly rising yields (from, for example, a shift to more intensive farming systems) rather than to falling production.

In an attempt to shed further light on this question, we have also looked at data on the regional allocation of delivery quota which are available only from 1999/2000 to 2005/6. Changes in regional allocation over this much shorter time period are shown in Figure 7.6.

Figure 7.6 Regional changes in delivery quota, 1999/2000 to 2005/6, Spain



Source: Based on data from the Spanish Ministry for Agriculture, Fisheries and Food (MAPA).

In this most recent period, three regions – Galicia, Murcia and Navarra – had larger increases than the national average, and hence gained quota share. However, given the

10.8 per cent increase in delivery quota at national level (as part of Agenda 2000), all regions except five gained at least some extra quota in absolute terms. Over this period, Galicia's share of total quota increased from 30.8 per cent to 35.2 per cent (an extra 443 thousand tons). The national shares of Navarra and Murcia are small – just 3 per cent and 0.5 per cent, respectively.

The Spanish case study provides some evidence, much of which is anecdotal in nature, on the environmental implications of these regional changes. These appear to be quite varied with the majority either neutral or negative from an environmental perspective. Land released from low-intensity milk production in Extremadura has been taken over largely by suckler beef production, which may be a relatively neutral or positive change. However, accumulation of quota in Galicia is potentially quite negative for the environment. Land is scarce in Galicia, and especially the smaller farms have difficulty in expanding their area. The signs of concentration are manifest in high stocking rates, a trend away from grazing systems towards indoor systems relying on silage and increasing use of purchased feeds. The production system in the North West Atlantic regions has traditionally been small-scale, based on grazing and mowing (for hay) of permanent grasslands. Over the past twenty years most of these grasslands have been improved by reseeding and fertilisation. Maize was always an important forage crop in these regions as a grain crop but nowadays it is used more for silage. Stocking densities on farms surveyed in Galicia and Navarra increased from an average of about 2 LU/ha to 3LU/ha since the early 1990s, and can reach 5 LU/ha on the most intensive farms. Entirely indoor systems are becoming increasingly common, especially for larger holdings. The land area of the holding under such systems is primarily for the disposal of slurry, and feeds are purchased from off the holding. These may include forage produced on other farms, and compounds from feed companies (Spain case study).

According to the Spanish case study, most of the permanent transfer of quota without land between 1998 and 2005 was by private sale. Quota could be traded between regions only if justified on grounds of either improving the production structures of the recipient holding, or extensifying production, in which case the resulting stocking density must be at or below 2LU per forage hectare. Inter-regional transfers from the national reserve occurred only if demand within the region fell short of quota abandoned within the region. It is not easy to understand how the implementation of these cautious rules has nevertheless led to an increasing concentration of quota in Galicia over this relatively short time period. The question arises as to whether these rules were at all constraining on the process of concentration that would have occurred in a completely free quota market. Only if this were the case would the implementation rules have delayed even more profound concentration and associated environmental stress in the North West. It is not possible to answer this question definitively from the information available[59].

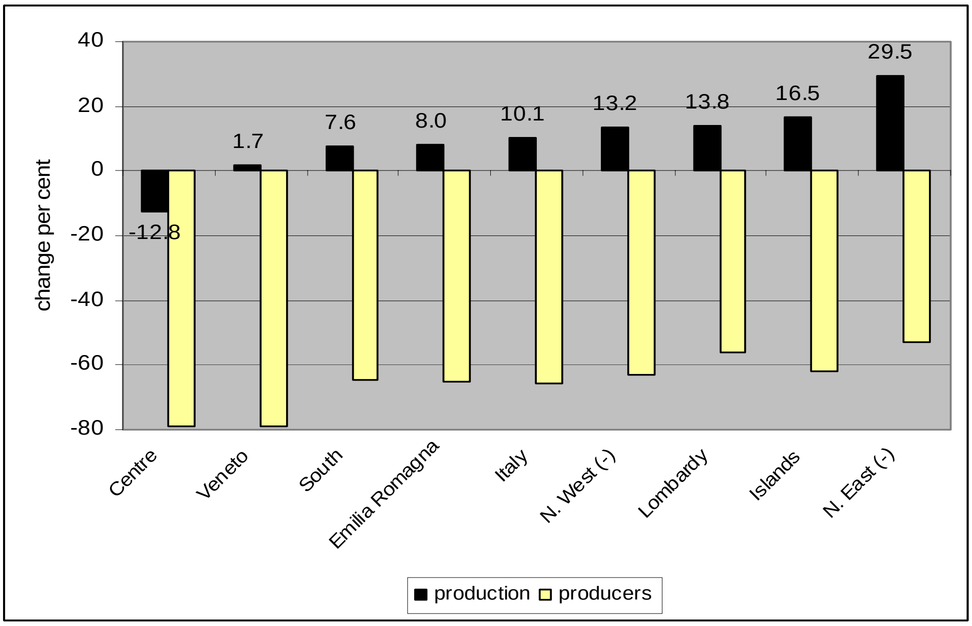
The Spanish case study reports that considerable concentration of production has also occurred *within* regions, with production shifting from more marginal locations (for example, the uplands) to more productive lowland and coastal areas, and nearer to

[59] See Chapter 8 for discussion of Spanish milk quota rules with explicit and implicit environmental objectives.

urban centres. Where production has survived in marginal areas, this too has become concentrated on the better land. It is not clear whether this occurred during the 1998-2003 period when quota transfers from LFAs were restricted, or whether it is a more recent phenomenon. According to the case study, habitats that have previously been maintained by extensive dairy management, particularly within upland areas, are either being replaced by grazing (suckler cows, sheep, and horses), abandoned or, as is more commonly the case, afforested, the example being given of an increase in eucalyptus planting in response to incentives for afforestation. Afforestation with eucalyptus in this context leads to the loss of open landscape and habitat, and often increases fire risk.

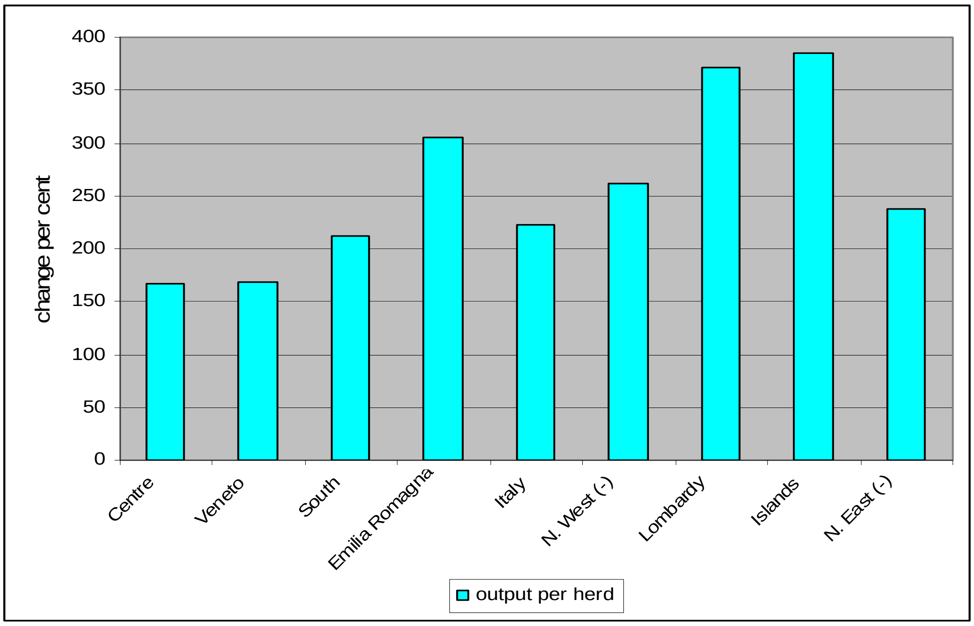
Italy
In Italy, milk production has traditionally been concentrated along the Po Valley, in the regions Piedmont (where the Po rises), Lombardy, Emilia Romagna and Veneto. In these areas, the great majority of milk producers use intensive farming systems with potentially greater negative environmental consequences than in most other parts of Italy. Lombardy, Emilia Romagna and Veneto alone are responsible for two-thirds of the milk produced in Italy, and no other region except Piedmont (with about 8 per cent of production) produces more than 4 per cent of the national total. These four regions always produce over quota, and hence, as well as their predominant share of quota, they benefit each year from temporary unused quota from elsewhere in the country. The fact that there is always unused quota in most of the other regions is perhaps due to the Italian regulation that prohibits a producer from leasing out unused quota for more than two consecutive years (in the third year, he cannot lease).

Figure 7.7 Regional changes in milk production and producers, 1993/4-2006/7, Italy



Source: Based on data provided by the Italian Authorities in response to DG Agri's questionnaire
Note: Regions are NUTS 1 level with the following exceptions: a) Emilia Romagna and Veneto are disaggregated from North East region (hence N. East (-); b) Lombardy is disaggregated from North West Italy (hence N. West Italy (-)).

Figure 7.8 Average regional changes in milk output per herd, 1993/4-2006/7, Italy



Source: Based on data provided by Italy to the European Commission.

There are 20 administrative regions in Italy, and production data are available at that level of disaggregation for the last 15 years. However, because of the low importance of most of these regions for milk production, a higher level of aggregation is used here. Specifically, we adopt a classification based on the five NUTS 1 regions, but have taken Emilia Romagna and Veneto out of the North East region, and Lombardy out of the North West region, in order to show them separately. The areas that remain in these two NUTS 1 regions are shown as North East (-) and North West (-) respectively. This results in eight separate regions for Italy. The North West without Lombardy consists almost entirely of Piedmont.

Figure 7.7 and Figure 7.8 show the percentage changes in milk production, milk producers and output per herd for these eight regions. Two separate figures are used because of incompatibility of scales between the two.

Between 1995/6 and 2005/6, Italy's total quota increased by 804,000 tons (8.3 per cent). Figures from the Italian case study report show that Lombardy steadily increased its quota holding over the same period, so that by 2005/6 producers in Lombardy held 459 thousand tons more quota than in 1995/6 (a 13 per cent increase). Quota in the other three Po valley regions also increased but at a somewhat slower rate, and this movement appears to have stabilised (Piedmont) or slightly fallen back recently (Veneto & Emilia Romagna), to the further benefit of Lombardy. Thus, not only is Italy's milk producing capacity shifting to this highly productive northern area, but also its concentration *within* the area is increasing. There is concern that, with drier summers expected due to global warming, such concentration of dairy cows will exacerbate competition for water with other agricultural and non-agricultural uses, resulting in a falling water table and destabilisation of the ecological balance. Figure 7.8 shows that over this 10-year period, average output per herd in Lombardy grew by over 350 per cent, a very rapid increase in scale.

When dairy farms are classified as extensive or intensive according to whether they have fewer or more than 1.4 LU per hectare, it appears from FADN data that, in each of the mainland NUTS 1 regions, around 70 per cent or more of holdings are intensive. Comparing data for 2000-5 with data for 1990-5, the proportion of farms using an intensive indoor system and those using an extensive outdoor system have both increased (from 48 per cent to 55 per cent, and from 14 per cent to 17 per cent, respectively). The proportion of farms using an intensive outdoor system has remained roughly constant, whereas the proportion of those using an extensive indoor system has fallen from 22 per cent to 11 per cent (Italy case study). In all four categories, there has been a shift away from fodder crops towards the use of purchased feedstuffs. Compared with the North, however, there is still more reliance on fodder crops in the South and Centre. Average figures for production systems in the North East and North West combine the large intensive indoor systems of the Po Valley with small extensive farms in LFAs, and do not reflect the full extent of intensification in the Po region itself.

The rapid shift of quota to the large intensive farms in the North has been at the expense of small, generally more extensive farms in the South and Centre. In order to keep production in marginal areas, LFAs have been ring-fenced with respect to quota movements, and since 2003 an inner ring-fence has also acted to keep quota within mountain LFAs[60]. As in France, but to a lesser extent, a sizeable proportion of total milk production comes from these generally less intensive systems in Italy.

Thus, Italy’s implementation policy has both allowed production to become more concentrated in its most productive area, with potentially environmentally damaging consequences, whilst at the same time broadly preserving production in the LFAs.

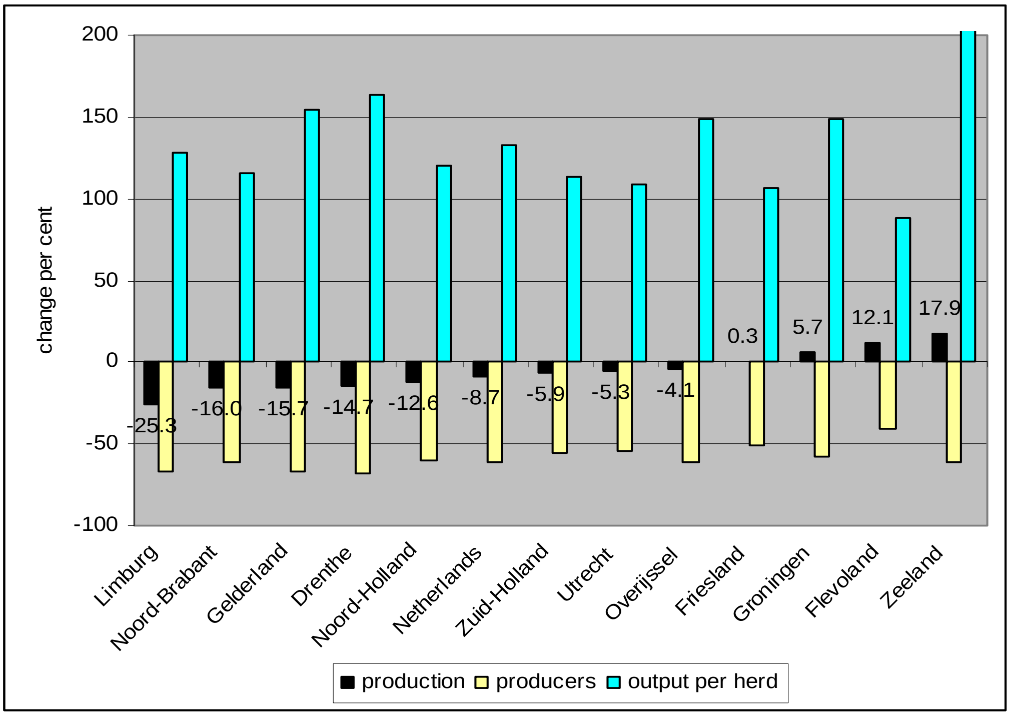
The Netherlands

Figure 7.9 shows regional changes in percentage terms over the entire quota period at the level of the twelve Dutch provinces. Five provinces had above-average falls in production, implying losses of quota share. In three regions, by contrast, production levels increased and in a fourth, production remained more or less constant. Zeeland and Flevoland – the largest gainers in percentage terms – are responsible for very small shares of total output and can be disregarded. Moreover, these provinces have a very low average density of milk production per square kilometre, so the purely regional (as opposed to farm level) concentration seems unlikely to have given rise to significant environmental stresses.

---

60 See Chapter 8 for discussion of Italian milk quota rules in relation to implicit environmental objectives linked to LFA production.

Figure 7.9 Regional changes in milk production, dairy producers and milk output per head, 1984/5-2006/7, the Netherlands



Source: Based on data provided by the Netherlands to the European Commission.
Note: Figures show percentage changes in production levels.

The two areas with the highest density of milk production are the predominantly agricultural provinces of Friesland and Overijssel, which together were responsible for a third of Dutch production in 2006/07. These two regions increased their share of national quota, if not their absolute production level. Milk production in these regions was 589 and 543 tons per square kilometre, relative to the national average of 328 tons per square kilometre, in 2006/07, implying 80 or more dairy cows to the square kilometre (0.8 dairy cows to the hectare). These figures are indicative only of differences between provinces, and should not be interpreted in an absolute sense. A more meaningful measure, not available at the time of writing[61], would be the total number of livestock units per hectare of land used by agriculture.

A major environmental problem in all agricultural areas of the Netherlands is nitrate pollution of water courses and ground water, particularly in the South where there is a high concentration of intensive livestock production. At first sight, therefore the shift of milk production out of the Southern provinces of Limburg and North Brabant, where intensive livestock production is also very dense, would appear to have been beneficial. However, it has been argued that, given the overall limits on livestock slurry disposal imposed by the Dutch manure policy, the exodus of some milk production from that region has simply permitted the further expansion of intensive pig and poultry production. Given the greater availability of land in the North and East, it is likely that the shift of some milk production into this region may have

[61] Data indicating number of dairy cows per forage hectare were obtained for the Netherlands at national level between 1990 and 2000 (see Table 2.7) but not at regional level.

permitted slightly less intensive management practices in these provinces relative to the south.

The Netherlands case study shows that there have been reductions in water pollution from livestock farming in the Netherlands in recent years. For example, the quantity of nitrogen in manure has fallen by 35 per cent since 1995 and phosphate levels, measured in kilograms, by 23 per cent. However, this seems to have been attributable to the falling number of dairy cattle and more stringent manure policy rather than changes in the distribution of milk production.

Clearly, the extent of regional mobility in the Netherlands is considerably less than that observed in the UK (England and Wales). However, given the size of the country, the very dense pattern of agricultural production and the fact that, land use is constantly being optimised as market conditions change, the extent of the changes in regional production shares observed over the last 20 years or so is what would be expected in such circumstances of a regime with an unconstrained quota transfer market. It may have been close to what would have been observed in a no-quota situation.

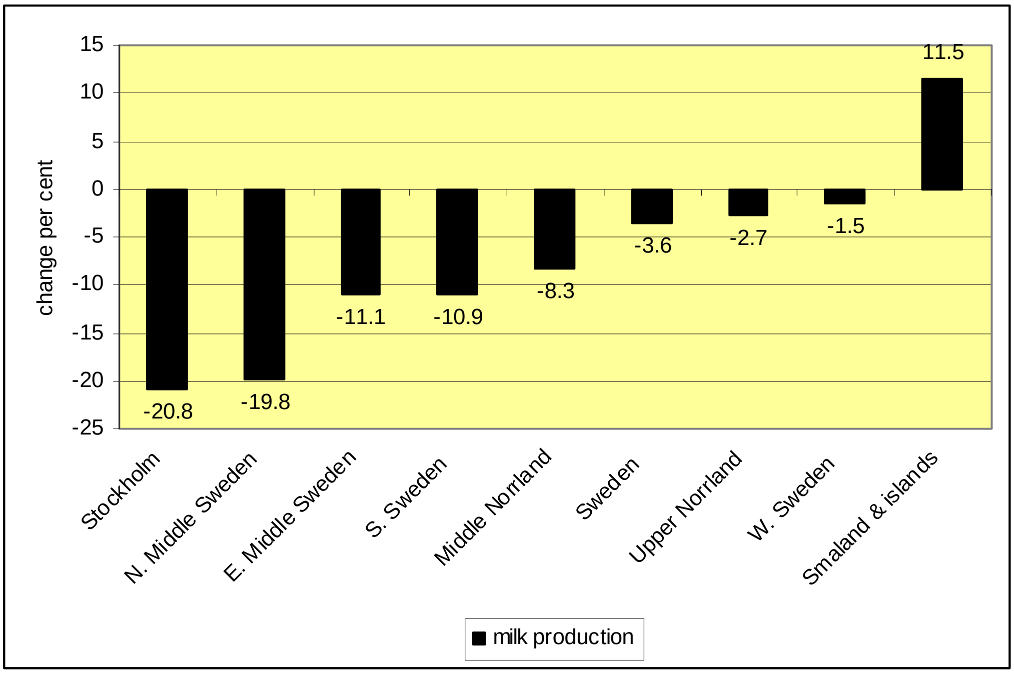
Other Member States
Based on available data, regional mobility of production, and therefore quota, has also taken place in some other Member States, for example Sweden and Greece, although it has not been possible to obtain data which might have enabled an assessment of the environmental impacts of this quota mobility.

Regional data on milk production in Sweden, which has relatively free market transfers for quota without land[62], indicate that between 1995 and 2006 a significant amount of redistribution has taken place (see Figure 7.10 below). It is noticeable that production in the ring-fenced trading zone in the north of Sweden[63] (accounting for less than 20 per cent of national production) has declined, while West Sweden and Småland, both located within the main trading zone, have been the beneficiaries relative to the national average.

[62] In Sweden there are two trading region with one of these accounting for more than 80 per cent of national production. The other trading region is located in the north of Sweden.

[63] Corresponding to the regions of Upper Norrland, Middle Norrland, and most of North Middle Sweden (see Figure 7.10).

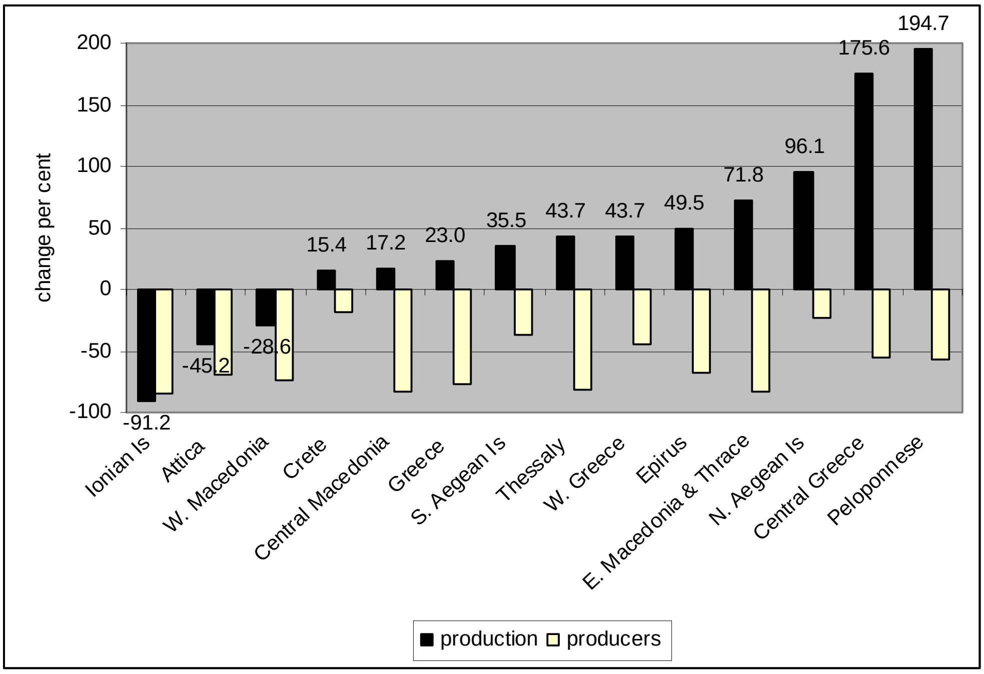
Figure 7.10 Regional changes in milk deliveries, 1995/6-2006/7, Sweden



Source: Based on data provided by Sweden to the European Commission.

Greece also operates a relatively free quota market without regional restrictions on quota mobility. The main production regions are Central Macedonia, Thessaly and Eastern Macedonia & Thrace, together accounting for approximately three quarters of national production. Between 1993/94 and 2006/07 Greece increased national quota by 23 per cent. Figure 7.11 shows that there has been a great deal of variation in the patterns of regional production over this period. Most, but not all, regions have increased milk production but with significant differences between regions. The Figure also indicates that over the same period the number of producers has declined in all regions, indicating that the underlying trends in restructuring have continued.

Figure 7.11 Regional changes in milk production and milk producers, 1993/4-2006/7, Greece



Source: Based on data provided by Greece to the European Commission.

7.2.3 Summary

Regarding the first order effects, quota mobility between regions appears to be considerably greater in Member States where a relatively free quota market has been operating. Regional quota mobility was most pronounced in the UK (England and Wales), and there was also substantial mobility in the Netherlands. In Germany, where separate quota markets have operated within 27 regions, there was only modest mobility between regions, mainly through the national reserve. Mobility was also restricted in France, although it is clear that some areas have been prioritised for redistribution, resulting in a slightly more dispersed pattern of regional changes than in Germany. It has to be borne in mind that in larger countries like the UK and France, the scope for inter-regional differences in comparative advantage and so in production shifts between regions is greater than in smaller countries like the Netherlands.

Despite the restrictions on their transfer markets, there is strong evidence of increasing regional concentration in Spain and Italy. However, these two countries differ regarding their policies towards marginal areas. In Italy, market transfers out of LFAs have not been permitted for some years, and more recently mountainous areas *within* LFAs have been specifically protected in this way as well. This policy is less proactive but also more explicit than what appears to have been happening in France, but as a result of their policies both countries have succeeded in keeping a significant share of production in marginal areas. No such policy was reported for Spain, and it appears that production shifts out of marginal, upland areas have had environmentally negative impacts as a result, through land abandonment or through the adoption of environmentally less benign alternative land uses.

In many Member States, the regions that have experienced the largest net loss of quota are those where milk is a small element of local agricultural production, although there are also exceptions to this rule.

Inevitably, the evidence relating to the second order environmental effects of this hypothesis is more impressionistic, and conclusions are not straightforward. For some Member States (for example, Sweden), where marked regional mobility trends were found, information was lacking to indicate the likely environmental consequences. In other Member States, where environmental information was available, it is clear that the second order environmental effects need to be addressed at a relatively more disaggregated level, and that it would be very difficult to aggregate different, somewhat conflicting consequences in different parts of the country to reach an overall, national level assessment. However, the discussion has indicated the range of different potential consequences that have been triggered by different implementation features of quota transferability.

In many Member States, milk production has been stable or fallen over the period and those regions gaining share of output will not necessarily have experienced an increase in milk production. In most cases, the number of dairy cows will have fallen but they will have concentrated on a smaller number of farms. Environmental effects arise from concentration at the regional, local and farm level and the regional element may not be most significant. In regions gaining share of national output there is a potential concern about a growing concentration of pollution but this may be more than offset by the influence of environmental regulations, improved management, particularly of nutrients, and in some cases better conditions for dairying.

In those regions losing relative share, there are likely to be benefits in terms of reduced pollution pressures, although the southern Netherlands presents an interesting but exceptional case where declines in dairying may have allowed expansion of other intensive livestock production systems. The subsequent management of land where dairying has ceased is difficult to determine but crucial for assessing the environmental impact. Arable land is one possibility, for example in parts of France and Germany, and beef or sheep production is a common alternative in more pastoral areas such as Ireland, the west of the UK and parts of southern Germany. Spain was one of fewer countries where outright abandonment was reported, albeit anecdotally. Both positive and negative outcomes are possible, with the evidence pointing to a reduction in pollution load and landscape diversity and loss of biodiversity where extensive High Nature Value (HNV) dairy systems – now rare -, are lost.

Some Member States such as France and Italy have succeeded in keeping a sizeable share of production in the LFA, where farming tends to be less intensive. This is explained further in Chapter 8. Within some LFAs, however, concentration is occurring, as illustrated by the Auvergne.

The examples of market-driven quota mobility cited from Italy and Spain suggest that, in those countries, economic forces have moved quota and production into areas already under environmental stress, and have contributed further to that stress by exacerbating concentration. Thus, a high degree of quota mobility can be both beneficial and/or harmful for the environment, depending on the characteristics of quota-gaining and quota-losing regions.

It is not surprising that a simple relationship between degree of quota mobility and negative environmental consequences cannot be found, since the regional shifts that national policies either restrain, or allow to continue to varying degrees, are driven by economic, not environmental, considerations. Whether or not these economic forces attract quota to areas of greater or less environmental fragility does not follow a predictable pattern, since by definition environmental costs are not reflected in farming costs. However, since economic forces recognise more profitable production systems, it is likely that quota *will* be attracted to regions whose combination of agro-climatic, topographic and structural conditions favour higher-performance production systems and these systems themselves may well create more environmental pressures, depending on how the farms are managed.

7.3 Hypothesis 2: Scale increases and intensification

First order effects

Restrictions on quota mobility between producers will slow down increases in average herd sizes, which is likely to slow down intensification of production methods (including higher input use and stocking densities). There may also be implications for the degree of specialisation in dairying.

Second order environmental effects

In general, more intensive production systems are associated with greater negative environmental impacts. Therefore, adverse environmental effects that are mitigated by regimes that restrict quota mobility between producers include:

- **Greater use of concentrated feeds/silage maize will often have negative impacts on the environment, particularly in relation to water quality/biodiversity/landscape.**
- **More production within indoor systems although the relative environmental impacts of indoor versus outdoor systems depend significantly on specific features such as provisions for manure management and stocking densities.**
- **Changes in breed of dairy cows – from local varieties to more input-demanding breeds or dual purpose breeds – are likely to have negative environmental impacts on soil, air and water and possibly on traditional landscape values although they may be beneficial in terms of greenhouse gas emissions.**
- **Higher stocking densities associated with greater aggregate negative environmental impacts unless offset by better management.**

For some decades before the imposition of milk quotas, there was a steady upward movement in the size distribution of herds, as very small dairy farms either closed down while a smaller number of somewhat larger farms grew in size, or were taken over by existing farms, which expanded as a result. The economic pressures driving such scale increases within agriculture are very strong, for two reasons. First, the minimum resource base that allows a producer to survive in commercial farming has been continually increasing. Second, the growing sophistication and capital intensity of dairy farming has favoured a trend towards specialisation so that, even if the size of the total farm business remains the same, farms that remain in dairying are likely to have a larger share of the farm's resources committed to that enterprise, resulting in larger herds. With free market transfers of quota between producers, this process is able continue as before, except that there are now financial implications, in the form of extra 'quota costs' for expanding farmers, and the equivalent of a 'reward' for giving up quota for the exiting producer. Without a market-driven transfer mechanism, however, this process will be arrested, or at least significantly slowed down.

Increases in scale are facilitated when quota can be transferred without restrictions between producers. In a market situation, the more profitable producers (with lower production cost per marginal litre of milk) are willing to pay more to buy a litre of quota. The most they will agree to pay is the (expected) difference between their marginal production cost and the milk price, capitalised over an appropriate time horizon. For unprofitable producers, it will be advantageous to sell some quota for this price if it is greater than the margin they make over costs for their marginal litres of production (also capitalised over an appropriate time horizon). If this price is greater than the average margin they make on all litres, then it will be advantageous for them to sell their entire quota and use the proceeds to start some other (presumably more profitable) activity.

There is considerable scientific evidence that, in the EU Member States, costs per litre (both marginal and average cost) fall quite sharply as herd sizes expand (see for example, Mukhtar and Dawson, 1990: Burrell, 1990; Alvarez and Arias, 2003). The scale of operation where this trend starts to flatten out varies from country to country, and has been increasing over time. Currently, one can situate it somewhere between a herd size of 70 to 120 dairy cows (or about 400 to 750 thousand litres per holding). This means that in a free quota market, ignoring individual variations due to differences in management expertise and farm specific factors, small producers are more likely to be quota sellers and larger producers are more likely to be quota buyers.

In a free market, we expect to see a continuing increase in average scale of operation. Indeed, most small scale quota sellers are likely to cease production altogether, since selling only part of their quota would make them even less economically competitive than they currently are. This increasing scale phenomenon is expected to occur even when quota markets operate only within regions rather than nationwide. We expect it to be more pronounced however, in a national market, because quota prices will reflect the margins of the most efficient producers anywhere in the country, rather than within a single region. Consequently, the quota price offered to potential sellers at any given moment is likely to be higher, and to offer a greater incentive to smaller producers to sell their quota, than when quota markets are segmented by region.

In a system where quota reallocation is performed administratively, whether or not the reallocation promotes scale increases depends on the criteria defining priority groups. In France, priority groups included young farmers (new entrants), producers within LFAs, and producers with investment plans. Clearly, the first two groups are more likely to be relatively small scale operations, even after receiving extra quota. The third group may contain both small scale producers and those further along the size spectrum. However, given some deliberate targeting towards less competitive producers, it is unlikely that quota reallocation to these groups would give the same boost to scale increases as is observed in a free quota market.

In order to test the idea that the rate of scale increase is related to the degree of market orientation, data on the growth in average holding size (measured in terms of quota per holding on specialist dairy farms) over the period 1989 to 2005 was analysed for the countries of the EU 12. The average scale at the start of the period is included as a variable in the regression in order to reflect the fact that, if average herd size was already large at the start of the period, percentage changes in scale would be smaller than for those countries starting the period with very small herd sizes. In addition, Member States were allocated to three groups – those with administrative reallocation only or very restricted quota markets (Belgium, France, Ireland, Germany, Ireland, Luxembourg and Portugal), those with a somewhat larger degree of market orientation (Italy, Spain, Greece, Denmark), and the two Member States at the most market-oriented end of the spectrum (the Netherlands and the United Kingdom). The last two groups mentioned are distinguished in the regression by two dummy variables (D1 and D2). A regression was run in order to quantify how much of the difference in the increase of average scale could be explained by the average scale already reached at the start of the period, and the degree of market orientation allowed by the quota implementation rules of the Member State. The data on average scale and the rate of increase in average scale are for specialist dairy farms only, and come from the FADN database. The results are given in Table 7.4

Table 7.4 Regression explaining rate of increase in average scale for 12 EU Member States 1989-2005

Variable	**Coefficient**	**Standard error**	**t-ratio**	***p*-value**
Constant	2.702	0.495	5.46	0.001
Average quota per holding in 1989	-0.000968	0.00023	-4.26	0.003
D1	1.428	0.287	4.98	0.001
D2	1.476	0.563	2.62	0.030
Number of observations = 12; R^2 = 0.858 ; F (3,8) = 16.1 ; *p*-value for F-test = 0.001				

D1= 1 for Member States with 'medium' market orientation, and zero otherwise; D2 = 1 for the two most market-oriented Member States, and zero otherwise.
Note: Analysis is of the EU 15 minus the three Member States which acceded to the EU in 1995, namely Austria, Finland and Sweden.

The results show that 86 per cent of the variation in the rates of scale increase observed over Member States can be explained in terms of two factors: average scale at the start of the period and the degree of market orientation in their rules for quota reallocation. All coefficients are highly significant. The negative estimated coefficient (of approximately 0.001) on average quota per holding in 1989 shows that, for every increase of 100 tons of quota per holding at the beginning of the period, the increase in average scale over the full period would be 0.1 (or 10 percentage points) lower. A statistical test indicated that the coefficients of D1 and D2 are not significantly different from each other. This is interpreted to mean that the full scale effect of market orientation is obtained as easily by Member States that allowed only 'medium' market orientation. In other words, the full effect on farm scale was realised even when some restrictions remained, and without going all the way to totally unrestricted quota trading in a single national market. When the equation was re-estimated to allow the effects of medium and full market orientation to be captured by a single parameter, the common parameter was estimated as1.435 (p=0.000). This means that, other things being equal, a certain degree of market orientation boosted the total scale increase over the period by about 143 percentage points above the increase that would have occurred if transfer mechanisms like those in the 'non-market' countries had been used.

The results in Table 7.4 are important evidence indicating that administrative transfers, or extremely restricted regional markets, have not promoted scale increases to the same extent as more market-oriented mechanisms for reallocating quota between producers.

Rates of scale increase in different Member States

Examining the rates of scale increase in different Member States more closely, Table 7.5 provides information regarding the average scale of dairy units in the EU 15. The *pivotal size* group is defined as the smallest size group that contains more producers in 2006/07 than in 1993/94. All size groups below this have reduced in numbers since 1993/94. The *smallest size group still expanding* is the smallest size group that has been gaining producer numbers in recent years. Producers are still moving into this size group and those above it, whereas the size groups below it are shrinking. When this group is at a higher level in the size distribution than the pivotal size group, it means that, although one or more size groups representing a smaller scale expanded considerably after 1993/94 and are still larger than their 1993/94 numbers, these groups have in recent years begun to decline again as producers move up through the size spectrum.

Some features of the patterns highlighted in Table 7.5 include:

- the highest average yields (milk output per dairy cow) are recorded in countries with the largest average herd sizes (Denmark, Sweden, and the Netherlands). The UK is the outlier here, which can be explained by its relatively low milk prices and agro-climatic conditions favouring more extensive, forage-based systems that give lower yields than the very intensive systems favoured in the other three countries.
- the lowest average yields tend to be associated with small average scale or with Mediterranean conditions, or both. Ireland is an outlier here, due to its agro-climatic conditions favouring low-input, grass-based production systems. France is also an outlier, which can be partly explained by its relatively high share of output produced in LFAs.
- the pivotal size group and the smallest size group still expanding tend to be positively correlated with average herd size. However, there are some interesting variations. In Germany and Italy, the pivotal size group (and also, in Italy, the smallest size group still expanding) appear to be rather large relative to the overall average scale in 2005. This indicates that there is quite a large group of dairy herds in lower size groups that are not moving up into higher groups, suggesting the development of a bi-modal size structure.

Table 7.5 Basic information on scale and increases in scale, Member States, EU 15

Member State	Percentage increase in average scale, 1989-2005[1]	Pivotal size group[2] (K tons quota)	Smallest size group still expanding[3] (K tons quota)	Average herd size, 2005 dairy cows per herd	Average milk yield, 2005 1000kg/ head
Austria	181	n.a.	n.a.	8[4]	5.871
Belgium	67	300-400	300-400	35[5]	5.692
Denmark	217	1000+	1000+	86	8.187
Finland	137	n.a.	200-300	19	7.825
France	67	200-300	300-400	36[5]	6.277
Germany	149	600-700	n.a.	38	6.784
Greece	213	200-300	200-300	14[5]	5.120
Ireland	82	200-300	300-450	42[5]	4.820
Italy	251	500-750	500-750	25[5]	5.824
Luxembourg	87	n.a.	n.a.	18	6.761
Netherlands	84	500-750	500-750	56	7.338
Portugal	263	n.a.	200-300	18	6.090
Spain	340	200-300	300-400	18[5]	6.607
Sweden	n.a.	n.a.	500-750	46	8.383
UK	90	1000+	1000+	79[5]	6.972

Sources: Commission questionnaires. EU Commission, *The Agricultural Situation in the European Union.*
n.a. – data not available
1. For Austria, Finland and Sweden, the increase is measured over the period 1995-2005.
2. Smallest size group (in terms of quota per holding) that is larger in 2006/7 than in 1993/4.
3. Smallest size group (in terms of quota per holding) that was still growing in numbers in most recent years.
4. Figure for 2001. 5. Figures for 2003.
The underlying data for this table can be found in Annex 8.

Many factors contribute to the large variation in scale between EU Member States, including different philosophies regarding the mechanism for quota transfer, agro-climatic variations, the profitability of dairy farming, the ownership and output of the processing industry and comparative advantage in different types of farming system.

Links between scale and intensification of production

It has to be borne in mind that there are exogenous trends working in favour of more intensive production methods, independently of scale increases. It is also true, however, that at any given moment in time, and holding constant agro-climatic and farm specific factors, the degree of intensity of production is expected to be higher as one moves up through the size distribution. This is partly due to substitution of capital for labour that occurs as scale increases – the farmer's effort is spread over increasing numbers of litres, but this is accommodated by substitution of farm-grown feed for bought in concentrates, and so on. Moreover, as the scale of operation increases, one may observe discontinuous switches in technology or farming system that become economically viable as the scale of operation increases. Here, we present concrete examples of this in several Member States.

Table 7.6 and Table 7.7 describe the size distribution of dairy herds in Galicia, and the input use at different levels in the herd size distribution. Caution should be exercised about identifying trends over time *within* size groups, as it is uncertain whether the annual samples are based on the same sample (if not, variation could be due simply to the changing composition of the sample). Moreover, weather conditions are not the same from one year to another, and this will introduce some variation. However, holding time and sample composition constant and comparing input use in the cross section dimension, the increase in yields, concentrate feeding rates and stocking densities that occurs as scale increases is striking. This phenomenon is very robust over the years.

Output rates and input use in the largest size group relative to those in the smallest size group (representing about 20 per cent of herds) are between 50 per cent and 170 per cent greater. Although input use per litre of milk may not vary so much between size groups (given the much higher yields in the higher size groups), input and output per hectare are considerably higher for the larger size groups which, other things being equal, will be associated with a higher environmental load.

Table 7.6 Size distribution of dairy holdings in Galicia, 2005

Size class	**<30 t**	**30-60 t**	**60-120 t**	**120-190 t**	**190-370 t**	**370-750 t**	**750-1500 t**	**>1500 t**
Percent	18.4	10.4	18.9	15.6	19.9	13.9	2.5	0.4

Table 7.7 Input use by size group, Galicia, 1997-2003

Size class	**<36 t**	**36-68 t**	**68-120 t**	**120-212 t**	**212-460 t**	**> 460t**
	Yield, litres/cow					
1997	3743	4302	5042	5844	6853	6976
2000	3828	4215	4834	5701	6834	8039
2003	3047	4521	4837	5871	6840	7594
	Concentrate feed, kg/cow					
1997	1137	1449	1838	2253	2823	3016
2000	1233	1439	1793	2231	2937	3384
2003	766	1647	1863	2397	3013	3284
	Stocking rates, cows/hectare					
1997	1.4	1.6	1.8	1.9	2.0	2.5
2000	1.6	1.5	1.7	2.0	2.2	2.7
2003	1.6	1.5	1.6	1.7	2.0	2.2

Source: Garrido and Barbeyto Nistal (2005).

In another example, evidence on the yields of producers supplying milk for Parmigiano and Grana Padana cheeses (both PDO cheeses produced in northern Italy) shows the same increase in intensity of production with farm size. Table 7.8 shows a systematic increase in yield along the scale spectrum, indicating a move to more intensive farming practices as scale increases.

Table 7.8 Milk Yields by farm size, northern Italy (tons/cow)

	Parmigiano Reggiano				**Grana Padano**			
	<200t	**200t-500t**	**500t-800t**	**>800t**	**<200t**	**200t-500t**	**500t-800t**	**>800t**
1990	5.21	5.76	6.40	6.73	4.55	5.75	6.38	6.84
1994	5.25	6.22	6.86	7.31	4.60	6.08	7.02	7.44
1998	5.51	6.54	7.58	7.80	4.89	6.69	7.66	8.30
2000	5.76	6.48	7.45	7.95	5.03	6.46	7.74	7.88
2001	5.86	6.63	7.08	7.79	5.28	6.75	7.52	7.99
2002	5.87	6.65	7.62	7.80	5.36	6.68	7.54	7.86

Source: Arfini *et al.* (2006). Based on FADN data.

One expects to find similar scale intensity differences as size increases in countries where there is still considerable quota held by very small herds. By contrast, the UK and the Netherlands already had a relatively ‘good’ size structure at the start of the quota period. It is therefore likely that, as the scale increases that occurred in these Member States were more limited, that this led to more limited changes in the degree of intensification within the same location, as shown in Figure 7.13.

Figure 7.12, Figure 7.13 and Figure 7.14 provide systematic and comparable evidence for all Member States of the EU 15 (except Luxembourg) on increases in milk yields, stocking densities and fertiliser costs per hectare as herd size (here using the proxy of farm size measured in European Size Units – ESU) increases. Even when the potential intensity indicators are declining over time (as happens, for example, with fertiliser costs in Italy and Germany, or stocking densities in the Netherlands and the UK), for each given year intensity is higher as we move up the size spectrum. Since the herd size group boundaries are more articulated for smaller herd size groups in the FADN data presentation, some Member States (Italy, Ireland and Germany) have been able to report data for more size classes than Member States with larger-scale herds, which have no or sparse representation in the lower size groups. However, regardless of the number of groups reported (a minimum of three is needed for a trend to emerge), the upward movement of yield and input use as one moves up the size spectrum is very clear.

It was not possible to obtain comparable figures for other inputs (such as plant protection products, mechanisation and so on) with potential environmental relevance. However, evidence of a more anecdotal nature indicates that on average, these inputs are also rising with herd size, driven by the same economic logic that is driving the variables shown in the graphs.

It must be stressed that scale increases and associated increases in the average degree of intensity would have occurred anyway independently of the quota regime. The question here is whether different implementation rules of some Member States acted to slow down this process, with resulting beneficial effects on the environment (relative to the counterfactual). The two Member States with the fewest restrictions on market orientation already had the largest or amongst the largest average scale of production. Member States where most producers were producing at a relatively small scale, and where the scope for scale-induced increases in production intensity was greater, tend to have chosen less market-oriented or more restrictive mechanisms for reallocating quota. In the cases where this has not happened (for example, Greece), the increases in scale are very large. Although most of these smaller countries have shown greater percentage increases in scale over the period than the UK and the Netherlands, it must be stressed again that this is because of their much lower-scale starting point. Without the restrictions they imposed on quota transfer, it is arguable that their scale increases over the period of study – if they had adopted the same transfer mechanisms as in the counterfactual – would have been even greater. This conclusion is confirmed by the regression equation reported in Table 7.4, which shows that when the average scale at the start of the quota period is controlled for, then the degree of market orientation had a strong effect on the growth in average farm size.

Therefore, there are grounds for concluding that the extent of scale increases and accompanying intensification have been slowed down in Member States with more restrictions on quota transfer mechanisms.

Figure 7.12 Milk yields per cow by economic size class (ESU), specialist dairy, 1989, 1995, 2005 (FADN)

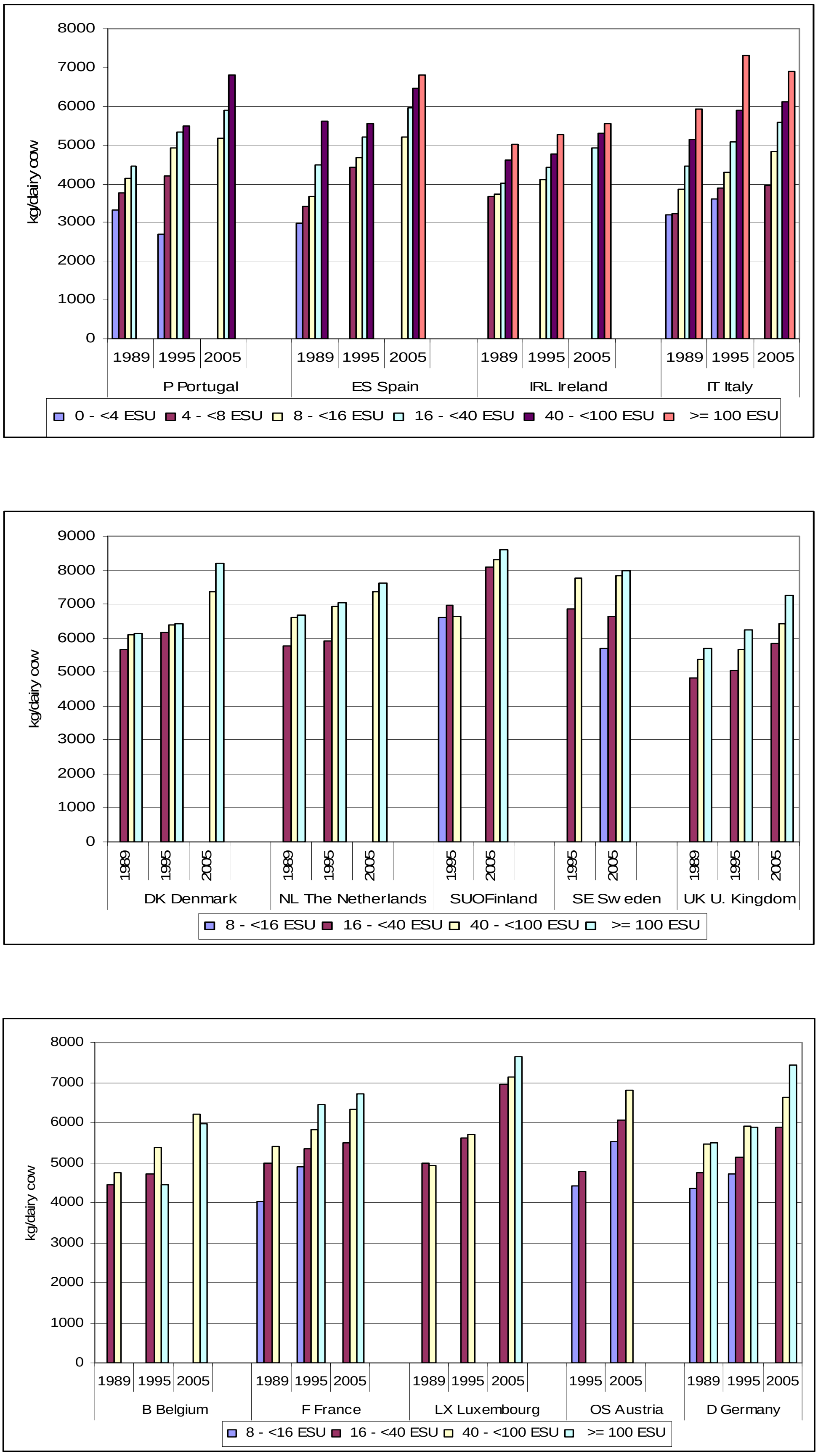
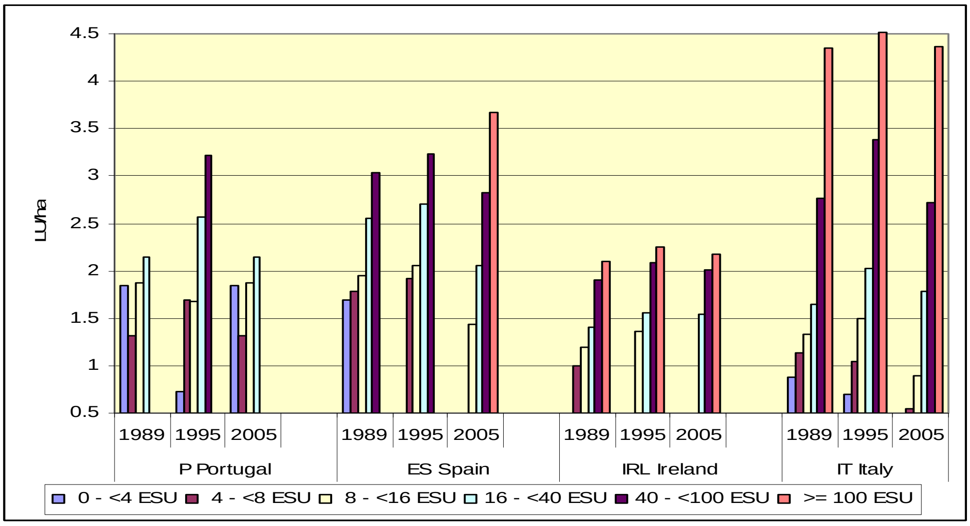
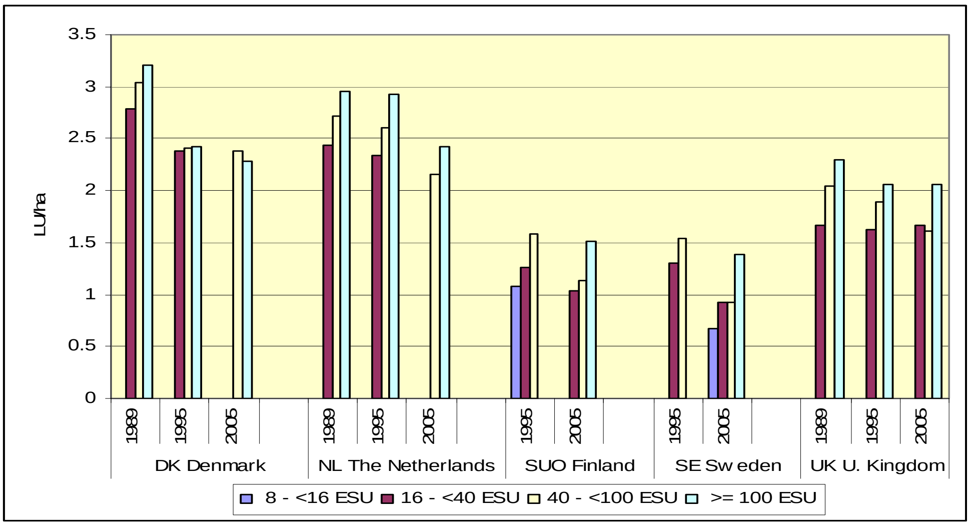


Figure 7.13 Stocking densities by size class (ESU), specialist dairy, 1989, 1995, 2005 (FADN)





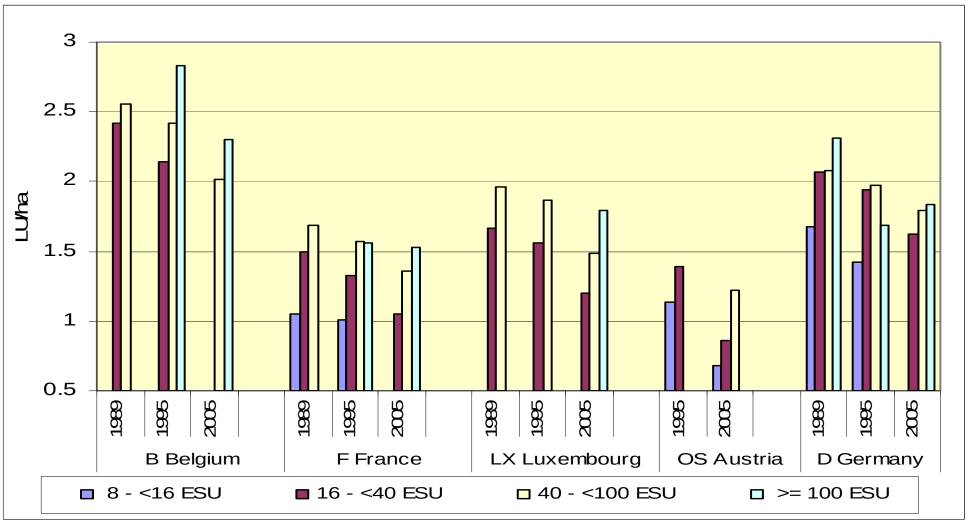
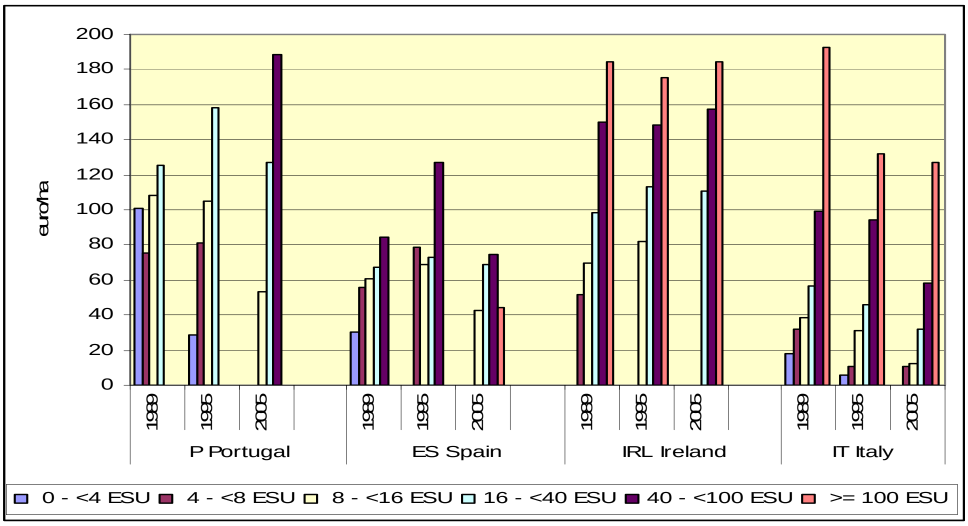
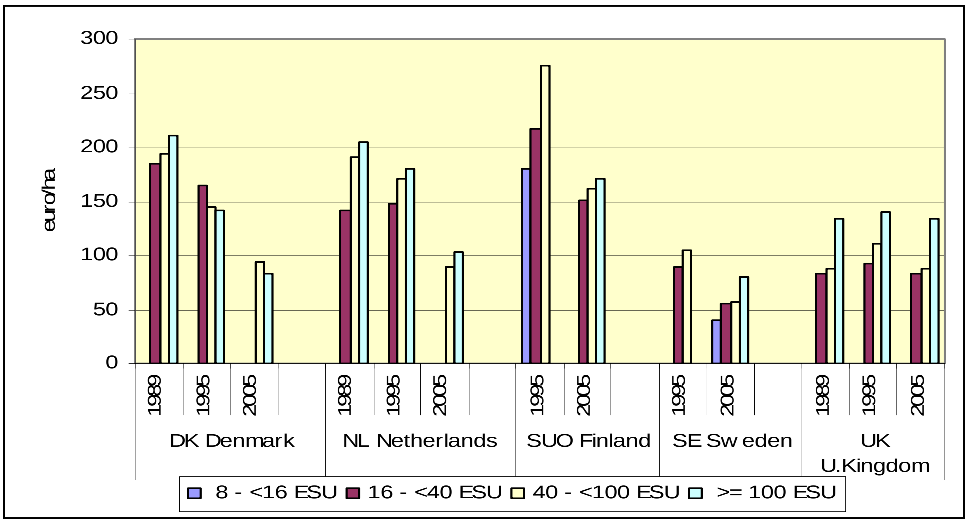
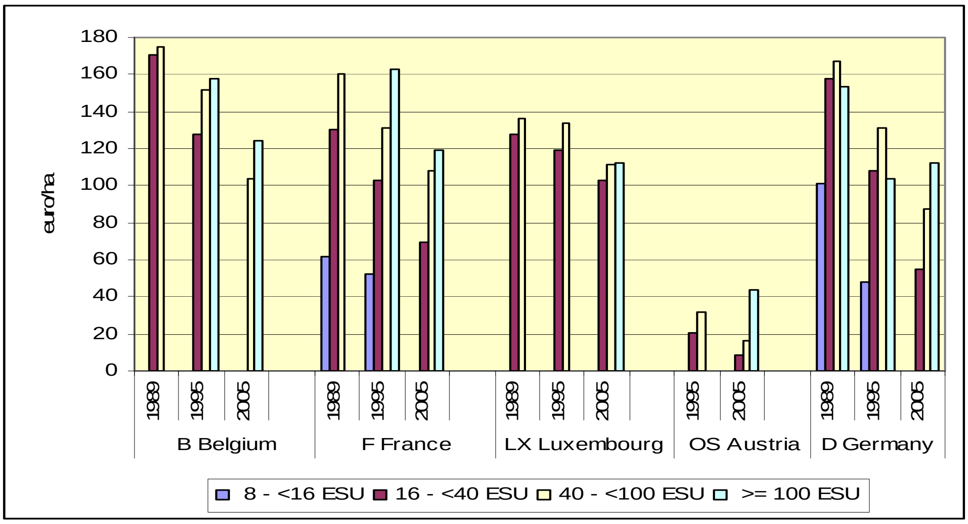


Figure 7.14 Fertiliser costs per hectare of forage area by size class (ESU), specialist dairy, 1989, 1995, 2005 (FADN)







Environmental second order effects

Regarding the environmental consequences, again the conclusions are more impressionistic. From the outset, it is important to recognise that increasing scale may also have environmentally positive outcomes, alongside negative impacts that are more usually associated with increased intensity of production. For example, more efficient waste management technologies may become economically viable at larger herd sizes, and greenhouse gas emissions may be reduced in some intensive systems. Unfortunately, the data needed to examine the extent to which increasing scale has stimulated the use of less environmentally damaging technologies are not available.

In general, however, more intensive systems, with their higher rates of inputs and outputs per hectare and higher stocking densities, tend to be more harmful for the environment than extensive systems. For example:

- More intensive grassland management can result in:
    - increased fertiliser and slurry applications that raise nitrate and phosphate levels, which can result in the leaching of nitrates into water bodies and can damage the habitats of some ground nesting birds and certain species of flora (Figure 7.14 shows that fertiliser use grows with scale);
    - greater loss of species and damage to wetland habitats where drainage is improved;
    - decreased plant diversity and possible soil erosion and damage to below-ground archaeological features as a result of ploughing and re-seeding.

- In some cases, but certainly not all, larger units are associated with increased stocking densities which are more likely to cause poaching and soil compaction leading to a greater risk of soil erosion (Figure 7.13 shows that stocking density tends to increase with scale).

- Movement into greater use of feed regimes reported in Spain and Italy, where maize production appears to increase as scale increases. Greater production of forage maize will bring with it increased risks of erosion. Land growing maize is particularly vulnerable to soil erosion due to the extended period with low ground cover and late harvesting, which leaves bare and potentially compacted soil at times of high rainfall. With this will come associated pollution of watercourses with sediment and nutrients. Associated higher levels of manure applications and increased fertiliser and herbicide application will also have negative impacts on water quality.

Conclusive evidence of these environmental effects of intensification requires a much more disaggregated approach then we have been able to follow here.

7.3.1 Summary

Analysis of the FADN evidence on input and output intensity in different farm size groups provides strong support for the anticipated first order effects under Hypothesis 2. As for the second order environmental effects, there are strong *a priori* grounds for the hypothesised effects, and considerable anecdotal evidence. Specific, quantitative empirical evidence has not been found at the level of aggregation adopted in this study.

7.4 Hypothesis 3: Cessation of production

First order effects

In Member States where producers cannot sell their quota separately at a price equal to its 'true' economic value or where quota can only be sold in the context of a farm sale, it is expected that the exit rate from the dairy sector will be lower than in Member States where a market price for giving up quota can be earned without having to sell the farm.

Second order environmental effects

- **Cessation of intensive dairying systems will generally be environmentally beneficial in most cases.**
- **Cessation of extensive dairying systems in marginal areas where milk production is the sole economically viable land use, is likely to be environmentally negative, leading potentially to land abandonment, scrub encroachment, loss of biodiversity, and so on.**

Payments to producers for the release of quota act as an incentive to give up milk production. A quota market is one possibility for producers to sell their quota. It has been observed that when a dairy farm is sold with the quota attached, the value of the quota is capitalised into the value of the farm as a whole. In some countries and periods, the price differential between a farm without quota and a farm with quota has been substantial. In countries where a market exists for quota without land, it has been possible to confirm that the price differential is approximately equal to the value of the quota on the quota market.

Restructuring schemes and quota buy out programmes, where payments against quota are funded by government, are an alternative mechanism for permitting producers to trade in their quota. It makes little sense for a government to operate such a scheme when a market for quota without land is in operation. In that case, government payments per litre of quota would have to be at least as great as the value realised on the quota market in order to be attractive to producers. Typically, Member States operating buy out schemes have fixed the price somewhat lower than that which economists have calculated to be the true implicit value of the quota.

In Member States with a free market in tradable quotas, without regional barriers, quota will reach its highest value (this has been seen in particular in the Netherlands, where quota prices in the early 2000s were five to six times above the purchase price of milk). Where the value of quota can only be realised by selling the farm, or at an administrative price that does not reflect what is thought to be its true value, then the incentive to quit will be reduced. However, since many other factors contribute to the exodus of farmers from dairying, a decline in producer numbers will still be observed.

There has been considerable variation in the extent to which, and the way in which, Member States have approached this aspect of quota implementation. At the most market-oriented end of the spectrum, the United Kingdom and the Netherlands participated in the initial EU funded buy out programmes only, and achieved a very low take-up rate. Thereafter, in these two countries, cessation of production has been 'funded' by market transactions. At the other end of the spectrum, restructuring programmes have been in continuous operation in France, first in the form of the EU funded programmes (which despite a rather low rate of payment had a particularly high take-up rate, especially amongst the smallest and most elderly producers), and then in the form of nationally funded programmes. Between these two extremes, a variety of specific programmes have been operated at different times in different Member States (see Table 5.1 in Chapter 5 – methodology).

Table 7.9 Rates of exit of milk producers from dairying, 1983/84-2006/07

Member State	Number of milk producers			Percentage change in the number of milk producers (%)	
	1983/84	1993/94	2006/07	1983/84-2006/7	1993/94-2006/7
Austria[1]		78,441	45,847		-41.6
Belgium	47,053	24,272	14,311	-69.6	-41.0
Denmark	32,679	16,390	5,364	-83.6	-67.3
Finland	73,766	36,187	14,897	-79.8	-58.8
France	384,945	162,384	94,332	-75.5	-41.9
Germany[2]	383,369	220,679	105,800	-72.4	-52.1
Greece		27,805	6,294		-77.4
Ireland	67,981	41,390	21,872	-67.8	-47.2
Italy		140,878	48,020		-65.9
Luxembourg	2,226	1,524	923	-58.5	-39.4
Netherlands[3]	54,013	43,928	21,172	-60.8	-51.8
Portugal		87,254	12,461		-85.7
Spain[4]		137,330	29,341		-78.6
Sweden[5]		17,640	8,369		-52.6
United Kingdom	50,625	36,709	18,499	-63.5	-49.6

Source: Member State responses to DG Agriculture questionnaire (2007)
[1] Data for 1993/94 is based on year 1995/96. Figures from presentation on Austrian Milk Sector (Lebensministerium 2007).
[2] Data correspond to following years: 1983, 1993, 2003 & 2006.
[3] Data for 1983/84 based on year 1984/85.
[4] Data for 2006/07 based on year 22005/06. Figures from Spanish case study report (COAG, 2006 based on data from MAPA)
[5] Data for 1993/94 is based on year 1995 (Eurostat).

Table 7.9 summarises the rate of exit of milk producers (measured as the rate of disappearance of herds) over the full quota period. In all the Member States shown in the table except Luxembourg, at least 60 per cent of milk producers left the dairy sector during the period 1983/84-2006/7. It is noticeable that the UK and the Netherlands (plus Luxembourg) show the slowest rate of decline. However, it would be wrong to link this result wholly, or even partly, to their high degree of market orientation. This result is undoubtedly due to the fact that at the start of the period, these two Member States had by far the largest average herd sizes, and the lowest proportion of small, unprofitable herds. The majority of milk producers in these Member States at the start of the period were 'professional' dairy farmers, with considerable investment in dairying and oriented towards the commercial market. This contrasts sharply with many other Member States, where many farms, small and not so small, kept small dairy herds for the purpose of providing milk for household and on-farm use, and where there were also many elderly farmers with small unprofitable herds and no successor (especially in Italy). One expects a much greater shake-out of producers in these conditions. The lower rate of decline in the UK and the Netherlands is probably the *net* effect of two opposing factors – the high prices earned in the quota market (which would tend to stimulate cessation) and the much lower proportion of marginal dairy units i.e. most farms were commercially viable (which would tend to depress cessation rates below those observed elsewhere).

Table 7.9 shows the net reductions in the number of dairy producers between 1983/84 and 2006/07. The timing of these exits is potentially interesting. Although in France and Ireland cessation schemes continued throughout the 1990s, a relatively small proportion of producers (less than 50 per cent) ceased production between 1993/94 and 2006/07. This is also true of Belgium, but information is not currently to hand regarding whether or not Belgium also continued with such programmes over the 1990s. By contrast in a number of other Member States,, between 70 and 90 per cent of producers ceased dairy production from 1993/94 onwards including Portugal, Spain, and Greece. One interpretation of these figures is that the second feature of the restructuring schemes, namely the redistribution of quota to priority groups including young farmers and new entrants, was relatively successful in France and Ireland in helping to offset other factors which, left to themselves, might have caused a higher net rate of exit in the second part of the period. This suggests that the allocations they received helped make them relatively viable and thus less prone to exit dairy production.

The environmental significance of a producer's decision to give up dairying depends on the destination of the released quota and the subsequent use of the land on which dairying was carried out. When the quota is sold with the farm, and the new owner continues with dairy production, there is probably the smallest potential environmental effect. However, since the purchaser will probably have borrowed to finance the purchase and may be under some financial pressure in the early years, he faces an incentive to exploit the new investment more intensively compared with long-established producers. If the quota is sold without land in a national market, there may well be some regional redistribution, with the potential effects that have already been discussed earlier in this chapter. When abandoned or bought out quota has been reallocated (as in France, Italy, Ireland, Spain), the potential environmental effects will depend on (a) the source of the quota to be reallocated and (b) the specific categories and locations of producers that are targeted by the reallocation. For example, if the quota to be reallocated has been given up as the result of a producer buyout, a considerable share of the quota is likely to come from smaller marginal dairy farms. A significant proportion of these are likely to have been operated by older farmers without successors using low input production systems. Many will have been relatively extensive but with limited investment in manure management. The disappearance of these dairy farms from their typical locations could result in a variety of alternative forms of land management. These range from arable production, intensive beef using dairy buildings, through to more outdoor beef production, predominantly outdoor sheep, afforestation in some areas, or outright abandonment. Most land used for dairying is of a better quality than average extensive grazing land so abandonment will usually occur only in special circumstances, for example, on very small holdings where beef production may be unprofitable. The environmental impact of the cessation of dairying depends on the alternative management regime but data on this are not available at present.

For example, the Spanish case study shows that many farms within marginal areas, mainly upland areas, have ceased milk production. In some cases, this has been replaced by other forms of grazing (for example, suckler cattle, sheep, horses), in other cases land has become abandoned, but more commonly it has been afforested, particularly with eucalyptus, with subsequent negative environmental impacts as referred to under Hypothesis 1.

Regarding the recipients of the reallocated quota, unless the targeted groups are specifically oriented towards more environmentally friendly forms of farming, it is unlikely that there will be an environmental gain from the reallocation except with regard to manure management which often is poor on smaller farms with a shortage of investment capital. In general terms it may be advantageous when the recipients are relatively small producers because of the link between scale and intensity noted in Hypothesis 2. In Member States that operate ring-fencing for their administrative reallocation (for example France and Italy), environmental effects resulting from transfers to intensive production regions will not occur. However, even in these cases, the identity of the recipients, as well as the amount of quota that is allocated to recipients, can affect the way the quota will be used. In France, the beneficiaries of this type of reallocation of quota have tended to be young farmers, and farmers with development plans. It is unlikely that young farmers would want to pursue milk production using the same production systems as the marginal farmers who have been bought out. They are more likely to seek to establish themselves on the bottom rung of the mainstream commercial dairying ladder in their area and to expand as quickly as possible to a more profitable scale, in order to intensify. Similarly, it is to be expected that farmers with development plans aim to modify their production system, most probably involving some form of intensification – but manure and waste management may be improved considerably with more modern equipment and a fresh outlook.

In other cases, the disappearance of the herd also means disappearance of the farm, with the land going into non-agricultural use (leisure enterprises such as golf courses or nature parks, house construction, road building and so on). This has been more than an isolated phenomenon in densely populated areas such as the Netherlands and South Eastern England, and in the peri-urban belt around cities. The net environmental effects of such developments can only be evaluated on a case-by-case basis. Of course, it is likely that in these cases, cessation of agricultural activity and the resulting transfer of land use would have occurred anyway, regardless of any incentives to release milk quota, given the large price differentials between agricultural land and land for development.

7.4.1 Summary

Many variables influence the rate of exit of producers from dairying, and the rate of disappearance of dairy herds. These include differences between Member States in the socio economic variables that drive the decision to quit, macro economic conditions, and the general educational and skill level of the farming population. The share of small, uneconomic dairy herds at the start of the quota period has also been a very important factor, together with the extent to which governments pursued active priority based allocations as described in Chapter 3, or allowed quota prices to reach their potential maximum in free, national quota markets. There are not enough observations here, relative to the number of potential factors influencing the decision to exit, to attempt a regression (as was done to test Hypothesis 4). Therefore, the discussion regarding the first order effects of the hypothesis must remain inconclusive.

Without any real evidence for the first order effects, our methodology indicates that it is not worthwhile to investigate the second link, if the aim is to try and find a causal chain between differences in quota implementation rules and environmental consequences. However, the question of the environmental consequences when a dairy farm ceases operation or a dairy farmer leaves the sector, is interesting in its own right and demands a more rigorous investigation with appropriate research methods.

7.5 Hypothesis 4: Constraints and incentives with respect to input use

First order effects

Where constraints or incentives regarding inputs are attached to rules for quota allocation or transfer, producers' decisions regarding input use will be influenced against or in favour of these inputs, *or* producers already using little or more of these inputs will gain quota share relative to others.

Second order environmental effects

The relative levels and proportions of various inputs used, and substitution between inputs, are not environmentally neutral, and have a variety of potential environmental impacts.

Member States have attached various constraints and incentives to their rules for quota allocation and transfer. For example, one of the priority groups for administrative transfers of quota in France is producers with investment plans. This can create positive incentives to upgrade fixed investment on the farm. Over time, as producers with investment plans are favoured, the general level of investment in the sector should increase, particularly at those levels in the herd size distribution where producers are most keen to expand their dairy enterprise. By contrast, when quota expansion has to proceed via the quota market, on-farm investment competes with market purchases of quota for financial resources, which may lead indirectly to a lower level of on-farm investment amongst quota purchasers. Since the latest generation of fixed equipment and infrastructure often leads to higher input efficiency, or is designed specifically to respect more environmentally friendly standards, particularly for manure management, there is the potential for differential environmental consequences.

Another priority group for redistribution, in France and Ireland, is young farmers, who are often new entrants to the dairy sector. Although the targeting of this group may have been motivated more by considerations of social justice and income redistribution than by concerns for input quality, it is nevertheless true that a young producer who is recently trained and motivated to succeed is likely to adopt a fresh, and potentially more efficient, approach to management and labour use than the elderly retiring producer whom he replaces. Given the ageing population of farm operators in the EU, the renewal of the farming profession from the younger age groups is perceived as a priority in some parts of the EU. In addition, it might be argued that the new entrant generation of producers is likely to be more environmentally aware than older generations, who faced quite different challenges during their formative years in farming. At the same time, however, younger producers are also more likely to adopt more intensive systems and to give up more traditional methods of production, some of which, such as hay making, are beneficial environmentally.

When quota is transferred via the market, young producers and new entrants tend to be at a disadvantage because of the extra capital outlay involved. Quota will flow towards those who are willing and able to pay the highest price. These purchasers will be established farmers with a sound financial position, or investors who are expanding the size of the activity they control as a profit-making concern. The combination of these two effects – encouragement of younger farmers in France and Ireland, and financial deterrents for younger farmers in the most market-oriented Member States – may be sufficient to cause a discernible difference in the age distributions of dairy farmers between these two cases. This discussion also raises questions (where we have no definitive evidence) concerning the relative quality of the management, and attitudes to the environment, of these two types of producer.

Other examples of input constraints and incentives built into implementation rules involve attaching conditions on stocking densities to farms buying quota, or fixing a quota/land maximum for transfers of quota with land. This latter rule is considered further in Chapter 8.

Given the types of incentives and constraints used, and their specific targeting of quota transfers, two crucial questions arise in relation this hypothesis. *First*, since input related incentives have been applied only *either* to those producers who transferred or received quota (a minority group), *or* to the units of quota actually transferred (typically a small proportion of total quota in use), has their aggregate effect been large enough quantitatively to show up in the statistics for the sector? *Second*, have the behavioural changes that these incentives and constraints may have influenced actually produced any environmental effects, even if only at the micro-level?

First order effects

It has been difficult to obtain empirical evidence on the extent to which these additional constraints or incentives have had a significant effect on producers' input decisions, or altered outcomes in a way that can be measured at sector level. The only relevant sectoral information that it has been possible to find, in relation to first order effects, concerns the age distribution of milk producers, and this evidence is reported in Table 7.10.

The main points of interest emerging from this table are:

- In virtually all Member States, the age distribution is younger for specialist milk producers than for producers on all holdings at EU level.
- Ten years after the start of the quota regime, Luxembourg, Germany, Finland and France had the greatest proportion of specialist dairy producers under the age of 45 (49.5, 46.0, 45.9 and 45.1 per cent respectively). The share of this age group increased quite steeply over the period between the 1985 and 1995 surveys. Moreover, this was not because of an accelerated wastage from the group aged over 65, since the shares in this age group are roughly similar in the two surveys. This suggests that the policy in France of targeting younger producers may well have played a role.
- By contrast, the proportion of producers in the lowest age groups in the two most market-oriented Member States, the UK and the Netherlands, is relatively low (27 and 28 per cent, respectively) in 1995, and the share of specialist dairy farmers under 45 years of age actually fell between the two surveys. In fact, by 1995, the proportions of producers in the lowest age group in the Netherlands and the UK were no higher than for all types of agricultural holding at EU level. This is *prima facie* evidence that the market-oriented approach was operating as a barrier to entry for young producers in these countries. However, the share of young dairy farmers in the Mediterranean countries (Spain, Italy, Greece and Portugal) was as low or lower, indicating that national factors influencing the age distribution of farmers as a whole may play as important role as sectoral policies in explaining these figures.
- The 2005 survey indicates that UK remains an outlier with only 22.2 per cent of specialist dairy producers under 45 years old. Sweden has the second lowest share of young producers (23.1 per cent) whilst the Netherlands and Ireland are much closer to the EU average (38.6 per cent), with 37.4 per cent and 36.9 per cent respectively. Greece, Austria, France and Germany have the greatest proportion of farmers under 45 years old, with 47.0, 46.0, 43.3 and 43.1 per cent respectively.

Table 7.10 Percentage of specialist dairy holders in different age groups, 1985, 1995 and 2005 for EU 10/EU 15

	1985 Survey				1995 Survey					2005 Survey				
Age of holder (years)	**<45**	**45-54**	**55-64**	**≥65**	**<35**	**35-44**	**45-54**	**55-64**	**≥65**	**< 35**	**35-44**	**45-54**	**55-64**	**≥65**
All holdings EU 10/15[1]	23.1	26.9	29.3	20.7	7.9	15.2	21.7	27.4	27.8	5.5	15.9	22.2	23.6	32.7
Specialist dairy EU 10/15[1]	30.1	32.0	29.2	8.6	15.1	23.0	25.5	26.3	10.2	10.4	28.2	31.0	21.7	8.7
Austria					18.9	25.3	24.2	22.6	9.0	13.3	32.7	30.7	15.9	7.4
Belgium	35.1	34.2	26.6	4.1	21.0	22.6	23.6	26.7	6.2	9.6	29.6	28.5	23.5	8.7
Denmark	35.7	30.9	25.7	7.8	10.0	22.7	29.6	28.1	9.4	10.3	30.8	28.2	21.9	8.8
Finland					19.0	26.9	32.0	18.0	4.1	9.7	28.3	34.3	24.3	3.4
Germany	35.8	36.1	24.4	3.7	19.8	26.2	23.3	27.1	3.6	10.6	32.5	32.8	20.2	3.9
Greece	15.8	31.7	30.2	22.3	6.6	14.7	22.9	32.9	22.6	18.1	28.8	22.4	16.7	13.5
Spain					10.1	16.8	24.4	32.2	16.5	9.0	23.0	31.6	26.4	10.0
France	28.9	31.8	32.9	6.5	18.7	26.4	28.4	22.1	4.3	15.1	28.3	33.4	19.8	3.4
Ireland	29.8	26.6	28.4	15.2	15.4	20.9	24.5	24.8	14.5	11.6	25.4	26.6	23.0	13.4
Italy	19.5	29.4	33.3	17.7	10.4	17.4	21.5	29.9	20.8	8.9	26.3	27.9	19.1	17.8
Luxembourg	39.9	30.4	20.5	9.1	15.3	34.2	24.3	18.9	7.2	8.7	27.5	40.6	15.9	7.2
Netherlands	30.7	31.5	29.6	8.2	7.4	20.8	28.2	30.1	13.4	6.4	31.1	29.5	23.9	9.2
Portugal					11.6	20.2	25.4	25.4	17.3	8.0	20.7	27.7	26.1	17.4
Sweden					10.7	25.6	30.2	23.2	10.2	5.5	17.6	26.5	29.4	21.0
United Kingdom	31.4	28.4	28.8	11.3	6.5	20.1	28.2	27.8	17.4	3.6	18.7	28.3	29.5	19.9

Source: Eurostat, Farm Structure Survey.

1 European Community (EU) 10 in 1985, European Union (EU) 15 in 1995 and 2005.

These data suggest that, after 20 years of milk quotas, changes in the age distribution of dairy farmers due to different national rules for quota transfer and allocation are inextricably combined with national patterns of age distribution for farmers as a whole, and no clear pattern is discernible that could be attributed to quota implementation rules. Whilst these differences in the evolution of the age distribution of dairy farmers could have environmental consequences, for example because of differences in input intensity or choice of waste management system, this cannot not be pursued further.

7.5.1 Summary

The evidence relating to this hypothesis presented above is very sparse, and no empirically supported conclusions can be drawn.

As already predicted when specifying this hypothesis, it has been difficult to obtain empirical evidence on the extent to which Member States' specific rules have had a significant effect on producers' input decisions, and the consequences for the environment have proved impossible to pin down from the data sources available to this study.

8 THE EFFECTIVENESS OF QUOTA MEASURES WITH ENVIRONMENTAL OBJECTIVES

Evaluation Question 2
To what extent did measures **relating to the allocation and transfer of milk quota**, for which the national legislation provides for the objective of environmental protection or enhancement, **contribute to achieving positive environmental effects?**

8.1 Introduction

This chapter focuses on the extent to which measures relating to the allocation and transfer of milk quota, for which national legislation explicitly or implicitly sets an environmental protection or enhancement objective, contribute to achieving positive environmental effects at the European, Member State and farm levels.

The analysis considers in particular the measures for specific transfers of quota taken in the context of national or regional restructuring programmes. These measures are referred to in Council Regulation (EC) 1234/2007 (Article 75) and the two preceding Regulations[64] which mention ‘improving the environment’ as a possible objective for restructuring programmes. The measures include *inter alia*:

- compensation for producers who abandon milk production - Article 75 1(a);
- provision for the retention of milk quota by producers who transfer land with a view to improving the environment - Article 75 1(d); and
- provision for producers to transfer quota without also transferring land to allow for the extensification of production - Article 75 1(f).

The issue of (environmental) effectiveness is particularly relevant for these kinds of measures. It should be noted that Article 75 1(e), which refers to objective criteria for determining the regions or milk collection areas within which permanent transfers of quota without land can take place (for example, milk purchaser areas, LFAs, etc), only refers to the aim of ‘improving the structure of milk production’ in the legislative text, and not ‘improving the environment’.

In this study, implicit environmental objectives are also considered to be relevant. It is important to note that the primary objectives of such measures are not explicitly environmental, although their subsidiary objectives may be. On the contrary, the primary objectives will be driven by other factors including socio-economic objectives linked to farm income and rural population. Nonetheless measures included within this chapter have the potential for positive environmental impacts, even if these will tend to be indirect in relation to objectives.

Since the farmed landscape in many LFAs is valuable in environmental terms it might be reasonable to assume that, where national rules distinguish between producers in LFAs and non-LFAs in terms of quota allocation and transfer, there is an *implicit*

[64] Article 18 of Council Regulation (EC) 1788/2003 and Article 8 of Council Regulation (EEC) 3950/92.

environmental objective in allocating or ring-fencing quota to LFAs, even if the primary objective lying behind such rules is economic or socio-economic[65].

In practice, however, the reality of any environmental objective behind LFA-related quota rules will vary between Member States. In a number of Member States (for example France and Italy), the objective of ring-fencing quota to LFAs has been specifically to maintain farming activity and the rural population within these marginal areas. As a result of this, caution must be exercised in attributing any environmental basis to such quota regimes, let alone any intended environmental effects. For the purposes of this evaluation question, we assume that LFA related rules *may* have an implicit environmental objective in some Member States and explore the effects accordingly.

In this chapter the counterfactual is taken as the situation *without* those quota allocation and transfer measures considered to have explicit or implicit environmental objectives. However, in line with the counterfactual scenario outlined in Chapter 5, comparisons are also made between Member States taking account of the continuum ranging from the interventionist to minimalist approach to quota management.

The central question of the effectiveness of any environmentally focussed quota measures is addressed through two hypotheses. This chapter examines the evidence for each hypothesis in turn, where appropriate building on analysis already undertaken as part of Evaluation Question 1.

8.2 Overview of measures with explicit or implicit environmental objectives

A summary of the measures with explicit or implicit environmental objectives is set out below. These take account of the responses of national authorities in case study countries to the DG Agriculture survey of national milk quota regimes in 2007.

Measures with explicit environmental objectives

Of the seven Member States for which case studies have been undertaken, only **Spain** has an explicit environmental objective in its milk quota legislation. This and the associated measures are outlined below.

'Improving the environment' appeared as an objective of the Spanish milk quota regime in 1994, although the precise meaning of this objective is not explained. The reference appears to echo the wording in EU legislation but there are no related measures or text referred to in the Spanish legislation (Guy Beaufoy, Pers. Comm. 19.11.07). Then in 1998, extensifying dairy production was given as one possible justification for applicants wishing to transfer quota between regions without land (in this case the resulting stocking density was required to be at or below 2 LU per forage hectare), with the other justification being that applicants could improve production structures.

[65] This is in line with the economic or socio-economic basis for the *designation* of LFAs which can also take into account natural handicaps.

A review of responses to the Commission's survey has not identified any other Member State having milk quota regimes or measures with explicit environmental objectives.

Measures with implicit environmental objectives
Several Member States appear to have measures which may have implicit environmental objectives as part of their milk quota regime.

A number of Member States - France, Italy, Ireland, Spain, Germany and UK - currently have, or have had, rules regarding the transfer of quota between regions which seek to maintain a territorial distribution of milk production. However these generally appear to be socio-economic in purpose and can only be construed at best as having *implicit* environmental objectives. As indicated previously, the EU legislation for determining regional bases for transfers of quota - Council Regulation (EC) No 1234/2007 Article 75 1(e) – only refers to 'improving the structure of milk production' not 'improving the environment'.

A few Member States - Belgium, Finland, Italy, Luxembourg and the Netherlands - have rules referring to a maximum amount of quota that can be transferred with land, expressed in kg or litres per hectare of land which can be used for milk production. However, none of these countries appears to have explicit environmental objectives for their milk quota regimes as such.

A summary of milk quota measures with (possibly) implicit environmental objectives is set out in Table 8.1 below.

Table 8.1 Milk quota measures with (possibly) implicit environmental objectives by Member State

Member State	Implicit environmental objective or measure
BE	Belgium's milk quota regime stipulates that a maximum of 20,000 litres quota/ ha is able to be transferred with land. In addition, both the entire farm belonging to the producer receiving the transfer and the transferred land itself must lie within a 30km zone surrounding the production unit to which the quota that is to be transferred belonged on 31 March/1 April 2002 (Walloon/ Flanders). Both elements could be construed as having implicit environmental objectives. Note, however, we are not aware of environmental objectives being cited by the government for Belgium's milk quota regime.
DE	Germany's milk quota regime has had some relatively minor components in the past which one could consider to be implicitly environmental. These included: preferential allocation of milk quota (from the national reserve) to smaller farms or in favour of mountain areas in certain regions (e.g. Baden Württemberg); the possibility of granting compensation to farmers who voluntarily abandon all or part of their milk production (Article 75 1(a)); and small amounts of quota allocated in favour of farms which manage grassland used by wild geese and LFAs in North Rhine-Westphalia. None of these measures still exists today. The regional basis for the transfer of quota without land could also be regarded as implicitly environmental (e.g. maintaining dairy production in regions with LFAs and/or high landscape value). In general, Germany follows the principle that the milk quota system should not be overloaded with environmental or structural policy objectives, as these are better targeted by specific agri-environmental and structural policies which are implemented via numerous programmes.
ES	Aside from the explicit environmental elements already referred to, Spain's milk quota regime included a LFA rule (from 1988 to 2003) which could be regarded as implicitly environmental. Where quota was transferred between administrative regions, transfers from within the LFA of a region could not result in a decline of total quota within the area of more than 1.5 per cent in any one year. Where quota was transferred within an administrative region, this restriction did not apply. New legislation was introduced in 2003 dropping the reference to the LFA rule.
FI	Finland's milk quota regime stipulates that a maximum of 12,000 litres quota/ha is able to be transferred. In addition, quota is allocated to three groups, one of which is organic producers and/or producers with indigenous

Member State	Implicit environmental objective or measure
	breeds. Both elements could be construed as having implicit environmental objectives. Note, however, we are not aware of environmental objectives being cited by the government for Finland' milk quota regime.
FR	France's milk quota regime includes territorial development objectives, which could be seen as being implicitly environmental. These favour the preservation of the territorial distribution of dairy activities as it was in the early 1980s, thus seeking to protect more economically fragile rural areas from agricultural decline or further specialisation with respect to dairying. Specific caution is reserved for LFAs, in particular mountain areas, which have been the object of quota redistribution and less quota reduction than other areas. In order to benefit from allocations from the national reserve, farmers must comply with the relevant environmental legislation/standards with particular reference being made to: – Nitrate Directive (<170 N kg per ha), – PMPOA (programme aimed at limiting agricultural pollution), – Norms applying to buildings where cattle are housed, – Regional specificities (norms on water quality in Poitou-Charente for example).
IE	Ireland's milk quota regime includes the objectives of sustaining a balanced spread of milk production and processing throughout the country and favouring small scale producers, many of which are in the LFAs. These could be seen as implicit environmental objectives. Relevant milk quota rules include: – Milk purchaser based quota management – Ring fencing provisions within LFAs for land and quota transfers – Restructuring, temporary leasing and unused quota rules in favour of small and medium sized producers The main objectives behind these rules and the regime as a whole are economic and socio-economic.
IT	Italy's milk quota regime includes an objective of preserving production in LFAs and mountain areas. Prior to 2003, milk quota could only be transferred within the same region or homogeneous area (i.e. LFA, mountain or plain). After 2003, the transfer of quota outside regions was permitted (up to 70 per cent of the reference quantity) although milk quota in LFA and mountain areas could still only be transferred to other farmers within these areas. Similar rules applied to temporary transfers, in terms of only permitting transfers between farmers in homogeneous areas (after 2004), and the operation of the national reserve which prioritised LFA and mountain

Member State	Implicit environmental objective or measure
	areas. The redistribution of unused quotas also favoured LFA and mountain dairy producers. Permanent or temporary transfers were also subject to a maximum limit of 30,000 kg quota/ha UAA (only producers with less than 30,000 kg/ha can buy or rent additional quota and, after the acquisition of additional quota, producers cannot exceed this limit). These objectives and elements could be viewed as implicitly environmental.
LU	Luxembourg's milk quota regime stipulates that following a purchase of quota without land, the producer can have a maximum of 12,000 kg quota/ ha. This could be construed as having an implicit environmental objective; however we are not aware of any environmental objective being cited by the government for Luxembourg's milk quota regime.
NL	The Netherlands' milk quota regime stipulates that a maximum of 20,000 kg quota/ ha is able to be transferred with land (unless the average exceeds this in which case the average applies). Also, since 2006, quota can only be sold and bought without land if the average amount (including the bought quota) does not exceed 20,000kg/ha. These measures could be regarded as implicitly environmental. However, discussions with officials at the Ministry of Agriculture, Nature and Food Quality about the foundations for the limit of 20,000 kg milk per ha have not been able to clarify the basis for the 20,000 kg/ha limit (Co Daatselaar, Pers. Comm. 21.11.07). One explanation is that in 1986, 1 ha was just enough to be self-supporting for roughage in the case of 3 cows with the average production per cow at that time (about 6,500 kg) and no young stock or other grazing cattle.
PT	Portugal's milk quota regime stipulates that transfers without land may only take place if the receiving farm is not located in an environmentally vulnerable area (specifically NVZ) unless certain conditions are complied with. Similarly national reserve rules seek to minimise production in environmentally vulnerable areas. These could be construed as having (at least) an implicit environmental objective although we are not aware of environmental objectives being cited by the government for Portugal's milk quota regime.
UK	The UK's milk quota regime includes the ring fencing of quota in the Scottish Islands. This could be construed as expressing an implicit environmental objective. However its primary objective is socio-economic, to prevent milk production from running down in these isolated areas.

8.3 Hypothesis 5: Milk quota regimes with *explicit* environmental objectives

Where Member State milk quota regimes have *explicit* environmental objectives, then less dairying or more extensive dairying is expected to occur in certain regions of those Member States, relative to the counterfactual.

As indicated previously, Spain is the only case study Member State with any explicit environmental objective in its milk quota legislation. Furthermore we have not come across any other national milk quota regimes with explicit environmental objectives or measures.

In **Spain,** the environmental element of the 1994 legislation can be discounted as there are no related measures or text in the legislation to support the environmental objective cited.

The 1998 legislation sets out two possible justifications for applicants wishing to transfer quota without land between regions. One is the improvement of the production structure of the recipient holding, the other is the extensification of production. In the case of the latter, the applicant's resulting stocking density after quota transfer must be at or below 2 LU per forage ha. Anecdotal evidence suggests that the vast majority of applicants (if not all applicants) used the improvement of the production structure as their justification for quota transfers between regions (Guy Beaufoy, Pers. Comm. 19.11.07). This is for the simple reason that this avoided the need to comply with the maximum stocking density associated with the extensification justification (which may have affected some producers). Even if producers had opted for the extensification justification, this would have only achieved relatively limited extensification (2 LU/ha is still fairly intensive). A further point to note is that the optional stocking density condition only applied to a small proportion of overall quota transfers. Transfers of quota without land *between* regions comprised only around 10 per cent of total transfers of quota without land (most were within regions).

In summary, in Spain the environmental element of the 1994 legislation appears to have had no impact and the 1998 measure is likely to have had little or no effect in terms of extensifying production. We are able to conclude that only one Member State had any explicit environmental objective to its milk quota regime and the relevant measures had little or no impact in terms of reducing or extensifying dairying.

Given the absence of structural or farm level impacts, the environmental consequences of this legislation are likely to have been very limited or negligible. In other words, the only Member State milk quota regime with an explicit environmental objective does not appear to have been effective in delivering any environmental benefits of note.

8.4 Hypothesis 6: Milk quota regimes with *implicit* environmental objectives

First order effects

Where Member States have milk quota measures with *implicit* environmental objectives relating to the LFA, then milk production, dairy cows and dairy farms are expected to have been maintained in LFAs and/or other priority areas at a higher level than otherwise. Where these objectives relate to limits on milk production, levels of production are expected to be maintained or reduced.

There are six Member States with milk quota measures targeted at either the whole or part of the LFAs – France, Italy, Ireland, Spain, Germany and the UK.

In **France**, the rules for quota management effectively sought to freeze the geographic distribution of dairy production by *Département* as it was in 1983. Although the milk quota regime does not specifically target LFAs, the effect is that dairy production has been sustained in these mountainous zones or less competitive areas (see also Section 7.4). Depending on the farm management and other factors this is likely to have contributed to the maintenance of traditional landscapes, and pastoral habitats, and the preservation of an important part of dairy production under mainly pastoral practices

The distribution of dairy holdings and milk production by LFA and non-LFA is shown in Table 8.2. This illustrates the significant share of dairy holdings located in the LFA and the relatively modest proportion of production derived from dairy farms in Mountain LFAs.

Table 8.2 Distribution of dairy holdings and milk quotas in LFA and non-LFA in France in 2005

Area	Share of dairy holdings (%)	Share of national milk quota (%)
Mountain LFA	19	13
Other LFA	17	17
Non-LFA	64	70

Source: Breeding Institute

Over the period 1984/85 to 2004/05, the proportion of national milk production delivered within Mountain LFAs increased from 10.4 per cent to 13.5 per cent, in total amounting to a 16.5 per cent increase in quota, see Table 8.3. While comparable data does not exist for the full period for other LFAs, there are similar positive trends for quota in these areas over the past decade.

Table 8.3 Distribution of milk quota (1000 tons) in France per type of region

<table>
<tr><th></th><th>1984/85</th><th>1994/95</th><th>1995/96</th><th>2004/05</th><th>Percentage change (%) 1984/05 – 2004/05</th><th>Percentage change (%) 1995/06 - 2004/05</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Mountain LFA</td><td>2,665,926</td><td>3,086,872</td><td>2,978,731</td><td>3,105,209</td><td>16.5</td><td>4.2</td></tr>
<tr><td>Other LFA</td><td rowspan="2">22,957,301</td><td rowspan="2">20,472,825</td><td>3,831,592</td><td>3,975,769</td><td rowspan="2">-13.1</td><td>3.8</td></tr>
<tr><td>Non-LFA</td><td>16,073,179</td><td>15,971,367</td><td>-0.6</td></tr>
<tr><td>Total France</td><td>25,623,227</td><td>23,559,697</td><td>22,883,502</td><td>23,052,345</td><td>-10.0</td><td>0.7</td></tr>
<tr><td>Mountain LFA / Total France (%)</td><td>10.4</td><td>13.1</td><td>13.0</td><td>13.5</td><td></td><td></td></tr>
<tr><td>Other LFA / Total France (%)</td><td>n/a</td><td>n/a</td><td>16.7</td><td>17.2</td><td></td><td></td></tr>
</table>

Source: ONILAIT (Année laitière 2004)

In terms of the number of specialist dairy holdings, there was a slower decline in mountainous zones (-20 per cent) compared to non-LFA areas (-40 per cent) over 1990-99 (Ruas, J.F. 2002). This evidence of a slower rate of reduction in the number of dairy farms in both Mountain and Other LFAs, relative to non-LFAs, can be compared with results although the differences are not great from FADN for the period 1995-2004, for the seven case study Member States. This also points to differences in the rate of decline although the differences especially between Mountain LFA and non-LFA dairy farms are not great (-28 per cent compared to -32 per cent), see Table 8.4 below (caution must be exercised with FADN data due to the changing sample from year to year).

Table 8.4 Indication of change in number of LFA and non-LFA dairy farms in case study Member States over 1995-2004 based on data drawn from FADN

LFA dairy farms	France		Germany		Ireland		Italy		Netherlands		Spain		UK	
Mountain LFA dairy farms	-7622	-28%	n/a	n/a	n/a	n/a	-10169	-29%	n/a	n/a	-11513	-56%	n/a	n/a
Other LFA dairy farms	-4208	-21%	-43416	-42%	-7528	-33%	n.d.	n.d.	n/a	n/a	-11971	-45%	-3746	-29%
Non-LFA dairy farms	-28817	-32%	-26373	-45%	-8953	-54%	-13152	-39%	-11438	-33%	-10115	-71%	-8019	-38%

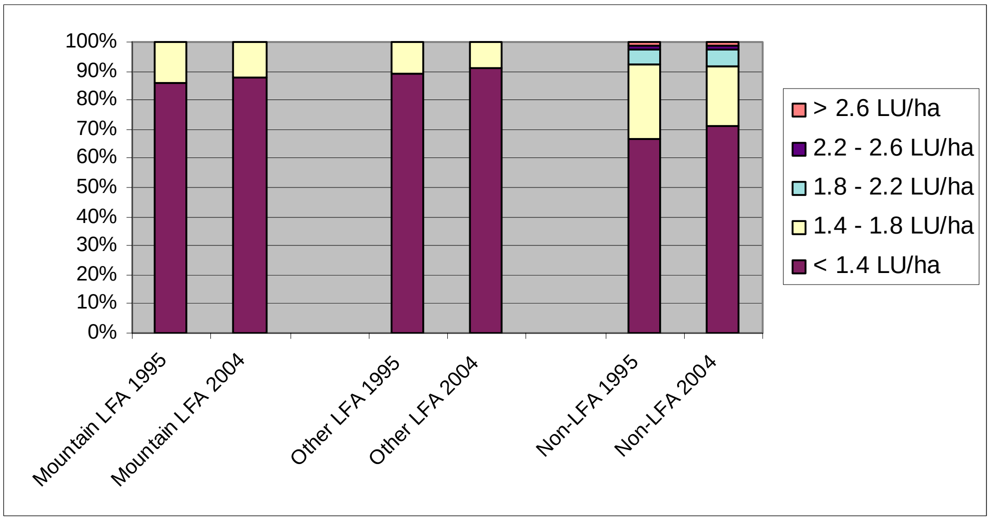
n/a = not applicable
n.d. = no data available

N.B Because FADN data is based on a changing sample of participating farms rather than a comprehensive survey it provides only an indicative picture of changing numbers of dairy farms.

In broad terms mountainous and non-LFA areas hold different dairy farming systems. Mountainous holdings are generally grass-based, small, and specialised (or mixed with meat production) with lower stocking densities. Non-LFA holdings on the other hand are mainly silage and cereal feed based, reasonably large, and often diversified (with pig, poultry or cereals production).

Changes in the proportion of dairy farms with different stocking densities over the period 1995-2004 are shown in Figure 8.1, using FADN data. This shows an increase in the proportion of more lightly stocked (<1.4 LU/ha) dairy farms in all three categories, Mountain LFA, Other LFA and non-LFA.

Figure 8.1 Number of dairy farms in France by LFA status and stocking rate, 1995-2004



Source: FADN
Note: the reservations about using FADN time series data noted in Table 8.4 apply here too.

In summary, in France, there has been a proportionate increase in the amount of milk produced in Mountain LFAs compared to non-LFA areas, a slower decline in the number of dairy farms in Mountain LFAs compared to non-LFA areas and an increase in the proportion of lightly stocked dairy farms both inside and outside LFA areas.

Without the territorial approach to milk quota, it is likely that previous trends would have continued, namely the migration of production to Western regions and away from areas with a comparative disadvantage for dairying (such as the LFAs with low dairy cow density, small farms, low milk value etc).

In **Italy**, the quota regime has sought to maintain milk production both within administrative regions but also within Mountain and Other LFAs. While the aim was primarily social, an implicit environmental objective can be construed.

The distribution of milk production and milk quota by LFA and non-LFA in Italy is shown in Table 8.5. Milk production in LFAs, especially mountain areas, has generally been under quota compared to non-LFA areas.

Table 8.5 Distribution of milk production and milk quotas in LFA and non-LFA in Italy in 2006/07

Area	Share of milk production (%)	Share national milk quota (%)
Mountain LFA	17.5	18.6
Other LFA	5.2	5.3
Non-LFA	77.3	76.2

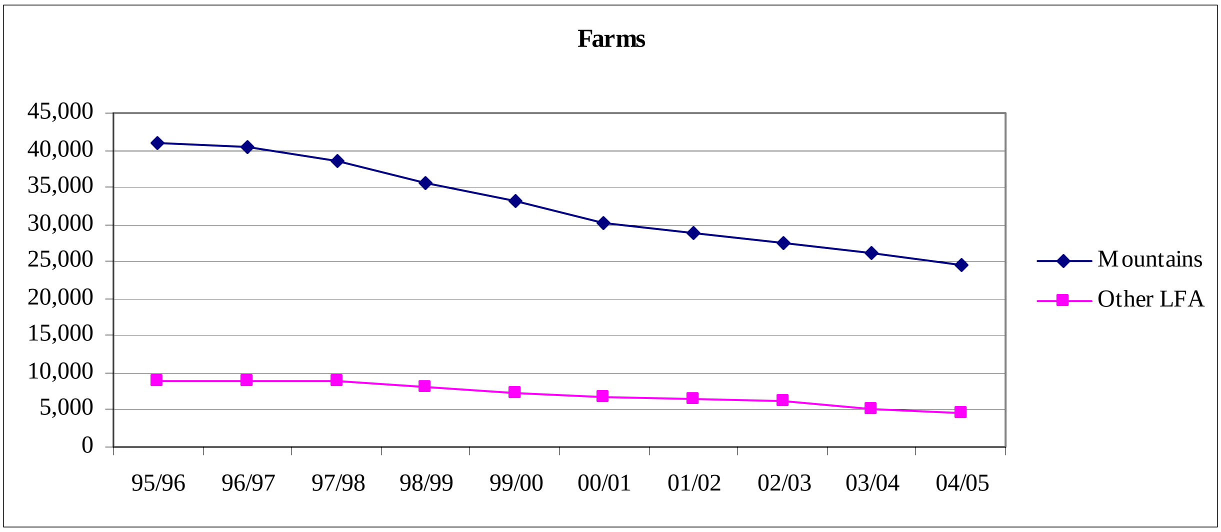
Source: ISMEA - Osservatorio Latte

Although milk production has increased in LFAs, milk output per Livestock Unit is still lower in LFAs than non-LFAs due to the presence of more extensive, outdoor systems and the greater specialisation and more intensive, indoor production systems in non-LFAs.

The reduction in the number of dairy farms in Italy over the period 1995-2004 as suggested by FADN data is shown in Table 8.4. This suggests that Mountain LFA dairy farm numbers decreased by 29 per cent compared to 39 per cent for non-LFA dairy farms with no FADN data for 'Other LFA' farms.

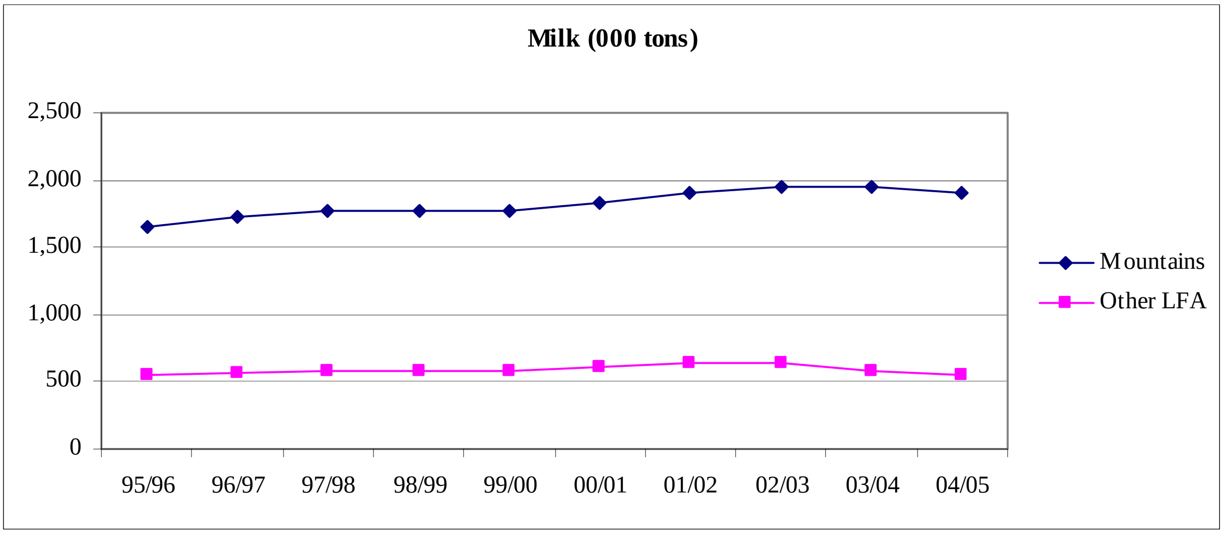
The case study illustrates recent trends in the total number of dairy farms and milk production in the Mountain and Other LFA. This shows the decline in the number of dairy farms in both types of LFA and the increase in milk production on Mountain LFA farms (see Figure 8.2 and Figure 8.3).

Figure 8.2 Number of dairy farms in Italian Mountain and in Other LFAs



Source: AGEA.

Figure 8.3 Milk production in Italian Mountain and in Other LFAs



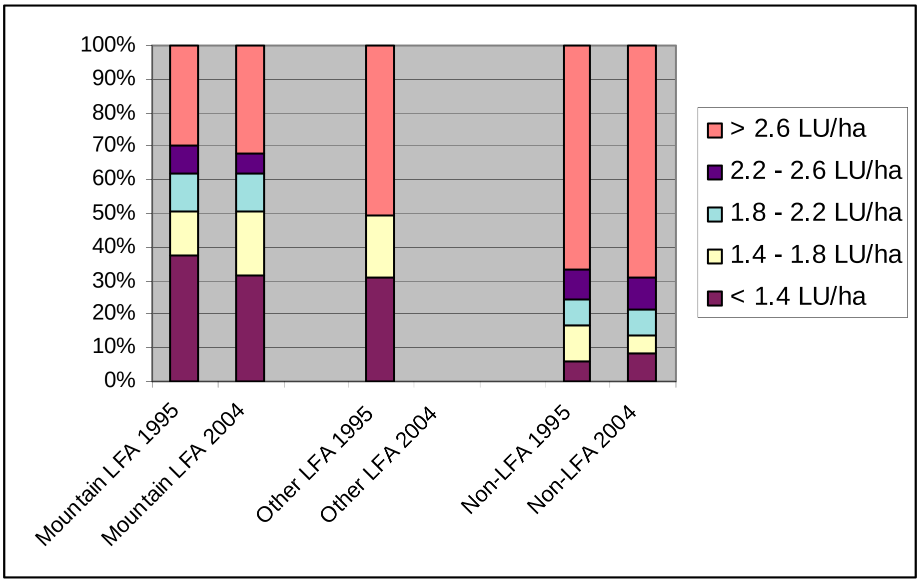
Source: AGEA.

The case study also identifies the following trends in farming systems:

- An increase in the proportion of outdoor systems of dairy production in LFAs (from 40 per cent in 1990-95 to 50 per cent in 2000-05) and, to a lesser extent, non-LFAs (from 1.5 per cent in 1990-95 to 4 per cent in 2000-05);
- A greater increase in the proportion of outdoor systems in Mountain LFAs (from 40 per cent in 1990-95 to 53 per cent in 2000-05) compared to Other LFAs (from 21 per cent in 1990-95 to 26 per cent in 2000-05);
- An increase in the proportion of all systems using feedstuffs as opposed to fodder crops, both in LFAs (from 11 per cent in 1990-95 to 41 per cent in 2000-05) and non-LFAs (from 16 per cent in 1990-95 to 50 per cent in 2000-05);
- A stronger process of concentration and intensification (farms with more than 1.4 LU/ha) occurring on farms in Mountain LFAs compared to farms in other LFAs.

FADN data support the final one of these points regarding the trend of relatively rapid concentration and intensification trend in Mountain LFAs. Figure 8.4 shows an increase in the proportion of more intensive (>1.4 LU/ha) dairy farms in Mountain LFAs during 1995-2004. There are no 2004 data for ‘Other’ LFA farms.

Figure 8.4 Number of dairy farms in Italy by LFA status and stocking rate, 1995-2004



Source: FADN
Note: the reservations about using FADN time series data noted in Table 8.4 apply here too.

According to the case study authors, the milk quota regime in Italy has had a positive impact in maintaining production in LFAs, especially thanks to the temporary redistribution of unused quota and, to a lesser extent, to the permanent transfer of quota without land and the temporary transfer of quota (see also Section 7.4).

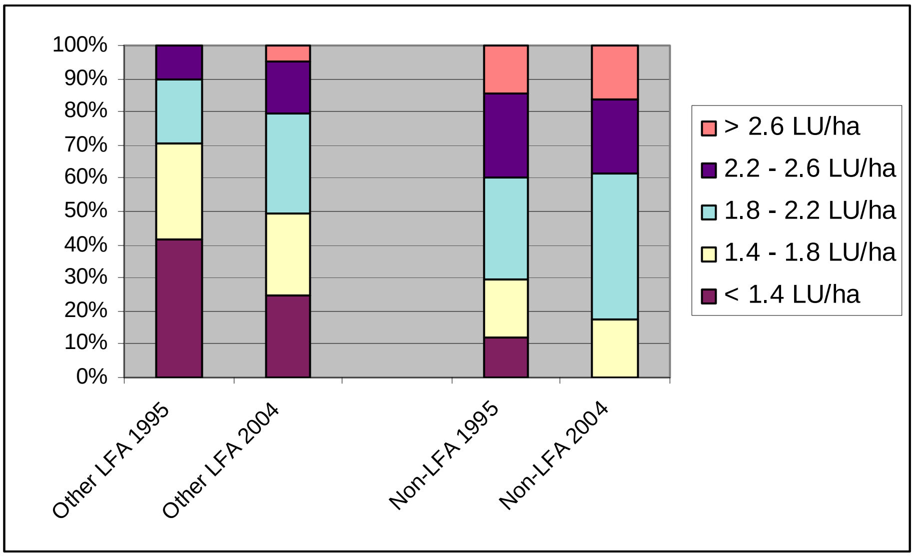
In **Ireland**, milk quota is allocated and managed at the milk purchaser level. This equates to loosely defined geographic areas (although the number of milk purchasers has reduced by a series of amalgamations over the years, resulting in fewer, larger areas). Initially land and quota sales were relatively free, however ring fencing provisions introduced in 1995 restricted the loss of milk quota out of LFAs. Quota transfers without land have been operated by milk purchasing co-ops via restructuring schemes or programmes and more recently by the Milk Quota Trading Scheme, small scale producers being one of the priority categories. Temporary leasing and the redistribution of unused milk quota are also operated at milk purchaser level, again with small scale producers being prioritised.

By restricting quota transfers to within milk purchasing areas, the regional distribution of milk quota and milk production/processing has been conserved to a large degree. This includes the maintenance of milk quota and milk production/processing in LFAs (which comprise around 75 per cent of Ireland's agricultural land). The prioritisation of small-scale producers via restructuring and other schemes has also benefited LFA dairy farmers, as they have a smaller average herd size compared to dairy farms outside the LFA. In some LFAs, the structure of dairying has been developing and quota has been more readily available in recent years. In other areas, dairy production was already well established and the supply of quota was limited.

The reduction in the number of different types of dairy farm in Ireland over the period 1995-2004 is indicated by FADN data (important caveats noted above). This suggests that LFA dairy farms have decreased by 33 per cent compared to 54 per cent for non-LFA dairy farms, see Table 8.4.

Changes in the proportion of dairy farms with different stocking densities over the period 1995-2004 are shown in Figure 8.5. This suggests a significant increase in the proportion of more intensive (>1.4 LU/ha) dairy farms in the LFA, although this must be seen in the context of overall intensity. Average milk yields have also increased, but are still low relative to the EU average.

Figure 8.5 Number of dairy farms in Ireland by LFA status and stocking rate, 1995-2004



Source: FADN
Note: the reservations about using FADN time series data noted in Table 8.4 apply here too.

Without the allocation and management of quota at milk purchaser level, and to some extent the priorities set for reallocation of quota, there would have been greater restructuring nationally. A regional shift in production away from the North and West to the more advantaged dairying areas of the South and East could have been expected.

In **Spain,** a mechanism introduced in 1998 to slow the exodus of quota from the LFA applied only to quota being transferred out of the administrative region, and not to transfers out of the LFA within the same region. In other words, the mechanism seems to have been intended to slow the movement of quota between regions, rather than to keep quota specifically within the LFA. As indicated previously, only the minority of quota transfers in Spain took place between regions (22,000 tons out of a total of 132,000 tons (17 per cent) transferred without land in 2002/3) so the LFA mechanism is only likely to have had limited impact. The national Constitutional Tribunal drew attention to the incoherence of this mechanism, and it was abolished in 2003.

Unfortunately, data is not available to show the amount of quota and number of farms potentially affected by the LFA mechanism.

In **Germany**, the elements of the milk quota regime that could be regarded as implicitly environmental include: the preferential allocation of milk quota to smaller farms or farms in mountain areas in some Länder; the granting of compensation to farmers who voluntarily abandon all or part of their milk production; and small amounts of quota allocated in favour of farms which manage grassland used by wild geese and in LFAs in North Rhine-Westphalia. The regional basis for quota trading in Germany (1993-2007) could also be construed, potentially, as being implicitly environmental (for example by maintaining dairy production in those Länder with alpine pastures or Länder with a high proportion of LFA). 'Maintaining the landscape' and 'preventing the migration of milk production from unfavourable locations' were cited as policy objectives of the milk quota rules by ministry experts interviewed as part of the case study. In general, however, Germany follows the principle that the milk quota system should not be overloaded with environmental or structural policy objectives, as these are better targeted by specific agri-environmental and structural policies which are implemented via numerous programmes.

The preferential allocation of milk quota (from the national reserve) to smaller farms or in favour of mountain areas was carried out in some Länder (for example, in Baden Württemberg, but not in Bavaria) in the first years of the milk quota regime, However, the administrative implementation proved to be difficult, and this programme was soon given up because of administrative problems. According to the experts interviewed as part of the case study, key factors in the decisions not to use preferential allocations on a wider scale were a) problems in finding objective criteria which would withstand legal scrutiny as well as being acceptable to stakeholders; and b) the low confidence of dairy farmers in administrative allocations (resulting from bad experiences with hardship cases during the first years of the milk quota regime).

The possibility of granting compensation to farmers who voluntarily abandon all or part of their milk production (Article 75 1(a)) was used only during the first years of the milk quota system. Quota allocated to the national reserve through this process was mainly used to reduce the national excess quota, with a small share being used to support farms in particularly difficult situations.

Länder were permitted to distribute reference quantities to producers according to objective criteria. However, only one Land made use of this possibility, North Rhine-Westphalia. Small amounts of quota were allocated in favour of farms which manage grassland used by wild geese and in LFAs and the latter was abandoned in 2005.

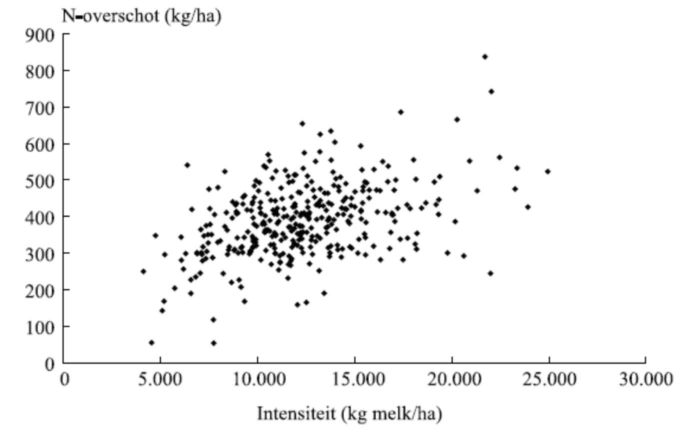
There is no data on the economic or structural impacts of these measures however it is likely that the impacts are relatively minor in the overall context.

The impacts of the regional basis for quota trading in Germany are explored in Section 7.2. Milk production has declined across the country with no apparent significant difference between regions with LFAs or high value landscapes and regions without. Furthermore milk quota allocations from the national reserve did not have a marked regional bias. Within certain regions however, there has been a significant relocation of production (e.g. in Bavaria milk production has become increasingly concentrated in areas with a high share of permanent grassland; reductions have primarily taken place in arable areas). Greater relocation might have occurred without the regional basis for quota trading.

In the **Netherlands,** the exact rationale behind the 20,000 kg/ha maximum limit on the amount of quota able to be transferred with land since 1986 is unclear. However, assuming that the rationale is at least partly 'environmental', the fact remains that the 20,000 kg/ha limit is intensive even by the standards of dairy farming in the

Netherlands. Figure 8.6 below highlights the relationship between nitrogen surpluses (kg per hectare)[66] and dairy farming intensity (milk production in kg per hectare) in the mid-1990s in the Netherlands. The graph shows both a) that there is a relatively weak correlation between the two variables; and b) that the great majority of farms were producing at below the 20,000 kg/ha threshold specified in the Netherlands.

Figure 8.6 Dairy production intensity against N-surpluses (1996/97)



Figuur 3.5 Intensiteit (kilogram melk/hectare) en fosfaatoverschot (kg P_2O_5/ha) zeer sterk gespecialiseerde melkveebedrijven 1996/97 (Informatienet LEI)

Source: LEI

The ceiling of 20,000 kg of quota transferred for one hectare of land has tended to be taken as the 'rule of thumb' for the exchange of milk quota with land in the Netherlands. Usually this has involved transferees taking on a lease of one hectare (or the relevant fraction of this) for one year, using that land for milk production and then, at the end of the period, giving up the lease and releasing the land back to the transferor for whatever purpose he desires (often arable). The net result is that the transferee receives an extra 20,000 kg quota to add to his existing quota holding on an unchanged farm area and the transferor gets his land back for his own use (Co Daatselaar, Pers. Comm. 19.11.07).

Both the intensive level of production associated with the maximum limit and the requirement for only a temporary land holding suggest that the measure will not have been effective in terms of limiting the level of intensification or promoting any other substantial environmental benefit.

66 Nitrogen and other mineral surpluses are captured by the MINAS system introduced in the Netherlands to address nutrient management on farms and hence assist with compliance with the Nitrates Directive. MINAS is a 'farm-gate balance approach' that calculates the difference between nutrients entering and leaving the farm 'through the farm gate'. Only nitrogen and phosphorus entering (input) and leaving (output) the farm through the farm gate is taken into account, while the farm itself is considered as a 'black box'. The difference between inputs and outputs is referred to as the farm surplus and is assumed to be lost to the environment. Mineral surpluses are considered as the best available indicators for farmers in relation to water and soil quality and provide a good means of quantifying some of the main environmental pressures arising from dairying. The case study suggests that the milk quota regime contributed to lower surpluses in the first years of its existence but by restraining production in later years other legislation mainly concerning manure and minerals nutrient took over this role.

In the **UK**, there is little data on the economic or structural impacts of ring-fencing quota to the Scottish Islands which affects only a very small proportion of national production. Colman (1998) indicates that ring-fencing has kept quota prices low (favouring expanding and new producers) and both milk production and processing has been maintained (with production in the Southern Isles under quota and Shetland production over quota over the period 1994/5-1996/7). Rationalisation has occurred with the number of milk producers declining in the islands, as elsewhere in the UK, with many producers increasing the scale of their operations.

8.4.1 Summary of farm level impacts

- In France, Italy and Ireland, measures designed to conserve the regional distribution of milk production have helped to sustain dairy farming in LFAs although other factors also will have played a part, including the profitability of local cheese production in some regions. An increasing proportion of national output in France and Italy has been produced in LFAs, with the increases highest in Mountain LFAs. Without such measures, some milk production would have migrated to better endowed dairying areas, those with a comparative advantage in terms of dairy cow stocking density, grassland productivity, proximity to processing plants etc.
- There has been a slower decline in the number of dairy farms in the LFA compared to non-LFA dairy farms. In France, the decline in the number of dairy farms in Mountain LFAs appears to have been more rapid than that in other LFAs.
- The proportion of more intensive dairy farms (>1.4 LU/ha) in LFAs has increased between 1995 and 2004 in both Italy and Ireland but not in France. Milk output per LU has increased in both LFAs and non-LFAs in Italy, although productivity is still lower in LFAs due to the presence of more extensive, outdoor systems compared with generally more intensive, indoor production systems in non-LFAs.
- Measures intended to favour small scale producers have also tended to benefit LFA dairy farmers. LFA dairy farms are generally smaller, and in Mountain areas often more extensive, compared to non-LFA dairy farms.
- In Spain, the mechanism in place between 1998 and 2003 which was intended to slow the exodus of quota from LFAs is likely to have had limited impact as it only applied to the minority of quota transfers which took place between administrative regions.
- The regional basis for quota trading in Germany could be construed as having an implicitly environmental objective and greater relocation of production may have occurred without this system. Other measures that might be considered implicitly environmental, such as aid for LFA producers, have been implemented on a sufficient scale to have significant economic impacts.
- In the Netherlands, the measure imposing a limit on quota transfers (in terms of amount of quota that can be transferred per hectare) is unlikely to have been effective in environmental terms. The majority of farms fall below the 20,000kg/hectare threshold which is intensive even by the Netherlands' standards. Furthermore the limit could be circumvented by acquiring temporary land holdings.
- In the UK there is little or no data on the structural and farm-level effects of measures with implicit environmental objectives.

Where implemented, milk quota measures with *implicit* environmental objectives, based on the allocation or ring-fencing of quota to LFAs do appear to have helped support milk production and dairy farming in those areas relative to what might have occurred under more liberal regimes. It should be noted however that dairy farms in these areas are also likely to have benefited from a range of other support measures including LFA and agri-environment scheme payments and investment aid. The environmental consequences of maintaining milk production in the LFA are less clear, however. This aspect is explored below.

Second order environmental effects

Where milk quota measures with *implicit* environmental objectives have led to reduced production or the maintenance of dairying in LFAs and/or other priority areas, then a range of environmental benefits (e.g. biodiversity, landscape etc) is expected to have been maintained.

In **France**, the case study authors conclude that by helping to conserve the geographical distribution of milk production over the territory, the milk quota regime has had positive environmental effects in terms of soils, biodiversity and the maintenance of pastoral landscapes. Dairy production has provided an economic rationale for the maintenance of important areas of grasslands, and cattle grazing in the LFA. The regime has also helped to maintain the regional specificities of dairy farming systems and dispersed employment, albeit on a declining number of farms. Furthermore, a range of adverse environmental impacts associated with the geographic concentration of dairy production in the most productive dairying areas have been reduced (see previous chapter). A rigorous examination of the precise role of dairying in contributing to environmental outcomes requires more knowledge of the counterfactual, particularly the management of farmland if dairying was not continued. The possibilities are several and include beef or sheep grazing (generally more extensive than dairying), arable production on more fertile soils, afforestation, especially on steeper land, or abandonment. These different options have diverse environmental profiles which are site specific to a significant degree.

In **Italy**, most of the same arguments apply. According to the case study authors, the milk quota system has had an overall positive environmental impact with respect to farms located in Mountain and Other LFAs. The milk quota system is considered to have contributed to maintaining livestock levels in the less productive and marginal areas of the country with likely positive environmental effects in terms of soil (soil fertility and organic matter favoured by the presence of permanent meadows and pasture and continued management by extensive livestock systems) and biodiversity and landscape (positively influenced by the presence of permanent meadows and pasture). Again however, greater knowledge of the counterfactual is required to be sure of these environmental effects. The actual milk production practices adopted on LFA farms reflect a variety of influences, including the physical restraints on production, structural and economic factors, the requirements of any specialised local products such as distinctive local cheeses, and policy interventions such as agri-environment measures, investment aid, etc. The milk quota rules influence the distribution of production rather than the management practice, as in France. Consequently, the environmental impact of the milk quota system on dairy farming in LFAs should not be overstated.

In **Ireland**, the main environmental impacts of the milk quota system in LFAs include biodiversity and landscape benefits arising from a greater diversity of land use. However, disbenefits have also occurred in certain locations as a result of higher stocking rates, more intensive grassland management and loss of landscape features relative to the counterfactual. Extensive beef and sheep grazing is the main alternative land use in Ireland's LFAs. Within the LFAs land abandonment is not uncommon. Water pollution risks are likely to have been higher on certain farms and in clusters of farms (around milk processing facilities, for example) due to the number of dairy cows sustained and the more intensive grassland management on dairy farms relative to other grazing systems. Some soil compaction and erosion may also have occurred on certain farms in less productive areas, where cow numbers have increased and stocking rates have risen, all in relatively high rainfall areas. Conversely, water pollution risks are likely to have been lower in more productive regions (the South and East) than they might have been under a freer regime.

In **Spain**, there is no data on the environmental impacts of the LFA mechanism. As the mechanism only covered the minority of quota transfers which occurred between regions, and then only a proportion of these (those which led to a greater than 1.5 per cent reduction in quota in the area), the environmental impacts are not expected to have been significant. In other words, quota mobility is unlikely to have been impeded much by the LFA mechanism, and production shifts out of marginal, upland areas will have continued unabated. There will have been negative impacts as a result of land abandonment or the adoption of environmentally less benign land uses (see Section 7.3) but benefits where less intensive grazing was introduced.

In **Germany**, there is no data on the environmental impacts of those milk quota measures that could be regarded as having implicit environmental objectives. The limited implementation of these measures suggests that the environmental impacts were relatively minor in the overall context. The exception is the regional basis of quota trading which operated from 1993 to 2007. This is likely to have slowed the process of geographic concentration in the dairy sector across the country, with environmental implications including reduced nutrient loading in certain locations. There is however no data to quantify this.

In the **Netherlands**, the 20,000kg/hectare limit on quota transfers is likely to have had limited environmental effects as indicated previously.

In the **UK**, there is no data on the environmental impacts of ring-fencing quota to the Scottish Islands. However, it is likely that dairy farming will have been sustained, maintaining a more varied livestock base (alongside beef cattle and sheep) than might otherwise have been the case.

8.4.2 Summary of environmental impacts

- In all Member States a clear picture of the alternative forms of land management likely to take place on farmland withdrawing from dairy production is essential in order to allow an analysis of the environmental impact of quota retention in the LFA.
- In France and Italy, the contribution of the quota rules to maintaining the regional distribution of milk production, including milk production in LFAs, is likely to have had positive environmental impacts in terms of soils, biodiversity and

pastoral landscapes by maintaining important areas of grasslands, open spaces and cattle grazing. However, there has been some intensification of production and there is little information on the alternative land rules in the absence of dairying.
- In Ireland, similar benefits arise, but disbenefits may have also occurred in certain locations arising from higher stocking rates, more intensive grassland management and loss of landscape features than might otherwise have occurred (under beef and sheep enterprises).
- The environmental impacts of milk quotas *per se* can be overstated for the LFAs given the already extensive nature of dairy farming in these areas and the range of other measures supporting dairying in LFAs and influencing the forms of management adopted.
- The measures intended to conserve the regional distribution of milk production also have the positive effect of reducing adverse environmental impacts arising from the geographic concentration of dairy production in the most productive dairying areas, such as water pollution, soil deterioration and loss of biodiversity and traditional landscapes.
- The environmental impacts of measures with implicit environmental objectives in Spain, Germany, the Netherlands and the UK are likely to have been relatively minor due to their limited implementation and/or farm level impacts. However there is a lack of data relating to these measures.

We are able to conclude from the above, that milk quota measures with *implicit* environmental objectives, by supporting dairy farming in LFAs, may have maintained a number of environmental benefits relating to the management of soils, pastoral landscapes and biodiversity. However some environmental disbenefits affecting biodiversity, landscape features and water quality are also likely to have occurred in areas including parts of the West of Ireland where dairying has intensified in certain locations fuelled by the ready availability of quota. Again, it should be noted that appropriate land management will also have been supported by agri-environment and similar schemes operating in these sensitive areas.

8.5 Conclusions

It appears that only one Member State, Spain, had an *explicit* environmental objective in its milk quota regime. However, the environmental element of the 1994 legislation appears to have had no impact and the 1998 measure is likely to have had little or no effect in terms of extensifying production. Therefore, very limited environmental benefits would appear to have been delivered.

A number of Member States, including France, Italy, Ireland, Spain, Germany, the Netherlands and the UK have had milk quota measures which one could construe as having *implicit* environmental objectives. These measures include quota and transfer rules which distinguish between LFA and non-LFA dairy farms. Based on the limited evidence available, the measures appear to have helped support milk production and dairy farming in LFAs relative to what might have occurred under a more liberal regime. The main environmental effect has been to maintain grazing systems in these areas, although there is considerable uncertainty about the forms of land management that would be employed in the absence of dairying.

9 CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

9.1.1 National Milk Quota Regimes

The imposition of a quota system on EU milk producers from 1984 has had the effect of limiting production close to the quota level in subsequent years, with some variations between Member States. By restraining the rise in production that would have occurred without quota in response to EU milk price levels, the quota system as a whole had a significant environmental impact. Air and water pollution were lower than they would have been in the absence of quota, for example (Alliance Environnement 2007).

The system prevented transfers of quota between Member States in sharp contrast to the regional redistribution of production that has been occurring in the US in the absence of parallel restraints on the movement of production between States. The relative rigidity of quota distribution between Member States has held back production in some regions and inhibited a greater level of specialisation at the European scale. This will have had both positive and negative environmental effects.

In the present study, the focus is on the operation of the milk quota system at the national level. Member States manage the system by establishing rules that must comply with a legal framework laid down in EU regulations. The national measures are concerned particularly with the transfer of quota between producers, whether temporary or permanent. These rules vary significantly between Member States and have changed over time. In most cases the tendency has been to move towards a more market based set of rules with fewer administrative interventions in the distribution of quota. There are exceptions to this rule but it is clear that the ten new Member States joining the Community in 2004 have adapted a relatively liberal and less interventionist approach than several of the EU 15.

Several aspects of national regimes can be identified as at least potentially significant in terms of possible environmental consequences. These are:

- Any formal environmental objectives embodied in national legislation. Implicit environmental objectives are also potentially significant;
- Rules governing the permanent transfer of milk quota with land, which may include constraints of environmental relevance, for example, maintaining production in the LFA or limiting the volume of quota that can be transferred per forage hectare;
- Rules governing quota transfer without land;
- Rules covering temporary transfer of milk quota;
- Redistribution of unused quota;
- Management of the national reserve, allocation of quota from the national reserve and the use of siphons to feed the national reserve;

9.1.2 Explicit and Implicit Objectives

In practice, it was found that only one Member State, Spain, had explicit environmental objectives in its national legislation with relatively limited measures to support these objectives. In some Member States there are measures with implicit environmental objectives. In France, Ireland and Italy for example, there are quota transfer rules that distinguish between producers inside and outside the LFA, either generally or at the regional level, although these rules have primarily been introduced for socio-economic rather than environmental reasons. Several Member States, including Belgium, Denmark, Finland, the Netherlands, Luxembourg and Italy have limits on the quantity of quota that can be transferred without land. Typically these are set at rather a high level – 20,000 litres in some cases and 30,000kg in Italy

9.1.3 Characterising National Regimes

Given the lack of explicit environmental objectives, much of the study is devoted to the analysis of measures with primarily economic rather than environmental goals. Broadly, national regimes can be categorised along a spectrum, ranging from those that are predominantly market based in their regulation of quota transfer, such as the Netherlands and the UK through to those that are more interventionist, with a greater role for administrative action in the transfer of quota, build up of a national reserve and other matters. France is an example of this group, as is Ireland, though less so than previously, whereas Spain has become more interventionist in recent years.

We have assumed that, at the most market-oriented end of the spectrum, trends in location of production and in the structure of the sector are the least distorted from what they would have been without the quota scheme at all. Therefore, trends in Member States that are characterised as 'unrestrictive' serve as a 'minimum intervention' counterfactual with which Member States situated at other points of the continuum can be compared.

9.1.4 Identifying Environmental Impacts

In practice, there is little empirical evidence available to establish the precise environmental outcomes attributable to the milk quota rules and so it has been necessary to rely on logical reasoning and rather indirect evidence in most cases. A series of hypotheses have been developed and tested to produce a clear structure for this reasoning.

Environmental effects will arise from factors such as changes in the overall number of cows, production methods used, particularly in relation to grazing and type of feed, the intensity of production, and the character of the location in which production takes place. Where milk production ceases, the subsequent land use is also relevant. The more intensive the production system, the greater the negative environmental impacts usually will be on biodiversity and landscape but this relationship does not necessarily hold for other parameters, such as greenhouse gas emissions, where the management of the farm and investment in appropriate equipment are important variables. The maintenance of grazing on semi-natural grassland is the principal environmental benefit of dairying. However, proving causality between observed environmental effects and the different ways in which Member States have implemented the milk quota system and observed environmental effects is not straightforward.

9.1.5 Quota Mobility and Concentration

Changes in the regional distribution of milk production have occurred in all Member States, irrespective of the quota regime or whether the overall trend in output has been rising or, in several cases, falling. As would be expected, evidence from the seven case study countries, shows that greater mobility has occurred in those Member States that permit national markets in transferable quota to operate.

This leads to two distinct but related effects:

- Transfer of production between regions, to the benefit of more competitive regions, a process expected to have environmental implications.
- In some Member States, such as Spain, a tendency for production to concentrate over time in a smaller number of regions, leading to a significantly reduced level of dairying in others.

Greater regional concentration does not always result in higher production in those regions that have gained a larger share of national output. In several cases absolute levels of production have declined, along with larger falls in the number of farms and dairy cattle. Environmental effects arise from the combination of concentration and other structural changes.

Below the regional level there is an active process of concentration occurring at the more local level and amongst farms as the number of producers declines.

Identifying concentration effects in the available data is not straightforward, since concentration phenomena that are quite acute in particular localities may not be picked up in data compiled at the level of a large region – and are likely to be less affected by quota rules.

It appears that a greater degree of quota mobility between producers leads to larger herd sizes, which is likely to promote intensification of production methods (input use, milk production per hectare, stocking densities).

- The highest average yields (milk output per dairy cow) generally are recorded in countries with the largest average herd sizes (Denmark, Sweden, and the Netherlands). The UK is the outlier here.
- The lowest average yields tend to be associated with small average scale or with Mediterranean conditions, or both, although neither Ireland nor France entirely fit this trend.
- Other things being equal, moderate or full market orientation boosted the rate of scale increase by about 143 percentage points above the rate that would have occurred over the 25 year period to 2005 if transfer mechanisms like those in the 'non-market' countries had been used.
- Administrative transfers, or extremely restricted regional markets, have not promoted scale increases to the same extent as more market-oriented mechanisms for reallocating quota between producers.
- Different national philosophies regarding the mechanism for quota transfer are one of the factors determining the current size structure and its environmental

consequences. However, the starting level of scale was also a very important determinant.

While there are exogenous trends developing over time in favour of more intensive production methods, independently of scale increases, scale still appears a significant driver of management decisions.

Interregional transfers by contrast can be either (a) beneficial environmentally, for example, where production moves to better managed farms or more appropriate production regions, such as those rare cases where it moves out of Nitrate Vulnerable Zones; or (b) more problematic, for example, where more traditional upland pastures are abandoned or landscape diversity is reduced in predominantly arable areas.

9.1.6 Environmental Objectives

The *explicit* environmental objective in the Spanish milk quota regime was related to measures targeted at extensification of production and production in LFAs. However, it does not seem to have been effective in either reducing or extensifying dairying in these regions and no environmental benefits of note appear to have been delivered.

Based on the limited evidence available, quota measures aimed at retaining dairying in the LFA in several Member States, including France and Italy, appear to have contributed to achieving this outcome relative to what might have occurred under a more liberal regime.

More data is needed to assess the environmental implications but there is likely to have been:

- More variation in production patterns in the LFA than otherwise, which may have led to landscape benefits in a number of areas.
- Maintenance of some environmentally valuable grazing systems – although it is unclear how far this would occur by other means, such as through beef production, if dairying was abandoned.
- Less production in regions where more intensive forms of management predominate, but some intensification on LFA farms.
- Prevention of some abandonment of land in LFAs, although this is not clear, given the role of other policy drivers and market factors, and the environmental profile of alternative land uses to dairying needs more examination.

9.1.7 Broader Environmental Impacts

Other environmental impacts arise more from the economic effects of the quota regime than the explicit objectives. The study found little direct relationship between milk quota rules and environmental impacts. These depend upon the structural changes that are influenced by the way in which milk quota rules have been designed and implemented and will depend also on the type of farm management in place. Environmental impacts are, therefore, necessarily location specific. Generalised statements are not easy to make and often hide a wide range of differing outcomes on the ground, both positive and negative. Changes at farm level may have negative impacts on one factor, such as biodiversity, but positive impacts on others, such as greenhouse gas emissions. The differing effects need to be individually and systematically assessed. It is not possible to trade one environmental issue off against another.

The evidence would suggest that a more liberal milk quota regime tends to allow for a greater degree of structural change to take place in terms of regional mobility of quota, concentration of production, change in scale of production etc. This suggests that the more restrictive, less market-oriented implementation regimes, by reducing quota mobility, curbed the potential environmental impact (both positive and negative) of structural changes. In particular, more restrictive regimes, by constraining regional mobility, are likely to have prevented the transfer of environmental impacts from one region to another. The underlying driving force behind these structural changes has not been the quota regime itself, but rather market and technological forces common to all Member States. Differences in quota implementation rules have altered the pace (or, marginally, the bias) of these trends but the quota regime itself has not been a leading driver in most cases. The retention of quota in the LFA in some Member States is a notable exception.

The most common restrictive rule, a ceiling on the quantity of quota transferred per hectare, generally has been set at too high a level to constrain transfers to more intensive production systems, as illustrated in the Netherlands.

National quota regimes are only one of a number of factors influencing dairy farm management. Others include market requirements; the Nitrate Directive and other environmental legislation; agri-environment and LFA payments; and PDO designations, which may include environmental conditions placed on production, for example as seen in parts of France and Italy. Due to the added value received through the production of, for example, cheeses, these PDOs are likely to have more of an impact on production systems than the milk quota regime in certain localities.

9.2 Recommendations

In principle, it is to be expected that, if the milk quota system comes to an end by 2015, as proposed by the European Commission, trends towards greater regional concentration of milk production will gather pace. In some Member States, this might involve a significant net loss of dairying from the LFA (with potential for both positive and negative environmental impacts) although the economic dynamics of the sector in such a scenario lie beyond the scope of this study. On the evidence of the case studies, LFA production appears likely to remain profitable in a number of locations in some Member States, particularly where natural handicaps are not too severe or where producers are able to capture a premium linked to a particular market.

It is recommended that in Member States where there is a concern about the potential loss of milk production in the future detailed studies be undertaken of the likely viability of continued production, particularly in more extensively farmed regions. These need to take account of market and price developments as well as policy scenarios. Insofar as a decline in production is predicted, the impacts on land management need to be identified, taking account of alternative farming systems that might take over. If a loss of grazing in areas of high landscape or biodiversity value is expected then remedial measures should be developed to meet environmental goals and commitments. Such measures could potentially take a number of different forms and the options include:

- Pillar II rural development measures targeted at dairy systems associated with the delivery of biodiversity and landscape benefits, for example through agri-environment schemes; and
- Targeting of direct payments from Pillar I resources at such dairy systems through Article 69 of Regulation 1782/2003 or its successor following the CAP Health Check.

REFERENCES

Alliance Environnement, (2007) *Evaluation of the environmental impacts of Common Agricultural Policy measures related to the beef and veal sector and the milk sector.* Report for DG Agriculture, European Commission. Available from: http://ec.europa.eu/agriculture/eval/reports/beefmilk/index_en.htm

Alvarez, A. and Arias**,** C. (2003). *Diseconomies of Size with Fixed Managerial Ability*, American Journal of Agricultural Economics 85 (1), 134–142.

Artis, M. and Nixson, F., (2007, fourth edition), *The Economics of the European Union: Policy Analysis.* Oxford University Press.

Arfini, F., Boccaletti, S., Giacomini, C., Moro, D. and Sckokai, P. (2006). *Case Study: Parmigiano Reggiano*. Report for JRC of the European Commission,, IPTS Seville. Available from:
http://foodqualityschemes.jrc.es/en/documents/Casestudies_8-ParmigianoReggiano.pdf

Bobbink, R, Hornung, M and Roelofs, JGM (1998) *The Effects of Air-Borne Nitrogen Pollutants on Species Diversity in Natural and Semi-Natural European Vegetation*. The Journal of Ecology, **86**, 5, 717-738.

Bos, J., Pflimlin, A., Aarts, F. and Vertès, F. (2005) *Nutrient management at farm scale. How to attain policy objectives in regions with intensive dairy farming?* Plant Research International, B.V. Wageningen.

Burrell, A. (1990). *Les coûts de production laitière au Royaume Uni*, Economie Rurale, N° 195.

CEAS Consultants (Wye) Ltd and European Forum on Nature Conservation and Pastoralism. (2000). *The Environmental Impact of Dairy Production in the EU: Practical Options for the Improvement of the Environmental Impact*. Report for DG Environment, European Commission.

Cederberg and Mattsson (2000), *Life cycle assessment of milk production — a comparison of conventional and organic farming*. Journal of Cleaner Production, **8**, (2000) 49–60.

Chatellier V. (2003). *L'élevage bovin et l'environnement en France : le diagnostic justifie-t-il des alternatives techniques ?* INRA Production Animale, 16 (4): 231-249

Chatellier, V., and Jacquerie, V. (2003) *Les exploitations laitières dans l'Union Européenne, Situation actuelle et perspective face aux réformes de la PAC*, INRA/ONILAIT.

Chatellier, V., and Jacquerie, V., (2004) *La diversité des exploitations laitières européennes et les effets différenciés de la réforme de la PAC de Juin 2003*, INRA Productions animales 2004, 17 (4), 315-333

Colman, D. (Editor) (2002) *Phasing Out Milk Quotas in the EU*, University of Manchester.

Colson, F., Chatellier, V., Daniel, K., (1998) *Using the Farm Accounts Data Network (FADN) to identify the structural characteristics and economic performance of the EU cattle systems*, INRA

Defra, (2007) *The environmental, social and economic impacts associated with liquid milk consumption in the UK and its production - A review of literature and evidence*. Department for Environment, Food, and Rural Affairs, London. Available at: http://www.defra.gov.uk/foodrin/milk/documents/milk-envsocecon-impacts.pdf

DG Agriculture, (1997) *Situation and Outlook Dairy Sector*, CAP 2000 Working Document.

DG Agriculture, (2006) *Agriculture in the European Union – Statistical and economic information 2005*. Available at: http://ec.europa.eu/agriculture/agrista/index_en.htm

Eurostat, (2007). *Agricultural Statistics (2007 Edition) Data 1995 – 2005*. Office for Official Publications of the European Communities, Luxembourg

Garnett, T. (2007) *Meat and dairy production and consumption. Exploring the livestock sector's contribution to the UK's greenhouse gas emissions and assessing what less greenhouse gas intensive systems of production and consumption might look like*. Food Climate Research Network, Guildford.

Garrido, C.L. and Barbeyto Nistal F. (2005). *A Evolução dos resultados económicos das explorações leiteiras Galegas 1996-2003*. Análise Empresarial No. 35.

IEEP (2006). *An Evaluation Of The Less Favoured Area Measure In The 25 Member States Of The European Union*. Report for DG Agriculture. Available at: http://ec.europa.eu/agriculture/eval/reports/lfa/index_en.htm

Isermeyer, F., Brockmeier, M., Gömann, H., Hargens, R., Klepper, R., Kreins, P., Offermann, F., Osterburg, B., Pelikan, J., Salamon, P., Thiele, H. (2006): Analyse *politischer Handlungsoptionen für den Milchmarkt*. Landbauforschung Völkenrode, Sonderheft 300. Braunschweig.

Mukhtar, S.M. and Dawson, P.J. (1990). *Herd Size and Unit Costs of Production in the England and Wales Dairy Sector*. Journal of Agricultural Economics 41: 9-20.

OECD, (2004) *Agriculture Trade and Environment, The Dairy sector*. OECD, Paris.

Promar International (2003). Strategic Development Plan for the Irish Dairy Processing Sector. http://www.icos.ie/content/content.asp?section_id=183

Raymond, F.W., (1985) *Options for Reducing Inputs to Agriculture: A Non-Economist's View*, Journal of Agricultural Economics XXXVI (3), 345-354.

Ruas, J. F., (2002) *La réforme de la PAC de 1992: bilan d'une décennie d'adaptation des élevages laitiers*, NEE N°16, avril 2002, p117-p142

Schmid, W., (2001) *Biodiversity of extensively used pastures and meadows in Switzerland: reflections on their management and proposals for agricultural policy support*. In '*Recognising European pastoral farming systems and understanding their ecology: a necessity for appropriate conservation and rural development policies*', of the Seventh European Forum on Nature Conservation and Pastoralism, EFNCP Occasional Paper No. 23. Available at:
ftp://ftp.fao.org/docrep/nonfao/LEAD/X6191e/X6191e00.pdf

World Bank (2004). *Environment at a Glance 2004: Greece*. World Bank, Washington D.C.

ANNEXES

Annex 1 Production of cows' milk in the EU 25 (2005)

Member State	Production of cows' milk, thousand tons	Percentage of production in EU 25 (%)	Share of production in EU 15 (%)	
			EU 15 Member States	Case study Member States
EU 25	142,560	100.0		
EU 15	120,617	84.6	100.0	
Austria	3,114	2.2	2.6	
Belgium	3,005	2.1	2.5	
Cyprus	147	0.1		
Czech Republic	2,813	2.0		
Denmark	4,587	3.2	3.8	
Estonia	670	0.5		
Finland	2,433	1.7	2.0	
France	24,675	17.3	20.5	20.5
Germany	28,453	20.0	23.6	23.6
Greece	768	0.5	0.6	
Hungary	1,929	1.4		
Ireland	5,100	3.6	4.2	4.2
Italy	10,975	7.7	9.1	9.1
Latvia	807	0.6		
Lithuania	1,854	1.3		
Luxembourg	268	0.2	0.2	
Malta	41	0.0	0.0	
Netherlands	10,845	7.6	9.0	9.0
Poland	11,923	8.4		
Portugal	2,061	1.4	1.7	
Slovenia	659	0.5		
Slovakia	1,100	0.8		
Spain	6,553	4.6	5.4	5.4
Sweden	3,206	2.2	2.7	
United Kingdom	14,574	10.2	12.1	12.1

Source: Agriculture in the European Union (2007)

Annex 2 Regional dairy production characteristics in seven Member States (1990-2005)

Member State/region	1990			1995			2000			2005		
	Share of cows (%)	Share of holdings (%)	Cows per holding	Share of cows (%)	Share of holdings (%)	Cows per holding	Share of cows (%)	Share of holdings (%)	Cows per holding	Share of cows (%)	Share of holdings (%)	Cows per holding
Germany	**100**	**100**	**22**	**100**	**100**	**25**	**100**	**100**	**31**	**100**	**100**	**38**
Baden-Württemberg	9	15	13	10	15	16	9	15	20	9	13	27
Bavaria	30	42	15	30	43	18	31	44	21	30	47	25
Lower Saxony	16	15	23	16	15	29	17	15	35	17	14	46
North Rhine Westphalia	9	10	19	9	10	24	9	9	30	9	9	41
Ireland	**100**	**100**	**27**	**100**	**100**	**31**	**100**	**100**	**37**	**100**	**100**	**45**
Border, Midlands and Western							24	31	28	24	28	38
Southern and Eastern							76	69	41	76	72	48
Spain	**100**	**100**	**8**	**100**	**100**	**11**	**100**	**100**	**16**	**100**	**100**	**24**
Galicia	30	41	6	34	48	8	36	51	11	39	51	18
France	**100**	**100**	**23**	**100**	**100**	**29**	**100**	**100**	**33**	**100**	**100**	**37**
Lower Normandy	12	11	27	14	11	33	12	10	38	12	10	43
Pays de la Loire	13	12	25	14	12	30	13	12	35	13	13	39
Brittany	18	18	24	21	18	30	19	18	34	19	18	39
Rhône-Alpes	7	10	16	8	10	21	7	10	25	7	9	30
Auvergne	7	7	21	7	8	24	7	8	28	7	8	32
Italy	**100**	**100**	**13**	**100**	**100**	**19**	**100**	**100**	**23**	**100**	**100**	**30**
Lombardy	27	12	28	35	14	42	30	15	46	28	16	53
Veneto	11	14	10	11	12	16	10	13	19	9	10	27
Emilia-Romagna	14	9	21	15	8	31	15	9	36	15	9	47
Campania	5	11	6	8	15	9	8	12	17	11	11	31
Netherlands	**100**	**100**	**40**	**100**	**100**	**46**	**100**	**100**	**47**	**100**	**100**	**61**
North	27	22	48	27	22	54	28	23	57	30	25	74
East	34	41	34	35	40	39	34	39	41	33	37	54
West	18	20	37	18	20	42	19	20	44	19	21	55
South	21	17	47	20	18	52	19	18	51	18	17	64
United Kingdom	**100**	**100**	**64**	**100**	**100**	**67**	**100**	**100**	**73**	**100**	**100**	**78**
South West England	25	22	73	25	21	78	24	21	82	23	22	83
Wales	11	14	52	11	14	55	12	14	62	13	13	75
Scotland	9	7	79	9	8	79	9	7	88	10	7	103
Northern Ireland	10	15	41	11	16	45	12	17	54	14	17	66

Source: Adapted and updated from OECD (2004). All data from Eurostat except data for German regions in 1990 & 1995 from OECD based on Eurostat.

Annex 3 Summary of rules[67] for transfer of quota with land (including rural leases) in the EU 25

Member State	Conditions relating to quota transfers Limit on quantity of quota transferred (QL) Regional restrictions on transfer (R) Quota use after purchase (QU) Priority groups (PG) Siphon (S) Leasing arrangements (LA)
AT	No significant restrictions.
BE	**(QL)** Maximum 20,000 litres per forage hectare **(QU) (PG)** Obligation to produce for 9 years unless transfer to family member (1st or 2nd degree, or in-laws with renewed obligation) **(S) (PG)** Compulsory sale to quota fund of 40% of quota for accumulation of quota only (relatives exempt). Not for new farms ('first installation'). Quota transfers over the per hectare limit result in 90% transfer of excess quota to national reserve (Wallonia). **(R)** No transfers between Wallonia and Flanders. Transfer must be to holding within 30km zone (exception for close relatives & spouses).
DE	Transfer of whole farm or parts of it including **(PG)** inheritance and successors. **(R)** Limited to Länder until 2007. Government districts in Bavaria and Baden Württemberg. **(QL)** Initially limit of 5,000kg/ha, 12,000 kg/ha from 1990. No limit since 1993. **(S)** 30% siphon on transfers above 350,000 tons. No siphon since 1993. **(LA)** 'Old land lease contracts' from before 1984 linked to quota ownership and transfer.
DK	**(QL)** Maximum 10,000 litres/ha until 2002. Since 2002 no limit. **(S) (PG)** 50% deduction of quota to national reserve.
EL	**(QL)** Minimum 5 tons per transaction unless transferor's total quota <5 tons **(S) (PG)** 5% of quota per transaction goes to national reserve (family transactions exempted).
ES	**(S)** Quota not transferred with entire holding goes to the national reserve. No significant restrictions on transfers of quota with land.
FI	**(QL)** Maximum of 12,000 litres/ha. Transfers must be accompanied by 2/3 of holding's arable land. If sold to several buyers then arable land divided proportionally. **(R) (PG)** Distance between buyer's and seller's holdings not more than 60km (exception for married couple or successors). **(LA)** Arable land can be leased as part of transfer but 6 year agreement necessary. Lessee has first option on purchasing quota used for >4 years sold to

[67] Information in Annexes 3-7 is drawn from a number of sources including case studies in seven Member States, information provided by DG Agri in response to a questionnaire circulated to national authorities and publicly available literature. Insofar as it is possible, information relates to the entire evaluation period of this study. However, in some cases it has only been possible to obtain information in regards to the recent situation rather than to the entire evaluation period.

Member State	Conditions relating to quota transfers **Limit on quantity of quota transferred (QL)** **Regional restrictions on transfer (R)** **Quota use after purchase (QU)** **Priority groups (PG)** **Siphon (S)** **Leasing arrangements (LA)**
	administration by quota owner.
FR	**(S) (PG)** Transfers subject to 'clawback' (siphon) to national reserve – regional rules vary. Since 1995 10% siphon is normal. Additional siphon between 0 and 40% for larger farms (typical thresholds >200,000 or >300,000 litres). No siphon for transfer of entire holding to a farmer who had no quota, transfers within LFAs, and transfers relative to the constitution of a special form of agricultural holding (GAEC). Before 1995 100% siphon for transfers <20 ha; 50% siphon for transfers to producers whose quota exceeds a threshold (fixed by the regulation and >200,000 litres quota). **(R)** Milk quotas transfers outside the *Département* are highly limited. Only 20% of the reserved quotas can potentially be attributed outside the Département they come from ("arrêté" of November, 10th. 1994)
IE	**(PG)** Since 2000 mainly family transfers, sale of land or renewal of lease created before 2000 **(PG) (S) (LA)** 'Clawback' (siphon) of up to 20% of quota transferred discontinued in 2000. 10% 'clawback' from 1995 until 2000 on all new 'land and quota' leases. Family and some other transactions excluded from 'clawback'. **(R)** Since 1995 'ring-fencing' of production in LFAs within 48km of original holding. **(LA)** Long term 'land and quota lease' common in late 1980s and 1990s. Quota often sold to lessee after expiry of lease. Since 1999 such quota could only be sold with land. New 'third party' land and quota lease prohibited since 2000.
IT	**(QL)** For partial transfers, land transferred must be in proportion to quota. No significant restrictions.
LU	Since 2000 transfers of quota have not been allowed except where entire holding is transferred and remains as a distinct unit.
NL	**(QL) (PG)** Since 1986 maximum 20,000 kg/ha (100,000 kg/ha limit in 1984). In 1985 quota transferred in proportion to area. No 20,000 kg/ha limit for transfers within families. **(LA)** Since 1989 producer can rent land with quota for at least a year. After this period quota is transferred to the producer who has rented the land.
PT	**(S) (R)** 7.5% of transaction to national reserve except for transfers from Nitrate Vulnerable Zones to non-designated zones. **(R)** Preference given to transfers to holdings outside of Nitrate Vulnerable Zones
SV	**(LA)** No specific entitlement by lessees to purchase quota at end of agreement unless agreed by producers. **(QL)** Specific amount of quota per hectare per transaction.
UK	**(QL)** Transfers of quota should not usually exceed 20,000 litres/ha **(LA)** When a new tenancy is granted on land attached to quota, the quota must be transferred to new occupiers unless tenancy is less than: 8 months (Scotland), 10 months (England and Wales) or 12 months (Northern Ireland).

Member State	Conditions relating to quota transfers **Limit on quantity of quota transferred (QL) Regional restrictions on transfer (R) Quota use after purchase (QU) Priority groups (PG) Siphon (S) Leasing arrangements (LA)**
	(R) 'Ring-fencing' of quota in Scottish Islands. Until 1994 transfers not allowed between 5 Milk Marketing Boards (MMBs). **(QU)** Once transferred, normal rules of apportionment apply to transferee.
CY	No quota transfers with land in practice. Quota sold without land
CZ	No quota transfers with land in practice. Quota sold without land.
EE	**(QU)** Transferor must have quota for 12 months prior to transfer (except in case of *force majeure*). **(LA)** Quota can be leased with land - no specific conditions.
HU	**(QU)** Quota cannot be transferred for 2 quota years. **(LA)** Quota can be leased with land - no specific conditions
LT	Quota transfer must take place within 3 months of taking over dairy holding. **(QL)** National standard for quota transfers is 10 tons per hectare. **(QU** Transferor cannot obtain quota from national reserve, or transfers.
LV	Quota linked to producer (or herd). No quota transfers with land. **(PG)** Future rules to permit transfer of quota with land due to 'early retirement'.
MT	No significant conditions. Milk quota is not attached to the holding (land) in Malta.
PL	No significant conditions. **(LA)** If a holding is leased the right to the quota passes to the lessee for the duration of the contract.
SI	**(QL)** Specific amount of quota per hectare per transaction is 15 tons.
SK	Transfer of quota takes place with transfer of dairy cattle. Quota transfers to new producer with land or change of farm ownership. **QU)** Transferred quota cannot be sold during following quota year. Transferor cannot acquire additional quota during following quota year. **(QL)** Quota leases with farm and dairy cows are possible for long term leases (>1 year).

Annex 4 Summary of rules for permanent transfer of quota without land in the EU 25

Member State	Transaction Method	Geographical restrictions	Other conditions relating to quota transfers
	Market price (M) **Administrative price (A)** **Administrative transfer (AT)** **Central Quota Exchange (QE)** **Private sale (PS)**	**Regional level (R)** **Purchaser level (P)** **Less Favoured Areas (LFA)**	**Limit on quantity of quota transferred (QL)** **Quota use after purchase (QU)** **Priority groups (PG)** **Siphon to national reserve (S)**
AT	**(M)** Market price	No regional restrictions since 1996. **(R)** Exception – restrictions on alpine pasture quota	
BE	**(A)** Administrative price for 40% **(AT)** Quota purchased by administration allocated to other producers in same area. **(M)** Market price for remaining 60% of quota. In Flanders market transfers until 1996.	**(R)** No transfers between Wallonia and Flanders. Within Cadre (W) 30 km zone (F)	**(QL)** Maximum 20,000 litres/ha (Flanders). No limit on quota transfers; depends on available quota and number of producers (Wallonia). In general, no purchases possible beyond 800,000 kg (Flanders) 90% siphon to NR on amounts over 800,000 kg (Wallonia). Exemptions in certain circumstances. **(PG)** Preference (50% of quota) given to young producers (<35 years old) (Wallonia), (<40 years old) (Flanders)
DE	**(M)** Transfers without land since 1993 **(QE)** Market price via regional quota exchange since 2000 (3 selling dates).	**(R)** Länder, Regierungsbezirke in Lower Saxony (1993-96), Bavaria and Baden Württemberg. Quota trade in new Länder not allowed until 2000. 2 trading regions since 2007 ('West and 'East')	**(PG)** Since 2000 direct transfers outside quota exchanges only between registered life partners e.g. spouses **(S)** Siphon of 5-15% to national reserve for unsuccessful bids on quota exchange 2000-2002.
DK	**(M) (QE)** National quota exchange since 1997. Since 2005 4 annual exchanges, previously 2. **(A) (AT)** National restructuring scheme 1989-1997	None.	**(S)** 1% deduction to national reserve **(QL)** limit of 300,000 kg for one man farms (stopped in 2005)
EL	**(M) (PS)** Negotiations between buyers and sellers. Transfers permitted until 31st January in quota year.	None.	**(S)** 5% deduction to national reserve **(QL)** Minimum transaction of 5 tons
ES	**(M) (PS)** Private transfers 1994-2005 (1 transfer per quota year by 1st October). **(A) (AT)** administrative transfers since 2005	**(R)** Since 1998 transfers between regions to improve production structures or extensify production (until 2003 <2LU/forage ha)	**(PG)** Before 2003 transfers within regions subject to conditions (e.g. full-time producers, young farmers, LFA holdings, etc)

Member State	Transaction Method	Geographical restrictions	Other conditions relating to quota transfers
	Market price (M) **Administrative price (A)** **Administrative transfer (AT)** **Central Quota Exchange (QE)** **Private sale (PS)**	**Regional level (R)** **Purchaser level (P)** **Less Favoured Areas (LFA)**	**Limit on quantity of quota transferred (QL)** **Quota use after purchase (QU)** **Priority groups (PG)** **Siphon to national reserve (S)**
		(LFA) 1998-2003 transfers out of LFA into another administrative region not allowed to result in decline >1.5% of region's total quota.	**(QL)** Minimum 50,000 kg per transaction (or entire holding) **(QU)** Producers who purchase quota without land cannot transfers quota out for 3-5 years.
FI	**(A) (AT)** 50% of quota sold to administration (at national price). Twice per year. **(M) (PS)** 50% free trade of quota at regional market price. Authorities to be notified by end of Feb.	**(R)** 7 trading areas	**(QL)** Up to 12,000 litres/ha (excess quota transferred to national reserve). **(PG)** 3 groups of producers: producers with a) free production capacity, b) 'other' producers (e.g. organic, rare breeds) and c) investing producers <65 years old (50% of quota available to groups a & b) **(QL)** Minimum of 15,000 litres. **(LT)** Free trade: transactions < 78,000 litres limited to one producer. Transactions >117,000 to no more than 3 producers.
FR	**(AT)** Abandonment programmes (ACAL[68]) compensate farmers who cease dairy production. Quota redistributed from national reserve according to regional priorities. No transfers without land between producers until 2006 **(AT) (A)** Since 2006 producers can sell quota to administration for sale to other producers (except Bretagne). Price determined by administration	**(R)** Since 1994 up to 20% of national reserve quota can move between Départements (little used in practice). No producer transfers between Départements (or very little because the quotas were tightly linked to land until 2006).	**(PG)** ACAL – objective criteria for allocation set at regional level (Département) for targeting at specific groups of farmers (e.g. young farmers, hardship cases, small producers, other producers) **(PG)** Since 2006 Office de l'Elevage defines groups of farmers for transfers without land.
IE	**(A)** Restructuring Schemes - main mechanism for acquiring quota (2000-2006). **(QE)** Milk Quota Trading Scheme since	**(P)** Milk purchaser level – geographic extent varies across country.	Restructuring Schemes: **(PG)** Priority groups: successors, producers with lost lease entitlements, young (<35 years) or new farmers, or producers

68 Aide à la Cessation de l'Activité Laitière.

Member State	Transaction Method Market price (M) Administrative price (A) Administrative transfer (AT) Central Quota Exchange (QE) Private sale (PS)	Geographical restrictions Regional level (R) Purchaser level (P) Less Favoured Areas (LFA)	Other conditions relating to quota transfers Limit on quantity of quota transferred (QL) Quota use after purchase (QU) Priority groups (PG) Siphon to national reserve (S)
	2007/08. **(A)** 30% of quota sold to priority pool at max €0.12/litre and **(M)** 70% in quota exchange at market price. Two stages per year.		with <350,000 litres. Milk Quota Trading Scheme: **(QL)** Since 2007/08 transaction limit of 60,000 litres per producer. 80,000 litres in 2008/09. **(PG)** 30% allocated to priority groups.
IT	**(M) (PS)** Transfers without land since 1992. **(A) (AT)** Abandonment programmes	**(R)** 1992-2003 no transfers between regions or autonomous provinces. Since 2003 no transfers out of mountain areas; no transfers from LFA to lowland holdings (except within Sicily & Sardinia);	**(QL)** Limit of 30 tons of quota per ha of UAA. Since 2003 transfers out of region limited to 70% of holdings quota in 2003/04. Island regions limited to 50%.
LU	**(M)** Market price. Since 2000/01		**(PG) (S)** 15% to national reserve but not for 1st degree relatives or spouses, where entire holding is transferred. **(QL)** Limit of 12,000 kg/ha of forage surface
NL	**(M) (PS)** Transfers of quota without land since 2006.	None	**(QL)** Limit of 10% of buyer's quota unless buyer can prove he has less than 20,000 kg/ha (no limit). **(QU)** No sale of purchased quota for 3 years.
PT	**(M) (PS)** Market price, private sale.	**(R)** Restrictions on transfers to Nitrate Vulnerable Zones.	**(S) (PG)** 7.5% siphon to national reserve except family transfers or in case of rules for limited producer companies.
SV	**(M) (PS)** Market price, private sale since 2000.	**(R)** Two regions. Only direct sales quota may be transferred between regions.	**(QL)** For purchases >300,000kg holding must have <16,000kg/ha of arable land (previously 12,000) or at least 1 cow per 10,000 kg quota (recent requirement).
UK	**(M) (PS)** Market price, private sale. Since 1992. Main method of quota transfer since 2002 (simplification of requirements).	**(R)** Ring-fencing of Scottish Islands. No restrictions in rest of UK. Before 1994 transfers within but not between 5 Milk Marketing Boards (MMBs).	Requirement to demonstrate improvement to structure of milk production on holding. Easing of administrative requirements in 2002. **(QU)** Apportionment of transferred quota to be agreed by all parties with a legal interest in quota. **(QL)** Recommended limit per hectare of 20,000 litres/ha.
CY	**(M) (PS)** Market price	None	**(S)** 5% deduction to national reserve.
CZ	**(M) (PS)** Producer to producer transactions.	None	**(S)** 15% deduction to national reserve

Member State	Transaction Method	Geographical restrictions	Other conditions relating to quota transfers
	Market price (M) Administrative price (A) Administrative transfer (AT) Central Quota Exchange (QE) Private sale (PS)	**Regional level (R) Purchaser level (P) Less Favoured Areas (LFA)**	**Limit on quantity of quota transferred (QL) Quota use after purchase (QU) Priority groups (PG) Siphon to national reserve (S)**
EE	**(PS)** Since 2006/07 quota transfers with cows. No direct price.	None	**(QU)** Transferor must have had quota for 12 months before transfer. **(QL) (S)** Quota transferred per cow is maximum 85% of average milk yield per cow. Any additional quota goes to national reserve.
HU	(**M) (PS)** Since 2005/06 Producer to producer transactions.	None	**(QL)** Amount of quota to be transferred linked to number of registered cows.
LT	**(M) (PS)** Private producer to producer transactions. **(M) (QE)** Since 2007/08 central quota exchange.	None	**(QL)** Limit of 10 tons/ha. **(PG)** Quota transfers allowed a) between family, b) for dairy farm restructuring c) inheritance and divorce. **(S) (PG)** 5% to national reserve except family transfers, inheritance, or to existing business partners (including co-ops). **(QL)** Transfer of quota with cows (stricter rules from 2007)
LV	**(M) (PS)** Producer to producer transactions. **(A) (AT)** Producers can sell all or part of their quota to national reserve.		**(QU)** Quota allocated from national reserve may not be transferred during same quota year. Quota leasing and quota donation (no payment) abolished in 2006.
MT	**(M)**	None	Transfer applications administered by Milk Reference Quantity Competent Authority.
PL	**(M)** Market price	**(R)** Transfers at level of Agricultural Market Agency branch.	**(S)** 5 % siphon to national reserve **(QU)** Transferor not eligible for national reserve allocations for 5 years.
SI	**(M) (PS)** Producer to producer transactions.	None	Transferor must produce documentation to show improvement to dairy production. **(QL)** Minimum 1000 kg transfer. **(S)** Siphon on transfers within regions (5-10%) and between regions (25-30%). Exceptions for mountain areas and LFA.
SK	**(PS)** Transfers of quota linked to transfer of cows and milk yield.	None	**(S)** No siphon unless insufficient cows to quota. **(PG)** Reallocation of quotas linked to quota size.

Annex 5 Summary of rules for temporary transfer of quota without land in the EU 25

Member State	Temporary transfers of quota	Geographical restrictions	Other conditions relating to quota transfers
	Market determined (M) **Administrative (A)**	**Regional level (R)** **Purchaser level (P)** **Less Favoured Areas (LFA)**	**Limit on quantity of quota transferred (QL)** **Priority groups (PG)** ***Force majeure* (FM)**
AT	**(M)**	None Except restrictions in **(LFA)** alpine pastures	**(QL)** Maximum 2 years. In second year only 30% (was (50%). Then 2 year waiting period **(QL)** Maximum 100,000kg per holding until 2005/06 (50,000kg in 2006/07, 30,000kg in 2007/08
BE	Not permitted in Flanders since 2007 (except for *force majeure*) **(M)** producer to producer transactions (Wallonia)	**(R)** Transfers within cadre (W)	**(QL)** Before 2007/08 up to 20,000 litres (Flanders). **(QL)** Transfers up to 20,000 litres (Wallonia) **(FM)** in Flanders
DE	Temporary transfers without land since 1993 Temporary transfers limited since 2000	**(R)** Since 1993 21 trading regions (Länder or Regierungsbezirke) (P) since 2000	**(PG)** this relates to land leases. **(FM)** Since 2001 short term leasing only in cases of animal epidemics or *force majeure*
DK	None		
EL	None		
ES	**(M)** Temporary transfers from 1994. Regional authorisation required.	**(R)** Transfers can be limited between different regions Since 1998 authorised transfers between regions permitted	**(QL)** Since 1998 minimum transfer of 5,000 kg **(QL) (FM)** A producer cannot lease out >25% of quota held for more than 2 successive years except increase in *force majeure*.
FI	Since 2006/07. **(M)** Private producer to producer transactions	**(R)** Within area (7).	**(QL)** Minimum transfer is 10,000 litres. Maximum 12,000 litres per arable ha after transfer. **(QU)** Producers cannot lease out quota in consecutive years. **(QU)** From 2007/08 quota bought for 'investing support' may be leased out for up to 3 consecutive years.
FR	None		

Member State	Temporary transfers of quota	Geographical restrictions	Other conditions relating to quota transfers
	Market determined (M) Administrative (A)	**Regional level (R) Purchaser level (P) Less Favoured Areas (LFA)**	**Limit on quantity of quota transferred (QL) Priority groups (PG) *Force majeure* (FM)**
IE	**(A)** Temporary Leasing Scheme (administrative price).	**(P)** Milk purchaser level, however provision for national pool	Allocations twice a year. **(PG)** Priority categories for successors, producers who have lost land and quota leases and producers with <350,000 litres (producers with more quota receive reduced allocation). **(FM)** Entire quota may be leased only in cases of *force majeure*.
IT	Temporary transfers allowed since 1993 (deadline 30th November) **(M)**	**(R)** Since 2004 temporary transfers must take place between active producers located in 'homogenous' areas (except Sardinia).	**(QU)** Since 1993 quota can be leased for 1 quota year and agreement only renewed once. After 2 consecutive years no leasing allowed in third year. **(QU)** Since 2003 temporary transfer of unused quota by active producers limited to current quota year
LU	None		
NL	**(M)** Producer to producer private transactions since 1987/88	**(P)** Purchaser level until 1996	**(QL)** Minimum 10,000 kg per transaction. Since 2004 no leasing out of all of quota (max 30% of quota). **(QU)** No leasing in after leasing out quota and vice versa.
PT	(**M)** Producer to producer private transactions		**(QL)** Transferor can lease out up to 10% of quota on mainland and 30% in Azores
SV	None		
UK	**(M)** Since 1986/87. Producer to producer private transactions	**(R)** 'Ring fencing' in Scottish Island. Before 1994 no temporary transfers between 5 Milk Marketing Boards.	Last date for transfers of unused quota initially 31st July, then 31st September, 31st December now 31st March. **(QU**) Since 2002 not possible to lease out all quota in same year. **(QL)** Until 2002 no limit on renewal of temporary transfer to same producer in consecutive years. Since 2002 temporary transfer must be different producer.
CY	None		
CZ	None		
EE	None		
HU	**(M)** Producer to producer private transactions	None	**(QL)** Up to 30% of producer's quota can be leased out for that quota year.
LT	(**M)** Producer to producer private transactions since 2007/08	None	**(QL) (PG)** At least 1.5 tons of quota but not more than 30% of a holding's quota to be leased unless producers members of same co-op production (<70%) or *force majeure* (100%).

Member State	Temporary transfers of quota	Geographical restrictions	Other conditions relating to quota transfers
	Market determined (M) Administrative (A)	**Regional level (R) Purchaser level (P) Less Favoured Areas (LFA)**	**Limit on quantity of quota transferred (QL) Priority groups (PG) *Force majeure* (FM)**
			(FM) Transferor cannot obtain additional quota in same quota year except for *force majeure*. Transferor cannot renew lease during following quota year or sell it.
LV	None since October 2006. **(M)** Before then producer to producer private transactions.	No information	**(QL)** At least 1000 kg for delivery quota, 500 kg for direct sales quota
MT	**(M)**	None	Transfer applications administered by Milk Reference Quantity Competent Authority.
PL	**(M)** Market transfers by 31 January	No information	**(QU)** Temporary transfers no longer than 3 consecutive years
SI	None		
SK	None		

Annex 6 Summary of rules for temporary redistribution of unused quota in the EU 15

Member State	Distribution of unused quota for calculation of the levy National level (N), Purchaser level (P)
AT	1. Linear reallocation to all eligible producers 2. In proportion to size of eligible producer's excess deliveries
BE	**(N)** National level In proportion to eligible producer's quota Maximum 15,000 litres per holding
DE	**(P)** Purchaser level then national level (before 2000 at regional level purchaser, regional then national level) From 2006/07 limit of 10% of holding's quota on purchaser level allocation.
DK	**(N)** National level In proportion to eligible producer's quota
EL	**(N)** National level 1. In proportion to size of eligible producer's quota 2. In proportion to size of eligible producer's excess deliveries
ES	**(P)** Until 2005/06 Purchaser level then national level **(N)** Since 2005/06 national level 1. In proportion to size of eligible producer's quota 2. Fixed criteria without reference to quota.
FI	**(N)** National level In proportion to size of eligible producer's excess deliveries
FR	**(P)** 1. Purchaser level during the quota year -general limit of 10% per producer but up to 20% in recent years, no priority groups **(N)** 2. National level at the end of the quota year - focused on small producers
IE	**(P)** Purchaser level then national level 'flexi-milk' – preference given to small producers In proportion to size of eligible producer's quota (two categories) 2. Common allocation to all eligible producers within each category
IT	**(N)** National level Advance of levy is deducted and paid by purchasers monthly on basis of producers' overruns. Allocations of unused quota made at the end of quota year according to criteria that preserve quota allocated to mountain areas and LFAs and give priority to both producers that have undergone a cut in the quota 'b' of their individual quantity (that is the difference between the quota referred to the theoretical reference period (1988-89, quota 'a') and the one referred to the actual reference period (1991-92) and young producers.
LU	**(P)** Purchaser level then national level In proportion to size of eligible producer's quota

Member State	Distribution of unused quota for calculation of the levy National level (N), Purchaser level (P)
NL	**(P)** Purchaser level then national level In proportion to size of eligible producer's excess quota
PT	**(P)** Purchaser level then national level In proportion to size of eligible producer's quota
SV	**(N)** National level In proportion to size of eligible producer's quota. (N.B. National quota never exceeded so no reallocation has been necessary)
UK	**(N)** National level (at producer level until 2004) 1. Unused quota is allocated to producers with herd restrictions. 2. In proportion to size of eligible producer's excess deliveries.
CY	**(P)** Purchaser level then national level In proportion to size of eligible producer's quota
CZ	**(N)** National level Common allocation to all eligible producers
EE	**(N)** National level In proportion to size of eligible producer's excess deliveries
HU	**(N)** National level In proportion to size of eligible producer's excess deliveries
LT	**(N)** National level Criteria for allocation of unused quota is common for all eligible producers
LV	**(N)** National level Common allocation criteria to all eligible producers
MT	No information on criteria. Reference Quantity not exceeded at national level.
PL	No information
SI	**(N)** National level In proportion to size of eligible producer's excess deliveries
SK	**(N)** National level In proportion to size of eligible producer's quota

Annex 7 Summary of national reserve management in the EU 25

Member State	Buying Schemes (Abandonment programmes, restructuring schemes, early retirement schemes)	Quota holders partial inactivity Article 72 (2)	Siphon to national reserve	National Reserve Allocations Quota use after allocation (QU) Priority Groups (PG) New Producers (NP)
AT	No information	Confiscation of unused quota if production <70% (was 50%) after 2 years	None	Linear allocations to all eligible producers based on quota size. Minimum 50kg per farmer. **(QU)** No sale of quota in year of allocation. Allocated quota not tradable for specified period. No temporary transfers.
BE	No information	No information	No information	Linear allocations to all producers based on quota size.
DE	Early retirement schemes between 1984 and 1991. No related programmes since 2000.	Article 72 (2) not implemented	30% siphon on transfers above 350,000 tons until 1993. 5-15% siphon on unsuccessful quota exchange bids 2000-2002	National reserve quota made available free of charge to quota exchanges to meet excess demand. Länder have option to distribute quota according to objective criteria but only applied in North Rhine-Westphalia.
DK	EU abandonment schemes 1986-1992. National restructuring scheme 1989-1997	Article 72 (2) not implemented	50% siphon (permanent transfer with land) 1% siphon (quota exchange transfers)	**(PG)** Young producers (22-41 years old) **(NP)** New producers receive allocations from national reserve. **(QU)** National reserve allocations returned if sold or transferred.
EL	Early retirement schemes	Confiscation of unused quota if production <70% after 1 year	5% siphon (permanent transfers with or without land)	Objective criteria depend on circumstances. **(NP)** New producers receive allocations from national reserve. **(QU)** National reserve allocations not transferred for 3 years (exceptions for early retirement programme, transfers to relatives or entire transfer to member of same legal entity).

Member State	Buying Schemes (Abandonment programmes, restructuring schemes, early retirement schemes)	Quota holders partial inactivity Article 72 (2)	Siphon to national reserve	National Reserve Allocations Quota use after allocation (QU) Priority Groups (PG) New Producers (NP)
ES	Abandonment programmes since 1991. Since 2003 National Quota Fund and National Quota Bank redistribute quota from abandonment programmes. Significant increase in quota transferred from 2005 (due to restrictions on private transactions)	Confiscation of unused quota if production <70% (75% pre-2003)	From 2003 15-20% siphon (transfers between regions, optional within regions).	Free quota allocated to producers on points system agreed in each region. Since 2005 National Quota Fund buys unwanted quota to sell to producers for fixed price. National reserve allocations cannot be transferred to another producer.
FI	None	Article 72 (2) not implemented	None	Quota distributed at regional level in proportion to existing quota. **(PG)** 50% of allocations to producers with free capacity and other producers (e.g. organic or rare breed). <50% to investing producers. **(QU)** National reserve allocations not transferred for 3 years.
FR	Abandonment programmes (ACAL) compensate farmers who cease dairy production since start of quota regime. Originally financed by EU then at national and regional level. Compensation favours smaller farmers (tiered payments). Rates varied	Confiscation of unused quota if production <70% - (appeals possible at regional level)	10% siphon as a general rule but with regional variation. Additional siphon (0-40%) possible depending on quota size. No siphon for purchase of whole farms by farmers without quota, for transfers within LFAs, and for transfers relative to the constitution of a special form of agricultural holdings (GAEC).	National reserve managed at regional level (Département) since 1991 (previously at level of 'collect zone') Since mid-1990s 20% of national reserve managed at national level but limited regional redistribution in practice. **(PG)** Quota allocations to priority groups first: young farmers, farmers in financial difficulties, small producers, farmers in mountainous areas.

Member State	Buying Schemes (Abandonment programmes, restructuring schemes, early retirement schemes)	Quota holders partial inactivity Article 72 (2)	Siphon to national reserve	National Reserve Allocations Quota use after allocation (QU) Priority Groups (PG) New Producers (NP)
IE	Restructuring Schemes (2000-2006).	Confiscation of unused quota if production <70%	No siphon since late 1990s Up to 20% ‘clawback’ until late 1990s (not transfers with land between close relatives and some other transactions). .	Objective criteria based on recommendations of Milk Quota Appeals Tribunal. **(PG)** Priority given to small scale farmers but range of factors taken into account. E.g. current quota size, commitment to dairying, off-farm income, size of holding, family circumstances, previous allocations, exceptional circumstances.
IT	Abandonment programmes.	Confiscation of unused quota if production <70% for 1 year (not *force majeure*)	Until 2003 10-15% siphon on quota transfers based on quota transferred.	Quota retained in region of origin up to level of excess production in previous year. Additional quota divided between regions and allocated according to producer’s supply record previous 3 years. Allocation criteria include young producers and limiting overproduction. **(NP)** New producers receive allocations from national reserve.
LU	None	Article 72 (2) not implemented	15% siphon on transfers without land (not between close relatives)	Allocations made according to objective criteria including: **(PG)** Young producers, structural improvements, development plans, hardship cases.
NL	None	Confiscation of unused quota if production <70% for 2 years	None	Linear allocations to all producers based on quota size

Member State	Buying Schemes (Abandonment programmes, restructuring schemes, early retirement schemes)	Quota holders partial inactivity Article 72 (2)	Siphon to national reserve	National Reserve Allocations Quota use after allocation (QU) Priority Groups (PG) New Producers (NP)
PT	None	Confiscation of unused quota if production <70% for 1 year	7.5% siphon (except transfers out of NVZs (with land) or transfers to family members or certain transfers to limited companies (without land).	Objective criteria: **(PG)** producer's age, producer's existing quota size, producer's location in specific areas or producers in exceptional circumstances. **(NP)** New producers receive allocations from national reserve. **(QU)** Allocated quoted cannot be sold for 4 years. **(PG)** Priority outside NVZs and to holdings with 'sustainable economic levels'.
SV	None	Article 72 (2) not implemented	None	Linear allocations to all producers based on quota size. **(NP)** New producers receive allocations from national reserve. Producers can apply for direct sale quota based on future sales.
UK	None	Article 72 (2) not implemented	None	Linear allocations to all producers based on net quota at end of year (previous allocations on basis of permanent quota).
CY	None	Article 72 (2) not implemented	5% siphon (permanent transfers)	Objective criteria: **(PG)** producer's age, producer's existing quota (<400,000 litres), producer's supply record in previous 3 years (>90% used), sale of quota in last 3 years, producers location in specific area (Limassol/Paphos) **(NP)** New producers receive allocations from national reserve. **(QU)** Allocated quota cannot be sold for 5 year

Member State	Buying Schemes (Abandonment programmes, restructuring schemes, early retirement schemes)	Quota holders partial inactivity Article 72 (2)	Siphon to national reserve	National Reserve Allocations Quota use after allocation (QU) Priority Groups (PG) New Producers (NP)
CZ	None	Confiscation of unused quota if production <70%	15% siphon (permanent transfers)	Producer's supply record in current year relative to quota. **(NP)** New producers receive allocations from national reserve.
EE	None	Confiscation of 50% unused quota if production <70%	Siphon on quota above 85% of the average yield per transferred cow.	Producer's supply record in previous year (>90% quota used). **(QU)** No allocation if producer has transferred out quota during last year.
HU	None	Confiscation of unused quota if production <70%	None	Producer's supply record in previous year relative to quota
LT	None	Confiscation of unused quota if production <70% quota for 1 year	Until 2007/08 5 % siphon (except family transfers, inheritance or between members of a co-op or holding)	Common allocation criteria unless there is a lack of quota in the national reserve. **(NP)** New producers receive allocations from national reserve **(QU)** Allocated quota return top the national reserve if quota is transferred within 2 years
LV	Abandonment programme	Confiscation of quota if production <70% quota	1% siphon (transfers without land)	Producer's supply record in current year (>70% quota used) Allocations 3 times during year (1 June, 1 Sept, 1 Dec) **(NP)** New producers receive allocations from national reserve. **(QU)** Allocated quota cannot be sold during same quota year
MT	No information			
PL	None	Confiscation of quota if production <70% quota	5% siphon (permanent transfers without land)	National reserve quota used: in response to successful appeals against initial allocations; to limit potential for national quota overrun; and to producers developing their milk production.

Member State	Buying Schemes (Abandonment programmes, restructuring schemes, early retirement schemes)	Quota holders partial inactivity Article 72 (2)	Siphon to national reserve	National Reserve Allocations Quota use after allocation (QU) Priority Groups (PG) New Producers (NP)
SI	None	Unused quota can be confiscated to national reserve if production <70% quota	5-10% siphon (transfers within regions) 25-30% siphon (transfers between regions) Exceptions/lower rates for given to mountain areas and LFA.	2005/06 allocations to establish base level for milk production From 2006/07: Producer's supply record in previous year relative to quota; Producers who bought quota on the market, linear allocation to all producers based on quota size. **(QU)** Allocated quota cannot be transferred for 5 years.
SK	None	Unused quota can be confiscated to national reserve if production <70% quota over 1 year period	Siphon applied if quota transferred is greater than number of dairy cows (up to 5,500 kg per cow or average yield of transferor in previous quota year if higher).	1. Producers whose quota was confiscated due to inactivity but resume production. 2. **(NP)** New producers (up to 50,000 kg each) 3. Producers can apply for additional quota (<15% of individual quota held) **(QU)** Allocated quota not transferred during following quota year.

Annex 8 Size distribution of dairy farmers according to amount of quota held

Source: Data provided to the European Commission by Members States.

These data have been used to calculate columns 2 and 3 Table 7.5.

	Number of producers by size of quota holding								
	Spain			**Portugal**			**Ireland**		
Quota (tons)	**1993/4**	**2003/4**	**2006/7**	**2003/4**	**2006/7**	**Quota (tons)**	**1993/4**	**2003/4**	**2006/7**
1000+	197	512	717	142	165				
750-1000	138	389	522	80	110				
500-750	385	1,059	1,331	258	355				
400-500	323	938	1,088	289	342	450+	757	1,204	1,508
300-400	667	1,700	1,844	527	651	300-450	1,263	2,780	3,660
200-300	1,664	3,696	3,539	1,097	1,200	200-300	5,433	6,654	6,542
100-200	7,562	8,891	6,708	2,817	2,363	100-200	11,626	9,123	6,712
50-100	16,882	8,424	5,355	2,743	1,950	0-100	22,311	5,451	3,620
0-50	111,091	16,001	7,512	9,663	5,325				
Total	**138,909**	**41,610**	**28,616**	**17,616**	**12,461**	**Total**	**41,390**	**25,212**	**22,042**

	Number of producers by size of quota holding						
	United Kingdom				**Netherlands**		
Quota (tons)	**1983/4**	**1993/4**	**2003/4**	**2006/7**	**1993/4**	**2003/4**	**2006/7**
1000+	967	860	6,573	4,763	263	862	1,544
750-1000				2,387	624	1,693	2,396
500-750		5,215	4,100	3,571	3,161	6,005	6,291
400-500	6,474			1,749	3,856	4,020	3,050
300-400		8,972	4,459	1,942	6,777	3,870	2,617
200-300	22,450	8,299	2,604	2,007	8,642	3,669	2,274
100-200	12,800	8,370	2,285	1,504	10,261	4,092	2,034
50-100	5,134	3,185	816	377	5,745	2,304	662
0-50	2,800	1,808	716	199	4,599	1,874	304
Total	**50,625**	**36,709**	**21,553**	**18,499**	**43,928**	**28,389**	**21,172**

	Number of producers by size of quota holding							
	Italy			**Belgium**			**Sweden**	
Quota (tons)	**1993/4**	**2003/4**	**2006/7**	**1993/4**	**2003/4**	**2006/7**	**2003/4**	**2006/7**
1000+	1,089	1,762	2,091				385	549
750-1000	872	1,143	1,209	282	795	1,190	342	410
500-750	1,862	2,102	2,183				1,002	1,036
400-500	1,467	1,483	1,437	314	862	1,009	849	808
300-400	2,489	2,395	2,142	1,269	1,746	1,765	1,336	1,183
200-300	4,893	4,117	3,570	2,892	2,808	2,404	2,018	1,547
100-200	13,959	9,477	7,743	5,891	4,851	3,951	2,473	1,784
50-100	20,705	10,915	8,504	6,280	2,758	1,631	985	656
0-50	93,542	26,804	19,141	8,268	1,876	1,120	637	396
Total	**140,878**	**60,198**	**48,020**	**25,196**	**15,590**	**13,070**	**10,027**	**8,369**

Number of producers by size of quota holding

	France		
Quota (tons)	**1993/4**	**2003/4**	**2006/7**
400+		8,764	11,494
300-400	32,638	12,111	13,568
200-300		28,630	27,340
100-200	58,405	36,080	27,812
60-100	30,920	11,247	7,153
0-60	49,816	11,139	6,966
Total	**171,778**	**107,971**	**94,332**

	Germany		
Quota (tons)	**1983**	**1994**	**2005**
1000+	3,201	1,789	1,532
700-1000			3,368
600-700	410	1,608	6,220
300-600	3,818	14,182	12,888
200-300	4,383	34,883	23,507
0-200	385,686	157,040	62,856
Total	**397,498**	**209,422**	**110,371**

	Number of producers by size of quota holding								
	Greece			**Finland**		**Denmark**			
Quota (tons)	**1993/4**	**2003/4**	**2006/7**	**2003/4**	**2006/7**	**1983/4**	**1993/4**	**2003/4**	**2006/7**
1000+	8	47	84	7	28			1,038	1,844
750-1000	14	24	53	14	41	983	1,372	1,260	862
500-750	29	91	178	121	260			1,684	892
400-500	18	126	150	236	364	1,107	1,548	790	418
300-400	71	200	246	614	846	2,070	2,894	881	426
200-300	166	402	418	2,208	2,362	6,010	4,221	837	452
100-200	751	870	715	7,085	5,511	10,703	4,283	609	334
50-100	1,576	1,217	916	5,001	3,229	7,349	1,526	197	105
0-50	25,172	5,692	3,534	3,115	2,256	4,457	546	36	31
Total	**27,805**	**8,669**	**6,294**	**18,401**	**14,897**	**32,679**	**16,390**	**7,332**	**5,364**