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Analysis of price transmission along the food supply chain in the EU

Accompanying document to the

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A better functioning food supply chain in Europe

{COM(2009) 591 final}

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1. INTRODUCTION

Agricultural prices have displayed extreme fluctuations over the last two years: reaching exceptional levels in the second half of 2007 and the first months of 2008, before falling sharply in the wake of the economic crisis. Whereas the commodity price surge generated a rapid and strong increase in food consumer prices, the subsequent pronounced fall in agricultural prices only triggered a slight decline in the consumer price of most food products to date.

The magnitude, the delay and asymmetry in the adjustment of food prices – which are particularly marked in some Member States – have raised serious concerns about the functioning of the EU food supply chain and the distribution of value-added between primary producers, food processors, wholesalers and retailers. Ensuring the effectiveness and efficiency of the food supply chain is crucial to raise its competitiveness at the benefits of both consumers, with lower prices, and stakeholders of the chain, with a sustainable distribution of value added. It is also essential in order to ensure that the various actors of the economy fully benefit from agricultural policy reform towards more market orientation.

This document aims at analysing the price transmission mechanism in the EU food supply chain, based on specific investigations of the pork and dairy sectors in certain Member States and with a specific focus on the extent to which the changes in commodity prices were transmitted to food consumer prices. It complements the work undertaken in the framework of the roadmap set up in the December 2008 Communication on "Food Prices in Europe", COM(2008) 821 and informs the conclusions laid out in this year Communication on "A better functioning food supply chain in Europe", COM(2009) 591.

Section 2 of the staff working document sets the framework of the overall analysis of price transmission along the food supply chain by providing an overview of the main concepts, recent evidence from research as well as the developments in agricultural and food prices at aggregated European-level. Then, the empirical assessment of the pass-through of price developments along the dairy and pork supply chain in a selected set of countries is given in section 3. The main findings and conclusions drawn from these empirical analyses are summarised in Section 4, with all the necessary caution given the diversity and complexity of the food chain across Member States and agri-food sectors, as well as the limited availability of reliable data on prices and margins along the chain.

2. PRICE TRANSMISSION ALONG THE FOOD SUPPLY CHAIN

2.1. Theoretical background

The assessment of price transmission along the food supply chain, i.e. how much and how fast price changes are passed through between the different stages of the chain, is often used as an

indicator of the effectiveness and efficiency of the chain as well as of the degree of competition in food processing and distribution.

The adjustment of the food supply chain to price changes is an important characteristic of the functioning of markets as it reflects the nature, structure and organisation of the chain. Measuring the degree of vertical price transmission thus helps to identify potential market failures. However investigating the price formation mechanism in the food chain is a complex exercise, mostly due to the lack of comprehensive and reliable data on prices, mark-ups as well as on the costs structures at each step of the chain.

In this section we briefly introduce the main concepts and definitions related to the analysis of price transmission and summarise the main factors that influence the extent, the timing and the potential asymmetry of price adjustments along the supply chain.

2.1.1. Definitions/background

The food supply chain is complex and heterogeneous, exhibiting a wide diversity of products, enterprises and markets. It basically connects three main economic sectors: the agricultural sector, the food processing industry and the distribution sectors (wholesale trade and retail trade). These sectors are linked through transactions carried out at specific prices between the various agents of the chain, e.g. farmers, food processors, wholesalers, retailers and final consumers.

Price formation in the food supply chain depends on several factors: the intrinsic specificities of the product (e.g. storability, perishable nature, seasonality), the market structure (e.g. intensity of competition at each step of the chain, number of intermediaries in the chain) as well as the existing public policies. The assessment of price transmission typically aims at addressing the following issues:

- the magnitude of the price adjustment, i.e. how much of the price change at one step of the food supply chain is transmitted to the downwards step;
- the speed of the price adjustment, i.e. the pace at which changes in prices at one level of the supply chain are transmitted to the other levels (e.g. are price changes transmitted instantaneously or distributed over time?);
- the asymmetry of the price adjustment, i.e. to what extent price increases and decreases are transmitted differently in terms of magnitude and speed (e.g. are increases in input prices transmitted more quickly than decreases in input prices?).

The analysis of the magnitude, speed and degree of asymmetry can thus contribute to identifying potential market malfunctioning and price stickiness in the food supply chain, i.e. the absence or the low level of price transmission along the chain.

However, it requires relevant and reliable price data. While prices for raw agricultural products are in general available and accurate, the situation is more problematic at the level of the food processors and retailers, hampering any complete measurement of the degree of price transmission. Moreover, data on prices at the wholesale level are virtually non-existing, leading to aggregate the impact of the distribution sector into the sole consumer price indicator. It is thus not possible to distinguish between the effects of the wholesale and retail sector in price transmission analysis.

2.1.2. *Key determinants of price transmission*

Perfect transmission of price movements along the food supply chain would imply that changes in prices at a given level of the chain would be fully and instantaneously transmitted to the other stages.

Furthermore, even if the changes in the price for the raw agricultural materials are fully passed on to consumers, primary agricultural producer, food producer and retail prices will show different percentage changes (other factors being equal) as the cost of raw agricultural products represent only a share in the total costs of the final consumer food product.

Complete and immediate short-run price transmission is in fact difficult to find in the real world. Yet, it does not necessarily always mean that there is market malfunctioning. Recent research has identified the most important factors that play a role in the degree of price transmission. These are addressed below in this section.

2.1.2.1. The cost structure of food production

The structure of the food supply chain and the range of food products available to consumers have changed dramatically over the last decades in the European Union. These developments have mainly been linked to the sustained rise in living standards, demographic and social trends (e.g. women activities, urbanisation and modern lifestyle), technological and structural changes in the production, transport, storage and distribution of agricultural and food products (which in turn allowed a considerable reduction in the cost of food production). Dietary patterns in the EU shifted considerably towards more processed food¹.

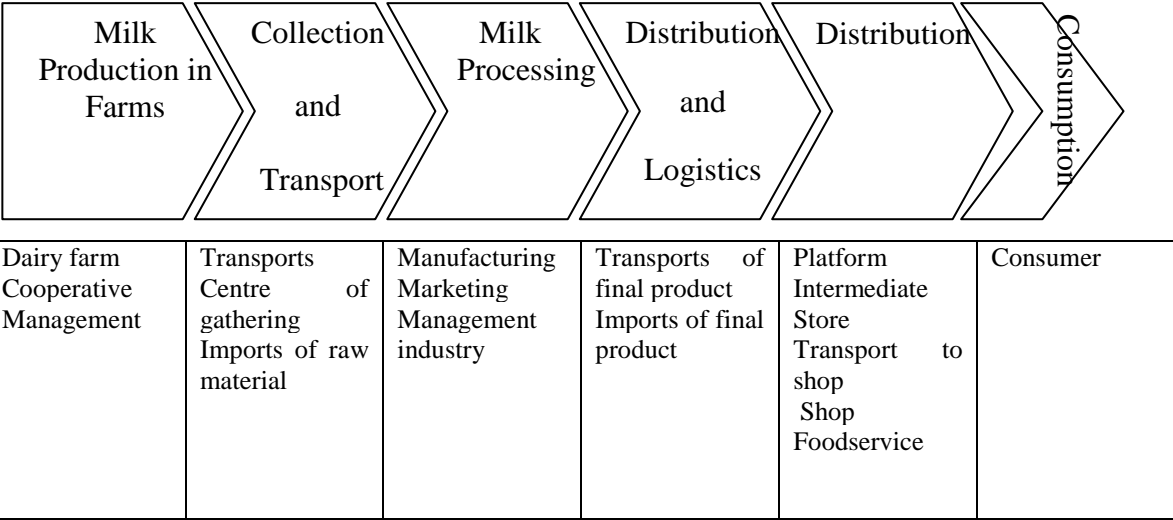
As a consequence, the structure of the production cost changed significantly. Nowadays, the costs of food products paid by final consumers are more influenced by costs of labour, energy and marketing than by the costs of the raw agricultural products. It is estimated that on average over the whole food chain, the cost of the agricultural products only make up approximately 20% of the final consumer prices². The other cost components relate to the complementary goods and services which are added during the increasing complex processing, logistics and marketing stages (e.g. energy, labour, capital). The importance of these costs which do not exhibit such pronounced short- and medium-term fluctuations as prevalent for agricultural goods, vary widely across product chains and countries.

The graph below illustrates the various stages of the chain in the dairy sector in Spain.

¹ McCullough, Pingali and Stamoulis (2008).

² http://ec.europa.eu/economy_finance/publications/publication_summary15232_en.htm

Figure 1: Value Chain in milk production



2.1.2.2. The competitive structure of the chain

The food chain is characterised by a wide diversity of market structures, with varying degrees of horizontal concentration and/or vertical integration³, and a large diversity of economic actors from independent SMEs to multinational enterprises. This diversity occurs both at product and Member State levels and can contribute to explain the different degree of price transmission between sectors and countries. Research tends to show that the presence of a non-competitive market structure and the exercise of market power are often perceived as the main potential cause of imperfect price transmission. For example, oligopoly and oligopsony market situation can cause price distortions and lags in price adjustments⁴. However, recent research⁵ argues that imperfect price transmission may not automatically imply uncompetitive environment and market power.

Imbalances in bargaining power within the supply chain can also affect the degree and speed of price transmission. Imbalances in bargaining power occur when more powerful enterprises are able to impose contractual arrangements on their suppliers/customers, either through better prices or through other contractual conditions. An enterprise with strong bargaining power in the chain will thus have the opportunity to diminish or delay the transmission of changes in input prices.

Consolidation has been taking place throughout the food supply chain in the EU, though at differing pace across product categories and sectors, with direct implications on the degree of

³ A vertical coordination is possible through contract between producers and purchasers. Contracts are usually an agreement on price, quality, quantity and/or time of delivery. The contract permits to share risk, benefit and cost. The vertical integration influences both the degree and asymmetry of price transmission, but the influence differs between sectors and stages of the food supply chain.

⁴ Wohlgenant, 1985; Schroeter and Azzam, 1991; Goodwin and Holt, 1999; Vavra and Goodwin, 2005; von Cramon-Taubadel, 1998; and Meyer and von Cramon-Taubadel, 2004.

⁵ Peltzman, 2000 McCorriston et al., 2001; Weldegebriel (2004); Azzam 1999.

bargaining power held by individual enterprises. However, the existence of strong concentration at one level may be counterbalanced by countervailing market power at another level of the chain (e.g. through the presence of a monopolistic seller or similar statutory and non statutory price determination mechanisms). Retailers' bargaining power has increased significantly in recent decades⁶, especially in their relations with SMES – e.g. in the case of producers of food identified with the supermarkets own label.

The agricultural sector, which is more fragmented, less organised with non-differentiated products, is often perceived as facing an unbalanced bargaining power vis-à-vis the rest of the chain (although the development of groups in the production and/or marketing of agricultural products has in some sectors improved this situation).

2.1.2.3. Other factors

Several other factors have been identified theoretically or empirically that can explain why prices changes (e.g. at farm level), are not always fully and quickly transmitted along the chain most notably in the short run (e.g. at retail level) and exhibit some asymmetry, even in a competitive environment. They mainly relate to adjustment constraints and costs such as:

- **Menu costs and price levelling practices**, i.e. agents prefer to absorb some of the upstream changes in order to minimise the costs associated with frequent changes in retail prices (e.g. advertising, labelling), consumer disruptions (for certain products such as fresh products, consumers are more sensitive to price changes than to price levels) and uncertainty over whether the source of the exogenous shock is permanent. This is particularly the case when changes are linked to temporary phenomenon⁷;
- **Perishable nature of some food products**: economic agents may not increase prices to avoid the risk of being left with spoiled products (Ward, 2008);
- **Internalisation of price variation**: in case of increasing input prices, economic agents may decide to keep output at constant price: e.g. when there are foreseeable price variation, a price average could be used (like for seasonal products), to fulfil a long-term contract (even if there are often clauses for price adaptation), to keep or increase their market share with reduced margins;
- **The number of vertical stages along the chain**, linked either to processing, moving or marketing, may induce some lags in price transmission and adjustment;
- **Spatial location and dispersion of the food chain**: low and asymmetric price transmission may occur in cases where retailers face low competition regarding alternative shop outlets at local level. On the other hand, producers remain constrained by the purchasers' ability to source from the next closest market. This may play a key role for important and concentrated retailers which organise their purchasing operations at EU level;

⁶ Harvey (2007).

⁷ When price changes originate from short-term weather conditions (e.g. fruits and vegetables), there is often little time to achieve full price restoration before the onset of another price change. The fact that prices are not fully restored may thus partly explain the continuing value divergence of some agricultural prices.

- Inventory **management**: stock behaviour by retailers may create lags in reducing prices. Likewise, the choice of accounting method such as FIFO (first in first out) or LIFO (last in first out) could cause a delay in price transmission due to the stock of products. If the method is different between agents or changes it is possible to observe an asymmetric adjustments to price shocks;
- **Imperfect information with regards to price changes**. Firms have imperfect knowledge of the current state of the price and value added distribution in the food supply chain. They gain information by observing the prices set by others. This gives each firm an incentive to set its price shortly after other firms set theirs. Yet, the risk of launching a price war may make firms more reluctant to lower prices in case of downwards price change;
- **Public intervention to support producer prices and/or control supply** could also cause asymmetry in price transmission as agents may anticipate government intervention in case of sharp price drops or may face stronger competition to access supply⁸.

2.1.3. *Recent evidence from research and studies*

A substantial amount of research and studies has recently been carried out on the assessment of price transmission in the EU food supply chain⁹. Although most research tends to show that imperfect and asymmetric price transmission is linked to market imperfections, concentration and agent's pricing policies, the empirical evidence and the theoretical underpinnings of these findings remain often mixed and vary widely across markets and countries.

Most empirical studies find little evidence of systematic imperfect price adjustments along the EU food chain, although this may happen in the short run in some specific sector/country situation. Furthermore, it seems that there is no consensus on the explanations for asymmetries in farm-retail price transmission.

Empirical analyses carried out in Denmark (Jensen and Møller, 2009) suggest that for most commodities, price transmission tends to be upward asymmetric, i.e. stronger impact of upward than downward price changes. Most asymmetries in price transmission occur in the retail stage. Furthermore, most asymmetries in price transmission take place in the short run, whereas price transmission is symmetric in the long run in most of cases. Another investigation in Denmark (Danish Competition Authority, 2009) also showed changes in margins along the supply chain over the most recent years, mainly to the benefit of processors (notably in the dairy sector). A study of the milk supply chain in Belgium (SPF Economie, 2008) concluded that differences in pricing on the short term are not to be necessarily linked to any anomaly and no irregularities could be found at the level of price formation at any stage of the chain. Similar conclusions were drawn by the French Price Observatory (FranceAgriMer, 2009) which could not find reasons for significant concerns in terms of price transmission and distribution of margins within the dairy and pig meat supply chain.

⁸ Gardner, 1975; Serra and Goodwin (2003); Kinnucan and Forker (1987)

⁹ Secrétariat d'état chargé de la prospective, de l'évaluation des politiques publiques et du développement de l'économie numérique (2008); London Economics (2004), SPF Economie, P.M.E., Classes moyennes et Energie (2008), Comité Economique, Social et Environnemental, (2009); Jensen and Møller, (2009), DairyCo (2009), Danish Competition Authority (2009).

As a result, caution is deemed necessary in drawing firm and far-reaching policy conclusions from these findings. These analyses point to the need for further research, most notably to improve the knowledge and understanding of the underlying economic behaviour of the agents along the chain¹⁰, as well as the measurement of price transmission (with regards to both data and statistical techniques).

2.2. Price development and transmission along the food supply chain

The section provides an overview of the aggregated price developments along the food supply chain¹¹, i.e. the agricultural sector (commodity price, farm-gate price), the food industry (food producer price, factory-gate price) and the retail industry (food consumer price). An econometric analysis of the transmission mechanism of these prices between each step of the chain is then given. The recent period of price decline in the European food supply chain enables to provide a more complete view of price transmission, since it can be analysed for both upwards and downwards trends.

2.2.1. Prices evolution along the food supply chain

2.2.1.1. Long-term price evolution within the food supply chain in the EU (over more than 5 years)

Comparing the respective evolution of price indices in sectors along the chain is insightful for the identification of the main potential issues affecting the sector. Figure 2 compares the evolution of price indices along the chain since 2000 in the EU27.

Three major observations can be derived from Figure 2 concerning price evolution in nominal terms within the food supply chain:

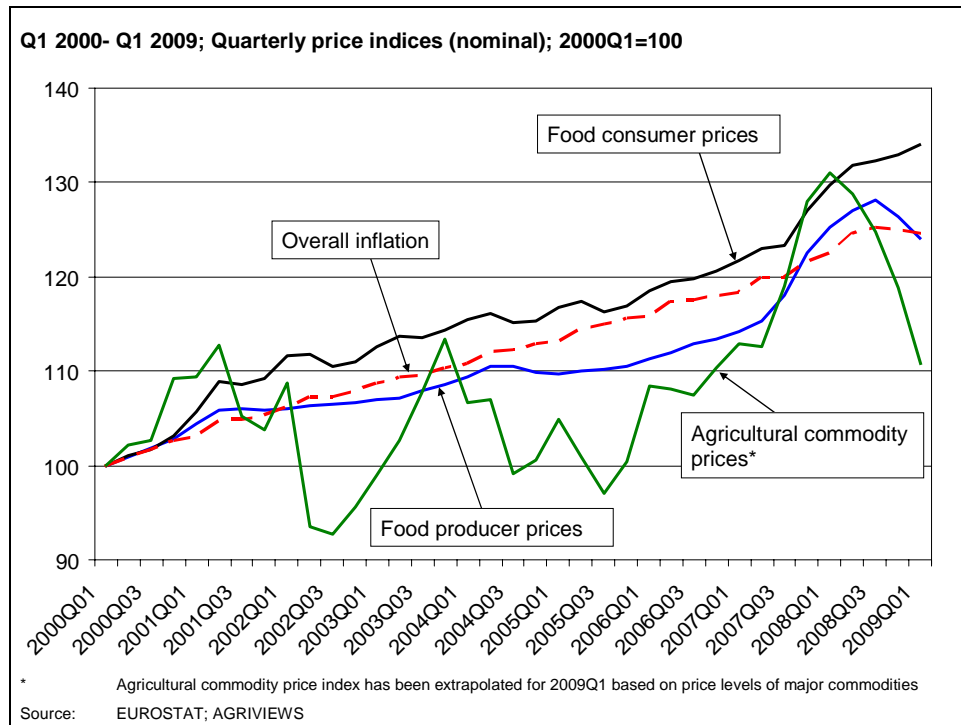
- **Agricultural prices are volatile:** over the time period considered, agricultural commodity price index has experienced three 2-year cycles of price increase and price decrease with significant magnitude – the maximum price in the cycle being ~20% higher than the minimum price. The current cycle, starting in 2006 and peaking in 2008Q1, shows the highest price variations (+30% in increase phase, -15% in decrease phase to date) and might not yet be over.
- **Food producer and consumer prices have stable inflation rates:** over the same period, variations in producer and consumer prices have been much smoother. Food producer prices have increased steadily at a ~2% yearly inflation rate between 2000 and 2007. Food consumer prices have increased at a higher pace at 2.7% per year, alongside overall inflation in Europe (~2.6%)¹².

¹⁰ The price transmission mechanism along the food supply chain is becoming increasingly blurred by the increasingly complex pricing behaviour of retailers based on products cross-subsidisation.

¹¹ For the agricultural sector, price evolution is measured by the average agricultural commodity price index and excludes VAT; for the food industry, by the producer price index of food and beverage producers (NACE15) and excludes VAT; for the distribution sector, by harmonised consumer price index for food and beverage products (COICOP CP011) and includes VAT.

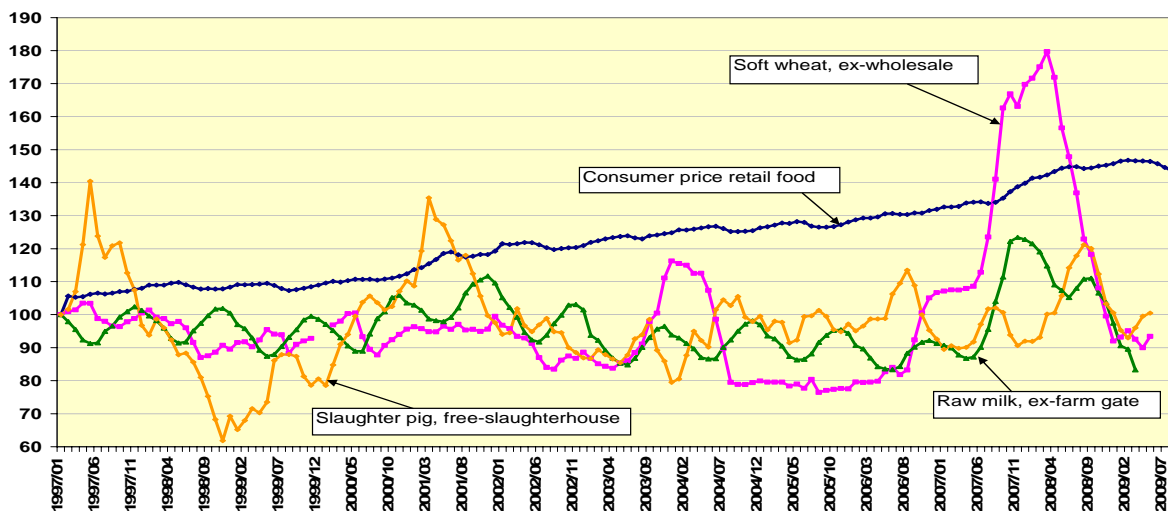
¹² On a longer term basis (last 30 years) food prices have decreased in real terms. Since 2000, food consumer prices increased faster than inflation only in 2001-2002 and 2006-2007.

Figure 2: Long-term prices evolution within the food supply chain, EU27



- **The pattern in price evolution has changed since 2007:** the unusually sharp and long increase in prices of agricultural commodity products has led to a doubling of inflation rates for food producer and food consumer prices since 2007. Moreover, the sharp decline in commodity prices since 2008Q1 has conducted to an unprecedented decline in food producer prices from 2008Q3 on. Consumer prices however have kept on increasing until Q1 2009 when they have started to stabilise and slowly decline – see Section 2.2.1.2.

Figure 3: Comparative developments in EU agricultural market, retail food consumer price indices in nominal terms (Jan1997-August2009, Jan1997=100)



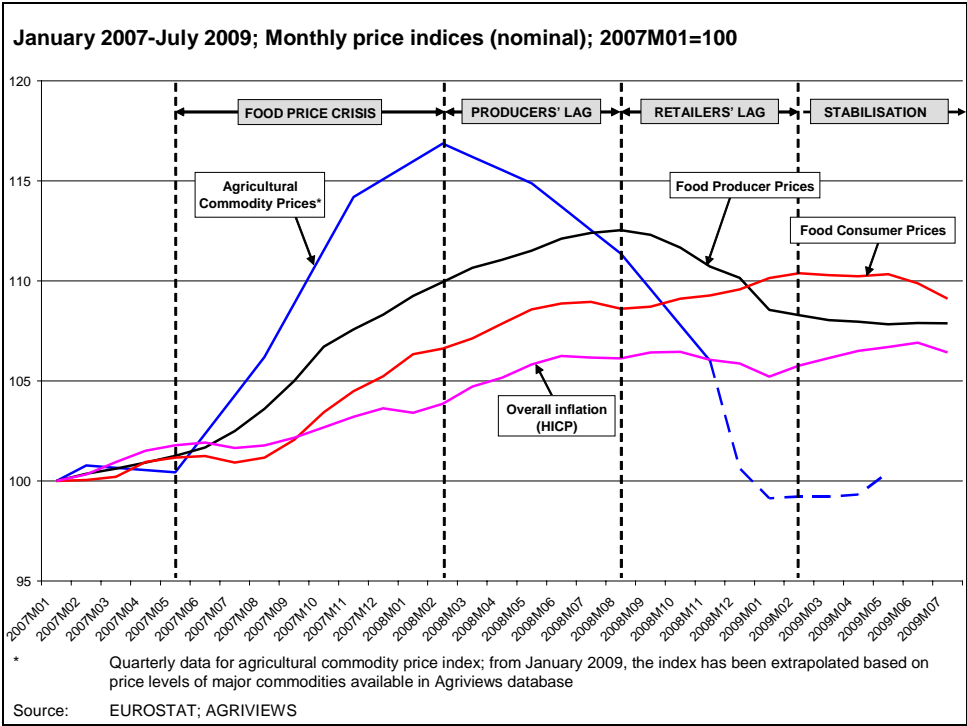
Moreover **agricultural prices have been declining both in nominal and real terms**: The strong gains in total factor productivity of the farm sector allowed an important expansion of the volume of production which outpaced the slow development of an inelastic demand for agricultural and food products. This generated a regular and steep decline in real prices, which was then reinforced in some sectors by the gradual shift from 1993 onwards from market price support to direct income support in the Common Agricultural Policy.

One of the major features of price transmission along the food supply chain is the apparent stability of producer and consumer price changes compared to the volatility of prices of agricultural inputs. Agricultural prices and food prices exhibit diverging trends. While food prices principally showed relatively continued increase, agricultural producer prices exhibited more pronounced seasonal and medium-term fluctuations and tended to decrease in the long run, widening the gap between agricultural and food prices. The food and retail industries have played a role in smoothing agricultural price variations for consumers – food consumer prices are historically much more linked to overall inflation than to commodity prices. The stickiness of consumer prices since 2007 and the change in transmission pattern 2007 are nonetheless striking and demand further analysis.

2.2.1.2. Recent price evolution in the food supply chain in the EU (since 2007)

Price developments within the food supply chain since 2007 are presented in Figure 4. It highlights both the sharp increase experienced in commodity prices in the EU27 between May 2007 and February 2008 (increase by 16%) and the stickiness of food consumer prices. The latter have increased until February 2009 (increase by 9%) and then stabilised until May 2009, showing higher increase than overall inflation in the EU over the period. They have in turn started to decline from May 2009 on, by 2% as of July 2009.

Figure 4: Short-term price evolution within the food supply chain, EU27



Four main phases of price evolution can be identified in the considered period:

- **Food price crisis (May 2007-February 2008):** agricultural commodity prices sharply increase by 16% in 10 months; consequently, food producer and consumer prices increase by respectively 9% and 5% in the same period.
- **Producers' lag (March 2008-August 2008):** commodity prices start declining (-5% in 6 months) but producer prices and consumer prices continue to increase in the period, albeit at a lower pace of 2%.
- **Retailers' lag (September 2008-February 2009):** commodity prices continue their sharp decline (-10%, with a stabilisation from January 2009) and producer prices start declining by 4%). However, food consumer prices are still on the rise in the period and only appear to stabilise from March 2009 on and begin to decline in May 2009.
- **Stabilisation (February 2009-July 2009):** prices in the chain stabilise and consumer prices start to decline in May 2009.

The magnitudes of price changes are detailed in the following Table 1.

Table 1: Magnitude of price variations in the EU27 food supply chain, between May 2007 and July 2009

Phase	Begin date	End date	Price evolution			
			Agricultural commodity	Food Producer	Food consumer	Overall prices
Food crisis	May 2007	February 2008	16%	9%	5%	2%
Producers' lag	February 2008	August 2008	-5%	2%	2%	2%
Retailers' lag	August 2008	February 2009	-11%*	-3%	2%	0%
Stabilisation	February 2009	July 2009	n.a.	0%	-1%	1%

* Evolution of agricultural commodity price index based on extrapolated agricultural commodity price levels

The analysis from price variations since 2007 enables to identify several trends in price transmission mechanisms along the chain. First, variations in producer and consumer prices appear to be of a lesser magnitude than variations of commodity prices. Second, significant time lags (~6 months from agriculture to food producers, ~6 months from producers to retailers) occur along the chain in transmitting price changes downwards – the transmission upwards appears to be instantaneous. Last, food consumer prices present signs of stickiness, having only very marginally decreased whereas all prices upwards in the chain have experienced significant declines.

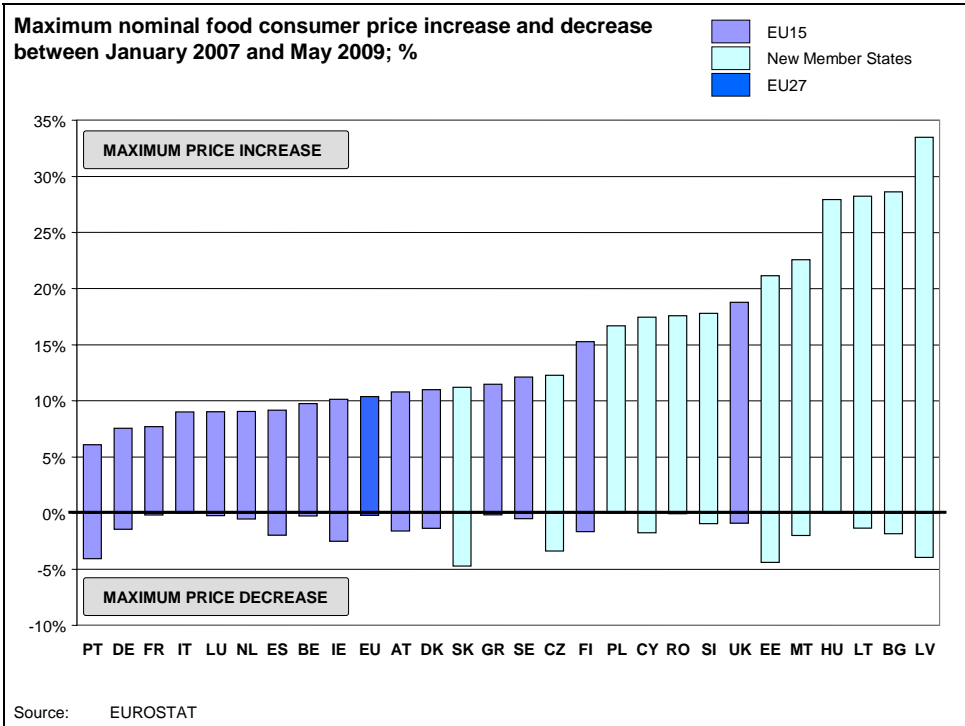
2.2.1.3. Differences in price evolution across Member States

The pattern of prices evolution within the food supply chain in the EU27 has been pervasive across a very large majority of Member States. They all have experienced steady increase in agricultural commodity prices, leading to an increase in food producer and consumer prices. Most countries have also experienced significant lags in food producer and consumer prices decline after the very sharp decrease in agricultural commodity prices. However, some Member States have shown specific price evolutions, with some experiencing continued price increases all along the supply chain since 2007 (MT, RO) or others experiencing delayed

decrease in agricultural prices (FI, IT) or even declining food producer and consumer prices while agricultural commodity prices were still on the rise (CZ, PT, SK).

If food price evolutions patterns have overall been similar across the EU, the magnitudes of price variations, as well as the duration of the different periods of producers' and retailers' lags, have vastly differed across Member States. Figure 5 presents the respective maximum food consumer price increases and decreases¹³ between January 2007 and May 2009 in the EU Member States. The maximum food consumer price increase measures the intensity of the food crisis in each Member State. However, the timing of the crisis has differed by Member State, and in some the maximum food consumer price increase will have occur in 6 months while in other in only 3. The maximum food consumer price decrease provides indications if food prices have decreased in a given Member State.

Figure 5: Variation of food consumer prices by Member States during the food crisis (January 2007-May 2009)



Strong discrepancies exist across Member States both for food consumer price increases and decreases. Maximum consumer price increases range from 6% in PT to 33% in LV. Eighteen Member States have experienced higher consumer price increases than the EU average of 10%. Differences have occurred as well in consumer price decreases, ranging from 0% (food prices haven't started decreasing in 3 Member States as of May 2009 – IT, PL, HU) to -5% in SK.

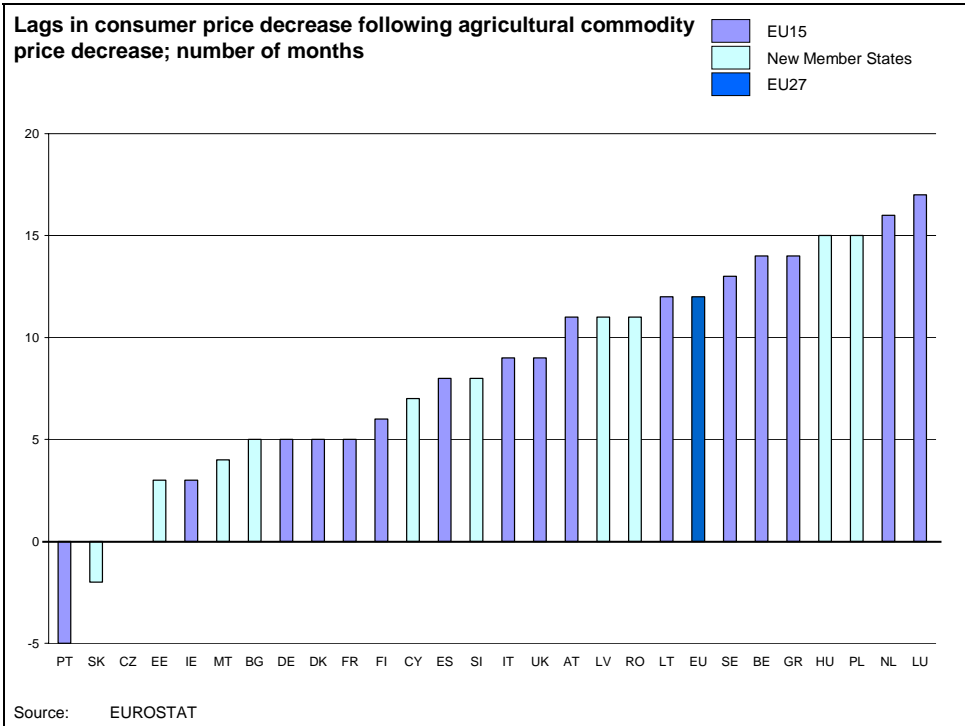
The increase in food consumer prices has been more acute in new Member States in nominal terms. This confirms the results presented in last year Communication on "Food prices in

¹³ The maximum price increase is the difference in % between the lowest food consumer price before the spike (usually in January 2007) and the highest food consumer prices in the period (usually in February 2009). The maximum price decrease measures the difference in % between the highest food consumer prices and the lowest value in the following months (usually in May 2009).

Europe". All new Member States have experienced higher food consumer price increase than the EU average, with 6 of them showing price increase of more than 20%¹⁴. In none of the EU15 Member States have food price increases reached such levels; FI and UK have suffered from the highest price increase of 15% and 19% respectively. Interestingly, decreases in consumer price also appear to be higher in new Member States than in the EU15. The average – simple average over countries – decrease in the EU12 has so far been of -2% vs. -1% in the EU15.

Price transmission mechanisms also differ across Member States in terms of the duration of lags between the decrease in commodity prices and the decrease in food consumer prices. The duration of these lags are presented in figure 6. Three Member States (CZ, PT SK) haven't experienced any lags in price transmission. However, in a large majority of Member States, food consumer prices have started to decrease more than 6 months after agricultural commodity prices did. Delay in food consumer price decrease has been the most important in LU, NL or PL where it has exceeded 15 months. The average lag in the EU has lasted 1 year.

Figure 6: Lags in consumer price decrease following agricultural commodity price decrease by Member States



The analysis of price evolution at each step of the food supply chain over the recent period provides interesting insights on how prices are transmitted along the food supply chain. There are long lags in transmission of price decreases along the chain (price stickiness): it took approximately 6 months for producer price to decrease following the decrease in agricultural commodity prices and another 6 months for consumer prices to start declining. Second, the increase in commodity prices are transmitted only partially (by ~60%) to food consumer prices. There are also strong differences in the intensity of food price evolution across Member States. New Member States have experienced higher food consumer price increases.

¹⁴ Overall inflation in these countries has also been higher than in the EU15.

2.2.2. Price transmission along the food supply chain

The results from the previous section are deepened further by conducting econometric analyses of price changes along the chain in order to take into account other factors that can explain price evolution at each step of the chain, such as variations in energy prices and labour costs. It also enables to distinguish between the impact of price increases and price decreases¹⁵. The econometric analysis has been run for a long term period (from 2000 to 2009) but also for two sub periods (from 2000 to 2006 and from 2007 to 2009) to identify if there has been a change in price transmission pattern.

2.2.2.1. Price transmission from agricultural commodity price to food producer price

Table 2 presents the results of panel data regression relating monthly variations in food producer prices to monthly variations in agricultural commodity prices. It shows how variations in energy and unit labour costs and of course variations in agricultural commodity prices (current and with 3 and 6 months lags) explain the variations in food producer prices.

Table 2: Results from panel data regression of monthly food producer price changes with monthly agricultural commodity price changes

Dependent variable - Monthly variations in:	Food Producer Prices		
Panel coverage:	EU27 Member States		
Time coverage:	2000-2009	2000-2006	2007-2009
Explanatory variables - Monthly variations in:	Coefficient	Coefficient	Coefficient
Commodity prices (current)	2%***	1%***	11%***
Commodity prices (3-month lag)	2%***	1%**	11%***
Commodity prices (6-month lag)	-	-	10%***
Energy prices	3%***	2%*	4%***
Energy prices (3-month lag)	1%*	-	-
Energy prices (6-month lag)	-	-	-
Unit Labour costs	-	-	-
Unit Labour costs (3-month lag)	-	-	3%**
Unit Labour costs (6-month lag)	-	-	-
Fit of the regression - Adjusted R ²	0.25	0.14	0.38

*** Indicates significance at 1%
** Indicates significance at 5%
* Indicates significance at 10%
- Indicates no significance

Source: EUROSTAT price indices, own calculation

Results for the period 2000-2009 highlight the fact that there is very little link between food producer prices variations and agricultural commodity price variations. Only 4% (2% instantly and 2% with 3-month lag) of agricultural price variations are passed through to food producer prices. This is not surprising given the very strong volatility of agricultural commodity prices and the stable inflation experienced by food producer prices during the period: changes in agricultural commodity prices were not reflected in producer prices.

¹⁵ This section is based on the results of panel data regression in all Member States of the EU between output prices (dependent variable – either food consumer prices or food producer prices) and explaining factors (explanatory variables: input prices – either commodity prices or food producer prices, energy prices and unit labour costs). Results were controlled with dummy variables for seasonal effect and country effect (cf. Annex A.2. for the detailed relationship estimated by the panel data regression).

However, when the regression is run for the recent period only (from January 2007 to May 2009), the impact of changes in agricultural prices on changes in food producer gains significance. The instantaneous price transmission is 11%, but significant lags of 3 and 6 months of similar magnitude (respectively 11% and 10%) appear as well. Thus, a 10% increase in agricultural commodity prices will translate into a ~3% increase in food producer prices after 6 months. This reflects the significant 6 months lag between the decline of agricultural commodity prices and the start of the decline of food producer prices highlighted in 2.2.1.

On the contrary, the relationship between producer and agricultural prices over the period 2000-2006 is much weaker. It is hard to identify the cause of the change in price transmission pattern occurring from 2007 on. It may relate to the intensity of agricultural commodity price increase that has forced food producer to translate their costs increase into price increases. Another explanation might be the implementation of the CAP reform towards more market orientation.

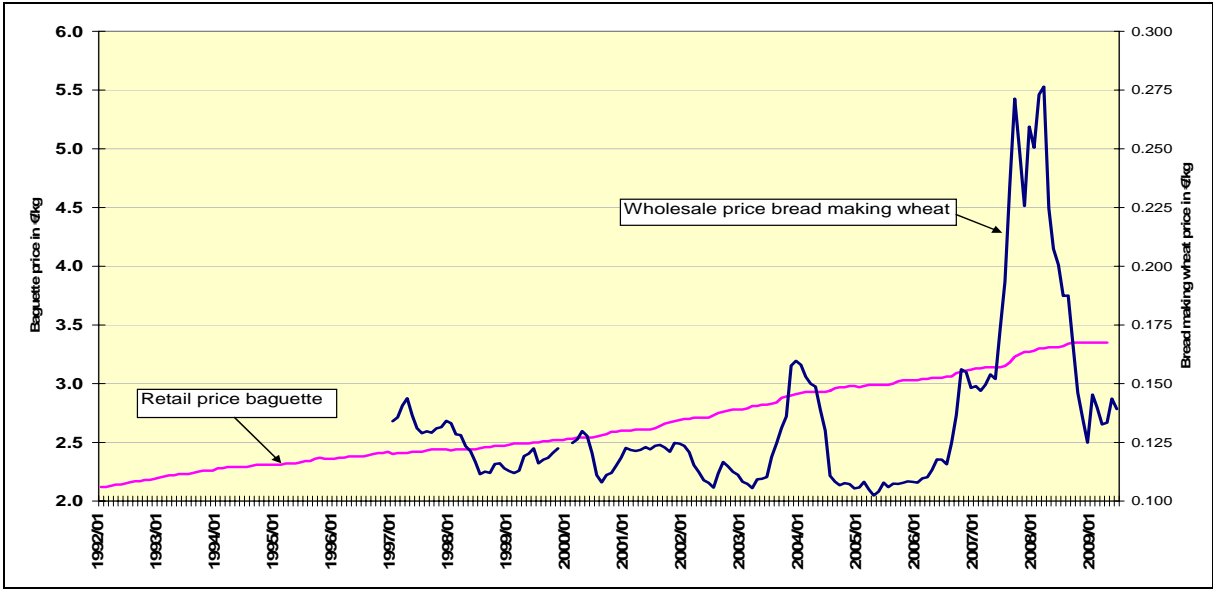
The overall small magnitude of price transmission should not be surprising given that agricultural commodity prices are only a part of the food processing industry inputs¹⁶. It is also found at disaggregated level within individual Member States and single product supply chains. The ever-increasing margin between agricultural market prices for bread making wheat (0.13 €/kg in April 2009) from retail consumer prices for baguette (3.35 €/kg in April 2009) in France can illustrate these developments (which are also reflected at manufacturer levels for grain mill and bakery and farinaceous products) – see figure 7.

Similar regressions have been run separately for the EU15 and the EU12¹⁷. Results show a low impact of agricultural price changes over the period 2000-2009 (respectively 2% in the EU15 and 7% in the EU12). Both regions have experienced a strong change in transmission patterns from 2007 on, with pass-through reaching ~30%. Moreover, price transmission for commodity to producer prices appears to be slightly faster in the new Member States with an instantaneous pass-through of 14% in EU12 vs. 8% in EU15.

¹⁶ For example for Germany, the value share of bread making cereals in the value of bread at retail level is estimated to have fallen from around 18% in 1977 to around 4% in 2005 (Source: Institut für Marktanalyse und Agrarhandelspolitik der Bundesforschungsanstalt).

¹⁷ See Table A.1. for detailed results in Annex.

Figure 7 France: Comparative development in the wholesale price of bread making wheat and in the retail price of baguette (in €/kg; Jan1992-Jun2009)



2.2.2.2. Price transmission from food producer price to food consumer price

The role of the retail sector in the food supply chain can be illustrated by analysing price transmission from food producer prices to food consumer prices. Table 3 presents the results of the panel data regression between food consumer and producer prices over the period 2000-2009 for the EU27, the EU15 and the EU12.

The first characteristics of the relationship between food producer and consumer prices in the EU27 is the relatively high total pass-through – compared to the upwards step of the food supply chain – of around 50%. A second feature is that the price transmission occurs quite fast in the chain with 30% of price changes in food producer prices transmitted instantly to consumer prices, and ~20% transmitted with a one-month lag. The pass-through is higher in the EU12 (66%) than in the EU15 (39%) and price changes are transmitted much faster in new Member States where instantaneous pass-through is 45% and the maximum lag is one month. On the contrary, instantaneous price changes are transmitted with a 10% pass-through in the EU15 and lags up to 6 month with a similar magnitude of ~10% appear. As for price transmission from agricultural commodity prices to producer prices, price changes seem to be transmitted faster in new Member States than in the EU15.

Similar regressions were run for the 2000-2006 and 2007-2009 periods to test if there has been a change in price transmission patterns as was the case between agricultural commodity prices and producer prices¹⁸. The total pass-through has increased in the EU27, from ~50% to ~70% – especially in new Member States where it amounts to ~90% since 2007. Another noticeable change in price transmission patterns between the 2 periods is the increasing delays in price transmission that are visible since 2007. While lags in transmission are limited to 1 month between 2000 and 2006, they go up to 6 months since 2007, reflecting the delay in consumer price decrease experienced in most Member States. Thus, price transmission from producer to consumer prices have experienced similar changes than price transmission from

¹⁸ See Table A.2. for detailed results in Annex.

agricultural commodity to producer – higher pass-through and increased delays in price transmission – but to a lower extent.

Table 3: Results from panel data regression of monthly food consumer price changes with monthly food producer price changes

Dependent variable - Monthly variations in:	Food Consumer Prices		
	EU27 MS	EU15 MS	EU12 MS
Panel coverage:	2000-2009		
Time coverage:	2000-2009		
Explanatory variables - Monthly variations in:	Coefficient	Coefficient	Coefficient
Food producer prices (current)	31%***	10%***	45%***
Food producer prices (1-month lag)	20%***	12%***	21%***
Food producer prices (3-month lag)	-	9%**	-
Food producer prices (6-month lag)	-	9%**	-
Energy prices	1%*	-	-
Energy prices (3-month lag)	2%*	-	5%*
Energy prices (6-month lag)	-	-	-
Unit Labour costs	5%***	-	7%***
Unit Labour costs (3-month lag)	-	-	-
Unit Labour costs (6-month lag)	-	2%***	-
Fit of the regression - Adjusted R ²	0.22	0.18	0.30
*** Indicates significance at 1% * Indicates significance at 10% ** Indicates significance at 5% - Indicates no significance			
Source: EUROSTAT price indices, own calculation			

2.2.2.3. Asymmetry in price transmission along the chain

A major issue in price transmission is to test whether output prices react similarly to increases and decreases in input prices, *i.e.* to test the symmetry of price transmission. As the first review of prices evolution along the food supply chain in section 2.2.1. suggests, there seems to be an asymmetry in price transmission along the chain from 2007 since food consumer prices and producer prices have failed to decline significantly following the plummeting of agricultural commodity prices.

A recent European Economy Economic Paper¹⁹ has investigated asymmetry in price changes in the Euro Area for several industry and service sectors. Results specific to the food supply chain are detailed in Box 1. In order to assess potential asymmetry along the food supply chain, the same regressions as in Section 3.1 and 3.2 between output and input price changes are run separately for input price increases and decreases. This enables to identify both the pass-through upwards and downwards – the transmission is symmetric if both pass-through are of similar magnitude, asymmetric otherwise²⁰.

Box 1: Price rigidity in the Euro Area along the food supply chain

A recent study on Price Rigidity in the Euro Area has analysed the frequency and magnitude of micro-level price changes in countries from the Euro Area based on a set of detailed

¹⁹ Dhyne et al. (2009)

²⁰ See Annex A.2. for the detailed equation of the regression.

monthly price data. The study introduces the concept of price flexibility (how often do prices change) and of price rigidity (do prices change when and by how much they should – *i.e.* reflecting variations in input costs).

A major conclusion of the study concerning the food supply chain is that prices change frequently in the chain, both at the producer and consumer levels. At the consumer level, the frequency of unprocessed food price changes is 28%, meaning that 28% of unprocessed food prices change each month. The frequency of change is of 14% for processed food whereas the average for Euro Area prices is 15% – for services it is 6%, for non-energy industrial goods it is 9%. Similarly, producer prices of food products also change frequently, with an average frequency of 27%, compared to an average of 22% for intermediate products. Moreover, price decreases are quite as frequent as price increases in the sector, with 46% of all price changes being decreases.

However, the study also identifies significant rigidity in food prices at consumer level. Although food consumer prices change often, consumer prices for food do not change as often as they should given the more frequent changes in food producer prices. The study does not identify significant asymmetry in upwards and downwards rigidity in food consumer prices. Thus the food sector appears counter-intuitively as a quite rigid sector in terms of price, where frequent price changes mask rigidity in price transmission.

The symmetry of price transmission at both steps of the chain has been tested over the periods 2000-2009, 2000-2006 and 2007-2009²¹ – see Figure 8. for simplified results.

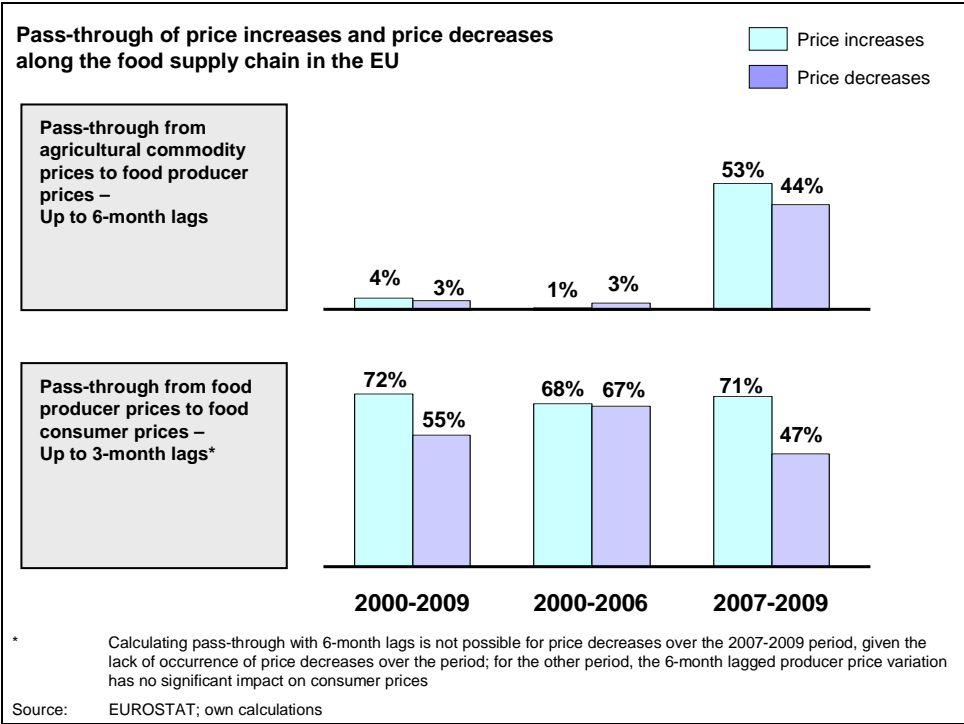
Pass-through of agricultural commodity price changes to food producer price changes in the EU27 is around 4% for price increases and around 3% for prices decreases. These figures are in line with the total pass-through (for all commodity price changes, whether increases or decreases) of 4% found in the previous section. This small difference is statistically not significant and suggests symmetry in price transmission between the agricultural sector and the food industry. However, since the relationship between commodity and producer prices is very weak over the period, the notion of symmetry is of little relevance.

The same analysis conducted for the 2007-2009 period is much more instructive, given the higher link between commodity price changes and producer price changes outlined in Section 3.1. As expected, pass-through for both price increases and decreases increase significantly compared to the 2000-2009 period, respectively to 53% and 44%. The difference in price transmission upwards and downwards becomes large at ~10%, suggesting asymmetry along the chain. After having faced a strong spike in their input prices during the year 2007, producers have tended to reduce price decreases, even when commodity prices reached a lower level than before the crisis.

The analysis of lags in price transmission upwards and downwards does not show strong difference between commodity increases and decreases. However, producer prices tend to increase slightly faster than they decrease – instantaneous pass-through is 20% for commodity price increase and 14% for commodity price decreases.

²¹ See Table A.3. for detailed results of the regression.

Figure 8: Differences in pass-through for price increases and price decreases in the EU along the food supply chain



The situation is somewhat different at the producer-retailer interface of the chain. The magnitude of price transmission from producer prices to consumer prices is 72% for price increases and 55% for price decreases over the period 2000-2009, suggesting significant asymmetry in the long run. Moreover, producer price increases are passed on to the consumer slightly faster than decreases with an instantaneous pass-through of 40% upwards vs. 30% downwards.

Over the period 2007-2009, the price transmission pattern has changed significantly. There seems to be more asymmetry in the magnitude of pass-through (71% for increase and 47% for decrease). However, this conclusion should be taken with caution since it is possible that price transmission of decreases in producer prices occurs with lags of 6 months since 2007. This would mean that the decrease in producer prices has not yet had the time to have an impact on consumer prices in May 2009. These strong delays in downwards price transmission are confirmed by the comparison of lags between 2000-2006 and 2007-2009.

Over the 2000-2006 period, the maximum lags are one-month for both increases and decreases. Since 2007, there have been lags up to 6 months for increase and decreases are only showing an impact after 3 months. Retailers indeed start passing producer price decreases with a 3-month lag whereas price increases have been passed on almost completely after 1-month. This might explain the current high-level of consumer prices and it will be important to ensure that food consumer prices decline in the next few months.

2.2.3. Conclusion

An analysis over the long term would tend to suggest that there is a limited link between the evolution of agricultural commodity prices and the evolution of food consumer prices. Two combined effects explain this counter-intuitive result: (i) there is virtually no relationship

between agricultural commodity prices and food producer prices, especially before 2007, (ii) the limited (~ 50%) pass-through from food producer prices to consumer prices mitigates price variations for the consumers. This overall low price transmission along the food chain can be explained by several factors: the limited share of agricultural commodities into final food prices, inefficiencies in the market structure of the chain (either linked to imbalances in bargaining power and/or anti-competitive practices), and some adjustments constraints and costs (e.g. costs of changing prices for both producers and retailers, the slow price transmission due to long-term contracts between economic actors).

However, there has been a significant change in price transmission pattern in the chain from 2007 on with the sharp rise and the following plummeting of commodity prices. At each step of the chain, the magnitude of price transmission has increased and actors have tried to pass on to their customers the unusual increase in their input costs. It is hard at this point to understand what has caused this change, but the acuteness of the agricultural commodity crisis has certainly contributed to change price transmission patterns: producers and retailers have faced price increases too high to contain in the long run, and have thus passed on price increases.

Meanwhile, another key feature of price stickiness has emerged since 2007, with consumer prices – and to a lesser extent producer prices – failing to decrease following the decrease in commodity prices. A key feature of this stickiness is the important lags that occur in price transmission along the chain, where decreases in agricultural commodity prices can be passed on up to one year later to the consumers. Prices in the food supply chain have thus followed a 'rockets and feathers' evolution pattern since 2007, in which prices are fast to raise and slow to decrease.

Finally, the European food supply chain is characterised by a strong fragmentation across Member States in terms of price transmission patterns at each step of the chain. Both magnitude and speed of price transmission vary significantly across Member States, resulting in strong differences in consumer food prices evolution. One obvious distinction is between the EU12 and the EU15: in the EU12, prices seem to react faster and stronger to changes in input prices.

3. EMPIRICAL INVESTIGATION FOR SPECIFIC SECTORS WITHIN THE FOOD SUPPLY CHAIN

As highlighted in chapter 2, existing empirical studies have found large variability in the degree and asymmetry of price transmission between product chains and countries. However, most of these studies are based on price indices at aggregated level (e.g. for the category “milk, cheese and eggs”) and not on absolute price levels due to the lack of reliable data, in particular at consumer level. The diversity in structure of the food supply chain across Member States and between product chains cannot be entirely reflected by aggregated price indices and prevents from drawing conclusions on the functioning of the price transmission mechanism in the food supply chain.

This motivated the undertaking of a specific in-depth enquiry on the **dairy** and **pig meat sectors** which have been particularly affected by the economic crisis and for which a certain number of concerns have been raised recently regarding the functioning of the chain. Based on absolute prices, this investigation covers eight countries for which data were available

(France, United Kingdom, Germany, Austria, Denmark, Czech Republic, Slovenia and Lithuania)²².

A brief overview of the market characteristics and of the policy developments in these two sectors is provided in the first part of the section. The most recent price developments through the respective supply chains are then assessed. Finally, a statistical analysis is carried out to assess the degree of price transmission between primary producers and consumers. The empirical statistical techniques which are regularly used in recent literature are applied to 1) test for causality between producer and consumer price movements and 2) measure the degree and delay in price transmission based on simple and multiple regressions.

For each country and product chain, a graph summarising the results of the statistical analysis is provided for all food products that have shown significant causality with respect to the price of the agricultural raw material. The graph is divided into two sections: one for the pre-price-spike period (i.e. until 2006) and one from 2007 to 2009. For each food product key information about the regression statistics is provided: the coefficient of correlation and the regression coefficients. These coefficients represent a proxy for price transmission indicator: for example a coefficient 0.350 for a given product means that a 10% price variation in farm-gate milk price has generated on average a 3.5% change in retail price. More detailed information concerning other regression parameters and indicators (number of observations, significance levels, and relevant lags) can be found in annex.

3.1.1. Empirical evidence from the milk supply chain in some EU member States

3.1.1.1. Milk supply chain background

The EU dairy sector

Milk is the largest agricultural activity in the EU representing 14% of total agricultural output. For some Member States it forms a very important part of the agricultural economy. The share of milk in total production varies between Member States, from 5.8 % to 33.5 %. The share tends to be higher in northern Europe and below 10 % in Mediterranean countries. In 2008 the value of milk output reached about EUR 50 billion at farm level.

The European dairy industry processes approximately 135 million tonnes of raw milk into a broad range of products, both for direct consumption and for use in the production of many food, feed and pharmaceutical products. The raw milk delivered by the EU27's 1.6 million dairy farmers and processed by the dairy industry, plays a crucial role in many rural areas. The dairy industry represents roughly 15 % of the turnover of the food and drinks industry in Europe (employing about 13 % of its total workforce). The EU dairy industry is also characterised by a dual structure, with some major groups making more than half of the European dairy turnover and with numerous small and medium-sized enterprises (SMEs). Economic pressure, technical requirements and governance led these groups to concentration and specialisation.

²² Since data on consumer prices (aggregated indices) currently available at Eurostat do not allow for a detailed analysis at food product level, monthly series of absolute consumer prices for a number of dairy products were collected directly from Member States (data were transmitted by FR, UK, DE, DK, CZ, SI, AT, LT). This lack of price data along the food supply chain at national level prevented to extend the analysis to other products and countries.

Within the EU27, the situation of the dairy sector varies from region to region. This difference is reflected by its diversity in terms of economic importance, with countries or regions specialised in dairy production, in terms of system of production, with an average national quota by holding ranging between 10 and 900 tonnes, an average yield by cow at NUTS2 level which varies from 3200 to more than 8000 litres and a very disparate farm structure, and eventually in terms of prices paid to the producers, with a price variability in time and space which can reach up to 50% from one year to another and from one country to another.

EU dairy policy has always had a strong impact on the economics of the dairy sector, in particular on the price formation at primary and dairy processing level. This policy has rapidly and significantly evolved over the past few years: it is now increasingly targeted at encouraging producers to be more market-oriented in a context of lower price support. Milk quotas are scheduled to expire in 2015.

The prices of dairy products are closely interlinked horizontally as dairy processors naturally switch raw milk into the most lucrative dairy markets at any point in time. For example, more butter and SMP will be produced at the expense of cheese when the returns from processing raw milk into butter and SMP are higher than cheese. The organisation of the dairy chain is also strongly influenced by the national and EU institutional framework (as regards the development of cooperatives, the concentration of industries and the contractual relations) which plays a fundamental role in the price formation along the chain and therefore in the distribution of the value added between the players involved in the chain.

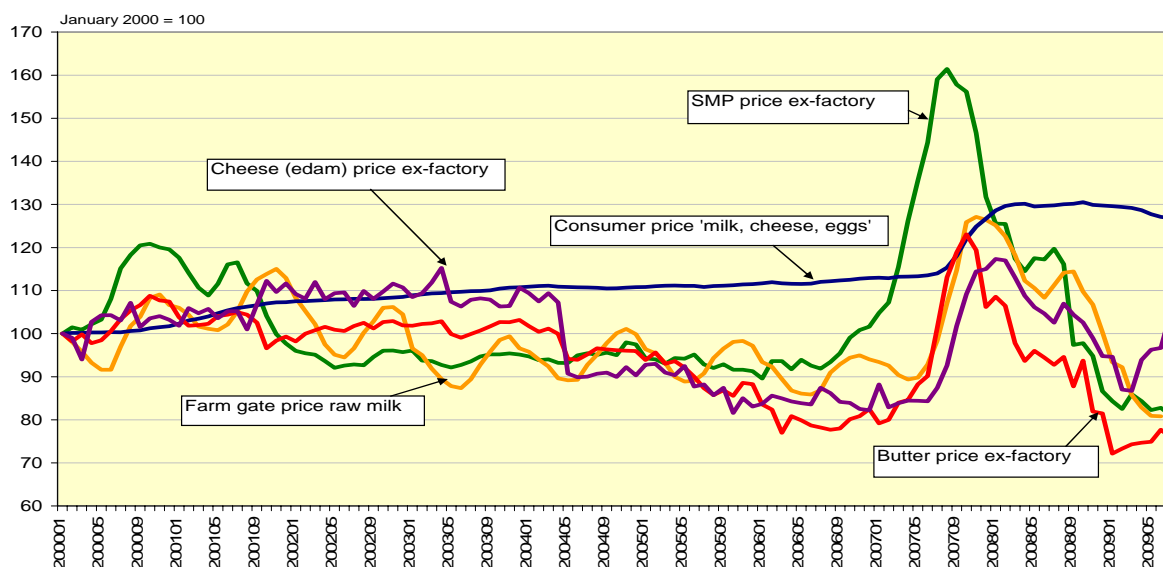
Market situation

The dairy market situation has deteriorated dramatically since summer 2008. After a price spike in 2007 alongside the general food price surge, prices dropped substantially, affecting significantly dairy producers' income.

At the level of dairy farmers, the prices for milk delivered to the dairy have come down from 30-40 c/l to an EU27 weighted average of 24 c/l by June 2009, with prices for many primary producers at 20-21 c/l or even less. As price support operates essentially at the level of first processing with butter and SMP intervention prices it is not the price of milk that drives those of processed products but rather the contrary, in particular in periods of low prices.

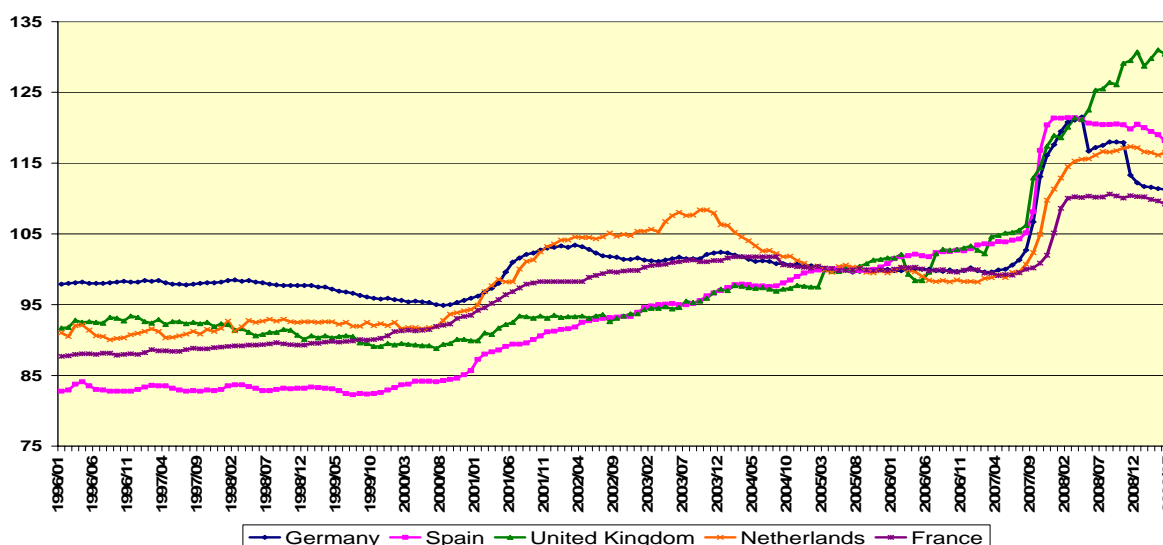
At retail level the price index for the category "milk, cheese and eggs" has followed, to a lesser extent and with a certain delay the increase in the price of dairy products (ex-factory). Available statistics until August 2009 indicate that consumer prices for dairy products have been coming down for some months but further decline in the next months would be needed if they were to fully reflect the drop in milk and dairy commodity prices at producer level.

Figure 9: Developments of producer and consumer price indices in the EU dairy sector, 2000 – 2009 (2000 = 100)



In some Member States prices at retail level ("milk, cheese and egg" index) have come down faster and to a larger extent than in others.

Figure 10: Consumer price index for "Milk, cheese and eggs", 1996 – 2009 (2005=100)



3.1.1.2. Main findings of statistical analysis on milk and dairy products

An examination of the price developments over the last two years (cf. Table 4) illustrates the **differences in market situation** along the dairy supply chain in the EU. The following table summarises the change in prices over the last two years for milk at the farm gate and for selected dairy products at retail level. These data provide some insights concerning changes in margins at the processors/retailers level. They also reveal the specific marketing and pricing strategies of the downstream sector (processor/retailer), where e.g. some dairy products at

retail level seem to fully reflect the drop in farm-gate milk prices whereas others would tend to show an increase in their margin.

Table 4: Price change between May 2009 and May 2007 for milk at the farm gate and selected dairy products at retail level (in national currency)

	Germany	France	United Kingdom	Denmark	Austria	Slovenia	Czech Republic	Lithuania
Farm gate price	-13%	-4%	18%	-13%	0%	-8%	-18%	-22%
Retail prices								
Fresh whole milk	-1%		63%	5%	2%	44%	12%	
UHT semi-skim milk	0%	15%		9%		27%	8%	8%
Butter	-17%	7%	74%	19%	1%	40%	-6%	5%
Cheese - Gouda	25%				17%			19%
Cheese - Emmentaler	24%	6%			19%	40%		
Cheese - Cheddar			74%					
Cheese - Brie				9%				
Cheese semi hard				17%				
Cheese - Camembert					25%			
Buttermilk				11%				
Double cream				2%				
Crème fraîche				4%				
Natural yogurt		0%			7%	24%	13%	20%
Yogurt with fruit				2%	10%		15%	

Source: European Commission based on information sent by selected Member States

The trends in milk producer prices and dairy consumer prices tend to show a **widening in the gross margin**²³ of the downstream sectors for most dairy products and countries studied, most notably over the last two years²⁴. The distribution of these higher gross margins between the processing and retail sectors is difficult to assess precisely on the basis of the data available which only provide a partial picture of the recent developments in prices and margins along the dairy chain (in terms of country, product and stages of the chain covered). However, evidence from national studies (Danish Competition Authority, 2009; FranceAgriMer, 2009) shows that there has been a clear trend lately towards an increase in the level of gross margins at processing level for some dairy products (e.g. UHT milk and yogurt in France, and liquid milk and butter in Denmark).

The statistical analysis²⁵ of price transmission shows that:

- There are **wide differences** of results between similar products across countries and between products in each country, reflecting the diversity in the competitive structure and

²³ It is important to differentiate gross margins (i.e. output prices minus the cost of agricultural or food inputs) from net (operational) margins (which correspond to the gross margin less all the costs incurred). As a result, an increase in gross margins does not necessarily imply an increase in profit levels.

²⁴ This tends to confirm earlier results from AgraCeas (2007) which shows that there has been a general further widening of producer-consumer margins over the period analysed in the milk and dairy product chain.

²⁵ Data series were first tested to detect the presence of causality between producer and consumer prices. Simple and multiple regression analyses were then carried out to identify the magnitude of and the relevant time lags at which price transmission takes place. In the regressions the retail price of the given dairy product is considered as the dependent variable while farm-gate milk price, without or with one or more lags, represents the explanatory variable. In this exercise other potential explanatory variables like energy costs, labour costs etc were not included. All prices are deflated and taken to the log.

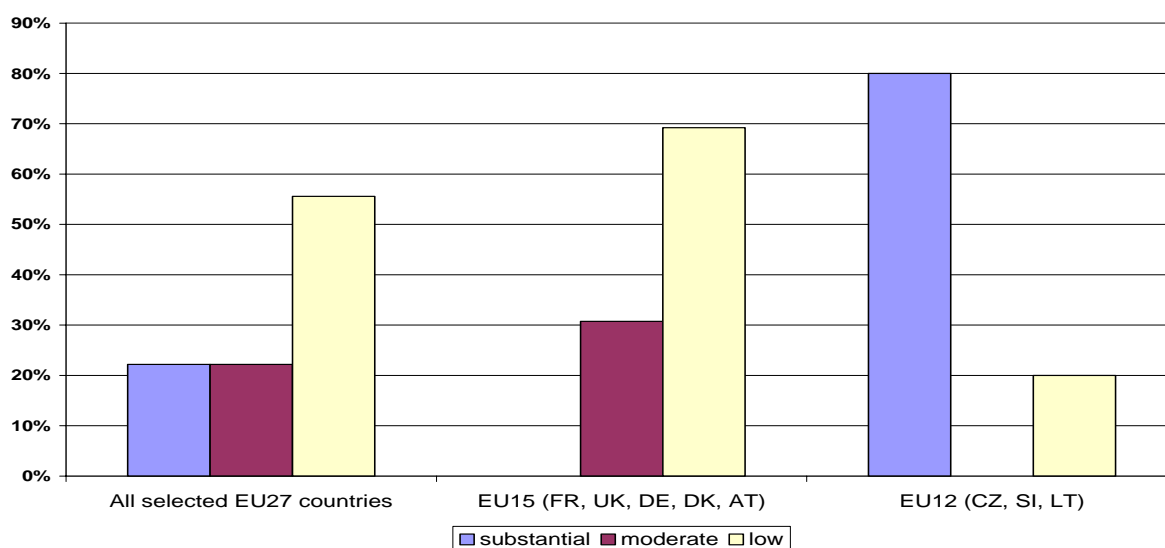
the functioning of the chain in each country as well as differences in the price formation mechanism. This does not mean that the whole analysis is inconclusive. On the contrary this supports the view that the identification of potential malfunctioning along the food supply chain needs a level of analysis which goes beyond the level of detail that is currently allowed by the available statistical information provided by Member States to Eurostat.

- **Causality tests** show that for around 40% of the observed dairy products the degree of statistical causality between the agricultural raw material price movements and that of the corresponding consumer products is low or even null. Though this result seems rather high in terms of lack of causality linkage between producer and consumer prices, it remains in line with the findings obtained in other studies (AgraCeas, 2003). Furthermore, weak causality was also detected for some dairy products whereas the mere observation of producer and consumer price developments did not raise particular concern of imperfect price transmission (e.g; weak causality was detected for French natural yogurt even though the price developments in the last couple of years have closely followed farm-gate milk price movements). This weak causality could be explained by factors such as the limited share of raw material in final product and/or the pricing strategy of processors and retailers.
- For the dairy products which demonstrate a significant degree of causality between producer and consumer prices, the analysis shows that only approximately 20% exhibited a substantial **price transmission**²⁶, 30% showed moderate price transmission while slightly more than 50% of the products indicated a low degree of price transmission between producer and consumer prices. At Member State level, evidence tends to show higher price transmission in the new Member States (CZ, SI and LT) than in the old Member States. Among the dairy products analysed, a higher degree of price transmission was detected for relatively unprocessed products like butter, bulk cheese and liquid milk. More processed and/or differentiated products showed lower degree of price transmission, reflecting the higher importance of other cost components and margins.
- **Speed of transmission:** the delay in price response seems to be higher in the EU-12 than in the EU-15. At EU-27 average price response at consumer level takes place with a delay of around one month. Fastest response was detected for butter, with a lag often below one month. Price transmission appears to have taken place at significantly faster pace than what the evidence obtained at aggregate level tended to indicate. However, this rapid transmission of price changes only concerns dairy products whose price developments were found to be closely linked to those of milk producer prices. When examining the whole spectrum of dairy products, it becomes clear that changes in the consumer price of many dairy products which are not closely linked to changes at producer levels took place at much slower speed (at least after a 12 month-delay). Furthermore, when the statistical analysis indicates that some price transmission has taken place after a given number of months, it does not necessarily provide information concerning its completeness. The transmission of price changes between the primary and the downstream sectors seems to have taken place at very different pace across product chains and countries depending on

²⁶ The notation "substantial", "moderate" and "low" degree of price transmission is used here to summarise both the degree of correlation between time series and the statistical significance of parameters.

the competitive structure of the supply chain and the production/marketing strategies put in place.

Figure 11: Frequency of substantial, moderate, low price transmission results in the dairy sector



- **Price asymmetry:** the analysis of price developments and the statistical tests on price transmission provide indication of asymmetric behaviour across the dairy chain where dairy consumer prices have been fast to increase, but slow to decline in the wake of the sharp drop in milk producer prices (e.g. Slovenia, United Kingdom, Denmark, Lithuania).
- **Price transmission over time:** the statistical analysis shows that in all the countries studied the price transmission pattern has significantly strengthened since the commodity price surge in 2007: in many countries, the importance of the changes in milk price at producer level in explaining the changes in dairy consumer prices has substantially augmented (although the magnitude of price transmission slightly declined for many dairy products).

The overall rather low price transmission between the agricultural producer stage and the consumer stage may be linked to several factors: the steadily declining share of the milk raw materials into the consumer price of dairy products, potential inefficiencies in the market structure of the chain (either linked to imbalances in bargaining power and/or anti-competitive practices), some specific adjustments constraints and costs (e.g. long-term contracts between economic actors) and pricing/marketing strategies in the downstream sectors. Furthermore, the role of dairies in the price formation mechanism may significantly alter the causality and degree of price transmission between the milk producer prices and dairy consumer prices. Finally, the importance of producer organisations in the dairy sector in many countries may mask some developments in the analysis of price transmission along the dairy supply chain (as producers may receive dividends and/or price bonuses in addition to the observed price of milk).

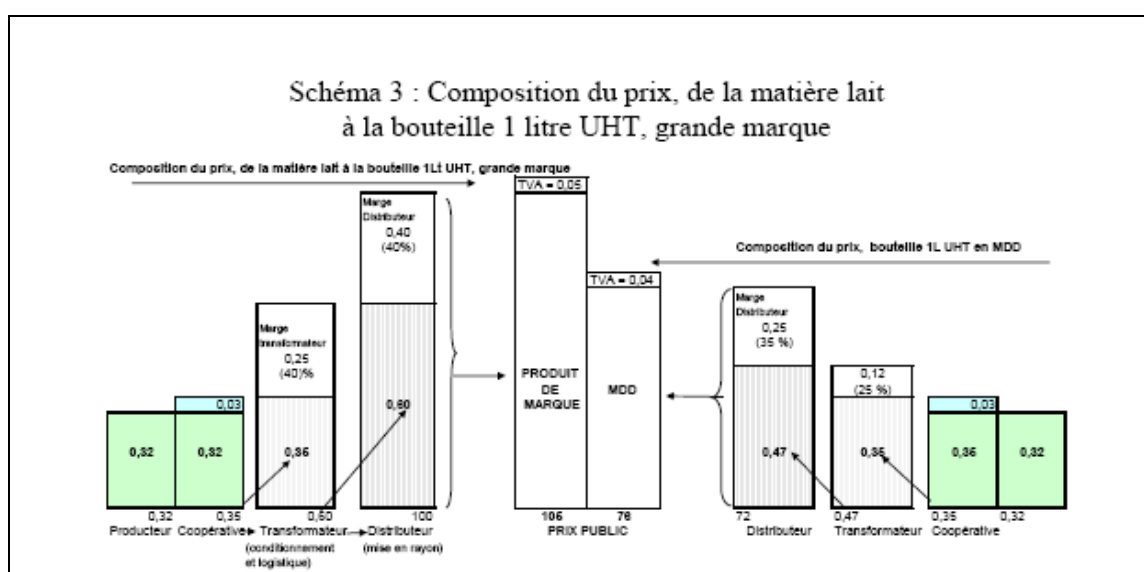
In the following sections, the situation in selected Member States will be assessed, putting the statistical analysis in perspective with the structure and functioning of the dairy supply chain and the domestic consumption pattern, which can often explain certain price developments and differences between Member States.

3.1.1.3. France

The French dairy sector has shown a significant restructuring and consolidation over the recent years. The top 10 French dairies now process 70% of the milk produced and the supermarkets sell the major part of the production of the dairy industry (specialised retailers such as "crèmerie-fromager" sell only 8%). The consumer prices for dairy products can generally be differentiated between 3 types of products: the "first price" or "discounter price", the own brands of retailers and the quality products or processor brands.

The graph below illustrates this differentiation by showing that for a similar price of raw milk material at 0.36 €/litre, the "processor brand" UHT milk is sold 1.05 €/litre, whereas the retailer brand is sold at 0.76 €/litre. However liquid milk is not very representative of the dairy supply chain in France as dairy consumption is dominated by cheese which absorbs almost 50% of the total household expenditure on dairy products.

Figure 12: Price and margin for liquid milk in France



Source: Comité Economique, Social et Environnemental, France (2009)

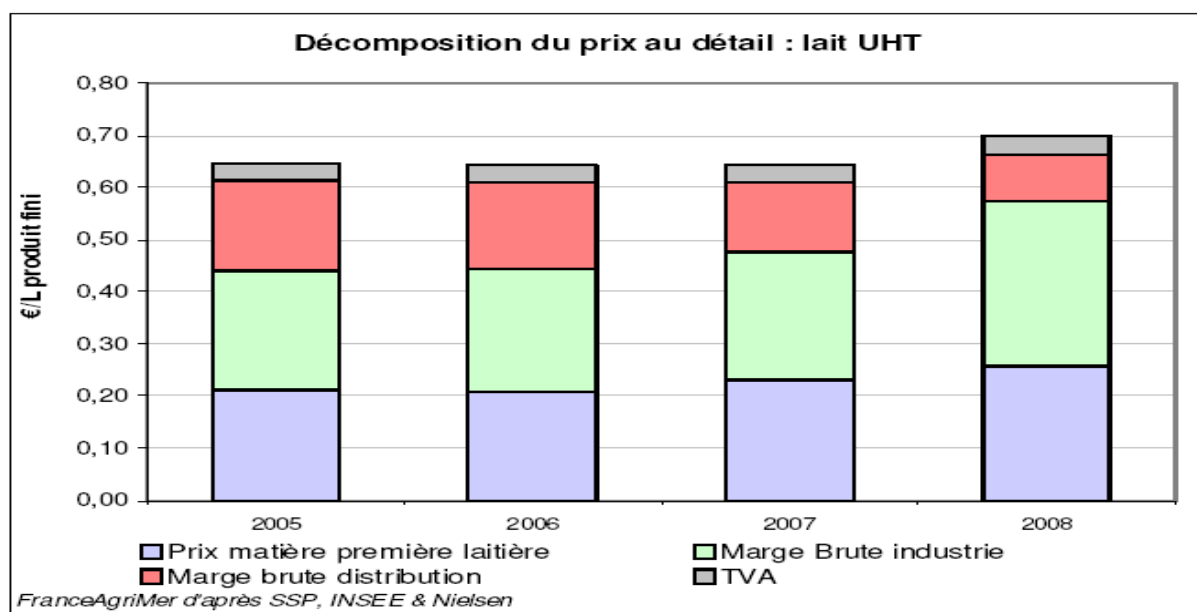
Recent analysis carried out in France (FranceAgriMer, 2009) shows that the cost of raw materials to produce cheese (i.e. the main ingredient like fat, proteins and lactose) represents between 27 and 38% of the cheese consumer price (Emmental in this case). The prices of cheese products ex-factory and at consumer level are more stable than that of their raw materials, as the seasonal changes in milk prices, which are known and foreseeable, are internalised in the chain in order to avoid any pricing-cost. The gross margin (including all costs) of the dairy industry varies between 32 and 35% of the final retail price over the observed period. Prices at retail level have broadly followed the developments at food processing level, with more stable margins at about 30% of the final price. The evidence produced in this analysis carried out by the French Price Observatory does not show major reason of concern for cheese in terms of sharing of the value added and, on the contrary, indicates some stability in gross margins on average over the last few years.

By contrast, the French Price Observatory shows that the gross margins of the industry on UHT milk sharply increased since the beginning of 2005 from 34.1% to 52% in the second quarter of 2009. The share of the producer price and of the retail gross margin in the final

consumer price dropped over the same period from 32 % and 28% to 26% and 17% respectively (cf. figure 13). A similar pattern was found for higher value added product such as yogurts where the share of the retail margin in the final consumer price fell from 40% to 34% over the 2005-2009 period whilst that of the milk producer and industry rose by 2 and 4 percentage points respectively. Evidence for butter was more mixed and irregular with an increase in the retail share in the beginning of 2009.

The availability of data on absolute monthly prices for milk at the farm-gate and for some dairy products at retail level enables to make product-specific considerations concerning the price linkages from producers to consumers. Considering the period from January 2001 to August 2007, i.e. before the surge in milk prices, the milk price trend at farm gate decreased slightly in the wake of the dairy support price cuts adopted in the context of the 2003 dairy policy reform. On the other hand the consumer prices of liquid milk, Emmental and butter, after having gone slightly up at the beginning of 2001, remained rather stable until the second half of 2007. By contrast, the trend was clearly decreasing for yogurt prices.

Figure 13: Prices in the French UHT milk supply chain in €/kg of final product, 2005-2009



Source: FranceAgriMer, Observatoire des Prix et des Marges – Filière Laitière, (2009)

When milk producer prices sharply increased by more than 50% in the autumn of 2007, dairy consumer prices followed within 2 months on average. However, when the milk producer prices started to decrease, down -4% against their pre-spike level in May 2007, the consumer prices of most dairy products remained stable at high level for some time before starting to decline in Spring 2009²⁷. For example while the yogurt prices at retail level came back to their May 2007 levels, cheese and butter prices remained around 7% higher and in the case of UHT milk prices in April 2009 were still 15% higher than two years earlier.

²⁷ Although available data until April 2009 do not enable to draw conclusions about the full extent of the decline in retail prices, it can be observed that most of these prices have so far stabilised a higher level than before the price rise.

The statistical analysis of price transmission shows that a substantial causality link could only be found for UHT semi-skimmed milk and for bulk cheese, both relative to the price paid to milk producers. Camembert cheese and natural yogurt showed only a weak degree of causality between milk producer prices and their consumer prices²⁸. Price transmission was tested for the dairy products showing substantial causality link over a long-term time series of monthly price (from 1996 to 2009) but also for the period before the extreme price movements (1996-2006, when prices were more stable) and for the more recent period 2007-2009.

Figure 14: Summary of the main results of the statistical analysis of price transmission: dairy sector, France

		Correlation R ²	Price transmission coefficient
1996-2006	UHT semi-skimmed milk	0.15	0.117
	Bulk cheese	0.016	0.035
2007-2009	UHT semi-skimmed milk	0.483	0.309
	Bulk cheese	0.391	0.16

For UHT semi skim milk and bulk cheese products the degree of price transmission was higher during the most recent years than during the decade 1996-2006. This may be explained by the relative price stability that prevailed during the decade ending in 2006 for farm-gate prices. Furthermore, as dairies play a central role in the price formation mechanism for dairy products, the low causality and degree of price transmission from the milk producers to the consumers may not fully reflect the price transmission dynamics²⁹. During the period 2007-2009 statistical indicators improved: the correlation index for UHT milk (related to milk producer price) increased threefold and remained slightly below the average level found in the other observed Member States. In the case of bulk cheese the correlation with milk producer

²⁸ The whole statistical analysis was not carried out for butter and camembert as the retail price information was only available for a shorter period (while for the rest of the products data availability starts in 1996).

²⁹ However a statistical investigation was carried out to assess the link between price movements at processors level and those at the farm-gate and at retail level. For France, before 2007, little link was found between monthly changes in bulk commodities prices (butter and SMP) and milk producers' prices. Since 2007 the linkage has improved although the correlation and the price transmission coefficients remain low. Reasons for such a low linkage may have to be found in the specificity of the price setting mechanism between producers and processors. Moreover, when the sector is dominated by producer organisations, e.g. cooperatives, price transmission may be masked by dividends and/or price bonuses milk producers may receive in addition to the price of milk. Similarly the link between processor and retail price improved since 2007 but remains rather weak. For example ex-factory butter price changes explain only a small part (2.4%) of butter retail price changes.

price is higher in France than in other countries. Price transmission coefficients were particularly low especially for bulk cheese while for consumption milk (at least in the 2007-2009 period) they reached 0.3 (i.e. a 10% increase in milk producer prices generated on average a 3% increase in consumer prices for UHT milk). The observed retail prices seem to have responded with little delay (within the same month or with a month delay) to changes in milk producer prices.

3.1.1.4. United Kingdom

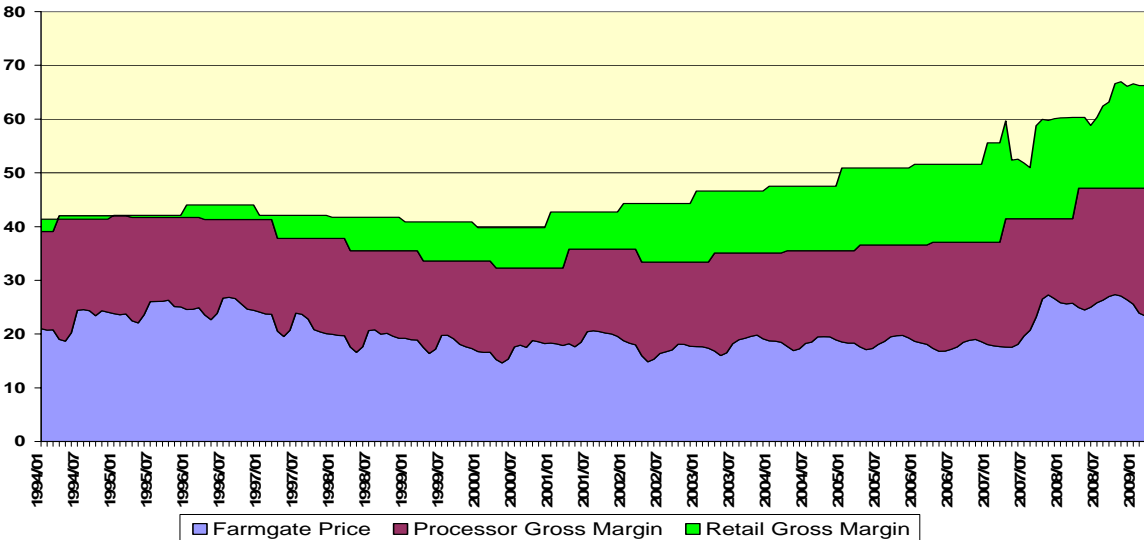
The majority (more than 50%) of raw milk produced in the UK goes into the production of liquid milk and approximately 20% is used for the production of Cheddar cheese. Liquid milk seems to be the main dairy product for which the largest British retailers have made arrangements to secure the stability of the supply chain, as the UK is not self sufficient overall and liquid milk is not easily tradable.

In order to reduce storage costs and to ensure cash flow, processing raw milk into liquid milk is often the favoured option of processors in the United Kingdom. This results in increased competition, lower prices and consequently lower margins on contracts that are negotiated frequently such as those with some food service and wholesalers.

As a reaction to the economic downturn, and in an attempt to attract consumers back from shopping at ‘discounters’, most of the major multiple retailers also now sell a ‘discount’ brand or type of milk.

An important income stream for liquid milk processors comes from the sale of surplus cream, as the majority of liquid milk sold is not whole milk but semi-skimmed or skimmed. This cream goes into a number of end uses including the production of butter. This gives liquid milk processors a direct financial exposure to one of the basic commodity markets which have fallen significantly in the past year.

Figure 15: Liquid milk margins in pence/litre, United Kingdom, 1994 - 2009



Source: Milk Development Council (in pence/litre)

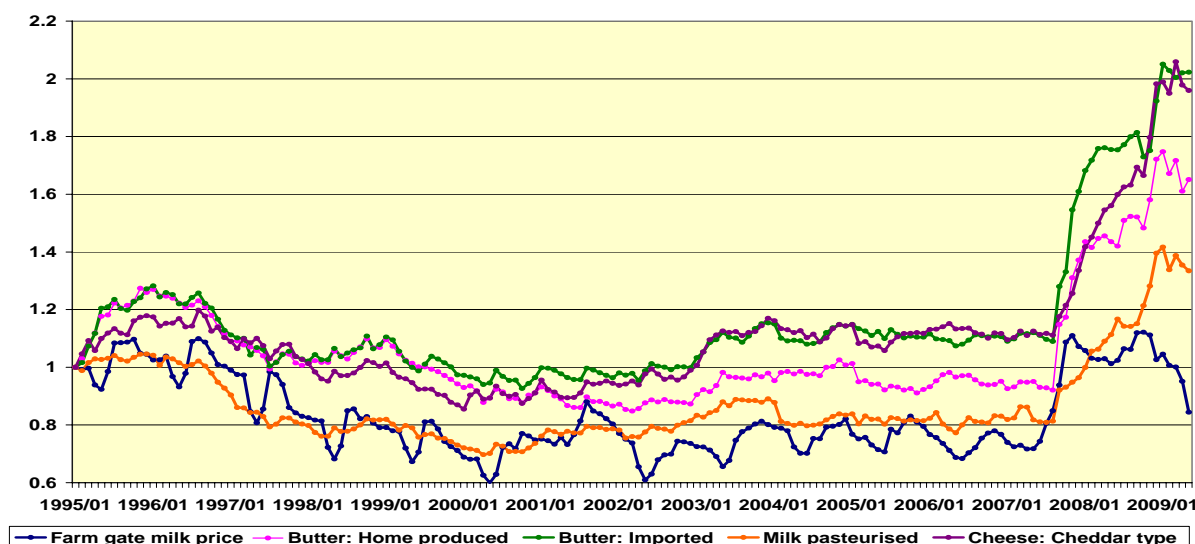
The fall in cream income to liquid processors observed in 2008 is likely to have put liquid milk processors’ margins under strong pressure since processor gross margin has to cover all

processor costs (apart from the purchase of milk), including transport, bottling and financing costs. It seems that liquid milk processors were absorbing this volatility before the farm-gate price cuts seen at the beginning of 2009, notably to maintain the price at which they purchase milk at competitive level with cheese processors.

The low returns from selling whey powder, when added to the low gross margins from processing Cheddar, are expected to have resulted in significantly lower overall margins for cheese producers in 2008/09.

Figures 15 and 16 show retail price developments for dairy products with respect to the price of milk paid to the agricultural producers. Exchange rate movements have somewhat levelled out the sharp drop in prices at EU and world level since the second semester of 2008. While farm-gate prices (in British pound terms) in May 2009 remained 18% above their level before the price spike in May 2007, most retail prices of dairy products only showed minor reductions after the price peak reached by the end of 2007. In spring 2009 they still stood some 63% (fresh milk), 74% (butter) and 74% (cheddar) higher than before the milk price increase two years earlier.








Figure 16: Indices for the farm-gate milk price and the retail price of several dairy products, United Kingdom (Jan 1995 = 1)



The statistical analysis of price transmission for the UK detected a substantial causality link for butter and cheddar cheese relative to the price paid to milk producers. Furthermore retail prices seem to have responded with little delay (within the same month) to changes in milk producer prices. This could also mean that farm-gate and retail prices have changed with the same lag to changes in ex-factory prices³⁰.

³⁰ A statistical investigation to assess the link between price movements at processors level and those at the farm-gate and at retail level has been carried out which, for the United Kingdom, produced mixed results. A substantial link between monthly changes in bulk commodities prices (butter and SMP) and milk producers' prices could be established, especially in more recent years, with positive correlation and price transmission coefficients (R^2 0.56 and price transmission coefficient of 55% with a three months delay). Similarly in the case of butter the link between processor and retail price is remarkable and improved since 2007 (with a correlation coefficient R^2 of 0.52 and price transmission of 22% for

Figure 17: Summary of the main results of the statistical analysis of price transmission: dairy sector, United Kingdom

		Correlation R ²		Price transmission coefficient	
1999-2006	Cheddar	 0.168		 0.2	
	Butter	 0.372		 0.649	
2007-2009	Cheddar	 0.385		 0.152	
	Butter	 0.806		 0.649	

Here again for both butter and cheddar cheese the importance of the milk producer price in explaining changes in dairy consumer price levels was higher during the most recent years than during the decade 1999-2006. Price transmission coefficients on the other hand remained comparable over the two sub-periods, but were relatively high compared to other countries, in particular for butter.

All these statistical indicators show that strong causality, high correlation and substantial price transmission took place in the UK dairy supply chain. The fact that retail prices for most dairy product remain high while farm-gate price dropped tends to demonstrate an asymmetric price response (i.e. higher price transmission of upwards price movements than for price declines) and may be linked to factors such as imbalanced bargaining power along the dairy chain and/or pricing strategies in the downstream sectors.

3.1.1.5. Denmark

The Danish dairy industry consists essentially of the international dairy group Arla Foods, which processed more than 91% of Danish milk and 37 smaller dairy companies, together processing 4.5 million tons of milk. The number of drinking milk producers is very limited and around 1/3 of all drinking milk is organic.

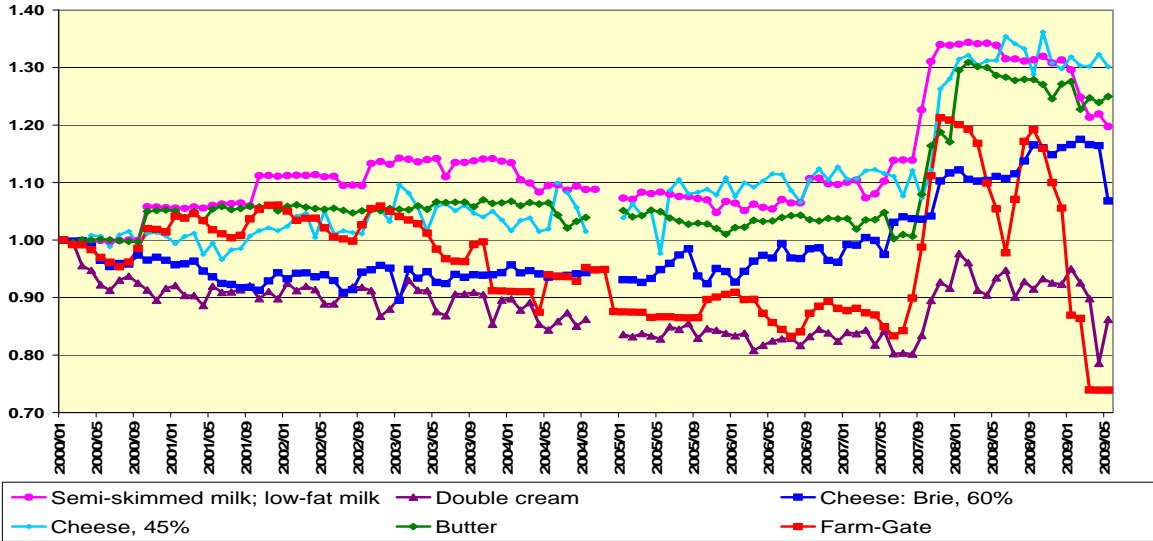
The retail chains have had difficulties in introducing German milk to the Danish consumers: attempts by Aldi some years ago stimulated Arla to introduce a discount type of milk. Despite renewed attempts in 2009 the market share of foreign milk remains modest. Like the processing sector, the Danish milk producers have seen an important structural change, with production now resting on a few large farms. More than 2/3 of the total Danish milk goes into export products.

lag 2 and 22% for lag 4). On the other hand it is found that in the case of cheese this link has been deteriorating over time.

A recent investigation in Denmark (Danish Competition Authority, 2009) showed that the distribution of the margins along the dairy supply chain has changed over the most recent years, mainly to the benefit of processors. However, it should be noted that this increase in the margin generated by the dairy industry should in turn benefit milk producers as the industry is dominated by a farmer cooperative.

The farm-gate prices of milk (in national currency) rose by 38% during the price hike of 2007 but came back sharply in the second half of 2008, down -13% compared to pre-spike levels. Available price data at retail level show that the consumer prices for most dairy products have already come down after the price spike in 2007/2008, but by May 2009 all observed retail prices remained above their pre-crisis levels (+5% for liquid milk, +2% for yogurt, and up to +17% for cheese and +19% for butter).

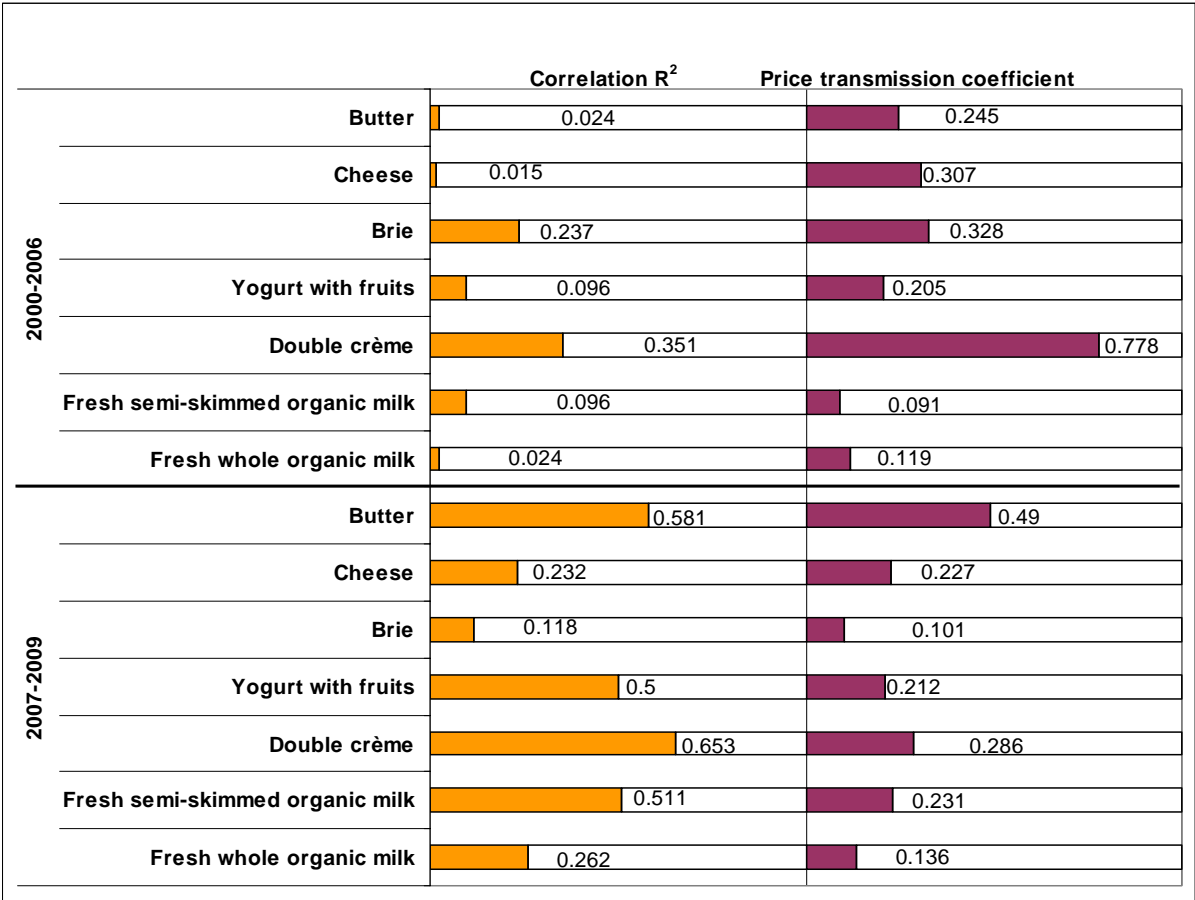
Figure 18: Indices for the farm-gate milk price and the retail price of several dairy products, Denmark (Jan2000 = 1)



The statistical analysis of price transmission for Denmark exhibited a substantial causality link for 7 out of 13 dairy products as shown in figure 19. The causality tests for fresh and UHT non-organic types of milk and cream surprisingly showed only a weak link between milk producer and the consumer prices of these dairy products. The correlation indicators remain rather low, suggesting the presence of other explanatory variables more important in the dairy price formation at consumer level than the milk price paid to the farm producers. Retail prices are reactive to producer price movements with little or very low delay (i.e. one month). By contrast to what was observed in other countries, price transmission seems to be higher for more processed products, in particular over the 2000-2006 period.

For most products the importance of the milk price in explaining the changes in consumer prices and the degree of price transmission has been higher during the most recent years than during the decade 2000-2006. On the other hand price transmission coefficients have been slightly lower over the last few years. This asymmetric price transmission may be explained by the fact that the available retail prices (until April 2009) may have not yet completed their decline following the sharp drop in farm-gate prices.

Figure 19: Summary of the main results of the statistical analysis of price transmission: dairy sector, Denmark

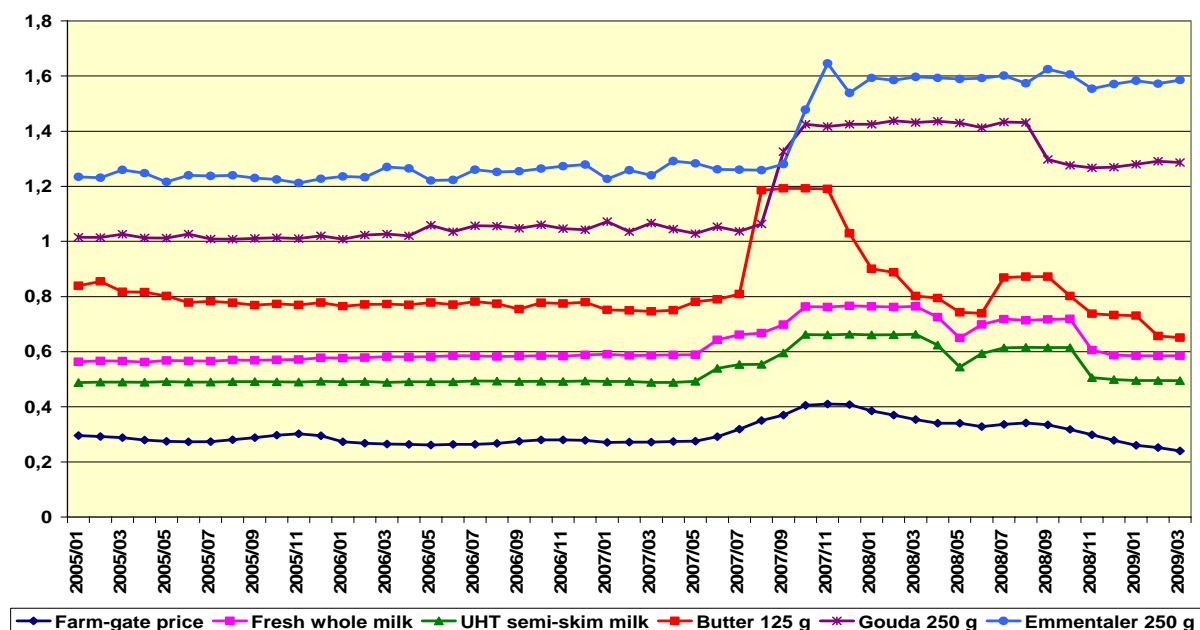


3.1.1.6. Germany

With around 30 million tons of cow milk produced annually Germany is the 6th largest milk producer worldwide and the largest milk producer in the EU with 20% of EU production. German dairy factories process the second largest amount of milk in the world after those in the United States. Milk processing has a turnover of more than 23 billion euros per annum. About half of the total milk delivered is processed into cheese and a third into fresh dairy products. These proportions have been increasing for years. Germany is one of the most important exporters of milk products, in particular of cheese, milk powder, condensed milk, but also of butter and liquid milk.

The following graph shows how the sharp price increase in farm-gate milk prices (reaching more than 40 €cents in October 2007) and decrease in the second half of 2008 (down -13% compared to pre-spike levels) is reflected in the retail prices of dairy products.

Figure 20: Farm-gate milk price and retail price of several dairy products, Germany, (€/per litre, unless otherwise specified)



While retail prices for butter show a marked decline below pre-price spike levels (-17%), the price of cheeses declined only marginally, at least until April 2009 where it still stood some 25% higher than before the price increase of 2007.

Out of the five dairy products for which retail price series were available only one, Gouda cheese, showed some causality linkage with milk producer prices³¹. For this product the regression showed moderate correlation³². This empirical evidence tends to indicate an absence of price transmission from the milk producer level to the consumer level for most dairy products. This may be linked to many factors, including the high degree of processing in the dairy chain, pricing and marketing strategies of the downstream sectors. Furthermore, the role of support prices for butter and SMP (as well as the export refunds granted only to processed dairy products) may result in price formation mechanism that, from the price ex-factory for key dairy products is transmitted upstream to the dairy farmers and downstream to the retailers. As a result, focusing the analysis on the link between the farm-gate and the consumer levels may not be sufficient to fully evaluate the price transmission mechanism³³.

3.1.1.7. Slovenia

With a dairy herd of 130 000 animals and around 20 000 holdings, the Slovenian dairy sector is a typically small scale family business. The sector went through a significant structural

³¹ The other products observed, fresh and UHT milk, butter and emmentaler showed only weak causality between farm-gate and retail prices.

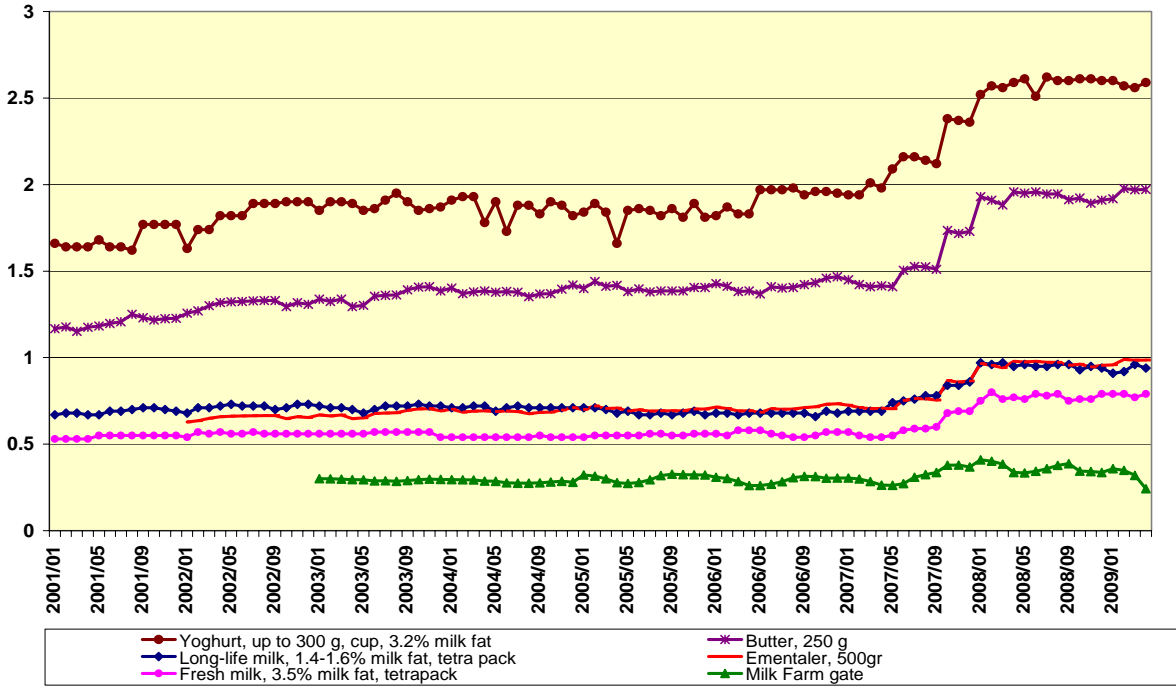
³² Regression results for Gouda cheese prices with respect to farm-gate milk prices are presented in annex, table A.7.

³³ The link between price movements at processors level and those at the farm-gate and at retail level was also investigated. For Germany, the linkage before 2007 was stronger than in France and the UK, except for cheese where the linkage is comparable in the two periods.

change, illustrated by the rather rapid decrease of the number of dairy holdings since 1997. Slovenia counts only few milk processing companies. Most of the milk is sold to these dairies through agricultural cooperatives. Nearly all farmers are member of a cooperative.

Compared to the other Member States who joined the EU in 2004, Slovenia experienced prices comparable to the EU15 already before accession. The graph below shows that retail prices of dairy products have rapidly risen almost in parallel with the farm-gate milk prices during the summer 2007. The increase in milk producer price reached +50% in just a few months while most dairy products exhibited slower increases in their consumer price (between 12% for emmentaler to 45% for fresh pasteurised whole milk). Available price data until May 2009 show that, while milk producer prices have come down substantially (8% below pre-price-spike levels), the retail prices of the main dairy products have stabilised at close to peak levels, i.e. largely above the level of prices before the increase in milk prices in May 2007 (ranging from +24% for yogurt to more than 40% in the case of butter, cheese and fresh milk).

Figure 21: Farm-gate price of milk and retail prices of several dairy products, Slovenia, 2001-2009 (€per litre, unless otherwise specified)



The statistical analysis (causality test and regression) indicates that price transmission between milk producer prices and the consumer prices of dairy products was significant. Regression coefficients are also rather high, suggesting a high level of pass-through from producer to retail prices.

For most products the importance of the milk price in explaining the changes in consumer prices and the degree of price transmission was higher during the most recent years than during the 2004-2006 period.

Figure 22: Summary of the main results of the statistical analysis of price transmission: dairy sector, Slovenia

		Correlation R ²	Price transmission coefficient
2004-2006	UHT semi-skim milk	0.87	0.861
	Butter	0.343	0.309
	Natural Yogurt	0.006	0.051
	Fresh whole milk	0.164	0.169
2007-2009	UHT semi-skim milk	0.792	1.216
	Butter	0.765	1.334
	Natural Yogurt	0.579	0.722
	Fresh whole milk	0.776	1.561

Dairy retail prices respond with within a lag of 0 and 3 months to milk producer price changes. Other lags were tested but coefficients were not significantly different from zero. In some cases the price-transmission coefficient is estimated to be very high: the statistical analysis shows for example that a 10% increase in milk prices during the 2007-2009 period resulted on average in an increase of 7% of the price of natural yogurt. For other products the sum of two coefficients for two significant lags goes largely beyond 1, suggesting a more than full price transmission. Given the precise technical content of dairy products in milk components (e.g. in terms of fat, protein, lactose, etc), it appears that only parts of the observed increases in the retail prices of some dairy products observed in Slovenia can be attributed to the rise in the raw milk materials. Hence, the main causes of the consumer price rise in question are to be found in other sectors than agriculture.

Statistical indicators show that strong causality, high correlation and high price transmission took place in the Slovenian dairy supply chain. The fact that retail prices for most dairy product remain high while farm-gate price have declined tends to demonstrate an asymmetric price response (i.e. higher price transmission of upwards price movements than for price declines) which may be due to pricing strategies in the downstream sector and imbalanced bargaining power.

3.1.1.8. Austria

In spite of the small size of its holdings, the dairy sector represents an important sector of the Austrian agri-food industry, with a turnover of about 2 billion €. Farm-gate milk prices rose by 44% in a few months in 2007 but have since dropped back to pre-spike levels. The retail prices of the observed dairy products broadly followed the developments in the milk producer prices and are now back to the levels of May 2007 for fresh milk, butter and, to a lesser extent, yogurt. Cheese retail prices on the other hand tend to remain higher than before the 2007 price surge: by May 2009 they still stood some 20% higher than two years earlier.

The statistical (causality) tests show that price transmission between milk producer and dairy consumer prices functioned for 4 out of 7 dairy product chains, though with a rather low degree of correlation. Delays in price transmission ranged from instantaneous transmission for liquid milk and yogurt to up to six months for cheese. The two other products studied (Emmental cheese, yogurt with fruit) showed no significant link between changes in their consumer price and changes in milk producer price.

For all 4 products, the importance of the milk price in explaining the changes in consumer prices and the degree of price transmission is higher during the most recent years than during the period 2000-2006. However, the degree of correlation remains very low compared to that measured in other EU Member States. On the other hand price transmission coefficients are more substantial, except for cheese where they remain particularly low.

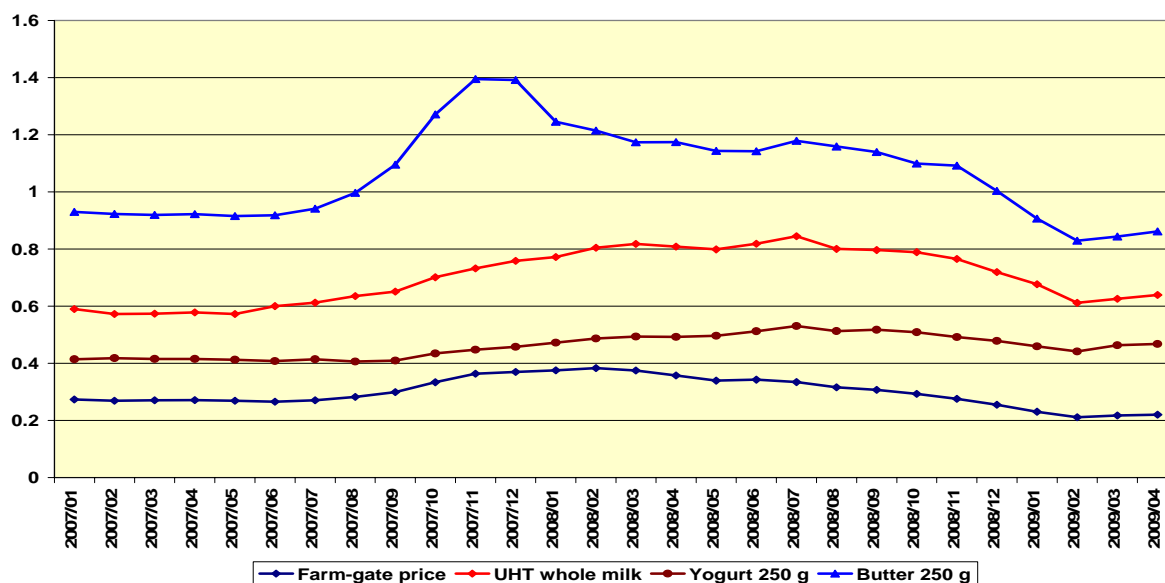
Figure 23: Summary of the main results of the statistical analysis of price transmission: dairy sector, Austria

		Correlation R ²	Price transmission coefficient
2000-2006	Yogurth	0.266	1.395
	Whole UHT milk	0.038	0
	Camembert	0.02	0.024
	Gouda	0.037	0.038
2007-2009	Yogurth	0.717	0.372
	Whole UHT milk	0.638	0.352
	Camembert	0.097	0.098
	Gouda	0.085	0.109

3.1.1.9. Czech Republic

The farm-gate prices of milk rose by 44% during the price hike of 2007 but came back sharply in the second half of 2008, down to -18% compared to pre-spike levels. Available price data at retail level show that the consumer prices for most dairy products have come down after the price spike in 2007/2008. However, most of the observed retail prices still stood above pre-crisis levels by April 2009 (+12% for fresh milk, +8% for UHT milk, +13/15% for yogurt). Butter is the only product for which retail prices have fallen below pre-spike levels (-6% in April 2009 compared to two years earlier).

Figure 24: Retail price level of several dairy products, Czech Republic, 2007-2009 (€ per litre, unless otherwise specified)



As retail prices were only available for the most recent years, the statistical analysis was only carried out for the period 2007-2009. Whereas the retail price of fresh whole milk showed weak causality with the milk producer price, the consumer prices of semi-skim milk, yogurt and butter exhibited low to moderate correlation with milk producer prices, and with little delay. Price transmission coefficients vary between 0.15 for natural yogurt and 0.772 for butter.

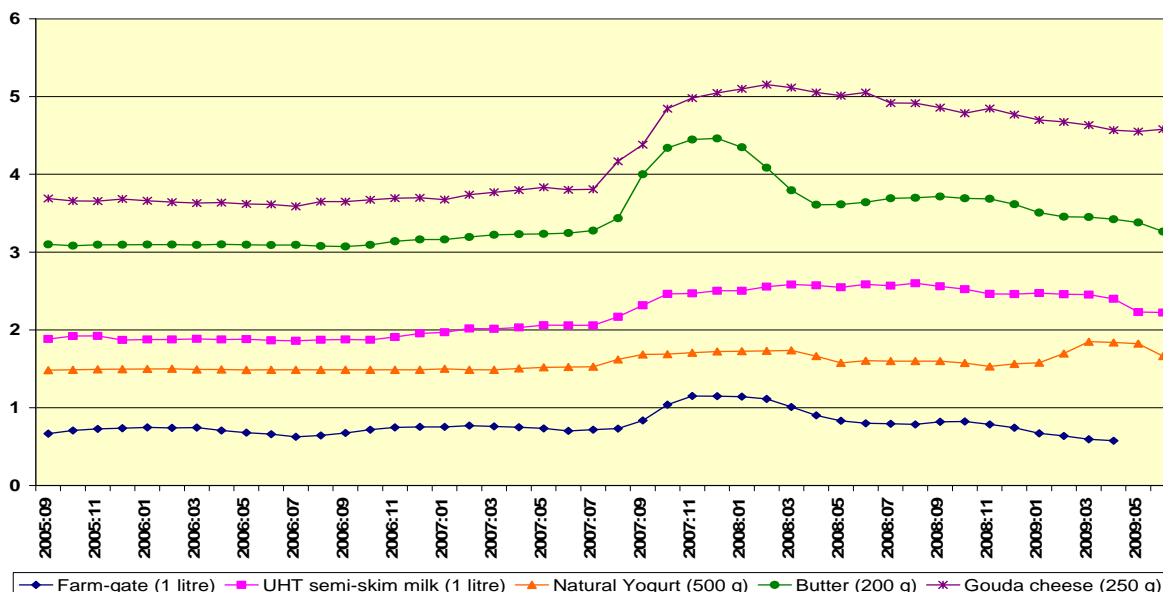
Figure 25: Summary of the main results of the statistical analysis of price transmission: dairy sector, Czech Republic

		Correlation R ²		Price transmission coefficient	
2007-2009	Butter		0.831		0.772
	Yogurth with fruits		0.335		0.272
	Yogurth		0.162		0.149
	Milk UHT, semi skimmed 1.5% fat		0.649		0.674
	Fresh milk, semi skimmed 1.5% fat		0.358		0.393

3.1.1.10.Lithuania

The farm-gate prices of milk rose by 57% during the price hike of 2007 but came back sharply in 2008, down to -22% compared to pre-spike levels. Available price data at retail level show that the consumer prices for most dairy products have come down after the price spike in 2007/2008. However, by May 2009, most of the observed retail prices still stood above pre-crisis levels (+5% for butter, +8% for sterilised UHT milk, +19% for yogurt and +20% for Gouda cheese).

Figure 26: Retail price level of several dairy products, Lithuania, 2007-2009 (LTL per unit)



Retail price for all observed dairy exhibited moderate to substantial causality link with respect to farm-gate price movements. For three out of four products, the importance of the milk price in explaining the changes in consumer prices and the degree of price transmission is higher during the most recent years than during the period 2005-2006 (zero price transmission in the period 2007-2009 can be explained by the opposite price developments observed since the beginning of 2009, with yogurt prices rising while milk producer prices decline markedly).

Retail prices are reactive to producer price movements with little or very low delay (i.e. one month). Only in the case of yogurt a longer time lag was detected (4 months).

Figure 27: Summary of the main results of the statistical analysis of price transmission: dairy sector, Lithuania

		Correlation R ²	Price transmission coefficient
2005-2006	Gouda cheese	0.289	0.152
	Butter	0.292	0.121
	Natural yogurt	0.332	0.13
	UHT semi-skim milk	0.327	0.176
2007-2009	Gouda cheese	0.458	0.263
	Butter	0.831	0.466
	Natural yogurt	0.43	0
	UHT semi-skim milk	0.444	0.179

3.1.1.11.Spain

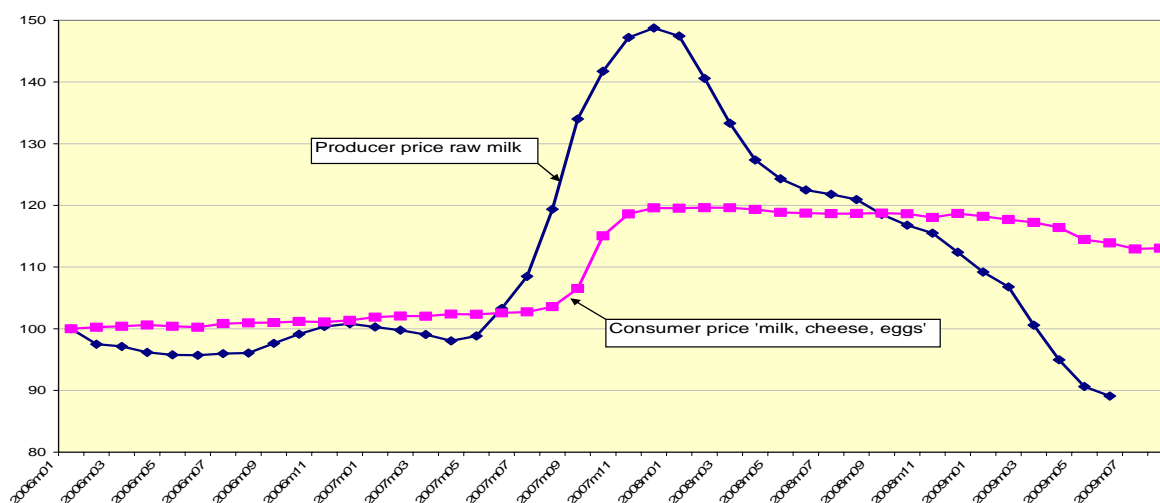
Most of milk produced in Spain (around 90%) is delivered to dairies for industrial processing. An important part (up to 60%) of the milk collected by the industry is earmarked for the production of liquid milk, a low value-added product. Although Spanish milk production is quite atomized at the level of agricultural holdings, the processing industry is more concentrated. The Spanish milk sector is characterized by an overall lack of marketing contracts and a relative scarcity of farmer cooperatives. While only 30% of the milk in Spain is marketed through cooperatives, this proportion reaches 68% on average in the EU (Foro Agrario, 2000).

As a result, prices are established by direct negotiation between the dairy industry and the farmer for a high proportion of the collected milk. This implies that the farm price is mainly determined by the industry, owing to the low bargaining power of the farmers relative to the dairy industry (Foro Agrario, 2000). However, it should also be noted that the implementation of the milk quota system after the Spanish accession to the EU has somewhat contributed to improve the balance of bargaining power between farmers and the industry by stimulating competition within the food industry to have access to the raw material.

The Spanish dairy industry underwent many mergers and acquisitions in the 1990s, especially in the liquid milk chain, yielding higher levels of industry concentration. Concentration in the dairy industry varies among sectors, being rather low in the cheese sector, high for yogurt and dairy desserts and average for liquid milk. Despite the active restructuring process, Spanish dairy industries continue to be relatively small in comparison to most retail firms, which also went through important changes leading to higher concentration levels.

Only limited statistical information was available in the case of Spain. However the Spanish Price Observatory has recently published some detailed information concerning the distribution of value added in the supply chain for liquid milk. It shows that raw material represents between around 39% of the final retail price. The food industry margins (which include all other costs) represent approximately 31% of the retail price while the retailing sector adds some 30% of the final price paid by the consumer (cf. annex).

Figure 28: Developments of producer and consumer price indices in the Spanish dairy sector, 2006-2009 (Jan 2006=100)



Like in other Member States farm-gate milk prices have increased by more than 50% in the second half of 2007 and dropped subsequently below pre-price surge levels. Consumer prices for the category "milk, cheese and eggs" (the only source of information on consumer prices currently available at Eurostat) experienced a steep increase (+15%) in the last three months of 2007. They have declined since the beginning of 2009. However, in August 2009 they still stood some 9% higher than two years earlier in August 2009.

3.1.2. Empirical evidence from the pork supply chain in some EU member States

3.1.2.1. Pork supply chain background

The EU pig meat sector

With a share of around 50% of total meat consumption in the EU, pork is the most consumed meat in Europe. In the framework of a relatively light market organisation within the Common Agricultural Policy (with import protection and occasional export support and private storage aid as major elements), the EU agricultural pig meat sector increased both its output and its exports over the last few years.

Increased costs, such as feed costs, and rather low producer prices have recently provoked a contraction in sector output. This contraction implied an acceleration of the already intensive process of structural change prevailing in the sector. For example, in Germany, the biggest pig meat producer in the EU in terms of output quantities, the number of pig holding farms decreased by more than 60% between 1996 and 2008, and the decrease in the number of holders recently amounted to 16.7% in just one year (in 2008 as compared to 2007), while the overall number of pigs decreased by just 1.5% (according to November/December 2007 and 2008 livestock survey results).

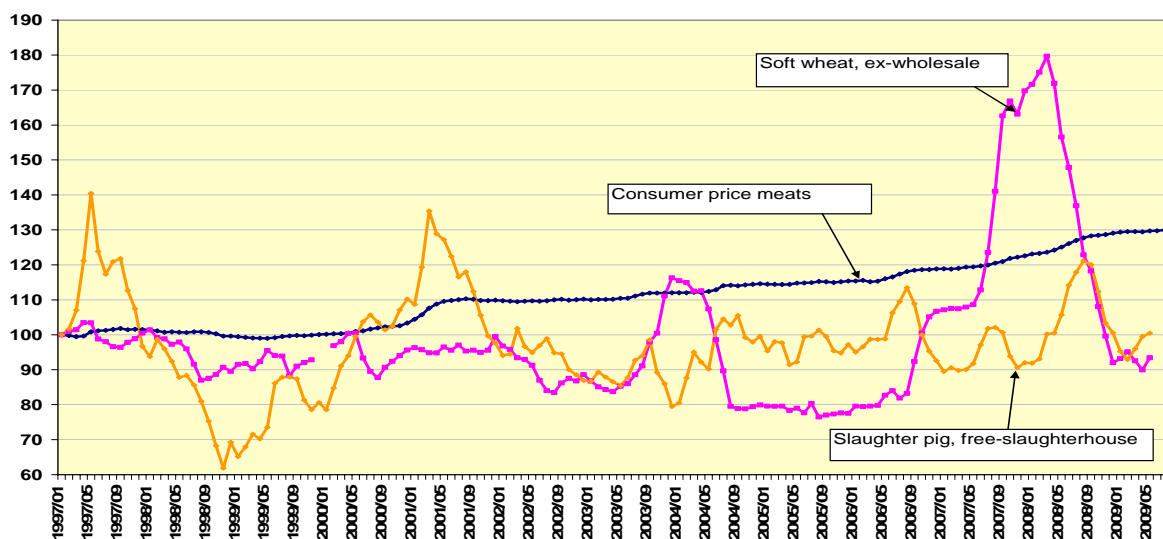
This structural adjustment helped the EU pig production sector to achieve remarkable efficiency gains over the last decades. In an environment of intensive competition on the agricultural supply side, the corresponding cost reductions have been transmitted to the downward supply chain. Over the years, the raw product value share at agricultural producer level in the final pork product value at consumer level has been decreasing continuously.

Despite ongoing structural change, the number of pig farmers in the EU competing for access to the pig product distribution channels remains rather important as compared to the number of actors involved and the degree of concentration reached in the first and second stage meat processing, wholesale, and retail sectors. The top 15 EU27 meat primary processors make up a market share of around 25%³⁴, and the top 30 European food retailers account for a market share of around 55%³⁵. It is often referred to as a 'retail driven supply chain rationalisation'³⁶, characterised by slowly growing pork consumption and continuous growth in discount market channels, which increasingly deliver processed meat and industrially packed fresh meat (preferably under own retail brands) to consumers.

Market situation

The pig meat market situation has been difficult over the past few years as rising feed and energy costs combined with stagnating demand in the wake of the economic crisis.

Figure 29: Developments of producer and consumer price indices in the EU pig meat sector, 1997-2009 (Jan 1997=100)



This resulted in a deterioration of pig producer's margins that in turn generated a contraction in output and increased structural change. Compared to other sectors, like the poultry sector, pig farmers were not able to fully transmit the increase in the production costs for feed, energy and labour to the processors and retailers.

³⁴ Gira (2006, 2007, 2008).

³⁵ Der Lebensmittelhandel in Europa 2007. Unternehmen, Strukturen, Entwicklungen. Deutscher Fachverlag, Lebensmittelzeitung. The delimitation of Europe refers to West-, Central- and Eastern Europe (excluding Turkey, including Russia) – more concrete definition available within the publication.

³⁶ Gira (2006, 2007, 2008).

3.1.2.2. Main findings of statistical analysis on pork products

The following table summarises the change in prices for pig meat at the farm gate and for selected pork products at retail level over the last two years³⁷. These data illustrate the **diversity of market situation** along the food supply chain in the EU and provide some insights concerning changes in margins at the processors and retailers levels. They also reveal specific marketing and pricing strategies of the downstream sector.

Table 5: Price change between April 2009 and May 2007 for pig meat at the farm gate and for selected pork products at retail level (in national currency)

	Germany	France	United Kingdom	Denmark	Austria	Slovenia	Czech Republic	Lithuania
Farm gate price	2%	8%	37%	6%	3%	3%	18%	19%
Retail prices								
Cutlets	4%	4%			9%			41%
Tenderloin	-8%			-3%		18%		20%
Roasted pork		4%					10%	
Shoulder, neck			39%				8%	19%
Chopped pork				-5%				
Minced pork	7%							36%
Pork loins			13%					
Pork belly					10%			
Bacon, back			18%					
Bacon, gammon			7%					
Ham		5%	18%				5%	37%
Sausage			8%			9%		

Source: European Commission based on information sent by selected Member States

The trends in pig meat producer prices and the consumer prices for pork-based products tend to show a **widening in the gross margin**³⁸ of the downstream sectors for most pork products and countries studied³⁹. However, when compared to the situation in the dairy sector, we can observe that in some countries and for some specific pork products (e.g. tenderloin in Denmark and Germany), retail prices in the pork chain have come down in line with and sometimes in excess of pig farm-gate prices over the last two years. Price developments in the UK are strongly influenced by the recent exchange rate fluctuations.

The statistical analysis of price transmission shows that:

- There are **wide differences** of results between similar products across countries and between products in each country, reflecting the diversity in the competitive structure and the functioning of the chain in each country as well as differences in the price formation mechanism. As for the dairy sector, this does not mean that the whole analysis is

³⁷ The identification of potential malfunctioning along the food supply chain requires a level of analysis which goes beyond the level of detail that is currently allowed by the available statistical information provided by Member States to Eurostat.

³⁸ It is important to differentiate gross margins (i.e. output prices minus the cost of agricultural or food inputs) from net (operational) margins (which correspond to the gross margin less all the costs incurred). As a result, an increase in gross margins does not necessarily imply an increase in profit levels.

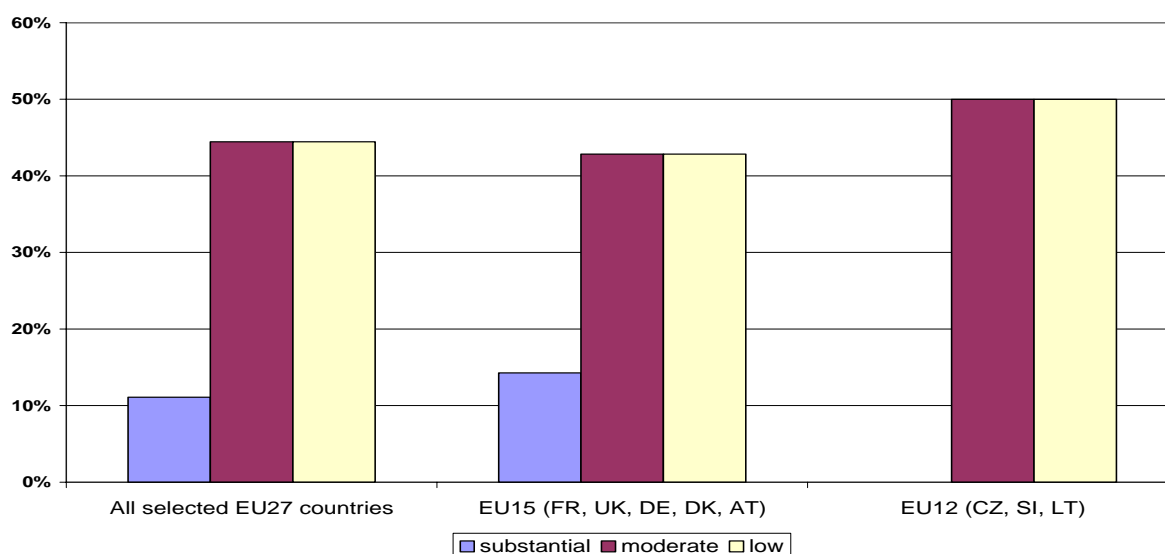
³⁹ In contrast to results from AgraCeas (2007) which shows that there has been a general further narrowing of producer-consumer margins over the period analysed in the pork product chain.

inconclusive. On the contrary this supports the view that the identification of potential malfunctioning along the food supply chain needs a level of analysis which goes beyond the level of detail that is currently allowed by the available statistical information provided by Member States to Eurostat.

- **Causality tests** show that for around 40% of the observed pork-based food products the degree of statistical causality between the agricultural raw material price movements and that of the corresponding consumer products is low or even null. Weak causality was also detected when the observation of producer and consumer price developments did not raise particular concern of imperfect price transmission (for example in France where consumer prices for the examined pork products have followed a similar path to pig meat price at producer level). This weak causality could be explained by factors such as the limited share of raw material in final product and the pricing strategy of processors/retailers.
- An analysis of the pork products which demonstrate a significant degree of causality between producer and consumer prices, shows that only approximately 10% exhibited a substantial **price transmission**, 45% showed moderate price transmission while around 45% of the pork products indicated a low degree of price transmission between producer and consumer prices.
- **Speed of transmission:** Price transmission was found to be higher for ham and boneless shoulders than for loins and tenderloins which showed below average price transmission coefficients. The delay in price response seems to be higher in the EU12 than in the EU15. At EU-27 level, the average price response at consumer level takes place with a delay of one month. Among the observed products loins and tenderloins showed a longer price response, up to 4 and 5 months (in the case of Slovenia and Germany respectively). Similar to the results of the empirical analysis for the dairy sector, price transmission appears to have taken place at significantly faster pace than what the evidence obtained at aggregate level tended to indicate. However, the rapid transmission of price changes only concerns relatively unprocessed pig meat products subject of this analysis and whose price developments were found to be closely linked to those of farm-gate pig meat prices. When examining the whole spectrum of pig meat products, it becomes clear that changes in the consumer price of many pig meat products which are not closely linked to changes at producer levels took place at much slower speed (at least after a 12 month-delay). The transmission of price changes between the primary and the downstream sectors seems to have taken place at very different pace across product chains and countries depending on the competitive structure of the supply chain and the production/marketing strategies put in place.
- **Price asymmetry and price transmission over time:** the statistical analysis does not enable to draw firm conclusions regarding the strengthening of the price transmission pattern over the most recent months (as was observed for the dairy sector and at aggregated agricultural level) as well as the existence of asymmetric behaviour.

The low price transmission found between the agricultural producer stage and the consumer stage in most countries (apart from the United Kingdom) tends to indicate that only a limited part of the changes in pork retail prices was generated by price changes at the farm gate. As shown by AgraCeas (2003), price transmission may be stronger from the retail and/or processing stage to the producer level (depending on the country, the net trade position and/or the relative strength of the downstream sectors).

Figure 30: Frequency of substantial, moderate, low price transmission results for the pig meat sector



In the following sections, a detailed statistical analysis of the pork supply chain is presented for three of the largest pork producing and consuming Member States (Germany, the UK and France). Results for other countries for which some data were provided are also summarised.

3.1.2.3. Germany

The German pig slaughter industry recently reached new output records, though this development was not driven by substantial additional indigenous pig production activity within Germany but by rapidly increasing piglet and slaughter animal imports, mainly from Denmark and the Netherlands, due to a more competitive German slaughter/processing industry. There was a strong concentration move in the pig slaughtering industry in recent years. The top three pig slaughter companies in Germany accounted for more than 50% of total pig slaughter in 2007.

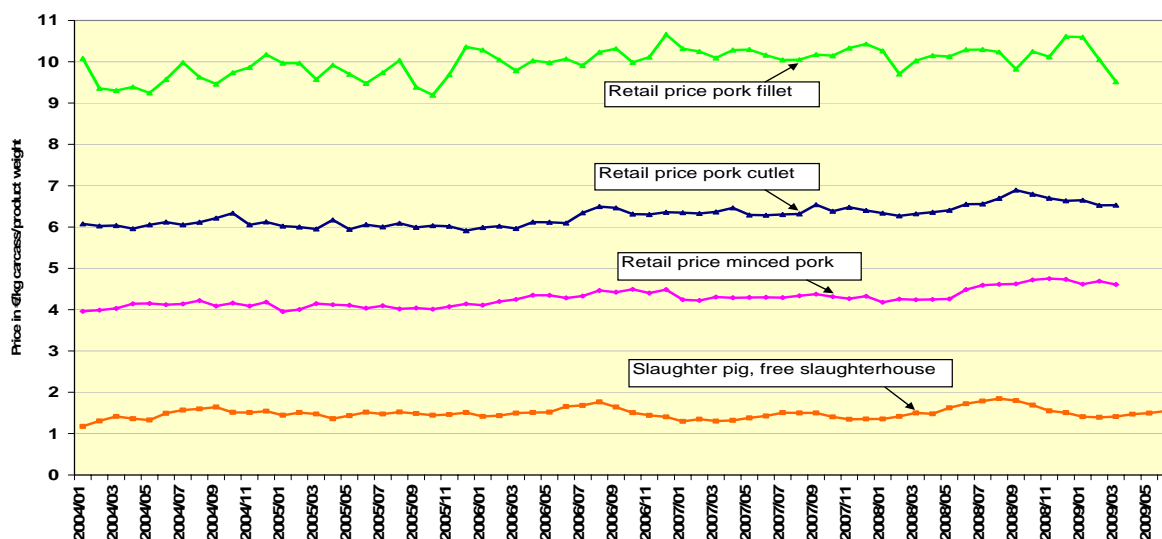
The share of pig meat used for further processing is relatively high in Germany at around 65%⁴⁰. Wholesalers play an important role in pig meat exports (30%) and as suppliers of the food service industry (more than 50%), they deliver however only 14% of the product amounts demanded by the food retail sector. Butchers hold a market share of less than 20% in total unprocessed pig meat sales in food retail. However their share is decreasing, as more and more fresh meat is sold in hard discounters. Around 18% of total consumption of unprocessed meat in Germany is served through the food service sector. The share of the food service sector is much higher for processed pork products like sausages, escalope, meat balls etc. Regarding processed pork products, hard discounters hold market shares of up to 50% for 'fast moving' products like certain cold cuts (sliced pork sausage, salami, cooked ham) (GIRA, 2006, 2007, 2008).

An examination of the actual price developments along the German pork supply chain shows that average retail prices have hardly fallen since 2004, despite stagnating agricultural producer prices and despite the increased market share of hard-discounters and the recent

⁴⁰ ZMP Marktstudie 2006: Warenstromanalyse Fleisch.

entry of the latter into the fresh meat segment (cf. graphs below). The margins realised within the non-agricultural downward supply chain tend to increase slightly. Retail prices appear to have increased more in the processed meat than in the fresh meat sector. According to (ISN, 2009), the agricultural pig producer received in January 2009 around 18% of the consumer expenditure for pig meat⁴¹.

Figure 31: Price developments (in absolute terms) within the German supply chain for fresh pig meat products (Jan 2004 - Jun 2009)



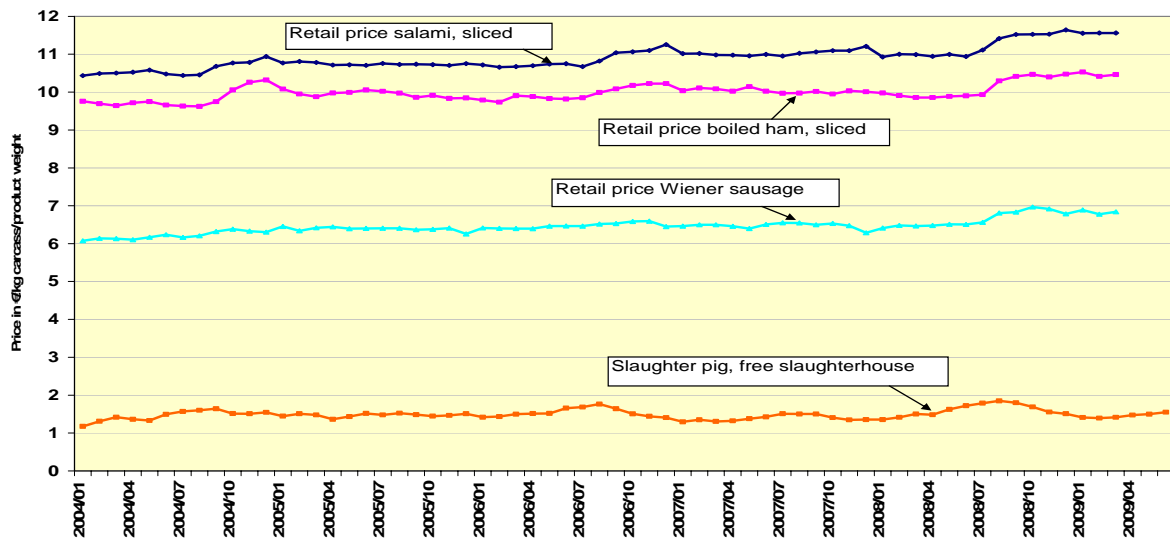
Source: DG AGRI, BMVEL/AMI.

Compared to milk, German farm-gate pig prices increased to a lesser extent during the food price hike of 2007/2008 as producers had difficulties to transmit the increasing production costs (e. g. feed, energy) to the food industry. Pig meat prices at producer level increased by 34% between May 2007 and August 2008, before falling close to pre price-spike levels by April 2009. Retail prices for the main pig meat cuts followed broadly, but less sharply, the same path: prices for cutlets and minced pork were in April 2009 only slightly higher compared to the situation two years earlier. In the case of tenderloins, retail prices in April 2009 were 8% lower than before the price spike.

The statistical analysis found weak causality in the case of pork cutlets and ham prices. The importance of the pig price in explaining the changes in consumer prices is rather low: for loin/tenderloin it is below the average correlation observed in selected Member States and it is lower during the most recent years than in the period 2004-2006. For minced pork on the other hand the correlation with the price of the raw material has been stronger and higher over the last couple of years. The transmission coefficients appear rather low as well indicating that only a limited part of retail price changes was generated by price changes at the farm gate.

⁴¹ ISN press release of 12/01/2009.

Figure 32: Price developments (in absolute terms) within the German supply chain for processed pig meat products (Jan 2004 – Jun 2009)



Source: DG AGRI, BMVEL/AMI.

Figure 33: Summary of the main results of the statistical analysis of price transmission: pig meat sector, Germany

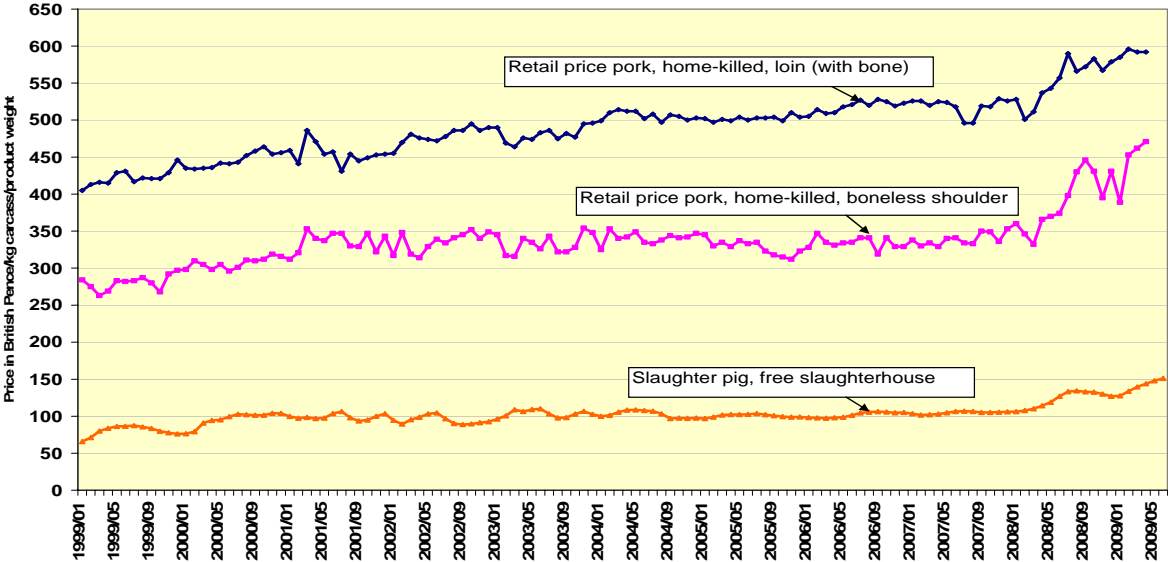
		Correlation R ²	Price transmission coefficient
2004-2006	Pork tenderloin	0.156	0.17
	Pork minced	0.112	0.131
2007-2009	Pork tenderloin	0.003	0
	Pork minced	0.308	0.205

3.1.2.4. United Kingdom

The UK pig farming sector has shown a remarkable decline over the last years and undergone a continued move towards larger specialised production units (specialised either into breeding or fattening, and also vertically aligned to specific slaughterers). The industry has been faced with permanent pricing pressures, further reinforced by major import flows in the framework of the EU Single Market (pork imports are estimated to make up for around 62% of UK domestic pig meat consumption, with Denmark and the Netherlands as main sources of supply).

The pig slaughtering sector is continuing to rationalise and consolidate, with the five largest slaughterers now accounting for around 80% of the UK's pig meat production. The total number of industrial abattoirs amounted to 180 in 2006.

Figure 34: Price developments (in absolute terms) within the UK supply chain for fresh pig meat products (Jan 1999 – Jun 2009)



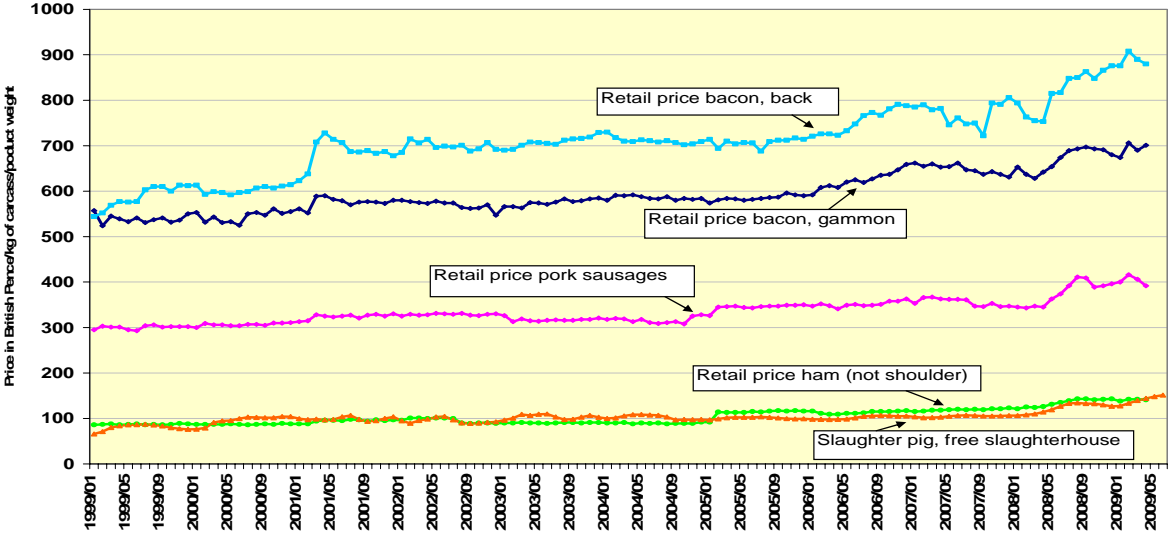
Source: DG AGRI; National Office of Statistics, UK.

The demand for pig meat in the UK concentrates on meat for processing into bacon, sausages and cooked meats, with retail consumption of fresh pig meat representing only around 16% of total pig meat consumption. Some 85% of fresh pig meat in retail is being supplied by pre-packed through specialist retail packing operations (GIRA, 2006). Although the consumption of bacon had declined markedly since the 1970s, the overall pig meat consumption, preferably in the form of further processed product (around 64% of total pig meat supply – excluding pork to be processed for the catering sector – is further processed), is estimated to have remained stable.

As shown in Graphs 34 and 35, the margins realised within the non-agricultural part of the fresh and processed pig meat supply chains have been increasing continuously, with a strong further push during over the most recent months.

During the food price hike of 2007/2008 UK farm-gate pig prices increased gradually by 37% between May 2007 and April 2009. The retail prices for the main pig meat cuts experienced only a limited increase followed by a slight decline in the first months of 2009. Retail prices only increased at the same rate as farm-gate prices for boneless pork shoulders. Interestingly fresh products increased at a faster pace than more processed products.

Figure 35: Price developments (in absolute terms) within the UK supply chain for processed pig meat products (Jan 1999 – Jun 2009)



Source: DG AGRI; National Office of Statistics, UK.

Figure 36: Summary of the main results of the statistical analysis of price transmission: pig meat sector, United Kingdom

		Correlation R ²	Price transmission coefficient
1999-2006	Pork sausage	0.265	0.321
	Pork ham	0.068	0.231
	Pork bacon, back	0.433	0.451
	Pork bacon, gammon	0.344	0.329
	Pork shoulder boneless	0.461	0.563
	Pork loin	0.474	0.365
2007-2009	Pork sausage	0.515	1.165
	Pork ham	0.659	0.878
	Pork bacon, back	0.352	0.869
	Pork bacon, gammon	0.394	1.202
	Pork shoulder boneless	0.615	0.907
	Pork loin	0.412	0.951

The statistical analysis (causality tests) shows that there is a close link (with a high level of correlation and the transmission coefficients) between changes in producer pig prices and changes in pork-based products at retail level. The regressions were able to explain a large

part of the variability for all products, with price transmission coefficients that in some cases stood above 1 (e.g. bacon, gammon and sausage) over the past couple of years.

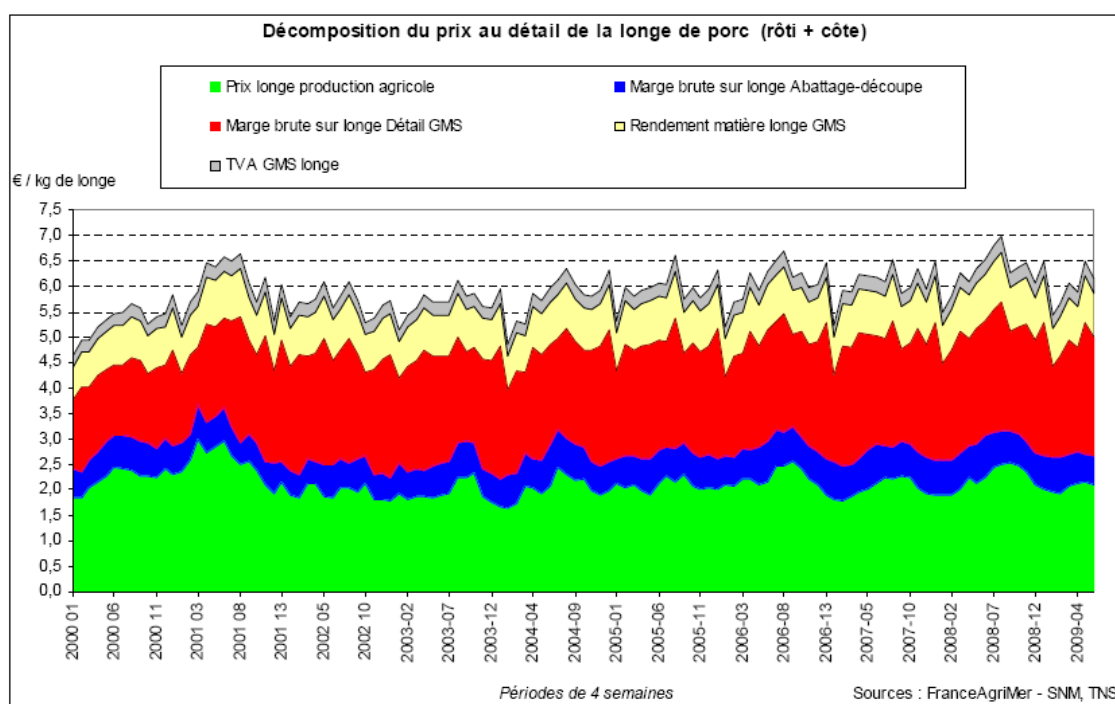
3.1.2.5. France

The French pig farming sector has been stagnating over the recent years. Pig meat is the most widely consumed meat in France, given its extensive use in processed products. Increased price pressure originates from pig meat imports from Spain, with competitively priced meat being used for further processing (mainly hams).

French pig farming is heavily concentrated in Brittany, and primarily involves medium size farms. The dominant activity is farrow-to-finish, which represents around 86% of the French pigs. The largest establishments are groups of independent producers. Producer prices in France are formed by auctions at the Marché du Porc Breton.

The top five slaughter groups in France account for around 52% of total national production. The total number of industrial abattoirs amounted to 182 in 2006. Developments in pig slaughtering have been characterised by an increasing downstream involvement (in cutting and processing) of the slaughterers, while processed meat manufacturers are not engaged in any slaughter activities. Accordingly, slaughterers (like COOPERL, BERNARD, SOCOPA and KERMENE) carry out more than 70% of all pork cutting in France.

Figure 37: Price developments (in absolute terms) within the French supply chain for longe de porc (2000-2009), €/kg



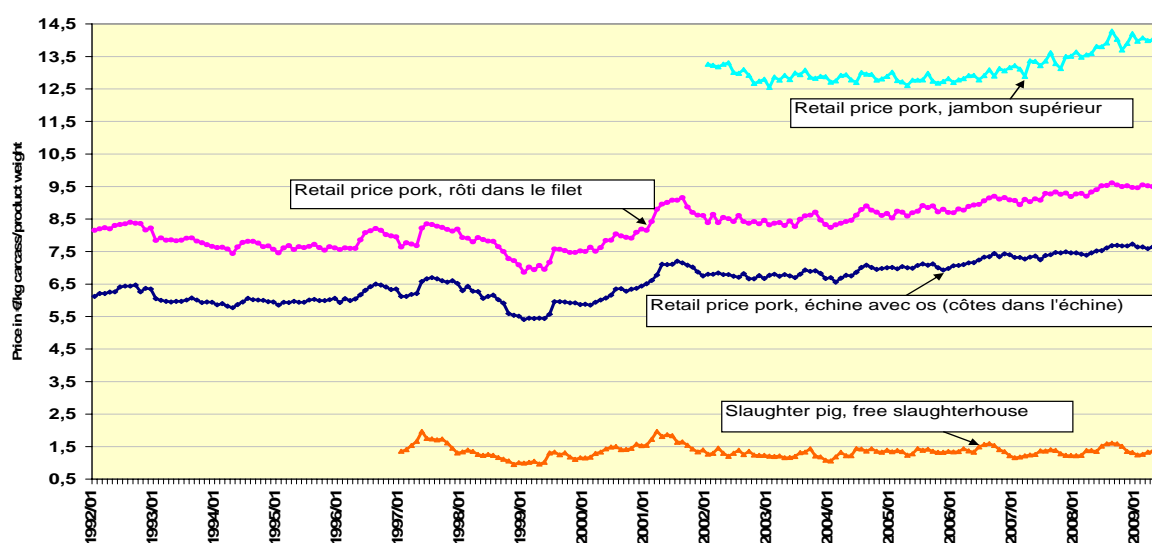
Around 65% of pork is consumed in the form of processed products (cooked ham, sausages) in France. Consumers usually consider fresh pig meat as a low price, basic product. Fresh pig meat is therefore mainly bought in modern retail outlets (and often in discount outlets).

An examination of price developments along the French pig meat supply chain shows that the margins generated by the non-agricultural part of the supply chain have been slightly

increasing over the last years (representing around 46% of the final price, in the case of fresh pork loins).

Farm-gate French pig prices increased by 28% between May 2007 and August 2008, before a sharp drop that brought prices down by more than 25 €cents per kg in just three months. Retail prices for main pig meat cuts have followed a similar but less spectacular development with prices increasing by between 5 to 7% during the surge in commodity prices. Price came down somewhat and by April 2009 stood 4% higher than before the price increase two years earlier. This moderate retail price increase compared to May 2007 can easily be explained by the relative increase in the price of raw material (+8%) and by the increase in other costs throughout the food chain and therefore does not raise particular concern in terms of price transmission.

Figure 38: Price developments (in absolute terms) within the French supply chain for fresh and processed pig meat products (Jan 1992 – Jun 2009)



Source: DG AGRI, Insee.

The two retail pig meat prices show only a weak causality with respect to farm-gate price and therefore the results of the regression analysis are not shown here.

3.1.2.6. Other observed countries

The following section summarises the main results of the statistical analysis based on data received from Denmark, Austria, Czech Republic, Slovenia and Lithuania.

Out of these five countries and a total of 15 products for which data was available only six are presented below. Weak causality is detected in Austria and Czech Republic where two out of three retail prices are dismissed because of weak causality (boneless and bone-in cutlets in Austria and roasted pork and pork shoulder in Czech Republic). The two examined Slovenian products, namely sausages and tenderloin, show both substantial causality but in the case of sausages the regression analysis suggests that the farm-gate prices barely explain changes in retail prices. For Lithuania two out of five products showed weak causality with respect to the price of the raw material (pork neck and cutlets).

Table 6: Summary of the main results of the statistical analysis of price transmission: pig meat sector, Austria, Czech Republic, Slovenia

Product	Country	Correlation (R^2)	Price transmission	Lag
Loins/tenderloins	SI	0.066	0.189	4
	LT	0.219	0.342	0
Minced pork	LT	0.022	0.118	0
Ham	CZ	0.379	0.28	0-1
	LT	0.181	0.403	1
Belly	AT	0.011	0.035	0

In the case of Denmark weak causality was detected for pork tenderloin retail prices with respect to pig meat producer prices. For chopped pork, the other product for which retail prices were available, causality link was established but regression results were extremely poor (very low correlation indicator and low significance transmission coefficients). Therefore no results are shown in the case of Danish pig meat.

4. CONCLUSIONS

The price transmission mechanism in the food supply chain has been analysed both at aggregated level across the EU and for the pork and dairy sectors for some Member States, with a specific focus on the extent to which the changes in commodity prices were transmitted to food consumer prices.

On the basis of the analysis at aggregated EU level, it appears that there is a very limited link between the evolution of agricultural commodity prices and the evolution of food consumer prices. This can be explained by the weak relationship between agricultural commodity and food producer price indices, especially before 2007. This overall low price transmission along the food chain can be explained by several factors: the limited share of agricultural commodities into final food prices, inefficiencies in the market structure of the chain (either linked to imbalances in bargaining power and/or anti-competitive practices), and some adjustments constraints and costs (e.g. costs of changing prices for both producers and retailers, the slow price transmission due to long-term contracts between economic actors).

There has been a significant change in the price transmission pattern along the chain from 2007 onwards with the sharp rise and the following plummeting of commodity prices. At each step of the chain, the magnitude of price transmission has increased and actors have tried to pass on to their customers the unusual increase in their input costs. Furthermore, since 2007, consumer prices – and to a lesser extent food producer prices – have failed to decrease in line with the decrease in agricultural commodity prices, exhibiting a 'rockets and feathers' evolution pattern in which prices are fast to raise and slow to decrease. The decline in agricultural commodity prices has been passed on up to one year later to the consumers.

The European food supply chain appears significantly fragmented across Member States in terms of price transmission pattern at each step of the chain. Both magnitude and speed of price transmission vary significantly across Member States, resulting in strong differences in consumer food prices evolution. This large variability in the degree, speed and asymmetry of price transmission between product chains and countries reflects the wide diversity in the competitive structure and the functioning of the food supply chain. This motivated the undertaking of a specific in-depth enquiry on the dairy and pig meat sectors which have been

particularly affected by the economic crisis and for which a certain number of concerns have been raised recently regarding the functioning of the chains.

In the dairy and pork supply chains, an examination of the price developments illustrates the differences in market situation across the EU and provides some insights concerning changes in margins at the processors/retailers level. Although available statistics until August 2009 indicate that consumer prices for dairy products have been coming down recently, further decline in the next few months would be needed if they were to fully reflect the drop in milk and dairy commodity prices at producer level. The trends in milk producer prices and dairy consumer prices tend to show a widening in the gross margin of the downstream sectors for most dairy products and countries studied, most notably over the last two years. The distribution of these higher gross margins between the processing and retail sectors is difficult to assess precisely on the basis of the data available which only provide a partial picture of the recent developments in prices and margins along the dairy chain (in terms of country, product and stages of the chain covered). However, evidence from national studies shows that there has been a clear trend lately towards an increase in the level of gross margins at processing level for some dairy products in some countries (e.g. UHT milk and yogurt in France, and liquid milk and butter in Denmark)⁴². Evidence of a trend towards a widening in the gross margin of the downstream sectors was also found for the pork chain, but to a much lesser extent.

The statistical analysis of price transmission in the dairy and pork sectors shows that:

- There are **wide differences** of results between similar dairy/pork products across countries and between dairy/pork products in each country, reflecting the diversity in the competitive structure and the functioning of the dairy/pork chain in each country as well as differences in the price formation mechanism. This does not mean that the whole analysis is inconclusive. On the contrary this supports the view that the identification of potential malfunctioning along the food supply chain needs a level of analysis which goes beyond the level of detail that is currently allowed by the available statistical information provided by Member States to Eurostat.
- **Causality tests** show that for around 40% of the observed dairy and pork products the degree of statistical causality between the agricultural raw material price movements and that of the corresponding consumer products is low or even null. Though this result seems rather high in terms of lack of causality linkage between producer and consumer prices, it remains in line with the findings obtained in other studies. Furthermore, weak causality was also detected for some dairy and pork products whereas the mere observation of producer and consumer price developments did not raise particular concern of imperfect price transmission (e.g; weak causality was detected for French natural yogurt even though the price developments in the last couple of years have closely followed farm-gate milk price movements). This weak causality could be explained by factors such as the limited share of raw material in final product and/or the pricing strategy of processors/retailers.

⁴² These findings appear to be broadly consistent with the analysis of the evolution of value-added repartition and profit margin across the overall EU food supply chain over the last few years (cf. Commission Staff Working Document "The evolution of value-added repartition along European food supply chain" accompanying the Communication "A better functioning food supply chain in Europe", COM(2009) 591).

- For the dairy and pork products which demonstrate a significant degree of causality between producer and consumer prices, the analysis shows that only approximately 20% and 10% respectively exhibited a substantial price transmission, 30% and 45% respectively showed moderate price transmission while around half of the products indicated a low degree of price transmission between producer and consumer prices. At Member State level, evidence tends to show higher price transmission in the new Member States (CZ, SI and LT) than in the old Member States. Among the dairy products analysed, a higher degree of price transmission was detected for relatively unprocessed products like butter, bulk cheese and liquid milk. More processed and/or differentiated products showed lower degree of price transmission, reflecting the higher importance of other cost components and margins.
- Speed of transmission: the delay in price response seems to be higher in the EU12 than in the EU15. At EU27 average price response at consumer level takes place with a delay of around one month, i.e. at significantly faster pace than what the evidence obtained at aggregate level tended to indicate. However, this rapid transmission of price changes only concerns dairy/pork products whose price developments were found to be closely linked to those of milk/pig meat producer prices. When examining the whole spectrum of dairy/pork products, it becomes clear that changes in the consumer price of many dairy/pork products which are not closely linked to changes at producer levels took place at much slower speed (at least after a 12 month-delay). Furthermore, when the statistical analysis indicates that some price transmission has taken place after a given number of months, it does not necessarily provide information concerning its completeness. Finally, the transmission of price changes between the primary and the downstream sectors seems to have taken place at very different pace across dairy/pork product chains and countries.
- The analysis of price developments and the statistical tests on price transmission provide indication of asymmetric behaviour across the dairy chain where dairy consumer prices have been fast to increase, but slow to decline in the wake of the sharp drop in milk producer prices (e.g. Slovenia, United Kingdom, Denmark, Lithuania). Furthermore the price transmission pattern in the dairy sector has significantly strengthened since the commodity price surge in 2007. By contrast, the analytical evidence for the pork supply chain does not enable to draw any firm conclusions regarding asymmetric behaviour and the degree of price transmission.

The overall rather low price transmission between the agricultural producer stage and the consumer stage in the two sectors of milk and pork may be linked to several factors: the steadily declining share of the agricultural raw materials into the consumer price of dairy and pork products, potential imperfections in the competitive structure of the chain (either linked to imbalances in bargaining power and/or anti-competitive practices), some specific adjustments constraints and costs (e.g. long-term contracts between economic actors) and pricing/marketing strategies in the downstream sectors.

In the case of the dairy chain, the specificities of the price formation mechanism and the importance of producer organisations in many countries may also contribute to water down the causality and degree of price transmission between the milk producer prices and dairy consumer prices. On the other hand, the price transmission in the pork supply chain may be stronger from the retail and/or processing stage to the producer level (depending on the country, the net trade position and/or the relative strength of the downstream sectors).

However, caution is deemed necessary in drawing firm analytical conclusions from the measurement and interpretation of the functioning of the price transmission mechanism owing to the wide diversity of the food supply chain in the EU across and within Member States and product chains. Furthermore, these analyses strongly rely on the availability and quality of price and margin information.

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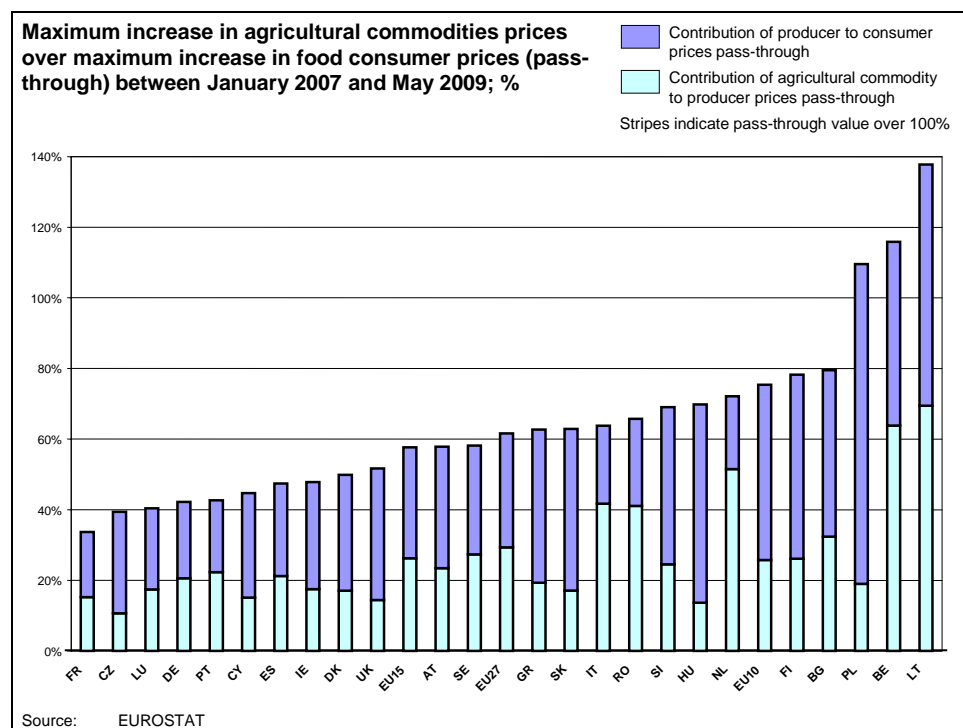
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6. ANNEXES

Figure A.1.: Pass-through from agricultural commodity prices to food consumer prices between January 2007 and May 2009 by Member States



Annex A.2.: Detailed equation of price transmission relationship estimated by panel data regression

The equation estimated by the regression is:

$$\Delta P_{Output}^t = \sum_{i=0.3.6} \alpha_i \Delta P_{Input}^{t-i} + \sum_{i=0.3.6} \beta_i \Delta P_{Energy}^{t-i} + \sum_{i=0.3.6} \gamma_i \Delta P_{Labour}^{t-i} + c$$

When estimating price transmission from agricultural commodity prices to food producer prices, output prices are food producer prices and input prices are commodity prices. When estimating price transmission at the retail level, output prices are food consumer prices and input prices are food producer prices. The coefficients α indicate the magnitude of the price transmission. A change of 10% in input prices translates into a $\alpha \cdot 10\%$ change in output prices. Variations of energy prices are proxied by the variation of producer prices of the energy sector and labour costs variations are the variations in unit labour costs for each relevant sector (*i.e.* manufacturing labour costs for price transmission from commodity to food producer, and trade services labour costs for price transmission from food producer to retailers.)

Table A.1.: Results from panel data regression of food producer monthly price variation with agricultural commodity monthly price variations

Dependent variable - Monthly variations in:	Food Producer Prices			Food Producer Prices		
Panel coverage:	EU15 Member States			EU12 Member States		
Time coverage:	2000-2009	2000-2006	2007-2009	2000-2009	2000-2006	2007-2009
Explanatory variables - Monthly variations in:	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Commodity prices (current)	1%***	1%*	8%***	4%***	2%***	14%***
Commodity prices (3-month lag)	1%**	-	14%***	3%***	1%**	9%***
Commodity prices (6-month lag)	-	-	10%***	-	-	9%**
Energy prices	3%***	-	6%***	4%**	6%**	-
Energy prices (3-month lag)	2%***	-	-	-	-	-
Energy prices (6-month lag)	-	-	-	-	-	-
Unit Labour costs	-	-	-	-	-	-
Unit Labour costs (3-month lag)	-	-1%**	-	-	-	6%***
Unit Labour costs (6-month lag)	-	-	-	-	-	-
Fit of the regression - Adjusted R ²	0.19	0.08	0.37	0.33	0.28	0.45

*** Indicates significance at 1% * Indicates significance at 10%
** Indicates significance at 5% - Indicates no significance
Source: EUROSTAT price indices, own calculation

Table A.2.: Results from panel data regression of food consumer monthly price variation with food producer monthly price variations

Dependent variable - Monthly variations in:	Food Consumer Prices					
Panel coverage:	EU27 MS		EU15 MS		EU12 MS	
Time coverage:	2000-2006	2007-2009	2000-2006	2007-2009	2000-2006	2007-2009
Explanatory variables - Monthly variations in:	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Food producer prices (current)	32%***	26%***	-	9%**	42%***	41%**
Food producer prices (1-month lag)	20%***	17%***	-	20%***	33%***	-
Food producer prices (3-month lag)	-	14%**	-	10%*	-	25%***
Food producer prices (6-month lag)	-	13%*	11%***	-	-	24%**
Energy prices	-	-	-	2%*	5%*	5%**
Energy prices (3-month lag)	2%*	-	-	-	4%*	-
Energy prices (6-month lag)	-	-	-	3%**	-	-
Unit Labour costs	6%***	-	-	-	-	10%**
Unit Labour costs (3-month lag)	-	-	-	-	-	-
Unit Labour costs (6-month lag)	-3%***	-	2%**	-	-9%***	-
Fit of the regression - Adjusted R ²	0.20	0.31	0.17	0.27	0.31	0.37

*** Indicates significance at 1% * Indicates significance at 10%
** Indicates significance at 5% - Indicates no significance
Source: EUROSTAT price indices, own calculation

Annex A.5.: Detailed equation of price transmission relationship to test symmetry

The equation estimated by the regression to test for asymmetry is the following:

$$\Delta P_{Output}^t = \sum_{i=0.3.6} a_i \alpha_i^+ \Delta P_{Input}^{t-i} - \sum_{i=0.3.6} a_i \alpha_i^- \Delta P_{Input}^{t-i} + \sum_{i=0.3.6} \beta_i \Delta P_{Energy}^{t-i} + \sum_{i=0.3.6} \gamma_i \Delta P_{Labour}^{t-i} + c$$

Where

$$a_i = \begin{cases} 1 & \text{if } \Delta P_{Input}^{t-i} \geq 0 \\ 0 & \text{if } \Delta P_{Input}^{t-i} < 0 \end{cases}$$

Price transmission will then be symmetric if we have a significant probability that:

$$\sum_{i=0.3.6} \alpha_i^+ = \sum_{i=0.3.6} \alpha_i^-$$

Table A.3.: Results from panel data regression testing asymmetry along the food supply chain

Dependent variable - Monthly variations in:	Food producer prices					
Panel coverage:	EU27 Member States					
Time coverage:	2000-2009		2000-2006		2007-2009	
Explanatory variables - Monthly variations in:	Coefficient for commodity price increase	Coefficient for commodity price decrease	Coefficient for commodity price increase	Coefficient for commodity price decrease	Coefficient for commodity price increase	Coefficient for commodity price decrease
Commodity price (current)	3%***	2%***	1%***	2%**	20%***	14%***
Commodity price (1-month lag)	2%***	2%***	-	2%***	17%***	16%***
Commodity price (6-month lag)	-	-	-	-	16%***	14%***
Energy prices	3%***	3%***	2%*	-	4%***	6%***
Energy prices (3-months lag)	1%*	1%*	-	-	-	-
Energy prices (6-months lag)	-	-	-	-	-	-
Unit Labour costs	-	-	-	-	-	-
Unit Labour costs (3-months lag)	-	-	-	-	-	3%**
Unit Labour costs (6-months lag)	-	-	-	-	-	-
Fit of the regression - Adjusted R ²	0.25	0.24	0.13	0.13	0.40	0.32

*** Indicates significance at 1% * Indicates significance at 10%
 ** Indicates significance at 5% - Indicates no significance

Source: EUROSTAT price indices, own calculation

Dependent variable - Monthly variations in:	Food consumer prices					
Panel coverage:	EU27 Member States					
Time coverage:	2000-2009		2000-2006		2007-2009	
Explanatory variables - Monthly variations in:	Coefficient for producer price increase	Coefficient for producer price decrease	Coefficient for producer price increase	Coefficient for producer price decrease	Coefficient for producer price increase	Coefficient for producer price decrease
Producer price (current)	40%***	30%***	42%***	36%***	34%***	-
Producer price (1-month lag)	24%***	25%**	26%***	31%***	21%***	-
Producer price (3-month lag)	8%*	-	-	-	14%**	47%**
Producer price (6-month lag)	-	-	-	-	13%*	n.a.
Energy prices	2%*	2%***	-	-	2%*	5%***
Energy prices (3-months lag)	2%*	2%**	2%*	2%*	-	-
Energy prices (6-months lag)	-	-	-	-	-	-
Unit Labour costs	6%***	6%***	6%***	6%***	-	-
Unit Labour costs (3-months lag)	-	-	-	-	-	-
Unit Labour costs (6-months lag)	-2%*	-2%*	-3%***	-3%***	-	-
Fit of the regression - Adjusted R ²	0.23	0.16	0.20	0.16	0.32	0.20

*** Indicates significance at 1% * Indicates significance at 10%
 ** Indicates significance at 5% - Indicates no significance

Source: EUROSTAT price indices, own calculation

Figure A.2: Household expenditure for dairy products in France

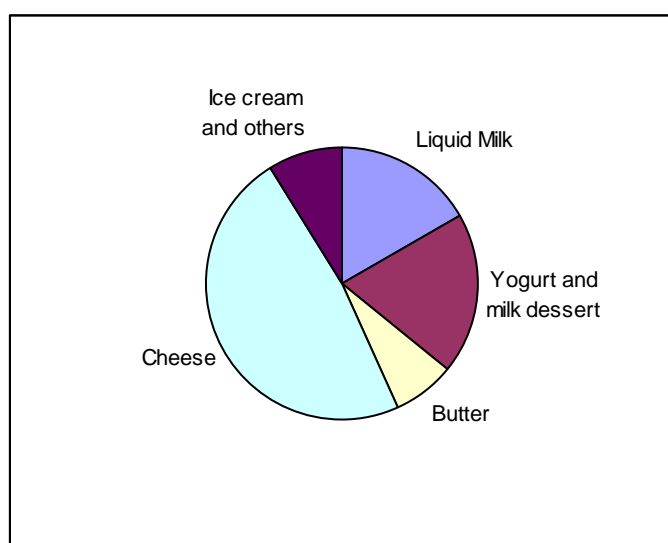


Figure A.3: Price level of several dairy products at consumer level (except from milk at farm-gate level), France, 2001 - 2009 (€per unit)

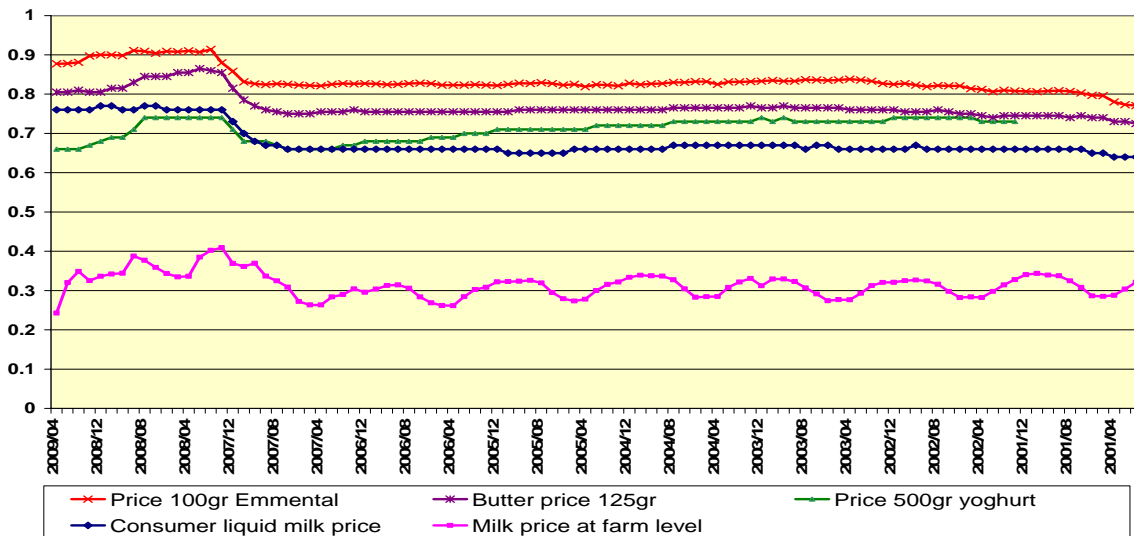


Figure A.4: Price level of several dairy products, at consumer level, United Kingdom, 1999 - 2009 (£pence)

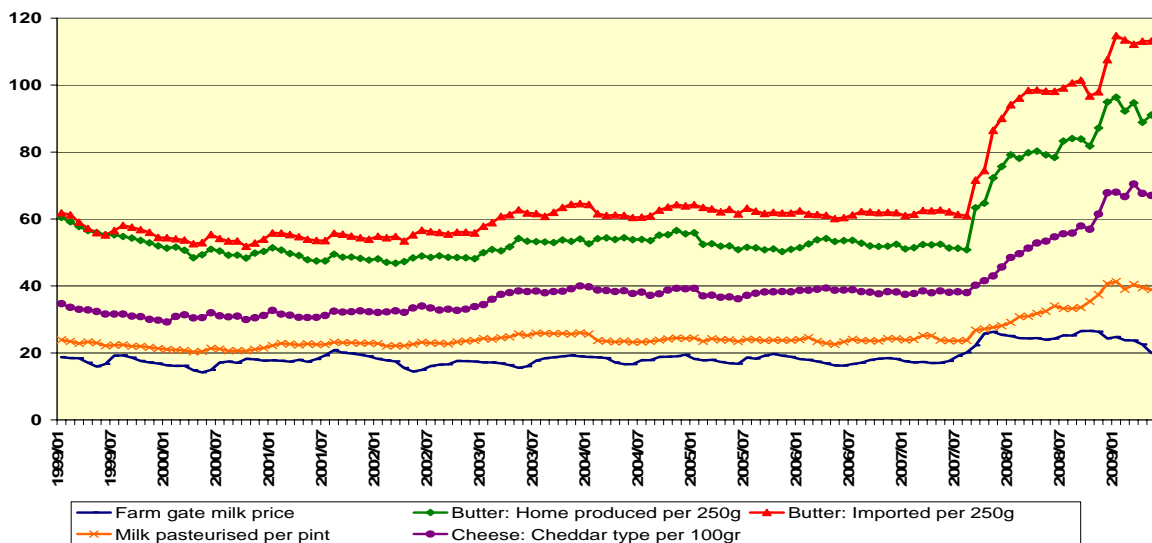


Figure A.5: Farm-gate milk price and retail price of several dairy products, Denmark, 2000-2009 (DKK per unit)

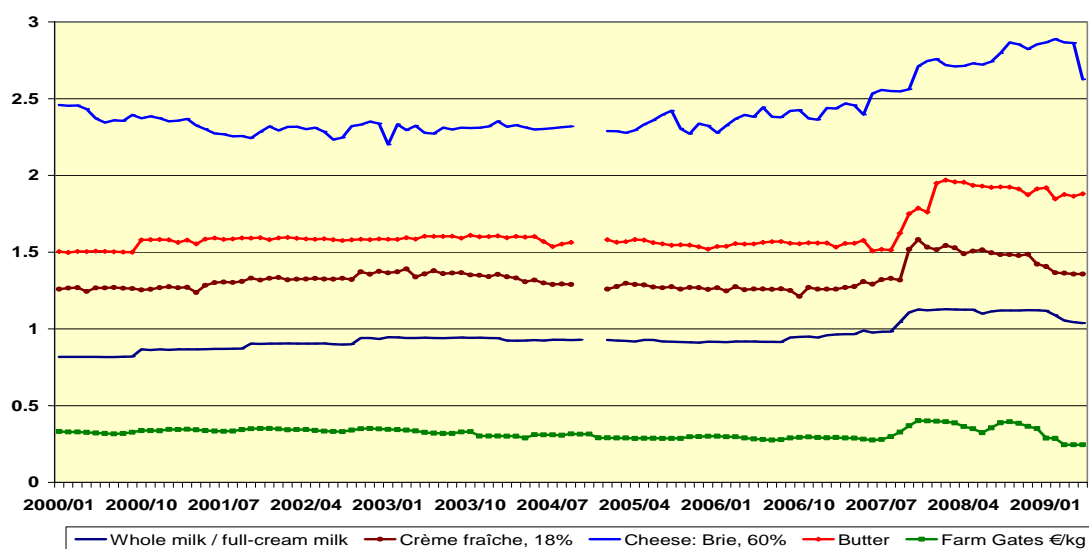


Table A4: Summary of the results of the statistical analysis of price transmission: dairy sector, France

Period	Dependent Variable	Obs	Centered LAG	R2	Significance F	Coefficients
1996-2009	Bulk cheese	158	1	0,065	***	0,071
	UHT semi-skim milk	158	0 1	0,209	! **	0.049 0.110
1996-2006	Bulk cheese	131	1	0,016	!	0,035
	UHT semi-skim milk	131	0 1	0,15	! !	0.074 0.043
2007-2009	Bulk cheese	26	1	0,391	***	0,16
	UHT semi-skim milk	26	0 1	0,483	! **	0.014 0.295

! = significance of F lower than 5%

Table A5 Summary of the results of the statistical analysis of price transmission: dairy sector, United Kingdom

Period	Dependent Variable	Obs	Centered LAG	R2	Significance F	Coefficients
1999-2009	Butter	123	0	0,407	***	0,645
	Cheddar	123	0	0,151	***	0,183
1999-2006	Butter	96	0	0,372	***	0,649
	Cheddar	96	0	0,168	***	0,2
2007-2009	Butter	27	0	0,806	***	0,649
	Cheddar	27	0	0,385	***	0,152

Table A6 Summary of the results of the statistical analysis of price transmission: dairy sector, Denmark

Period	Dependent	Obs	LAG	Centered		Coefficients	
	Variable			R2	Significance F		
2000-2009	Fresh whole organic milk	99	0	0.023	!	0.101	
	Fesh semi-skim organic milk	99	1	0.104	***	0.126	
	Double crème		110	0	0.284	!	0.327
				1		!	0.287
	Yogurt with fruit	111	0	0.162	***	0.238	
	Brie	111	0	0.114	***	0.201	
	Cheese	111	0	0.009	!	0.196	
	Butter	110	1	0.06	**	0.324	
2000-2006	Fresh whole organic milk	72	0	0.024	!	0.119	
	Fesh semi-skim organic milk	72	1	0.096	**	0.091	
	Double crème		83	0	0.351	***	1.727
				1		!	-0.949
	Yogurt with fruit	84	0	0.096	***	0.205	
	Brie	84	0	0.237	***	0.328	
	Cheese	84	0	0.015	!	0.307	
	Butter	83	1	0.024	!	0.245	
2007-2009	Fresh whole organic milk	27	0	0.262	***	0.136	
	Fesh semi-skim organic milk	26	1	0.511	***	0.231	
	Double crème		26	0	0.653	!	-0.104
				1		***	0.390
	Yogurt with fruit	27	0	0.5	***	0.212	
	Brie	27	0	0.118	!	0.101	
	Cheese	27	0	0.232	**	0.227	
	Butter	26	1	0.581	***	0.49	

! = significance of F lower than 5%

Table A7 Summary of the results of the statistical analysis of price transmission: dairy sector, Germany

Period	Dependent	Obs	LAG	Centered R2	Significance %	Coefficients
	Variable					
2004-2009		51	0	0.377	***	0.584
2004-2006	Cheese Gouda	24	0	0.032	!	-0.044
2007-2009		27	0	0.328	***	0.444

Table A8 Summary of the results of the statistical analysis of price transmission: dairy sector, Slovenia

Period	Dependent Variable	Obs	LAG	Centered		
				R2	Significance F	Coefficients
2004-2009	Fresh whole milk	56	0	0.596	***	0.768
			3		***	0.731
	Natural Yogurt	56	3	0.333	***	0.906
	Butter	56	0	0.6	***	0.713
3			***		0.664	
2004-2006	Fresh whole milk	29	0	0.164	!	-0.016
			3		!	0.185
	Natural Yogurt	29	3	0.006	!	0.051
	Butter	29	0	0.343	**	0.276
3			!		0.033	
2007-2009	Fresh whole milk	24	0	0.776	***	0.701
			3		***	0.860
	Natural Yogurt	24	3	0.579	***	0.722
	Butter	24	0	0.765	***	0.546
3			***		0.788	
2004-2006	UHT semi-skim milk	29	0	0.87	***	0.387
			3		***	0.474
	UHT semi-skim milk	24	0	0.792	***	0.615
			3		***	0.601

! = significance of F lower than 5%

Table A9 Summary of the results of the statistical analysis of price transmission: dairy sector, Austria

Period	Dependent Variable	Obs	LAG	Centered		
				R2	Significance F	Coefficients
2000-2009	Gouda	105	6	0,143	***	0,316
	Camembert	105	6	0,155	***	0,267
	UHT whole milk	111	0	0,122	***	0,3
	Natural yogurt	111	0	0,064	***	0,6
2000-2006	Gouda	78	6	0,037	!	0,038
	Camembert	78	6	0,02	!	0,024
	UHT whole milk	84	0	0,038	!	-0,07
	Natural yogurt	84	0	0,266	***	1,395
2007-2009	Gouda	21	6	0,085	!	0,109
	Camembert	21	6	0,097	!	0,098
	UHT whole milk	27	0	0,638	***	0,352
	Natural yogurt	27	0	0,717	***	0,372

! = significance of F lower than 5%

Table A10 Summary of the results of the statistical analysis of price transmission: dairy sector, Czech Republic

Period	Dependent	Obs	LAG	Centered	Significance F	Coefficients
	Variable			R2		
2007-2009	Fresh semi-skim milk	27	0	0,358	***	0,393
	UHT semi-skim milk	27	0	0,649	***	0,674
	Natural yogurt	27	0	0,162	**	0,149
	Yogurt with fruits	26	1	0,335	***	0,272
	Butter	27	0	0,831	***	0,772

Table A11 Summary of the results of the statistical analysis of price transmission: pork sector, Germany

Period	Dependent	Obs	LAG	Centered	Significance F	Coefficients
	Variable			R2		
2004-2009	Minced pork	62	1	0,183	***	0,152
	Loin	58	5	0,088	**	0,108
2004-2006	Minced pork	35	1	0,112	*	0,131
	Loin	31	5	0,156	**	0,17
2007-2009	Minced pork	26	1	0,308	***	0,205
	Loin	22	5	0,003	!	-0,015

! = significance of F lower than 5%

Table A12 Summary of the results of the statistical analysis of price transmission: pork sector, United Kingdom

Period	Dependent	Obs	LAG	Centered	Significance F	Coefficients
	Variable			R2		
	Loin	123	0	0,431	***	0,519
	Shoulder	123	0	0,514	***	0,677
	Bacon back	123	0	0,339	***	0,49
	Bacon gammon	123	0	0,444	***	0,535
	Ham	123	0	0,049	**	0,196
	Sausage	123	0	0,331	***	0,492
	1999-2006	Loin	96	0	0,474	***
Shoulder		96	0	0,461	***	0,563
Bacon back		96	0	0,344	***	0,329
Bacon gammon		96	0	0,433	***	0,451
Ham		96	0	0,068	**	0,231
Sausage		96	0	0,265	***	0,321
2007-2009		Loin	27	0	0,412	***
	Shoulder	27	0	0,615	***	0,907
	Bacon back	27	0	0,394	***	1,202
	Bacon gammon	27	0	0,352	***	0,869
	Ham	27	0	0,659	***	0,878
	Sausage	27	0	0,515	***	1,165

3.- ESTRUCTURA DE COSTES Y PRECIOS

3.2.- Análisis de la estructura de costes y precios

AGREGACIONES DE COSTES Y FACTORES CRÍTICOS EN LAS GRANDES ÁREAS DE ACTIVIDAD DE LA CADENA DE VALOR DE LA LECHE LÍQUIDA ENVASADA



AREAS DE ACTIVIDAD	INCREMENTO DE PRECIO RESPECTO A LA FASE ANTERIOR (€/l)	(%)	FACTORES CRÍTICOS/DE INFLUENCIA
Logística en campo	0.325 / 0.365	45.5/35.3	Costes de alimentación , amortizaciones, genética/ veterinaria, mantenimiento, coste oportunidad
Logística de recogida	0.020 / 0.030	2.8/2.9	Coste transporte , trazabilidad y control
Transformación, comercialización y gestión industrial	0.180 / 0.270	25.2/26.1	Costes envases y embalajes , costes de fábrica, costes comerciales/marketing
Logística de distribución	0.085 / 0.140	11.8/13.5	Coste de plataforma o almacén intermedio, coste transporte plataforma/almacén, costes transporte a tienda/HORECA
Tienda	0.105 / 0.230	14.7/22.2	Coste de la tienda (personal, mermas, amortizaciones, alquileres, seguros, gestión medioambiental, vigilancia, etc.)
TOTAL (SIN IVA)	0.715 / 1.035	100	
IVA (4%)	0.029 / 0.041		
TOTAL CON IVA	0.744 / 1.076		

3.- ESTRUCTURA DE COSTES Y PRECIOS

3.1.- Esquema de la estructura de costes y precios

