

## CHAPTER 4

# PRICING AND PERFORMANCE IN AGRI-FOOD SUPPLY CHAINS

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**Abstract.** This paper explores whether European food-processing and retail industries exert market power towards farmers and consumers. More in particular, this paper analyses (1) whether price changes at the farm level are fully and instantaneously transmitted into changes at the consumer level; and (2) whether there have been changes in the price risk distribution in post-war agri-food supply chains. With respect to the first research question, we do not observe a general pattern of price asymmetry to the disadvantage of farmers and consumers. In general, price symmetry and price levelling are as prevalent as price asymmetry is. With respect to the second question, I observe a shift in price risk from farmers to marketing organizations in the Dutch ware-potato supply chain.

**Keywords:** supply-chain performance; price transmission; risk distribution; agriculture

### INTRODUCTION

In the period between October 2000 and April 2001 there was a dramatic 35% decline in the farmer price for beef in The Netherlands. The price decrease was not followed by subsequent decreases at the wholesale and retail levels. On the contrary, while the wholesale price remained stable, the retail price even rose by 4% (CBS Statline). This difference in price development gave rise to a public debate on price formation in The Netherlands. Price changes at one stage in the food chain are not necessarily transmitted to other stages. Farmer and consumer associations accuse food-processing and retail companies of abusing their market power to increase profit margins. Farmers consequently receive too little and consumers pay too much.

This paper relates industry and supply-chain performance in agri-food supply chains to pricing in agri-food chains, more in particular to price transmission. The paper focuses on one particular aspect of performance: equity. Are the costs and benefits of the production and distribution of food evenly distributed? An uneven distribution of costs and benefits may have consequences for the viability of agri-food chains, since the uneven distribution of costs and benefits may hinder

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modernization efforts in agriculture. The paper uses the results of recent empirical studies to study industry and supply-chain performance on pricing.

The paper is constructed as follows. Section 1 presents some statistical artefacts on pricing in agri-food chains. Section 2 defines market performance and pricing in agri-food supply chains. Section 3 defines price transmission and reviews some major empirical studies. Section 4 analyses risk sharing in the Dutch ware-potato supply chain. The paper ends with a brief conclusion.

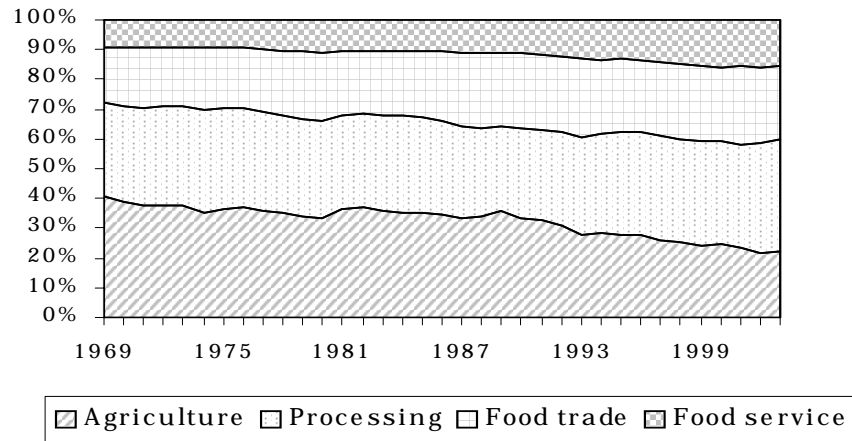
### FARMER'S SHARE IN CONSUMER EXPENDITURE

The farmer's share in consumer expenditure exhibits a steady downward trend in the long run. Figure 1 illustrates that more and more value added is generated in food processing, food trade and food service rather than in agricultural production, especially since the beginning of the 1990s. Interest groups, politicians and media express concern over the decline in the farmer's share in the supply chain's income. The producer's performance is thought to deteriorate with the fall in the farmer's share in value added. However, producer performance is not directly related to his share in value added, but rather to the return on his investment and his labour input. In theory, the producer's share may fall without harming his return on investment and labour, e.g. due to productivity increases. It is also possible that the producer's share remains equal, while the return on his investment and labour deteriorates, e.g. due to cost increases or price squeezes throughout the supply chain invoked by retailer price competition. Shares in value added provide useful information on supply chain performance, but not enough information to evaluate farmer performance.

Figure 1 illustrates that the farmer's share in consumer expenditure on food has been falling. Are there any reasons to be concerned about this fall? In order to answer this question, we briefly discuss the main reasons behind the long-term fall in the farmer's share in consumer expenditure on food (De Bont et al. 2000).

#### *Consumption patterns*

There is an important shift in food consumption from fresh produce to processed produce and from home consumption to out-of-home consumption. Processed food involves more value added than fresh produce, and out-of-home consumption involves more value added than home consumption. The shift in consumption patterns is directed to food products in which the processing and distribution trades have a larger share (Figure 1).



**Figure 1.** Shares in value added from food production and distribution: The Netherlands, 1969-2003 (source: CBS Nationale Rekeningen)

#### *Productivity patterns*

Factor productivity increases faster in agriculture than in manufacturing and services. Bernard and Jones (1996) indicate that factor productivity in agriculture increases at a 40% and 180% higher rate than factor productivity in manufacturing and services, respectively. As a result, agriculture employs fewer production factors and faces a drop in its share in value added of food products.

#### *Market power*

Farmers' share in consumer expenditure may also decrease due to abuse of market power by the processing and distribution trades. Downstream industries may extract either lower purchase prices or higher customer prices (or both). If the processing and distribution trades are able to exploit market power, they increase the wedge between consumer and farmer prices and reduce farmers' share of consumer expenditure. Up to now, the empirical literature has found limited evidence for abuse of market power in food processing and distribution (Peltzman 2000).

The change in consumption patterns and the difference in productivity increases explain the long-term gradual decline in farmers' share in consumer expenditure on food. The change in consumption patterns and the difference in productivity increases involve structural factors underlying consumer demand and industry costs. Market power gives an additional ground for developments from and shifts around the structural trend in the distribution of expenditure shares. Market power is a major policy concern, since it influences supply-chain performance.

## EFFICIENCY, EQUITY AND PRICING

Welfare theory may be used to assess industry and supply-chain performance on the basis of measures of social welfare. Social welfare depends on the welfare of society's main stakeholders: producers, consumers and taxpayers-citizens. Social welfare – in this case social supply-chain performance – depends on two elements: (1) efficiency (profit) and (2) equity (people). Efficiency is concerned with the creation of value added; equity is concerned with the division of value added over the respective stakeholders.

Efficiency and equity are not necessarily compatible. Efficient solutions may be very 'unequitable'. Maximizing value added is not necessarily beneficial to all stakeholders concerned. Tirole (1988) evaluates supply chain coordination devices by assessing their impact on supply chain performance, more in particular producer surpluses throughout the supply chain. Many solutions Tirole (1988) suggests involve monopoly solutions. These solutions maximize the supply chain's value added. However, value added accrues to the monopolist only, either a processor or a retailer. All other parties do not necessarily gain from supply-chain efficiency. Monopoly profits may be redistributed but there is no reason why they should be. Monopoly power – or more generally market power – does not disappear with supply-chain coordination. Supply-chain coordination may even be a mechanism to establish and maintain market power. So we conclude that supply-chain performance is more than efficiency and that equity matters. The rest of this paper, focuses on equity.

Pricing in supply chains is highly relevant to assess efficiency and equity in supply chains. Clarke et al. (2002) distinguish five aspects when discussing pricing in supply chains:

1. Price levels and profit margins. Firms may earn 'excess' profit margins. Profits are considered to be excessive if they exceed the level deemed necessary to induce firms to produce, to invest and to innovate. Firms may also earn insufficient profits. Profits are insufficient in the sense that they are not high enough to induce firms to produce, to invest and to innovate.
2. Price changes. Buying firms may or may not react to changes in supplier prices (or final prices). Firms may react instantaneously or with a lag, and they may react asymmetrically to decreases and increases in supplier prices. Asymmetries in the reaction to supplier prices generate temporary profits.
3. Price structure. There is more to pricing than unit prices. Firms may also agree to fixed payments, e.g. listing fees, slotting allowances and even retrospective payments.
4. Non-price aspects. Contracts also lay down product specifications. These specifications may substitute for price and other financial transfer clauses.
5. Price risk. A firm's well-being does not only depend on expected income, but also on the price and income risks the firms are exposed to. Price risks make firms more vulnerable, *ceteris paribus*.

The equity issue is at stake when firms are able to exert market power. Market power may be exerted on a permanent or temporary basis, by charging high

consumer prices and by commanding low supplier prices (points 1 and 2), by extracting fixed payments (point 3), by enforcing non-price specifications (point 4) and by shifting price risks to other supply-chain parties (point 5).

Ideally, empirical research into supply-chain pricing involves all five elements. However, due to restrictions in time, data and money, empirical research is confined to some research questions. These research questions typically have a partial nature and are restricted to areas for which data are available. This explains why one may indicate several white spots in empirical research. Research establishing the return on investment of subsequent links in supply chains is scarce (point 1). Empirical research on price transmission is abundant (point 2). We delve into this issue in the next section. Empirical attention for financial conditions other than unit prices is new (point 3). Systematic knowledge is not available yet. Empirical attention for the financial consequences of non-price specifications is also new (point 4). Analyses of price risks in agriculture are abundant (point 5), but generally do not address risk sharing in agri-food supply chains, especially not in developed countries. In general, there is little empirical research explaining the price patterns found.

### PRICE TRANSMISSION

Price transmission is one of the most heavily studied equity issues related to pricing studied in Industrial Organization. An important part of the empirical applications refer to agri-food chains. Price transmission refers to the way prices at one level in the product chain react to changes at another level. Market power may explain that price changes at one level are not transmitted to other levels. There are three types of imperfect price transmission:

1. Price changes are not fully transmitted.
2. There is a time lag between the price adjustments at the respective stages.
3. There is an asymmetry in reaction between positive and negative price shocks.

Imperfections in price transmission may be due to, among other things, market power or adjustment costs. Market power may explain why prices are not fully transmitted. Oligopolistic and oligopsonistic interdependence may give rise to lags in price adjustment. The risk of invoking a price war may make firms reluctant to lower prices. This may cause an asymmetry in the price reaction to positive versus negative price shocks.

Due to several adjustment costs (labelling, advertising and goodwill) changing prices may be expensive. Adjustment costs thus give rise to reaction lags. In combination with other arguments, such as inflation (Ball and Mankiw 1994), stock building (Blinder 1982) and perishability (Ward 1982), adjustment costs may also cause price asymmetries. Adjustment costs thus give rise to price levelling. The marketing literature gives several other arguments for this phenomenon. Apart from market power and adjustment costs, non-linearities in demand and supply may give rise to imperfections in price transmission.

*Table 1. Results of price-asymmetry studies (source: Meyer and Von Cramon-Taubadel 2002)*

	All methods	First differences	Test method			Other methods
			Summation first differences	Error correction	Threshold methods	
Number of tests	197	93	47	31	10	18
Symmetry	102	30	36	17	2	17
Asymmetry	95	63	11	14	8	1
Asymmetry (%)	48	68	23	45	80	6




There is a wide body of empirical literature on asymmetric price transmission. Meyer and Von Cramon-Taubadel (2002) have summarized the results of 38 studies, 25 of which refer to agricultural products. In these studies, 197 estimations have been performed. These estimations are based on different methods, among other things because estimation methods have been improved through time. Table 1 summarizes the estimation results. Table 1 shows that price asymmetry is a recurrent phenomenon. Almost 50% of the studies found price asymmetry. Note, however, that the estimation results seem to depend on the estimation method employed. Peltzman (2000) also establishes asymmetry in two thirds of the 242 product chains analysed<sup>1</sup>.

Recently, London Economics (2004) studied price transmission in European agri-food supply chains in the 1990s (Table 2). Table 2 indicates whether prices are transmitted symmetrically (green), asymmetrically (red) or levelled off (yellow). Table 2 analyses the transmission of price shocks both from upstream to downstream (U-D, from farmer to retailer) and the other way round (D-U, from retailer to farmer). London Economics establishes asymmetry in 13 out of 82 cases. Price symmetry (46 cases) and price levelling (23 cases) are more prevalent. London Economics concludes that there is no general pattern of price asymmetry in agri-food chains.

We conclude as follows. Price asymmetry is a recurrent phenomenon, in supply chains in general and in agri-food supply chains in particular (Meyer and Von Cramon-Taubadel 2002; London Economics 2004). However, there is no general pattern of price asymmetry in agri-food supply chains. Since there is no general pattern of price transmission, a general explanation that pertains to all supply chains cannot be drawn. This holds for both retail concentration and menu costs. The empirical literature still has problems explaining the price patterns found.

**Table 2.** Price symmetry and asymmetry in European supply chains (source: London Economics 2004)

	Austria		Denmark		France		Germany		Ireland		Netherlands		Spain		UK	
	U-D	D-U	U-D	D-U	U-D	D-U	U-D	D-U	U-D	D-U	U-D	D-U	U-D	D-U	U-D	D-U
Apples	Price symmetry	Price symmetry					Price symmetry	Price symmetry							Price symmetry	Price symmetry
Beef					Price symmetry	Price symmetry			Price symmetry	Price symmetry	Price symmetry	Price symmetry			Price symmetry	Price symmetry
Bread			Price symmetry	Price symmetry	Price symmetry	Price symmetry					Price symmetry	Price symmetry			Price symmetry	Price symmetry
Butter			Price symmetry	Price symmetry	Price symmetry	Price symmetry	Price symmetry	Price symmetry							Price symmetry	Price symmetry
Carrots	Price symmetry	Price symmetry					Price symmetry	Price symmetry							Price symmetry	Price symmetry
Cheese			Price symmetry	Price symmetry	Price symmetry	Price symmetry	Price symmetry	Price symmetry							Price symmetry	Price symmetry
Chicken					Price symmetry	Price symmetry	Price symmetry	Price symmetry								
Eggs			Price symmetry	Price symmetry	Price symmetry	Price symmetry					Price symmetry	Price symmetry			Price symmetry	Price symmetry
Flour			Price symmetry	Price symmetry											Price symmetry	Price symmetry
Lamb					Price symmetry	Price symmetry									Price symmetry	Price symmetry
Milk			Price symmetry	Price symmetry	Price symmetry	Price symmetry	Price symmetry	Price symmetry							Price symmetry	Price symmetry
Potato			Price symmetry	Price symmetry			Price symmetry	Price symmetry			Price symmetry	Price symmetry	Price symmetry	Price symmetry	Price symmetry	Price symmetry

 Price symmetry     
  Price asymmetry     
  Price levelling

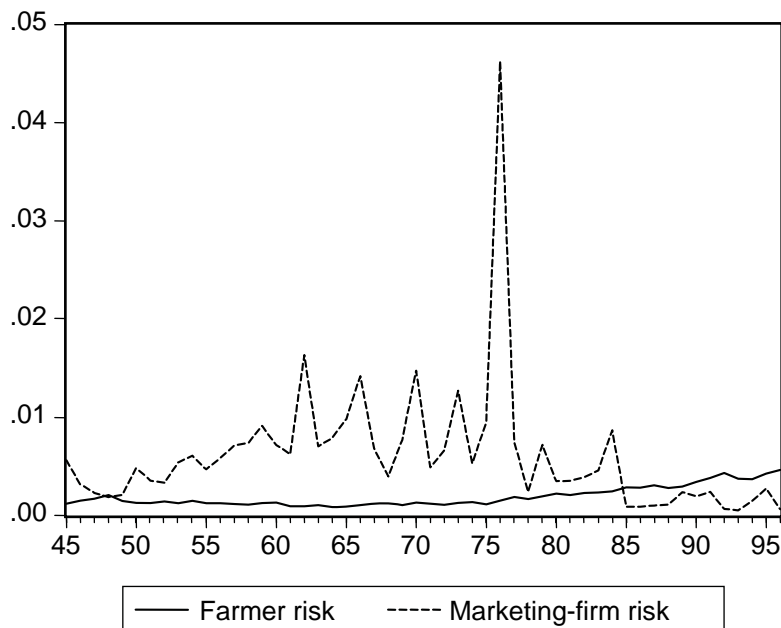
**PRICE RISKS IN THE DUTCH WARE-POTATO SUPPLY CHAIN**

This section presents the results of empirical research into price risk distribution. This section indicates that there is evidence of a ‘power shift’ in the Dutch ware-potato supply chain from farmers to wholesale and retail traders.

Marketing organizations and potato farmers engage in contracts with fixed and variable rewards. Marketing organizations and farmers have a principal-agent relation in which work effort and income risk are the main arguments. Marketing organizations are primarily interested in promoting farmer work effort at the lowest possible cost. Work effort may be enhanced by profit sharing, i.e. by a variable reward. Farmers are not only interested in maximizing expected income, but also in income insurance. Farmer income typically depends on a few products – often even one product – while marketing organizations are well able to diversify their product portfolio. Due to the associated difference in income risk as well as to a difference in attitude towards risk, marketing organizations tend to insure farmers against income variability. The fixed reward creates income certainty for the farmer.

Consequently, there is a trade-off between both arguments in the principal–agent relation: efficiency (variable reward) and insurance (fixed reward). Given further specifications, the optimum trade-off may be derived theoretically and the actual trade-off may be determined empirically.

Kuwornu et al. (2004) estimate the development of price and income risks for both farmers and marketing firms in the Dutch ware-potato supply chain. The price and income risks potato farmers bear have steadily increased in the period between 1946 and 1996, especially since 1975 (Figure 2). The price and income risks of marketing firms have diminished in the same period and have become minimal since 1985. Marketing firms have shifted price and income risks to farmers. This fact may be explained by a decrease in farmer risk aversion in the 1990s (Kuwornu et al. 2004). However, the results indicate that, while farmers still demand risk insurance whereas marketing firms do not, farmers actually insure marketing firms against price and income risks. The change in price risk distribution may be due to a shift in



**Figure 2.** Farmer and marketing-firm income risks in the Dutch ware-potato supply chain (billion €; source: Kuwornu et al. 2004)

bargaining power from farmers to retailers. The change in the supply–demand relations after the second world war and the rise in wholesale and retail concentration may have led to a shift in income risk at the expense of farmers. The change in price risk distribution may also be due to a change in supply-chain



efficiency requirements. Farmers may be given more price incentives in order to enhance supply-chain value added.

### CONCLUSION

This paper finds limited evidence for the abuse of market power in the European food processing and retail trade. There is no general pattern of price asymmetry in European agri-food supply chains. However, for ware potatoes there is evidence of a shift in income risk from marketing organizations to farmers. The paper also indicates that performance evaluation in agri-food supply chains deserves further attention. This holds notably for analysis into the return to investments of subsequent links in the supply chain and non-traditional financial transactions, such as slotting allowances. However, the biggest challenge that lies ahead is explaining what factors contribute to good performance and what factors do not. Measuring performance is one thing, explaining it is another.

### NOTES

<sup>1</sup> Peltzman's results are not summarised by Meyer and Von Cramon-Taubadel (2002)

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