Price volatility perceptions and management strategies in European food supply chains*

Tsion Taye Assefa¹, Miranda P.M. Meuwissen¹, Alfons G.J.M. Oude Lansink¹

¹Business Economics, Wageningen University

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ULYSSES project assess the literature on prices volatility of food, feed and non-food commodities. It attempt to determine the causes of markets' volatility, identifying the drivers and factors causing markets volatility. Projections for supply shocks, demand changes and climate change impacts on agricultural production are performed to assess the likelihood of more volatile markets. ULYSSES is concerned also about the impact of markets' volatility in the food supply chain in the EU and in developing countries, analysing traditional and new instruments to manage price risks. It also evaluates impacts on households in the EU and developing countries. Results will help the consortium draw policy-relevant conclusions that help the EU define market management strategies within the CAP after 2013 and inform EU’s standing in the international context. The project is led by Universidad Politécnica de Madrid.

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Authors of this report and contact details

Name: TsionTaye Assefa, Miranda P.M. Meuwissen, Alfons G.J.M. Oude Lansink Partner acronym: WU
Address: Hollandseweg 1, 6706 KN WAGENINGEN, The Netherlands
E-mail: tsion.assefa@wur.nl, miranda.meuwissen@wur.nl, alfons.oudelansink@wur.nl

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Abstract
We explored through forty-two in-depth interviews the price volatility perceptions and management strategies of farmers, wholesalers, processors and retailers in six EU food-supply chains (i.e. Bulgarian wheat, French wheat, German pork, Dutch cheese, Dutch tomatoes, and Spanish tomatoes supply chains). Results show that a more than 15% change in prices from their expected values is perceived as price volatility by a majority of the respondents. Except for farmers, adaptive strategies through flexibility in production and prices seem the way to go to manage price risk. Policy interventions are suggested for the farm stage where survival strategies through output and cost reduction were the main strategies adopted.

Key words: Price volatility perceptions, management strategies, European food supply chains, semi-structured interviews, exploratory.

Introduction
Prices in European agricultural markets have been increasingly volatile in the last decade (Tangermann, 2011). The decoupling of farm income supports through the successive reforms of the Common Agricultural Policy led to a more market oriented EU farm sector (Badarji, et al., 2011). In an increasingly globalized agricultural market, import and export restrictions in major producing countries, climate hazards, and animal health scares lead to supply shocks that translate into increased volatility in agricultural commodity prices (Badarji, et al., 2011). Price volatility leads to risk and uncertainty that has undesirable effects on farmers’ investment decisions (Tangermann, 2011), sourcing strategies of middlemen and of the food processing industry (Rabobank, 2011), and the consumption patterns of consumers (Hernandez, Ibarra, and Trupkin, 2013). Managing the risk from price volatility should therefore be a strategic priority of all actors in the food supply chain.

Even though the effects of price volatility extend beyond the farm sector, the effects on farmers have been the focus of academia. Previous research has extensively investigated farmers’ perceptions and management strategies of agriculture related risks (for instance, Martin, 1996; Bown et al, 1999; Meuwissen et al., 2001; Hall et al., 2003; Greinier et al., 2009; Bergfjord, 2009). These studies have generally included price risk as one variable among different variables measuring multitude sources of risks. An up-close investigation of how farmers perceive or understand price risk and the exploration of the set of management strategies they adopt in practise is therefore lacking. Even more lacking are studies that explore price risk perceptions and management strategies of the downstream sector of food supply chains (von Davier, 2010). In an era of increasingly volatile agricultural prices, exploring and sharing current practises in price volatility management provides a learning platform to both farmers and the food industry. Identification of gaps in price risk management strategies can further inform policy makers of where in the chain policy supports are most needed.

Policy objectives of reducing price volatility and its negative impacts could be best achieved if policy measures could target the ‘type’ of price volatility that poses the most risk to chain actors. The large number of price volatility modelling approaches that one observes in

1 The term price risk and price volatility will be used interchangeably from now onwards.
technical papers (Assefa et al., 2014) reflects the lack of agreement on a single definition for price volatility. In this respect, investigating price volatility perceptions of chain actors is worthwhile. Differences of chain actors in their perceptions of price volatility could further indicate whether there is need for different policy measures at different stages of the chain. Understanding actors’ perceptions of price volatility has also the added benefit of explaining their choices for risk management strategies.

The objective in this research is to explore, describe and compare the price volatility perceptions and management strategies of farmers, wholesalers, processors and retailers. Six EU food supply chains, namely the Bulgarian wheat, French wheat, German pork, Dutch cheese, Dutch tomatoes, and Spanish tomatoes supply chains were investigated. In-depth interviews were conducted at the different stages of these chains. A cross-country/cross-product approach is followed to represent various sectors and countries in the analyses. In the remainder of this paper, we briefly discuss previous studies related to price risk perceptions and management strategies, detail the methodological approaches used in this study, present the results, and conclude the study and make suggestions for further research.

**Previous research**

Previous research on risk perceptions and management strategies in the agricultural sector has mainly focused on the farm stage. Wilson and Armstrong (1987, p.545) defined risk perception as “the awareness of the factors in the social and economic environment that create risk and the degree to which one factor is more critical than the other”. This definition is shared by most of the studies that investigated farmers’ risk perceptions. The methodological approach these studies followed is that of listing a set of possible sources of agricultural risks and asking farmers to rate the importance of each source of risk using Likert scales (for instance, Patrick et al., 1985; Wilson and Armstrong, 1987; Martin, 1996; Knutson et al., 1998; Meuwissen et al., 2001; Hall et al., 2003; Ackaoz et al. 2005; Greinier et al., 2009; Bergfjord, 2009). A finding consistent across many of the studies is the high score that farmers assign to price risk (for instance, Patrick et al., 1985; Wilson and Armstrong, 1987; Knutson et al., 1998; Meuwissen et al., 2001; Bergfjord, 2009). The inconsistency in the terminologies the authors use to define price risk reflects, nevertheless, a lack of agreement of what price risk really is. Some of the terms used by the authors are “price changes” (Martin, 1996), “declining prices” (Greinier et al., 2009), “price volatility” (Morales et al., 2008). What farmers perceive as price risk therefore remains unclear.

The above cited studies adopt a similar approach to assess farmers’ risk management strategies. That is, farmers are presented a list of pre-specified risk management strategies and asked to rate the importance or the relevance of each strategy using Likert scales. A comparison of the scores assigned to the risk sources and those assigned to the risk management strategies are then compared. Surprisingly, many authors do not find a match between the score assigned to price risk and those assigned to the price risk management strategies considered (for instance, Martin, 1995; Meuwissen et al., 2001; Hall et al., 2003; Bergfjord, 2009). That is, while price risk ranks on the top of the list on risk sources, the importance or relevance scores assigned to the listed price risk management strategies are unexpectedly low. The main price risk management strategies these studies considered were
forward contracts, futures and options, and off and on farm diversification. This raises the question on whether these strategies are indeed the strategies farmers adopt to deal with price risk. The structured nature of the questionnaires used in these studies restricts the identification of the possible set of strategies that farmers use in practise.

The only two studies that attempted to investigate the price risk perceptions and management strategies of actors downstream to the farm stage are those of Heyder et al. (2010) and of von Davier (2010). Heyder et al. (2010), who surveyed German agribusiness firms, used actors’ expectations of price developments in the next five years as a measure of price volatility perceptions. Similar to farm level studies, a set of pre-defined price volatility management strategies were presented to the actors who had to evaluate the relevance of each strategy using Likert scales. The study by von Davier (2010) relied on a media content analysis to identify perceptions about causes and developments of price volatility and suggested management strategies. A limitation of both studies is that they failed to explore actual management strategies adopted by firms.

In summary, previous research provides limited evidence on actual price risk perceptions and management practises in the chain. The excessive reliance on structured questionnaires limits the opportunity to explore actual practises. The downstream sector of the chain has remained overlooked in previous research as the focus has been mainly on the farm sector. Though it is widely acknowledged that farmers face the highest risk from price volatility compared to the rest of the chain (Assefa et al., 2014), it can be argued that actors who use farm outputs as inputs in their production are also vulnerable to price volatility. In this research, the mentioned gaps in the literature are addressed by following an exploratory methodological approach and by including the downstream stages of the chain in the analyses.

**Methods**

*Exploration through in-depth interviews*

Exploration is used as a methodological approach “when a group, process, activity or situation has received little or no systematic empirical scrutiny or has been largely examined using prediction and control rather than flexibility and open-mindedness” (Stebbins, 2001, p.9). Previous research has given little attention to price volatility perceptions and management strategies of actors downstream to the farm sector. In addition, the structured nature of current farm level studies restricts the identification of the set of strategies farmers adopt in practise. An exploratory approach is therefore deemed appropriate to investigate chain actors’ price risk perceptions and management strategies.

Data was collected through in-depth interviews with semi-structured questions. Some structure was imposed on the questions to guide the interview process and keep the focus on the key topics that are the subjects of the investigation. The imposed structure also assured some consistency in the questions across the respondents. The questions, nevertheless, allowed some room for probing and in-depth inquiry. Probing was facilitated by including ‘non-standardized’ questions that can differ across respondents. Non-standardization in interviews is “most helpful when exploring new topics, sensitive […] issues, and when the businesses are highly variable in their characteristics” (Healey et al., 1993,
The newness of the topic of price risk perceptions and management strategies in downstream stages of food supply chains, the sensitive nature of disclosing business strategies, and the wide ranging types of companies included in this study justify the use of semi-structured interviews.

Participants
A total of 42 people were interviewed in this research. The respondents were farmers (n=15), wholesalers (n=15), processors (n=9) and retailers (n=3). Table 1 summarizes the characteristics of the participant farms and companies. The respondents were selected through a combination of purposive and snowball sampling methods. The respondent selection process per chain stage followed a series of steps that assured the representation of various EU countries, food products and types of farms and companies. This was important to avoid observations specific to a particular sector and country. In a first step, food chains corresponding to different classes of food products (i.e. meat, dairy, cereals and vegetables) were selected. This yielded the selection of the fresh tomatoes, fresh pork, bread-wheat and cheese supply chains.

The next step in the sample selection process was the choice of the countries for which the selected chains will be investigated. Five countries from different geographical corners of the EU were selected. These are The Netherlands, Germany, France, Spain and Bulgaria. Indicators such as the share of area used for tomatoes in total land for fresh vegetables, share of pig production in total livestock production, share of cheese production in raw milk collected, and share of wheat in total cereal production were used to rank the countries and determine the level of importance of each product in each country. Production, area of agricultural land and consumption data from 2006 to 2013 compiled from the Eurostat was used to calculate the indicators. The following 6 chains resulted from the rankings: Dutch cheese, Dutch tomatoes, German pork, French wheat, Bulgarian wheat and Spanish tomatoes supply chains.

The final step in the sample selection process consisted of choosing individual respondents. Experts from academics and industry were first contacted for brief interviews on the structure of each of the 6 supply chains. The aim was to have a grasp of the major types of farms (for instance, cooperative members/ and non-members) and companies (for instance, cooperatives and non-cooperatives) that characterized the respective chains. The experts additionally gave the names, email addresses and phone numbers of some of the interviewees. Contacts of additional interviewees were obtained through a snow-ball process. While farm owners are the respondents in the farm stage, general managers, sales managers, sourcing managers and financial directors were the respondents in the rest of the chain. Even though a minimum of 2 interviews were planned per country/chain/chain stage, it was not possible to reach any respondents in some of the country/chain/chain stages. In particular, obtaining the consents of German pig slaughterhouses/processors and those of retailers proved to be challenging. Price related strategies were confidential in these companies.
Table 1 – Frequency distribution of participant farms and companies

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<table>
<thead>
<tr>
<th>Farm (n=15)</th>
<th>Wholesale (n=15)</th>
<th>Processing (n=9)</th>
<th>Retail (n=3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BW</td>
<td>FW</td>
<td>GP</td>
<td>DC</td>
</tr>
<tr>
<td>n=2</td>
<td>n=2</td>
<td>n=2</td>
<td>n=3</td>
</tr>
</tbody>
</table>

**Member of a cooperative?**

Yes | 1 | 2 | 0 | 3 | 2 | 1

No  | 1 | 0 | 2 | 0 | 1 | 2

**Cooperative?**

Yes | 0 | 1 | 1 | 0 | 0 | 3 | 1 | 0 | 4 | 0 | 0

No  | 3 | 0 | 1 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | 2

1Note that BW: Bulgarian wheat chain, FW: French wheat chain, GP: German pork chain, DC: Dutch cheese chain, DT: Dutch tomatoes chain, ST: Spanish tomatoes chain. Farmers sell wheat in BW and FW, pigs in GP, milk in DC and tomatoes in DT and ST. Wholesalers sell wheat grain in BW and FW, pigs in GP, cheese in DC, and tomatoes in DT and ST. Processors sell wheat flour (n=2) and bread (n=1) in BW, wheat flour in FW, and cheese in DC. Retailers sell cheese in DC and tomatoes in ST.

2One of the wholesalers is a giant Dutch cooperative buying tomatoes from Spain. The suppliers in Spain are not a member of the Dutch cooperative.

3One of the retailers is a giant British supermarket buying tomatoes from Spain.
Table 1 – (Continued) Frequency distribution of participant farms and companies

<table>
<thead>
<tr>
<th></th>
<th>Farm (n=15)</th>
<th>Wholesale (n=15)</th>
<th>Processing (n=9)</th>
<th>Retail(n=3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BW FW GP DC DT ST</td>
<td>BW FW GP DC DT ST^2</td>
<td>BW FW DC</td>
<td>DC ST^3</td>
</tr>
<tr>
<td></td>
<td>n=2 n=2 n=2 n=3 n=3 n=3</td>
<td>n=3 n=1 n=2 n=3 n=2 n=4</td>
<td>n=3 n=1 n=5</td>
<td>n=1 n=2</td>
</tr>
<tr>
<td><strong>Number of employees</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;= 49</td>
<td>0 1 2 0 0 1</td>
<td>0 0 0 0 0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>50 - 249</td>
<td>0 0 0 2 2 0</td>
<td>2 0 3</td>
<td>0 0</td>
<td></td>
</tr>
<tr>
<td>&gt;= 250</td>
<td>3 0 0 1 0 3</td>
<td>1 1 2</td>
<td>1 1</td>
<td></td>
</tr>
<tr>
<td><strong>Involved in exports?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>3 0 0 3 2 3</td>
<td>0 1 4</td>
<td>0 0</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>2 2 2 3 3 3</td>
<td>0 1 2 0 0 1</td>
<td>3 0 1</td>
<td>1 2</td>
</tr>
</tbody>
</table>
Interview procedure
The interview questions focused on two key topics: price volatility perceptions and management strategies. Table 2 presents the structured and probing questions used to explore these two topics. The questions on price volatility perceptions were open and aimed at getting an understanding of what actors perceived as price volatility. Inquiry was made of actors’ past price volatility observations to obtain concrete examples of their perceptions.

The structured questions on price volatility management strategies inquired about both the strategies used in the past and those that would be used in the future. This gave an overall picture of the possible set of management strategies. In investigating future management strategies, we asked whether the respondents planned to change their sourcing or selling strategies in response to future price volatility. But since some of the respondents had no plans to make such changes, probing questions were added to explore how else actors would manage future price volatility instead of making changes in their sourcing and/or selling strategies.

Other sets of structured questions were used to explore the characteristics of the farms and companies, and their sourcing and selling strategies. The interviews were conducted from January till July 2014. The questions were sent one day in advance to the interviewees to allow them to prepare prior to the interviews. Each interview lasted from forty-five minutes to one hour and a half. The interviews were made in person with accompanying translators in some of the cases. The responses were audio-recorded and transcribed on the same day the interviews took place.
Table 2 – Key interview questions

<table>
<thead>
<tr>
<th>Topics</th>
<th>Structured questions</th>
<th>Sample probing questions</th>
</tr>
</thead>
</table>
| Price volatility perceptions | *Past price volatility observations:*  
   - Please describe the periods in which you experienced volatility in input/output prices\(^1\) in the past 5-7 years.  
   *Future price volatility:*  
   - Given current conditions, what is the input/output price change that you would consider to be a ‘non-volatile’ or a ‘stable’ price change? (give in % plus or minus an expected price) | *Past price volatility observations:*  
   - By how much did prices change?  
   - How fast did prices change?  
   - How long did the resulting price level last?  
   *Future price volatility:*  
   - Would you consider excess price changes as price volatility?  
   - If in the future, the input price increases by an amount higher than the specified %, how long should the resulting high price last to be problematic? |

\(^1\) *Considered inputs* are feed for dairy and pig farmers; wheat grain for wheat traders and processors; pigs for pig traders; cheese for cheese traders and retailer; tomatoes for tomato traders and retailers. *Considered outputs* are wheat grain for wheat farmers and traders; milk for dairy farmers; tomatoes for tomato farmers, wholesalers and retailers; cheese for cheese processors and wholesalers; flour and bread for wheat processors.
<table>
<thead>
<tr>
<th>Topics</th>
<th>Structured questions</th>
<th>Sample probing questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price volatility management strategies</td>
<td><em>Management strategies in response to past price volatility:</em></td>
<td><em>Management strategies in response to past price volatility:</em></td>
</tr>
<tr>
<td></td>
<td>➢ What did you do to manage the risk from the experienced level of input/output price volatility?</td>
<td>➢ Was the management strategy you followed a new strategy back then?</td>
</tr>
<tr>
<td></td>
<td><em>Management strategies in response to future price volatility:</em></td>
<td><em>Management strategies in response to future price volatility:</em></td>
</tr>
<tr>
<td></td>
<td>➢ How would you change/adjust your current input sourcing or output selling strategies if input/output prices are volatile in excess of the 'non-volatile' price change provided?</td>
<td>➢ How else would you manage the risk from future excess price volatility?</td>
</tr>
</tbody>
</table>
Analysis
A descriptive approach is followed to analyse volatility perceptions and management strategies of actors in the different stages of food supply chains (i.e. farm, wholesale, processing and retail). A comparative approach is additionally followed to gain insights on the differences and similarities in perceptions and strategies across chain stages. Within chain stages differences and similarities in perceptions and strategies are also highlighted when necessary. Both descriptive and comparative analyses are qualitative in nature. It should be noted that the findings ensuing from the descriptive and comparative analyses should be treated with caution given the relatively small number of respondents per chain stage. Future confirmatory studies could test the applicability of the findings to a wider sample. As shown below, both descriptive and comparative analyses of perceptions and management strategies were conducted per theme. The themes emerged from a process of coding and categorization of the interview transcripts.

Themes in price volatility perceptions
Two key dimensions of price volatility perceptions are described and compared across chain stages: The magnitude of price changes perceived as price volatility and the duration of price change making price volatility problematic. These two price change dimensions are defined below:

Magnitudes of price changes: Percentage price changes above or below expected price levels.

Durations of price changes: Period during which high input or low output price levels should persist for price volatility to be perceived as problematic.

Other features of price changes determining whether perceived price volatility is problematic are also discussed.

Themes in price volatility management strategies
To facilitate the descriptive and comparative analyses of the price volatility management strategies, emerging categories of strategies were identified through a coding process. This process led to the identification of four categories of strategies. These were survival strategies, adaptive strategies, control strategies and hedging strategies. A brief definition of each category is provided below.

Survival strategies: the focus is on minimizing losses from an adverse price movement.

Adaptive strategies: the focus is on flexibility, following the market, and securing a stable margin regardless of price movements.

Control strategies: the focus is on achieving price stability by taking control over prices.

Hedging strategies: the focus is on transferring price risk to another party.
Stebbins (2001) asserts that one way of assuring the validity of findings in exploratory studies is to check if enough cases have been investigated to constitute grounds for valid generalizations. Though it should be acknowledged that the number of cases observed here is not a representative one, the repetition of responses across actors within one chain stage provides grounds for validity in the findings. Another validity check recommended by Stebbins (2001, p.49) is to ‘concatenate research projects in the area of study’. This task is made difficult in the case of this study by the lack of studies conducted on the same area of research. The efforts at establishing full validity will therefore have to wait for similar studies to be conducted in the future. To establish reliability of findings, one needs to make sure that the same observations can be reached by other researchers with ‘similar methodological training, understanding of the field setting and rapport with its subjects’ (Stebbins, 2001, p. 49). In this research, attempt at establishing reliability was made through a continuous discussion of interview responses and emerging themes among the three researchers.

Results

Price volatility perceptions
The following subsections describe and compare actors’ perceptions of price volatility. Table 3 summarizes these perceptions.

Magnitude of price change
A more than 10-15% change in prices from their expected values is perceived as price volatility by a majority of the respondents. Actors in the Dutch and Spanish tomato chains are an exception to this as the majority perceives as price volatility a more than 25% price change. A similar perception is that of Dutch dairy farmers who argue that feed prices (maize in particular) are volatile if prices change by more than 20% from their expected values. Recurring large changes in the prices of fresh tomatoes and cattle feed justify the price volatility perceptions of the tomato and dairy farmers.

When defining the magnitude of price change perceived as price volatility, it is important to define what expected prices refer to. The interviews revealed that the minimum period for which actors form price expectations coincide with the frequency at which prices are set in the chain. For instance, because milk prices are set on a monthly basis in the Dutch cheese supply chain, dairy farmers form milk price expectations on a month to month basis or for longer time intervals. Since milk prices serve as a main reference to set cheese prices, Dutch cheese processors, wholesalers and retailers also form milk and cheese price expectations on a month to month basis or longer. In the tomato and pork chains, price expectations are made on a week to week basis or for longer time intervals. In the wheat supply chains, though high frequency trading can take place at the wholesale stage, weekly price expectations seem to be the norm.

A comparison of perceptions across chain stages shows some similarities and differences in the specified magnitudes of price changes perceived as price volatility. Similarities are noted
among farmers and wholesalers, and among processors and retailers. Though generalizations cannot be made at this point, processors and retailers seem to perceive lower magnitudes of price changes as price volatility. For instance, a more than 5% change in grain and flour prices is perceived as price volatility by Bulgarian and French wheat millers. A more than 5% change in milk and cheese prices is perceived as price volatility by Dutch cheese processors. The interviewed Dutch retailer indicated that a 3% change in cheese prices can be considered as ‘non-volatile’, with price changes exceeding this magnitude perceived as price volatility.

**Duration of price change**

Price volatility is in general understood by actors as being synonymous to short-term price changes in prices around an expected weekly or monthly price level. Such short-term price changes are not, however, perceived as problematic and needing strategic response by all interviewed actors. A finding common to most of the interviewed farmers is that a high input price or low output price level persisting for one year/production cycle (i.e. a year for wheat and dairy farmers, and one production cycle for pig and tomato farmers) or longer is perceived to be more problematic than weekly or monthly changes in prices. Even more problematic is when a persisting high output price level (or low input price level) changes to a persisting low output price level (or high input price level) between years/production cycles. When such reversals in price change directions occur, it becomes challenging for farmers to reverse major investments made during good price years. Though undesirable, higher frequency price changes (within the year/production cycle) are seen as less problematic because the farmers cannot easily respond to these changes anyway. Similar to farmers, retailers tend to be more concerned about the changes in yearly prices. Their argument is that higher frequency price changes can compensate each other during the year. This argument was also shared by some of the interviewed farmers.

Price changes occurring during the year were found to be more of a challenge to the wholesale and processing stages. This is particularly true for the wheat and cheese wholesalers and processors. Fixed-price sales contracts unmatched with a fixed-price purchase contracts (and vice versa) and storage are the main causes of this challenge. For instance, it is problematic when output prices drop and stay low during the period the input price is fixed at a high level through a contract (and vice versa for input prices). Sudden output price drops are also problematic for goods in stock. Cooperative German pig, Spanish tomatoes and Dutch tomato wholesalers are concerned about both weekly changes and persisting changes in pig and tomato prices received by their member farmers.

**Other features of price changes**

The reasons why prices change from their expected values also determine whether price volatility is perceived as problematic and needing strategic action. Price changes caused by sudden and major changes in local weather conditions and changes in global demand and supply conditions (caused for instance by conflicts in major producing countries and by border restrictions by major importing countries) are seen as worrying by actors in the cheese and wheat supply chains. Actors in the tomato supply chains mainly consider price changes caused by sudden and major changes in local weather conditions as problematic ones. In the pork supply chains, the most challenging price changes are those caused by
animal health related crises. Predictable seasonal price changes and price changes believed to have arisen from speculation are not considered as alarming by most of the actors.

Finally, the interviews revealed that actors are more concerned about downside price changes (increase in input price or decrease in output price) than price volatility in the sense of fluctuations (both upside and downside) in prices. Moreover, stability in margins was found to be more important than the stability in prices. All interviewed actors argue that a sudden and large decrease in an output price is not a concern if it is matched by a proportionate and immediate decrease in the input price (and vice versa). In practise, this rarely happens due, among others, to time lags in production, contracts (either on the buying or selling side), or price influences of retailers.
Table 3 – Price volatility perceptions

<table>
<thead>
<tr>
<th>Price change features</th>
<th>Farm</th>
<th>Wholesale</th>
<th>Processing</th>
<th>Retail</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Magnitude of price change</strong>¹</td>
<td>➢ 5% (pigs) – 20% (cattle feed, tomatoes)</td>
<td>➢ 10% (cheese, pigs, wheat) – 25% (tomatoes)</td>
<td>➢ 5% (wheat, milk, cheese)</td>
<td>➢ 3% (cheese) – 20% (tomatoes)</td>
</tr>
<tr>
<td><strong>Duration of price change</strong>²</td>
<td>➢ One year/production cycle (DC, DT, BW, GP, ST)</td>
<td>➢ Depending on stock position and position in forward contract (BW, DC, FW)</td>
<td>➢ Depending on stock position and position in forward contract (all chains)</td>
<td>➢ One year (all chains)</td>
</tr>
</tbody>
</table>

¹Price changes above the specified percentages are perceived as price volatility. We report a range of percentage price changes, and specify in parenthesis the products with the highest and lowest percentages. Note that DC: Dutch cheese chain, GP: German pork chain, ST: Spanish tomatoes chain, BW: Bulgarian wheat chain, and FW: French wheat chain.

²It is problematic if a high input or low output price level persists for the specified or longer period. Even more problematic is when a persisting high output price (low input price) changes to a persisting low output price (high input price) across the specified periods.

³It is problematic when output prices drop (input prices rise) and stay low (high) during the period input prices (output prices) are fixed through contracts at a high (low) level. It is problematic when output prices drop while there are goods in stock.
Price volatility management strategies
Results show that management strategies are implemented if price volatility is perceived to be problematic. Below, the major types of strategies adopted are described and compared across chain stage. Table 4 summarizes the management strategies per chain stage and per strategy category. For clarity, the frequency distribution across chain stage and strategy category is presented separately in Table 5.

Survival strategies
Survival strategies are loss minimizing strategies achieved, among others, through reductions of physical production, reduction of major investments, improvement in efficiency and diversification. These strategies, which are mainly long-term strategies, are mostly adopted by farmers. Since farmers cannot easily respond to short-term price changes, a majority of them concentrate their strategies on price changes that persist for one or more year/production cycle. Producers of storable products, as French wheat farmers in our sample attest, can be considered an exception to this as their ability to store wheat gives them the flexibility to decide when and how to sell. The interviewed Bulgarian wheat farmers, on the other hand, indicated their limited capacity to store wheat during the year. Survival strategies are also adopted among cooperative pig and tomato wholesalers. Because of the difficulty to keep pigs and tomatoes for a long time, the only strategy these wholesalers can adopt to minimize their member farmers’ losses in times of sudden price drops is to wait one more week before selling the pigs and tomatoes, respectively.

Adaptive strategies
Except for cooperative pig and tomato wholesalers, most of the interviewed wholesalers and processors adopt adaptive strategies which allow them to secure a stable margin regardless of market price movements. Setting buying and selling prices on the same day, linking output prices to input prices, and avoiding open long-term fixed price forward contracts are some of the major adaptive strategies adopted. The focus is on flexibility achieved through quick adaptation to market price movements. Not only is there an interest for flexible prices but also for flexible production. For instance, a Bulgarian wheat baker argues that switching from flour to bread production can be a solution in times of big drop in grain prices, and from bread to flour in case of big rises in grain prices. A specialty cheese processor argues that switching from processing milk to processing more volumes of specialty cheese can be a solution to manage the risk from milk price volatility. In case of a large drop in milk prices, it becomes profitable to process more specialty cheese than processing and selling milk because of the value that specialty cheese adds to the low priced milk.

Control strategies
The interest for control strategies through price-fixing contracts and vertical integration was not found as expected among most of the chain actors. This is particularly true for wholesalers and processors. Interest for contracts and vertical integration was found among farmers. Producing and trading premium products (for example, production of specialty cheese by cheese processors, production and trading of tomatoes with no pesticide residues and tomatoes of specialty varieties by tomato farmers, wholesalers and retailers) is another way of exercising control over prices. Many of the interviewed actors argue that prices of premium products are not as volatile and low as standard products. Such argument prevails
in particular among actors downstream from the farm stage. For retailers, transmitting sudden increases in input prices is easier when the product is a premium product. Improved marketing of produces through promotion and better services to fill customers' needs is yet another method to add value to the product and command higher and more stable prices.

**Hedging strategies**

Though hedging through futures and option contracts is a widely accepted price risk management strategy, its use was limited among the interviewed actors. Interest to use these instruments in the future was, nevertheless, expressed among German pig farmers, Bulgarian wheat traders, German pig traders, Dutch cheese traders and Dutch cheese processors. The absence of active futures markets for the respective products in the respective countries was mentioned as the main reason for the current non-use of these instruments. Except for one German pig farmer and one French wheat farmer who currently uses options, no mention of interest for hedging with futures and options was made by any of the interviewed farmers.
Table 4 – Price risk management strategies

<table>
<thead>
<tr>
<th>SC&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Farm</th>
<th>Wholesale</th>
<th>Processing</th>
<th>Retail</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Survive</strong></td>
<td>Substitute or cut output (DC, ST, BW)</td>
<td>Wait a bit and sell&lt;sup&gt;2&lt;/sup&gt; (ST)</td>
<td>Diversify production (DC)</td>
<td>Diversify suppliers (ST)</td>
</tr>
<tr>
<td></td>
<td>Substitute expensive ingredients (DC)</td>
<td>Cut production&lt;sup&gt;2&lt;/sup&gt; (ST)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increase production efficiency/cost leadership and productivity (DC, BW, DT)</td>
<td>Throw away excess production (ST, DT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Avoid major investments (DC)</td>
<td>Increase production efficiency&lt;sup&gt;2&lt;/sup&gt; (ST)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wait a bit and sell at whatever price (ST, GP, BW)</td>
<td>Diversify suppliers (ST) and buyers (DT)&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diversify production (BW, FW)</td>
<td>Sell quickly at whatever price&lt;sup&gt;2&lt;/sup&gt; (GP, DC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sell excess production through promotion by producer organization (DT)</td>
<td>Sell excess production through retail promotion (ST, DT&lt;sup&gt;2&lt;/sup&gt;)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


<sup>2</sup>Strategies used by cooperative traders whose main objectives are to minimize losses that member farmers face in times of sudden drop in prices.
<table>
<thead>
<tr>
<th>SC</th>
<th>Farm</th>
<th>Wholesale</th>
<th>Processing</th>
<th>Retail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adapt</td>
<td>Shorter contracts (FW)</td>
<td>Shorter contracts (DC)</td>
<td>Use milk pools to set output prices(^4) (DC)</td>
<td>Secure supply at whatever price (DC)</td>
</tr>
<tr>
<td></td>
<td>with small quantities per contract (FW)</td>
<td>Long-term contracts with flexible output prices (DC)</td>
<td>Shorter sales contracts (DC)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Closely follow market development and improve price predictions (ST, BW, DC)</td>
<td>Quick buying and selling in responses to price changes (DC)</td>
<td>Contracts with flexible output prices (flexible with input prices; output price bands) (DC)</td>
<td>Whatever price (DC)</td>
</tr>
<tr>
<td></td>
<td>Secure supply at whatever price (ST, BW)</td>
<td>Agree on buying and selling price on same day (FW, BW)</td>
<td>Switch production (DC, BW)</td>
<td>Transmit price changes (BW)</td>
</tr>
<tr>
<td></td>
<td>Agree on buying and selling price on same day (FW, BW)</td>
<td>Closely follow market development and improve price predictions (DT, BW, DC)</td>
<td>Adjust production volume (BW)</td>
<td></td>
</tr>
</tbody>
</table>

\(^4\)A cooperative producing only cheese can pay farmers a competitive milk price calculated based on a ‘weighted-average’ of final dairy prices of competitors.
Table 4– (Continued) Price risk management strategies

<table>
<thead>
<tr>
<th>SC</th>
<th>Farm</th>
<th>Wholesale</th>
<th>Processing</th>
<th>Retail</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Control</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Fixed price forward contract for inputs (DC, GP)</td>
<td>- Trade quality produce (ST, BW)</td>
<td>- Produce quality product (DC, BW)</td>
<td>- Secure quality product (DC, ST)</td>
</tr>
<tr>
<td></td>
<td>- Fixed price forward contract for outputs (FW, DT&lt;sup&gt;4&lt;/sup&gt;)</td>
<td>- Fixed price forward sales contract with 100% advance payment&lt;sup&gt;4&lt;/sup&gt; (BW)</td>
<td>- Do not overreact: fix input price at moderate level (DC)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Forward integration&lt;sup&gt;4&lt;/sup&gt; (DC)</td>
<td>- Fixed price forward contract for outputs (ST)</td>
<td></td>
<td>- Fixed price purchase contract (ST)</td>
</tr>
<tr>
<td></td>
<td>- Backward integration (DC)</td>
<td>- Pay farmers an average of 2 weeks’ prices (GP)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Improve output quality (BW, DT)</td>
<td>- Merger among wholesalers to gain more market power&lt;sup&gt;4&lt;/sup&gt; (DT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Closer relationship with retailers, with long-term fixed price</td>
<td>- Closer relationship with retailers for better marketing/promotion of</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>contracts&lt;sup&gt;4&lt;/sup&gt; (DT)</td>
<td>produces to better serve customers’ needs (DT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Better marketing/promotion of produces by producer organization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>to better serve customers’ needs (DT)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>4</sup>Are strategies not yet implemented, but planned for the future.
Table 4 – (Continued) Price risk management strategies

<table>
<thead>
<tr>
<th>SC</th>
<th>Farm</th>
<th>Wholesale</th>
<th>Processing</th>
<th>Retail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hedge</td>
<td>– Hedge in futures market (GP^4, FW)</td>
<td>– Hedge in futures market^4 (DC, GP, BW)</td>
<td>– Hedge in future market^4 (DC)</td>
<td>– None</td>
</tr>
<tr>
<td></td>
<td>– Use average seasonal price offered by cooperatives (FW)</td>
<td>– Use options (FW)</td>
<td>– Over-the-counter contracts for milk^4 (DC)</td>
<td></td>
</tr>
</tbody>
</table>

^4Are strategies not yet implemented, but planned for the future

Table 5 – Frequency distribution across strategy categories and chain stages

<table>
<thead>
<tr>
<th>Strategy^1</th>
<th>Farm (n=15)</th>
<th>Wholesale (n=15)</th>
<th>Processing (n=9)</th>
<th>Retail (n=3)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survival</td>
<td>13</td>
<td>7</td>
<td>2</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>Adaptive</td>
<td>2</td>
<td>10</td>
<td>9</td>
<td>3</td>
<td>24</td>
</tr>
<tr>
<td>Control</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>Hedging</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>7</td>
</tr>
</tbody>
</table>

^1Note that one actor can use a combination of strategies
Conclusions and implications

We explored through forty-two in-depth interviews the price volatility perceptions and management strategies of farmers, wholesalers, processors and retailers in six EU food-supply chains. These were the Bulgarian wheat, French wheat, German pork, Dutch cheese, Dutch tomatoes, and Spanish tomatoes supply chains. Results show that a more than 15% change in prices from their expected values is perceived as price volatility by a majority of the respondents. While high input or low output prices lasting for one more production year are perceived as most problematic by farmers and retailers, short-term price changes are also perceived as problematic by processors and wholesalers. Strategies price risk management were mostly survival strategies through output and cost reduction in response to adverse price movements. Wholesalers and processors focus on adaptive strategies that allow them to secure stable margins regardless of price movements. Though their strategies are adaptive in nature, retailers’ main focus is on securing a continuous supply of quality produce for their customers. Overall, the findings suggest that flexibility in production and price setting might be the way to go to manage the risk from price volatility.

An opportunity for policy intervention is identified at the farm stage where a gap in risk management seems to exist. Farmers have a limited opportunity to respond to short-term price change due to the inflexible nature of farm production. Though they can respond to prices persisting for one year/production cycle or longer, their responses are of limited value if the directions of price changes are suddenly reversed between years/production cycles. Income stabilization tools are useful policy tools in this respect. The single farm payment scheme currently in place is one such tool. Future policy support for whole-farm income insurance can be a future policy option. Further support of farmers to organize themselves in producer organizations and cooperatives is another policy option to allow farmers invest in the production of specialty products and create closer links with retailers by passing the wholesale stage. This can empower farmers vis-a-vis the downstream sector and help secure good and stable prices for their produces. The absence of active futures markets in the German pork, Dutch cheese and Bulgarian wheat sectors is another risk management gap that could be filled with policy intervention. Interest for these hedging instruments was expressed among wholesalers, farmers (German pig farmers) and processors (Dutch cheese processors) in these sectors. Finally, better prediction of short and long-term drivers of price volatility, and timely dissemination of price predictions can be useful to help chain actors better manage the risk from price volatility. While predictions of long-term trends in prices are particularly useful for farm investment decisions, predictions of short-term price changes can support the downstream sector’s decisions on whether and when to enter into contracts and on whether to raise stock levels.

Acknowledgements

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References


