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Monitoring of Prices and Margins in EU Food Supply Chains

Existing and Alternative Approaches

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Abstract

Unfair trading practices and other imperfections of food supply chains have been continuously discussed at EU and Member State level in recent years. Consequently, both the EU and many Member States have started operating price and margin monitoring systems in order to obtain a better insight into developments of prices, costs and profits along food supply chains. This study provides an inventory of the characteristics of food price and margin monitoring systems at EU and Member State level, in international organisations, the OECD and other countries. A typology of the existing monitoring approaches has been developed based on their quantitative in-detail evaluation. This is accompanied by a review of scientific literature empirically assessing asymmetric vertical price transmission along EU food supply chains. We have identified gaps in these existing methodologies and available datasets. Based on this comprehensive evaluation of the state of the art, three alternative food price and margin monitoring approaches have been proposed. The existing and alternative monitoring approaches have been ranked according to their cost efficiency. The practical use and value of two of these alternatives is illustrated by applying them to the supply chains of dairy, pig meat and apples in Bulgaria, France, Poland and the Netherlands.

Abrégé

Au cours des dernières années, les pratiques commerciales déloyales et autres imperfections des chaînes d'approvisionnement alimentaire n'ont cessé d'alimenter le débat au niveau tant de l'UE que des États membres. Tant l'UE que les États membres ont par conséquent mis en place des systèmes de surveillance afin d'obtenir une meilleure idée de l'évolution des prix, coûts et bénéfices tout au long des chaînes d'approvisionnement alimentaire. Cette étude fournit un inventaire des caractéristiques des systèmes de surveillance des prix et marges des denrées alimentaires mis en œuvre au niveau de l'UE, des États membres, d'organisations internationales, de l'OCDE et d'autres pays. Une classification typologique des approches de surveillance existantes a donc été établie sur la base d'une évaluation quantitative détaillée de ces approches. Un état des lieux de la littérature évaluant de manière empirique la transmission verticale asymétrique des prix au sein des chaînes d'approvisionnement alimentaire de l'UE a en outre été réalisé. Nous avons par ailleurs identifié des lacunes dans les méthodologies existantes et les ensembles de données disponibles avant de proposer trois approches alternatives pour la surveillance des prix et marges des denrées alimentaires en nous appuyant sur cette analyse approfondie de la situation actuelle. Nous avons ensuite classé les approches existantes et alternatives selon leur rentabilité, et avons mis en lumière l'apport et les implications pratiques de deux de ces approches alternatives en les appliquant aux chaînes d'approvisionnement de produits laitiers, de viande de porc et de pommes en Bulgarie, en France, en Pologne et aux Pays-Bas

Glossary

TERM/SYNONYM	DEFINITION	SOURCE
CAP	Common Agricultural Policy	
Consumer Euro Share	See Food Euro Share	
CPI	Consumer price index: 'The consumer price index, abbreviated as CPI, measures the change over time in the prices of consumer goods and services acquired, used or paid for by households. It is an important measure of inflation [...].'	Eurostat (2017e)
Cross-section data	Data of various subjects of interest observed at the same point of time or irrespective of their temporal occurrence, e.g., the average national prices of all grains and all meats produced in one MS observed in one given month	Authors of this study
EU15	States which were already EU members by 30 April 2004: Belgium (BE), Denmark (DK), France (FR), Germany (DE), Greece (EL), Ireland (IE), Italy (IT), Luxembourg (LU), Netherlands (NL), Portugal (PT), Spain (ES), United Kingdom (UK), Austria (AT), Finland (FI) and Sweden (SE)	Eurostat (2016e)
EU13	All states which accessed the EU after 30 April 2004: Cyprus (CY), Czech Republic (CZ), Estonia (EE), Hungary (HU), Latvia (LV), Lithuania (LT), Malta (MT), Poland (PL), Slovakia (SK), Slovenia (SI), Bulgaria (BG), Romania (RO) and Croatia (HR)	Eurostat (2016e)
EU25	EU15 and all MS which accessed the EU on 1 May 2004: Cyprus (CY), Czech Republic (CZ), Estonia (EE), Hungary (HU), Latvia (LV), Lithuania (LT), Malta (MT), Poland (PL), Slovakia (SK) and Slovenia (SI)	Eurostat (2016e)
EU27	The EU25 and all MS which accessed the EU on 1 January 2007: Bulgaria (BG) and Romania (RO)	Eurostat (2016e)
EU28	All states which are member since 1 July 2013: EU15 and EU13, that is, EU27 plus Croatia (HR)	Eurostat (2016e)
Food Euro Share	Indication of share the consumer price that is paid to a certain stage in the food supply chain e.g. primary producers, processers, retailers. The farm share would be calculated as the farm-gate price times the amount of agricultural raw material in one euro worth of final product.	Authors of this study
FPMM	Food price and margin monitoring	Authors of this study

TERM/SYNONYM	DEFINITION	SOURCE
FPMMA	Food price and margin monitoring approach Definition: A FPMMA is a single FPMM output publication produced by an FPMM initiative analysing a certain set of raw data by using a certain (set of) method(s). See Table 59 for examples.	Authors of this study
FPMMI	Food price and margin monitoring information	Authors of this study
FPMM entity	A country or an international institution that engages in FPMM. One FPMM entity may run more than one FPMM initiatives. See Table 59 for examples.	Authors of this study
FPMM initiative	A specific institution or website/information offer in the internet provided by a country or an FPMM institution for the purpose of sharing FPMMI with the public. One country or institution may run more than one FPMM initiative. National statistical authorities are not considered to be a FPMM initiative in the scope of that analysis as each of them collects to some extent FPMMI for the purpose of the calculation of the national Consumer Price Index (CPI). One FPMM initiative may implement more than one FPMM approach. See Table 59 for examples.	Authors of this study
FPMT	European Food Price Monitoring Tool	Eurostat (2017a)
FTE	Full Time Equivalent: a unit that indicates the workload of an employed person in a way that makes workloads or class loads comparable across various contexts.	Eurostat (2017f)
Marketing margin	The difference between the retail price p_{out}^{retail} and the farm gate price p_{out}^{farm} as defined in Figure 35.	Authors of this study
Margin (gross, net profit)	A margin may refer to e.g. the difference between selling prices and costs, or selling prices and buying prices. For our purpose the term margin is used as a profit margin, i.e. the difference between selling price and costs, unless otherwise specified. The profit margin may or may not include indirect costs. The gross profit margin is sales minus costs of goods sold (as a percent of sales revenue). When operating expenses are deducted, operating profit remains. The net profit margin is what remains when other non-operating expenses and incomes, as well as financial expenses and taxes are taken into account.	Authors of this study
MS	Member State(s) of the EU	Eurostat (2017b)

TERM/SYNONYM	DEFINITION	SOURCE
Panel data	Cross-section data repeatedly measured for identical subjects of interest at various subsequent time points which are typically equally spaced, e.g., the average national price of wheat in in all MS observed for each week of 2018	Authors of this study
Price spread	Difference between the buying and selling price of a product at a certain stage in the supply chain. Or price margin. This spread does not take into account that products may be transformed during processing or distribution. The calculation of the price spreads is explained in Annex I.1 Figure 35.	Authors of this study
Time series data	Data of one subject of interest repeatedly observed at various subsequent time points which are typically equally spaced, e.g., the average national price of wheat in one MS observed on each day of 2017	Authors of this study

Monitoring of Prices and Margins in EU Food Supply Chains: Existing and Alternative Approaches

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Executive Summary

Food price volatility and differences in profits of companies operating in food supply chains in the EU have been attracting the attention of national governments and the EU Commission. Monitoring and managing structural developments in EU food supply chains requires reliable information about price developments, the share of the consumer price each actor receives and the distribution of costs and profits.

Objective of the study and methods
This study has two objectives. The first objective is to propose and empirically test a set of methodologies to monitor price and margin developments along EU food supply chains. The second objective is to identify data and methodological gaps that allow policymakers and other relevant stakeholders to understand the improvements needed for better identification of the determinants affecting food price and margin formation. The following activities are executed to reach these objectives:

1) Inventory of existing approaches to price and margin monitoring;
2) Set-up of a method typology based on the analysis of methodological limitations, methodological robustness and data needs;
3) Development, methodological characterisation and testing of robustness of three alternative approaches to price and margin monitoring based on 1) and 2);
4) Analysis and ranking of existing and alternative methods according to their cost efficiency;
5) Application of each of the three alternative approaches to three EU food supply chains (dairy, pig meat and apples) in four Member States (Bulgaria, France, the Netherlands and Poland) in order to illustrate their practical use and value;
6) Identification of data and methodological gaps in the current literature on asymmetric and incomplete price transmission based on a literature review.

Inventory of existing approaches to price and margin monitoring
Sixty-five approaches to food price and margin monitoring of different countries and institutions are studied regarding their comprehensiveness and clarity of the presentation. A quantitative overview of 34 characteristics is made to analyse the approaches. A food price and margin monitoring approach is defined in this study as a single food price and margin monitoring (FPMM) output produced by an FPMM initiative analysing a certain set of raw data by using a certain (set of) method(s). For the selection two criteria are used: the approach should be public and should publish food

price and margin monitoring information. This selection reduced the number of approaches from 119 to 65.

Existing FPMM initiatives exhibit enormous heterogeneity of the structure, comprehensiveness and extent to which the price and margin data are gathered and monitored. They are similarly heterogeneous regarding the outcomes of monitoring analyses and the form and organisation of the finally published data. They are based on widely divergent raw data-gathering structures and procedures and on efforts and costs spent on the monitoring. Existing initiatives focus on different products and supply chain levels. Some countries opt for a regional focus. These choices seems arbitrary because there is barely any background material publicly available outlining the underlying rationale and direction of the initiative. Many of the existing initiatives are not explicit about which prices are exactly monitored and the terminology also shows wide variation. Existing approaches mainly focus on both ends of the food supply chain: selling prices received by the producers of the raw products and consumer purchasing prices. Selling prices, purchasing prices or even more demanding economic quantities such as costs or profits of food supply chain actors located in between these two ends are barely part of existing monitoring initiatives.

Narratives or other interpretations accompanying the numbers and meaningful and easily understandable indicators are often lacking in the presentation of the results of the FPMM initiatives. Thus, communication of the monitoring results needs improvement for enabling good understanding of the monitoring results by non-specialist users. Coordination between the many initiatives existing in parallel is weak. For example, the EU has several competing initiatives, and almost no website refers to another initiative.

At the international scale, but even at the level of EU Member States, a comparable general structure and approach to FPMM is missing. Similarly, a common vision of FPMM and harmonised guidelines for the data collection as well as the presentation and communication of results are absent.

Based on 37 characteristics, 17 FPMM approaches are selected for a qualitative in-depth analysis. Based on 8 typology criteria (see Table S.1) these 17 FPMM approaches are classified into three classes of FPMM approaches. Table S.1 lists the main typology criteria.

Table S.1: Typology of FPMM approaches

Typology class	Typical characteristic	Class 1	Class 2	Class 3	Class 4
Typical characteristics of the class	Graphical results and exportable data				X
	>2 supply chain levels monitored			X	X
	Using panel data			X	X
	Raw data available			X	X
	Price margins and/or costs and profits monitored			X	X
	Indicators based on more than single price series	X	X	X	X
	Illustrative graphical and commented results			X	X
	Time lag < 6 months		X		X

Source: Authors of this study.

Six of the 17 analysed FPMM approaches belong to class 1, 5 belong to class 2 and 6 belong to class 3. An 'X' indicates which of the typical characteristics are shown by each class. For the approaches belonging to typology Class 3, 6 out of 8

characteristics are typical. For approaches belonging to Class 2, only two characteristics are typical and for Class 1 only one. Table S.2 lists the most frequent advantages and disadvantage of each class.

Table S.2: Main advantages and disadvantages of the monitoring approach typology classes

Typology class	**Most frequent advantage**	**Most frequent disadvantage**
Class 1	Clarity of presentation of results and ease of understanding	Limited monitoring coverage or high level of aggregation in time, space and supply chain detail
Class 2	Clarity of presentation of results and ease of understanding	Low level of transparency and reproducibility
Class 3	Comprehensiveness, detail and insightfulness of price and margin monitoring	Limited monitoring coverage and completeness in terms of commodity range as well as temporal coverage

Source: Authors of this study.

Alternative FPMM

Based on the inventory of existing FPMM approaches and the typology, the following three alternative approaches are suggested:

Alternative Approach 1: Monthly price indices at three stages of the supply chain. Results are presented in interactive graphs with a narrative explaining the most important developments in price indices. This approach resembles the existing EU Food Price and Margin Monitoring Tool with the main difference that narratives are added to the results and that indicators and data sources are explained.

Alternative Approach 2: Monthly price indices, absolute prices and price spreads and food euro shares at three stages of the food supply chain. Results are presented in interactive graphs. For the developments in price spreads, a list of quantitative indicators for the most important determinants of the deviation from an optimal price transmission are distinguished. This approach resembles Approach 1 with the difference that in addition to price indices also absolute prices, price spreads and information to calculate Food Euro Shares are gathered, analysed and published.

Alternative Approach 3: Ideal type. Table S.3 lists per criterion the characteristics of the ideal FPMM approach. In a near-ideal world, all market participants have perfect knowledge about prices, costs and other product attributes, and market players' preferences; the future is forecast, but generally unknown, (e.g., weather or pests and diseases cannot be predicted).

Table S.3: Overview of the characteristics of the ideal FPMM per typology criterion

Category	Criterion	Most elaborate existing FPMM	Ideal FPMM approach
Institutional context	Output format	Providing the monitoring results in a pdf format OR interactive graphs AND exportable data files thereby combining information with interpretations of results or accessible information in a graphical form with data availability for interested users.	In any form necessary, including explanatory information
Monitoring focus	Supply chain levels monitored	Monitoring at least three supply chain levels: farm, processing, and retail. Monitoring prices across all of them.	All relevant stages of the supply chain, and all products and product aggregations
Data inputs	Quantitative data inputs	Using panel data for the analysis which is the ideal combination for being able to assess temporal changes as well as cross-section structures.	All relevant information about supply and demand in a quantified manner
	Transparency of (raw) data	Making the raw data publicly available to the user	All raw data available
Monitoring results	Quantitative results	Publishing price margins or costs and profits along the supply chain additionally to prices, price indices or simple indicators	All prices and margins
	Indicators	Calculating and publishing indicators based on more than a single price series (multivariate price indicators) or based on quantities other than prices.	All relevant indicators, explanations of developments
	Formats of graphical & commented results	Providing comprehensive, detailed, qualitative and illustrative graphical and commented results on the supply chain structure	Providing comprehensive, detailed, qualitative and illustrative graphical and commented results on the supply chain structure
Results communi-cation	Time lag	Having a very short time lag of less than half a year between data gathering and the publication of monitoring results.	None

Source: Authors of this study.

Therefore some temporary market distortions are still possible. For policy purposes, almost full availability of information about prices, margins and factors that determine them, would be ideal. Price volatility will be solved by information transparency about supply, demand and stocks. Market power issues will be solved, because nobody is able to strategically influence market outcomes. When price volatility and market power issues are solved, farmers' incomes will be more stable and will potentially increase if market power is exerted in the initial situation. Even the most elaborate existing FPMM approaches are not ideal under certain criteria (see Table S.3).

Data needs and sources per alternative approach

For Alternative Approach 1 only some additional data are needed compared to the present Food Price Monitor of Eurostat. For Alternative Approach 2 absolute prices at three stages of the supply chain (producers, processors and retail) are needed. These data are not publicly available for all Member States (MS) and some additional data gathering will be needed especially at the level of processors. In addition to information on prices, information about production and import and export is needed to get insight into the context of the food supply chain. This information is available. This does not hold for all proposed indicators for explaining developments in Food Euro Shares, such as market concentration ratios per product, and contractual arrangements.

Cost efficiency per alternative approach
The costs for Alternative Approach 1 have been estimated at €1.2m per year: €0.3m at EU level and €0.9m costs for the MS. For Alternative Approach 2 the total costs are €2.5m; €0.5m additional costs at EU level and €2m additional costs for MS. This cost estimate is done for 28 MS and the EU for 3 products and the assumption that there are no additional costs for data gathering. This is a rough estimate based on scarce data of existing approaches. No estimates were made for Alternative Approach 3.

Robustness per alternative approach
The robustness of Alternative Approach 1 is higher than existing FPMM approaches. The effort of gathering additional information is largely limited to the expert knowledge about the background of price developments per commodity and MS. The validity scores moderately because the basis of the price indices varies among MS. All other criteria such as applicability to other sectors, products and countries, reliability, and flexibility score high.

Application of Alternative Approach 1 and 2 to three products and four countries
Both proposed approaches have been applied to the commodities dairy, pig meat and apples in Bulgaria, France, the Netherlands and Poland. The third approach, the ideal FPMM, has not been analysed and applied. This approach is only used to place the other approaches in perspective.

Alternative Approach 1 can easily be applied to other commodities and countries. Compared to the present EU Food Price and Margin Monitoring Tool, two changes are proposed: a description of basic data used and a quarterly narrative produced by the country and product experts explaining the development in price indices at three levels of the food supply chain (producers, processors and retail). These narratives need to be analysed at EU level.

Alternative Approach 2 is far more difficult to implement than Alternative Approach 1 because public data (e.g., prices at processor level; indicators to explain developments of prices spreads and food euro shares) are lacking and additional expertise is needed to explain price indices, absolute prices, price spreads and food euro shares.

Practical implications
For Alternative Approach 1 the practical implications are that narratives per supply chain need to be written and published with a short time lag from the moment of data gathering. This requests good planning. For Alternative Approach 2 additional implications are that harmonisation of price definitions is needed to make the results comparable among Member States. Also the additional proposed indicators for explaining developments in Food Euro Shares need to be defined, sometimes gathered and calculated. The advantages and disadvantages of both alternative approaches are described in Table S.4.

Table S.4: Advantages and disadvantages of Alternative Approach 1 and 2

	Advantages	Disadvantages
Alternative Approach 1	• Timely information and regular update • Consistent across all EU MS • Wide range of commodities covered • Clear messages • Independent report	• Quality of raw data • Data for processor prices are not harmonised • Limited product comparability for categories like fruits, vegetables and meat
Alternative Approach 2	• Timely information and regular update • Consistent across all EU MS • Insight in differences among MS • Increased readability • Increased reliability of price monitor	• Need for additional data gathering at processing and packaging stage • Still data differences in the type of raw data among MS • No conclusion about prices and price spreads among MS

Source: Authors of this study.

State of the art of the literature on asymmetric and incomplete price transmission
Seventy-one studies that analyse vertical price transmission along food supply chains and published in ISI-ranked economic journals were reviewed. Five major classes of econometric methods used can be distinguished to analyse vertical price transmission in food supply chains: Autoregressive Distributed Lag models, Partial Adjustment models, Error Correction models, regime switching models and Vector Auto-regressive models. These studies discuss various determinants of vertical price transmission such as market power, adjustment costs, inventory management, farm price support policies, differences in retail demand shocks and farm level supply shocks, asymmetric price information and biased price reporting. These determinants are derived from theoretical models but usually not explicitly tested in the empirical analyses.

These econometric methods have the advantage that they can quantify a wide range of aspects of price transmission, are well developed and described and are available in standard econometric software packages, and various model classes allow for a comparison of results based on competing specifications. Their largest disadvantages are that most methods do not allow for explicit testing of factors affecting price transmission, most methods assume and estimate a constant adjustment parameter in time and quite some effort by researchers is needed to clearly communicate practical implications of results to non-specialists outside academia such as policymakers.

The largest advantages of the econometric models are that price time series are easy to obtain and allow quantifying various aspects of price transmission such as transmission speed and magnitude. The largest disadvantage is that most empirical studies are only based on price data. Those price series are often only available at aggregated temporal or geographical levels. Moreover, the details of the processing of the price data so that it fits the requirements of the methods applied to it are often not mentioned explicitly, e.g., how outliers or missing values are dealt with.

The major methodological gaps of the existing toolkit are that determinants of symmetric or asymmetric price transmission are hardly quantified or explicitly tested for, interactions between factors responsible for price asymmetries are virtually never discussed and little attention is given to quantifying welfare losses or gains of certain stakeholders. There is often a strong focus on one food chain. Comparitive analyses of various food chains are barely made. Moreover, retail scanner data are not widely used, effects and intermediate supply chain stages remain mostly a black box and

little advancement is made in understanding the theoretical effects of (interactions of) determinants of vertical price transmission.

The major data gaps in the vertical price transmission literature are a lack of data measuring determinants of price asymmetries, data on inputs and costs on intermediate stages of the supply chain and availability of data at various frequencies to check the robustness of estimation results. For comparative meta-studies, measurements on relevant explanatory structural factors are often lacking. The availability of scanner data raises issues like the level of analysis (product, brand), store or chain level or time frame (week or monthly).

Main conclusions of this report

- There are currently a large number of price monitoring approaches. They are heterogeneous in their structure and setup.
- Outputs and costs of these approaches differ substantially. They differ, e.g., regarding the extent and structure of data gathered, methods used for the analysis, intelligibility and frequency of results communication, time lag between data gathering and publication, number of products, product groups or regions covered and various other characteristics.
- Currently existing monitoring approaches cluster into three classes, each having different typical characteristics, advantages and disadvantages. These classes differ in the level of complexity of their price and margin monitoring as well as in their costs.
- Price margins or costs and profits of stakeholders along food supply chains are currently barely being monitored.
- Improvement of current monitoring across the EU is most needed with respect to the quality and clarity of the communication of monitoring results. A harmonisation of the current monitoring approaches across EU and its MS is very desirable.
- Two alternative monitoring approaches are proposed:
    - The first is an adaptation of the Food Price Monitoring Tool presented by Eurostat. The main improvements are narratives based on expert knowledge per food supply chain and MS to explain the developments of price indices. Also metadata about the raw data of the prices indices supports the analysis of the developments.
    - The second step can be to publish also absolute prices at three stages in the supply chain and to calculate and analyse price spreads and food euro shares. In this approach also narratives are proposed with additional indicators to monitor possible market failures. The monitor of costs per stage of the supply chain is not part of this step.
- The implementation of both alternative approaches have practical implications for MS and the EU. In the first step, the narratives need to be organised and the time lag involved in publishing the results needs to decrease to a few months. In the second step, additional data gathering, especially on processor level, is needed.
- The expected costs per year for the proposed alternative approaches are roughly €1.2m for Alternative Approach 1 and €2.5m for Alternative Approach 2. These are the costs for 28 MS and the EU for three products under the assumption that no additional costs for data gathering are needed. Cost estimates for alternative approaches are difficult because of a lack of information about costs of data gathering and limited information about the costs of existing FPMM approaches.
- Analyses of vertical price transmission await expansion into comparative studies ideally and explicitly measuring the effects of structural determinants by the use of statistical models. This requires additional data gathering of structural determinants of vertical price transmission.

Résumé

La volatilité des prix des denrées alimentaires et les différences de bénéfices entre les différentes sociétés impliquées dans les chaînes d'approvisionnement de l'UE ont attiré l'attention des gouvernements nationaux et de la Commission européenne. La surveillance et la gestion des évolutions structurelles des chaînes d'approvisionnement alimentaire de l'UE requièrent des informations fiables au sujet de l'évolution des prix, de la part du prix de vente au consommateur que reçoit chaque acteur, et de la répartition des coûts et bénéfices.

Objectifs de l'étude et méthodes
La présente étude a deux objectifs. Le premier est de proposer et de tester de manière empirique un ensemble de méthodologies utilisées pour surveiller l'évolution des prix et des marges au fil des chaînes d'approvisionnement alimentaire de l'UE. Le second est d'identifier les lacunes des méthodologies et données actuellement disponibles afin de permettre aux décideurs politiques et autres parties prenantes concernées de comprendre les améliorations nécessaires afin de mieux identifier les facteurs déterminants qui influent sur la formation des prix et marges des denrées alimentaires. Les activités suivantes ont été menées dans le but d'atteindre ces objectifs :

1) Inventaire des approches existantes pour la surveillance des prix et marges ;
2) Classification typologique des méthodes sur la base d'une analyse de leurs limitations, de leur solidité et des données qu'elles requièrent ;
3) Développement, caractérisation méthodologique et test de la solidité de trois approches alternatives pour la surveillance des prix et marges au vu des résultats des actions 1) et 2) ;
4) Analyse et classement des méthodes existantes et alternatives en fonction de leur rentabilité ;
5) Application de chacune des trois méthodes alternatives à trois chaînes d'approvisionnement de l'UE (produits laitiers, viande de porc et pommes) dans quatre États membres (Bulgarie, France, Pays-Bas et Pologne) afin de mettre en lumière leur apport et leurs implications pratique ;
6) Identification des lacunes des méthodologies et données actuellement disponibles dans la littérature sur la transmission asymétrique et incomplète des prix basée sur une analyse de la littérature existante.

Inventaire des approches existantes pour la surveillance des prix et marges
L'exhaustivité et la clarté de la présentation de 65 approches pour la surveillance des prix et marges des denrées alimentaires appliquées par divers pays et institutions sont étudiées. L'analyse de ces approches repose sur l''étude quantitative de 34 caractéristiques. Dans le cadre de la présente étude, une approche pour la surveillance des prix et marges des denrées alimentaires est définie comme l'unique résultat d'une initiative de surveillance des prix et marges des denrées alimentaires (SPMDA) consistant à analyser un certain ensemble de données brutes en employant une certaine méthode ou un certain ensemble de méthodes. Les approches sont sélectionnées en fonction de deux critères : l'approche doit être publique et des informations relatives à la surveillance des prix et marges des denrées alimentaires doivent être publiées. Cette sélection a permis de réduire le nombre d'approches de 119 à 65.

Les initiatives de SPMDA existantes font montre d'une grande hétérogénéité en termes de structure, d'exhaustivité et de mesure dans laquelle les données relatives aux prix et aux marges sont collectées et contrôlées. Elles sont en outre tout aussi hétérogènes en termes de résultats d'analyses et de forme et d'organisation des données publiées à la fin du processus. Elles reposent sur des structures et procédures de collecte des données brutes extrêmement différentes. Les efforts et les coûts associés à la surveillance divergent. Les initiatives se concentrer sur différents produits et niveaux de la chaîne d'approvisionnement. Certains pays choisissent même de se concentrer sur des régions particulières. Ce choix semble arbitraire car il n'existe presque aucune documentation de référence publique présentant l'orientation et la logique sous-jacente de l'initiative. Bon nombre des initiatives existantes ne précisent pas explicitement quels sont exactement les prix concernés par la surveillance, et leur terminologie varie grandement. Les approches existantes se penchent principalement sur les deux extrémités de la chaîne d'approvisionnement : les prix de vente appliqués par les producteurs des produits bruts, et le prix d'achat payé par les consommateurs. Les prix de vente, prix d'achat et autres quantifiables économiques plus complexes tels que les coûts ou bénéfices des acteurs de la chaîne d'approvisionnement alimentaire qui opèrent entre ces deux extrémités sont presque négligés par les initiatives de surveillance existantes.

Les présentations des résultats des initiatives de SPMDA manquent généralement d'explications et autres interprétations pour accompagner les chiffres. La communication autour des résultats des surveillances doit donc être améliorée pour permettre une bonne compréhension de ces résultats par des utilisateurs non spécialisés. La coordination entre les nombreuses initiatives qui coexistent est faible. Plusieurs initiatives de l'UE sont par exemple concurrentes, et il n'existe pratiquement aucun site Web renvoyant à une autre initiative.

À l'échelle internationale, mais également au niveau des États membres de l'UE, une approche et une structure générales et cohérentes de la SPMDA font défaut. Par ailleurs, il n'existe ni vision commune de la SPMDA ni directive harmonisée pour la collecte de données et la présentation et la communication des résultats.

Tableau S.1 : Typologie des approches de SPMDA

Catégorie typologique	**Caractéristique typique**	**Catégorie**			
		1	**2**	**3**	**4**
Caractéristique typique de la catégorie	Résultats sous forme de graphiques et données exportables				X
	Surveillance de > 2 niveaux de la chaîne d'approvisionnement			X	X
	Utilisation de données de panel			X	X
	Disponibilité des données brutes			X	X
	Surveillance des marges sur les prix et/ou des coûts et profits			X	X
	Indicateurs basés sur plus qu'une unique série de prix	X	X	X	X
	Résultats commentés et présentés sous forme de graphiques			X	X
	Délai < 6 mois		X		X

Source : Auteurs de la présente étude.

Au vu de 37 caractéristiques, 17 approches de SPMDA sont sélectionnées pour une analyse qualitative approfondie. Ces 17 approches de SPMDA sont ensuite classifiées en trois catégories d'approches de SPMDA en fonction de 8 critères typographiques (voir Tableau S.1). Le tableau S.1 présente les principaux critères typographiques.

Six des 17 approches de SPMDA relèvent de la catégorie 1, 5 de la catégorie 2 et 6 de la catégorie 3. Les « X » indiquent les caractéristiques typiques présentes dans chaque classe. Ainsi, seules six des huit caractéristiques prises en compte sont des caractéristiques typiques de la catégorie typologique 3, tandis que seules deux caractéristiques sont typiques de la catégorie 2, et une seule de la catégorie 1. Le tableau S.2 présente les avantages et inconvénients les plus fréquents de chaque classe.

Tableau S.2 : Principaux avantages et inconvénients des catégories typologiques d'approches de surveillance

Catégorie typologique	**Avantage le plus fréquent**	**Inconvénient le plus fréquent**
Catégorie 1	Clarté de la présentation des résultats et facilité de compréhension	Couverture limitée de la surveillance ou agrégation importante des détails concernant les aspects temporels et spatiaux ainsi que la chaîne d'approvisionnement
Catégorie 2	Clarté de la présentation des résultats et facilité de compréhension	Transparence et reproductibilité limitées
Catégorie 3	Exhaustivité, détail et pertinence de la surveillance des prix et marges	Complétude et couverture limitées de la surveillance en termes de produits et d'aspect temporel

Source : Auteurs de la présente étude.

Approches alternatives pour la SPMDA

Au vu de l'inventaire des approches existantes pour la SPMDA ainsi qu'au vu de la classification typographique, les trois approches alternatives suivantes sont suggérées :

Approche alternative 1 : Indices de prix mensuels en trois points de la chaîne d'approvisionnement. Résultats présentés sous forme de graphiques interactifs accompagnés d'une explication des principales évolutions des indices de prix. Cette approche ressemble à l'Instrument de surveillance des prix et marges des denrées alimentaires de l'UE existant, à la grande différence que des explications sont ajoutées aux résultats et que les indicateurs et sources des données font l'objet d'une explication.

Approche alternative 2 : Prix mensuels, indices de prix et écarts de prix en trois points de la chaîne d'approvisionnement alimentaire et le partage de l'euro alimentaire. Résultats présentés sous forme de graphiques interactifs. Pour l'évolution des écarts de prix, une liste d'indicateurs quantitatifs portant sur les principaux facteurs empêchant une transmission optimale des prix est compilée. Cette approche ressemble à l'Approche 1, à la différence qu'outre les indices de prix, les prix absolus et les partages de l'euro alimentaire et informations nécessaires au calcul les partages de l'euro alimentaire sont également rassemblés, analysés et publiés.

Approche alternative 3 : Approche idéale. Le Tableau S.3 présente, pour chaque critère, les caractéristiques de l'approche idéale pour la SPMDA. Dans un monde idéal (ou presque), tous les acteurs du marché auraient une parfaite connaissance des prix, coûts et autres attributs de chaque produit ainsi que des préférences de toutes les parties prenantes sur le marché ; le futur fait l'objet de prévisions, mais reste malgré tout incertain (il est par exemple impossible de prédire la météo ou l'incidence des nuisibles et des maladies). C'est pourquoi des distorsions du marché restent possibles. Dans le cadre de l'élaboration de politiques, l'idéal serait de disposer de toutes les informations concernant les prix, les marges et les facteurs qui permettent de les définir. La volatilité serait contrée par la transparence des informations relatives à

l'offre, à la demande et aux stocks. Le déséquilibre des pouvoirs au sein du marché serait résorbé car personne ne pourrait exercer une influence stratégique sur les résultats du marché. Une fois les problèmes de volatilité des prix et de déséquilibre des pouvoirs résolus, les revenus des exploitants agricoles se stabiliseraient et pourraient même augmenter s'ils exerçaient leur pouvoir de marché dans la situation initiale. Même les approches existantes les plus élaborées pour la SPMDA ne sont pas idéales selon certains critères (voir Tableau S.3).

Tableau S.3 : Aperçu des caractéristiques de l'approche de SPMDA idéale par critère typologique

Catégorie	Critère	SPMDA existante la plus élaborée	Approche idéale pour la SPMDA
Contexte institutionnel	Format des résultats	Résultats fournis au format PDF OU sous forme de graphiques interactifs ET de fichiers de données exportables, combinant ainsi des informations avec des interprétations des résultats ou des informations accessibles sous forme de graphiques avec des données disponibles pour les utilisateurs intéressés.	Sous n'importe quelle forme requise, informations explicatives comprises
Principal point d'attention de la surveillance	Niveaux de la chaîne d'approvisionnement surveillés	Surveillance d'au moins trois niveaux de la chaîne d'approvisionnement : exploitation agricole, traitement et vente au détail. Surveillance des prix à tous les niveaux.	Chaque étape importante de la chaîne d'approvisionnement, et chaque produit et groupe de produits
Données utilisées	Données quantitatives utilisées	Utilisation de données de panel pour l'analyse, ce qui constitue la meilleure combinaison pour l'évaluation des changements dans le temps et l'analyse des structures transversales.	Toute information pertinente relative à la quantification de l'offre et la demande
	Transparence des données (brutes)	Données brutes publiques disponibles pour l'utilisateur	Disponibilité de toutes les données brutes
Résultats de la surveillance	Résultats quantitatifs	Publication des marges sur les prix ou des coûts et profits au sein de la chaîne d'approvisionnement en plus des prix, indices de prix ou simples indicateurs	Tous les prix et toutes les marges
	Indicateurs	Calcul et publication des indicateurs en fonction de plus d'une unique série de prix (indicateurs de prix multivariés)	Tous les indicateurs, évolutions et explications pertinents
	Formats des graphiques et résultats commentés	Fourniture de résultats compréhensibles, détaillés et de qualité concernant la structure de la chaîne d'approvisionnement accompagnés de commentaires et présentés sous forme de graphiques	Fourniture de résultats compréhensibles, détaillés et de qualité concernant la structure de la chaîne d'approvisionnement accompagnés de commentaires et présentés sous forme de graphiques
Communication des résultats	Délai	Très court délai (mois d'une demi-année) entre la collecte des données et la publication des résultats de la surveillance.	Aucun délai

Source : Auteurs de la présente étude.

Données nécessaires et sources pour chaque approche

L'Approche alternative 1 ne requiert beaucoup donnée supplémentaire par rapport à l'actuel Instrument de surveillance des prix des denrées alimentaires d'Eurostat. L'approche alternative 2 requiert quant à elle les prix absolus en trois points de la chaîne d'approvisionnement (production, traitement et vente au détail). Ces données

ne sont pas publiques dans tous les États membres (ÉM), et des données supplémentaires devront être collectées, surtout au niveau du traitement. Outre les informations concernant les prix, des informations relatives à la production et à l'import et l'export sont nécessaires à une meilleure compréhension du contexte de la chaîne d'approvisionnement alimentaire. Ces informations sont disponibles, ce qui n'est pas le cas pour tous les indicateurs requis pour expliquer l'évolution des partages de l'euro alimentaire, tels que le taux de concentration du marché pour chaque produit, ou encore les arrangements contractuels.

Rentabilité de chaque approche
Les coûts de l'Approche alternative 1 ont été estimés à 1,2 million d'euros par an : 0,3 million au niveau de l'UE et 0,9 million au niveau des ÉM. Le coût total de l'Approche alternative 2 est de 2,5 millions d'euros : 0,5 million de coûts supplémentaires au niveau de l'UE, et 2 millions de coûts supplémentaires au niveau des ÉM. Cette estimation des coûts est effectuée pour 28 ÉM et l'UE sur la base de 3 produits et en partant du principe que la collecte des données nécessaires n'entraînera aucun frais supplémentaire. Il s'agit d'une estimation approximative reposant sur le peu de données relatives aux approches existantes disponibles. Aucune estimation n'a été réalisée pour l'Approche alternative 3.

Solidité de chaque approche alternative
L'Approche alternative 1 est plus solide que les approches de SPMDA existantes. L'effort lié à la collecte d'informations supplémentaires est limité en grande partie à la connaissance approfondie du contexte de l'évolution des prix par produit et par ÉM. La validité de cette approche reste toutefois modérée car les indices de prix sont basés sur différents facteurs à travers les divers ÉM. Elle remplit cependant à merveille tous les autres critères, tels que l'applicabilité à d'autres secteurs, produits et pays, la fiabilité et la flexibilité.

Application des Approches alternatives 1 et 2 à trois produits et quatre pays
Ces deux approches proposées ont été appliquées aux produits laitiers, à la viande de porc et aux pommes en Bulgarie, en France, aux Pays-Bas et en Pologne. La troisième approche, la SPMDA idéale, n'a encore été ni analysée ni appliquée. Cette approche n'est utilisée qu'afin de mettre les autres approches en perspective.

L'Approche alternative 1 est facile à appliquer aux autres produits et pays. Deux changements sont proposés par rapport à l'actuel Instrument de surveillance des prix et marges des denrées alimentaires de l'UE : une description des données de base utilisées, et une explication rédigée trimestriellement par les experts du pays et du produit portant sur l'évolution des indices de prix à trois niveaux de la chaîne d'approvisionnement alimentaire (production, traitement et vente au détail). Ces explications doivent être analysées au niveau de l'UE.

L'Approche alternative 2 est beaucoup plus difficile à mettre en œuvre que l'Approche alternative 1 en raison d'un manque de données publiques (p. ex. prix au niveau du traitement et indicateurs expliquant l'évolution des écarts de prix et le partage de l'euro alimentaire) et de la nécessité d'expertises complémentaires afin d'expliquer les indices de prix, les prix absolus et le partage de l'euro alimentaire.

Implications pratiques
Dans la pratique, l'Approche alternative 1 implique la nécessité de rédiger et de publier les explications relatives à chaque chaîne d'approvisionnement peu après la collecte de données pour que le délai reste court. Cette procédure requiert une bonne organisation. L'Approche alternative 2 implique quant à elle la nécessité d'harmoniser la définition des prix pour que les résultats obtenus dans les différents États membres

soient comparables. Les indicateurs proposés pour expliquer l'évolution des partages de l'euro alimentaire doivent en outre être définis, ce qui peut impliquer la collecte de données complémentaires ainsi que des opérations de calcul.

Le Tableau S.4 décrit les avantages et les inconvénients des deux approches.

Tableau S.4 : Avantages et inconvénients des Approches alternatives 1 et 2

	Avantages	**Inconvénients**
Approche alternative 1	• Informations en temps opportun et mises à jour régulières • Cohérence à travers tous les ÉM de l'UE • Large éventail de produits couverts • Messages clairs • Rapport indépendant	• Qualité des données brutes • Données relatives aux prix au niveau du traitement non harmonisées • Comparabilité limitée des produits pour des catégories telles que les fruits, les légumes et la viande
Approche alternative 2	• Informations en temps opportun et mises à jour régulières • Cohérence à travers tous les ÉM de l'UE • Compréhension des différences entre les ÉM • Lisibilité accrue • Fiabilité accrue de l'instrument de surveillance des prix	• Collecte de données supplémentaires nécessaire au niveau du traitement et de l'emballage • Différences persistantes en termes de types de données brutes entre les ÉM • Aucune conclusion concernant les prix et écarts de prix au sein des ÉM

Source : Auteurs de la présente étude.

État de la littérature actuelle en matière de transmission symétrique et asymétrique des prix

Soixante et onze études analysant la transmission verticale des prix le long des chaînes d'approvisionnement alimentaire et publiées dans des revues économiques figurant au classement de l'ISI ont été examinées. Cinq grandes classes de méthodes économétriques utilisées pour analyser la transmission verticale des prix au sein des chaînes d'approvisionnement alimentaire se sont ainsi distinguées : les modèles autorégressifs à retards échelonnés, les modèles à ajustement partiel, les modèles à correction d'erreur, les modèles à changement de régime et les modèles vectoriels autorégressifs. Ces études abordent plusieurs facteurs influant sur la transmission verticale des prix tels que le pouvoir de marché, les frais d'ajustement, la gestion des inventaires, les politiques de soutien des prix agricoles, les différences en matière de chocs de demande au niveau de la vente au détail et de chocs d'offre au niveau de la production, les informations asymétriques en matière de prix et la communication tendancieuse des prix. Ces facteurs sont tirés de modèles théoriques mais ne sont généralement pas explicitement testés dans le cadre des analyses empiriques.

Ces méthodes économétriques ont l'avantage de pouvoir quantifier un large éventail d'aspects de la transmission des prix. Elles sont bien développées et bien décrites, et sont disponibles dans des suites logicielles standard destinées à l'économétrie. De nombreuses catégories de modèles permettent en outre de comparer les résultats en fonction de spécifications concurrentes. Leurs principaux inconvénients sont que la plupart des méthodes ne permettent pas de tester explicitement les facteurs influant sur la transmission des prix, et que la plupart des méthodes présupposent et estiment en outre un ajustement constant dans le temps, ce qui entraîne le déploiement d'efforts considérables pour communiquer clairement les implications pratiques concrètes des résultats des estimations à un public non spécialisé et non académique – décideurs politiques compris.

Le principal avantage de ces modèles économétriques est que les séries chronologiques de prix sont faciles à obtenir, ce qui permet de quantifier divers aspects de la transmission des prix tels que la vitesse et l'amplitude de la transmission. Le plus gros inconvénient est toutefois que la plupart des études empiriques ne se basent que sur des données relatives aux prix. Dans ces séries de prix, les aspects temporels et géographiques sont bien souvent agrégés. De plus, le traitement subi par les données relatives aux prix afin qu'elles puissent être traitées à l'aide des méthodes qui leur sont appliquées (p. ex. la manière dont sont traités les cas particuliers et les valeurs manquantes) n'est généralement pas expliqué en détail.

Les principales lacunes méthodologiques des instruments existants sont que les facteurs qui déterminent si la transmission des prix est symétrique ou asymétrique ne sont pour ainsi dire ni quantifiés, ni explicitement testés, que les interactions entre les facteurs responsables des asymétries ne sont presque jamais abordées, et que la quantification des pertes ou gains de certaines parties prenantes en termes de bien-être est généralement négligée. Bien souvent, les analyses ne s'intéressent qu'à une seule chaîne d'approvisionnement. Il n'existe presque aucune analyse comparative entre différentes chaînes d'approvisionnement alimentaire. De plus, les données sur les ventes au détail recueillies par le biais des scanners ne sont pas utilisées de manière suffisamment large, les effets et les étapes intermédiaires des chaînes d'approvisionnement restent un terrain inexploré, et les avancées vers une compréhension des effets théoriques des (interactions entre les) facteurs influant sur la transmission verticale des prix restent limitées.

En termes de données, les principales lacunes de la littérature concernant la transmission verticale des prix relèvent d'un manque de données mesurant les facteurs influant sur les asymétries des prix et de données relatives aux intrants et coûts au niveau des étapes intermédiaires de la chaîne d'approvisionnement, ainsi que d'un manque d'accessibilité des données à diverses fréquences afin de déterminer la solidité des résultats des estimations. Bien souvent, il n'existe aucune mesure des facteurs structurels explicatifs pertinents permettant d'effectuer des méta-analyses comparatives. La disponibilité des données recueillies par le biais des scanners soulève diverses questions concernant le niveau d'analyse (produit, marque), l'aspect géographique (boutique ou ensemble de la chaîne) et l'aspect temporel (semaine ou mois).

Principales conclusions du présent rapport

- Il existe actuellement un grand nombre d'approches pour la surveillance des prix. Ces approches présentent des structures et configurations hétérogènes.
- Les résultats et les coûts de ces approches diffèrent considérablement. Ces approches diffèrent notamment en termes de portée et de structure des données collectées, de méthodes utilisées pour l'analyse, d'intelligibilité et de fréquence de la communication des résultats, de délai entre la collecte et la publication des données, de nombre de produits concernés, de groupes de produits et de régions pris en compte, et se distinguent les unes des autres par bien d'autres caractéristiques encore.
- Les approches existantes pour la surveillance des prix se regroupent en trois catégories, dont chacune présente des caractéristiques typiques, ainsi que des avantages et des inconvénients propres. Ces catégories se distinguent en outre par le niveau de complexité de la surveillance des prix et marges, ainsi que par leur coût.
- Les marges sur les prix et les coûts et bénéfices des diverses parties prenantes des chaînes d'approvisionnement alimentaire ne sont à l'heure actuelle presque pas surveillés.
- Une amélioration des mécanismes de surveillance actuellement appliqués au

sein de l'UE est le plus nécessaire en ce qui concerne la qualité et la clarté de la communication des résultats de cette surveillance. Une harmonisation des approches de surveillance mises en œuvre au sein de l'UE et de ses ÉM est en outre extrêmement souhaitable.

- Deux approches de surveillance alternatives sont proposées :
    - La première est une adaptation de l'Instrument de surveillance des prix des denrées alimentaires proposé par Eurostat. Les principales améliorations sont des explications basées sur une connaissance approfondie de chaque chaîne d'approvisionnement et ÉM présentant l'évolution des indices de prix. Des métadonnées concernant les données brutes en lien avec les indices de prix contribuent également à l'analyse de l'évolution.
    - Dans un second temps (seconde approche), les prix absolus en trois points de la chaîne d'approvisionnement sont publiés, et les écarts de prix et le partage de l'euro alimentaire sont calculés et analysés. Dans cette approche, les explications sont en outre assorties d'indicateurs supplémentaires permettant de surveiller les éventuelles défaillances du marché. Le suivi des coûts par point de la chaîne d'approvisionnement ne fait pas partie de cette étape.
- La mise en œuvre de ces deux approches alternatives entraîne des implications pratiques pour les ÉM et l'UE. Dans la première étape, la rédaction des explications doit être organisée et le délai de publication des résultats doit être ramené à quelques mois. Dans la seconde étape, des données supplémentaires – principalement au niveau du traitement – doivent être collectées.
- Le coût annuel envisagé des approches alternatives proposées est d'environ 1,2 million d'euros pour l'Approche alternative 1 et de 2,5 millions d'euros pour l'Approche alternative 2. Il s'agit là des coûts pour 28 ÉM et l'UE pour trois produits en partant du principe que la collecte des données nécessaires n'entraînera aucun frais supplémentaire. Estimer le coût d'une approche alternative reste un exercice difficile en raison du manque d'informations relatives au coût de la collecte de données et au coût des approches de SPMDA existantes.
- L'analyse de la transmission verticale des prix devra attendre les résultats d'études comparatives mesurant explicitement et de manière idéale les effets des facteurs déterminants à l'aide de modèles statistiques, ce qui requiert la collecte de données supplémentaires concernant les facteurs structurels influant sur cette transmission verticale des prix.

Monitoring of Prices and Margins in EU Food Supply Chains: Existing and Alternative Approaches

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1 Introduction

1.1 Research background and policy context

The past decade has witnessed a heated discussion about the levels and volatility of food prices. In the period 2007-2008, the international community was concerned about high levels of global food prices (e.g., The Economist, 2007). Expensive food threatened the food security and survival of the poor in many developing countries while EU dairy farmers were rejoicing over farm-gate milk prices (Ihle et al., 2017). Large net food producing countries such as Russia or Ukraine blocked exports in order to prevent national food price increases which further destabilised global food markets. Links between food security and food price speculation became a topic of immense public interest of international institutions and NGOs (Meijerink, 2015; Oxfam, 2011, 2012a, 2017).

At the same time, the loosening of the EU dairy market policy since the CAP Health Check in 2008 led to less public support for EU dairy farmers who increasingly faced price uncertainty which substantially challenged their livelihoods. The EU public experienced several waves of farmers protests in Brussels and Member States' capitals (New York Times, 2009; Reuters, 2017).

At the same time, EU farmers have been concerned about processors and retailers taking advantage of the price movements at their expense: pushing prices downwards (e.g., Sueddeutsche, 2014a; Copa-Cogeca, 2016a) and threatening their economic survival (The Economist, 2015; Euronews, 2017). EU consumers have been concerned about processing and retailing companies raising prices based on collusions and their growing market power (Independent, 2017; Sueddeutsche, 2014b). This has been mirrored in leading media of EU Member States which have become very concerned about the effects of concentration and market power among the food processing industry and retail chains in EU food supply chains (Sueddeutsche, 2014a; El Pais, 2015; Deutsche Welle, 2017). The EU food processing and distribution sectors became concerned about low profit margins and the challenges of unstable raw product prices (Reuters, 2014; EuroCommerce, 2016). Competition from low price discounters and emerging price wars among large retailers further put pressure on margins in food retailing across Europe.

Due to such intensive discussion about and attention to the formation of food prices at global as well as EU level, various societal stakeholders expressed substantial demands for action of policymakers to curb or avoid adverse effects of food price volatility. Policymakers in the EU and beyond have become concerned about processors and retailers taking advantage of price movements at the expense of both ends of EU food supply chains: primary producers and consumers.

The challenges and concerns discussed in societal and political discourses in the EU during the past decade have been acknowledged by the media and policymakers by keywords such as market power, concentration of the food processing and retails sectors, market transparency, competitiveness of the European food industry (European Commission, 2017b), anticompetitive practices (European Commission, 2010), and the international competitive position of the EU food and drink industry (ECSIP, 2016; FoodDrinkEurope, 2016a,b; Wijnands and Verhoog, 2016). Furthermore, unfair trading practices in EU food supply chains have received considerable public interest since a couple of years (UTPs; European Commission, 2014a; European Parliament, 2015; Wiewiórowska, 2015; Wiewiórowska–Domagalska, 2015; European Parliament, 2016a; Agricultural Markets Task Force, 2016; European Commission, 2017c). In summer 2016, the European Parliament adopted a resolution on Unfair Trade Practices (European Parliament, 2016b). In April 2018, a proposal for a new directive of the European Parliament and of the Council 'on unfair trading practices in business-to-business relationships in the food supply chain' (COM(2018) 173), was published, which proposes to prohibit a short list of specific unfair trading practices.

During recent years, concerns of societal stakeholders and policymakers have thus centred around the following issues:

- How can adverse effects of decreasing and volatile prices of farmer's output prices be cushioned or avoided?
- How to improve price transparency along the food supply chain?
- Which supply chain actors capture which share of consumers' food prices?
- Which supply chain actors have most influence on consumers' food prices?
- What are the effects of growing concentration along the supply chain?
- How to improve price transparency along the food supply chain?
- Which actors exercise market power and are, thus, able to make 'unfair' profits?
- To what extent are unfair trade practices a problem in EU food supply chains?

Consequently, various EU institutions have been acknowledging the importance of attaining sufficient scientific insight into and understanding of food price formation in various position papers (e.g., European Commission, 2014c) as well as expert and stakeholder consultations and a number of other activities in recent years (for an overview, see European Commission, 2017b,d). In response, the Commission announced that it aims at policies ensuring a 'smooth functioning of the food supply chain', wants to stimulate 'dialogue and exchange of good practices among EU countries and stakeholders along the chain', wants to prevent Unfair Trade Practices along EU food supply chains, aims at improving market transparency via setting up a monitoring of food prices in the EU, and will support and carry out research on 'the competitive position of the food and drink industry and other issues, relevant to the sector' (European Commission, 2017b).

Key actions were the establishment of the High Level Forum for a Better Functioning Food Supply Chain (European Commission, 2014b, 2017e,f) and the Agricultural Markets Task Force (European Commission, 2017g). On the side of the EU food

industry, the Supply Chain Initiative was established in 2013 (SCI, 2017). A number of consultations and workshops about key topics have been held in recent years. Examples are meetings on Unfair Trading Practices (European Parliament, 2015; European Commission, 2017c, Fałkowski et al., 2017), and about the establishment of the #Food€ (European Commission, 2017h). The Food Price Monitoring Tool for the EU has been established by Eurostat (2017). Furthermore, the European Commission established market observatories and market dashboards for selected supply chains (European Commission, 2017i,j).

Related initiatives are the establishment of income stabilisation tools by the European Parliament (2016b), and the Food Chain Analysis Network (FCAN) of the OECD (2015, 2017), or the Food Price Monitoring Tool of the FAO (2017). OECD's Food Chain Analysis Network has hosted several high-level expert meetings since its establishment. The 5th meeting (OECD, 2013) agreed to 'provide an overview of key elements determining the creation and the distribution of value along the modern food chain, including price formation and their relationship to classic competition issues. It focused on topics identified at the inaugural FCAN meeting in December 2010: promoting food chain efficiency and transparency and ensuring that agents capture their fair share of value.' The 7th meeting (OECD, 2015b) included a roundtable discussion of the FCAN under the theme 'Encouraging Price Transparency along the Food Chain.'

Since this societal discussion process was initiated, stakeholders have contributed their positions (Copa-Cogeca, 2016a, 2016b; EuroCommerce, 2016; FoodDrinkEurope, 2016). Several large-scale research projects and publications at EU level (Arete, 2012; European Commission, 2014c; Fałkowski and Ciaian, 2016; Ihle et al., 2017) and beyond (OECD, 2015) have already generated substantial knowledge. The Framework Programme 7 and Horizon 2020 have financed several large-scale research projects such as the Transparency of Food Pricing project (Transfop) (2010) and the project about Understanding and coping with food markets voLatilitY towards more Stable World and EU food SystEmS (Ulysses) (2012) which focus on price transmission and price volatility in EU food supply chains. Other projects have investigated specific aspects of market functioning in relation to food supply chain competitiveness (Compete, 2012) and price transmission in conventional and short food chains (Strength2Food, 2016).

1.2 Objectives of the study

Effective monitoring and management of structural developments in EU food supply chains require reliable information on how much of the consumer price of a product each actor is getting. It is equally important to know how profit margins are distributed and what determines the speed and extent of a price pass-through in the supply chain. Both aspects are key to ensuring a transparent and sound empirically-informed societal discussion which may ultimately lead to evidence-based policy choices.

The ultimate objective of this study is two-fold. The first objective is to propose and empirically test a set of methodologies to monitor price and margin developments along the EU food supply chain. The second objective is to go beyond the available studies on price transmission and identify data and methodological gaps that allow policy makers and other relevant stakeholders to understand the improvements needed for a better identification of the determinants affecting price transmission.

The proposal of the new methodologies in the first objective builds on the existing efforts in some Member States (e.g., Spain, France), the initiatives at EU level (e.g., the observatories and dashboards for milk, meat, and cereals markets and agricultural prices recently established by the European Commission (European Commission, 2017i,j) or the Food Price Monitoring Tool of Eurostat (2017), as well as practices applied in and lessons learned from other countries (e.g., United States, OECD). This knowledge on the currently implemented practice of price and margin monitoring is accompanied by a comprehensive review of the state of the art of the determinants of price transmission and the resulting data and methodological gaps.

Hence, the key specific objectives of the study are:

1) Establishment of an inventory of existing approaches to price and margin monitoring;
2) Set-up of a method typology based on the analysis of methodological limitations, methodological robustness and data needs;
3) Development, methodological characterisation as well as robustness testing of three alternative approaches to price and margin monitoring based on 1) and 2);
4) Comparative analysis and ranking of existing and alternative methods according to their cost-efficiency;
5) Application of each of the three alternative approaches to three EU food supply chains in order to illustrate their practical usage and usefulness;
6) Identification of data and methodological gaps in the current literature of asymmetric and incomplete price transmission based on a literature review.

1.3 Structure of the report

The report is structured as follows. In Chapter 2 the current methodologies for price and margin monitoring are described. The description includes a typology, the data needs and data gaps and a ranking based on cost-efficiency. Chapter 3 gives a literature overview of the price transmission assessments in food supply chains. For the different methodologies a description is given of the advantages and disadvantages of the methodologies, the methodological gaps and data gaps. In Chapter 4 three alternative approaches for price and margin monitoring along the food supply chains are described by their data needs and sources, their advantages and disadvantages (including robustness analysis) and their cost-effectiveness. In Chapter 5 alternative approaches described in Chapter 4 are applied to the dairy, pig meat and apple supply chains in Bulgaria, France, the Netherlands and Poland. In Chapter 6 the main conclusions regarding robustness, cost-efficiency and practical implication of existing and alternative approaches are described.

2 Current methodologies for food price and margin monitoring

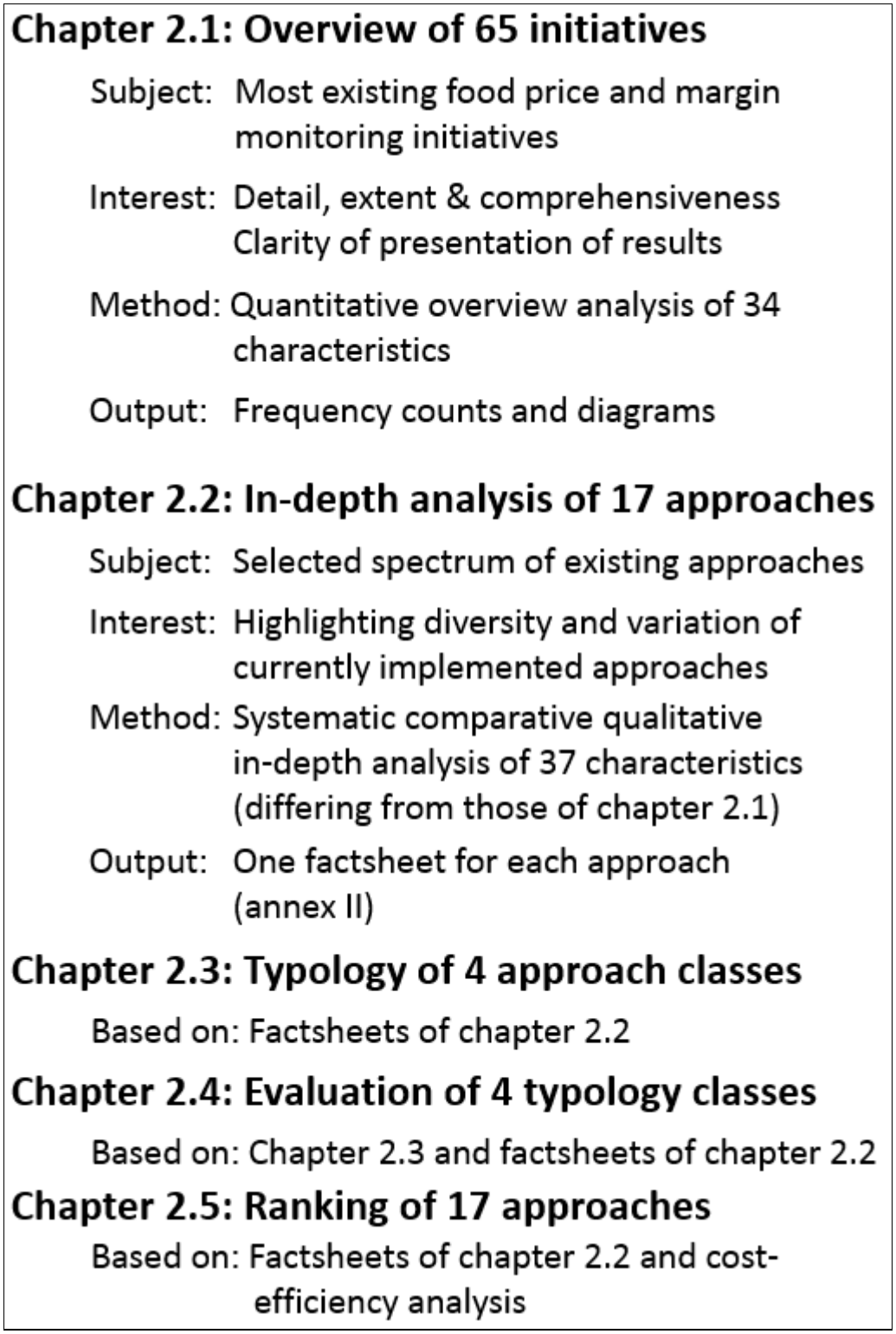
This chapter gives an overview and comprehensively evaluates the wide spectrum of existing methodologies for price and margin monitoring in order to highlight the plurality of approaches as well as analyse their strengths and weaknesses in a systematic way. Following a quantitative overview of 65 existing price and margin monitoring initiatives (Figure 1), 17 selected methodologies are qualitatively analysed in detail. The analysis aims at ensuring utmost transparency. This transparency is achieved by collecting new and updated datasets which form the basis for the analysis as well as by the implementation of structured, systematic and reproducible methodological approaches. The datasets gathered for this chapter are the following:

- One PDF file containing the inventory of existing FPMM approaches.
    - This is the raw data on which the analysis of Section 2.1 is based.
- 17 factsheets containing a mostly qualitative in-depth analysis of 37 characteristics.
    - This is the raw data on which the analyses in Sections 2.2, 2.3 and 2.4 are (partly) based.
    - These data are available in Annex II: Food Price and Margin Monitoring Factsheets.

While Chapter 2.1 yields counts, shares and diagrams of the frequencies of relevant characteristics of existing approaches (see AI.1 Methodology of Section 2.1 for a description of how this statistical analysis has been created), the primary goal of Chapter 2.2 is to mainly qualitatively highlight the diversity and variation among currently implemented approaches (see AI.2 Methodology of Section 2.2 for details on how this qualitative analysis has been set up). This is done by applying a systematic evaluation scheme yielding one factsheet for each approach. The focus of this part of the analysis lies on creating information which is comparable between the approaches analysed so that a transparent and structured assessment becomes possible.

Section 2.3 develops a typology of four classes of monitoring approaches using a subset of eight of the 37 criteria of Section 2.2. Three of these four classes are based on the patterns highlighted in Section 2.2 and one contrasts an optimal approach to the existing ones (see AI.3 Methodology of Section 2.3 for details on how this typology has been obtained). Subsequently, advantages and disadvantages of the four typology classes are highlighted in Section 2.4 before the approaches are ordered according to their cost-efficiency in Section 2.5.

Figure 1: Structure of the analysis of current monitoring approaches



Source: Authors of this study.
Note: See the glossary for an exact definition of monitoring initiatives vs. monitoring approaches. Table 59 contains examples.

2.1 Inventory of existing FPMM initiatives

The following four studies provide multi-national assessments of food price and margin monitoring initiatives:

FPMM study 1: Oosterkamp et al. (2013a, 2013b),
FPMM study 2: European Commission (2014c),
FPMM study 3: OECD (2015) and
FPMM study 4: Eurostat (2017a).

Although all focusing on the same topic, these studies slightly differ from each other in their perspectives on the topic. As they represent the state of the art, we briefly review and contrast their contents.

In their study for the Dutch Ministry of Economic Affairs, Oosterkamp et al. (2013a, 2013b) assess costs and effects of six prominent FPMM initiatives which are the food price observatories in Belgium, France and Spain as well as the FPMM initiatives implemented by the European Food Prices Monitoring Tool (FPMT, Eurostat, 2017a) and in Germany and the Netherlands. They first discuss theoretical effects and determinants of price transparency and summarise earlier cost assessments for the US (Perry et al., 2005; Becker, 2006). This is followed by an analysis of the aims, activities (and outputs), costs and effects of the six selected FPMM initiatives, of which the costs of the observatories in Spain and France are studied in depth. The report finally compares costs of three low-intensity and one high-intensity FPMM approach if they were applied in the Netherlands. The authors emphasise the higher costs needed for a continuous implementation of the high-intensity observatories such as in France and Spain (over 1m euros, including some additional primary data collection for the margin analysis). They estimate the costs for a price barometer of the FPMT-type in the Netherlands to about 80,000 euros per year and the cost of special in-depth margin studies for two selected food commodities at about 150,000 euros. The latter two estimates are produced subject to the condition that no primary data collection is needed. They point to cost savings by the usage of already gathered price information. They highlight a number of implementation challenges and limitations of FPMM initiatives. The comprehensive statistical information in the form of high amounts of price observations gathered is found to be not the main benefit of the initiatives evaluated. The authors of this study conclude that observatories themselves do not offer a solution for suspect unfair trading practices along food supply chain (see, e.g., European Commission, 2014a), but rather the dialogue between supply chain stakeholders created by the observatories may bring about trust between chain actors.

The study of European Commission (2014c) focuses on price developments in EU food supply chains during the past 10 years, the benefits for consumers and derives a number of recommendations for improving FPMM throughout the EU. The report contains a brief discussion of determinants of price transmission and provides a mostly visual analysis of price developments along EU food supply chains between 2005 and 2014. It highlights key findings from national MS initiatives and mentions a number of FPMM initiatives at EU level existing at the time of writing such as the Commodity Price Dashboard (European Commission, 2017j, 2017k), the Milk Market Observatory (European Commission, 2017i) or the Consumer Market Scoreboard (European Commission, 2017l). The report mainly focuses on discussing the aims of the FPMT and concludes with a number of suggestions for improving its usefulness for stakeholders as well as for harmonising national FPMM initiatives and approaches. This analysis does not assess costs or effects, but discusses in detail consumers' benefits

from FPMM. In the Annex, it contains a comprehensive list of initiatives at MS level. The report emphasises the value of FPMM and price transmission analysis as one of the multi-disciplinary efforts to gain a better understanding of the structure and performance of EU food supply chains. It recommends that the establishment of national FPMM initiatives is justified based on the cost-effectiveness assessment of Oosterkamp et al. (2013a, 2013b) and proposes three basic categories based on their intensity and comprehensiveness. It suggests that these initiatives should be tailored to the national contexts of the MS. Nevertheless, European Commission (2014c) emphasises the benefits of a certain degree of harmonisation between the national implementations and calls for an extension of monitoring efforts beyond the consumer (and the farm gate) level to supply chains levels connecting both actors.

The website of the FPMT (Eurostat, 2017a) has been established in response to European Commission (2014b, 2014c, 2014d, 2014e). It belongs to Eurostat's portfolio of experimental statistics (Eurostat, 2017c). The website reports price indices for agricultural commodities, food commodity imports, EU-internal farm gate prices and an harmonised index of EU consumer prices of the EU supply chains of 15 food categories (Eurostat, 2017d). Additionally it reports estimates of symmetric and asymmetric price transmission between farm gate, processing industry, retail and food import prices for all MS and Turkey, Norway and Switzerland. Finally, it contains a list of the names of single FPMM initiatives of the MS and links them to their original websites. These initiatives are split into 14 MS having national food price observatories and 5 MS without such observatories, in which national institutions implement the FPMM.

2.1.1 Comprehensive overview

This comprehensive overview of existing FPMM initiatives is based on the methodology elaborated upon in Annex Section AI.1 Methodology of Section 2.1. This overview considers 119 potential FPMM initiatives.[1] For each of these initiatives, we report the name of the initiative in the national language as well as in English, the link to the website publishing FPMM information, its status as explained in Table 1, whether it actually publishes FPMM information and whether it calls itself 'price observatory'. As the intention of FPMM is to inform the public about price and margin developments in food chains, the criteria for analysis of characteristics are that the initiative:

- is public and
- actually publishes FPMM information.

If an initiative met these two conditions, the existence of the characteristics mentioned in Table 56 (see Annex AI.1 Methodology of Section 2.1) has been evaluated.

As the aim was to produce an exhaustive overview of all FPMM initiatives run by major stakeholders, 45 countries and 6 international institutions have been covered (see Table 55, in Annex AI.1 Methodology of Section 2.1). Moreover, it has also been checked for each country and FPMM institution whether new FPMM initiatives have been established since they were covered by the four above-mentioned publications. Similarly, the timeliness and completeness of the list of the initiatives implemented by each country or institution was checked. If additional initiatives were identified/found to be no longer maintained, this has been considered in the evaluation.

[1] Of these initiatives, only the 109 run by public actors were assessed.

Several countries and international institutions have been found to have established and to currently run more than one publicly financed FPMM initiative. In contrast, a few countries considered have been found not to run any initiatives.

Scope of the analysis

Table 1 illustrates that the range of actors involved in some kind of FPMM due to various purposes is extensive. The focus of this inventory needs therefore to be limited. It is limited in the way that it only reviews existing FPMM initiatives of public actors at national level (EU MS, OECD MS[2], and China, India, Indonesia and South Africa) as well as a number of supranational institutions (EU, FAO, G20, IFPRI, WFP and World Bank).

Table 1 provides an overview of the most relevant actors engaged in FPMM. Food price and margin monitoring data are being collected by public actors, associations and lobby groups as well as private companies – each at the national or the supranational level. This study focuses on the public authorities, or private actors acting on their behalf, providing their analysis results for free to the public (typically on websites). That is, it evaluates levels A1) and A2) in Table 1 except for national statistical authorities.

This implies that there are potentially more food price and margin monitoring data than covered by the analysis of this report. These are data either collected by other than the institutions covered by this analysis (national statistics authorities as well as stakeholders of categories B) and C) of Table 1) or might be monitoring data gathered by public actors which are not made accessible to the public.

While many public actors share data and analysis results free of charge with the general public most often via the internet, associations and private companies gather and utilise FPMM data for the benefit for themselves, their members and clients, which often involves usage fees or data purchase. The potential availability of the data however can be of benefit for public actors too as these data can, e.g., straightforwardly be purchased without the need of having to set up the necessary data gathering by the public actor itself.

Table 1: Sources of FPMM information

Category	Level	Actor	Purpose/interest	Examples
A) Public actors				
	A1) At national level			
		National statistical authorities	Usual CPI calculation and inflation monitoring	Central Statistical Office of PL or of any other EU and OECD MS
		Ministries or other governmental institutions	Among other tasks mandated to provide FPMMI to national policy makers/public	State Commission on Commodity Exchanges and Wholesale Markets (BG)
		Separate price and margin observatories	Comprehensive FPMM 'not only on prices but also on the cost structure of specific product categories' (Europ. Comm., 2014c)	Observatoire de la formation des prix et des marges des produits alimentaires (FR), Observatorio de Precios de los Alimentos (ES)

[2] Note that the memberships of countries in the EU and OECD only partially overlaps. For the membership list of each group, see Eurostat (2017b) and OECD (2017a), respectively. See AI.1 Methodology of Section 2.1 for details on the country selection and the approach taken.

Category	Level	Actor	Purpose/interest	Examples
	A2) At supranational level			
		EU	Monitor CAP, provide FPMMI to policy makers/public in EU MS	Commodity price dashboard, Food Price Monitoring and Analysis Tool
		FAO, G20, IFPRI, OECD, WFP, World Bank and others	Monitor global farm gate prices and consumer prices for food	Food Price Monitoring and Analysis (FPMA) Tool of the Global Information and Early Warning System (GIEWS)
B) Associations and lobby groups				
	B1) At national level			
		General national farmer associations	Market intelligence for supporting members' economic performance and incomes	Boerenbond (BE), Latvian Farmer's Federation (LT), for an overview see the website of COPA
		National assoc. of specialised groups of farmers		Organic farming ass., Bund Dt. Milchviehhalter (DE), Unión de Pequeños Agricultores y Ganaderos (ES)
		Trader unions		Union of Chambers and Commodity Exchanges of Turkey, Royal Dutch Grain and Feed Trade Ass. (NL)
		Supply chain associations		ZuivelNL (NL), Verband der Fleischwirtschaft (DE)
	B2) At supranational level			
		General farmer associations	Market intelligence for supporting members' economic performance and incomes	Copa-Cogeca
		Assoc. of specialised groups of farmers		CEJA, European Dairy Farmers, IFOAM
		Trader unions		International Grains Council, Grain and Feed Trade Association,
		Supply chain associations		European Fresh Produce Ass., European Dairy Ass., Intern. Meat Secretariat, Intern. Dairy Federation
C) Industry/private companies				
	C1) At national level			
		Journals/newsfeeds/websites on farming, food trade etc.	Market intelligence for own and clients' business success	www.agronline.hu (HU), http://www.gfactueel.nl/ (NL), Boerderij (NL), L'Informatore Agrario (IT), Revista Agrícola (Chile)
		Market intelligence companies, data providers		AMI (DE), DCA Groep (NL), Clal (IT), scanner data (Nielsen, IRI), consumer panel data (GfK, IRI, Nielsen, Kantar), Bureau van Dijk (NL, now part of Bloomberg, US)
		Commodity auctions or commodity exchanges		Sofia Commodity Exchange (BG), Fruitveiling.nl (NL)
	C2) At supranational level			
		Journals/newsfeeds on farming, food trade etc.	Market intelligence for own and clients' business success	Agra Europe, Agrifuture
		Market intelligence companies, data providers		Global Dairy Trade, Rabobank's Food & Agribusiness Research
		Commodity auctions or commodity exchanges		MATIF, LIFFE, Chicago Board of Trade

Source: Authors of this study.

Analysis per country/international institution

Of the 109 public initiatives assessed, 65 were found to actually publish FPMM information (60%, first row of Table 2). The 13 countries or institutions running more than one initiative account together for 55% of all initiatives identified (36 of 65 initiatives). Few of them show efforts for implementing comprehensive FPMM: 75% of countries or institutions only provide 45% of the initiatives assessed (Table 2). The EU is leading with 7 FPMMA, followed by Bulgaria and Mexico with four each. A small number of 9 FPMM countries such as Canada, Germany, Hungary, New Zealand etc. have not been found to run public FPMM apart from their statistical offices. The remaining 29 countries and institutions run one FPMM initiative.

Table 2: Number of FPMM initiatives per country/institution

	Number of public FPMM initiatives per country or institution			
	More than 1	**One**	**None**	**Row sum**
Number of initiatives	36	29	0	65
Number of countries and institutions	13	29	9	51
Share of initiatives in row sum	55%	45%	0%	100%
Share of countries and institutions in row sum	25%	57%	18%	100%

Source: Authors of this study.

Of these 65 initiatives, 36 were categorised as explicit price observatories (first row of Table 4). These observatories are higher concentrated across countries or institutions than the FPMM initiatives. Eight countries and institutions host more than one observatory, accounting together for 56% of all observatories found. Indonesia has been found to run four, the EU and Mexico three, while Bulgaria, the Czech Republic, the FAO, Italy and Poland run 2 each. Sixteen more countries or institutions run exactly one, while 27 of the countries considered do not possess an explicit FPMM observatory.

Table 3 outlines the distribution of the 119 initiatives assessed. Of these initiatives, only the 109 which were found to be run by public actors were assessed. Fifteen initiatives are run by the international institutions considered (of that 8 by the EU). Ninety-four initiatives are run by public actors at national level. The 3 initiatives which are run by associations and the 6 which are run by private companies are excluded from the analysis.[3] Fifty-four of these public initiatives were found to be located in EU MS and 71 in OECD MS. Fifty-nine of the 94 were found to be run in European countries, 20 in Asia, 9 in North America, 4 in Oceania and 1 in South America and Africa, respectively.

[3] These initiatives were only considered because they were mentioned in at least one of the documents this inventory is based upon (see Section 2.1 Inventory of existing FPMM initiatives). For Iceland no institution was found.

Table 3: Distribution of public FPMM initiatives considered

		EU MS		Sum
		Yes	No	
OECD MS	**Yes**	42	29	**71**
	No	12	11	**23**
	Sum	**54**	**40**	**94**
Initiatives of international institutions				15
Total				**109**

Source: Authors of this study.

Table 4: Number of explicit price observatories per country/institution

	Number of observatories per country or institution			
	More than 1	**One**	**None**	**Total**
Number of observatories	20	16	0	36
Number of countries/institutions	8	16	27	51
Share of observatories	56%	44%	0%	100%
Share of countries/institutions	16%	31%	53%	100%

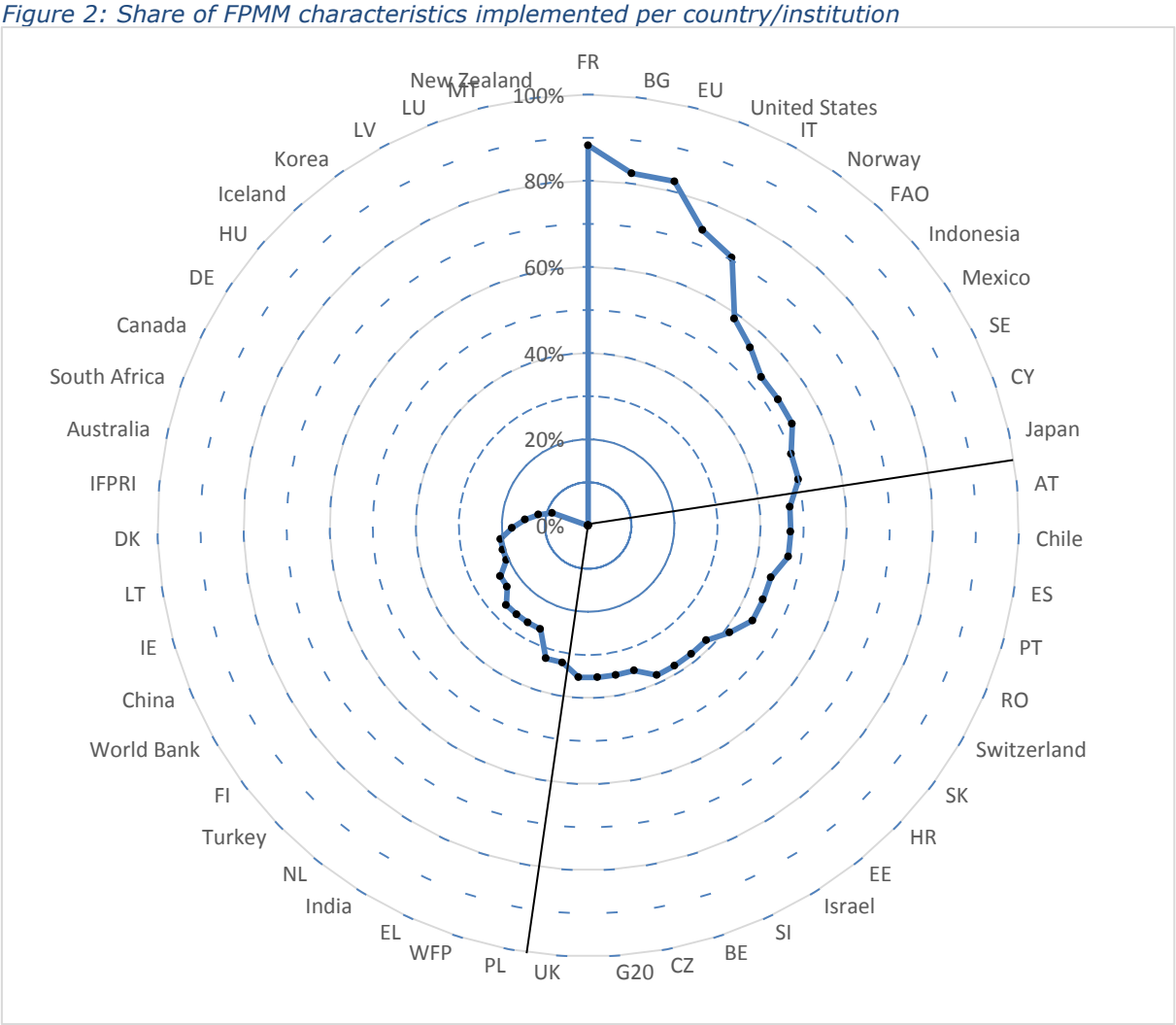
Source: Authors of this study.

Figure 2 shows for each country/institution whether and to what extent it currently engages in some kind of FPMM. This graph orders the countries and institutions according to the share of the 33 FPMM characteristics they have been found to implement in decreasing order in clock-wise direction. Twelve countries/institutions (24%, France until Japan) were found to implement at least 17 of the 33 characteristics. Three quarters of the 51 countries or institutions which have been evaluated on implement less than 50% of the 33 FPMM characteristics:[4] starting in clock-wise fashion with Austria below the almost horizontal line in the figure and finishing with New Zealand.

France, Bulgaria and the EU were found to have implemented more than 80% of the evaluated characteristics each. The US and Italy have implemented 74% and 71% of the characteristics, respectively. Seven more countries and institutions were found to have about 50% implemented. Further 15 countries/institutions implement 12 to 16 characteristics (29%). These are the countries/institutions located between the horizontal and the vertical black line in Figure 2, that is, all countries between Austria and the UK. The remaining 24 countries and institutions, that is, all those left of the vertical black line in Figure 2, implement between zero and 11 characteristics. Examples are Poland, the WFP, Malta or New Zealand.

[4] Details on these characteristics are contained in Table 56 and Table 57 in AI.1 Methodology of Section 2.1. As we here provide a quantitative assessment of the numbers of characteristics implemented, we do not elaborate on these details, but refer the interested reader to AI.1 Methodology of Section 2.1.

Figure 2: Share of FPMM characteristics implemented per country/institution



Source: Authors of this study.
Note: The countries and institutions are ordered clock-wise according to decreasing share. That is, France has most characteristics implemented while New Zealand has none implemented. The names of all EU MS are abbreviated with two letters as specified by the glossary entries EU15 and EU13.

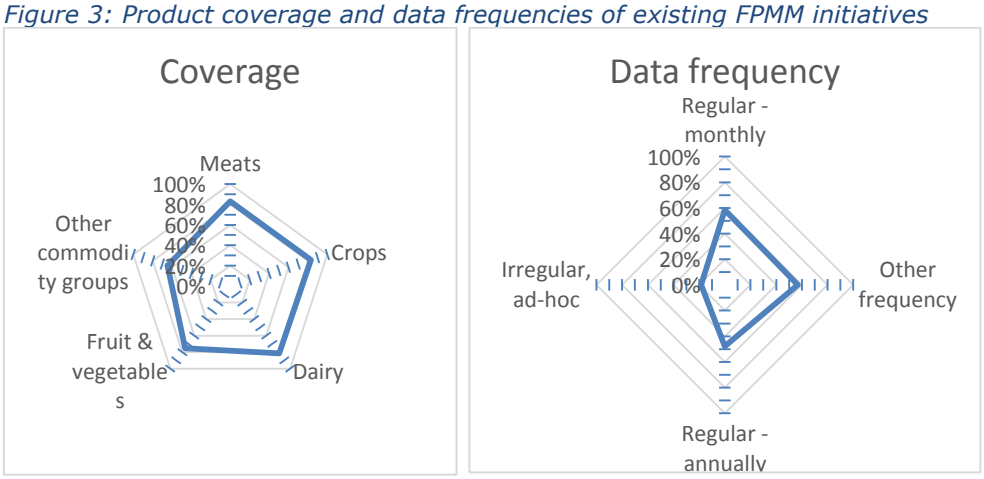
Although there is no country or institution which implements all 33 characteristics, several of them implement all characteristics of particular categories (as mentioned in Table 56 and Table 57). Twenty-eight entities monitor food prices and/or margins for at least the four products groups considered. Five FPMM entities monitor three and 18 monitor 2 or less. The monitoring of France is by far the most comprehensive one in terms of evaluation category B; the monitoring focus. It considers 10 of the 12 characteristics of category B. The EU currently considers 7, Bulgaria and Norway 6. Five countries/institutions monitor 5 characteristics, 7 countries/institutions 4 and 35 consider 3or less. Bulgaria as well as the EU implement all 14 types of monitoring outputs assessed (evaluation category C). Also France, the US, Italy and the FAO implement ten or more. Fourteen FPMM countries/institutions implement between 5 and 9, while 31 implement less than 9. Bulgaria and Italy offer FPMM in all 3 assessed data frequencies as well as at least one further frequency (category D). The EU considers all 3 frequencies. Thirteen further countries/institutions assess 2 frequencies as well as at least one additional frequency. The remaining 35 FPMM countries and institutions consider at most 2 of the 4 options evaluated.

Analysis per category and per characteristic

Figure 3 to Figure 5 summarise the comprehensiveness of the existing 65 FPMM initiatives. They report what share of these FPMM initiatives implement each of the characteristics mentioned in Table 56 and Table 57. The characteristics are ordered in clock-wise direction according to decreasing share of initiatives found to currently implementing them.

Figure 3 shows that the existing FPMM initiatives are very comprehensive in their coverage of the most important categories of agricultural/food products. They are mostly focused on regular monitoring either on annual, monthly or higher frequency. Raw and processed meats, crops and dairy products are most frequently monitored – by more than 80% of all existing FPMM initiatives. Fruits and vegetables are monitored by three quarters of them. Sixty-five per cent of them also monitor other prices (most frequently eggs, fish, cooking oil or wine).

Figure 3: Product coverage and data frequencies of existing FPMM initiatives



Source: Authors of this study.
Note: The graphs report the shares of the existing FPMM initiatives implementing each characteristic. The characteristics are ordered in clock-wise direction according to decreasing share of the 65 initiatives implementing them.

Monthly data is the most common data frequency considered (by almost 60% of all existing initiatives). Forty-eight per cent provide annual data and 18% irregular or ad-hoc FPMM. More than half of the existing initiatives (57%) provide FPMM at other frequencies, most often, at weekly level (21 initiatives) and daily level (11 initiatives).

Price spreads, costs or profits along food supply chains are virtually absent in current monitoring. Figure 4 shows that existing FPMM initiatives are generally of low data complexity as they mostly only monitor farm gate and/or retail prices. This graph orders the 12 monitoring focuses including the three 'other' options according to the decreasing share of FPMM initatives implementing them.

Only farm gate and retail prices are being observed by more than half of the existing initiatives. Wholesale prices until 'Other prices monitored' are monitored by 42% to 17% of the initiatives. Seven of the 15 categories are barely monitored by less than 10% of the existing initiatives. Price spreads as well as retailers' and other costs along the supply chain are found to be only monitored by the French Price Observatory. Profits along food supply chains or other than the explicitly mentioned spreads are found to be not at all monitored. The monitoring is sometimes carried out in a

regionalised fashion, that is, by national FPMM initiatives for various regions within the country or by international institutions for various countries.

Figure 4: Monitoring focuses of existing FPMM initiatives

Source: Authors of this study.
Note: The graph reports the shares of the existing FPMM initiatives implementing each characteristic. The characteristics are ordered in clock-wise direction according to decreasing share of the 65 initiatives implementing them.

Fourteen of the 33 characteristics assessed measure the existence of various types of monitoring outputs.[5] These 14 characteristics differ in terms of the effort needed to prepare them. The difficulty of preparing the output refers to the data complexity, knowledge, efforts and time needed to produce a specific type of output. Moreover they also differ in the statistical and economic expertise needed and their intelligibility for the (intended or unintended) beneficiaries. Table 5 classifies each of the 14 output types in terms of their intensity (low, moderate, high or very high) with respect to each of these three characteristics.

Tables and graphs of average prices need a low expertise and are therefore not difficult to prepare. Tables or graphs of price indicators of cross-section or of time series data need more – mainly – statistical expertise to be well-designed, calculated, clearly arranged and visually illustrated. As price indices and tables and graphs of them are a widely used standard measure, they have been classified as being at the second lowest difficulty level. However, the statistical and information science expertise needed to design insightful graphs of price indicators (Cd and Ch of Table 5) is high. Tables of prices or indicators – regardless of whether they portray cross-section or time series data - are most difficult to understand for non-specialist users. Graphical illustrations are easier understood. Time series graphs of price indicators tend to have high benefit for users since patterns on past developments may be

[5] These are the 14 characteristics evaluated in evaluation category C outlined in detail in Table 56 and in Table 57 in AI.1 Methodology of Section 2.1.

deduced on which projections into the near future may be based. Output types Cm (quantitative analyses) and Cn (qualitative analyses) need high to very high statistical, economic and information science expertise and therefore also largest efforts to be prepared. The reason lies in the fact that commented quantitative analyses as well as qualitative or even quantitative analyses of supply chain structures go considerably beyond the gathering, processing and analysis of only prices. They need a wide range of further information about food supply chains which can be very challenging to be gathered. They need also comprehensive expertise in market and/or supply chain analysis as well as in the intelligible presentation of analysis results to be well-communicated to and understood by the beneficiaries. The latter two output types are also most useful for stakeholders due to their comprehensiveness. The substantial expertise needed for performing these analyses ensures that the data are correctly understood, the analysis results are well-interpreted and the analysis insights are connected with crucial implications for the – potentially opposing – interests of stakeholders.

Table 5: Characteristics of various FPMM outputs

Evaluation subcategory	Monitoring output type	Difficulty/effort of preparation	Expertise contained	Intelligibility for stakeholders
C1) Observed cross-section data				
	Ca) Price tables	low	low	low
	Cb) Price graphs	low	low	moderate
	Cc) Price indicator tables	moderate	moderate	low
	Cd) Price indicator graphs	moderate	high	moderate
C2) Observed time series data				
	Ce) Price tables	low	low	low
	Cf) Price graphs	low	low	moderate
	Cg) Price indicator tables	moderate	moderate	low
	Ch) Price indicator graphs	moderate	high	high
C3) Cross-section price index data				
	Ci) Price tables	moderate	moderate	low
	Cj) Price graphs	moderate	moderate	moderate
C4) Time series price index data				
	Ck) Price tables	moderate	moderate	low
	Cl) Price graphs	moderate	moderate	high
C5) Other monitoring outputs				
	Cm) Commented quantitative analyses	high	high	high
	Cn) Qualitative analyses	very high	very high	very high

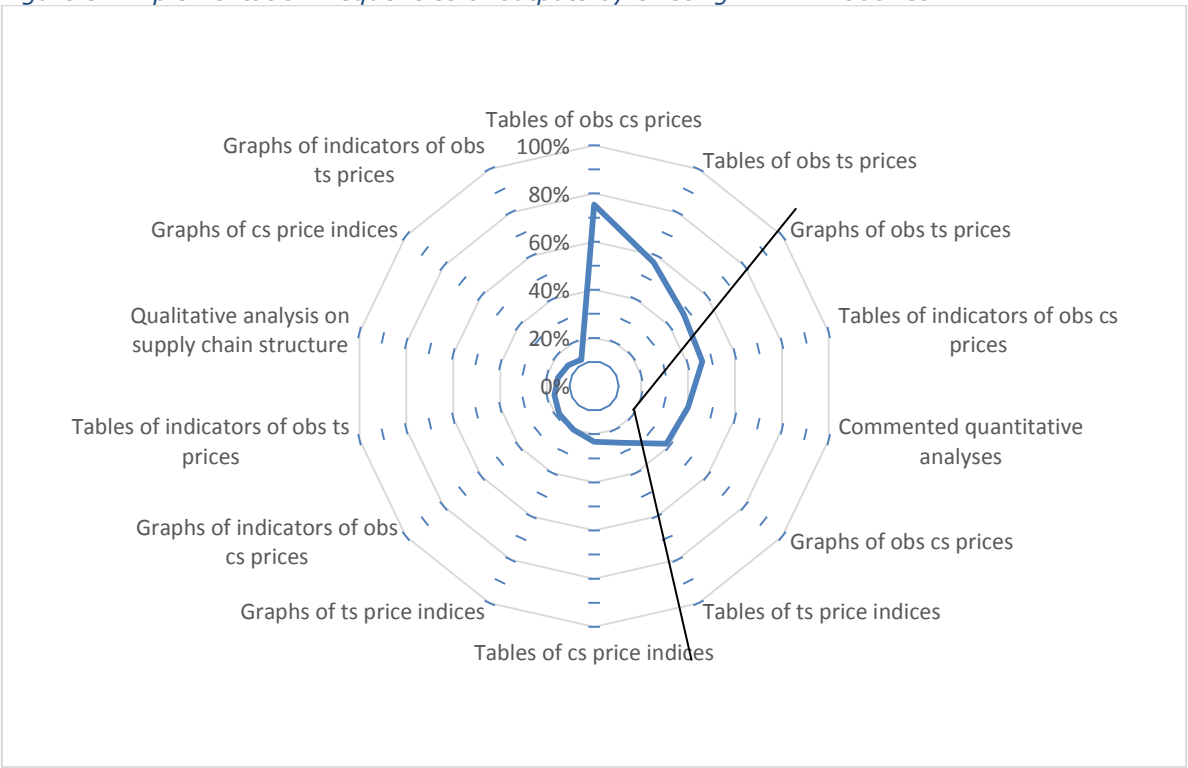
Source: Authors of this study.
Note: The evaluation subcategories and output types correspond to the ones elaborated on in Table 56.

Figure 5 confirms this finding as most existing FPMM initiatives offer the output options which are most simple to prepare. These options are, however, also of most limited benefit to societal stakeholders supposedly using the FPMM initiatives as the graphical processing and the economic analysis as well as the interpretation of the results is left to them without support or instruction. With the exception of price

indices, existing initiatives barely make use of summarising the large amounts of data available in insightful and intelligible indicators or graphical illustrations of indicators.

Figure 5 shows that tables of observed cross-section and time series prices are the only two of the 14 monitoring output options used by more than half of the existing initiatives. Five output options are implemented by a quarter until half of the initiatives (located between the two solid black lines in Figure 5). Half of the output options considered (located to the left of the second black line in clock-wise direction in Figure 5) are implemented by less than a quarter of the 65 current initiatives identified. These are often precisely those outputs which are more demanding in terms of statistical background, technological implementation and/or costs of preparation. However, they also tend to be the outputs which are most insightful for stakeholders (see Table 5) as they may provide stakeholders with (graphical) summaries of key characteristics of the food prices and margins monitored.

Figure 5: Implementation frequencies of outputs by existing FPMM initiatives

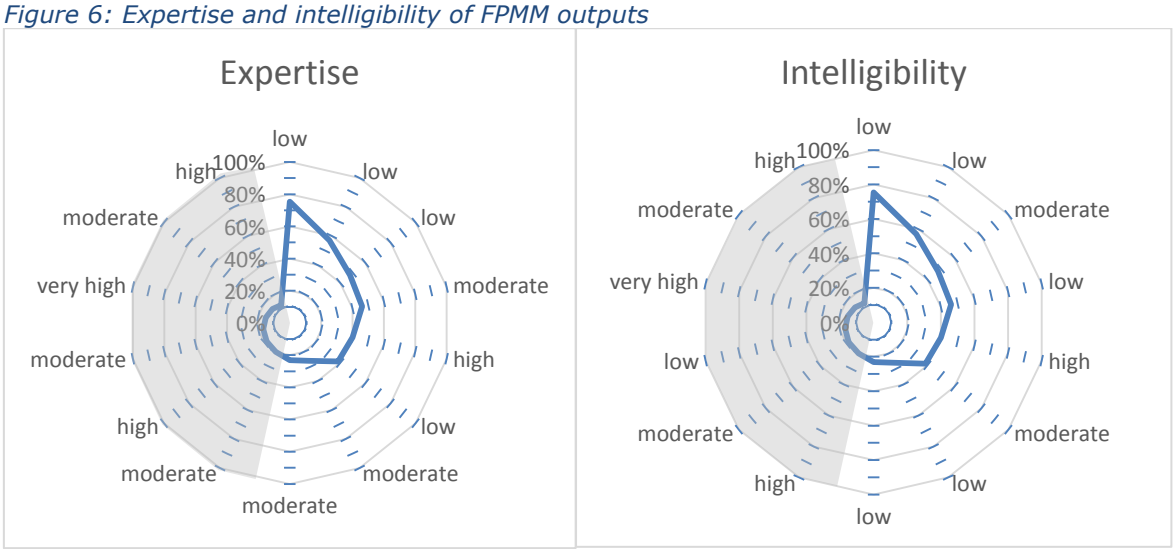


Source: Authors of this study.
Note: The graph reports the shares of the existing FPMM initiatives implementing each characteristic. 'cs' means cross-section, 'ts' means time series, 'obs' means observed. The characteristics are ordered in clock-wise direction according to decreasing share of the 65 initiatives implementing them.

Figure 6 illustrates that those of the 14 monitoring output types which need lowest expertise for preparation and which are of low intelligibility – examples are uncommented tables containing cross section (monitoring output type Ca) or time series data (Ce) or uncommented price time series graphs (Cf) - are most frequently implemented by the existing FPMM initiatives. Most of the 14 monitoring output types which need highest expertise for preparation and also offer highest intelligibility to the user cluster in the shaded areas of each subfigure. Examples are price indicator graphs (monitoring output type Ch) or qualitative supply chain analyses (Cn). Both shaded areas are clearly associated with lowest implementation rates. Commented quantitative analyses appear only as an exception: although requiring high effort and

expertise and having high intelligibility for users, they were found to be implemented by 40% of the 65 FPMM initiatives assessed.

Figure 6: Expertise and intelligibility of FPMM outputs



Source: Authors of this study.
Note: The order of the labels in each subfigure of Figure 6 is identical to the label order of Figure 5. The shaded areas indicate those of the 14 monitoring output types which are implemented by at most 20% of the 65 monitoring initiatives.

Conclusion

Existing FPMM initiatives are characterised by an enormous heterogeneity of the structure, comprehensiveness and extent of the price and margin data being gathered and monitored. They are similarly heterogeneous in terms of the outcomes of monitoring analyses and the form and organisation of the finally published data. They are based on strongly divergent raw data-gathering structures and procedures and efforts and costs spent for the monitoring. The depth and the detail of the data collection differs strongly. Existing initiatives are characterised mostly by an arbitrary focus of the product being monitored as well as seemingly arbitrary supply chain level focuses. Although some countries decided for regional focuses, these choices seem arbitrary too – at least there is barely background material publicly available outlining the underlying rationale and direction of the initiative. Many of the existing initiatives lack clarity on what prices exactly are being monitored and the terminologies used also show wide variations without being transparently explained. An, EU-wide comparable terminology is lacking.

Despite the enormous variety, one can say that existing FPMM initiatives, especially the ones run by national governments, are in most cases focused on farmers' output prices (63% of 65 initiatives assessed).[6] Retail prices are the second most frequent monitoring focus of existing FPMM initiatives (52% of all initiatives),followed by wholesale prices by 42%. Thus, existing initiatives mainly focus on both ends of the food supply chain: on selling prices of the raw product received by producers as well as on purchasing prices of the processed food products paid by consumers. Selling prices, purchasing prices or even more demanding economic quantities such as costs or profits along supply chains in-between these two ends are barely being monitored. Barely any focus is laid on the structure and dynamics of prices the processing chain

[6] Farmers' input prices are evaluated by 29% of these initiatives.

or consumption. Monitoring mostly focuses on products relevant for national agricultural production.

A common characteristic of most existing initiatives are the immense amounts of data (mostly average prices, partly also price indices) being gathered and published by almost each of them. However, these massive quantities of data and numbers are usually published without explanation and interpretation for the (non-specialist) user and, thus, rather confusing instead on enlightening. Large amounts of statistical data are difficult to understand for the non-specialist user such as producers and consumers, in most cases only specialist data analysists are able to make sense of it.

Most of the initiatives regularly publish raw data in the form of national or regional average prices, that is, putting out immense amounts of numbers often without meaningful and easily understandable indicators for public and stakeholder use. The more amounts of data are made available, the more confusing the understanding of them can be because many stakeholders lack the statistical, economic and information science expertise to make sense of them. Besides price indices, the most frequent indicators used are the percentage change in comparison to the previous month or to same month of previous year. Short-term or medium-term forecasts of price developments as well as qualitative analyses of supply chain structure to increase stakeholders understanding are barely provided by existing FPMM initiatives.

Such mostly user-unfriendly communication and representation of the data and the analysis outcomes raises the question to what extent these data masses are actually used and generate insights for societal stakeholders and which parties have the expertise to profit from them. To what extent are data communicated in this way beneficial and useful for potential data users? A more frequent use of graphs and insightful indicators as well as explanations of numbers, signals and insights into supply chain structures and price formation would be desirable.

The FPMM initiatives provided by international institutions show some overlap in the data they share with the public. The rationale for providing various competing FPMM initiatives at international level at various websites without referral to each other is questionable. A better coordination of efforts among these organisations might save resources and improve clarity for users by reducing contradictions between datasets. Especially for the FPMM initiatives of international institutions doubts about the quality and reliability of the data provided arise as time series often suffer from missing observations or reported prices appear to be stable for months.

The problems of lacking overview, transparency and coordination between existing initiatives also hold for the EU whose various directorates general are offering various competing FPMM initiatives. However, this wide range of initiatives and their websites are in almost no case linked or referred to each other. This raised the question to what extent these competing initiatives all published by the EU are coordinated with each other. At EU level, a central website bundling all FPMM efforts currently produced and all resources - including all kinds of official EU documents concerning FPMM (e.g. European Commission, 2014a, 2014b, 2014c, 2014d, 2014e) - and insights generated by the Commission and other EU bodies is clearly missing. Existing initiatives and websites are, for example, run by DG Agriculture and Rural Development (DG Agri, European Commission, 2017c, 2017g, 2017i, 2017j, 2017k), DG Internal Market, Industry, Entrepreneurship and SMEs (DG Grow, European Commission, 2017b, 2017d, 2017e, 2017f, 2017h), DG Justice and Consumers (DG Just) with its consumer scoreboards including market monitoring, consumer and retailer surveys, market studies and behavioural research (European Commission, 2017l) and Eurostat (2017b).

A high number of FPMM initiatives is currently existing at global scale. However, they are fragmented and extremely heterogeneous in their structure and approaches, barely comparable and barely coordinated with each other resulting in a confusing and non-transparent multitude of initiatives. The very heterogeneous approaches to FPMM, data gathering and communication implemented at national level by member states of the EU and OECD as well as at the level of international institutions suggests that coordination in partial food price and margin monitoring at least for subsets of these countries/institutions would improve clarity and comparability of the insights gained from the monitoring. Setting up an online platform for improving transparency by, e.g., giving an almost exhaustive overview of existing initiatives and approaches and providing a harmonised terminology would be progress.

At international scale, but even at the level of EU MS, a roughly comparable general structure and approach to FPMM is missing. Similarly, a common vision to FPMM and harmonised guidelines for data collection as well as presentation and communication of results is absent. For the analysis and the monitoring of structures and developments concerning the creation of value added at various levels of food supply chains, especially from a supranational perspective, comparability concerning the structure of the data gathered and the formats monitoring results are published in is badly needed.

2.2 Detailed characterisation of selected approaches

This section characterises in detail the methodological characteristics of 17 selected FPMM approaches in a mostly qualitative fashion. This characterisation serves as basis for the typology in Section 2.3 Typology of Food Price and Margin Monitoring Approaches. Their advantages and disadvantages are summarised in Section 2.4 Advantages and disadvantages of the typology classes and they are ranked according to cost-efficiency in 2.5 Ranking of approaches based on cost-efficiency.

This section provides a structured and reproducible comparative analysis highlighting similarities and differences of the seventeen FPMM approaches. The data this analysis is based upon are provided in the FPMM approach factsheets which can be found in Annex II: Food Price and Margin Monitoring Factsheets. The methodology used to compile the factsheets based on the 37 evaluation characteristics applied to each FPMM is explained in Section AI.2b Methodology of the detailed characterisation of selected FPMMA approaches and in Table 61 in the Annex.

The following analysis is exclusively based on the information contained in the 17 FPMM approaches' factsheets. The tables summarise whether each of the 17 approaches possesses a certain evaluation characteristic. This analysis aims at highlighting general patterns of single characteristics visible across the 17 approaches. The patterns serve for grouping the 17 approaches into a small number of categories some of which will serve in the following sub-chapter to construct the approach typology. As the names of the monitoring approaches tend to be long and bulky, we use a brief code for each of them all of which are outlined in Table 6.

2.2.1 Institutional context

The institutional context provides general background to the FPMM approaches. A first aspect that is assessed is the purpose of the different approaches. A first observation is that, with few exceptions (BE1, BE2, EU3, EU4 and LT2), most FPMM approaches do not specify the target audience for the information that is provided. This seems like an important shortcoming, as the identification of the target audience should inform the kind of information that is collected and the ways in which this information is provided. The FPMM approaches that do include a specific target audience in their purpose,

target a variety of audiences: government (BE1, BE2, LT2); actors in the supply chain (EU3, EU4, LT2); consumers and citizens (EU3, LT2).

Table 6: Codes of the 17 selected FPMM approaches for detailed analysis

Code	FPMM approach in English	FPMM approach in national language	FPMM initiative	FPMM country or institution
BE1	Annual and quarterly reports	Jaar- en kwartaalverslagen/Rapports annuels et trimestriels	Belgian Price Observatory	Belgium
BE2	Market functioning	Marktwerking/Fonctionnement du marché	Belgian Price Observatory	Belgium
BG1	Weekly retail price bulletin	СЕДМИЧЕН ИНФОРМАЦИОНЕН БЮЛЕТИ	System for Agro-market information	Bulgaria
BG2	Annual consumer Easter basket	Великденска Кошница	System for Agro-market information	Bulgaria
EU1	FPMT Price trends along the food supply chain	FPMT Price trends along the food supply chain	Food Price Monitoring Tool	European Union
EU2	FPMT Price transmission along the food supply chain	FPMT Price transmission along the food supply chain	Food Price Monitoring Tool	European Union
EU3	Agricultural markets dashboards	Agricultural markets dashboards	Market observatories	European Union
EU4	Further price reporting of the EU Milk Market Observatory	Further price reporting of the EU Milk Market Observatory	Market observatories	European Union
FR1	Macroeconomic decomposition of food expenditure	Décompositions macroéconomiques de la dépense alimentaire	French observatory on prices and margins formation of food products	France
FR2	Cost analysis in the agricultural, industrial and trade sectors	L'analyse des coûts dans les secteurs agricoles, industriels alimentaires et du commerce	French observatory on prices and margins formation of food products	France
LT1	Prices of agricultural and food products	Maisto produktu kainos	Agricultural and food price monitoring	Lithuania
LT2	Sector reviews and statistical information	Sektoriaus apžvalgos	Agricultural and Food Products Market Information System	Lithuania
NL	Agro & food portal	Voedselprijzenmonitor (Agrimatie)	Wageningen Economic Research	Netherlands
ES1	Value chain analyses of fresh products	Cadenas de valor productos frescos	Spanish Food Price Observatory	Spain
ES2	Value chain analyses of oil, garlic, bread and milk	Cadenas de valor - aceite, ajo, pan y leche	Spanish Food Price Observatory	Spain
US1	Food Dollar Series	Food Dollar Series	USDA Economic Research Service	United States
US2	Price Spreads from Farm to Consumer	Price Spreads from Farm to Consumer	USDA Economic Research Service	United States

Source: Authors of this study. Note: For details on the selection of these monitoring approaches see annex AI.2a Selection of national approaches reviewed in detail and Table 59 therein.

The most common purpose for FPMM approaches is that of providing more transparency in price formation along the supply chain. Several FPMM approaches also refer to an underlying component that relates to 'potential distortions of competition on the market' (BE1, BE2), the provision of 'objective information and the exclusion of the influence of private groups and interests in price formation' (BG1, BG2), and 'detecting possible supply chain imbalances' (ES1, ES2). Two of the FPMM approaches (BE1, LT2) explicitly include a comparison of price developments in domestic and foreign markets.

Key findings:
Without an explicit identification of the target audience for the FPMM approach, it is impossible to assess the appropriateness of the approach for reaching its goals.

Another relevant aspect that was assessed is the output format, frequency and starting year of the FPMM approaches. Table 7 summarises the results. First, the majority of FPMM approaches are available in pdf format. While pdf formats do not provide easy access to data for further analysis or processing by potential users, most of these pdf reports have the advantage of providing written interpretations of the data and analyses to the reader. Such user-friendly interpretations are often lacking for exportable data files. A second observation is that exportable data files are often provided together with interactive graphs (EU1, NL, US2). This dual approach in output formats has the advantage of providing both user-friendly graphical presentations and access to detailed underlying data for further analysis by users. Third, most common output frequencies are either weekly or annually. Finally, the FPMM approaches in the EU are initiated relatively recently, as compared to the US, with the exception of NL which provides price data since 2000 already.

Table 7: Output formats, output frequency and starting year of FPMM approaches

	Weekly	Monthly	Quarterly	Annually	Otherwise
Pdf	BG1 (2015) EU3 (n.a.) EU4 (n.a.) LT2 (2017)[c]		BE1 (2009)	BE2 (2014) FR1 (2010) FR2 (2010) ES2 (2009)[d]	ES1 (2009) BG2 (n.a.)
Interactive graphs		EU1 (2005) NL (2000)		US2 (2000)	EU2 (2016)
Exportable data files	EU4 (n.a.) LT1 (2016)[b]	EU1 (2005) NL (2000)		US1 (1993)[e] US2 (2000)	

Source: Authors of this study.
Notes: [a] Number in brackets is first year of availability of FPMM approach; [b] F tables in html; [c] [Agro Rinka publication] available bi-weekly; [d] Publication ended 2002/3; [e] Output formats: figures, graphs and tables

Key findings:
The majority of FPMM approaches provide their outputs only in pdf format. Exportable data files are rarely provided while interactive graphs are only provided by four approaches. This implies that most approaches implicitly expect that their users will not make further use of the monitoring outputs published. For enabling users to adapt the monitoring outputs to their specific needs, it would be desirable to change the output formats of more approaches to the latter two types. Providing multiple output formats (pdf reports, exportable data files, interactive graphs) offers advantages of data usability and interpretation. The public actors who commissioned the approaches evaluated appear to have diverging needs for the frequency of publishing monitoring outputs. About half of the approaches publish at a monthly or weekly frequency, while the other half of approaches only published yearly.

2.2.2 Monitoring focus

The main aspects that were assessed concerning the monitoring focus included the commodities/sectors and the different supply chain levels that are covered by the FPMM approaches. Table 8 gives an overview of the sectors that are covered. The dairy sector, meat and animal products (including at least one of the beef, pork and poultry sectors), fresh fruits and vegetables and cereals/bakery are most often covered. The sugar sector (and confectionary) seems to be underrepresented. All of the FPMM approaches that provide information at sector level, cover at least three sectors – with the exception of EU4, which focuses solely on the dairy sector.

Key findings:
The majority of FPMM approaches focus on the dairy sector, meat and animal products, fresh fruits and vegetables and cereals/bakery.

Table 8: Sectors covered by the FPMMA

FPMMA	Milk/dairy	Meat & animal products	Cereals/ bakery	Sugar/ confectionary	Fruits & vegetables	Fish	Oilseeds, oils & fats
BE1	X	X	X	X	X	X	X
BE2[a]							
BG1	X	X			X		
BG2	X	X	X		X		X
EU1	X	X			X	X	X
EU2	X	X	X		X	X	X
EU3	X	X	X	X	X		X
EU4	X						
FR1[b]	X	X	X	X	X	X	X
FR2	X	X	X		X	X	
LT1	X	X	X		X	X	
LT2	X	X	X		X	X	X
NL	X	X	X		X		
ES1		X			X	X	
ES2	X		X		X		X
US1	X	X	X	X	X	X	X
US2	X		X	X	X		

Source: Authors of this study.
Notes: [a] Sectors covered dependent on their degree of market functioning (based on calculated indicators). [b] Aggregate of total national food expenditures without differentiation by sector.

Table 9 gives an overview of the supply chain levels that are covered, farming, processing and retail. Several FPMM approaches cover all levels of the supply chain, some focus on the downstream supply chain level (retail, BE1, BG1, BG2), others provide information on upstream levels only (farming/processing, EU3, EU4). Spatial aggregation of information (at the regional level within a member state or disaggregated per member state for EU FPMM approaches) is provided in a limited number of cases (BG1, BG2, EU1, EU2, EU3, EU4).

Table 9: Supply chain levels monitored by FPMM approach

Supply chain level	BE 1	BE 2	BG 1	BG 2	EU 1	EU 2	EU 3	EU 4	FR 1	FR 2	LT 1	LT 2	NL	ES 1	ES 2	US 1	US 2
Farming					X	X	X	X	X	X	X	X	X	X	X		X
Processing		X			X	X		X	X	X	X	X	X	X	X		
Retailing	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X

Source: Authors of this study.

Key findings:
Comprehensive FPMM approaches cover at least the following three stages of the supply chain: farming, processing and retail.

An attempt was also made to assess the conduciveness of the FPMM approaches to their purpose. This assessment is qualitative and complicated by the fact that the

purpose of an FPMM approach is often only vaguely stated and the target audience is not identified. Despite these obstacles, some of the approaches seem to miss their purpose because of the following reasons:

- The purpose of the FPMM approach is to gain insight into the components of consumer prices but prices are monitored only at the retail level (BE1);
- The purpose of the FPMM approach is to improve market price information throughout the food chain but prices are monitored only at the retail level (BG1, BG2);
- The purpose of the FPMM approach is to monitor prices, but only price indices are presented (EU1).

Key findings:
The purposes of the evaluated FPMM approaches are often only vaguely stated which challenges the evaluation of their conduciveness. Several approaches have nevertheless found to miss their purpose. Conduciveness of the FPMM approach to its purpose, and therefore improving transparency and intelligibility for non-specialist users, requires a clearly defined purpose and target audience and alignment between purpose and the tools and information that are provided.

2.2.3 Data inputs required

We evaluate data inputs of the 17 FPMM approaches by looking at four aspects: qualitative data, quantitative data, information sources, and data transparency. 13 out of 17 approaches do not provide qualitative data. Only FR1 and FR2 provide information on the supply chain structure, and ES1 and ES2 provide a detailed supply chain structure analysis, detailed descriptions of the product transformation processes, and the composition of value added along the supply chain. The description of the organisation of the supply chain is an important piece of background information, and its absence in the majority of the FPMM approaches we study is a shortcoming. Because the organisation of the supply chain and the transformation processes do not change as frequently as quantitative data, their reporting (description) should be a standard, which would improve the user-friendliness of an FPPM.

About a half of the approaches use cross-sectional and the second half uses time series data (Table 10). EU1 uses unbalanced panel data for the European Union as a whole (and time series for the individual Member States). FR1 and FR2 use partly panel data of a few years and partly cross-section data for selected specific fruits and vegetables types, for example, for the estimation of the food expense decomposition. The data come in the form of indices (e.g., BE1), prices (e.g., EU1, EU2, FR2, LT1, LT2, ES1), food production and imports (e.g., FR1), or cost and profit estimates (ES2).

Table 10: Types of quantitative data used by the FPMM approaches

	BE1	BE2	BG1	BG2	EU1	EU2	EU3	EU4	FR1	FR2	LT1	LT2	NL	ES1	ES2	US1	US2
Cross section	X	X	X	X						X	X	X	X	X	X		
Time series					X	X	X	X					X	X		X	X
Panel data					X				X	X							

Source: Authors of this study.

Table 11 shows that most of the FPMM approaches report either the primary or secondary data sources and in some cases even both (FR2, NL, ES1, and ES2). The US1 approach does not provide sources for individual graphs but rather summarises them in the 'Documentation' section. The EU1 and EU2 approaches do not clearly document data sources on their websites; the reader can only get access to the Eurostat tables for which the data sources are not clear either.

Table 11: Information sources used by the FPMM approaches

	BE1	BE2	BG1	BG2	EU1	EU2	EU3	EU4	FR1	FR2	LT1	LT2	NL	ES1	ES2	US1	US2
Primary data			X	X						X	X	X	X	X	X		
Secondary data	X	X			X	X	X	X	X	X			X	X	X	X	X

Source: Authors of this study.

Credible monitoring of food prices and profit margins requires transparent data. The transparency has different aspects, including whether the raw data are publically available or if secondary data sources are explicitly mentioned. Table 12 summarises the public availability of raw data across the 17 FPMM approaches covered by our study. Except for BE2, FR1, FR2, NL, and ES2, raw data are, generally, not publically available. However, none of the approaches makes the complete raw data publicly available. One of the reasons is confidentiality. For example, according to the Lithuanian national information security (confidentiality) legislation, primary data cannot be published. In some cases, only parts of raw data are available (e.g., BG1, NL) or presented graphically (e.g., ES2). Some approaches summarise and present the raw data by calculating price indices or other indicators (e.g., BE1, BE2, NL) but lack the methodology for calculation of those.

Regarding the documentation of data sources, most of the FPMM approaches provide references or links. However, EU1, EU2 do not explicitly provide data sources, which is a significant shortcoming of the two approaches. The data transparency of the FR2 approach is of exemplary quality: raw data of each graph are publically available and can be copied from the website. The secondary data sources are completely and explicitly mentioned, and the approach discusses challenges of analysis and interpretation and spells out the limitations.

Table 12: Public availability of raw data

	BE1	BE2	BG1	BG2	EU1	EU2	EU3	EU4	FR1	FR2	LT1	LT2	NL	ES1	ES2	US1	US2
Raw data publicly available	no	X	no	no	no	no	no	no	X	o	no	no	X	no	X	no	no

Source: Authors of this study.
Note: o means that only partly available.

In summary, all the FPMM approaches use data at the level of Member States, although US1 and US2 use even a higher level of aggregation (i.e., the US). Prices and price indices are a reporting standard, whereas only ES1 and ES2 provide cost and profit estimates.

Key findings:
The lion's share of FPMM approaches do not provide qualitative data (e.g., organisation of the supply chain and the transformation processes). Qualitative data (e.g., indices, prices, food production and imports, or cost and profit estimates) are either cross-sectional or time series. Most approaches correctly report the primary or secondary data sources used. Raw data are generally not publically available (due to confidentiality). All the FPMM approaches use data at the Member State (national) level.

2.2.4 Evaluation of monitoring results

We comprehensively assess the components, structure and comprehensiveness of the monitoring results produced and published by each FPMM approach. Therefore, we consider in this category the following eleven characteristics each of which will be analysed in separate section.[7]

Evaluation characteristic 1:	Types of quantitative results
Evaluation characteristic 2:	Types of qualitative results
Evaluation characteristic 3:	Prices monitored
Evaluation characteristic 4:	Further quantities monitored
Evaluation characteristic 5:	Indicators published
Evaluation characteristic 6:	Reproducibility of approach
Evaluation characteristic 7:	Calculation methods used
Evaluation characteristic 8:	Form(at)s of numerical results
Evaluation characteristic 9:	Form(at)s of graphical results
Evaluation characteristic 10:	Form(at)s of commented results
Evaluation characteristic 11:	Intelligibility of results (justified expert rating)

Characteristics 1 and 2: Types of quantitative and qualitative results
The first two evaluation characteristics of the category of monitoring results give an overview of which types of quantitative (e.g. nominal or real data, cross-section data or cumulatively updated time series) and qualitative results (commented quantitative analyses, interpretation helps for non-specialists for better understanding numerical and graphical results) each FPMM approach publishes.

The 17 FPMM approaches group into three types concerning the comprehensiveness of quantitative results provided:

Type 1: FPMM approaches which only publish prices, price indices and/or simple indicators,
Type 2: FPMM approaches which (additionally/exclusively) publish price margins and/or costs and profits along the supply chain, and
Type 3: FPMM approaches which (additionally/exclusively) publish other data such as food expenditures decomposition or use non-standard analysis approaches.

[7] Evaluation characteristic 7 'calculation methods used' is not analysed because it is too heterogeneous for allowing comparisons across FPMM approaches.

Table 13: Types of quantitative results of the FPMMA analysed in detail

FPMMA	Prices	Price indices	Simple indicators	Price margins	Expenditures	Costs/profits	Column count	Type	Other
BE1		X	X				**2**	1	
BE2				X			**1**	2,3	Comprehensive set of indicators on market functioning, among those a price cost margin indicator
BG1	X		X				**2**	1	
BG2					X		**1**	3	
EU1	X		X				**2**	1	
EU2	X		X				**2**	3	% of commodity price change transmitted along supply chain
EU3	X						**1**	1	
EU4	X		X				**2**	1	
FR1					X		**1**	3	Decomposition of total annual food expenditures by value added at each supply chain level
FR2	X			X		X	**3**	2,3	Trade flows
LT1	X		X				**2**	1	
LT2	X		X				**2**	1	
NL	X	X					**2**	1	
ES1	X					X	**2**	2	
ES2	X					X	**2**	2	
US1					X		**1**	3	Decomposition of consumers' food expenditures by supply chain level
US2	X				X		**2**	3	
Column count	**12**	**2**	**7**	**2**	**4**	**3**			

Source: Authors of this study.
Note: The column 'column count' contains the number of how many of the six quantitative results are published by each approach.

These three types reflect varying levels of complexity and of focus of the FPMM approaches assessed. Types 1 and 2 both focus on price monitoring directly, but at differing levels of detail of analysis. Type 1 either publishes only observed or indexed prices and potentially simple indicators. Such simple indicators can be rates of change between current period and period before, current period and same period of the last year or a prognosis of % price change for next month. Type 2 requires a much more comprehensive data gathering, understanding of the institutional supply chain structure and level of disaggregation of analysis than Type 1. Type 3 also does FPMM. However, this monitoring is not directly price oriented, but takes either the perspective of the consumer by focusing on value shares of consumer expenditures or uses some non-standard analysis approaches in order to shed light on the development of food prices and margins.

Table 13 shows details by specifying which approach belongs to which type due to what reason as well as by providing insight into the frequency of six types of

quantitative results. Table 13 shows that most of the FPMM approaches (8 of 17, about 50%) belong to Type 1. Type 3 is the second most frequent type (7 of 17, about 40%), while only four FPMM approaches belong to Type 2 (about 20%). Thus, the most demanding analysis which provides the most insightful quantitative results (Type 2) is only implemented by a minority of approaches namely the Belgian market functioning analysis (BE2), the French cost analysis (FR2) and both Spanish approaches (ES1 and ES2).

Eleven of the 17 FPMM approaches publish observed price data either in time series or in cross-section format. Six of them complement these prices by one or more simple indicators. Four approaches measure or decompose consumer expenditures. Only three of them monitor costs and/or profits along food supply chains and two of them publish explicit price margin data. Thus, prices, price indices are most frequently implemented by the 17 FPMM approaches while more demanding cost/profit analysis or non-standard analyses are only implemented in very few approaches. Explicit price margins are only reported by the Belgian market functioning analysis (BE2) and the French cost analysis (FR2). Costs and profits along food supply chains are explicitly analysed by FR2 and both Spanish approaches (ES1 and ES2). Food expenditures are analysed by the Bulgarian consumer basket (BG2), FR2 and both US approaches analysed (US1 and US2).

Key findings:
Regarding the presentation of monitoring results, there exists a trade-off between insightfulness and comprehensiveness of the monitoring results and the effort to be required for the analysis to produce them: the more comprehensive and insightful results produced from the information contained in the data gathered are supposed to be, the more effort and time is necessary. For example, FPMM approaches publishing quantitative results of Type 1 do not make the effort to estimate margins, costs or profits along food supply chains. Therefore, such results are quickly to produce, but have also substantial overlap in the results they publish with standard CPI monitoring of national statistical agencies which publish very similar data (which potentially differ in product choice or product detail). Therefore, it would be desirable to for FPMM approaches to publish quantitative results of types 2 or 3.

The FPMM approaches fall into two groups concerning the provision of qualitative results. More than half of the FPMM approaches (9 of 17) do not provide qualitative results, while BE1, BE2, EU4, FR2, LT2, NL, ES1 and ES2 provide such results which facilitate the understanding of the FPMM output for non-specialist users. Most of these eight FPMM approaches provide some sort of explicit explanations on the meaning and the interpretation of the quantitative results. The French cost analysis (FR2) is unique

Key findings:
Offering comprehensive and detailed qualitative results which do not only help the (non-specialist) user to interpret the quantitative results correctly and to draw correct conclusions, but also help to understand the institutional structure and complexity of a specific food supply chain is a desirable feature of FPMM approaches. If no qualitative results are added to purely quantitative and numerical results published, users of FPMM approaches may not be able to understand the meaning and implications of the numerical results – in whatever amounts they are provided. Numbers are only capable to measure information which can be counted in some way, while for monitoring (changes in) supply chain structures also an intrinsic understanding of qualitative patterns such as actors involved and their relations is insightful (compare Figure 35 in the Annex).

by providing stylised typical structures of the supply chain analysed including product quantity flow graphs between the various supply chain levels for aggregated product groups. The two Spanish approaches ES1 and ES2 offer the most comprehensive and detailed qualitative results of exemplary quality. The two approaches analyse the supply chain structure for alternative most representative supply chain channels (often traditional vs. modern). They also add comprehensive explanations of the characteristics and functions of each level and characteristics, functions and types of businesses involved, explanations of the production/transformation processes of the specific food commodity analysed and the activities needed for that as well as detailed descriptions of costs incurring along the supply chain and explicit study conclusions.

Characteristics 3 and 4: Prices and monitoring further quantities

Evaluation characteristics 3 and 4 indicate which inputs are used to produce the results evaluated in evaluation characteristics 1 and 2. They assess which exact price levels, e.g., the price a farmer, a processor or a retail shop receives for its output ($p_{out}^{farm}, p_{out}^{processing}, p_{out}^{retail}$, respectively, see Figure 35 in the Annex for details) and which further quantities, e.g., price spreads between which price levels, costs or profits of which supply chain activities, are monitored by each approach. The FPMM approaches assessed group into three types concerning the comprehensiveness of quantitative results provided:

Type 1: FPMM approaches which only monitor price levels,

Type 2: FPMM approaches which (additionally/exclusively) monitor price margins and/or costs and profits along the supply chain, and

Type 3: FPMM approaches which (additionally/exclusively) use other data for producing their published results.

These three types reflect varying focuses and levels of complexity of the approaches assessed. This focus is measured by which price levels are chosen by the FPMM approaches to be monitored and complexity is reflected in the number of prices levels, margins or potentially additional quantities monitored. Therefore, types 2 and 3 require more data gathering efforts than Type 1.

Table 14 shows that 11 of the 17 FPMM approaches (about 2/3) belong to Type 1, while three belong to Type 2 and 6 to Type 3. The types of prices monitored fall into two groups. The price levels p_{out}^{retail}, p_{out}^{farm} and $p_{out}^{processing}$ at the three major supply chain levels are observed by more than half of the FPMM approaches. Price levels for distribution $p_{out}^{distribution}$ or wholesale $p_{out}^{wholesale}$ as well as retail-processing price spreads s_1^p and retail-farm gate margins s_1^{r-farm} are observed by only four FPMM approaches (<25%).

Twelve of the 17 approaches monitor three or less of the prices considered. Only five (ES1, ES2, FR2, LT1 and LT2) monitor at least four. The Spanish approaches, approaches FR2, US1 and EU1, EU2 and EU3 collect also data on further quantities which are not commonly collected by other approaches. These further data are either expenditures, import/export prices or costs and profits along food supply chains. This evidence strongly suggests that most of the approaches assessed have chosen to invest low efforts into FPMM. Price margins, costs and profits of supply chain actors are barely assessed by those FPMM approaches.

Table 14: Prices and price spreads monitored

FPMMA	p_{out}^{farm}	$p_{out}^{processing}$	$p_{out}^{distribution}$	$p_{out}^{pwholesale}$	p_{out}^{retail}	$s_1^p = p_{out}^{retail} - p_{out}^{processing}$	$s_1^{r-farm} = p_{out}^{retail} - p_{out}^{farm}$	Column count	Type	Further quantities monitored
BE1		X			X			2	1	
BE2								0	3	
BG1					X			1	1	
BG2					X			1	1	
EU1	X	X			X			3	1	Import prices
EU2	X	X			X			3	1	Import prices
EU3	X							1	1	Export price
EU4	X	X						2	1	
FR1*								0	3	
FR2	X	X		X	X	X		5	2,3	Trade flows & balances; profits & costs structures along supply chain
LT1	X	X	X		X			4	1	
LT2	X	X	X		X			4	1	
NL	X	X			X			3	1	
ES1	X	X	X	X	X		X	6	2,3	Detailed structure of price formation constituents along the supply chain; costs and profits for each supply chain level; national production; structure and size of subsidies
ES2	X	X	X	X	X		X	6	2,3	Detailed structure of price formation constituents along the supply chain; costs and profits for each supply chain level; national production, marketing, consumption and trade data; structure and size of subsidies
US1								0	3	Consumers' expenditures shares
US2	X				X			2	1	
Column count	11	10	4	3	12	1	2			

Source: Authors of this study.

Note: For the meaning of the symbols, see in the Annex. s_1^p denotes the spread between the output price at retail level and the output price at (the last stage of) processing. s_1^{r-farm} denotes the retail-farm gate price spread.

* The approach FR1 is not based on price information, but rather on input-output tables as it is the macroeconomic decomposition of total national food expenditures. Therefore, this line contains no cross.

Key findings:
Observing or estimating costs, profits and/or margins of supply chain stakeholders are extremely insightful for the purpose of monitoring (changes in) supply chain structures, but currently implemented by only a very small number of FPMM approaches. From observing and reporting only one to three price levels barely any insights into questions of supply chain costs and profits can be gained.

Characteristic 5: Published indicators
Evaluation characteristic 5 summarises which indicators of the quantities monitored by the preceding two evaluation characteristics are calculated and published by the FPMM approaches. An indicator is defined as any calculation based on observed prices or other quantities which goes beyond the mere reporting of these prices/quantities. Examples of such indicators can be a price index, rate of change in comparison with previous month, rate of change in comparison with same month of previous year, maximum price ranges, etc. The FPMM approaches group into two types concerning the comprehensiveness of quantitative results provided:

Type 1: FPMM approaches which only calculate and publish indicators based on single price series (univariate price indicators) or no indicators at all
Type 2: FPMM approaches which (additionally/exclusively) calculate and publish indicators based on more than single price series (multivariate price indicators) or based on quantities other than prices.

These two types reflect varying depth of the monitoring implemented. Therefore, Type 2 requires substantially more data gathering efforts than Type 1, but is also much more insightful for improving the understanding of the distribution of costs and profits along food supply chain actors.

Table 15 indicates that eight approaches belong to Type 1 while 10 approaches belong to Type 2, eight of which publish indicators which are not price changes, price ranges, indices or some kind of margin. These further indicators are either regionalised analyses (BG1), expenditure value shares (BG2, FR1, US1), price transmission percentages (EU2) or price decomposition into costs and profits (FR2, ES1, ES2). Price changes and margins are the most frequently published FPMM indicators while price indices and price ranges are less frequent.

Table 15: Indicators published

FPMMA	Price changes	Price ranges	Indices	Margins	Type	Further indicators published
BE1	X		X		1	
BE2				X	2	
BG1	X	X			1,2	Province(s) with highest price increases/declines of selected commodities, percentage changes at regional and national level in comparison with preceding week, highlighting of positive and negative changes
BG2					2	Expenditure value shares
EU1			X		1	
EU2	X				2	Percentage of commodity price change transmitted along the supply chain
EU3	X				1	
EU4	X				1	
FR1					2	Expenditure value shares
FR2				X	2	Price decomposition into costs and profits
LT1					1	
LT2					1	
NL			X		1	
ES1				X	2	Total costs per supply chain level, shares of value added and cumulated costs along supply chain, profits in percentages, contrasting of total value increase vs. total profits along chain, average price of the production year and its relation to the average prices of previous production years, annual average price trends
ES2				X	2	Total costs per supply chain level, shares of value added and cumulated costs along supply chain, profits in percentages, contrasting of total value increase vs. total profits along chain, annual average price trends, estimates of price spreads and added value shares of separate supply chain levels
US1					2	Expenditure value shares
US2				X	2	
Column count	5	1	3	4		

Source: Authors of this study.

Key findings:
Approaches publishing indicators of Type 2, especially multivariate price indicators allow potentially detailed insight into the distribution of costs, profits and price margins. It is potentially also insightful - if technically feasible – to compare cost and profit estimations generated by multivariate price indicators or by indicators based on quantities other than prices as robustness check of the credibility range of these estimations.
FPMM approaches only publishing Type 1 indicators based on univariate price series or no indicators at all result in the challenge that users of the monitoring themselves need to make sense of the mere price series presented. Such independent data analysis can be barely expected from non-specialist audience. It might lead to misinterpretations or very limited usage of the results. Type 1 indicators are barely capable to improve the understanding of the distribution of margins, costs or profits along food supply chains and their temporal development or differences between MS or EU regions. Simplistic or even absent indicators can therefore restrict the usefulness of the approach substantially and, thus, devaluate in some way the effort and costs spent on data gathering and processing.

Characteristic 6: Reproducibility
Table 16 summarises to what extent the 17 FPMM approaches are straightforwardly reproducible.

Table 16: Reproducibility of approaches

FPMM approach	Raw data available	Methodology sufficiently explained	Exact terminology given	Evaluation	Type
BE1	No	No		No	3
BE2	No			Yes, if raw data available	2
BG1		No	No	No	3
BG2		No	No	No	3
EU1		No		No	3
EU2	No			Yes, if raw data available	2
EU3	No			Yes, if raw data available	2
EU4	No			Yes, if raw data available	2
FR1	No			Yes, if raw data available	2
FR2	No			Yes, if raw data available	2
LT1				Yes	1
LT2				Yes	1
NL		No		No	3
ES1	No			Yes, if raw data available	2
ES2	No			Yes, if raw data available	2
US1		No	No	No	3
US2		No		No	3

Source: Authors of this study.

We assess this aspect for each approach in order to get an indication of whether/how easily it could be applied to some other country-product context. This characteristic assesses whether the calculations are transparently explained on the website, whether the terminology explicitly and exactly explained/defined, that is, whether the meaning of the published information is exactly defined and whether the raw data are available on the website. The FPMM approaches group concerning this characteristic into three types:
Type 1: FPMM approaches which are straightforwardly reproducible,
Type 2: FPMM approaches which were reproducible if the raw data was available, and

Type 3: FPMM approaches which are not reproducible based on the information given on the website.

Only two approaches (LT1 and LT2), two of the least complex ones, are straightforwardly reproducible. Eight FPMM approaches belong to Type 2 and seven to Type 3. Thus 15 of the 17 FPMM approaches cannot be directly reproduced based on the information published on the website of the approach.

Key findings:
Ideally, an monitoring approach should strive for maximum transparency and reproducibility. This would mean concerning this evaluation characteristic that also detailed, exact and explicit information on the terminology, methodology and raw data are given on the website publishing the monitoring results. Although this information will not be helpful for non-specialist audience, it could be of great use for policy makers and specialist users of the monitoring. This would be useful because if would make the enormous heterogeneity of existing FPMM approaches explicit and allow in-detail-comparisons which could ultimately facilitate a general convergence of approaches, e.g., when best practices or insightful indicators are taken over by FPMM institutions in the same or other countries. If raw data or at least an exact and complete description thereof were available, then ten out of the 17 approaches would be reproducible.

Characteristics 8 and 9: Form(at)s of numerical and graphical results
Evaluation characteristics 8 and 9 assess the form(at)s of numerical and graphical results. The form(at)s of numerical results (evaluation characteristic 8) are quite homogenous across the 17 FPMM approaches. Almost all of them present numerical results either in cross-section tables, time series tables or a combination of both. Only the approach EU2 does not provide any numerical results. The approach ES1 illustrates all price & cost data in graphs, approach NL provides downloadable excel tables and approach BE2 adds descriptive statistics to the cross-section tables.

In contrast, form(at)s of graphical results (evaluation characteristic 9) are more diverse. The most frequent and from a data processing point of view one of the most easy illustration to be produced are time series graphs produced by nine of the 17 FPMM approaches. Some of those are interactive which allows users to easily adapt the illustrations to their purposes (NL, US2). If cross-section data are to be illustrated, (stacked) bar graphs are used by six FPMM approaches. Three approaches (BG2, LT1 and LT2) do not provide any graphical illustrations. Besides such standard approaches a number of additional illustrations are implemented (in decreasing order of comprehensiveness):
1.

- Detailed and summarised supply chain structure diagrams with plenty of adequately illustrated numbers for illustrating the exact location of the number along the food supply chain analysed (ES1 and ES2)
- Food Euro for illustrating – similarly to the Food Dollar – the size of expenditures shares in total food expenditures (FR1)
- Tendencies, maps, changes coloured, focus on graphical illustration (EU3)
- 3D graphs (BE2)
- Flow charts for illustrating the structure and importance of connections along supply chains (FR2)
- Pie charts for illustrating shares (FR2, EU3)
- Thumps up & thumps down for indicating tendencies (BG1)

Key findings:
Intuitively understandable illustrations help users to make sense of the monitoring results more easily and the more usable they will be for stakeholders basing business decisions on them etc.. The more monitoring results are intended for a non-specialist audience, the more illustrations should be used for communicating monitoring results and the more intuitively understandable they should be. Approaches such as the EU agricultural markets dashboards (EU3), the Spanish and the French price observatories (ES1, ES2, FR1, FR2) have invested substantial effort in developing multidimensional yet intuitively understandable infographics of exemplary quality facilitating intuitive understanding.
The raw data underlying such graphs should be made available for download. If this is not feasible, data sources should least be cited according to scientific standards as a minimum requirement so that interested users will be enabled to re-create the graphs themselves or to produce adapted versions of them.
Making the numerical results available in well-arranged and well-explained tables (including example interpretations of selected values) is a desirable characteristic of an exemplary FPMM approaches. For the user would either cumulatively updated tables or archives of past tables be useful. If they could be downloaded in MS Excel or any other standard file format (data in pdf format can no straightforwardly be processed), data processing would be facilitated. This would facilitate that the numerical results can easily be used and processed by stakeholders for their own analyses or for education or research purposes.

Characteristic 10: Formats of commented results
The formats of commented results take a variety of intensities and qualities ranging between not existing (BG2, EU1, EU3, LT1) and exemplary comprehensive and detailed explanations of analyses of supply chain structures, comprehensively commented and interpreted quantitative analyses (ES1, ES2, FR1, FR2). Examples are (in decreasing order of comprehensiveness):

- Written interpretations (BE1)
- Texts of one paragraph including summary of main price developments but comments are limited in providing background (LT2)
- Comprehensive, useful & easy to understand interpretations of key results (US1)
- Background info on market situation, supply chain etc. (EU4, NL)
- Interpretation and main conclusions (BE2)
- Commented highlighted changes (BG1)
- Explanatory notes provided at the end of tables (EU2, US2)

While the 17 FPMM approaches do not differ much concerning the formats of numerical results (characteristic 8), they group into two broad types concerning the evaluation characteristics 9 and 10:

Type 1: FPMM approaches which provide limited or no graphical and commented results and

Type 2: FPMM approaches which provide comprehensive, detailed and illustrative graphical and commented results on the supply chain structure helping the user to well understand it.

Table 17 shows that only four of the 17 approaches provide both comprehensive and illustrative graphical results and similarly detailed and insightful comments on quantitative and qualitative results which are the approaches of the French and the Spanish observatories.

Table 17: Approaches grouped by formats of graphical and commented results

FPMM approach	BE 1	BE 2	BG 1	BG 2	EU 1	EU 2	EU 3	EU 4	FR 1	FR 2	LT 1	LT 2	N L	ES 1	ES 2	US 1	US 2
Type	1	1	1	1	1	1	1	1	2	2	1	1	1	2	2	1	1

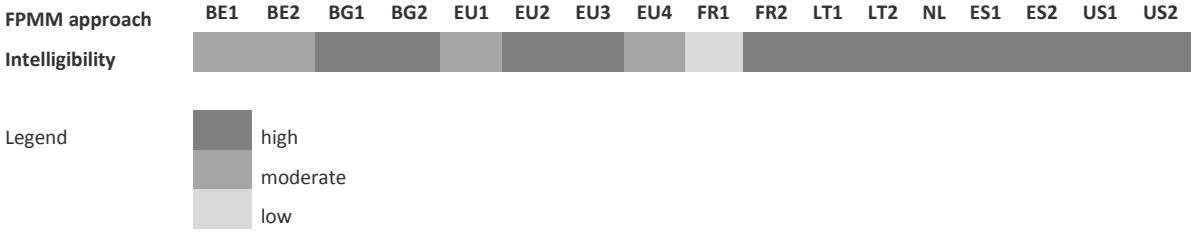
Source: Authors of this study.

Key findings:
Commented results should be an integral part of any FPMM approach. Commented monitoring results should provide example interpretations of numerical results which are presented in tables etc. and elaborate how graphical illustrations need to be interpreted. Sufficiently extensive commenting is of very high value for any non-specialist audience as it will help users to grasp what kinds of conclusions can be drawn and cannot be drawn from the monitoring results. The benefit for the user of the monitoring outputs will be higher if these commented results add institutional or other kinds of background information beyond the quantitative results and connect these with any other relevant qualitative insights. If no or only rudimentary commented results are provided then users may either not be able to make sense of the published information or are likely to draw wrong conclusion.

Characteristic 11: Intelligibility of results

The last characteristic assess as a justified expert rating at the possible levels low, moderate or high to what degree are the published results insightful and intelligible given the purpose of the monitoring. This represents a general assessment of the amount of information and the general insightfulness of the monitoring results published. Table 18 summarises the results visually. Most of the approaches (12 of 17) yield a high level of this characteristic, four result in a moderate level (BE1, BE2, EU1, EU4) and one in a low level (FR1). Approaches which are not classified to the highest level do not supply sufficient information on the underlying calculations impeding straightforward interpretation of indicators. In case of FR1, the high aggregation level of the analysis challenges interpretability as the monitoring considers total annual food expenditures in France including all kinds of food expenditures for all kinds of food products leading to a quite abstract analysis results based on which disaggregated statements for single products or supply chains can hardly be derived.

Table 18: Intelligibility of results



Source: Authors of this study.

Key findings:
Striving for as high as possible general intelligibility of the monitoring results published should be integral part of a well-designed FPMM approach. Intelligibility is, however, not only determined by the quality of graphical illustrations and commented results, but also by the limitation of the amount of information publicly presented. A too high amount of information or a too high level of aggregation of results in time, space and product category may confuse the audience and challenge drawing specific conclusions of practical relevance. Thus, a conscious choice of the sort and amount of information published would be desirable.

2.2.5 Results communication

We assess the quality of the communication of the results because the characteristics of this communication crucially determine to what extent the entire FPMM approach is useful and intelligible to non-specialist users. Therefore, we consider in this category the characteristics of whether the FPMM results are accessible for free for the user, in which language(s) they are communicated, the time lag between the last available analysis results and publication and the two justified export ratings on the intuitiveness of presentation of the results and the knowledge transfer efforts made by the FPMM approach in order to communicate the FPMM results in a way so that they are understandable and useful for non-specialist readers/users.

Key findings:
In the context of the European Single Market, accessibility of monitoring results for each EU citizen is desirable. EU food trade frequently crosses borders and national food market developments in one MS impact market developments in other MS. Communicating monitoring results only in English severely restricts their usability because large parts of the populations of non-native English-speaking MS often lack sufficient language skills. On the other hand, communication in exclusively the national language can lead to substantial differences in information access especially between MS having languages with a low number of speakers or whose languages are not frequently known as foreign language among EU citizens. Consistently implementing the Commission's policy 'to provide visitors with web content either in their own language or in one they can understand, depending on their real needs.' (European Commission, 2018a) for price monitoring is desirable also for national initiatives throughout the EU. Only for very view monitoring approaches, results are currently available in more than the national language. The FPMT is a notable exception as it is available in 23 official EU languages.

The first characteristic assesses whether any users have free access to the results of whether access is restricted by fees. This characteristic is measured by whether access is free or, if not, how much users need to pay to access the results. All 17 FPMM approaches evaluated in detail supply their data for free to potential users. This is a reasonable approach: as the data collection, processing and communication is financed by public funds, the results are shared with all users who speak the respective language which is used for results communication. Language constraints appear therefore to be a more substantial limiting factor for the usage of the FPMM outputs than economic access restrictions. On the other hand, the FPMM approaches are designed to target the domestic stakeholders instead of the EU-wide audience which make this approach comprehensible. The FPMT of Eurostat (that is, FPMM approach EU1 and EU2) are the only approaches reviewed which communicate their entire results in 23 languages. In contrast, the EU agricultural dashboards (EU3) as well as the Milk Market Observatory (EU4) are only available in English.

In addition to access costs and language of results communication, the duration between the data gathering and the results communication – measured in months – determines the usefulness of the FPMM approaches. This duration is however subject to a crucial trade-off between the timeliness of the results published and the degree and extent of data processing possible during this period. For being able to gain insights into effects of recent major market shocks on food prices and margins, one would wish for a duration as short as possible. A short duration, however, also entails that the time for data processing and analysis is short, which limits the extent and the depth to which this analysis can be performed. However, more extensive analysis, which needs more time, offers the possibility of the calculation of more elaborate indicators. If these indicators can therefore only be published a couple of years after the data have been gathered, market conditions can have changed in the meantime so that, e.g., the analysis of the effects of a major market shock which occurred three years ago might no longer be relevant. This means also that indicators for effects of current shocks on prices and margins will only be available after a couple of years.

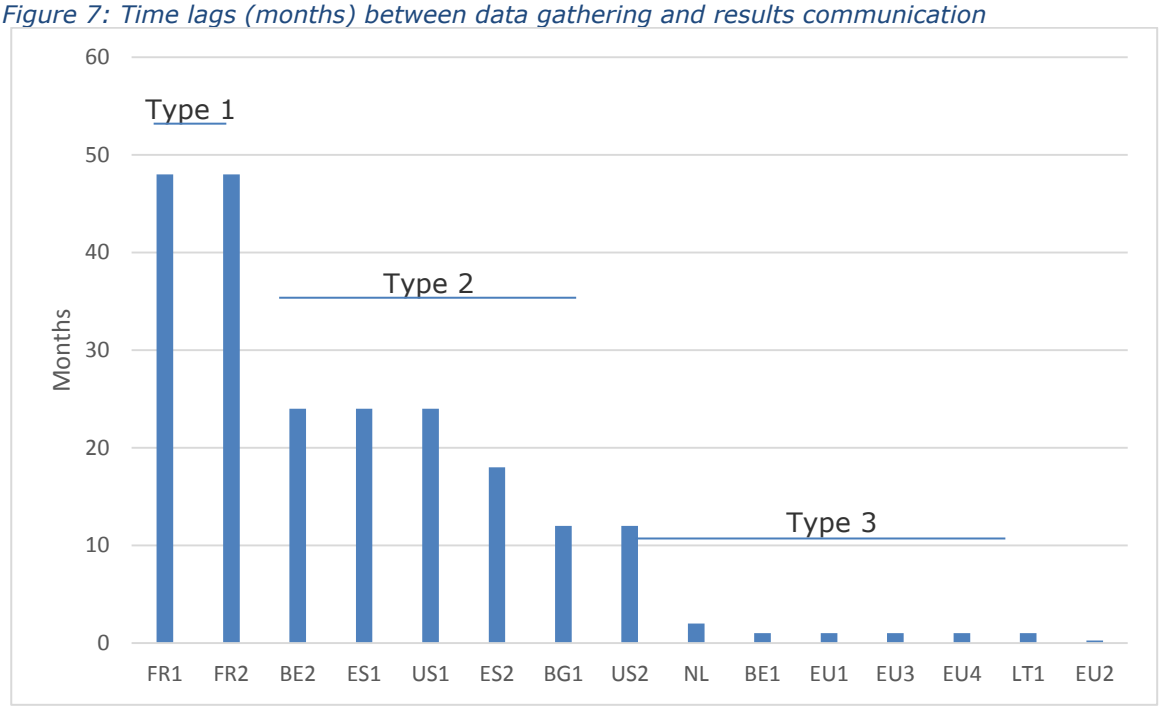
Figure 7 summarises these durations for the 17 FPMM approaches assessed in months on the ordinate. The graph suggests that these approaches can be clustered into three types:

Type 1: FPMM approaches which have a pronounced time lag of more than two years

Type 2: FPMM approaches which have a modest time lag of half a year to two years

Type 3: FPMM approaches which have a short to very short time lag of less than half a year

Figure 7: Time lags (months) between data gathering and results communication



Source: Authors of this study.

Note: For French and Spanish FPMM approaches which possess a time lag range between 36 to 60 months and 12 to 24/36 months, the average time lag of this span has been used in this graph. For LT2 no explicit time lag was reported. As output frequency and time lag of BG2 is not transparent, it cannot be assigned to any of the types.

Type 1 consists only of the two French approaches and is therefore the most rarely applied type, while types 2 and 3 consist of 6 and 8 approaches, respectively. Thus, FPMM approaches with very short time lags are most frequent among the 17 assessed approaches. The typical time lag[8] of Type 1 amounts to 48 months, while it is 21 months for Type 2 and 1 month for Type 3. Hence, although the duration between data gathering and results publication for Type 1 is about twice the duration for Type 2, the difference with the typical results communication time lag of Type 3 is much larger. Hence, the FPMM approaches evaluated cover the main cases as described above: about half of them give timely insight into food prices and margin developments in the short run while the other half of approaches only allows insights with a delay up to 5 years.

Key findings:
There is a trade-off between the timeliness of FPMM outputs communicated to the public and the depth of analysis. Therefore, a political decision is needed which of the two aspects should be considered to be more important. Is the political preference that rather simple analyses (which require often less comprehensive data) are quickly produced in the short run preferred in order to be able to timely assess the effects of market shocks on food prices and margins? This would be a preference for more market emergency analyses. Or should the main interest consist in the monitoring of medium-run and long-run developments of markets? This would mean that single shocks are of less interest, but interest is mainly in average long-run developments. Currently, all FPMM approaches provided by the EU as well as the approaches BE1, BG2, LT1 and NL allow quick and timely insights into price and margin developments.

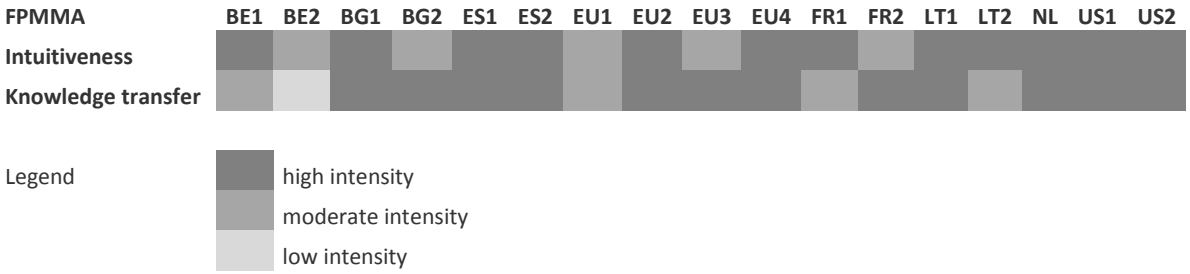
The third and fourth crucial aspects of the communication of FPMM results are the intuitiveness of presentation and the effort invested to transfer knowledge to society, respectively. The effort for knowledge transfer assesses the quality and appropriateness of the visualisations and illustrations of results as well as the clarity and explicitness of insights and conclusions and the usefulness for non-specialist readers. Thus, the intuitiveness of presentation is a crucial aspect of the efforts made for knowledge transfer. The degree of intuitiveness assesses to what extent the results – e.g. in the form of graphical summaries, explanatory texts, enlightening examples/case studies, the extent and usefulness of infographics or other clarifying resources – are intuitively understandable to the non-specialist user. Both characteristics are categorised as being either of low, moderate or high intensity by a justified expert rating.

These aspects of results communication are very important because public FPMM approaches are set up – financed by tax funding – precisely due to the transfer of knowledge regarding the structure and development of food prices and margins to societal stakeholders. Thus, easily and intuitively understandable outputs will be used more frequently by a higher number of stakeholders. Thus, the usefulness and therefore the value of the FPMM output for society increases with the knowledge transfer efforts made and the intuitiveness of results communication. Consequently, FPMM approaches should ideally sufficiently invest effort into knowledge transfer otherwise their outputs will be at a too technical level and therefore barely useful for non-specialist users. An intuitive and easily understandable presentation of FPMM results would be desirable as an FPMM approach is typically intended to be beneficial for as many stakeholders, that is, to create as much benefit for society as possible.

[8] As measured by the median duration.

Figure 8 illustrates the intensities of the knowledge transfer efforts invested in general and the intuitiveness of results communication in particular. Most of the FPMMA assessed - 12 of the 17 FPMMA - invest high efforts into the knowledge transfer and into the preparation of intuitive results. The assessed FPMMA of Spain, the US and the Netherlands have the highest scores for both characteristics. Evidence is mixed for the Bulgarian, French, Lithuanian and the EU approaches as they are partly rates as 'high' and partly as 'moderate'. The Belgian approaches turn out to have the most diverse qualities regarding these two characteristics ranging from low to high. The approach BE2 is rated as having a low knowledge transfer intensity because its usefulness to non-specialists is very limited due to high challenging technical level of presentation.

Figure 8: Intensity of knowledge transfer and intuitiveness of results communication



Source: Authors of this study.

The intuitiveness of some of these approaches was rated as 'moderate' because:

- information density of the results presentation is high (multi-dimensional graphs), thus, interpretation might be too complex for non-specialists and the underlying calculation and hence interpretation of indicators is not straightforward (BE2),
- they only presented results in the form of rather large tables (BG2),
- they only contained graphical summaries without additional explanatory texts helping users to make sense of the results and to understand them correctly (EU1, EU3) and
- conclusions about the structure of specific single food product supply chains are not straightforward although well-designed and insightful graphs are used for results communication, but product-specific insights are difficult to obtain because the results are produced at aggregated product category level (FR2).

The knowledge transfer efforts of some of these approaches were rated as not belonging to the highest category because:

- usefulness to non-specialist readers is limited (BE2),
- non-specialist readers may find the results communicated hard to understand and overwhelming due to the technical level although graphs are beneficial for the visualisation of results, commented interpretations are clear, provide some insights beyond the quantitative data in the tables and graphs (BE1),
- the main message is clear from title of website but developments are not expanded upon and no additional interpretation is provided (LT2),
- because detailed interpretations lacking although combination of numerical results with adequately designed graphical illustrations (FR1) and
- the not clear how the base for the index presented is calculated (EU1).

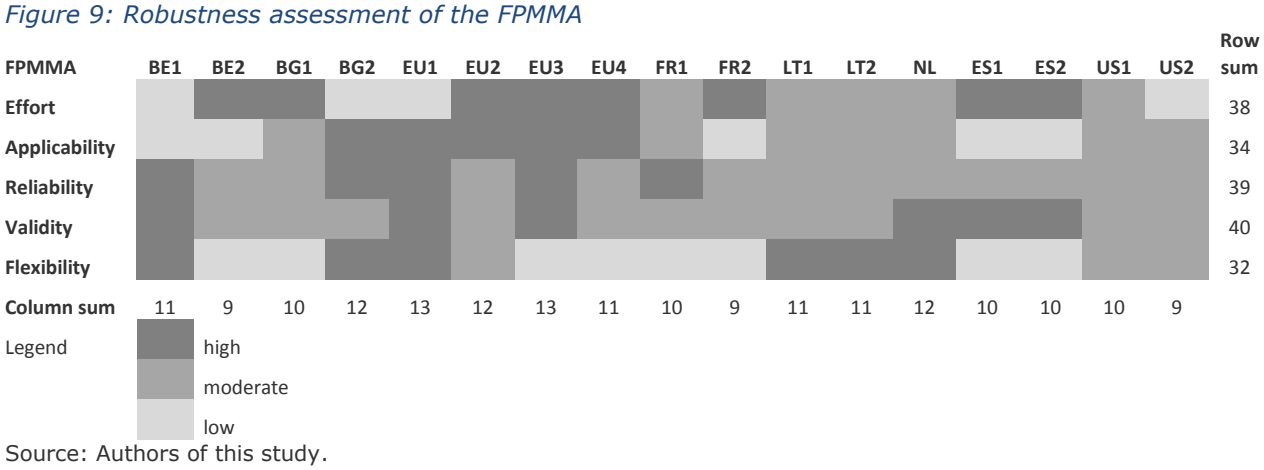
2.2.6 Robustness assessment

The last category of evaluation characteristics is the assessment of the robustness of the evaluated FPMMA. This category consists of five justified expert ratings by three of the authors of this report of the levels low, moderate or high on the following aspects:

- Effort: What effort needs to be invested for implementing the FPMMA?
- Applicability: To what extent is the FPMMA applicable to other sectors and periods?
- Reliability: Does the approach produce reliable (and complete) results? Important aspects are the amount, completeness and quality requirements of data, representativeness of data sources or extent of data gathering.
- Validity: Does the approach constitute a valid measurement of what it intends to measure?
- Flexibility: To what extent is the FPMMA flexible for application at EU or MS level? Important aspects are the topical focus, reaction time/time lags of data gathering and results publication – last visible output on website.

Figure 9 summarises the evaluations of all FPMMA for all five aspects. There are only four approaches (BE1, BG2, EU1, EU3) which score 'high' for at least three of the five aspects. Most of the approaches score 'low' for at least one characteristic. The approaches EU1 and EU3 have the highest aggregated score while BE2, FR2 and US2 score lowest for general robustness. The characteristics 'validity', 'reliability' and 'effort' follow closely on each other having the highest aggregate scores across all FPMMA. Applicability and flexibility are scored lowest in general.

Figure 9: Robustness assessment of the FPMMA



Source: Authors of this study.

Note: Each colour depicts one of the three levels high, moderate or low. For example, the intersection of the column for approach BE2 and the line for applicability is shaded in light grey. Therefore, the applicability of BE2 is low, while, e.g., the reliability of BE2 has been categorised as moderate (the row beneath in the same column).

For creating the number in the column sum and the row sum each level 'high, 'moderate' and 'low' was assigned the value 3, 2 and 1, respectively. The maximum (minimum) column sum is 15 (5). The line 'column sum' gives thus an indication about the aggregate position of each FPMMA vis-a-vis the other 16 approaches. The column 'row sum' indicates which of the five characteristics scores highest among all 17 FPMMA.

2.3 Typology of Food Price and Margin Monitoring Approaches

For constructing the typology (step IIa mentioned in Table 62 in the Annex), eight typology criteria have been selected from the 37 evaluation characteristics contained in the FPMM factsheets (see Table 61 and Table 63 for the overview of these criteria).

Table 19 contains these eight criteria used to classify the 17 approaches into the typology classes. This table also shows the evaluation categories they belong to as well as the optimal type of each criterion.[9] These 'optimal types' are selected based on the insights gained from the comparative analysis in Section 2.2 Detailed characterisation of selected approaches and the intention of this analysis. They are used for classifying the 17 FPMM approaches and for characterising each typology class.

Table 19: Optimal types of the typology criteria

Category	**Optimal criterion type** (as used in Table 20)	**Explanation of optimal criterion type**
Institutional context	Graphical results and data available (output format: Which technical output formats are used?)	Providing the monitoring results in pdf format OR interactive graphs AND exportable data files thereby combining information with interpretations of results or accessible information in a graphical form with data availability for interested users.
Monitoring focus	>2 supply chain levels monitored (Supply chain levels monitored: Which supply chain levels are monitored?)	Monitoring at least three supply chain levels: farm, processing, and retail thereby providing insight into these supply chain levels by monitoring prices across all of them.
Data inputs	Using panel data (Quantitative data inputs: Which types of quantitative data is the FPMMA based upon?)	Using panel data for the analysis which is the optimal combination for being able to assess temporal changes as well as cross-section structures.
	Raw data available (Transparency of (raw) data: Are the raw data and numerical outputs made completely publicly available?)	Making the raw data publicly available to the user which makes the monitoring transparent.
Monitoring results	Price margins and/or costs and profits monitored (Quantitative results: Which types of quantitative results does the FPMMA publish?)	Publishing price margins and/or costs and profits along the supply chain either additionally to prices, price indices and/or simple indicators or exclusively being focused on that.
	Indicators based on more than single price series (Indicators: Which indicators are calculated and published?)	Calculating and publishing indicators based on more than a single price series (multivariate price indicators) or based on quantities other than prices.
	Illustrative graphical and commented results (Formats of graphical & commented results: What formats have the graphical results & commented qualitative analyses published?)	Providing comprehensive, detailed, qualitative and illustrative graphical and commented results on the supply chain structure helping the user to well understand it.
Results communication	Time lag < 6 months (Time lag: How much times passes approximately between the data gathering and the results publishing?)	Having a short to very short time lag of less than half a year between data gathering and monitoring results publication.

Source: Authors of this study.

[9] The methodology based upon which the typology is constructed is explained in Table 62.

Table 20 contains the typology of the 17 FPMM approaches which have been assessed in detail. It contains three classes which the existing monitoring approaches have been classified into as well as one class of a hypothetical optimal approach. Class 1, Class 2 and Class 3 are created by identifying which of the 17 observed approaches are most similar and classifying them into one class. Table 20 summarises each of the three typology classes and characterises each in terms of its typical class characteristics most of the approaches belonging to it fulfil as well as mentions which FPMM approaches belong to it. The most frequent advantages and disadvantages of each class are summarised in the next section.

Table 20: Typology of FPMM approaches

Typology class	Typology criteria	Class 1	Class 2	Class 3	Class 4
Most outstanding characteristics of class (that is, belonging to the optimal types of the indicated typology criteria)	Graphical results and exportable data				X
	>2 supply chain levels monitored			X	X
	Using panel data			X	X
	Raw data available			X	X
	Price margins and/or costs and profits monitored			X	X
	Indicators based on more than single price series	X	X	X	X
	Illustrative graphical and commented results			X	X
	Time lag < 6 months		X		X
Number of FPMM approaches belonging to class		6	5	6	
FPMM Approach belonging to class		BE1, BG1, BG2, EU3, LT2, US1	BE2, EU2, EU4, LT1, US2	EU1, FR1, FR2, NL, ES1, ES2	Hypothetical FPMM approach

Source: Authors of this study.
Note: All background information about the steps taken to produce this typology in a transparent, reproducible and systematic fashion and the decision rules it is based upon are outlined in detail in AI.3 Methodology of Section 2.3, especially step IIIc in Table 62 and the explanation of the methodology thereafter in the Annex. An 'X' at the intersection of a column and a row indicates that the *majority of approaches* (i.e. at least 50%) belonging to that class *show this optimal characteristic* as commented on in Table 19. Therefore a cross indicates that a given typology characteristic *is typical* for a certain class. For details see step IIIc in Table 62 and the explanation of the methodology thereafter in the Annex. For details, see the example interpretation in Annex AI.3 Methodology of Section 2.3.

Table 20 shows that the FPMM approach which is deemed to be optimal with respect to the chosen typology (Class 4) satisfies all eight optimal typology criteria mentioned in Table 19, while the Class 3 approaches satisfy six, the Class 2 approaches satisfy two and Class 1 approaches satisfy one optimal criterion.

This typology suggests that the optimal (hypothetical) food price and margin monitoring approach Class 4 is characterised by:

1. It provides its monitoring results in pdf format OR interactive graphs AND also makes exportable data available to the user,
2. It monitors at least all three supply chain levels (farm, processing and retail),
3. It uses panel data for analysis,
4. It makes the raw data used for the calculations publicly available,
5. It publishes information about price margins, costs and profits along the supply chain additionally to prices and simple indicators,
6. it publishes multivariate price indicators or indicators based on quantities other than prices alone,
7. it provides comprehensive, detailed and illustrative graphical and commented results on the supply chain structure and, lastly,
8. It has a time lag of less than half a year until monitoring results are published.

The six actually existing Class 3 approaches satisfy most of these optimal characteristics of Class 4, but they typically differ from the optimal monitoring approach by:

- Not providing the optimal output format (which is monitoring results in pdf format OR interactive graphs AND exportable data) and
- Not ensuring publication of monitoring results within the optimal time lag (which is less than half a year).

The five approaches belonging to Class 2 differ in their typical characteristics much stronger from the optimal approach of Class 4. Instead of all eight, they satisfy only the following two optimal characteristics:

- Publishing multivariate price indicators or indicators based on quantities other than prices and
- Having an optimal time lag of less than half a year until results publication.

Lastly, the six approaches which belong to Class 1 show typically only one of the eight optimal characteristics by publishing multivariate price indicators or indicators based on quantities other than prices.

2.4 Advantages and disadvantages of the typology classes

In this section, we attempt to find patterns among the most important advantages and disadvantages of each of the three identified typology classes. The patterns outlined below are exclusively based on the collection & systematisation of the three largest advantages and three largest disadvantages of all FPMM approaches belonging to a class as reported at the end of the factsheet tables contained in Annex II: Food Price and Margin Monitoring Factsheets. The advantages and disadvantages explicitly mentioned below in alphabetical order, thus, originate from the factsheets and are literally contained in the cells of each factsheet labelled 'Largest advantages' and 'Largest advantages', respectively.

These advantages and disadvantages, therefore, reflect the most representative advantages and disadvantages of each typology class. In a similar way as the optimal typology criteria mentioned in Table 20, they need to be considered to be typical advantages or disadvantages, but are not necessarily valid for every approach belonging to a class. That is, not each of them applies to all approaches belonging to one class. On the contrary, single advantages and disadvantages often apply to one or

a few approaches. However, they often refer to similar categories of advantages and disadvantages which are considered to be typical advantages or disadvantages of the class if sufficiently often reported across all approaches belonging to one class.

2.4.1 Typology Class 1 (BE1, BG1, BG2, EU3, LT2, US1)

Advantages

The **most frequently mentioned advantage** of this class of approaches is the **clarity of presentation of results/ease of understanding**. Most of the approaches in Class 1 present this limited information in a clear and intuitive graphical form, often with concise clarifying commented interpretation. Parts of or all presented values tend to be interpreted which facilitates users' understanding. The main messages to be conveyed by these approaches is mostly immediately clear to interested parties. In particular, the following examples belong to this advantage:

- Direct comparison across regions easily possible,
- Easy to understand,
- Interpretations of the values provided,
- Intuitiveness and
- Main message on recent market developments is immediately clear to interested parties.

The second set of commonly reported advantages of these approaches is their **limited scope of the monitoring** they conduct. This limited scope facilitates the understanding of monitoring results by non-specialists avoid that users are overwhelmed by the comprehensiveness of results:

- Reduction of analysis scope by highlighting only selected products and regions,
- Small and intuitively understandable amount of information and
- Short summary briefs.

The third distinguishing feature of Class1 is their **replicability, high reliability, and validity**. Two of these approaches have the major advantage that they are **updated frequently**/at a weekly basis. Other advantages (occurring twice within the class) relate to the **ease of applying the monitoring methodology**:

- Flexible approach as implementable with low effort and
- Standard methodology.

Two of the approaches belonging to that class have **comprehensiveness** and wealth of information as major advantage.

Disadvantages

The **most frequently mentioned disadvantage** of Class 1 approaches refers to their **limited monitoring coverage** or **high level of aggregation** in time, space and supply chain detail. Several of them show actually major gaps in supply chain monitoring as their most outstanding disadvantage:

- Aggregated results at the US level,
- Consumption differences between provinces and wealth groups not considered,
- Incompleteness of results (selection of a few commodities and regions),
- Information aggregated at the EU level but not provided by Member States,
- Insights into market functioning/supply chain limited and

- Only price changes at short-run assessed (from week to week), but no information of longer-run price trends.

The two disadvantages which are pointed out four times each refer to the **low level of transparency and reproducability** of Class 1 approaches:

- Difficult to retrieve the background data from figures,
- Not clear how the EU aggregated prices/indices calculated,
- Raw data are not presented and
- Transparency of raw data not given, and

their often **limit efforts for results communication**:

- Focus on quantitative information,
- Illustration via graphics could be improved, e.g., maps for regionalised monitoring,
- Only numbers without further explanations of graphical illustrations as well as
- Reports targeted at specialist readers (because little background and insights beyond the quantitative information is provided).

Major disadvantages only occassionally mentioned refer to **substantial data requirements**:

- Extensive raw data collection and
- Quality of the entries depends highly on the raw data collection, as well as a substantial time lag between data gathering and results publication
- Annual updates might be too long for some sensitive commodities and
- Two-year delay in the published data.

2.4.2 Typology Class 2 (BE2, EU2, EU4, LT1, US2)

Advantages

Class 2 shares with Class 1 the advantages of **clarity of results presentation/ease of understanding** which is also its most frequently mentioned advantage**:**

- Clear graphical representations,
- Clear presentation,
- Concise, clarifying commented interpretation,
- Easy to understand,
- Intuitiveness as well as
- Provision of examples how to interpret the values, furthermore

frequent updating:

- Practically no time lags so price data series are up-to-date and
- Updated frequently and finally

comprehensiveness of information:

- Comprehensive and
- Wealth of information.

Replicability, high reliability, and validity have not explicitly been mentioned as most outstanding advantages of these approaches which does not mean that they do not fulfil these conditions. It means that other advantages of these approaches have been regarded to be more worth to be pointed out.

The second major advantages of Class 1, namely limited scope of the monitoring, is not existing among approaches belonging to Class 2. On the contrary, the Class 2 approaches distinguish themselves in terms of **coverage and richness of monitoring results** published which partly is accompanied by methodological transparency:

- Consistent approach across all EU MS,
- Detailed price data,
- Different supply chain segments are covered,
- Methodology for price cost margin indicator is clearly elaborated and
- Wide range of products (of different level of processing) covered.

Disadvantages

The **most frequent disadvantage** of Class 2 approaches is their **low level of transparency and reproducibility** which is more frequently mentioned than for Class 1 approaches:

- Clear (and easy to find) definition of the price indices missing,
- Difficult to retrieve the background data from figures,
- Methodology for data gathering and averaging cannot be assessed,
- No details provided how the aggregation to the US level is done and
- Not clear how the EU aggregated prices/indices calculated.

The second main disadvantage is their **limited monitoring coverage** or **high level of aggregation** which is less frequently mentioned than for Class 1 approaches but very similar in qualitative terms:

- Aggregated results at the US level,
- Information aggregated at the EU level but not provided by Member States,
- Only a few commodities covered and
- Results are not provided per sector but only for sectors with problematic market functioning.

Major disadvantages only occassionally mentioned refer – as for Class 1 approaches - to **substantial data requierements**:

- Annual updates might be too long for some sensitive commodities,
- Time lag in reporting as well as a substantial time lag between data gathering and results publication
- Data-intensive and
- substantial primary data gathering necessary.

Another difference with Class 1 approaches is that limited efforts for results communication ('No interpretation or background provided to the numerical information') is only mentioned once (four times for Class 1 approaches). The completeness of monitoring is mentioned once ('data for many MS missing').

2.4.3 Typology Class 3 (EU1, FR1, FR2, NL, ES1, ES2)

Advantages

The major advantages of the approaches belonging to Class 3 differ starkly from the ones of Class 1 and Class 2. Their most frequently mentioned advantage is their comprehensiveness, detail and insightfulness of price and margin monitoring along food supply chains which clearly distinguishes them from the approaches belonging to Class 1 and Class 2:

- Insightful combination of price, cost and profit ranges with temporal price development,
- Insightfulness of the channel-based supply chain structure analysis,
- Insightfulness of the supply chain structure analysis,
- Macro-economic indicator of the role of agriculture relative to other sectors,
- Partly also development of supply chain and consumption analysed and
- Price information provided for different supply chain levels.

They share with Class 1 and Class 2 approaches the advantage of clarity of results presentation/ease of understanding. However, as discernible from the following list the clarity of results presentation of Class 3 approaches is at a more elaborate level and the ease of understanding they provide is of exemplary quality:

- Concise provision of additional background for interpretation,
- Easily intelligible summary and illustration of complex economic relationships (mentioned for two approaches),
- Exemplary results communication in terms of intuitive illustration, commenting interpretation and transparency of methods and sources,
- Intuitive representation of price information, and
- Limited amount of analysis output which can be intelligibly illustrated (Food€).

The third most outstanding advantage of Class 3 approaches refers to the data inputs they use for the monitoring:

- Monitoring not only based on price data, but also on I-O data and
- No extra data gathering needed due to dependency on secondary data.

Class 3 approaches share with Class 2 approaches the advantage of coverage and richness of monitoring results which is related with their detailed coverage of food supply chains:

- Consistent approach across all EU MS,
- Scope of the analysis: extremely comprehensive and detailed estimation of prices, costs and profits and
- Wide range of commodities covered.

One of the approaches belonging to this class is, as several of the Class 1 and Class 2, characterised by 'Timely information due to monthly publication'.

Disadvantages

The most widely spread disadvantage across Class 3 approaches is the limited monitoring coverage and completeness in terms of commodity range as well as temporal coverage (more frequently than for Class 2 approaches):

- For many commodities at most two study updates published,
- For several commodities no analyses available for last 5 years or more (mentioned for two approaches),

- Limited set of specific food products covered due to the large effort needed for the analysis,
- Only two or three study updates published for each commodity and
- Very limited set of specific food supply chains covered.

Also more frequently than for Class 2 approaches is the high level of aggregation appearing:

- Extremely high level of aggregation only allowing very abstract statements,
- Only rough estimation of value shares in total national annual food expenditure,
- High level of aggregation and abstractness of results: only average results for product groups available which raises the question how the results can be translated/extrapolated for specific product supply chains and
- Price information across supply chain segments is limited to price indices.

Transparency and reproducibility appears to be only the third most important disadvantages of Class 3:

- Not clear immediately which year is the base for the indices,
- Not clear whether the percentage change measures the relative change in index or price and
- Methodology for calculation of price indices is not explained.

Most outstanding disadvantages only occassionally mentioned refer – as for Class 2 approaches - to substantial data requirements. Calculation of price indices at different supply chain levels is data intensive. A substantial time lag – sometimes over three years - between data gathering and results publication is often occuring.

Inconsistencies of indicators ('for some commodities the annual percentage does not cover the same period as the indices') is only a major disadvantage for one of the approaches belonging to Class 3.

2.5 Ranking of approaches based on cost-efficiency

2.5.1 Costs of existing approaches

The cost-efficiency assessment is based on the information collected in interviews and the country/approach sheets which have been drafted by the research team and validated and corrected by the representatives of the various price and margin monitoring initiatives.

For this cost assessment we were able to use information on the costs of 9 different monitoring approaches and/or organisations, from 5 different monitoring entities (statistical offices, Ministries, Directorate Generals, Observatories, and (public) price research companies). For some of the other entities only partial information was obtained or respondents were unable to give information on the costs. We could only obtain information on costs and labour input for a limited number of approaches. These approaches are BE1, BE2, EU1, EU2, EU3, EU4, FR1, FR2, NL. In addition we obtained information on the total costs and/or labour input of the organisation for Bulgaria and Lithuania, and estimates of total costs for the US monitoring approaches. The latter were not used in the calculations because the respondents indicated that a full cost calculation was not available. Judging from the estimates about the number of people working on the approaches, however, it seems that including the estimates for the US approaches would not fundamentally alter the results. For Spain, a similar situation was reported by the price monitoring entity. Recent and ongoing changes to

the approaches caused changes in costs and respondents were not yet able to give accurate estimates of these costs. However, earlier studies of Oosterkamp et al. (2013) sketch a picture about the costs of price and margin monitoring in Spain and judging from those estimates, here too, we find that they are in line with the findings in the current report.

Through the questionnaire and the interviews, available information was collected on the total costs of the price and margin monitoring initiatives, as well as specific costs incurred to produce the output of the specific monitoring approaches. Besides costs, the number of staff in annual full-time equivalent employment (FTE per year) was inquired.

Differences in average labour costs between countries may influence the total costs of the approaches. For estimating the costs associated with a certain amount of labour input we used data from Eurostat on the labour costs per hour, the average FTE hours per week in 'Professional, scientific and technical activities' from Eurostat Labour cost levels by NACE Rev. 2 activity [lc_lci_lev], and the minimum number of total paid leave days per year per country. Note that a large share of the costs of these organisations consists of non-labour costs. In the period 2012-2015, on average only about 32% of the costs (defined here as turnover minus gross operating surplus) of the sector 'Professional, scientific and technical activities', were labour costs.

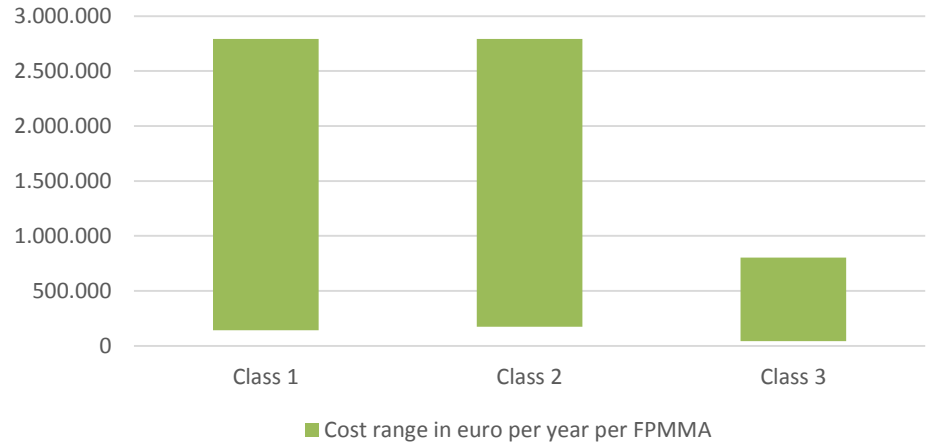
In the results presented below, the ranges of costs per approach in euros per year are given. The costs will obviously depend on wage rates and costs of buildings and equipment, which differ per country. If we have only countries with low labour costs this might decrease calculated averages. However, for the approaches that actually provided specific cost information about the approach, labour costs are not very different. Therefore, we did not adjust or weight for differences in labour costs.

Figure 10 illustrates the cost ranges of the various approaches as classified into the three classes. When we just present the information as obtained in the interviews it seems as if the simplest type of monitoring is actually the most costly. However, the costs greatly depend on the scope of the monitoring. The three classes are not easily comparable as they are composed of quite different monitoring approaches in terms of scope; e.g. numbers of products, supply chain stages and geographical areas covered.

Class 2 includes the EU Market Observatories (Milk, Meat, Sugar, Crops) which involve about 2FTE per dashboard and hence are estimated to cost a lot more in total than most other approaches. Class 1 includes the 15 EU dashboard which have a lot of data combined, among others from the observatories and other EU sources.[10] The costs of these dashboards are similar to those of the observatories, but there are 15 dashboards and just 4 observatories. The costs of the dashboards for the four sectors that have a separate Observatory are not included in the cost estimate for the dashboards as most of the data gathering and processing is covered by the observatories. The EU FPMT (prices along the food supply chain) is classified as Class 3, but is using data that is already available for a limited number of products, and publishes less data in general than the dashboards, and hence costs a lot less. The EU approaches are inherently more costly than purely national initiatives as they deal with 28 MS instead of just one.

[10] See https://ec.europa.eu/agriculture/dashboards_en for an overview of sectors

Figure 10: Cost ranges observed for each typology class, in euros per year



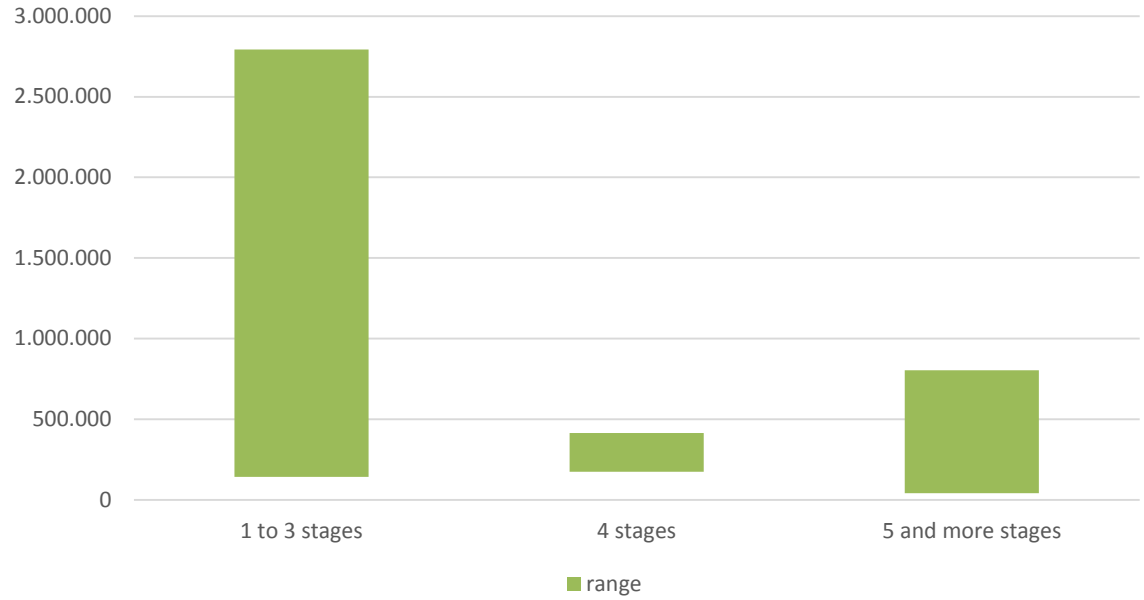
Source: Authors of this study. N=9.
Note: The lower (upper) border of each green bar indicates the minimum (maximum) total cost observed for an FPMM approach belonging to the respective class. Including labour costs and overhead, but excluding costs of collecting data that is already collected by national statistics offices and similar institutions.

If the EU approaches are excluded the Class 3 approaches are generally more expensive than the Class 1 and Class 2 approaches combined. It must however be noted that the number of observations, especially for Class 1 and 2 is limited. Separate figures for Class 1 and Class 2 cannot be given in the charts, due to the limited number of observations. However, a qualitative assessment of the available data shows that Class 2 approaches generally cost a little bit more than Class 1 approaches. This result depends however on the scope of the monitoring and differences in e.g. wage rates between countries.

To shed a little bit more light on the costs of price and margin monitoring, we take a look at the relation between the scope of the monitoring and the costs. Note, again, that we have only limited information to base our cost estimates upon. Results should be interpreted with some caution.

The costs generally tend to increase with the number of supply chain stages monitored. However, the differences depend on the amount of data that is already collected and particularly on the type of monitoring involved, i.e. whether or not costs and margins are also monitored. Also, the scope of the monitoring in terms of sector and supply chain stages covered has a large impact on the total costs. Therefore, in Figure 11, the average costs involved in monitoring 1 to 3 supply chain stages is greatly influenced by the inclusion of the EU market observatories and dashboards which are in this category. If the EU wide monitors are excluded from Figure 11 all of the remaining monitor approaches for which we were able to collect cost information have either 3 or 5 stages of the supply chain. The ones with more supply chain stages cost 430,000 euros on average, as opposed to about 150,000 euros for the ones with just 3 supply chain stages.

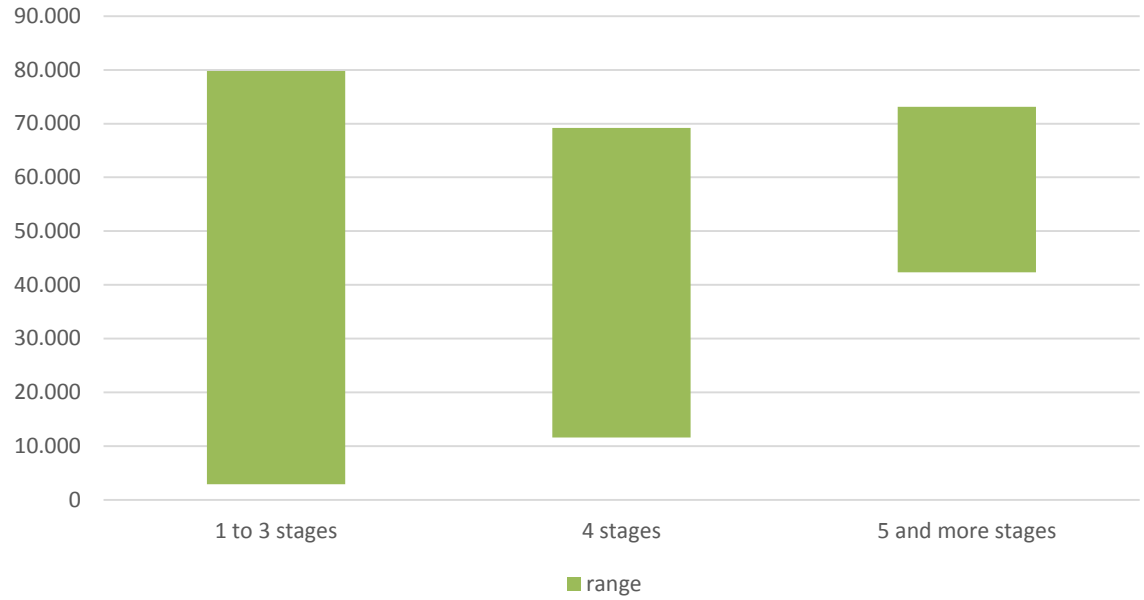
Figure 11: Cost ranges per number of stages monitored, euros per year



Source: Authors of this study. N=9.
Note: Including labour costs and overhead, but excluding costs of collecting data that is already collected by national statistics offices and similar institutions.

In Figure 12 cost ranges are shown per product, product group or sector monitored, for three different ranges of supply chain stages included, and including the EU monitors. For 1 to 3 and for 4 supply chain stages monitored, the average costs per product (or sector depending on the type of monitoring) per year are estimated at 30,000 and 40,000 euros, and for 5 and more stages the average costs were almost 60,000 euros. Although the number of observations is small, the data suggest that increasing the number of supply chain stages monitored does increase the costs.

Figure 12: Costs per product (group) and number of stages, in euros per year

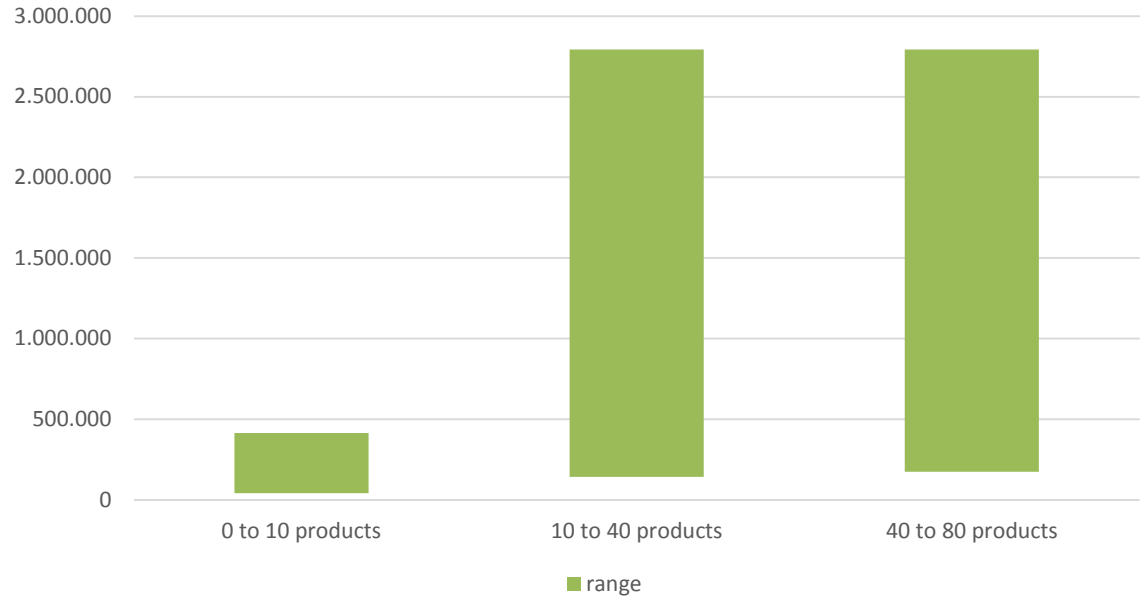


Source: Authors of this study. N=9.
Note: Including labour costs and overhead, but excluding costs of collecting data that is already collected by national statistics offices and similar institutions.

In addition to the EU monitoring (dashboards and market observatories), the most expensive form of monitoring approach for which we were able to collect cost estimates, involves monitoring costs and margins in no less than 5 different supply chain stages for about 10 different products (or sectors). Increasing the number of products beyond that would further increase the costs. In Figure 13 the costs are shown for the various approaches depending on the number of products (or sectors) covered. Each product (group) or sector is counted separately if separate data series or analyses are produced for the item. The median approach has about 10 different products in the monitoring.

A clear relationship is observed between the scope of the monitoring in terms of products covered and the costs, although also here the variation in the costs is very large. Although not shown in Figure 13, average costs were significantly higher for the approaches with 40 to 80 products, than for the approaches with 10 to 40 products. The most expensive approaches involve more than 50 different products, and their estimated annual costs range up to 2.8m euros per year. The amount of primary data collection (or equivalently the lack of already available data) is causing a lot of these differences), as well as the number of indicators, and the inclusion of costs and margins besides price data. Note that most monitoring organisations (or observatories) are executing more than one of the approaches, and hence total costs of the observatories are higher.

Figure 13: Cost ranges per number of products monitored, euros per year



Source: Authors of this study. N=9.
Note: Including labour costs and overhead, but excluding costs of collecting data that is already collected by national statistics offices and similar institutions.

2.5.2 Cost structure of existing initiatives

In the interviews, we collected as much as possible detailed information on the costs and labour input involved in the organisation as well as the specific approaches. As much as possible, costs and labour input (full time jobs, FTE) and other costs were further split into:

- costs of buying data
- costs and FTE of primary data gathering
- costs and FTE of data processing/modelling/data analysing/reporting personnel
- costs and FTE of support/overhead personnel
- other costs

In most cases, the representatives were however unable to provide detailed information on costs and/or the number of staff involved in specific activities such as data gathering or data processing. In only three cases (Bulgaria, Lithuania, the Netherlands) we were able to collect accurate data on both costs and FTE (per year) for the entire monitoring organisation, including costs of overhead. For individual approaches, only two organisations were able to provide detailed information on total costs and/or FTE involved in various activities like primary data gathering and reporting. For most of the other organisations and approaches the interviews only yielded information on FTE involved, and in some cases, a separate estimate of the overhead costs or FTE involved. For Spain and the US we were unable to collect any information on the costs.

For those approaches or monitoring organisations that only provided information on the number of staff involved, we estimated the costs of personnel on the basis of country specific labour costs per hour of 'Professional, scientific and technical activities' (from Eurostat; Labour cost levels by NACE Rev. 2 activity [lc_lci_lev]),

average FTE working hours per week and total number of paid leave days. Overhead costs were estimated using country specific information on the personnel costs in total turnover minus gross operating surplus (from Eurostat; Annual detailed enterprise statistics for services (NACE Rev. 2 H-N and S95) [sbs_na_1a_se_r2]). Total costs were estimated as the difference between turnover and gross operating surplus for the sector M - Professional, scientific and technical activities. In this way we were able to estimate the shares of the costs of labour and other costs (purchases of goods and services, which are in this sector mostly indirect costs like rent for buildings, computers, paper, et cetera) for 10 of the organisations, either from the cost structure of the entire monitoring organisation or from the cost structure of the specific approaches.

The costs of collecting data turns out to be a challenging part of the costs assessment. In most cases, the public monitoring authorities make use of already existing data collection (e.g. in the context of consumer price indices and inflation monitoring, or in the context of collecting farm gate prices, or farm costs and incomes in FADN). In all except for a few cases the organisations indicate that they receive necessary data for the approach for free from the statistical offices and have no idea on the costs of collecting data (see Table 21).

Table 21: Data collection costs of observatories per supply chain stage

	Sources	Farm prices	Wholesale/processing prices	Retail prices
BE	Mostly collected by Statistics Belgium; some purchased data on consumer prices in several countries, some data purchased on company financials	Free	Free; some data bought (10,000 euros estimate)	Free; some data bought (50,000 euros estimate)
BG	Mostly collected by public company SAPI and bought by Ministry Observatory	Bought from SAPI (costs for all supply chain stages 88,000 euros per year)	Bought from SAPI	Bought from SAPI
ES	n.a.	n.a.	n.a.	n.a.
EU	Free from MS	Free	Free	Free
FR	Collected by FranceAgriMer	Free	Free	Free
LT	Mostly collected by public company Agricultural Information and Rural Business Centre and Statistics Lithuania, and free of use for Observatory/Ministry	Free	Free	Free
NL	Mostly collected by Statistics Netherlands, and Wageningen Economic Research for Ministries. Free use for Observatory	Collected by Wageningen Economic research for Ministry. (costs 100,000 euros per year)	Free	Free
US	Data collected by several Ministries; e.g. annual U.S. input-output tables published by the U.S. Department of Labor's Bureau of Labor Statistics (BLS); Economic Census and Annual Survey of Retail Trade	Free	Free	Free

Source: Authors of this study.

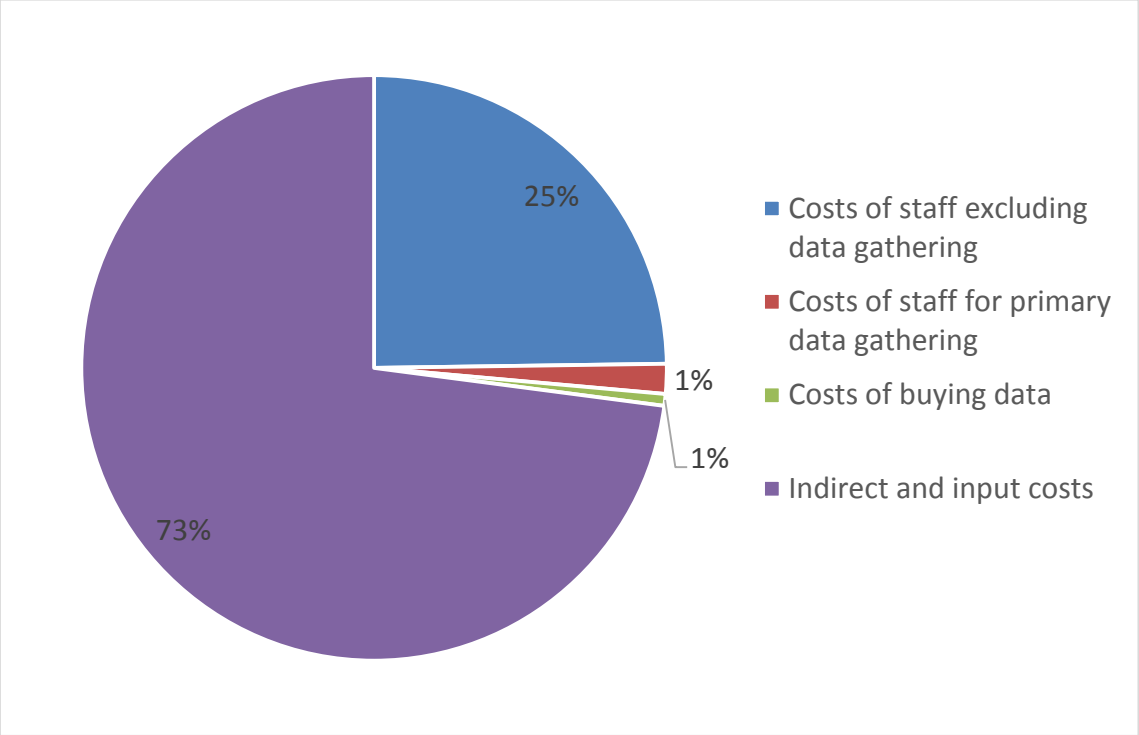
Only in two cases, interviewees indicated that data were purchased from third parties. Some monitoring organisations collect data themselves, such as in Bulgaria. These were used in addition to the ones that provided information on purchased data to estimate the costs of collecting data. Note however, that most organisations do not gather primary data themselves, and hence the estimates of the costs of primary data gathering are quite low. For organisations that actually do gather primary data, the costs of data collection can be substantial, or up to 10 or 15% of the total costs of the organisation or approach.

Only two of the organisations indicated to buy specific data for the observatory, other than what was already purchased for other purposes. From the sample of organisations and approaches interviewed, we have established that most of them use only data that are already available from other sources or get their information for free, e.g. because of an obligation for firms to submit information.

From the collected information and with estimates of indirect costs for some of the organisations and approaches we were able to calculate an average share of the costs of personnel for collecting data, the costs of other staff involved in the monitoring, the costs of buying data and the costs of other costs (indirect cost or input costs). In our calculations, personnel costs include all the staff directly involved in the monitoring, for gathering data, for processing/modelling/data analysing/reporting, as well as for support activities directly linked to the monitoring (which includes overhead staff allocated to the monitoring unit). Indirect costs includes all other costs except buying data and is estimated from the share of labour costs in total costs as explained above.

About 25% of the total costs of the approaches are attributed to the costs of staff (including support staff). On average only a small part of this staff is involved in primary data collection. Although we have explained that this is an average of all the monitoring organisations including the ones not actually gathering data we estimate that about 75% of the total costs of the monitoring is indirect costs, which are here defined as all costs other than labour costs. The costs of buying data are also limited as most data are provided to the organisations for free or already purchased for other purposes.

Figure 14: Division of costs for staff, data and overhead, for all FPMM approaches



Source: Authors of this study.

2.5.3 Costs to private operators

The costs described above include only those costs that are borne by the European institutions and the MS authorities. These costs include personnel costs and overhead costs. The costs of gathering data are relatively low in these calculations. This is caused by the fact that most data are already available to the authorities as they are gathered for other purposes already or companies are obliged to provide data. For example, consumer price data are in many cases already collected to construct Consumer Price Indices.

Moreover, in the cases that we studied, the private operators are not compensated for their costs by the monitoring organisations. Private operators are either voluntarily contributing to the monitoring or provision of data is compulsory. In just a few cases, data are bought from data vendors, which may compensate the data providing companies, e.g. by means of free data analyses. Depending on the type of monitoring, costs will be incurred. The costs include collection, compilation and provision of the data in the requested format.

The costs to private operators of supplying price information greatly depend on:

i. the level of detail required in product aggregations and specifications,
ii. the time period of the data,
iii. the level of uncertainty allowed (i.e. the type of price information and level of acceptable error), and
iv. the frequency of the data request,
v. the size of the company and the number of transaction and/or products,
vi. the type of data collected: varying from individual transaction data to e.g. weekly quotes from expert committees,

vii. the correspondence between the company information systems and the monitoring data system.

Company sales and purchasing information systems may vary. For some companies it is quite sufficient to store daily totals of sales of product aggregates, while other companies may keep records of actual transactions of all individual products that may have many different specifications. If the product characteristics in the information system of the company correspond to or can be made consistent with the required product aggregation of the monitoring system, costs to the private sector are lower. In practice however, companies may have quite a lot of difficulties aggregating and disaggregating data.

The type of price information is a very important factor. Depending on the market characteristics, price information may be based on a sample of companies, publicly available market information from e.g. price lists or company quotes, or expert committees. In commodity markets, in some cases standard contract prices are available from commodity exchanges. For some commodities like pigs and raw milk, the processing companies may publish the prices that they pay to farmers to attract supply, although often actual prices paid differ depending on actual product specifications. Markets may be very complex, including a diversity of contracts, product specifications, weights and packaging, after payments, and a variety of sales channels (such as domestic markets and exports, or direct to supermarkets or to wholesale). In any case the sample of companies or experts providing data, and the actual product specifications should be well understood by both the providing companies, the data collectors, the researchers, and the policy makers that use the data. Despite all complexity, there is always a trade-off between the costs of data collection to both private operators and the public authorities, and the intelligibility of the data.

Although providing an estimate of the total (marginal) costs to the private operators is outside the scope of this study the (marginal) costs greatly depend on the market structure, the information systems installed, the data already collected and the number of companies. Data of farm prices is generally better available than prices at processing or wholesale stages of the supply chain. One-time collection of data from processors and wholesalers about weekly prices for the last year, will generally cost a few days of work for the involved companies.

In addition, some companies may incur costs that have to do with increasing market transparency. In most cases, regulations regarding statistics prevent statistical offices from publishing data if less than a certain number of operators is included or only after a certain period of time. Nevertheless, in some cases companies may prefer not to improve market transparency as they benefit from a lack of transparency.

3. Gaps in the current price transmission literature in food supply chains

3.1 Current methodologies for assessing determinants of price transmission

The analysis of price transmission has a long tradition in the economic literature, and particularly in agricultural economics where the first empirical studies date back to the late 1960s (Frey & Manera, 2007; Meyer & Cramon-Taubadel, 2004). The price transmission literature usually distinguishes vertical price transmission from horizontal transmission. The former focuses on transmission of prices within supply chains, viz. the topic of this study, whereas the latter concentrates on interconnectedness of markets in a spatial sense, i.e. spatial price integration. Although studies on both types of price transmission have many issues in common, e.g. methodologically, this chapter focuses explicitly on vertical price transmission and studies on horizontal or spatial price transmission (Fackler & Goodwin, 2001) are therefore not discussed.

In this review of the price transmission literature in food supply chains we used a mixed approach. First, given the long history in analysing price transmission in food supply chains three well-cited reviews on vertical price transmission already exists, i.e. Meyer & Cramon-Taubadel (2004), Vavra & Goodwin (2005), and Frey & Manera (2007).

Second, a systematic literature review (Jesson et al., 2011: 103-127) is performed on more recent literature which is not discussed in the above-mentioned reviews. The methodological steps taken in this systematic review are the following:

1. The main question to be answered by the systematic literature review is: 'What are the main data and methodological gaps in the literature related to determinants of price transmission in food supply chains'.
2. Based on this question the following keywords are derived: price transmission, food, agricultural, supply chains, vertical, data, theory, empirical analysis, determinants.
3. Inclusion criteria: price transmission; food or agriculture or agricultural; Exclusion criteria: horizontal or spatial.
4. Database(s) used: Econlit.
5. Period: 2005-2017.
6. Type of documents: Peer-reviewed journal articles written in English.

Initially this yielded 238 journal articles, of which all abstracts were screened on their relevance. Publications that do not deal with price transmission in food supply chains (e.g. spatial price transmission, price transmission between food and non-food markets, or price transmission in agricultural non-food supply chains such as biofuels), and publications in journals without an impact factor (IF) in Thomson Reuters' Journal Citations Reports database were filtered out. Finally, 71 peer-reviewed scientific articles were included. A detailed summary of all these studies is provided in an Excel file as an electronic supplement. Table 22 gives an overview of the journals in which these studies were published.

Table 22: Journals with reviewed food price transmission studies 2005-2017

Agrekon	1
Agribusiness	21
Agricultural and Food Science	1
Agricultural Economics	4
Applied Economics	5
Aquaculture Economics and Management	4
Australian Journal of Agricultural and Resource Economics	1
Canadian Journal of Agricultural Economics	2
China Agricultural Economic Review	1
China Economic Review	1
Economic Modelling, part B	1
Empirica	1
Energy Economics	1
European Review of Agricultural Economics	4
Food Policy	5
International Food and Agribusiness Management Review	2
Journal of Agricultural and Resource Economics	2
Journal of Agricultural Economics	4
Journal of Development Economics	1
Journal of Policy Modeling	1
Monthly Labor Review	1
New Medit	2
Post-Communist Economies	3
Review of Development Economics	1
South African Journal of Economics	1

Source: Authors of this study.

What is striking is the large number of studies published in *Agribusiness*, 21 out of the 71 reviewed studies. Moreover, no studies were found in major economic field journals (e.g. *Economic Journal, Review of Economics and Statistics*, *Journal of Business Economics and Statistics*) nor in an important field journal such as the *American Journal of Agricultural Economics*.

Table 23 provides an overview of the countries in which specific food supply chains were studied.

Table 23: Frequency of countries in food price transmission studies 2005-2017

Australia	1	Hungary	2	Slovenia	2
Bangladesh	2	Italy	3	South Africa	3
Brazil	1	Netherlands	2	Spain	7
Canada	2	Panama	1	Switzerland	1
China	1	Philippines	1	Turkey	3
Egypt	1	Poland	2	Ukraine	2
France	4	Portugal	1	United Kingdom	1
Germany	4	Serbia	1	United States	17
Greece	1	Slovakia	1		

Source: Authors of this study.

Note that three studies analysed price transmission in two or more countries and five studies did not focus on a specific country because the paper had a theoretical or review focus. Table 24 provides an overview of the specific products and supply chains studied.

Table 24: Frequency of products in food price transmission studies 2005-2017

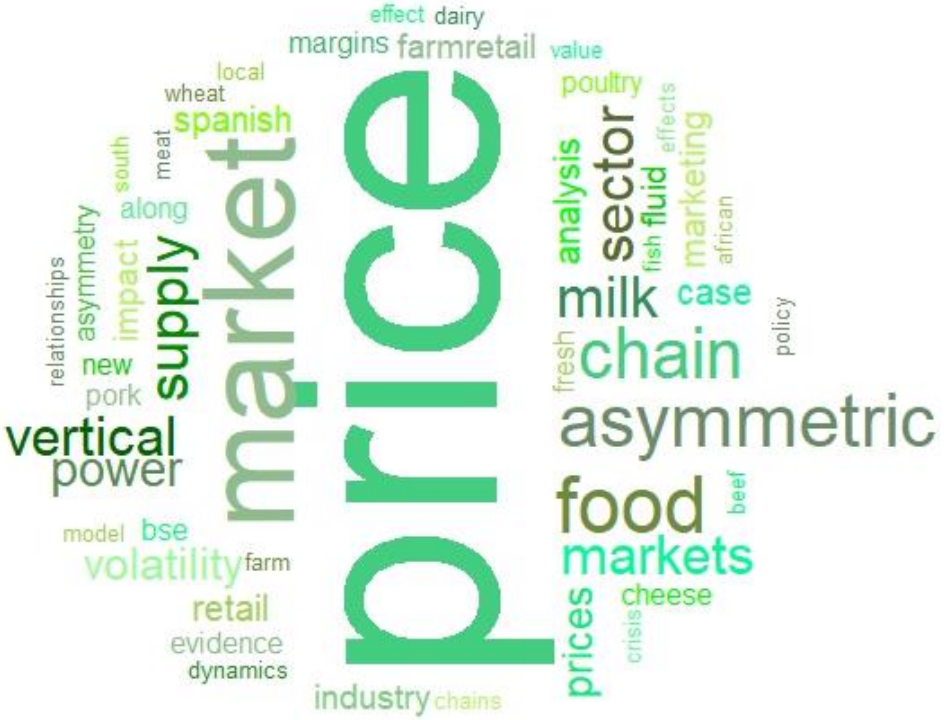
Cereal products	6
Coffee	2
Fish	9
Fruits and vegetables	5
General food products	3
Meat	19
Milk and dairy products	15
None	4
Potatoes	1
Rice	1
Various	6

Source: Authors of this study.

Particularly meat, dairy products and fish supply chains have been studied extensively, whereas supply chains of arable products are studied to a lesser extent.

Finally, Figure 15 presents a word cloud based on the titles of all 71 studies reviewed. This provides a nice summary of all the issues addressed in these studies such as food supply chains studied etc.

Figure 15: Word cloud based on titles of 71 reviewed studies.



Source: Authors of this study.

In the following paragraphs we first discuss main findings from Meyer & Cramon-Taubadel (2004), Vavra & Goodwin (2005), and Frey & Manera (2007) supplemented by findings from our own review of the more recent literature.

3.1.1 Approaches for the assessment of vertical price transmission

Meyer & Cramon-Taubadel (2004), Vavra & Goodwin (2005), and Frey & Manera (2007) all provide an overview of the (evolution in) main approaches used to assess price transmission in food supply chains. Note that Meyer & Cramon-Taubadel (2004) and Vavra & Goodwin (2005) focus exclusively on agricultural supply chains, whereas Frey & Manera (2007) considers price transmission in gasoline and agricultural markets. The approaches discussed in these papers are all econometric methods.

Before discussing the various approaches for analysing price transmission it is useful to summarise first different aspects of price transmission, which may require specific methods for analysing them. Both Meyer & Cramon-Taubadel (2004) and Vavra & Goodwin (2005) distinguish (i) the *speed* of adjustment, (ii) the *magnitude* of adjustment, (iii) whether there is adjustment to positive and/or negative shocks (*nature* of adjustment), and (iv) whether prices are adjusted upwards or downwards the supply chain (*direction* of adjustment). Following Peltzman (2000), Meyer & Cramon-Taubadel (2004) refine the *nature* of adjustment by referring to *positive adjustment* if downstream prices respond quicker to upstream price increases than upstream price decreases, whereas negative adjustment occurs when downstream prices respond quicker to upstream price decreases than price increases. In that sense positive adjustment might be beneficial to farmers, but bad for consumers, whereas *negative adjustment* benefits consumers and may harm farmers. Frey & Manera (2007) define eight specific aspects of asymmetric price transmission that are based on the various econometric approaches they review. These include three types of price effects (contemporaneous, distributed lag, and cumulated), reaction time, the (long-

run) equilibrium adjustment path and its momentum (increasing or decreasing), regime effects, and regime adjustment paths. Note that this distinction also focuses on speed, magnitude, nature and direction of adjustment but add refinements with respect to time horizon (short-run vs. long-run), adjustment paths, and price transmission regimes.

The approaches discussed by Meyer & Cramon-Taubadel (2004), Vavra & Goodwin (2005), and Frey & Manera (2007) are all econometric approaches. Of these three review papers Frey & Manera (2007) provide the most detailed and up-to-date discussion, distinguishing five major classes of econometric methods used[11].

1. The first quantitative studies on price transmission which appeared in the 1970s and well into the 1990s used simple *Autoregressive Distributed Lag (ARDL) models*. These models use a particular price from a certain stage in the food supply chain (e.g. farm, wholesale, or retail price) as dependent variable, and include its own lagged values and lagged values of another price as explanatory variables. By separating the other price into positive and negative changes it is possible to test whether prices respond symmetrically or asymmetrically to other prices. These symmetry tests can be performed on the parameters associated with period *t* (contemporaneous effect), parameters in a particular period *t-k* (distributed lag effect), or all parameters of the included lags (cumulated effect).
2. *Partial Adjustment (PA) models* allow for modelling and testing asymmetries in the speed of adjustment towards a target or equilibrium level (equilibrium adjustment path asymmetry). This is done by separating lagged values above the target level from lagged values below and testing whether the associated parameters are similar (symmetric equilibrium adjustment path) or not (asymmetric equilibrium adjustment path). Although PA models are discussed by Frey & Manera (2007), they don't seem to have any applications to food supply chains since all studies using PA models referred to by Frey & Manera (2007) deal with crude oil-gasoline price transmission.
3. A third major approach that became popular in the 1990s are Error Correction models (ECM). ECMs can be estimated when two price series are cointegrated, i.e. they are by themselves non-stationary but there is a long-run stationary relation between them. ECMs are basically a combination of an ARDL model with first-differenced data and a PA model, which implies that all aspects of price transmission that these models can estimate, can also be estimated in an ECM. Put the other way around, ARDL and PA models are restricted versions of the more general ECM approach. ECMs allow for (testing) asymmetries in short-run lagged values, but also asymmetries in the long-run error-correction term. A number of extensions have been proposed to the general ECM framework, e.g. allowing for non-linearities in the error correction term and so-called (Momentum) Threshold AutoRegressive (TAR and M-TAR) approaches, which specify thresholds for adjustments of the error correction term that allow for asymmetries depending on whether the equilibrium deviation is increasing or decreasing. For detailed discussions see Meyer & Cramon-Taubadel (2004) and Frey & Manera (2007).
4. A more recent approach are *regime switching models*, which first stared to be used in the late 1990s. In these models different regimes for price transmission are

[11] In combination with the eight specific aspects of price transmission that Frey & Manera (2007) distinguish, this leads to a refinement towards 15 different econometric models, see table 5 in Frey & Manera (2007).

modelled, based e.g. on the quantity traded, time periods during and outside food crises or government policies. In these regimes all aspects of price transmission (speed, magnitude, nature, and direction) may differ.

5. The final group of approaches are multivariate extensions of the four aforementioned methods. E.g. a system of ARDL equations is jointly estimated as Vector AutoRegressive (VAR) model, and a system of Error Correction equations is estimated as a Vector Error Correction Model (VECM). But basically in these systems of equations the same aspects of price transmission can be estimated.

Next, we discuss the approaches used in the price transmission studies reviewed for the period 2005-2017. Many of these studies use one or more of the above-mentioned approaches. However, there were also a few new econometric approaches applied. Beyond, we also reviewed a few non-econometric studies. Table 25 summarises the approaches used in the 71 reviewed studies:

Table 25: Frequency of approaches in food price transmission studies 2005-2017

ADL	12	Volatility transmission	5
ECM	15	Structural models	7
TAR and M-TAR	5	Theory only	3
VAR	3	Theory and simulations	4
VECM	8	Review paper	3
Regime-switching models	13	Meta-analysis	1

Source: Authors of this study.

The first column shows that the methods reviewed by Meyer & Cramon-Taubadel (2004), Vavra & Goodwin (2005), and Frey & Manera (2007) were still being used to a great extent in the period 2005-2017. However, there were also some innovations in these approaches. E.g. Gervais (2011) and Fousekis, Katrakilidis, & Trachanas (2016) use novel methods to investigate non-linearities in both short-run and long-run price transmission. Various studies test for structural breaks in the price series and try to adapt their analysis accordingly (Bakucs, Falkowski, & Ferto, 2012; Guillotreau, Le Grel, & Simioni, 2005; Pokrivcak & Rajcaniova, 2014). Also with respect to the regime-switching models some new approaches were implemented. Acharya, Kinnucan, & Caudill (2011) use a mixed finite model to test whether market power is exercised by retailers in time of strawberry harvesting compared to off-season periods. Hassouneh, Radwan, Serra, & Gil (2012) and Hahn, Stewart, Blayney, & Davis (2016) use a smooth transmission VECM where regime switching occurs in a smooth fashion based on an explicit transition variable, e.g. a food scare index variable or news index. Brummer, von Cramon-Taubadel, & Zorya (2009) and Djuric & Gotz (2016) use a Markov switching VECM to model multiple shifts in price regimes. The advantage of this approach is that one does not need to have an explicit transition variable since regime changes depend on an unobserved state variable.

After the rapid price increases and decreases of food in the period 2007-2013 a new type of study focusing on price volatility transmission (instead of price level transmission) became popular. Many of these studies, which are not discussed here focus on volatility spillovers from crude oil or biofuels to crop prices. However, there are also some studies that focus on volatility spillovers within food supply chains. Most of these studies use a variant of a (multivariate) generalised autoregressive conditional heteroscedasticity ((M)GARCH) model. These models consist of two parts. In the first part relationships among price levels are modelled, e.g. using a VAR or

VECM specification. In the second relationships in the squared residuals of the various price equations are modelled, which provide a measure for conditional volatility in prices. Serra (2011) considers different regimes in smooth transition conditional correlation (STCC) GARCH model in analysing price volatility transmission in the beef supply chain in Spain during and outside the BSE crisis. An, Qiu, & Zheng (2016) use an asymmetric GARCH model to analyse differences in price volatility spillovers during and outside periods of government wheat export restrictions in Ukraine. Hassouneh, Serra, Bojnec, & Gil (2017) use an MGARCH model to analyse volatility spillovers in the Slovenian wheat market in the period 2000-2012. Assefa, Meuwissen, Gardebroek, & Oude Lansink (2017) study price level and price volatility spillovers in the German pork supply chain in the period 2000-2011. Sidhoum & Serra (2016) study price volatility spillovers in the Spanish tomato sector in the period 2001-2011.

Another category of studies that was not discussed in existing reviews are structural econometric models, which are firmly grounded in economic theory. The contribution of these studies is that they often start with an explicit micro-economic model that results in a set of structural equations to be estimated, which allows for directly testing the theory. These models may differ substantially in theory and focus. Soregaroli, Sckokai, & Moro (2011) specify a multi-output demand and price transmission equation system and use this estimated system to simulate various policy measures. Sckokai, Soregaroli, & Moro (2013) use the generalised method of moment to a structural system of demand, supply and price-transmission equations in order to obtain market-power parameters and supply and demand elasticities jointly. Bonnet & Villas-Boas (2016) estimate a consumer demand system to analyse consumers purchasing decisions of various coffee brands and use this to analyse retail price asymmetries. A rather different model is specified by Abbassi, Tamini, & Gervais (2012) who include a measure for chicken inventories into a farm-wholesale price margin equation, to test whether inventories are related to this margin. Mehta & Chavas (2008) specify a dynamic model for coffee production and coffee price dynamics and estimate a VAR based on this theoretical model.

Whereas the above-mentioned studies still have an empirical focus using real world data from specific food supply chains, there are also a few studies that only make a theoretical contribution in analysing price transmission. Some of these papers also provide numerical simulations, but this is often not based on a real case. Xia & Li (2010) show theoretically how consumer inertia can lead to asymmetric price transmission. Drabik, Ciaian, & Pokrivcak (2016) present a theoretical model to show the effects of ethanol policies on the price transmission in corn and food markets and complement this with a simulation analysis. Weldegebriel, Wang, & Rayner (2012) show that in case of non-constant returns-to-scale price transmission is not straightforward to infer when oligopolies and oligopsonies interact (e.g. wholesale and retail) and therefore plead for using structural models instead of reduced form models as often used in testing for APT. Kinnucan & Zhang (2015) theoretically show that absolute marketing margins respond differently to shifts in retail demand, input supply, and technical change in the marketers' production function than relative marketing margins and discuss what this implies for empirical studies on price margins.

Three studies do not make a specific theoretical or empirical contribution but have the objective of reviewing a specific body of price transmission literature. Cotterill (2006) reviews literature that explicitly focuses on antitrust analysis of supermarkets. Assefa, Meuwissen, & Oude Lansink (2015) review price volatility studies in the food chain. T. Lloyd (2017) provides an overview of forty years of price transmission analysis in the food industry in his 2016 presidential address for the Agricultural Economics Society.

The final approach discussed here is the so-called meta-analysis, which goes beyond a traditional literature review by statistically analysing the results found in all reviewed

studies. Frey & Manera (2007) already did this in their review paper by running a metaregression with the F-statistic of the price symmetry test as dependent variable and various characteristics of the study such as data type, region studied, model used etc. as explanatory variables. This provides insights which factors relate to price asymmetries. A more recent meta-analysis is done by Bakucs, Falkowski, & Ferto (2014) who use presence of price asymmetry in farm-retail relationships as dependent variable and various organisational and institutional characteristics of the respective agro-food supply chain as explanatory variables.

3.1.2 Determinants of vertical price transmission

Both Meyer & Cramon-Taubadel (2004) and Vavra & Goodwin (2005) discuss various determinants of price transmission along the food chain based on economic theory:

1. Market power is the most intuitive determinant of asymmetric price transmission. Supply chain actors with market power are assumed to pass through price changes in such a way that their margins are maintained or even increased. However, there are not many studies that explicitly test whether market power affects price transmission along food supply chains (Meyer & Cramon-Taubadel, 2004; Weldegebriel, 2004). Since most studies only focus on one product without much variation in market structure it is often also not possible to test. Moreover, since pure monopolies/monopsonies are rare in food chains, market power is often materialised in oligopolies/oligopsonies for which strategic considerations (e.g. loss of market share, fear of price wars) and scale economies may prevent asymmetric price transmission.
2. Adjustment costs related to prices and quantities may differ between firms in different stages of supply chains. Both Meyer & Cramon-Taubadel (2004) and Vavra & Goodwin (2005) note that retailers may abstain from raising consumer prices out of fear unsold stocks of perishable products, reputation loss of products with long shelf-life, or price wars. However, for each reason they only mention one supporting study, all from the 1980-1990's. E.g. against the perishability argument one could counter that farm price increases therein only arise in case of shortages, e.g. due to low harvests. However, in that case also retail may face shortages reducing the probability of unsold stocks. Moreover, with low income and price elasticities for food products it is not clear whether a consumer price increase would lead to a substantial decrease in demand. A more convincing argument seems to be fear of idle processing capacity for food processors, making farm prices sooner go up than down.
3. Inventory management may also lead to price asymmetries. In periods of low demand, processors may build up stocks instead of lowering retail prices, whereas in periods of high demand retail prices may be increased. Although this is a plausible argument explaining price asymmetries in retail, it is not discussed whether this also implies asymmetries between farm and retail prices.
4. Farm price support policies could make processors and retail reluctant in lowering their prices since they believe that lower farm prices will be compensated through these policies. Higher farm prices would be translated in higher retail prices though.
5. Differences in retail demand shocks and farm level supply shocks could also be a cause of price asymmetries, but only if their occurrence is unevenly distributed. M-CT suggest that this may have occurred in the European beef market during a sequence of various animal diseases leading to substantial demand shocks.

6. Asymmetric price information and biased price reporting by parties with vested interest is also suggested to be a determinant of asymmetric price transmission.

Most of these determinants are derived from theoretical models, but their existence is usually not explicitly tested in the many empirical studies that test for price asymmetries. Often these arguments are used to interpret findings on asymmetric price transmission. This also holds for the literature in the period 2005-2017. Most of the papers reviewed test for the existence of asymmetries (speed, magnitude, nature and/or direction) without explicitly testing what determines price transmission. However, there are also a few studies that did investigate these determinants. Some results confirm the existence of the six aforementioned determinants, but some new determinants have also been found.

Market power was found as an important determinant in a number of studies, sometimes interacting with other factors such as seasonality or perishability of products. Cutts & Kirsten (2006) compare four different food supply chains in South Africa (maize meal, bread, sunflower cooking oil, milk) and find that differences in price transmission can be explained by market concentration. More concentrated markets have more asymmetric price transmission, except if the product is perishable. Falkowski (2010) finds that retail market power in the Polish dairy supply chain leads to positive price transmission. Acharya et al. (2011) found that during peak harvesting season of strawberries market power is exercised by buyers, but not in the off-peak regime. Price transmission is complete in the off-peak regime when the market power parameter is zero, but not in the peak-harvest regime when the market power parameter is positive and statistically significant. Lass (2005) compares price transmission in the periods before and after the formation of the Northeast Dairy Compact in the US in 1997 and finds that the formation of this compact has increased price transmission. Sckokai et al. (2013) find that retailers exercise market power towards processors of Italian cheese affecting price transmission.

Inventories were also already mentioned as a reason for price asymmetries. Abbassi et al. (2012) include a measure for chicken inventories into a farm-wholesale price margin equation and find that the price transmission elasticity is lower (higher) when inventories are above (below) the target level.

Differences in retail demand shocks and farm level supply shocks may occur in different time periods, and this is what many regime-switching studies investigate. Mehta & Chavas (2008) finds that during the operation of the International Coffee Agreement between 1981-1989 price transmission between farmers and processors was less than in the periods where the agreement was not active. Brummer et al. (2009) identify four different regimes for price transmission in the Ukrainian wheat-flour supply chain, all four with their own characteristics. A number of these regime-switching studies focus on the effects of food scares on price transmission. Hassouneh et al. (2012) find that during a period of Avian Influenza in Egypt price transmission differs from the period before. During this crisis prices do adjust to long-run equilibrium, but retail seems to increase its margins. The latter finding is in line with (T. A. Lloyd, McCorriston, Morgan, & Rayner, 2006) who found that during the BSE crisis in the UK retailers also increased their margins. Serra (2011) finds that transmission of food price volatility differed during the BSE crisis in Spain compared to the period before.

Besides confirming existing hypotheses on determinants of price transmission, there are also a number of new determinants discussed in the literature. The first one are consumer inertia to price changes. Xia & Li (2010) showed theoretically how consumer inertia can lead to asymmetric price transmission. Bonnet & Villas-Boas (2016) estimate a consumer demand system to analyse consumers purchasing decisions of various coffee brands and find that consumers respond less to price increases than

price decreases. Retail may therefore be inclined to pass through cost increases than cost decreases.

Second, Tifaoui & von Cramon-Taubadel (2017) investigate how temporary sales by retail affect price transmission. They find that such temporary sales increase the speed and asymmetry of vertical price transmission.

Third, Drabik et al. (2016) show theoretically how biofuel (ethanol) policies reduce responsiveness of corn and food prices to shocks in agricultural (corn and food) markets. They show that in the presence of these policies imperfect price transmission may occur even if markets are perfectly competitive.

An advantage of the two meta-analyses discussed before (Frey & Manera (2007) and Bakucs et al. (2014)) is that they combine findings of many studies in order to draw general conclusions. Frey & Manera (2007) conclude from their meta-analysis that certain aspects of price asymmetries are better captured by some models than others and that daily data signals more asymmetries than weekly or monthly data. In European and US markets also less often price asymmetries are found than in markets in other parts of the world. Bakucs et al. (2014) find that price asymmetries are more likely in fragmented farm sectors and sectors with strong governmental support. A strong processing industry may reduce asymmetries in farm-retail price transmission. Regulations limiting price competition among retailers may lead to more price distortions.

3.1.3 Advantages and disadvantages including robustness analysis

To assess the robustness of the methodologies and data used for analysing price transmission and its determinants we use the following criteria: *Effort, Applicability, Reliability, Validity, Flexibility, and Largest advantages and disadvantages.* Of course there is substantial heterogeneity in methods used, but this will be considered in the assessment. In assessing the robustness of the various methodologies used for analysing price transmission and its determinants it should be noted that most studies only focus on quantifying and testing (asymmetric) price transmission without investigating its determinants explicitly. Often the asymmetries found are ascribed to market power or other factors without formal tests backing up these claims.

Effort
The effort in implementing most of the applied empirical methodologies can be rated as *low*. Econometric techniques used for analysing price transmission such as asymmetric ADL, ECMs or VECMs are readily available in software packages as Stata or R, e.g. the APT R package. Also the more advanced methods such as threshold ECM or regime-switching techniques are often available. For meta-analysis the methodological effort is also low as this often uses standard regression techniques. Of course one needs to have knowledge about the methodologies but these are also well-documented.

Relating the found asymmetries to possible determinants would require more effort, since this often requires non-standard techniques (Abbassi et al., 2012) and additional data for possible determinants.

The effort in collecting price data for transmission studies can in general be qualified as *low*. Many studies use monthly farm, wholesale, or retail prices and these are often available from national statistical agencies. Weekly data may be more difficult to obtain for various stages of the food supply chain and therefore these are used less often. To illustrate, of the 71 studies reviewed 63 use data, of which 48 use monthly data, 10 use weekly data, and the remaining studies use yearly, half-yearly or four-

weekly data. No study uses daily data. So, doing the analysis at higher frequencies requires substantially more effort in obtaining such data.

If one also wants to investigate the factors affecting price transmission, additional efforts have to be made in order to have good proxies for possible factors responsible for price transmission at the same frequency (e.g. monthly). These may not always be available, e.g. data on processing or menu costs, or data on inventory.

Applicability
Most of the methods can easily be applied to other sectors, countries or time periods, provided of course that complete weekly or monthly data are available. So, applicability is rated as *high.* This is reflected in the large number of similar studies that were reviewed, which often use similar methods. Another illustration is the study by Kim & Ward (2013) who compare price transmission for 100 different food products in one study. The high applicability also implies that most studies are easily replicable. This also holds for simulation studies and meta-analyses, provided of course that all steps taken in existing studies are well described.

The applicability of the data can be classified as *moderate*. Data for a specific food supply chain can only be used for that chain. However, it is easy to extend the data to a longer period, split it up in multiple periods for robustness checks or to make comparisons over multiple periods. Of course results from an existing dataset can also be compared to results from other data, either a different food chain or a different frequency.

Reliability
Most methods allow for a *highly* reliable assessment of size, speed, nature and direction of price asymmetries since not only the asymmetry parameters are estimated, but also the standard errors, allowing for statistical tests on the parameters. Some studies apply and compare different methods to test for asymmetries, which enlarges the reliability of the outcomes even further. However, the factors affecting price transmission are not always considered, so on this aspect reliability has to be evaluated as *moderate*. There are studies that explicitly test the relation between price transmission parameters and market power (e.g. using a concentration index), inventories, temporary sales, or consumer inertia. Moreover, regime-switching studies explicitly link certain periods of market turmoil to the price asymmetry parameters. However, even the studies that do investigate underlying factors of price transmission do so in isolation. The only exception to this is the meta-analysis performed by Bakucs et al. (2014).

The reliability of the data is judged as *moderate*. Most data used are official price statistics. Despite the stamp 'official' it is not always clear how these are obtained or processed. E.g. are monthly data equal to values from the first or last day of the month, or are they simply averages? How are missing values and outliers dealt with? Or more fundamental question is what average farm or retail prices actually represent. Farmers receive different prices for their products based on many factors, e.g. product quality, competition among processors etc.. T. Lloyd (2017) showed that the price of a loaf of bread varies dramatically in the major UK supermarket chain due to different average prices, different timing of temporary sales, leading him to conclude that economic concepts like 'law of one price' and 'representative firm' don't seem to make sense in food retail. In their empirical study on this issue von Cramon-Taubadel, Loy, & Meyer (2006) conclude that results based on aggregated data can lead to wrong conclusions about price transmission behaviour at the level of the individual retail stores. Therefore analyses at the individual retail level would require supermarket scanner data, as e.g. used by Tifaoui & von Cramon-Taubadel (2017). A problem in

such analyses is however that individual data at wholesale or processing level are often not available. Tifaoui & von Cramon-Taubadel (2017) in the end also aggregated their scanner data in order to match them with average wholesale prices.

Another issue is whether a monthly time-frame is sufficient to capture price asymmetries. If these happen within a month, an average monthly price may only partly capture the asymmetries. In such cases it is advisable to do the analysis with both monthly and weekly data (if available) in order to assess the robustness of the results.

Validity
In terms of size, speed, nature and direction of price asymmetries most methodologies applied provide valid measurement of price transmission, so this validity can be classified as *high*. However, again when it comes to the factors affecting price transmission, most studies simply attribute price asymmetries found to market power or other factors, so that in this respect validity has to be qualified as *low*.

Since the price series used are often time-series, validity depends on careful checking of the data properties, in particular whether the data are stationary, or in case of non-stationarity whether series are cointegrated. Failure to assess this correctly may lead to invalid (spurious) inference. Recent studies also have accounted for the possibility of structural breaks in the data series. Market conditions may have changed due to policies, a food crisis or other major events. Methods such as regime-switching models can deal with such changes in data properties. So, validity largely depends on the care taken by the researcher in the analysis.

As mentioned before, price series can only provide a valid assessment of the nature of price transmission, not for its causes. In order to assess these additional data are necessary to represent factors such as market power, menu costs, inventories, etc. Since often proxy variables are used for these, validity in this case has to be judged as *moderate*.

Flexibility
Most approaches used are *highly* flexible in their application. The methods can be used with different data frequencies, different lengths of data (although for time-series applications one would argue that a certain minimum number of observations (>40?) is required, different sets of prices (farm, processing, wholesale, retail, etc.) for different products. On the other hand, one can argue that the used methods are only able to investigate certain aspects of price transmission that can be quantified, such as speed or direction of transmission, but less flexible in integrating the factors that cause price transmission.

Flexibility of monthly price data is judged as *high*, but for other data frequencies *moderate* or even *low*. Many countries regularly update their monthly price series and the large variety of series used in the reviewed studies from different countries and for various food supply chains illustrates the wide availability. Price series are also flexible in their application as they allow for including lagged values, first-differences etc.

Largest advantages
1. Econometric methods for assessing price transmission can quantify a wide range of aspects of price transmission, such as speed of adjustment in both short-run and long-run, the direction of adjustment, the size of asymmetries etc. Also thresholds for price adjustment can be quantified as well as different regimes for price

transmission. This provides a very good quantitative overview of how prices in food supply changes adjust to one another.
2. The methods are rather well developed and described in the literature and are often available in standard econometric software packages such as Stata and R, making it possible for many researchers to apply them.
3. Various econometric methods exist for assessing price transmission, allowing for a comparison of results based on different methods, thereby enlarging the reliability of the results.
4. Price data are often relatively easy to obtain. This enables replication or follow-up of analyses in order to check robustness of findings on price asymmetries. It also makes it possible to compare price transmission of many different products in various regions.
5. Price data are flexible to use. It is easy to include lagged values or first-differences. Analyses can be performed with subsets of data to check the robustness of the analyses.
6. Price data allows for quantifying various aspects of price transmission, e.g. speed, magnitude, nature and direction of price transmission, providing a clear picture of price transmission.

Largest disadvantages

1. Most methods do not allow for testing which factors affect price transmission. Many researchers simple ascribe the asymmetries found to plausible factors, without formally testing what is causing the asymmetries.
2. Most methods assume and estimate a constant adjustment parameters in time. However, structure of the supply chain may change and therefore also the price asymmetry parameters. There are some studies that test for structural breaks and allow for different regimes, but then it also matters how these regime switches are modelled. Some studies allow for gradual regime shifts (Hahn et al., 2016; Hassouneh et al., 2012)
3. Although the methods are available and well-documented in the academic literature, their specification and the various aspects of price transmission that can be estimated (distributed lag parameters, speed of adjustment parameters, threshold parameters, etc.) can be quite overwhelming for non-academics or policy makers. In other words presenting the models and their outcomes requires quite some effort by researchers.
4. Most studies only use price data, which only allows for assessing the quantitative nature of price transmission, not the factors that cause it. However, such data are often difficult to obtain, particularly at the same time interval (monthly) as price data.
5. Data are often only available at aggregate level, so that price transmission at individual retail, wholesale or farm level cannot be investigated. This also holds for product level. E.g. it may not be clear what a general meat price or dairy price represents.
6. Not always clear how the data series are constructed. E.g. how are missing values and outliers dealt with, or what is the date of measurement?

3.2 Gaps in the current literature

3.2.1 Methodological gaps

Several methodological gaps appear from reviewing the existing price transmission literature.

1. There is hardly any testing of factors responsible for asymmetric price transmission. Most studies only focus on quantifying the nature of price asymmetries and then attribute this to market power. Of course how to test which factors determine the asymmetries requires substantial methodological and data efforts. Nevertheless, some efforts have been made in this respect, e.g. Abbassi et al. (2012) who explicitly include the ratio of inventories to sales in an econometric price transmission model. Regime-switching models investigate whether price transmission differs in certain periods, but still it is not clear what the actual determinants are within these periods, e.g. plain market power, increased inventories, or simply a different supply-demand structure? One approach that could be used more are the so-called meta analyses that are able to connect results from a large number of price transmission studies to factors that cause price transmission. However, this also puts demands on the data, which are discussed in the next section.
2. If there would be methodological advancement on linking price transmission parameters to factors causing asymmetric price transmission, an additional issue would be to investigate whether there are interaction between factors responsible for price asymmetries. The few studies that do investigate determinants, often focus on only one factor. An exception to this is Cutts & Kirsten (2006) who consider both market concentration and perishability of products. However, there could be more of such interaction, e.g. between perishability and consumer inertia, or inventories and market power. The most promising method to investigate such interaction might be meta-studies since they could have sufficient variation in different market settings, products and time periods.
3. Meyer & Cramon-Taubadel (2004) already concluded that most of the asymmetric price transmission literature focuses too much on methodology of estimating and testing asymmetry parameters and too little on quantifying losses or gains (welfare effects) to certain groups. This criticism is still valid for most studies conducted in the period 2005-2017. Simple calculations of forgone revenues or additional costs for certain groups, or more changes in producer and/or consumer surpluses are mostly lacking. A few exceptions to this are studies by Acharya et al. (2011) who calculate welfare losses for farmers during harvest times, Assefa, Kuiper, & Meuwissen (2014) who calculate welfare losses in their simulation model for the case where farmers have oligopoly power, and Djuric & Gotz (2016) who calculate welfare losses for consumers during government interventions in the wheat-bread supply chain.
4. The large emphasis on empirical analysis of price transmission has the drawback that there is not much theoretical advancement in understanding price transmission and its determinants. Many empirical studies refer to classic work by Gardner (1975) or (Appelbaum, 1982). There are a few studies that do present new theoretical insights, e.g. Mehta & Chavas (2008), Xia & Li (2010), Weldegebriel et al. (2012), Kinnucan & Tadjion (2014) or Kinnucan & Zhang

(2015), showing that it is still possible and necessary to contribute to theoretical understanding of price transmission.

5. Most studies only focus on one food chain, which provides a lot of detail for that particular chain, but makes it hard to compare how the asymmetries found can be compared to other food chains in that country or time period. A few studies used series from multiple food chains to allow for such comparisons Cutts & Kirsten (2006); Liu, Keyzer, van den Boom, & Zikhali (2012); Reziti & Panagopoulos (2008); von Cramon-Taubadel et al. (2006). A very interesting study that allows for a wide comparison is Kim & Ward (2013) who compare price transmission of 100 food products in the US food supply chain for a long period 1970-2009. Studies like these put transmission parameters in a wider perspective. Moreover, they could be extended by linking the price transmissions found to potential factors causing it.
6. A recent development is the use of retail scanner data, which provides a wealth of information for specific products, in different stores and chains, often at a high frequency (e.g. weekly sales). A few studies reviewed also use (Tifaoui & von Cramon-Taubadel, 2017) or discuss (T. Lloyd, 2017) this type of data, and touch upon a number of methodological issues. These and others are:
    - How to connect highly disaggregated retail scanner data to aggregate wholesale data?
    - How to deal with local and temporary price variations?
    - How to estimate price transmission equations?
7. Unobserved product and store characteristics can be dealt with using panel data techniques, but the lengthy series may also require panel time-series techniques to deal with non-stationarity and cointegration in a panel data context. It is obvious that many methodological issues are open in this area.
8. Even if scanner data are not available, some studies use price series from multiple locations. E.g. Capps & Sherwell (2007) use milk price data from 7 US cities. With more locations use of panel time series techniques and specification tests could be recommended.
9. A final issue is that intermediate supply chain stages (processing, wholesale) are still much like a black box. It is not clear how raw farm products are combined with other inputs, which pretty much blurs the whole view on what the final retail food products consist of. This is of course mostly a data issue, but may also require some methodological advancements.

3.2.2 Data gaps

There are also a number of data gaps that appear from reviewing the current literature:

1. Data relating to factors causing price asymmetries are often lacking. Whereas price data are readily available this does not hold for proxies for market power, inventories, temporary sales or other possible factors responsible for price asymmetries. What the frequency of such variables should be also depends on how this is combined with available price data.
2. Related to the previous issue is data on inputs used in intermediate production stages, transportation costs, marketing costs, etc. in order to get a better view on how farm products are combined into final retail products. Understanding these

processes can help in better understanding how prices evolve in various stages of food supply chains.

3. Using price data at various frequencies can help to check the robustness of price transmission estimation results. It could well be that asymmetries that materialise within a month are less visible in monthly data. With weekly data such asymmetries might be spotted better. Redoing the analysis using data at various frequencies may also show the robustness of results.
4. A fourth data issue relates to meta-studies that generate insights over multiple food supply chains and different time periods. Currently these studies are often limited in the number of relevant explanatory factors they can include, since information on them may not be available in all included studies.
5. A final data issue relates to scanner data that become more available. This raises all kinds of issues, such as what the appropriate level of analysis is at product level (individual brands, aggregated by product type), store or chain level, and timeframe (weekly or monthly).

4 Alternative approaches for price and margins monitoring

In Chapter 2 existing price and margin monitoring systems have been described and classified. Based on this analysis an 'ideal' FPMM approach is developed that scores high on all criteria distinguished in Chapter 2. The 'ideal' FPMM approach cannot be realised in the short term and will be very costly given the current availability of data. Given this 'ideal' FPMM approach two alternative approaches have been described that can be implemented on short notice. In this chapter the two alternative approaches and the ideal approach are described including the advantages and disadvantages. In Chapter 5 the two alternative approaches are implemented for three products in 4 MS. The alternative approaches have been based on the existing EU Food Price Monitoring tool of Eurostat. The main reasons are time and budget constraints, availability of many basic data, present monitor is not highly valued and it is for this research more easy to communicate how the alternative systems will look like.

Given the fact that a general vision and mission regarding FPMM is lacking we assumed that the FPMM will be used to monitor price developments in markets of the EU. Since most of these markets are more or less local markets for many products FPPM approaches need to be implemented in all 28 MS.

For both alternatives monthly data are chosen as starting point. In some cases weekly prices are available at one stage of the supply chain but not at other stages. For analysing price developments and price spreads the added value of weekly prices in only a part of the supply chain is very limited.

For Alternative Approach 2 the availability of buying prices at a certain stage of the supply chain would offer a lot of additional information about the price transmission in the supply chain. The reality is that in practice it is very hard to obtain this information from companies and the definition of buying prices differs a lot between companies.

4.1 Details of the suggested approaches and indicators

4.1.1 Approach 1 Price developments along the food supply chain

Purpose and monitoring focus

Approach 1 is to a large extent based on the existing EU Food Prices Monitoring Tool (EU FPMT). In addition to the existing price indices, the approach mainly adds missing data from national price data, presents both import and export prices, and when possible wholesale prices, a narrative, and an explanation of indicators and data sources. Also, the products included in the illustrations in Chapter 5 show besides more general product groups such as 'fruit', 'vegetables', or 'milk, cheese and eggs' also more specific product groups like 'apples' can be included in the monitoring. The purpose of Approach 1 is:

1. to provide monthly changes in prices at various stages of the supply chain for major food items and the agricultural commodities that they are derived from;
2. to give insights into the factors that determine price developments for policy makers and other stakeholders in a general way.

The basic data will be updated monthly in interactive graphs and published on a public website of the EU. The information can be made available from 2005 for most of the EU-28 MS. The monitor will focus on the three stages of the supply chain: agricultural

production, processing or wholesale, and retail. For each stage output price-indices are made available.

The approach, its data needs and sources, the (dis)advantages and costs will in this report be explained on the basis of the three selected product groups: pig meat, dairy products, and apples. However, eventually it could be implemented for each of the 14 products in the FPMT and for additional products.

Table 26 gives a general description of the output of approach 1 and Table 27 gives more details on the output.

Table 26: Details of Approach 1: price developments along the food supply chain

Institutional context	
	The purpose of approach 1 is to provide insight into price developments and explain factors that determine prices in MS and the EU.
Output form(at)s	Interactive graphs on price indices; Data in tables; Narrative explaining most important price developments in the EU and market structure per country.
Output frequency	Monthly; narrative will be adapted quarterly or if shocks occur.
Duration of publication	Info available since January 2005 although fragmented. Extent of data availability increases over time, (e.g. the harmonised index of consumer prices is not calculated from the beginning).
Monitoring focus	
Commodities/sectors	Pig meat; dairy; apples (in practice relatively easily extendable to commodities currently included in the EU FPMT, and a number of other products that are already included in agricultural, trade and consumer price monitoring)
Supply chain levels monitored	Agricultural production; imports; exports; processing and packaging or wholesale (when applicable); retailing
Data frequencies	Monthly
Spatial disaggregation	EU-28, MS level
Conducive to purpose	Yes

Source: Authors of this study.

Monitoring results

Every month the price indexes will be updated. Time lags are dependent on the time lags of the current data collection, which differ per data series. In Table 27, the average time lags in the various data series are shown as we have found them to be in August 2018. It is recommended to make an effort to shorten and harmonise the time lags for the different series.

Table 27: Average time lags for different prices series in the approach, in months

	pig meat	dairy	apples	average
consumer price	5	5	3	4.3
processor prices	8	6		7.0
wholesale prices			8	8.0
import prices	4	4	4	4.0
export prices	4	4	4	4.1
agricultural price	8	8	4	6.6

Source: Authors of this study, from various sources. See Annex IV.

In Approach 1 narratives are added. These narratives consist of information on market structure and price formation for the EU-28 and per MS. This background information will be updated once every year. The other part of the narrative is the explanation of the market developments. Every quarter the market analysis will be updated or if severe shocks in prices at EU level are visible. EU-wide the most important price developments are explained. Table 28 gives the characteristics of the output.

Table 28: Monitoring results of Approach 1

Types of quantitative results	Price developments per product per stage of the supply chain. Developments based on price indices with 2010=100. Annual rate of change in %.
Types of qualitative results	Explaining text to the price developments (actual market analysis). Background of market structure (including price mechanism) at EU level with highlights per MS.
Prices monitored	Indices of p farm out, p processing out, p retail out, import prices and export prices.
Further quantities monitored	None, but qualitative and quantitative information of the demand and the supply is part of the narrative.
Indicators published	Commodity price index, harmonised index of consumer prices, export price index, import price index and producer price index
Reproducibility of approach	Methodology of data gathering explained, sources described; Review process explained on the narratives (explanation of price developments and background on market structure)
Calculation methods used	Clear base for index. Calculation of annual percentage explained
Form(at)s of numerical results	Time series tables
Form(at)s of graphical results	Time series graphs
Form(at)s of commented results	Conclusion on price development in title plus more explanation short and long-term price developments in the EU. Background on value chain and market structure and price mechanisms per country on the three stages of the value chain.
Intelligibility of results	High, because tables have explanatory text and variables are explained. Market reviews include interpretations.

Source: Authors of this study.

Results communication

Table 29 shows the performance of the approach with respect to results communication.

Table 29: Results communication of Approach 1

User costs	Free of charge
Time lag	1-6 months depending on the data series and sources
Intuitiveness of presentation	High, main changes are presented, background information is given in the narrative and the main conclusion in title
Knowledge transfer efforts	Moderate, brief qualitative explanation of developments at EU level and for most noticeable developments

Source: Authors of this study.

The knowledge transfer efforts are moderate. Expert knowledge is used to provide insights into the developments of prices and the factors causing changes in prices, but will be of a qualitative nature.

4.1.2 Approach 2 Price indices, absolute prices and euro shares

Purpose and monitoring focus

Approach 2 resembles Approach 1 with the addition of annual average absolute price levels and spreads between supply chain stages, and Food Euro Shares (Consumer Euro Shares, or shares in value added), and additional narratives to explain the changes in Food Euro Shares (see Table 30). The purpose of Approach 2 is:

1. to provide monthly changes in prices at various stages of the supply chain for major food items and the agricultural commodities that they are derived from;
2. to give insights into the factors that determine price developments for policy makers and other stakeholders in a general way;
3. to provide insight into the developments in (annual) price spreads (differences in absolute prices at two successive stages in the supply chain);
4. to provide insight into the shares that actors in different stages of the supply chain have in the total value added in the chain, i.e. the Food Euro Shares.

Table 30: Details of Approach 2: price indices, absolute prices, and euro shares

Institutional context	
Purpose/description	The purpose of Approach 2 is to provide insight into price developments across the different stages, in price spreads per stage of the food production chains in MS and EU, and the shares of each supply chain stage in the so-called Food Euro. The tool reports on monthly price indices for agricultural commodities and (derived) products at various stages of the supply chain (farm-gate, processor or wholesale, consumer, and import and export), and on annual absolute prices, and Food Euro Shares.
Output form(at)s	Interactive graphs; and narrative text. Data also available in tables from website;
Output frequency	Monthly; narrative will be adapted quarterly
Duration of publication	Info available since January 2005 although fragmented. Extent of data availability increases over time, (e.g. the harmonised index of consumer prices is not calculated from the beginning). No pdf issues, only interactive figures; updated continuously (i.e. longer time series)
Monitoring focus	
Commodities/sectors	Pig meat; dairy; apples (in practice relatively easily extendable to commodities currently included in the FPMT, and a number of other products that are already included in agricultural, trade and consumer price monitoring)
Supply chain levels monitored	Agricultural production; imports; exports; processing and/or wholesale (when applicable); retailing
Data frequencies	Monthly; narratives are reported quarterly
Spatial disaggregation	EU-28, MS level
Conducive to purpose	Yes.

Source: Authors of this study.

The basic data will be updated monthly in interactive graphs and published on a public website of the EU. The information can be made available from 2005 for the EU-28 and per MS. The monitor will focus three stages of the supply chain: agricultural production, processing & packaging, or wholesale, and retail, but it also includes prices of imports and exports. Depending on the choice of products these import and export prices may resemble wholesale prices, processor prices or agricultural prices. Although generally, import and export prices are found to be more volatile than average wholesale and processor prices.

For each stage, monthly output price indices, annual absolute output prices, and annual Food Euro Shares (differences between value added at different stages as a share of consumer price) are made available. Technical information will be used to make prices in the total value chain comparable and to calculate the Food Euro Shares. E.g. about 10 kg of milk is needed to produce 1 kg of cheese. Therefore when calculating Food Euro Shares for dairy, each euro spent on a kg of cheese requires 10 kg of raw milk input and the prices at various stages should be adjusted accordingly. In Table 30 a description is given of the output of Approach 2.

Next to the statistical information about monthly prices indices, annual absolute prices and spreads, and Food Euro Shares a narrative will be produced every quarter to indicate the background of price developments and the development in euro shares. Specific for the euro shares, determinants are distinguished which can partly be quantified by specific indicators (see Table 31). Meyer & Von Cramon-Taubadel (2004) and Vavra & Goodwin (2005) mention the following determinants of price transmission along the food value chain based on economic theory (see Section 3.1.2):

1. Market power;
2. Adjustment costs;
3. Inventory management;

4. Farm price support policies;
5. Differences in retail demand shocks and farm level supply shocks;
6. Asymmetric price information and biased reporting.

In Table 31 per determinant indicators are suggested. In addition, the nature of the processing industry, the quality of the products produced and the importance of international markets also play a pivotal role in determining Food Euro Shares. In some countries, domestically produced products are priced differently than imported products. Sometimes this has to do with the nature of the processing industry, or the fact that the market is divided between products for fresh consumption and product for processing, e.g. for apples. Ideally, the data collection is able to split these products, but in practice that is not always the case.

Table 31: Quantitative and qualitative indicators for explaining developments in prices and Food Euro Shares

Determinants for level and developments in price spreads and Food Euro Shares	Selected qualitative indicators	Selected quantitative indicators
Market structure	• supply chain overview • entry and exit of firms	• number of firms • C4 (concentration ratio; combined market shares of 4 largest firms) • cooperatives market shares • cooperatives number • recognised producer organisations • % SMEs • market shares of supermarkets in food sales • market shares of discounters in food sales
Adjustment costs	• contracted production/sales (forward or fixed price)	
Quality & consumer choice	• product differentiation • product quality	• number of new products • number of food quality schemes
Inventory management		• stocks (relative to annual production) • perishability (time) • stocking costs or capacity
Demand & supply shocks	• crises • weather	• (harvested) production
Policies	• policies	
Costs		• labour costs • energy costs • input costs
Information biases	• metadata • quality of data (data revisions; accuracy; sampling error)	

Source: Authors of this study.

Monitoring results

Table 32: Monitoring results of Approach 2

Monitoring results	
Types of quantitative results	Monthly price indices per product per stage of the supply chain; Annual absolute prices per product per stage of the supply chain; Food Euro Shares for primary producers, processors or wholesale, and retail
Types of qualitative results	Explaining text to developments in price indices, absolute prices and Food Euro Shares
Prices monitored	Indices of p farm out, p processing out, p retail out and other consumer prices, import prices and export prices; Absolute prices at each stage, also needed to calculate the Food Euro Shares (including some technical information on the transformation of products during processing or storing)
Further quantities monitored	Yes: production quantities, import and export quantities
Indicators published	Commodity prices, consumer prices, import prices, export prices and producer prices; Absolute prices for farmers, processors and retail
Reproducibility of approach	Methodology of data gathering explained, reviews provide summaries of main developments in the market
Calculation methods used	Clear base for index. Calculation of annual percentage change in prices explained. Calculation of Food Euro Shares explained.
Form(at)s of numerical results	Time series tables.
Form(at)s of graphical results	Time series graphs.
Form(at)s of commented results	Conclusion in title, explanation of short and long term price developments. Background on value chain and market structure and price mechanisms. Background on possible variation in Food Euro Shares qualitative including some indicators added for Food Euro Shares (see Table 31 for determinants of variation in Food Euro Shares and possible indicators)
Intelligibility of results	High, because tables have explanatory text and variables are explained. Market reviews include interpretations.

Source: Authors of this study.

Results communication

The use of information is free of charge for all. The information is provided with a time lag of two months and presented in the way which is intuitive. Every quarter a narrative is added for understanding the statistical changes in data. As information is complex, e.g. many indicators, narratives are needed to make the information understandable. Efforts to transfer knowledge are high.

Table 33: Result communication of Approach 2

User costs	Free of charge
Time lag	2 months
Intuitiveness of presentation	High, main changes are presented, main conclusions in title
Knowledge transfer efforts	Low, because qualitative and quantitative information is supplied to explain price and Food Euro Share developments.

Source: Authors of this study.

4.1.3 Approach 3

Introduction

Approach 3 is the most ideal approach. In this paragraph the rationale behind the ideal type of information from the perspective of the policy maker is explained.

A world of full information

From economic perspective, perfect information is an attribute of efficient markets, where all market participants have perfect knowledge about prices, costs and other product attributes, and market players' preferences.[12] Generally, market players benefit from information transparency in two ways:

1. Search costs are low. When the transparency level is high, market players make less costs to get the necessary information prior to a transaction. This results in more efficient markets as its players are able to respond to changes faster.
2. The results of a market transaction meet expectations of all involved parties with efficient allocation of resources as result. Market players pay prices they expect to pay for getting products and quality they expect to get.

Lack of information in the market involves market imperfections that can lead to:

1. Too few transactions or no market at all;
2. Margins are too high or too low compared to an efficient ideal;
3. Some market players unintentionally pay (get) more money than others for the same product.

Information about the market discloses these imperfections.

Each stakeholder in the value chain has different preferences on what type of information is needed and when. Value chain actors, such as primary producers, processing industry and retail, have preference for the actual detailed information, mainly about prices and volumes, and/or their forecasts. In policy-related contexts, market information is often used to monitor market efficiency. Information about prices, costs and margins in the total value chain can help to signal market failures better and faster. Information about factors determining prices, costs and margins can help to develop policies aimed at tackling market failures and increasing competitiveness. The smaller the information time lag is and the more detail, the faster governments get the signal about disturbances that adversely affect the efficient market equilibrium in a very specific market. In addition, policy makers can intervene in the inefficient markets by providing market information to value chain

[12] https://www.ecnmy.org/learn/you/social-influences-culture-information/what-is-perfect-information/

actors, which is otherwise difficult to obtain.[13] The type and timeliness of this information is the same as preferred by market players.

Table 34: Type of information and stakeholder needs in Approach 3

Information	Value chain actors	Policy makers
Real-time and detailed, forecasts	Decision making prior to a transaction	Early warning, market intervention by providing information, market monitoring
Less recent and less detailed	Interest representation	Market monitoring

Source: Authors of this study.

In an ideal world, policy makers own market information at all detail, i.e. real-time and evidence based, which will help them, on the one hand, to signal distortions fully and immediately and in all relevant food markets, and, on the other hand, to be able to intervene e.g. by providing information to market players, if necessary.

In an ideal world, policy makers can observe real-time distortions, but also market players can monitor all prices and volumes. In this case, the economy will be in a continuous state of equilibrium and all market players' attempts to deviate will be disciplined in the short term.

In a near-ideal world, all market participants have perfect knowledge about prices, costs and other product attributes, and market players' preferences, the future is forecasted, but generally unknown, especially unpredictable factors like the weather and pests and diseases. Therefore some temporary market distortions are still thinkable. For policy purposes, an almost full availability of information about prices, margins and factors that determine them, would be ideal. Price volatility will be solved by information transparency about supply, demand and stocks. Market power will be solved, because nobody is able to strategically influence market outcomes. When price volatility and market power issues are solved, farmers' incomes will be more stable, and also potentially will increase if there is market power exerted in the initial situation.

Approach 3 characteristics

Following from above, the purpose of an ideal approach will be to provide information and understanding needed for all thinkable purposes that are aimed at increasing market efficiency and preventing the occurrence of market failures, and within a broad policy context. Therefore, Approach 3 is characterised as an approach with a maximum level of information. Considering that Approach 3 is rather a thinking construct of the most extreme information availability, no precedent approaches resembling Approach 3 have been implemented. Existing approaches, as described in Chapter 2, are generally meeting the needs of a pre-defined set of goals in a certain policy context, and therefore, have predefined features, such as level of characteristic disaggregation and period coverage.

Institutional context

An ideal approach is aimed to meet all information and understanding needs in all EU policy contexts for all relevant food markets for all relevant policy goals increasing market efficiency and preventing the occurrence of market failures. The goals can differ across regions, markets and time. The ideal monitoring tool will give all relevant information instantly as information is continuously available.

[13] Other groups interested in obtaining market information are service providers and the audience. Their information interests are left out of scope.

Table 35: Institutional context of Approach 3

Purpose/description	To meet all information and understanding needs in all EU policy contexts for all relevant food markets for all relevant policy goals, related to increasing market efficiency and preventing the occurrence of market failures.
Output form(at)s	Interactive graphs, tables and charts; all other thinkable formats.
Output frequency	Continuous
Range of historical data included	All past

Source: Authors of this study.

Monitoring focus

Table 36: Monitoring focus of Approach 3

Commodities/sectors	All at transaction level, and aggregated at different levels;
Supply chain levels monitored	All relevant stages, at firm level, or even at activity level, and aggregated at different levels
Data frequencies	All periods
Spatial disaggregation	At every relevant geographical disaggregation level

Source: Authors of this study.

The monitoring focus of an ideal approach will be on one hand at the lowest level of detail for every characteristic. This because market distortions can be related to every single type of product, firm or other entity, and transaction, and can occur in all periods.

On the other hand in the ideal situation, information is also provided at different levels of aggregation, as for some policy goals this will sufficient and will be leading to more understanding. Within the EU, the size of a market, at which policy is directed, is relevant for the level of information detail. For example, the level of the ideal type of information per situation can differ between Member States, regions and the EU as a whole, as EU product markets are less and less bounded by regions and states. This implies that, in addition to full access to every detail of market information, for different situations, full access to different aggregation levels is provided by an ideal monitoring tool.

Monitoring results

In an ideal approach, the quantitative results will include all information about prices, costs and margins, and with information about all factors determining prices, costs and margins, such as factors explaining changes in supply and demand, market and value chain structure. All thinkable types of qualitative results will be provided. All prices and quantities are monitored at transaction level, but also aggregated at different product levels, geographical levels and economic activity levels. The indicators include prices, costs and margins plus all factors determining prices, costs and margins.

Table 37: Monitoring results of Approach 3

Types of quantitative results	Prices, costs and margins plus all factors determining prices, costs and margins
Types of qualitative results	Narrative: causes of price changes/qualitative analyses, all thinkable types
Prices monitored	All at transaction level and aggregated at different levels
Further quantities monitored such as quantities produced and quantities sold	All at transaction level and aggregated at different levels
Indicators published	Prices, costs and margins plus all factors determining prices, costs and margins
Reproducibility of approach	Extremely high, given that raw data and applied calculations are stored.
Calculation methods used	All relevant and clear for all
Form(at)s of numerical results	Time series, tables and all other thinkable formats
Form(at)s of graphical results	Time series charts, graphs and all other thinkable formats
Form(at)s of commented results	All thinkable formats
Intelligibility of results	Extremely high

Source: Authors of this study.

In an ideal approach, calculation methods used are clear to everyone. All methodological difficulties are solved. The reproducibility of data is extremely high, given that raw data and applied calculations are stored.

An ideal approach provides numerical, graphical and commented results in all thinkable formats that are fit for instant reading and understanding of the results.

The intelligibility of the results is extremely high, as everyone gets results with characteristics, the level of aggregation and in a format that are perfectly understandable and insightful.

Results communication

Table 38: Results communication of Approach 3

User costs	Free of charge
Time lag	Real-time
Intuitiveness of presentation	Extremely high
Knowledge transfer efforts	Extremely low

Source: Authors of this study.

The use of information is free of charge for all. The information is provided real-time and is presented in the way which is extremely intuitive. As all information is understandable for all at every time, knowledge transfers efforts are extremely low.

4.2 Data needs and sources

4.2.1 Approach 1

The starting point of this alternative approach is the available (experimental) data in the European Food Price Monitoring Tool (FPMT). In the tool there are three types of data series available; indices (2010=100), indices (2015=100) and percentage changes compared to last years (m-12). The overall availability of data is however quite limited. For the selected products, the tool has some data for 'Milk, cheese, and eggs', 'Whole milk', 'Cheese and curd', and 'Pork'. For apples there is no data available. Only for fruit as a whole, agricultural commodity price indices (2010=100), import price indices (2010=100) and consumer price indices (2010=100, 2015=100), and associated annual percentage changes are available. Some series, like all of the agricultural commodity price indices are only available for 2010=100 and not for 2015=100. An overview of the current availability of data in the FPMT is presented in Annex IV.

For the three commodity groups dairy, pork and apples, no prices of processors (producer prices) are available in the FPMT. With respect to import prices, only some fragmented data are available for whole milk, cheese and curd, and pork. Because apples are just a small part of the total production, trade and consumption of fruit in the EU, these data are deemed unsuitable to monitor the apple market. Hence, the FPMT data needs to be supplemented with other data.

In Table 39 the main data inputs are mentioned to present the price developments per stage of the food supply chain, while in Table 40 the sources of the prices is mentioned. In Annex V a complete overview of the sources of price information is given.

No other indicators are presented and analysed quantitatively. Other indicators (see Table 31, Section 4.1.2) are part of the narrative and either describe the long run market structure and price formation or are mentioned to explain price developments.

Table 39: Data inputs Approach 1

Qualitative data used	Expert knowledge for commenting graphics
Quantitative data used	Monthly time series of prices indices for each MS; unbalanced panel for the EU
Data transparency	The underlying data for graphs downloadable for free from Eurostat Data sources explicitly specified and links are provided

Source: Authors of this study

Table 40: Data sources of Approach 1

Prices	Source
Index of Agricultural output prices	Eurostat (FPMT); DG AGRI; EU prices for selected representative products; Eurostat Price indices of agricultural products, output (2010 = 100) - quarterly data [apri_pi10_outq]; National observatories like OFPM, SAPI;
Index of Producer prices or Index of Wholesale prices	Eurostat (FPMT); Eurostat, Producer prices in industry, total - monthly data [sts_inpp_m]; National observatories like OFPM, SAPI;
Index of import and export prices	Eurostat Comext
Consumer price index	Eurostat (FPMT); Statistics Poland; National observatories like OFPM and SAPI.

Source: Authors of this study.

4.2.2 Approach 2

The data needs of approach 2 can be grouped into:

1. Statistical data about monthly prices per stage in the supply chain, including an explanation per MS of the raw data used. This information is completed with information about export and import prices of processed products if no monthly data are available on the output prices of processors and with technical information about the processing to calculate relevant Food Euro Shares. Using import or export price for calculating the Food Euro Share is a next best option for using prices of processed products.
2. Statistical data to calculate indicators for determinants of developments in price indices, absolute prices and Food Euro Shares. Since these indicators are used in the narratives the frequencies will be the same as the frequency of the narratives (quarterly).
3. Qualitative information about supply, demand and markets to give background information of the developments in price indices, absolute prices and Food Euro Shares. This information can be divided in more or less structural market information (market structure; market share, use of contracts; technical data of food processing) and actual market information (crisis, change of policies, development of supply, demand and stocks).

Table 41: Data inputs for Approach 2

Qualitative data used	Expert knowledge for comments to statistical information divided in structural and actual market information
Quantitative data used	Monthly and annual time series for each MS; unbalanced panel for the EU; Technical data for processed food. E.g. quantity of milk needed to produce 1 kg of cheese; Additional quantitative data on production, exports, imports, concentration in retail, and a number of other explanatory factors.
Data transparency	The underlying data for graphs downloadable for free from Eurostat. Data sources are explicitly specified and links are provided to the data sources (see Table 42).

Source: Authors of this study.

In Table 42 the main data sources are mentioned to calculate the price developments per stage of the food supply chain. Also the sources of the technical data of the food processing and the sources for calculating the indicators for explaining the determinants of the developments of the Food Euro Share are described. See Annex V for a more elaborate overview of sources.

Table 42: Data sources prices for Approach 2 (additional to Approach 1)

Indicator	**Source**
Absolute agricultural output prices	DG AGRI; EU prices for selected representative products; National observatories like OFPM and SAPI.
Producer prices	Eurostat Prodcom
Import and export prices	Eurostat Comext
Consumer prices	Eurostat Detailed average prices - 2015 [prc_dap15] National observatories like OFPM and SAPI. Statistics Poland;
Technical data	Information about technical relation between input and output of processing food
Quantitative indicators for Food Euro Shares	See Table 31: Quantitative and qualitative indicators for explaining developments in prices and Food Euro Shares

Source: Authors of this study.

4.2.3 Approach 3

Table 43: Data needs for Approach 3

Qualitative data used	All relevant knowledge
Quantitative data used	All relevant knowledge
Information sources	All relevant sources
Data transparency	The underlying data continuously accessible, all sources known

Source: Authors of this study.

In a world with perfect information, all relevant knowledge is used from all relevant sources. When information transparency is full, the sources are known, and the knowledge is continuously accessible.

4.2.4 Data requirement compared to existing FPMM initiatives

Table 44 compares the data requirements for enabling detailed vertical price transmission analyses along food supply chains as outline in Chapter 3 and current data gathering by existing monitoring approaches and the alternatively suggested approaches as analysed in Sections 2.1 to 2.3. The first column refers to the data needed for conducting detailed vertical price transmission analyses along food supply chains as discussed in detail in Chapter 3. The second column gives examples for each type of input data. The third column specifies what share of the 65 FPMM initiatives as analysed in Section 2.1 is currently collecting each data type. The fourth column mentions to which extent the class(es) of the typology in Table 20 are currently collecting each data type. The last column specifies which of the three alternative approaches suggested in Chapter 4 collects each data type.

Table 44: Data requirements vs. current data gathering

Data needed	**Collected by existing FPMM initiatives**	**Typology classes***	**Alternative Approaches 1 and 2**
Farm-gate prices	63%	Class 1, Class 2, Class 3	yes
Retail prices	53%	Class 1, Class 2, Class 3	yes
Prices of food services	Barely collected	Some Class 3 approaches	no
Intermediate price levels	Less than half, e.g., wholesale by 42%	Class 3	yes, processing, import and export
Costs or profits	Barely implemented (<5%)	Class 3	no
Frequency of data collection	most monthly and annually		monthly and annually
Disaggregated data	Less than half, e.g., regionalisation by 40%	Partially implemented in all classes	product or product group level, 3 stages and 28 MS
Measures of supply chain structure	15% - mostly as narratives, numeric measurement not existing	Barely collected, only partially by some Class 3 approaches	narratives in both approaches and additional indicators in approach 2

Source: Authors of this study.
Note: * Only the observed and currently existing FPMM approach classes are considered here, that is, Class 1, Class 2 or Class 3.

4.3 Advantages and disadvantages including robustness analysis

4.3.1 Approach 1

Robustness assessment

Table 45 give an overview of the robustness analysis of Alternative Approach 1. Reliability is high as far as the data are concerned. Validity of prices, especially for comparison along the chain may vary per commodities. Reliability and validity of the reviews may be improved by reviews and possibility to give feedback.

Table 45: Robustness analysis Approach 1

Effort	Moderate – Data available, gathering expert knowledge per MS (or groups of MS) is needed.
Applicability	High - already done for some EU MS e.g. the Netherlands[14]
Reliability	High - calculated directly from Eurostat data.
Validity	Moderate- High - calculated directly from Eurostat data
Flexibility	High - updated monthly; a wide range of commodities covered

Source: Authors of this study.

Advantages and disadvantages

The main advantages of Approach 1 is the regular update of the statistical information and the explanation of market analysis. The approach is consistent across all EU MS although some differences in the type of raw data still exists and the product may not match completely along the chain. Table 46 gives a summary of the advantages and disadvantages.

Table 46: Advantages and disadvantages Approach 1

Large advantages	Timely information due to monthly publication and quarterly update of narratives; Consistent approach across all EU MS; Wide range of commodities covered; Short summary, main messages on recent market developments are immediately clear to interested parties, high reliability (independent report)
Large disadvantages	Quality of data depends on the raw data collection in the MS (not harmonised, data definition is unclear, types of markets included or excluded, weighting of prices is unclear). Data for processor prices are not harmonised nor well defined (some products are processed several times by different companies before sold to the producer e.g. bread). Product comparability is limited along the chain and among countries if price indices are made for groups of products like fruits, vegetables or meat.

Source: Authors of this study.

4.3.2 Approach 2

Robustness assessment

Compared to Approach 1 additional effort is needed for the calculation of Food Euro Shares. For the calculation of Food Euro Shares absolute prices per unit and per stage of the supply chain (and not only indices) are necessary. Next to that technical information about the transformation of raw materials into food products in food processing is needed for calculation of the Food Euro Shares. Additional information is also needed every quarter to gather expert knowledge and supporting indicators (see Table 31) to explain the developments in prices and Food Euro Shares.

Approach 2 is currently not applicable to all supply chains in all MS. For many supply chains no absolute monthly prices are available. The reliability of the data is high if the data sources are known including the rules how the prices and Food Euro Shares have been calculated.

[14] See as an example of the commented price monitoring of a selected group of agricultural products: https://www.agrimatie.nl/ThemaResultaat.aspx?subpubID=2424&themaID=3596&sectorID=2423

Table 47: Robustness assessment of Approach 2

Effort	High– Most data available for price indices but absolute price levels are needed to calculate the price spreads. For some products additional data collection beyond the current monitoring is required to make the approach complete. Gathering expert knowledge per MS (or groups of MS) is needed.
Applicability	Low to moderate; Monthly prices for products at processing & packaging level are not always available.
Reliability	High – mostly calculated directly from Eurostat data; sources of raw data are known including rules to calculate the prices and Food Euro Shares.
Validity	High - sources of raw data are known including the attached advantages and disadvantages. Validity can be increased by involving stakeholders in the process of drafting the narratives.
Flexibility	High - updated monthly; a wide range of commodities covered

Source: Authors of this study.

Advantages and disadvantages

The main advantages of the approach with prices and Food Euro Shares are that information is timely with regular updates of the statistical information and the background information. The approach is consistent across all EU MS although some differences in the type of raw data still will exists. The main advantage is that insight is given in these differences. The readability of the results is increased by supplying a narrative that gives a conclusion and the main messages of the development in prices and Food Euro Shares. This increases the reliability of the price monitor.

The main disadvantage is that additional data need to be gathered at the processing and packaging level on a monthly basis. For the time being export prices of processed products can be an alternative for these prices if the domestic consumption resembles the export products. Another disadvantage is that the type of raw data still differ between MS which makes it difficult to conclude about differences in prices and Food Euro Shares among MS.

Table 48: Advantages and disadvantages Approach 2

Largest advantages	Timely information due to monthly publication and a quarterly update of the narratives; Consistent approach across all EU MS; A wide range of commodities covered; Short summary and main messages on recent market developments are immediately clear to interested parties, high reliability.
Largest disadvantages	Quality of data depends on the raw data collection in the MS. Additional data need to be gathered at the stage of processing and packaging on a monthly basis for many countries. Export prices of processed products can be a next best alternative for the prices at this stage.

Source: Authors of this study.

4.3.3 Approach 3

Robustness assessment

The applicability of the ideal approach is high as it already covers all areas and situations relevant in food markets. The approach produces reliable results, of high

completeness and quality representing all relevant data sources and the broadest extent of data gathering. By its nature, the ideal approach constitutes valid measurements.

Table 49: Robustness of Approach 3

Effort	Extremely high (required new technology and regulations)
Applicability	Extremely high
Reliability	Extremely high
Validity	Yes
Flexibility	Extremely high

Source: Authors of this study.

The efforts that are needed to collect, process, carry and present information in the ideal approach are unthinkable high. New effort diminishing solutions have been regularly introduced in the past to solve this problem. Think of microchips and computer, and as example their introduction in stock trading. Other solutions have still a long path of development to follow. Think of brain-machine interface technology and block chain. At this moment the ideal approach is hardly feasible, because the technology that facilitates the feasibility is to be developed yet.

Advantages and disadvantages

Table 50: Advantages and disadvantages Approach 3

Largest advantages	Extremely high level of information and understanding
Largest disadvantages	Extremely high costs

Source: Authors of this study.

The largest advantage of the ideal approach that it provides an extremely high level of information and understanding, which is fit for all EU policy contexts and for all relevant food markets and for all relevant policy goals.

The largest disadvantage are the unthinkable high costs of collecting, processing, carrying and presenting information.

4.4 Ranking of approaches based on cost-effectiveness at EU level

For the estimation of the costs involved in implementing the approaches for the three products pig meat, dairy, and apples in the EU-28, we resort to using a relatively simple approach. First, although we know that some data are missing in some countries, we assumed that the costs of additional data gathering will be borne by the MS. From the exploration into the data regarding the three products and four countries selected for this study, we have learned that most data are actually available, although not always made publicly available in the same format or following the same definitions. Once a new EU monitoring approach is to be implemented, consensus among EU MS should be reached on the products covered. There is already a lot of information available at some of the national price and margin observatories, which could be used. Hence, some of the costs will be incurred during the process of harmonisation, which we envisage will take some time to be completed.

We discern costs at two levels: EU level and MS level. At the EU level costs are made for collecting the information from the MS, for coordinating the effort, for checking and

analysing the data and combining the narratives into one common story. Furthermore, metadata must be kept up to date, data and text need to be published, and the process of harmonising data is to be coordinated.

Labour costs (wages and social security payments, plus taxes minus subsidies received by the employer) and indirect costs are estimated from Eurostat data on hourly labour costs in Professional, scientific and technical activities, and the share of non-labour costs in total turnover minus gross operating surplus for the same sector. For the costs of the EU, we used data for Belgium. At MS level the labour costs and indirect costs shares were calculated for the MS and used to estimate the euro costs per working day and indirect costs. On average about 30% of the total costs are associated with labour costs. The rest is costs of goods and services and other indirect costs. A 10% costs of project management and other overhead staff was assumed for both the EU as well as the MS level.

Table 51: Cost estimate for Approach 1, in person days and euro per year

		Person days	Labour costs	Indirect costs	Total costs
EU level	Additional gathering data from MS	72	28,166	88,777	116,943
	Harmonising approach and data with MS and stakeholders	30	11,736	36,990	48,726
	Gathering narratives from MS	12	4,694	14,796	19,490
	Analysis of data and MS	24	9,389	29,592	38,981
	Publishing	36	14,083	44,388	58,471
	Overhead, management	17	6,807	21,454	28,261
	Total	191	74,876	235,998	310,873
		Per MS	EU-28	EU-28	EU-28
MS level	Writing narratives price developments	24	142,328	305,527	447,855
	Writing market and value chain structure	15	88,955	190,954	279,909
	Harmonising approach and data with MS and stakeholders	6	35,582	76,382	111,964
	Overhead, management	5	26,687	57,286	83,973
	Total	50	293,552	630,150	923,701
	Grand total				1,234,575

Source: Authors of this study.

For Approach 1, the total costs at EU level are estimated at about 310,000 euros per year. This estimate includes wages of people working on the monitoring as well as indirect costs. The total costs for the MS of Approach 1 were estimated at 925,000 euros. The costs range however from just 10,000 euros to 70,000 euros per MS. In total the annual costs of Approach 1 are estimated at 1.2m euros. Note that these costs were calculated on the basis of three products. If the number of products increases the costs will also increase almost proportionately. Although some efficiencies may be attained, the product specific characteristics of the data gathering and expert knowledge require that for each product additional effort is needed in the

same order as for the three products analysed in this study. The economies of scale for extending the number of products is regarded relative small.

The annual costs of approach 2 are estimated at a total of 2.5m euros, of which almost 500,000 for the EU and 2m for the MS. The costs for the MS are higher because of the additional data gathering with respect to factors explaining price developments, and market and value chain structure. There will probably also be an additional data gathering required to provide series of absolute prices for selected products to the EU. However, for these calculations we assume that these data are already available at the MS level. Whether that is true will depend on the choice of products. For pig meat, dairy and apples, most series were available or are probably available at the MS level although not publicly, e.g. for the monthly producer prices indices (processors) of pig meat and dairy in Bulgaria and Poland. Confidentiality may prevent MS from publishing such data, but with sufficient market actors we assume that they can be collected and published.

Table 52: Cost estimate for approach 2, in person days and euro per year

		Person days	Labour costs (euro per year)	Indirect costs (euro per year)	Total costs (euro per year)
EU level	Additional gathering data from MS	72	28,166	88,777	116,943
	Harmonising approach and data with MS and stakeholders	30	11,736	36,990	48,726
	Gathering narratives from MS	12	4,694	14,796	19,490
	Analysis of data and MS	48	18,778	59,184	77,962
	Publishing	72	28,166	88,777	116,943
	Overhead, management	70	27,462	86,557	114,019
	Total EU	304	119,003	375,081	494,084
		Per MS	EU-28	EU-28	EU-28
MS level	Additional data gathering	30	177,910	381,909	559,819
	Writing narratives price developments	48	284,656	611,054	895,710
	Writing market and value chain structure	15	88,955	190,954	279,909
	Harmonising approach and data with MS and stakeholders	6	35,582	76,382	111,964
	Overhead, management	10	58,710	126,030	184,740
	Total MS level	109	645,813	1,386,330	2,032,143
	Grand total EU and MS				2,526,227

Source: Authors of this study.

5 Application of the proposed approaches

5.1 Introduction

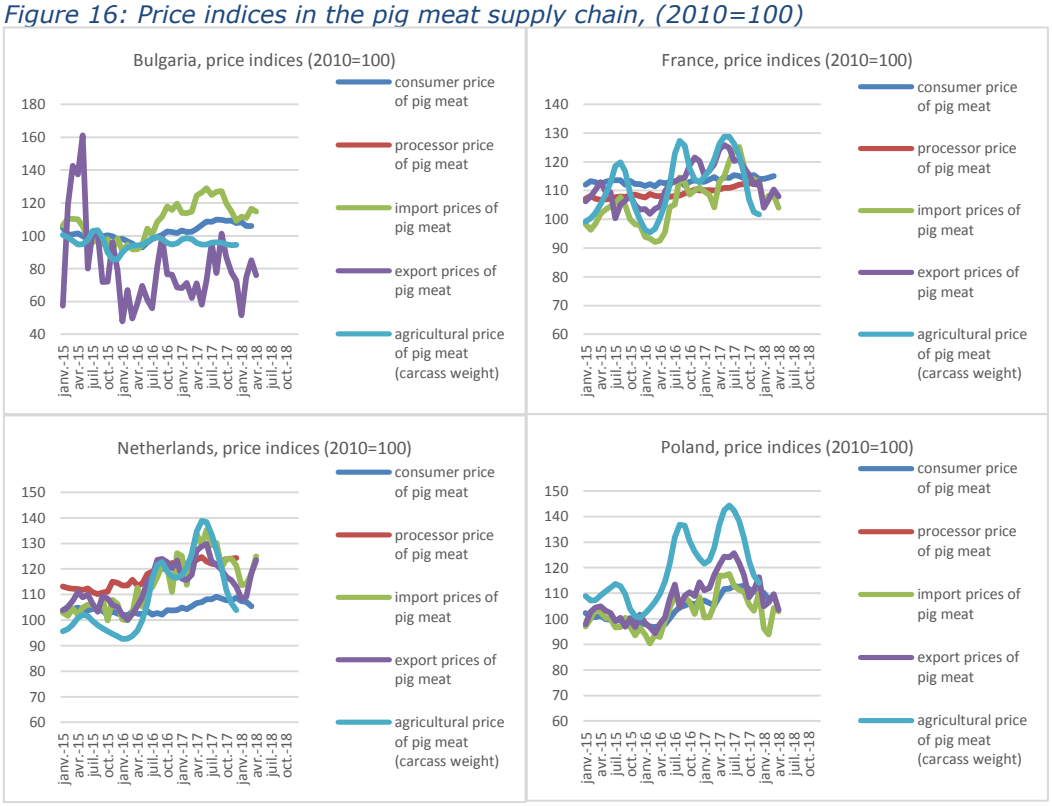
In this chapter the alternative approaches described in Chapter 4 are applied to the supply chain of dairy, pig meat and apples for the EU Member States Bulgaria, France, the Netherlands and Poland. The objective is to apply the Approaches 1 and 2 to illustrate the practical usage and usefulness of these approaches. The illustration is done with public available data and with supply chain experts in the Netherlands. The results are for illustration purpose only.

5.2 Approach 1: A simple monitor of price indices with narrative

5.2.1 Approach 1 for pig meat: highly fluctuating agricultural prices and stable prices for consumers

Price developments

Figure 16: Price indices in the pig meat supply chain, (2010=100)



Sources: see Annex V.

Agricultural price indices for pig meat are strongly fluctuating (see Figure 16). Within three years price indices fluctuate between 90 and 140. Bulgaria is an exception, the index fluctuates between 94 and 103. Price indices at processors level, if known, are fluctuating far less than agricultural price indices. If we look at the prices for meat products exported then the fluctuation resembles the developments of agricultural price indices. Again Bulgaria is an exception with highly fluctuating export price indices

and for more stable agricultural price indices. The low self-sufficiency rate of about 35% for Bulgaria in this period can be an explanation for this. In all four countries the consumer price indices of pig meat are far more stable than the price indices at other stages of the supply chain.

Factors explaining price developments

The European pork market is in equilibrium in the period 2015-2017. The production of pork is more or less stable. In the EU there is a 4% decrease in number sows and a productivity increase per sow in the same order. In Bulgaria the number of sows increased with 17% between end of 2014 and 2016 while the number of sows decreased with 10% in Poland. Production of pig meat was hardly influenced by disease outbreaks although African Swine Fever still is a problem at the eastern border of the EU. The intensity of pigs is low in this region and production is not strongly influenced by this.

The consumption in the EU is rather stable in the EU with annually 20m to 21m tonnes of pig meat. Differences among MS are small. Small increases in production and a stable consumption lead to an increase of the export of pig meat and an increase of the self-sufficiency (see website pork.ahdb.org.uk). The export of pig meat is steadily increasing with China, Japan, Hong Kong and South Korea being the main export countries. The feed price index in the EU decreased with 4% in the period 2015Q1 to 2017Q4. Feed prices increased in Bulgaria (2%), were stable in Poland and decreased in France and the Netherlands with respectively 6 and 4%. Feed costs are the main cost element, over 50% of the total costs, for the production of pig meat.

Value chain and market structure

The supply chain of pig meat consists of primary producers, slaughterhouses, meat processors and retail organisations.

Bulgaria

The pig meat sector is Bulgaria is characterised by many small-scale farms and firms. Production fluctuates and many farms and firms quit production. Self-sufficiency is about 35% and not changing. Also retail sector still has many small shops and a few big supermarkets. The markets can be characterised as spot markets at all stages in the supply chain. Coops don't play a role in this supply chain.

France

The French pig meat sector is stable. Production is slightly decreasing and the number of farms is reducing. Self-sufficiency is just above 100%. Much of the pig meat is sold by a few big supermarkets. Markets are characterised by spot markets at all stages in the supply chain. Coops are not a major player in this supply chain.

The Netherlands

The Dutch pig meat sector is stable. The number of farms steadily decreases. Self-sufficiency is between 200% and 250% with big exports of piglets, pig and pig meat to Germany. Meat is also imported from Germany. Most of the meat is sold by the supermarkets with a fierce competition on prices. Coops don't play a role in pig supply chain in the Netherlands. Spot markets determine the prices although retail has annual contracts with meat processors for delivery without fixed prices.

Poland

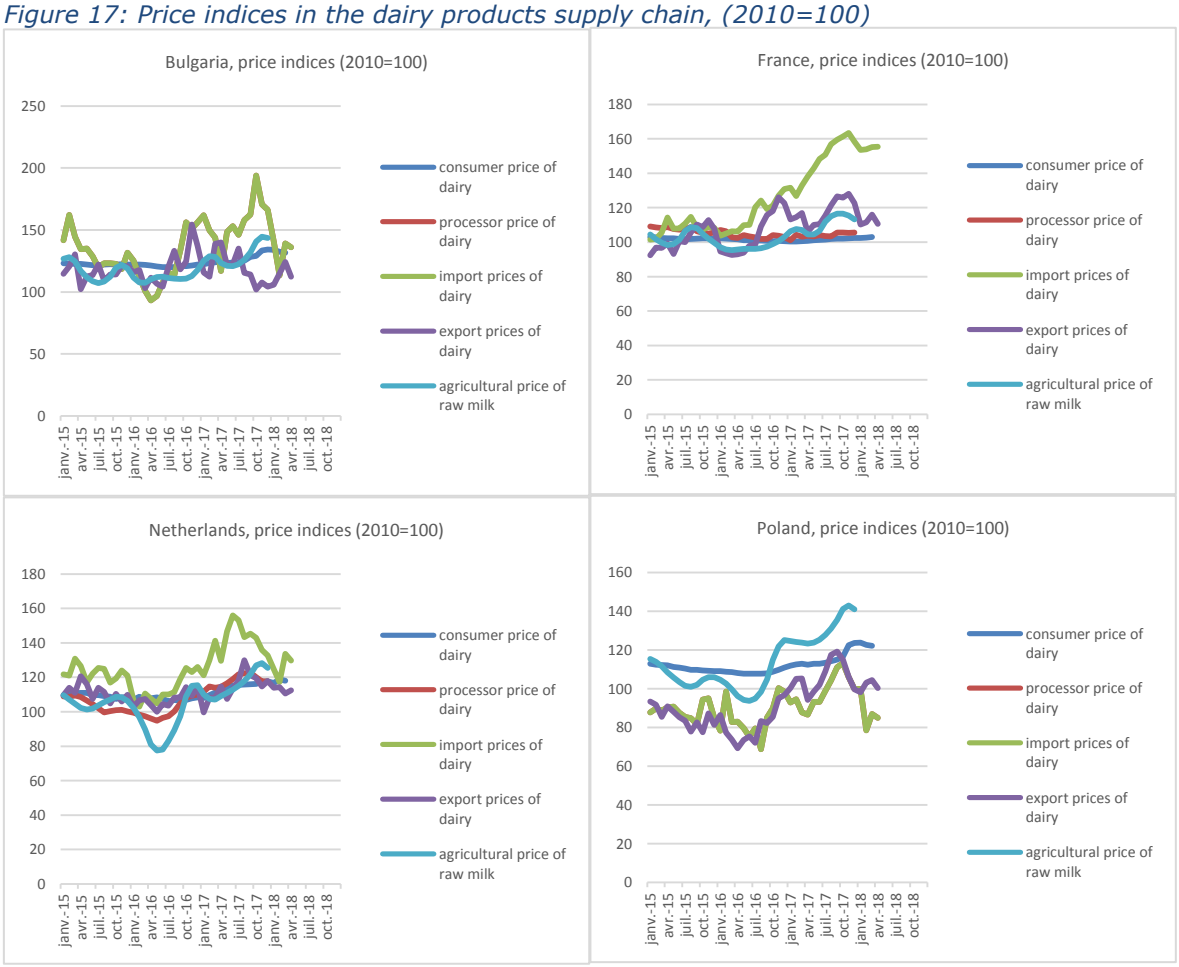
The pig meat sector in Poland has still many, although decreasing number of small farms. Production fluctuates over time. Self-sufficiency is just below 100%. Most of

the pig meat is sold by a few supermarkets. Coops play a limited role in the price formation, most markets are spot markets.

5.2.2 Approach 1 for dairy: highly fluctuating prices of dairy products due to changing demand in export markets

Price developments

Figure 17: Price indices in the dairy products supply chain, (2010=100)



Sources: see Annex V.

In Figure 17 the price developments of dairy are depicted: agricultural prices, dairy processor prices, consumer prices and import and export prices for the period 2015-2017. All prices are expressed as indices with 2010 = 100.

Farm level prices of raw milk show strong fluctuation between 2015 and 2017. The raw milk prices were the lowest in 2016 and the highest in 2017. In this period raw milk monthly price indices fluctuated between 78 and 145 (the year 2010 = 100). In 2017, prices of raw milk have been increasing starting from the months March 2017 in all four countries: Bulgaria, France, the Netherlands and Poland. This increase came to an end by the end of that year. In all studied countries except for France the index was at the highest level in October 2017. In Bulgaria the index went up from 122 to 145, in France from 104 to 117, in the Netherlands from 107 to 128 and in Poland from 94 to 143 in that period.

The processor price indices are only available for France and the Netherlands. This price indices follow the same trend as agricultural price indices, although in France the fluctuations are less strong than e.g. in the Netherlands. In France, the processor price index fluctuated between 101 and 109 points in the period 2015-2017, whereas in the Netherlands the index fluctuated between 95 and 123 points in the same period. In 2017, the processor price index increased from 95 points in March 2017 to 117 points in October 2017 with 9 points difference between January and December 2017. In France the processor price indices are quite stable varying between 101 and 106 points throughout 2017. The lowest levels were observed in 2016 in France and the Netherlands.

Consumer price indices for dairy have been relatively stable in the period starting from 2015 to 2017. There has been some gradual increase from 2016 to 2017 in all studied countries. In 2017, dairy consumer prices have been stable in Bulgaria, Poland and France, whereas in the Netherlands the price index was fluctuating with a range of 9 points. At the end of 2017 there is an observed increase of price indices in Bulgaria and Poland with 5 to 7 points.

Export and import prices have been more volatile than prices at each stage of the value chain, but generally follow the trend at agricultural and processing level. In the period 2015-2017 the import and export price indices fluctuated between 69 and 194 points..

Factors explaining price developments

Within a year, prices of raw milk and dairy show seasonal patterns. In the summer months there is a greater supply of milk than in the winter months, which has an effect on short-term price changes. The price development of dairy reflects the international market situation, dairy products like butter, milk powder and cheese are worldwide traded commodities. Despite the (seasonal) price patterns at agricultural and processing level, producer, processor and consumer price indices follow each other only to a limited extent. This is partly explained by different developments in prices on different dairy commodity markets. In addition, raw-milk is not the only one exclusive cost component in the production of dairy products in the dairy industry and distribution via retail. E.g. the developments of energy and labour costs affect the processors' and retailers' prices as well. The prices of these components are more stable as they are linked to periodically adjusted contracts.

The abolition of the milk quota in 2015 led to a general increase of raw milk production in France and the Netherlands, whereas in Bulgaria and Poland the trend of consolidation and efficiency increase continued in the dairy supply chain. At the same time, the sales of dairy products from the EU faltered, partly due to the boycott of EU dairy products by Russia and the lagging Asian demand. This has had a major impact on milk prices for farmers and industry. Due to the seasonal high supply of milk, the drop in raw milk prices in the first half of 2016 was strengthened. The market situation has been tilted since the second half of 2016. The rapidly increasing demand for dairy in the Asian markets has pushed up prices quickly. In the course of 2017, the increase in global demand was greater than the supply, which positively affected dairy prices (based on agrimatie.nl). The expectation in the European Union is that, following OECD and FAO (Agriculture Outlook), the dairy market will grow in the coming years. The EU would account for almost 30% of the increasing global demand.

Value chain and market structures

Bulgaria
Bulgarian dairy farmers deliver raw milk to the dairy processing industry that transforms milk into different dairy products. These products are exported, or sold on domestic markets through the traditional and modern retail to consumers, or through wholesale to other domestic markets like food service. In addition, significant non-industrial raw milk processing takes place at farms. Fresh milk and milk products from farms are mostly put up for direct sale and on-farm consumption, however this trend is declining.

There are over 27,000 specialised dairy farms active in Bulgaria. Most dairy farms with cows in Bulgaria are small subsistence farms with 1-2 cows. Bulgaria has over 250, mostly small, operators active in the dairy processing with two leading dairy processors accounting together for over 30% of the market in 2010, but their shares were increasing. In Bulgaria, collective production and processing within cooperatives is limited. Most milk delivery to private dairies is agreed in long-term contracts. The retail market has many small traditional shops and a few big supermarkets.

France
French dairy farmers deliver raw milk to the French dairy processing industry that transforms milk into different dairy products. These products are exported, or sold on domestic markets through the retail to consumers, through wholesale or directly to other domestic markets like food service.

There are over 41,000 specialised dairy farms active in France. In addition, France has a significant amount of non-specialised dairy farms in the Northern regions. There are almost 900 firms active in the French dairy industry. For a part of the raw milk supply, cooperative farming and processing takes place. A small number of large dairy cooperatives and private companies dominate the French dairy processing market. Long term delivery contracts are used for raw milk delivery to private dairy firms. Also between the processors and the retailers, delivery contracts are common.

The Netherlands
Dutch dairy farmers deliver raw milk to the Dutch dairy processing industry that transforms milk into different dairy products. These products are exported, or sold on domestic markets through the retail to consumers, or through wholesale or directly to other domestic markets like food service.

There are over 16,000 specialised dairy farms active in the Netherlands. Almost half of Dutch dairy farms have more than 80 cows. There are almost 200 firms active in the Dutch dairy industry (Eurostat sbs), but a few large cooperative firms, like FrieslandCampina, dominate the market. For almost 90% of the raw milk supply, cooperative farming and processing takes place.

About 75% of dairy products is sold to consumers by supermarkets. The supermarket channel is concentrated with only a few purchasing organisations. Dairy firms and supermarkets agree in bilateral contract negotiations on the conditions and the price of deliveries, under their own brand or private label.

Poland
Polish dairy farmers deliver raw milk to the Polish dairy processing industry that transforms milk into different dairy products. These products are exported, or sold on domestic markets through the traditional and modern retail to consumers, or through wholesale to other domestic markets like food service.

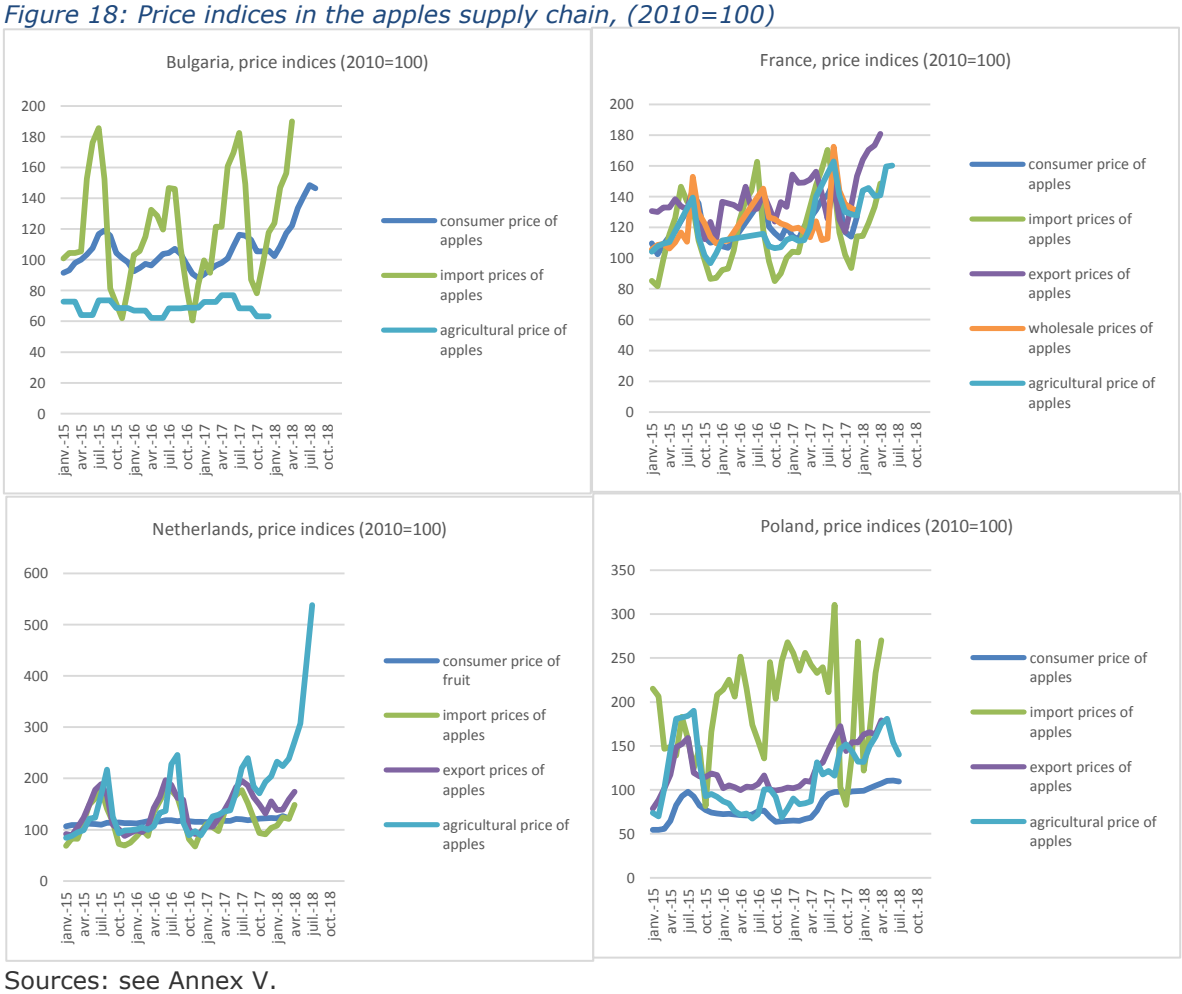
There are over 101,000 specialised dairy farms in Poland. About two thirds of the farms with cows are small subsistence farms with one to five cows. Poland has over 280 operators active in dairy processing, including private and cooperative firms. A significant amount of raw milk is processed in cooperative dairies. The retail market has some traditional shops and a few big supermarkets.

5.2.3 Approach 1 for table apples: Increasing prices due to two seasons of unfavourable growing conditions

Price developments

Consumer prices of apples show a seasonal pattern with increased prices before the new harvest season. In Bulgaria most recent consumer price index (August 2018) show high rising prices. The consumer price index reflects both the import price index developments and the agricultural price index. The import price index shows however much more volatility ranging from 60 till 180 points, but in Poland the import price index even peaked on 300 July 2017. Agricultural apple prices also show seasonality. Seasonal fluctuations were high in the Netherlands, indices ranging between 90 and 250 in 2016 and 2017 and sky rocketing in July 2018 to 538. Seasonal fluctuations were much less prominent in Bulgaria. Export prices generally follow the pattern of the agricultural prices. Note that exports from Bulgaria were virtually non-existent.

Figure 18: Price indices in the apples supply chain, (2010=100)



Sources: see Annex V.

Factors explaining price developments

The present explosion of prices of table apples is the result of the frost in the spring of 2017 that destroyed 23% of the crop across Europe, resulting in poor harvests and low stocks. Continuing high temperatures and rain shortage in the summer of 2018 is expected to have adverse effects on this year yields, which additionally will lead to the increase of prices. The seasonal pattern in prices relates to the harvesting of apples late summer in Europe, with increasing agricultural prices before harvest and for early apples. Apples can be stored for a long time. Unstocking is usually at highest in January till March, the period in which exports peak. Imports from the southern hemisphere rise from April on till end of July till the supply of fresh table apples from the harvest in the northern hemisphere.

The Russian ban also affected the EU's export of apples, in particular Poland's exports, but the main effect came in 2016. Poland was able to reach the Russian market through re-exports from Ukraine and Belarus in 2015, but in 2016 the latter country faced tougher border controls. As a result Poland sold a maximum of almost 1.6m tonnes as cider apple that year which is reflected in the lower agricultural and export prices for apples without a seasonal peak that year.

Poland, France, Italy and Germany make up 70% of EU-28 apple production, which is around 12.5m tonnes per year in 2014-2016. There is a huge variety in apples. The main distinction is between table apples and those to process (juice, cider, compote, dried etc.) In 2016 apple acreage is 523,000 ha. EU-28 is slightly more than self-sufficient. Around 3.7m tonnes (=30% of apple production) are processed in 2014-2016. Consumption of table apples, 7.0m tonnes in 2016/17, will decrease at a low pace of 0.3% per year and of processed apples at 0.4% per year. Growing income will diversify fresh fruit consumption with tropical fruits. Finally consumption in the EU is expected to stabilise. EU apple production is expected to stabilise coming decade around the 12.5m tonnes. This leaves room for a slight growth of export both for fresh apples as well as for processed apples. Increasing yields will compensate for the reduction in production area.

EU-28 imports about 440,000 tonnes of table apples of which 87% comes from the southern hemisphere (especially from New Zealand and Chili). Imports from the northern hemisphere (Serbia and Macedonia as main suppliers) are generally highest in autumn.

Value chain and market structures

The supply chain of table apples can consists of only two stages only: Cooperatives of apple growers may deliver to local supermarkets directly. More complex chains include wholesalers and importers or exporters.

Bulgaria

Production of apples is located in the south-central region of Bulgaria. In 2017 48.000 tonnes are harvested (7% more than in 2016). Acreage in 2016 is 4,100 ha (which is 17% lower compared to the last 10 year average). Largest varieties grown are Golden Delicious and Granny Smith. Other main fruits produced in Bulgaria are cherries and plums, peaches and nectarines and cherries. There are four Producer Organisations and eight Producers Groups in the fruit and vegetables sector. The organisation level is still low.

There are 100 fruit processors in Bulgaria processing 85,000 tonnes fruit processed of which 27% are apples. Bulgaria is a net exporter of processed vegetables and fruits.

France
France is EU's third largest producer of apples after Italy and Poland. Total apple production in 2017 is 1,439m tonnes, which is 20% lower than in 2016. In 2014, 2015 and 2016 the share of table apples was resp. 75%, 63% and 75%. The apple acreage is 49,700 ha in 2017 (6% lower than the 10 years average). Main type of table apples are Gala and Golden Delicious, that make up respectively 16% and 31% of the apple production. Most fruit is sold through supermarkets.

The Netherlands
Total apple production in 2017 is 233,000 tonnes (-27% compared to 2016) and acreage is 7,300 ha (14% lower than the 10 years average). Main type of table apples grown are Elstar 41% and Jonagold 23%. Trade balance (export value minus import value) is zero, which is a result of increased exports in 2017, especially to Germany. Export unit value is slightly above import unit value.

There are 1084 farms growing apples (2016). The average acreage is 7 ha. The largest growers have however 40 to 60 ha. Most growers grow pears as well and are member of one of the five Producer Organisations. These are cooperatives for the marketing, stocking, packing and transport of the produce. The four biggest have a total market share of 40-50%. So growers in the Netherlands are well organised.

These Producer Organisations sell to wholesale (15%) or retail directly (85%). Up to one third of the production will be processed. Wholesalers consist of importers, exporters and trade companies specialised in local fruit, or a combinations of these activities. They usually trade other fruits and vegetables too. Their costs consists mainly of labour, transport and packaging.

Poland
Poland is EU's largest producer of apples. Apple production in Poland is 3,213m tonnes in 2017 (estimation DG Agri), which is 11% lower than in 2016. Acreage is 164,8,000 ha, only 4% lower than the 10 years average. The share of the apple production directed to processing (cider) was 56% in 2016 and is under 5% in 2017. Poland sold a maximum of almost 1.6m tonnes as cider apple in 2016. Unit value of export apples are 0.34 euro per kg, while import apples are 0.58 euro per kg. Largest part of export is towards third countries.

5.3 Approach 2 Price and margin monitoring and narrative

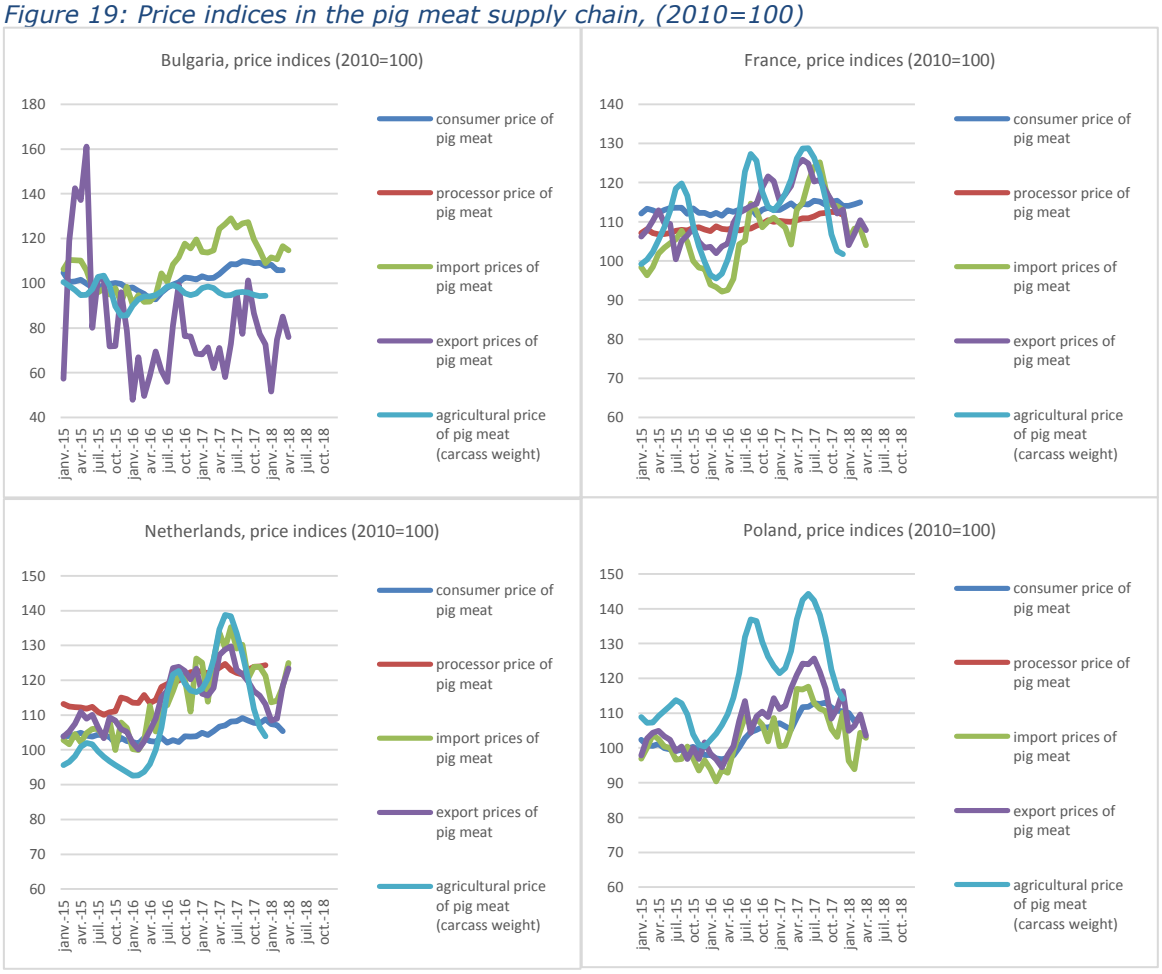
5.3.1 Approach 2: For pig meat: a stable market with fluctuating agricultural prices

Price developments
Agricultural price indices for pig meat are strongly fluctuating (see Figure 19). Within three years price indices fluctuate between 90 and 140. Bulgaria is an exception, with the index fluctuating between 94 and 103. Price indices at processors level, if known, are fluctuating far less than agricultural price indices. If we look at the prices for meat products exported then the fluctuation resembles the developments of agricultural price indices. Again Bulgaria is an exception with highly fluctuating export price indices and for more stable agricultural price indices. The low self-sufficiency rate of about 35% in this period can be an explanation for this.

The absolute prices of pig meat expressed as an annual average price shows an increase in the period 2015-2017. This holds for all stages in the supply chain and for all countries (BG, FR, NL and PL). There is a huge variation in price level. The consumer prices in the Netherlands have a level of almost 9 euros per kg while Poland

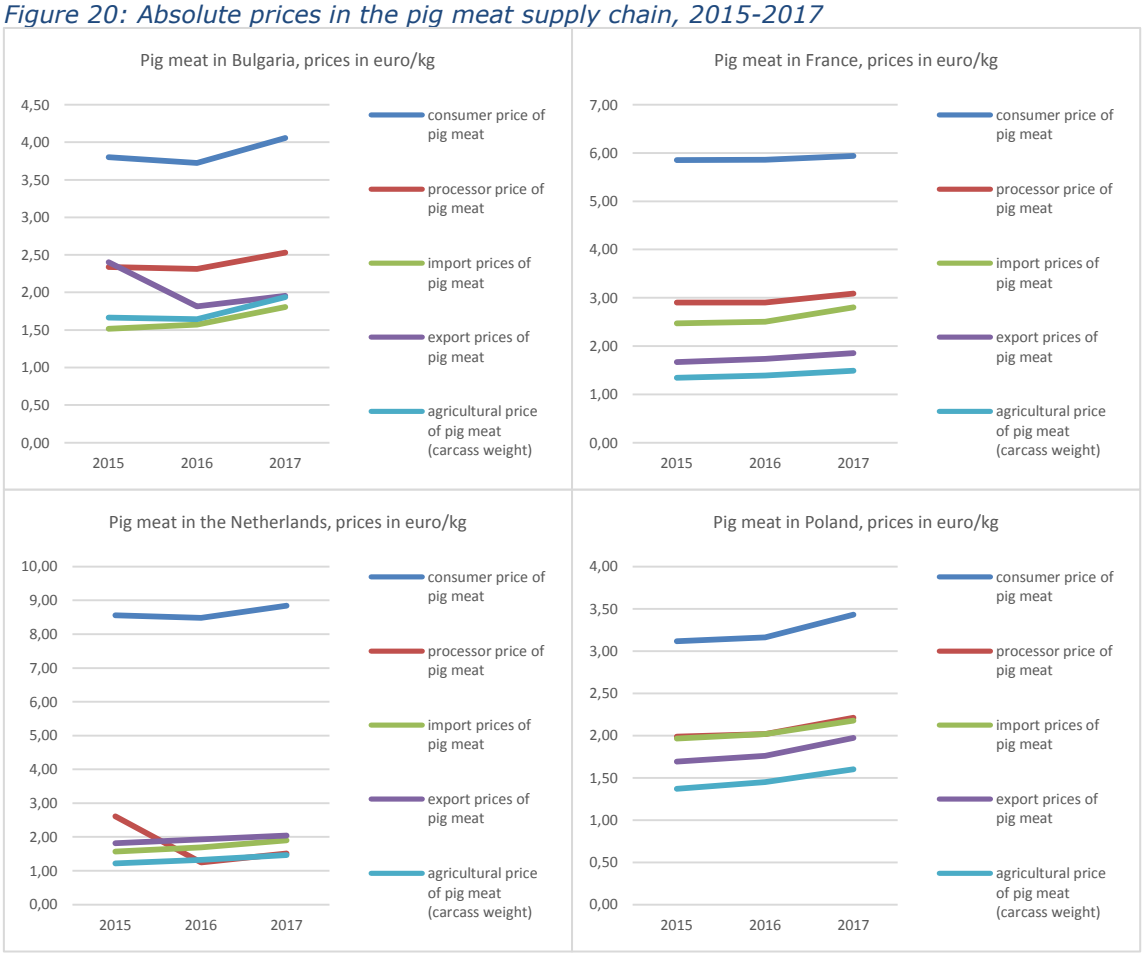
has a level of less than 3.50 euros per kg. At the level of agricultural prices the prices vary from 1.30 euros per kg in the Netherlands, to 1.60 euros per kg in Poland and 1.90 euros per kg in Bulgaria.

Figure 19: Price indices in the pig meat supply chain, (2010=100)



Sources: see Annex V.

Figure 20: Absolute prices in the pig meat supply chain, 2015-2017



Sources: see Annex V.

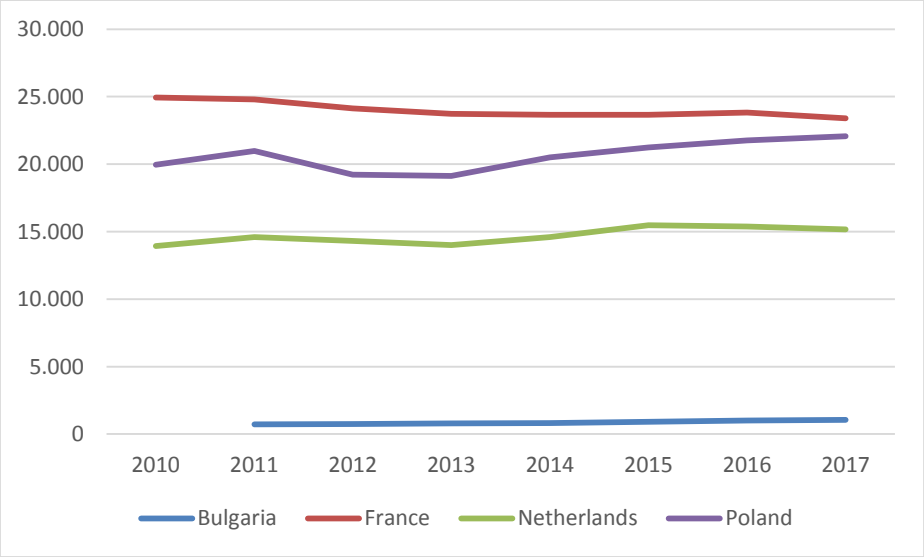
Factors explaining price developments

The European pork market is in equilibrium in the period 2015-2017. The production of pork is more or less stable (see Figure 21). In the EU there is a 4% decrease in number sows and a productivity increase per sow. In Bulgaria the number of sows increased with 17% between end of 2014 and 2016 while the number of sows decreased with 10% in Poland. Production of pig meat was hardly influenced by disease outbreaks although African Swine Fever still is a problem at the eastern border of the EU. The intensity of pigs is low in this region and production is not strongly influenced by this.

The consumption in the EU is rather stable in the EU with annually 20m to 21m tonnes of pig meat. Differences among MS are small. Small increases in production and a stable consumption lead to an increase of the export of pig meat (see Figure 22) and an increase of the self-sufficiency (see website pork.ahdb.org.uk). The export of pig meat is steadily increasing with China, Japan, Hong Kong and South Korea being the main export countries.

The feed price index in the EU decreased with 4% in the period 2015Q1 to 2017Q4. Feed prices increased in Bulgaria (2%), were stable in Poland and decreased in France and the Netherlands with respectively 6 and 4%.

Figure 21: Production of pig meat, in 1,000 animals slaughtered, 2010-2017



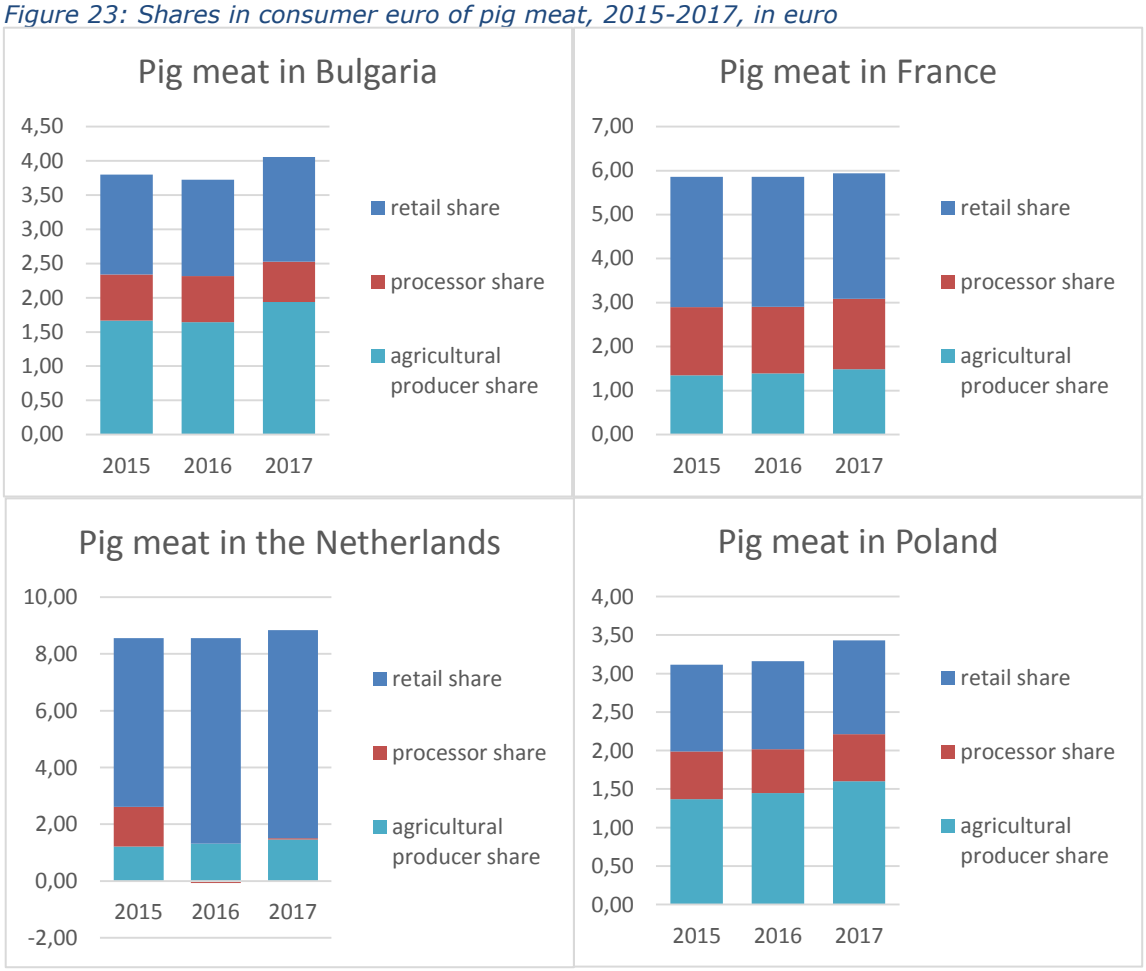
Sources: see Annex V.

Figure 22: Imports and export of pig meat, in tonnes

Sources: see Annex V.

Shares in consumer euro

Figure 23: Shares in consumer euro of pig meat, 2015-2017, in euro



Sources: see Annex V.

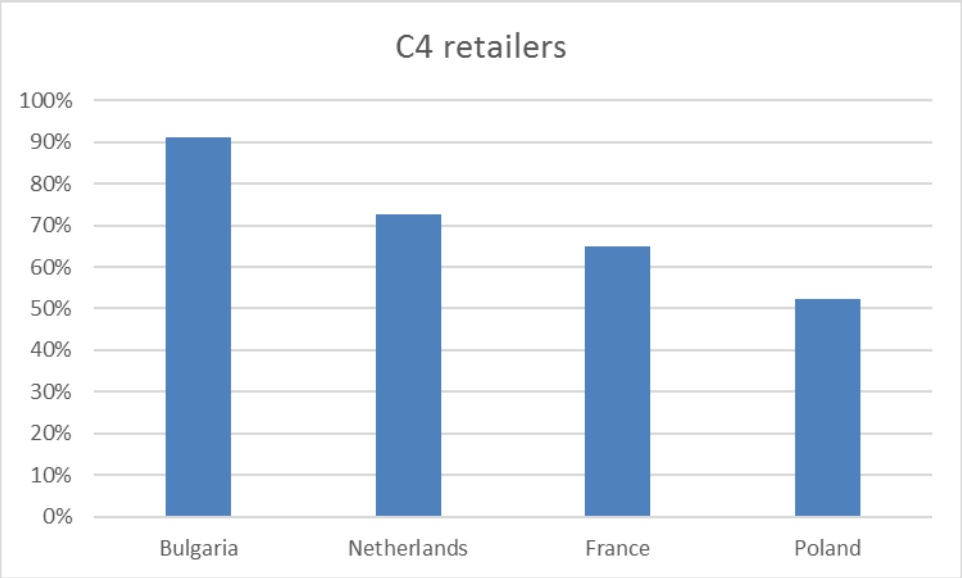
The shares in the consumer euro are more or less stable during the years 2015-2017 (see Figure 23). Per country the shares differ a lot. In the Netherlands the retail share was more than 7 euros per kg, while the share for the processor equals almost zero in 2016 and 2017. In Poland and Bulgaria the share of the retail is 1.50 euros per kg and the processors have 60 to 70 eurocent per kg. France is in between with a 3.30 euros per kg for the retail and 1.50 to 1.60 euros per kg for processors.

Cooperatives don't play a decisive role in the pig markets and supermarkets are important in all four countries. As shown before, prices are relatively stable with some variation within a year at the level of agricultural products. Also other factors like changing policies and demand or supply shocks can't explain the huge differences among countries in euro shares. Probably the raw data differ per country, especially at processor level, leading to differences.

At agricultural level it can be expected that the prices are higher in countries with a low self-sufficiency like Bulgaria with 35% than in the Netherlands with 250%. The stability of the price spreads and euro shares within countries can be explained by the relatively stable context in which this supply chain operates in all countries: steadily decreasing number of farms and firms, almost no stocks, no food scandals and no animal disease crises and also relatively stable feed prices which are the main cost component of pig meat.

Value chain and market structure

Figure 24: Combined market shares of largest four food retailers, 2017, in %



Source: IGD.

Bulgaria

The value chain of pig meat production consists of primary producers of pigs (holdings with sows producing piglets, holdings fattening pigs and holdings integrating both activities), slaughterhouses, meat processors and retail. Bulgaria is a relatively small producer with 1m slaughter pigs per year. Pig production takes place on 30,000 farms in 2016 (Eurostat) which means that many farms are small. Their number is quickly decreasing, in 2013 there were more than 50,000 farms. Total production is more or less stable with about 60,000 sows. Also the number of meat processors is stable at a level of 180 companies. About 45% of Bulgarian grocery purchases is done in the traditional retail, but this share is decreasing. The traditional retail are small (family) outlets, selling for 12,000 BGN (approximately 6,000 euros) on average per year (USDA Gain Report, 2016). The modern retail includes hypermarket, supermarket chains and convenience stores, making 127,000 BGN per outlet (approximately 65,000 euros) on average. The modern grocery market is quite concentrated (C4 =91%; see Figure 24) and includes the following retailers groups Kaufland, Lidl, Rewe Group and Fantastico.

Bulgaria is a net importer of pig meat. The self-sufficiency level is about 35% and has been relatively stable over the past years. Almost all of the imports concerns pig meat, while imports of carcasses are rather limited. Exports of pig meat and carcasses are negligible (see Figure 22). Consumption of pig meat is stable in Bulgaria at a level of 0.2m tonnes per year (see website pork.ahdb.org.uk).

The Bulgarian pig and pig meat market is a spot market. Prices depend on the supply and demand of meat. Because two third of the consumption is imported prices also strongly depend on the prices of the imported meat. The markets for piglets, pigs and pig meat are EU markets and pig meat is a commodity, so easy exchangeable. Because the self-sufficiency of the EU is increasing also the impact of prices in third markets is becoming more and more important (see agrimatie.nl).

France
The value chain of pig meat production consists of primary producers of pigs (holdings with sows producing piglets, holdings fattening pigs and holdings integrating both activities), slaughterhouses, meat processors and retail. France produces about 24m slaughter pigs per year. Production is decreasing a little and the number of farms with pigs decreased from 18,500 to 16,320 between 2013 and 2016. The number of meat processors was in the same period stable at a level of 1300. Most pig meat is sold by supermarkets. The big four companies are Carrefour, LeClerc, Les Mousquetaires and System U with a market share of 65% in France.

France is a net exporter of pig meat (self-sufficiency is between 100 and 103%; source pork.ahdb.org.uk).

The markets for pigs and pig meat are spot markets in France. These markets are connected to the EU markets for pigs and pig meat.

The Netherlands
The value chain of pig meat production consists of primary producers of pigs (holdings with sows producing piglets, holdings fattening pigs and holdings integrating both activities), slaughterhouses, meat processors and retail. The Netherlands produces about 25m piglets. Ten million of them are exported alive mainly to Germany where they are fattened and slaughtered (www.agrimatie.nl). The production is more or less stable but the number of farms decreased from 5,500 in 2013 to 4,500 in 2016. The farms are specialised in pig production. There are a limited amount of slaughterhouses, like VION, Van Rooi Meat and Westfort meat products slaughtering most of the pigs. There a few hundred meat processing companies (Eurostat, Nace_R2; processing and preserving meat) and their number is rather stable. Most of the pig meat is sold by supermarkets. The biggest four companies are Ahold Delhaize, Jumbo, Lidl and Aldi with a market share of 73% (see Figure 24).

The Netherlands is a net exporter of pig meat (see Figure 22). There is a huge export of live animals (piglets and slaughter pigs) mainly to Germany. Besides export of pig meat (1.2m tonnes) also pig meat is imported (0.4m tonnes) while the consumption is about 0.6m tonnes or 37 kg per capita (see agrimatie.nl).

Retail companies determine their prices by looking at their competitors, by promotion activities and the buying prices. Retail companies have annual contracts with the meat industry except for the promotions which are tendered separately. Slaughterhouses more or less pass through the price developments in the retail market to the primary producers. The markets for piglets, pigs and pig meat are EU markets and pig meat is a commodity, so easy exchangeable. Because the self-sufficiency of the EU is increasing also the impact of prices in third markets is becoming more and more important.[15]

Poland
The value chain of pig meat production consists of primary producers of pigs (holdings with sows producing piglets, holdings fattening pigs and holdings integrating both activities), slaughterhouses, meat processors and retail. Poland produces about 22m slaughter pigs per year. Production is decreasing a little and the number of farms with pigs decreased from 278,000 to 172,000 between 2013 and 2016. This means that a lot of farms have only a few pigs. The number of meat processors was in the same period stable at about 14,500. Most pig meat is sold by supermarkets. The big four

[15] https://www.agrimatie.nl/SectorResultaat.aspx?subpubID=2232&sectorID=2255&themaID=3596

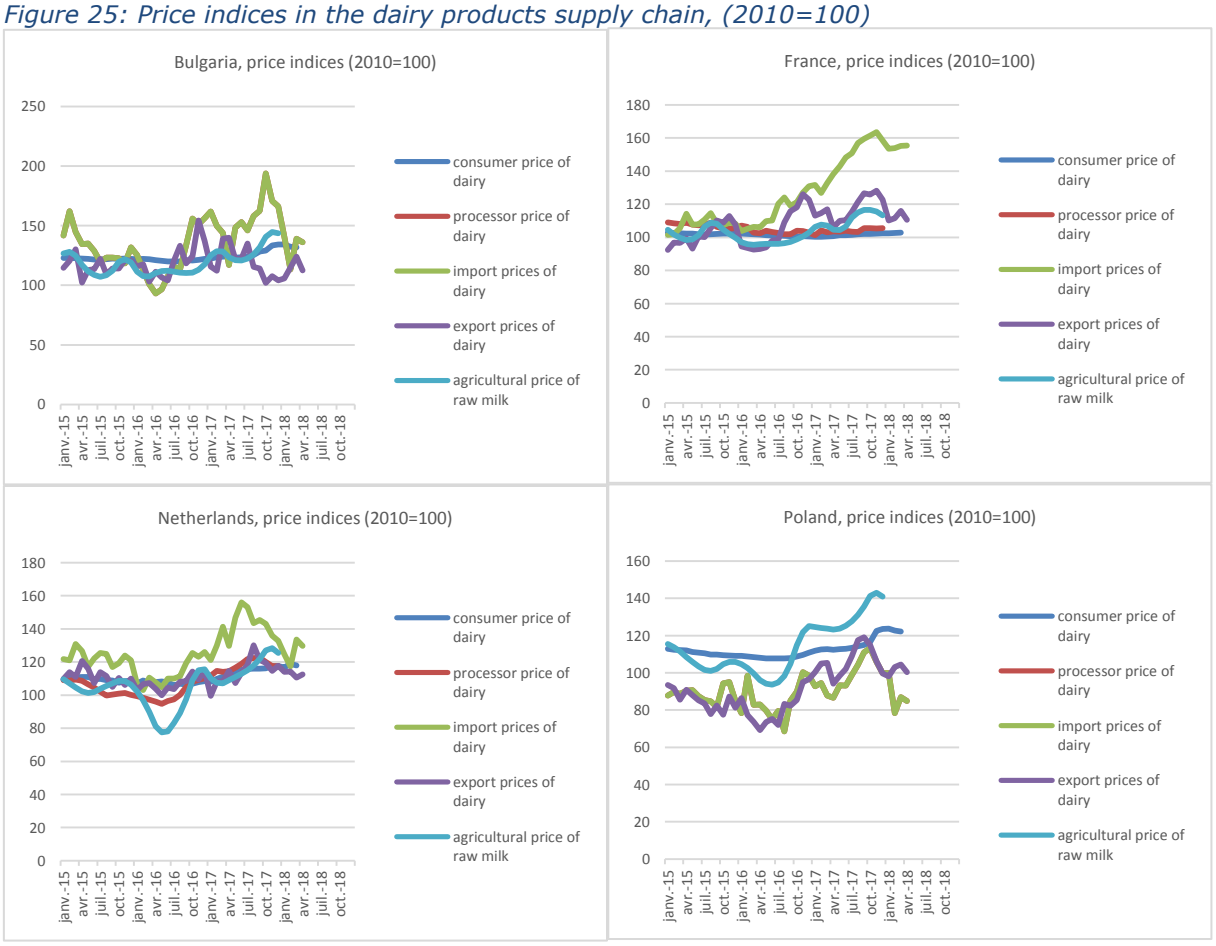
companies are Jerónimo Martins, Lidl, Auchan Group and Lewiatan with a market share of 52% in Poland.

For pig meat Poland is a net importer (See Figure 22). Self-sufficiency of pig meat is between 92 and 100%.[16] The markets for pigs and pig meat are spot markets in Poland. These markets are connected to the EU markets for pigs and pig meat.

5.3.2 Approach 2: For dairy: highly fluctuating prices of dairy products due to changing demands at export markets

Price developments

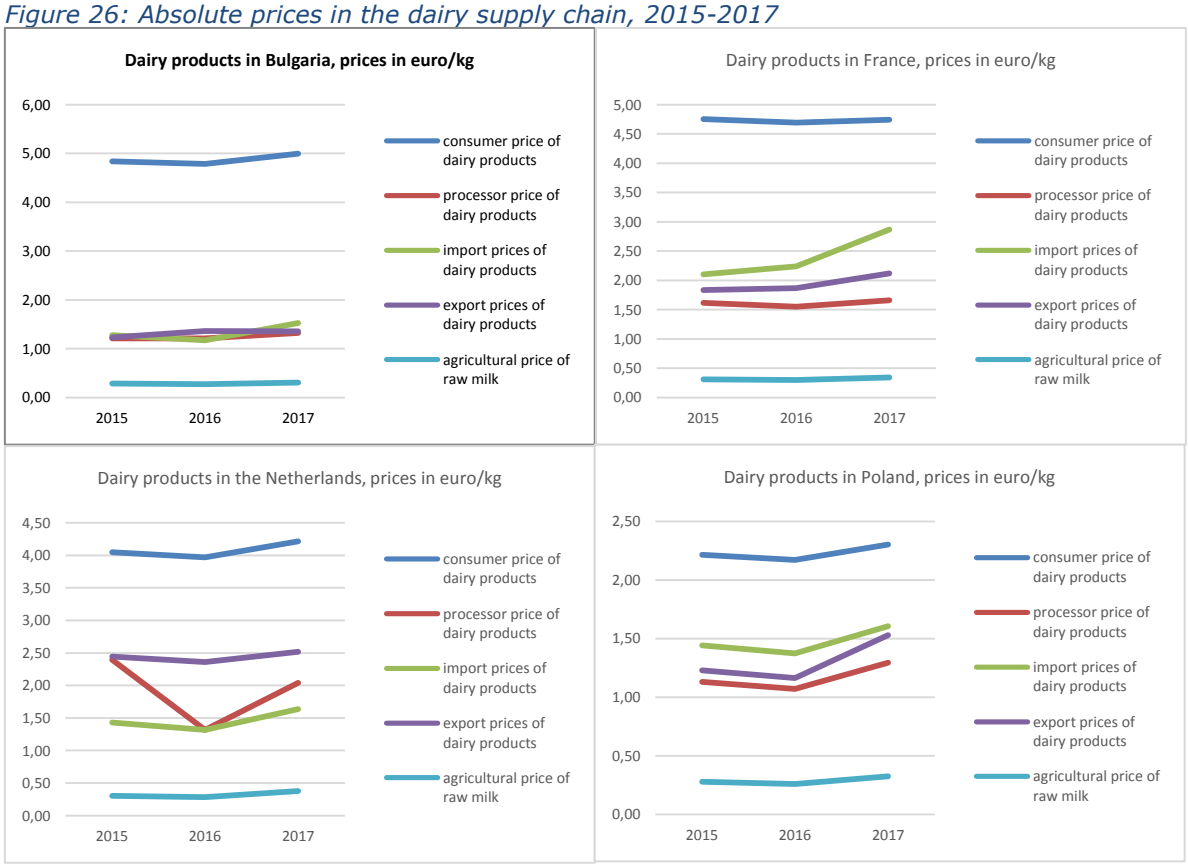
Figure 25: Price indices in the dairy products supply chain, (2010=100)



Sources: see Annex V.

[16] pork.ahdb.org.uk

Figure 26: Absolute prices in the dairy supply chain, 2015-2017



Sources: see Annex V.

In Figure 25 the price indices developments of dairy are depicted: agricultural prices, dairy processor prices, consumer prices and import and export prices for the period 2015-2017. All prices are expressed as indices with 2010 = 100.

In Figure 26 the price developments of dairy are depicted: agricultural prices, dairy processor prices, consumer prices and import and export prices for the period 2015-2017.

Farm level prices of raw milk strongly fluctuates between 2015 and 2017. In this period raw milk price indices fluctuated between 78 and 145, with lowest levels in 2016. In 2017, prices of raw milk have been increasing starting from the months March, May and June 2017 in all four studied countries: Bulgaria, France, the Netherlands and Poland. This increase came to an end by the end of 2017, i.e. in November or December, in all studied countries except for France where the index was at highest in October. Bulgaria went up from 122 to 145 points, France from 104 to 117 points, the Netherlands from 107 to 128 points and Poland from 94 to 143 points in that period. The raw milk price indices ended at higher level in December 2017 compared to January 2017: 9 points higher in France, 18 points higher in Bulgaria and the Netherlands, and 25 points higher in Poland.

In 2016 the raw milk prices per kg milk varies between 0.26 (Poland) and 0.30 (France) euro per country, whereas in 2017 the prices per kg of milk were between 0.31 (Bulgaria) and 0.38 (the Netherlands).

The processor price indices are only available for France and the Netherlands. This price indices follow the same trend as agricultural price indices, although in France the

fluctuations are less strong than e.g. in the Netherlands. In France, the processor price index fluctuated between 101 and 109 points in the period 2015-2017, whereas in the Netherlands the index fluctuated between 95 and 123 points in the same period. In 2017, the processor price index increased from 95 points in March to 117 points in October with 9 points difference between January and December 2017. In France processor prices are quite stable varying between 101 and 106 points throughout 2017. The lowest levels were observed in 2016 in both countries.

The price levels of dairy processors vary per country. The Dutch dairy processors have the highest prices, selling a kg of dairy product for 2.45 euros in 2015, 1.32 euros in 2016 and 2.04 euros in 2017. The Polish dairy processors have the lowest dairy processor price: 1.07 in 2016 and 1.29 in 2017.

Consumer prices for dairy have been relatively stable in the period starting from 2015 to 2017. In 2017, dairy consumer prices have been stable in Bulgaria and Poland and France, whereas in the Netherlands the price index was fluctuating with a range of 9 points. At the end 2017 there is an observed increase of price indices in Bulgaria and Poland with 5 to 7 points compared to the start of 2017.

Consumer prices for dairy have been relatively stable in the period starting from 2015 to 2017. There has been some gradual increase from 2016 to 2017 in all studied countries. The price levels vary per country. In 2017 a kg of dairy was sold for 4.99 euros on average in Bulgaria, for 4.74 euros in France, for 4.34 euros in the Netherlands, and for 2.30 euros in Poland.

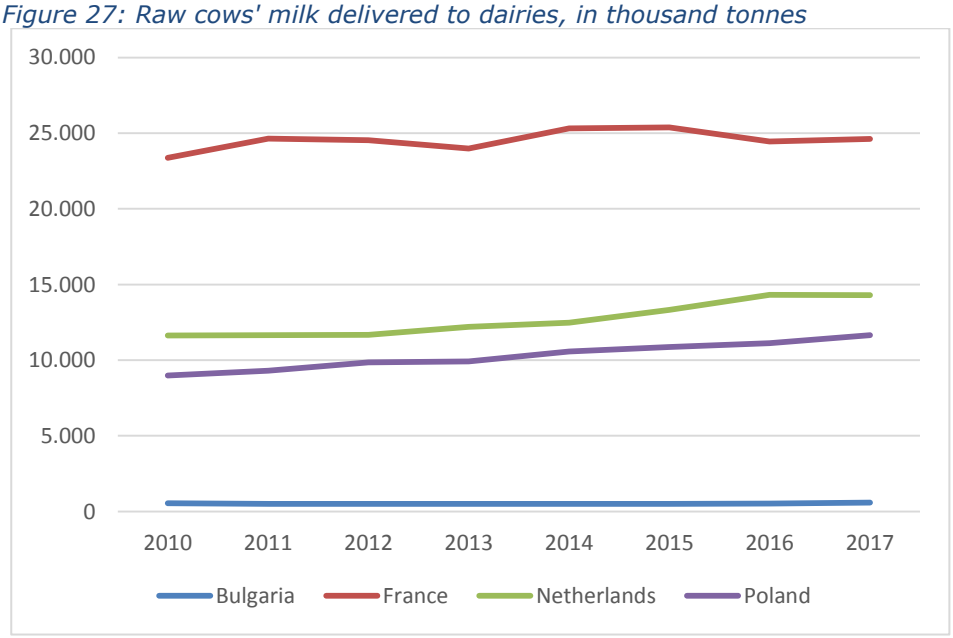
Factors explaining price developments

Within a year, prices of raw milk and dairy show seasonal patterns. In the summer months there is a greater supply of milk than in the winter months, which has an effect on short-term price changes. The price development of dairy reflects the international market situation, dairy products like butter, milk powder and cheese are worldwide traded commodities. Despite the (seasonal) price patterns at agricultural and processing level, producer, processor and consumer prices follow each other only to a limited extent. This is partly explained by different developments in prices on different dairy commodity markets. In addition, raw-milk is not the only one exclusive cost component in the production of dairy products in the dairy industry and distribution via retail. E.g. the developments of energy and labour costs affect the processors' and retailers' prices as well. The prices of these components are more stable as they are linked to periodically adjusted contracts.

The abolition of the milk quota in 2015 led to a general increase of raw milk production in France and the Netherlands, whereas in Bulgaria and Poland the trend of consolidation and efficiency increase continued in the dairy supply chain (see Figure 27). At the same time, the sales of dairy products from the EU faltered, partly due to the boycott of EU dairy products by Russia and the lagging Asian demand. This has had a major impact on milk prices for farmers and industry. Due to the seasonal high supply of milk, the drop in raw milk prices in the first half of 2016 was strengthened. The market situation has been tilted since the second half of 2016 (see Figure 25). The rapidly increasing demand for dairy in the Asian markets has pushed up prices quickly. In the course of 2017, the increase in global demand was greater than the supply, which positively affected dairy prices (based on agrimatie.nl). The expectation in the European Union is that, following OECD and FAO (Agriculture Outlook), the dairy market will grow in the coming years. The EU would account for almost 30% of the increasing global demand.

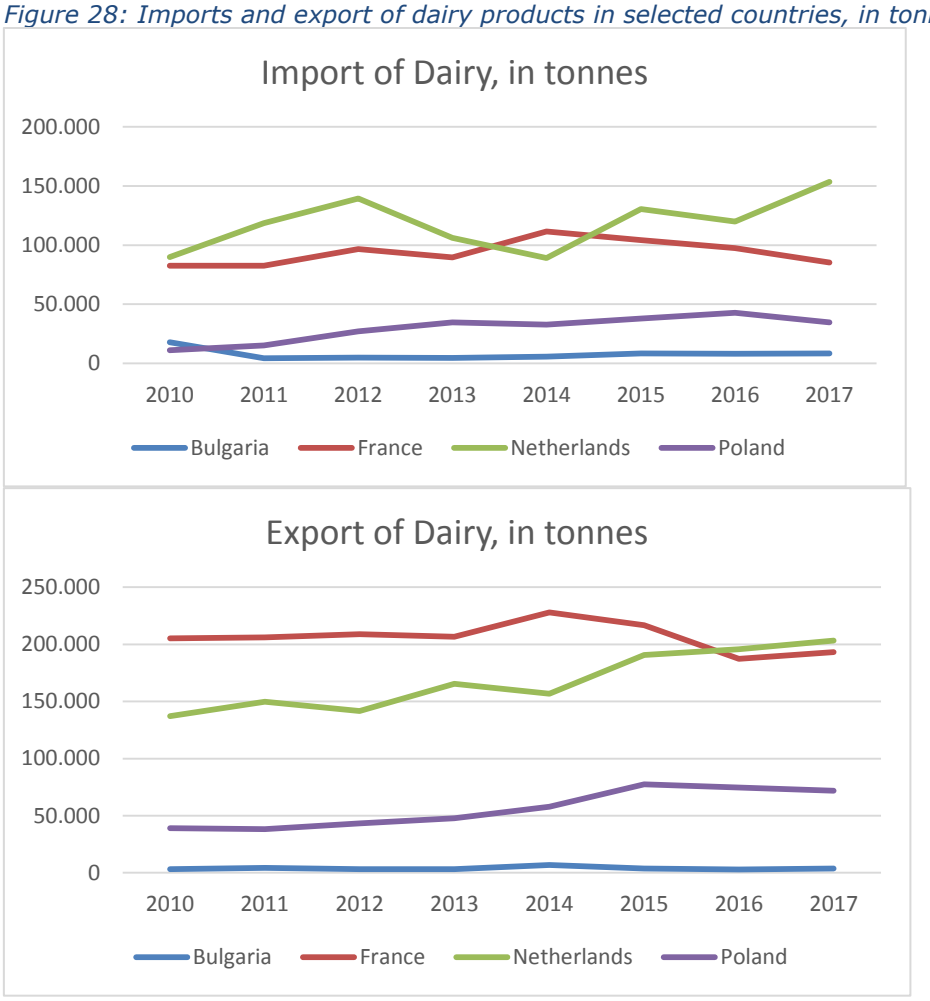
There are some differences in processors and consumer prices between the countries, which are forthcoming from the different focus on product made and/or distributed, e.g. more high value in the Netherlands and more low value in Poland, and other input cost levels, such as labour. In addition, there are some price differences on the agricultural level, which are forthcoming from different contracts, and cooperative agreements with dairies, including agreements on discounts and surcharges. Sometimes raw milk prices are linked to the performance on specific dairy markets.

Figure 27: Raw cows' milk delivered to dairies, in thousand tonnes



Sources: see Annex V.

Figure 28: Imports and export of dairy products in selected countries, in tonnes

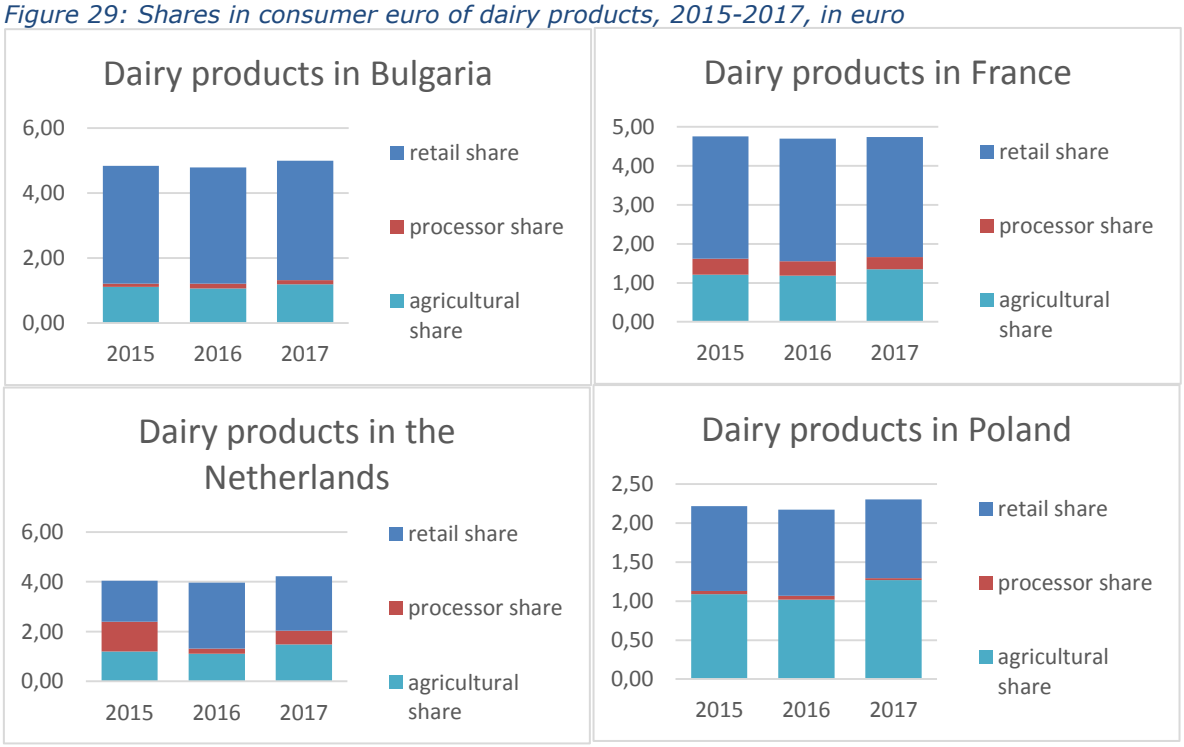


Sources: see Annex V.

Shares in consumer euro

In Figure 29 the share of different types of value chain actors in the consumer price is depicted: the agriculture, the dairy processing, and the grocery retail for the period 2015-2017. The price spreads are more or less stable each year in the studied countries except for the Netherlands. The retail gets the highest share of the consumer euro in Bulgaria (74-75%) and the lowest in the Netherlands in 2015 (41%) and in Poland in 2016 and 2017 (51 and 44%). The dairy processors get the highest share from the consumer euro in the Netherlands in 2015 and 2017 (30 and 13%) and the lowest in Poland (1-2%) in the 2015-2017 period. Price spread differences among countries can be explained by chain structure differences between the countries, the type of processing (cooperative versus private) and a different product focus (efficient lower value high volume production versus differentiated high value products). In the Netherlands, the decline in dairy prices in 2016 was mostly absorbed by the cooperative dairy processing sector.

Figure 29: Shares in consumer euro of dairy products, 2015-2017, in euro



Sources: see Annex V.

Value chain and market structure

Bulgaria

Bulgarian dairy farmers deliver raw milk to the dairy processing industry that transforms milk into different dairy products. These products are exported, or sold on domestic markets through the traditional and modern retail to consumers, or through wholesale to other domestic markets like food service. In addition, significant non-industrial raw milk processing takes place at farms. Fresh milk and milk products from farm are mostly put up for direct sale and on-farm consumption, however this trend is declining.

There are over 27,000 specialised dairy farms active in Bulgaria. About two thirds of dairy farms with cows in Bulgaria are small subsistence farms with 1-2 cows. Only 4% of dairy farms have more than 50 cows. In 2016, about 1m tonnes raw cows' milk was produced on farms, which is 89% of all raw milk production. About 530,000 tonnes of raw cows' milk was delivered to dairies. The other part is processed on farms.

Bulgaria has over 250 operators active in the dairy processing. The leading dairy processors are United Milk Company AD (UMC) and the French based Danone. These two firms accounted together for over 30% of the market in 2010, but the shares are increasing. Other dairies are not expected to have market shares higher than 5%. UMC accounts for 36% value share in cheese. Danone accounts for 18% value share in yoghurt and sour milk products (based on FAO/European Bank 2004 and Euromonitor).

The Bulgarian dairy sector produces about 74m litres of fresh consumption milk and 226,000 tonnes other dairy products per year. Other products include yoghurt (66%), cheese (18%), flavoured yoghurt (5%).

Bulgaria is a net importer of dairy. In 2017, Bulgaria imported 103m tonnes dairy products with a value of 158m euros. Whereas the exports accounted for 42m tonnes dairy, worth 103m euros. The large share of import flows is milk, some of which is used in further food processing.
About 45% of Bulgarian grocery purchases is done in the traditional retail, but this share is decreasing. The traditional retail are small (family) outlets, selling for 12,000 BGN (approximately 6,000 euros) on average per year (USDA Gain Report, 2016). The modern retail includes hypermarket, supermarket chains and convenience stores, making 127,000 BGN per outlet (approximately 65,000 euros) on average. The modern grocery market is quite concentrated and includes the following retailers groups (and their market shares in 2017) (based on IGD; see also Figure 24):

- Kaufland (47%)
- Lidl (22%)
- Rewe Group (12%)
- Fantastico (10%)
- Maxima Group (6%)
- CBA (2%)
- Dohle (1%)
- Other (0%)

In Bulgaria, collective production and processing within cooperatives is limited. Most milk delivery to private dairies is agreed in long-term contract, where the quality, assets, capacity, product specificity, site and time of delivery are specified. Between the dairy processors, and the retailers and foodservice delivery contracts are common specifying timing, quantity, products differentiation, packaging requirements (Krol et al. 2010; Bachev, 2011).

France
French dairy farmers deliver raw milk to the French dairy processing industry that transforms milk into different dairy products. These products are exported, or sold on domestic markets through the retail to consumers, trough wholesale or directly to other domestic markets like food service.

There are over 41,000 specialised dairy farms active in France. In addition, France has a significant amount of non-specialised dairy farms in the Northern regions. About half of French dairy farms have more than 50 cows. In 2016, about 25m tonnes raw cows' milk was produced on farms, which is 96% of all raw milk production. About 24.5m tonnes of raw cows' milk was delivered to dairies. Non-industrial dairy processing and on-farm consumption of own milk is rather insignificant compared to the industrial dairy processing.

There are almost 900 firms active in the French dairy industry. A small number of large dairy cooperatives and private companies dominate French dairy processing market. There are five prominent French dairy groups with international activities (based on Euromonitor):

- Lactalis, private, over 12bn euros turnover, 23% value share in cheese, 20% value share in consumption milk products
- Danone, private, 11bn euros turnover, 35% value share in sour milk products
- Sodiaal, cooperative, 4.4bn euros turnover
- Savencia, private, 4.0bn euros turnover, 8% value share in cheese
- Bel, private, 2.5bn euros turnover, 11% value share in cheese

In addition there are 15 smaller dairy processors with over 200m euros annual turnover. France has more than 240 dairy cooperatives, which account for 56% of all milk produced and collected in France.

The French dairy industry produces yearly over 3bn litres of consumption milk and other products. Other products, in total 226m tonnes, include (37%), yoghurt and yoghurt products (31%), cream (11%), milk powder (11%) and butter (9%) (Eurostat apro).
France is a net exporter of dairy. France imported 1.2m tonnes dairy with a value of 3.3bn euros in 2017. In the same year, France exported 2.3m tonnes with a value of 4.9bn euros.

About 75% of French household food grocery purchases are made in super and hypermarkets, hard discounters and convenience stores (USDA Gain Report, 2018). The grocery market is relatively concentrated with the following retailers groups (and their market shares in 2017) (based on IGD. See also Figure 24):

- Carrefour Group (23%)
- Leclerc (18%)
- Les Mousquetaires (13%)
- Système U (11%)
- Auchan Group (11%)
- Casino Group (10%)
- Lidl (6%)
- Other (8%, not exceeding 3% per retail group)

In France, for a part of the raw milk supply, cooperative farming and processing takes place. Long-term delivery contracts are used for raw milk delivery to private dairy firms. Also between the processors and the retailers, delivery contracts are common.

The Netherlands
Dutch dairy farmers deliver raw milk to the Dutch dairy processing industry that transforms milk into different dairy products. These products are exported, or sold on domestic markets through the retail to consumers, or through wholesale or directly to other domestic markets like food service.

There are over 16,000 specialised dairy farms active in the Netherlands. Almost half of Dutch dairy farms have more than 80 cows. In 2016, about 14.3m tonnes raw cows' milk was produced on farms, which is 98% of all raw milk production. About 14m tonnes of raw cows' milk was delivered to dairies. Non-industrial dairy processing and on-farm consumption of own milk is insignificant compared to the industrial dairy processing.

Raw milk delivered to dairies is processed in cheese (53%) and milk powder (15%). Over 7% of raw milk is processed into various consumption milk and yoghurt products (based on Zuivel.nl).

There are almost 200 firms active in the Dutch dairy industry (Eurostat sbs). These include 25 firms with 53 production facilities with a capacity of more than 10,000 tonnes (based on Zuivel.nl). Dairy cooperatives dominate the Dutch dairy market. Almost 90% of raw milk is delivered to a dairy cooperative. FrieslandCampina is the largest dairy cooperative, also operating in other countries. FrieslandCampina is one of the biggest dairy companies in the world with a turnover of over 12bn euros in 2017.

The Netherlands is a net exporter of dairy. In 2017, the Netherlands exported 2.6m tonnes of dairy valued 6.6bn euros. In the same year, the Netherlands imported 1.7m tonnes of dairy valued 2.8bn euros.

In the Netherlands about 75% of dairy products is sold to consumers by supermarkets. The other part is distributed via foodservice and other sales channels. In the Dutch retail market, the purchasing organisations of supermarkets Ahold Delhaize (39% market share), Jumbo (18% market share) and Superunie (25% combined market share of affiliated supermarket formulas) are the most important relevant for the sales (based on IGD; see also Figure 24).

In the Netherlands, for the most raw milk supply, cooperative farming and processing takes place. Delivery contracts between dairy farmers and private firms are common. Dairy firms and supermarkets agree in bilateral contract negotiations on the conditions and the price of deliveries, under their own brand or private label.

Poland
Polish dairy farmers deliver raw milk to the Polish dairy processing industry that transforms milk into different dairy products. These products are exported, or sold on domestic markets through the traditional and modern retail to consumers, or through wholesale to other domestic markets like food service.

There are over 101,000 specialised dairy farms active in Poland. About two thirds of dairy farms with cows in Poland are small subsistence farms with 1-5 cows. About 3% of Polish dairy farms have more than 50 cows. In 2016, about 13.2m tonnes raw cows' milk was produced on farms, which is almost all raw milk production. About 11.1m tonnes of raw cows' milk was delivered to dairies.

Poland has over 280 operators primarily active in dairy processing, including private and cooperative firms. A significant amount of raw milk is processed in cooperative dairies. Large producers are cooperative Mlekovita, cooperative SM Mlekpol (23% of milk products value share), Lowicz, French-based Danone (29% of yoghurt and sour milk products value share), cooperative Piatnica and German-based Hochland Polska (17% of cheese value share) (based on Euromonitor and forummleczarskie.pl 2014 data).
The Polish dairy industry produces about 1,657m litres of fresh consumption milk and 1,282m kg of other dairy products per year. Other products include cheese (68%), butter (16%), milk powder (16%).

Poland is a net exporter of dairy. In 2017, Poland imported 466,000 tonnes of dairy valued 748m euros. In the same year, Poland exported 1bn tonnes of dairy valued at 1.6bn euros.

About 20% of Polish grocery purchases is done in the traditional retail, but this share is decreasing. The traditional retail are small (family) outlets, accounting for 70% of all grocery outlets in Poland (Roland Berger, 2016). The modern retail includes hypermarket, supermarket chains and convenience stores. The modern grocery market includes the following retailers groups (and their market shares in 2017) (based on IGD; see also Figure 24):

- Jerónimo Martins (29%)
- Lidl (9%)
- Auchan Group (8%)
- Lewiatan (7%)
- Kaufland (6%)

- Tesco (6%)
- Eurocash (5%)
- Other (30%, not exceeding 5% per retail group)

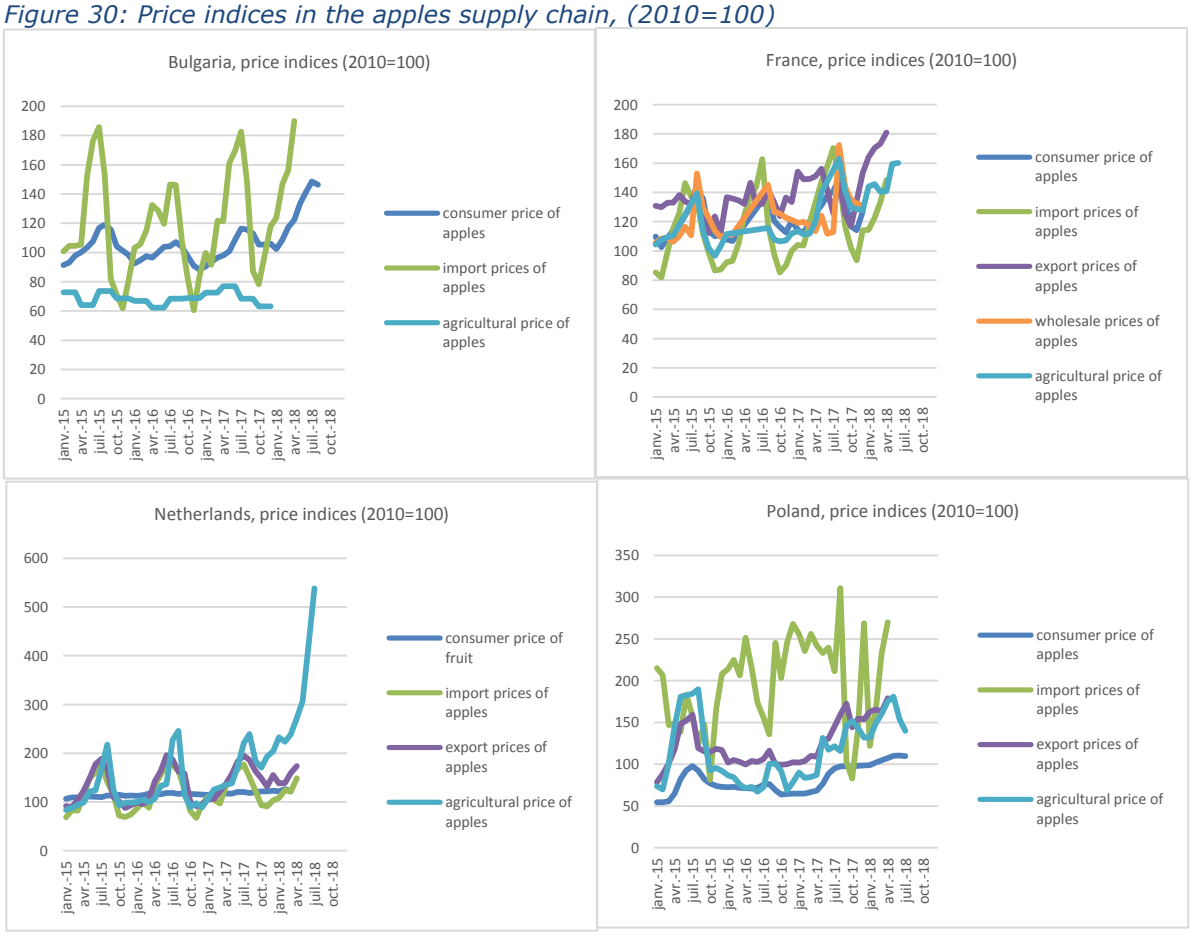
In Poland, for a large part of raw milk supply, cooperative farming and processing takes place. Delivery contracts between dairy farmers and private firms are common. Between the dairy processors, and the retailers and foodservice delivery contracts are common.

5.3.3 Approach 2: For table apples: Increasing prices due to two seasons of unfavourable growing conditions

Price developments

Consumer prices of apples show a seasonal pattern with increased prices before the new harvest season. In Bulgaria most recent consumer price index (August 2018) show high and rising prices. The consumer price index reflects both the import price index and the agricultural price index. The import price index shows however much more volatility ranging from 60 till 180 points, but in Poland the import price index even peaked on 300 July 2017. Agricultural apple prices also reflect seasonality, but with less volatility in the case of Bulgaria. Volatility is high in the Netherlands, with indices ranging between 90 and 250 in 2016 and 2017 and sky rocketing in July 2018 to 538. Both in France and Poland the agricultural apple price index lack a peak in 2016. Export prices follow the course of the agricultural prices.

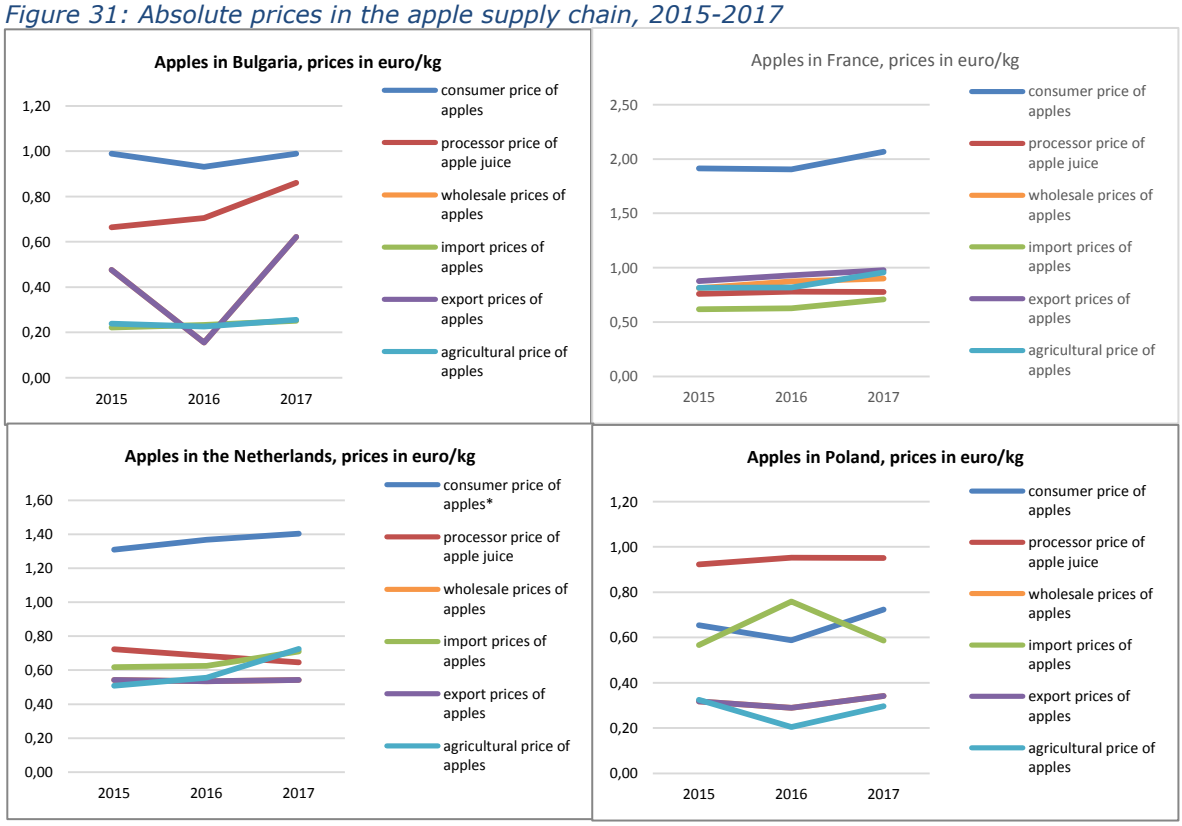
Figure 30: Price indices in the apples supply chain, (2010=100)



Sources: see Annex V.

The average consumer prices for apples are at the highest level in France over the last three years (about 2 euros per kg) and at the lowest in Poland (about 0.70 euro per kg), see Figure 31. This is reflected in prices paid at EU's main wholesale markets. Prices paid at the French markets are higher for Gala and Golden Delicious, whereas prices at Polish markets are among the lowest. Even for Idared, one of Poland's main products prices are low compared to the prices paid in the Austria and Czech markets. Prices in 2017 are at least as high as in 2015 for all countries. The average import and export prices and the average agricultural price are close together and far lower than the consumer price level for apples, except for Poland where the average level of import price was even higher than the consumer price in 2016. Within France the import price is the at the lowest level and still about 0.70 euro per kg.

Figure 31: Absolute prices in the apple supply chain, 2015-2017



Sources: see Annex V.

Factors explaining prices and price developments

The present explosion of prices of table apples is the result of the frost in the spring of 2017 that destroyed 23% of the crop across Europe, resulting in poor harvests and low stocks. Continuing high temperatures and rain shortage in the summer of 2018 is expected to have adverse effects on this year yields, which additionally will lead to an increase of prices. The seasonal pattern in prices relates to the harvesting of apples late summer in Europe, with increasing agricultural prices before harvest and for early apples. Apples can be stored for a long time. Unstocking is usually at highest in January till March, the period in which exports peak. Imports from the southern hemisphere rise from April on till end of July till the supply of fresh table apples from the harvest in the northern hemisphere.

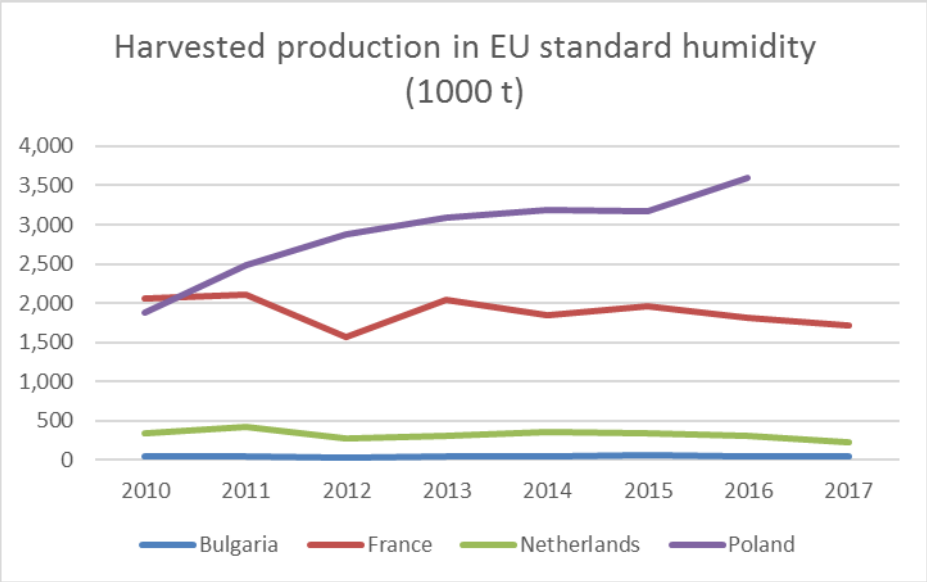
The Russian ban also affected the EU's export of apples, in particular from Poland exports, but the main effect came in 2016. Poland was able to reach the Russian market through re-exports from Ukraine and Belarus in 2015, but in 2016 the latter country faced tougher border controls. As a result Poland sold a maximum of almost 1.6m tonnes as cider apple that year which is reflected in the lower agricultural and export prices for apples without a seasonal peak that year.

Poland, France, Italy and Germany make up 70% of EU-28 apple production, which is around 12.5m tonnes per year in 2014-2016. There is a huge variety in apples. Main distinction is between table apples and those for processing into juice, cider, compote, dried, etc. In 2016 the total apple acreage was 523,000 ha. The EU-28 is slightly more than self-sufficient. Around 3.7m tonnes (=30% of apple production) were processed in 2014-2016. Consumption of table apples, 7.0m tonnes in 2016-2017, is expected to decrease at a low pace of 0.3% and of processed apples at 0.4%. Growing income will diversify fresh fruit consumption with an increase in consumption of tropical fruits.

Finally consumption in the EU is expected to stabilise. EU apple production is expected to stabilise in the coming decade around 12.5m tonnes. This leaves room for slight growth of export both for fresh apples as well as for processed apples. Increasing yields will compensate for the reduction in production area.

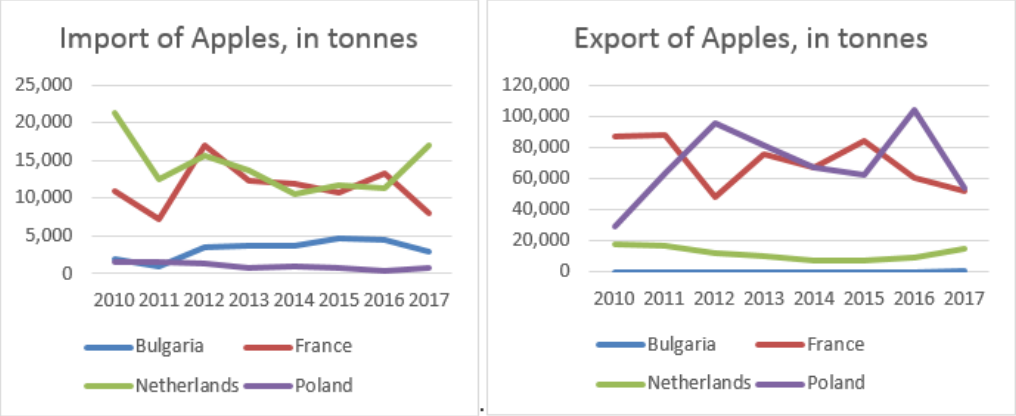
The EU-28 imports about 440,000 tonnes of table apples of which 87% comes from the southern hemisphere, in particular from New Zealand and Chile. Imports from the northern hemisphere (Serbia and Macedonia as main suppliers) are generally highest in autumn.

Figure 32: Production of apples in selected countries, in 1000 tonnes



Sources: see Annex V.

Figure 33: Imports and export of apples in selected countries, in tonnes



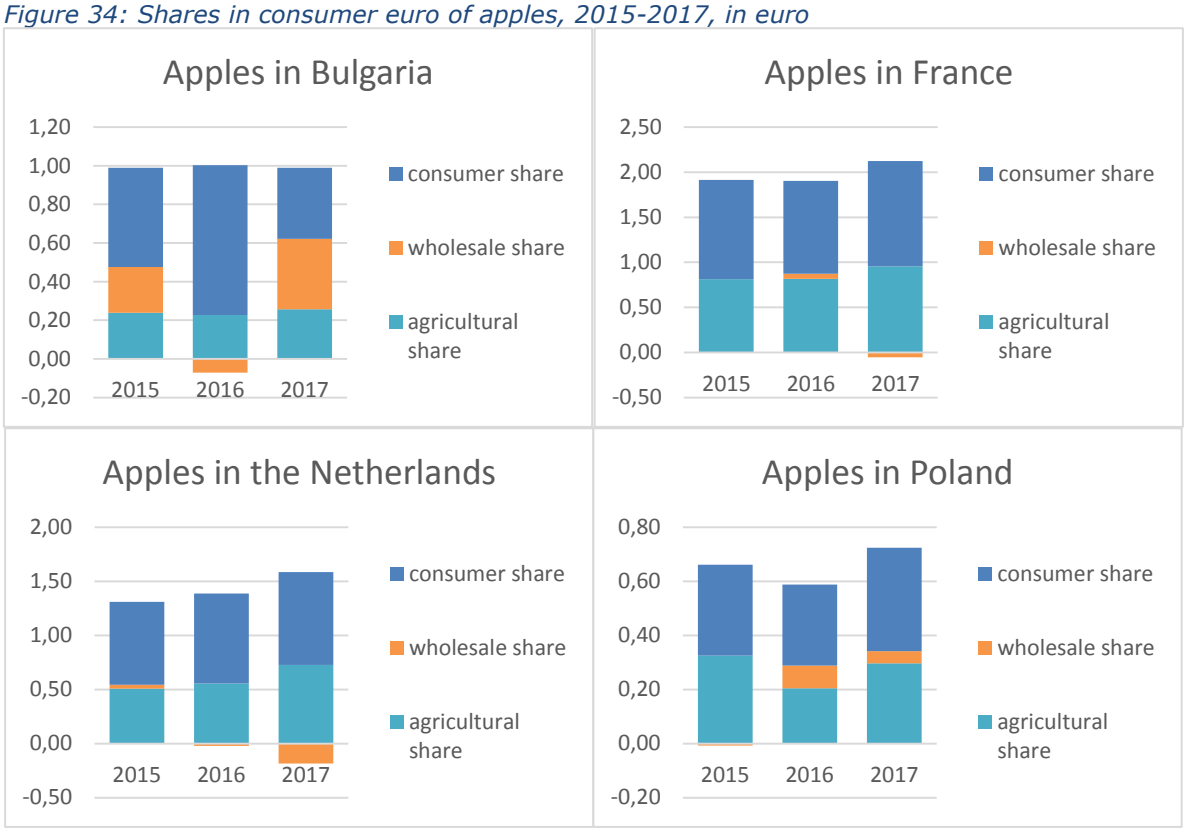
Sources: see Annex V.

Shares in consumer euro

The agricultural share of the primary producers is the lowest in Bulgaria, both absolutely (slightly above 0.2 euro per kg) as relatively. Relative share is about 20%, whereas in the other countries the share is about 40%. The agricultural share is highest in France (up to 1 euro per kg of apples). The value of the agricultural share seems to increase, except for the period in which the Russian effected Poland's

exports severely. Prices dropped throughout the chain, also the consumer share dropped, but it particularly hit the Polish growers.

Figure 34: Shares in consumer euro of apples, 2015-2017, in euro



Sources: see Annex V.

Value chain and market structure

The supply chain of table apples sometimes consists of only two stages as farmers or cooperatives of apple growers may deliver to local supermarkets directly. More complex chains include wholesalers and importers/exporters.

Bulgaria

Production of apples is located in the south-central region of Bulgaria. In 2017 48,000 tonnes were harvested (7% more than in 2016). Acreage in 2016 was 4,100 ha (which is 17% lower compared to the last 10 year average). Largest varieties grown are Golden Delicious and Granny Smith. Other main fruits produced in Bulgaria are cherries and plums, peaches and nectarines and cherries. There are four Producer Organisations and eight Producers Groups in the fruit and vegetables sector. The organisation level of primary producers is still low.

There are 100 fruit processors in Bulgaria processing 85,000 tonnes fruit processed of which 27% are apples. Bulgaria is net exporter of processed vegetables and fruits.

France

France is EU's third largest producer after Italy and Poland. Total apple production in 2017 was 1.7m tonnes. In 2014, 2015 and 2016 the share of table apples was resp. 75%, 63% and 75%. The apple acreage was 49.7,000 ha in 2017 (6% lower than the 10 years average). The main types of table apples are Gala and Golden Delicious, that make up respectively 16% and 31% of the apple production. Most fruit is sold through supermarkets.

The Netherlands
Total apple production in 2017 was 233,000 tonnes (27% lower compared to 2016) and acreage was 7,300 ha (14% lower than the 10 years average). Main type of table apples grown are Elstar 41% and Jonagold 23%. Trade balance (export value minus import value) is zero, which is a result of increased exports in 2017, especially to Germany. Export unit value is slightly above import unit value.

There were 1,084 farms growing apples in 2016. The average acreage is 7 ha. The largest growers have however 40 to 60 ha. Most growers grow pears as well and are member of one of the five Producer Organisations. These are cooperatives for the marketing, stocking, packing and transport of fruit. The four biggest cooperatives have a market share of 40 to 50%. So growers in the Netherlands are well organised. The Producer Organisations sell to wholesale (15%) or retail directly (85%). Up to one third of the production will be processed. Wholesalers consist of importers, exporters and trade companies specialised in local fruit, or a combinations of these activities. They usually trade other fruits and vegetables too. Their costs consists mainly of labour, transport and packaging costs.

Poland
Poland is EU's largest producer of apples (see Figure 32). Apple production in Poland was 3.2m tonnes in 2017 (estimation DGAgri), which is 11% lower than in 2016. Acreage was 165,000 ha, only 4% lower than the 10 years average. Main apple types are Idared (20%), Jonagold (13%) and Shampion (11%). The share of the apple production directed to processing (cider) was 56% in 2016 and was under 5% in 2017. Poland sold a maximum of almost 1.6m tonnes as cider apple in 2016. Unit value of export apples were 0.34 euro, while import apples were 0.58 euro. The largest part of export is towards third countries.

5.4 Improvement for the present illustrations

As indicated in the introduction the described alternative approaches for pig meat, dairy and apples is just an illustration. The narratives have been described by sector specialists from the Netherlands who have some but not a deep insight in the value chains in markets in Bulgaria, France and Poland. This is also the main reason that more information is given about the Dutch market compared to the others in the illustrations in this chapter.

Next to a lack of qualitative knowledge about markets also detailed information of e.g. market structure (like share of cooperatives or producer organisation (their C4) and other main players on the markets) is not publically available. This also holds for buying channels. It is unknown which part of the product is sold by large retailers, specialty shops, week markets and out of home. Only some general information regarding food is available e.g. share of supermarkets, but detailed product information is scarce. Also information about total consumption of products is scarce. In most cases the production in volumes plus the import minus the export in volumes is a proxy for the domestic consumption in volumes.

Information about the price formation (existence of price contracts; contracts, future markets) is often lacking. Some information is available about the agricultural markets but almost none about processors' markets nor the retail markets. Research shows that these markets can differ for the different food products (Baltussen et al., 2014).

For the illustration public available data from Eurostat and Comext have been used. For the interpretation of the data insights in the raw data can be very helpful. The illustrations in this chapter show that (see for example the price spreads for pig meat)

comparison of price spreads among countries is more or less meaningless as long as insights in the raw data are lacking.

Information about processor prices is scarce and even more difficult to define because some products have more than one processing stage e.g. cured ham with slaughtering, cutting, curing, slicing and packaging. For many countries monthly information about processor prices are lacking.

6 Conclusions and discussion

6.1 Robustness of alternative versus existing approaches

In Section 2.2.6 the robustness of existing approaches is classified and in Chapter 4 the characteristics of the alternative approaches have been described. In Table 53 the existing approaches with highest scores on robustness are compared with the Alternative Approaches 1 to 3.

Table 53: Robustness scores of alternative approaches versus existing approaches per indicator

	Existing Approaches [1]				**Alternative Approaches**		
Robustness indicator	**BE1**	**BG2**	**EU1**	**EU3**	**1**	**2**	**3**
Effort	1	1	1	3	1	>3	>>3
Applicability	1	3	3	3	3	3	>>3
Reliability	3	3	3	3	3	>3	>>3
Validity	3	2	3	3	3	>3	>>3
Flexibility	3	3	3	1	3	3	>3
Total score on robustness	9	10	13	13	13	>15	>>15

Source: Authors of this study.

[1]See Figure 9: Robustness assessment of the FPMMA in Chapter 2 for the scores on existing approaches and the way of scoring. See Annex II for description of the existing approaches.

From Table 53 it becomes clear that the proposed alternatives are at least as robust as the best existing approaches. As stated in Chapter 4 and 5, Alternative Approach 1 resembles the Food Price Monitoring tool of Eurostat (EU1) with additional narratives to explain the changes in price indices. The additional effort is still low so the total score doesn't differ between Alternative Approach 1 and EU1. On all other criteria (applicability, reliability, validity and flexibility) Alternative Approach 1 and EU1 have the highest score of '3'. The reliability of the results of Alternative Approach 1 is better than the reliability of EU1 since the developments of the prices indices are placed in the context of developments in supply and demand of products and the structural context is given. For applicability, validity and flexibility EU1 and Alternative Approach 1 are comparable in absolute sense.

Alternative Approach 2 scores higher on robustness than the existing approaches and Alternative Approach 1. Alternative Approach 2 scores a '3' on all indicators. Compared to existing approaches and with another scaling the score on robustness would be far higher. However, the effort to implement Alternative Approach 2 is relative high. Prices at the level of processors are presently not available on a monthly base for all MS. Also the indicators for the explanation of the price spreads need to be defined, harmonised and calculated. Some of these indicators need to be defined at the level of product group. Alternative Approach 2 is applicable to other sectors although part of the data is only available per stage and are hard to make them supply chain specific e.g. the C4 of supermarkets is known at sector level but not for each value chain or product. With the, compared to Alternative Approach 1, additional information about absolute prices, price spreads and the related narratives a far better and more reliable insight can be given in the developments in different markets in the different MS. The information should give a far more valid measure for the functioning of markets (or market failures). This could be a first step to an early warning system for the functioning of divers food markets at all stages in the supply chain. Alternative Approach 2 doesn't contain information about costs per stage of the supply chain. So, limited insight can be given in the development of margins and price transmission.

Alternative Approach 2 is as flexible as the present approach of EU1 and Alternative Approach 1. Of course next to the price indices also the absolute prices and the narratives need to be produced and published.

Alternative Approach 3 is extremely robust compared to existing approaches and complete insights in markets at all stages is produced.

6.2 Different products per MS and regions

I this research it has been assumed that products are defined the same in all MS. In reality definitions of products do differ a lot among MS and products are not completely comparable. For example apples for cider production is a different supply chain compared to apples for fresh apple consumption or for the production of apple juice. Also prices, price spreads and price developments can be quite different for each supply chain. Also per MS there can be supply chains that don't exist in other MS (i.e. cider production).

We propose not to harmonise product definition and supply chains among MS. I will be very hard to get data per stage of the supply chain because some supply chains will not be important in some MS. On the other hand by producing metadata and narratives the differences among countries can be explained.

6.3 Cost-Efficiency of alternative versus existing approaches

In Table 54 an overview is given of the costs and outputs per alternative approach compared to the existing approaches. As concluded in Section 2.5 it is difficult to get insight into the costs for different approaches per MS. Especially the costs for data gathering or buying data are more or less unknown. For the existing approaches the monitoring is strongly based on existing information that is freely available for the observatories in the MS, the EU gets the information from the MS, also for free.

For Alternative Approach 1 no additional data are needed. For Alternative Approach 2 absolute monthly prices per stage of the food supply chain are needed. Basic data are presently lacking for producer prices in many EU countries see Annex IV. Also for some supporting indicators regarding the price spreads in Alternative Approach 2 additional data gathering is needed (see Section 5.4).

For Alternative Approach 1 and Alternative Approach 2 additional costs per MS and at EU level is necessary to

- analyse the data;
- write the narrative;
- publish the results.

This is done 4 times per year for all products and product groups and an additional few times if diseases outbreaks or other crises occur to explain price shocks and shocks in price spreads.

For the cost calculations the basic information is scattered. The costs mentioned in Section 4.4 (see Table 51 and Table 52 for the two proposed alternatives are for three products and for all 28 MS. The reasons for this choices lies in the purpose of the monitoring approach: are markets in food supplies working without market failures. Milk, pig meat and apples are relevant for almost all 28 EU MS, because in all countries these products are produced and/or consumed. For some products like olive oils or oranges the production and processing is relevant for only a few MS.

In case the purpose of the FPMM approach is to estimate prices levels of products in certain stages of the food supply chain other choices can and will be made i.e. monitoring of prices in the main production and consumption MS of the EU. The costs will in that case be lower than estimated in Section 4.4. Another purpose of FPMM could be the monitoring of prices for different kind of products i.e. organic, sustainable and the normal product. This would give farmers insight into their position in the value chain. However in that case several value chain per product need to be monitored and for many of these value chains no price information on all stages is publicly available. Compared to the cost estimates made in Section 4.4 this would increase the costs.

In the present food price and monitoring tool of Eurostat 15 supply chains are covered. We assumed that costs will increase more or less linear with the number of products because all additional activities (producing narratives; gathering additional information) is supply chain specific and the economies of scale are limited. Of course some economies of scale will exist like the design of website (the same for all products) and update of websites.

Table 54: Costs of alternative versus existing[1] approaches

	Existing approaches	**Alternative approaches**	
Costs/outputs	**Price observation Margin observation**	**1: price indices**	**2: price indices and price spreads**
Total costs per year	0.1m euros - 2.8m euros	1.5m euros	2.5m euro
Outputs	Price indices; divers	Price indices and narratives	Price indices, prices, price spreads and narratives

Source: Authors of this study.
[1]See Sections 2.5 and 4.4 for the estimated costs per type of food price and margin monitoring; The estimated costs are excluding the costs for additional data gathering and are calculated for 3 products and 3 stage per value chain.

6.4 Practical implications and recommendations for implementation at EU level

Alternative Approach 1 can be implemented as an improvement of the Food Price Monitoring Tool of Eurostat. The implementation of Alternative Approach 1 gives information about:

- The additional value the users get from the narratives;
- The increased use of the monitor with the additional information;
- The additional costs and complications with the introduction of Alternative Approach 1;
- Cooperation between MS and Eurostat.

This information can be used to decide on the implementation of Alternative Approach 2. Alternative Approach 2 is a further extension of Alternative Approach 1. If Alternative Approach 1 does show added value, increased use of the monitor by stakeholders, low additional costs and a good cooperation between MS and the EU the implementation of Alternative Approach 2 can be considered. The implementation of Alternative Approach 2 should be evaluated because for MS and the EU there will be a substantial increase in costs for implementing this alternative without knowing the added value of the additional information from this monitor.

Alternative Approach 3 is not a real option in the present situation. The costs for monitoring prices and margins are very high without knowing to what extent the working of markets will improve or which current market failures will be solved. If costs for information gathering and analysing can be strongly reduced and the added value is high for policy makers and/or stakeholders Alternative Approach 3 can become an alternative in the future.

Practical implications for implementation of Alternative Approach 1 are:

- Next to the price indices per supply chain a narrative needs to be written each quarter. In many cases the organisations delivering the data do not have the experts for writing the narratives. These experts need to be selected and contracted to deliver the narratives each quarter and more frequently if a crisis occur. Experts are independent sector exports and not policy officers or people from branch organisations, because then the narratives can become politically biased. Experts should come up with factual information.
- To supply actual information a good planning of the publishing of the price indices and the narratives is needed. A delay of two months between data gathering and publishing the results seems acceptable for the data and the narratives. A good organisation of the activities is core to avoid a longer time lag.

Practical implications for implementation of Alternative Approach 2 are:

- All implications mentioned for Alternative Approach 1;
- Definitions on the absolute prices published to increase the comparability over countries; This holds for all stages of the supply chain but the most critical are the prices at the level of processors; In the short term, import or export prices can be a proxy for the processor prices but the results in Chapter 5 show that in many cases there are huge differences between export prices, import prices and processor prices for those countries where these prices were available.
- Data for the calculation of the indicators explaining the price spreads need to be defined, sometimes gathered and calculated.

6.5 Conclusions

- There are currently a large number of price monitoring approaches. They are heterogeneous in their structure and setup.
- Outputs and costs of these approaches differ substantially. They differ, e.g., regarding the extent and structure of data gathered, methods used for the analysis, intelligibility and frequency of results communication, time lag between data gathering and publication, number of products, product groups or regions covered and various other characteristics.
- Currently existing monitoring approaches cluster into three classes, each having different typical characteristics, advantages and disadvantages. These classes differ in the level of complexity of their price and margin monitoring as well as in their costs.
- Price margins or costs and profits of stakeholders along food supply chains are currently barely being monitored.
- Improvement of current monitoring across the EU is most needed with respect to the quality and clarity of the communication of monitoring results. A

harmonisation of the current monitoring approaches across EU and its MS is very desirable.

- Two alternative monitoring approaches are proposed:
    - The first is an adaptation of the Food Price Monitoring Tool presented by Eurostat. The main improvements are narratives based on expert knowledge per food supply chain and MS to explain the developments of price indices. Also metadata about the raw data of the prices indices supports the analysis of the developments.
    - The second step can be to publish also absolute prices at three stages in the supply chain and to calculate and analyse price spreads and food euro shares. In this approach also narratives are proposed with additional indicators to monitor possible market failures. The monitor of costs per stage of the supply chain is not part of this step.
- The implementation of both alternative approaches have practical implications for MS and the EU. In the first step, the narratives need to be organised and the time lag involved in publishing the results needs to decrease to a few months. In the second step, additional data gathering, especially on processor level, is needed.
- The expected costs per year for the proposed alternative approaches are roughly €1.2m for Alternative Approach 1 and €2.5m for Alternative Approach 2. These are the costs for 28 MS and the EU for three products under the assumption that no additional costs for data gathering are needed. Cost estimates for alternative approaches are difficult because of a lack of information about costs of data gathering and limited information about the costs of existing FPMM approaches.
- Analyses of vertical price transmission await expansion into comparative studies ideally and explicitly measuring the effects of structural determinants by the use of statistical models. This requires additional data gathering of structural determinants of vertical price transmission.

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Annex I: Methodological approaches

A general note on measurability:
The goal to measure and compare a range of monitoring approaches to each other in a structured way as implemented in Chapter 2 faces a number of challenges. The most important ones are:

- Lack of a common vision of FPMM
- Extreme heterogeneity in design and outputs of FPMM
- Variable definitions
- Comprehensiveness
- Data gathering
- (Presentation of the) outcomes of analysis
- Way of publishing
- Transparency of monitoring

The main challenge of this analysis consists in the fact that many of the characteristics of monitoring approaches can hardly be measured by numbers in an objective and meaningful way. Several of their characteristics can be counted, e.g., how many price series are monitored. However for other characteristics such as the formats of monitoring outputs it can only be assessed whether or not they are incorporated into the monitoring approach to be analysed. Other characteristics such as the intelligibility of monitoring results can only be qualitatively assessed by an justified expert rating.

This challenge also applies to the construction of the typology. This typology only assesses how similar or dissimilar existing approaches are and classifies those of them which are most similar with respect to a number of characteristics into one class. It only sheds light on the typical characteristics and advantages and disadvantages of each group and how the approaches belonging to it differ typically from approaches belonging to other classification classes. Hence, the approaches classified into one typology class are more alike to each other than any of them is to any other approach not belonging to this class.

This challenge also applies to the construction of the typology. The typology only assesses how similar or dissimilar existing approaches are. It classifies those of them which are most similar with respect to a number of criteria into one class. Hence, the approaches classified into one typology class are more alike to each other than any of them is to any other approach not belonging to this class. The typology can only give insight into how similar or dissimilar two approaches are with respect for the relevant criteria. It sheds light on the typical characteristics and typical advantages and disadvantages of each group and how the approaches belonging to it differ typically from approaches belonging to other classification classes.

Due to this challenge, the comparative analysis as well as the typology only allow the measurement of the following aspects:

- Assessing whether a given FPMM approach possesses a certain narrowly defined characteristic or not – that is, the answer can only be 'yes' or 'no', e.g., whether the approach monitors the retail-farm gate price spread or uses graphs for communicating its outputs (for all narrowly defined characteristics used in Chapter 2 see Table 56)
    - If the existence of such narrowly defined characteristics is assessed for all approaches, frequency counts can be created to get a comparative

overview of which characteristics are most or least commonly shown by all approaches (done in Chapter 2.1)

- Assessing what quality of a certain widely defined qualitative characteristic a given FPMM approach possesses – that is, the answer now cannot be 'yes' or 'no' but a verbal description of the quality of this characteristic, e.g., which output form(at)s the approach uses – to which the answer could be 'interactive graphs; data also available in tables from the Eurostat website' (for all widely defined qualitative characteristics used in Chapter 2 see Table 61, see the 17 factsheets for the results of this assessment for the 17 approaches analysed in detail)
    - If the quality of such widely defined characteristics is assessed for all approaches, the varying qualities can be structured and grouped into categories in order to get a structured insight into the forming of this characteristic among all approaches (done in Section 2.2)
- From all widely defined qualitative characteristics considered, a subset of particular relevance can be chosen. For each characteristic in this subset a normative assessment can be done about which of its formations comes closest to the desired characteristics for FPMM (see Table 19 and Table 63)
    - Then it can be checked which of the approaches shows this optimal type of each characteristic (see Table 66)
    - Based on that information, the typology classes as outlined in Table 20 can be constructed based on the procedure described in Table 62
    - The typology classes as outlined in Table 20 allow then to assess which of the optimal types of the characteristics of this subset are typical for each class (i.e. at least 50% of the approaches belonging to it show this optimal type)
    - Last, the advantages and disadvantages as contained in the 17 factsheets can be used to obtain a systematic picture of the most important advantages and disadvantages of each typology class. 'most important' is defined as those advantages and disadvantages most frequently appearing among all approaches belonging to a class. In this way a list of the typical advantages and disadvantages of each class can be obtained.
    - Therefore, this qualitative assessment and the typology **only allows statements about typical characteristics** and advantages and disadvantages ('most of the approaches have...' or 'most of the approaches have not...' where 'most' means at last 50%) – **it does not allow conclusions about whether all or none** of the approaches belonging to one class possess a certain characteristic.

The qualitative analysis and the typology do not allow entail judgments about whether a group of approaches is better or worse performing than others. Such analysis does not allow to summarise the heterogeneous range of often quantitative characteristics into a single number or an average score. Therefore, the analysis does not allow to deduce conclusions from such (kinds of unidimensional numeric) metrics such as: 'approach A is a better monitoring approach than approach B because the former scores 2.5 while the latter scores only 2.1'. Thus, the typology does not allow conclusions about the best- or the worst-performing approaches as the 'performance' of these approaches is not measurable. Qualifications such as 'best-performing' or

'worse-performing' are normative statements which depend on the expectations of political decision makers setting up the monitoring institution or approach. As those expectations have not been the focus of this report (and are actually barely explicitly written down), the analysis in Chapter 2 does not allow conclusions about which of the existing approaches is 'best-performing'.

The typology developed in Chapter 2 is only able to cluster approaches according to their (multivariate) similarity into a number of subgroups whose approaches are internally more similar to each other than to any other approaches. Hence, the result of this analysis is a classification of existing methodologies in order to structure and to simplify the enormous heterogeneity which is currently existing.

The notion of an 'ideal approach' remains subjective because it is a relational characteristic referring to an approach which satisfies a number of desirable characteristics each in the best way feasible in each separate dimension. Depending on the set of requirements for price monitoring precisely needed in a certain context and for a certain purpose, ideal monitoring approaches might look very different.

The heterogeneity of such an comparative analysis can be compared to the comparison and classification of all possible modes of transport. Such modes of transport may range from going on foot, being carried in a sedan chair, riding a donkey or a horse, moving in an animal-drawn carriage or going by (different types of) bike(s), car(s) or any other self-propelled vehicle(s) such as trains, airplanes, jet planes, rockets, etc.. As for FPMM approaches, also many characteristics of this wide range of modes of transport cannot be measured by numbers. Moreover, an ideal mode of transport depends on which of the extremely heterogeneous and wide range of transport options fits best to the expectations desired by the use of this transport, e.g., being very fast, environmentally friendly and robust in its usage at the same time.

AI.1 Methodology of Section 2.1

The goal of the inventory be prepared in Section 2.1 is to obtain an overview of existing FPMMA, to summarise their key characteristics and their contents in order to generate a quantitative summary of existing approaches for food price and margin monitoring.

For this aim, we combine the existing inventories, match their contents, check whether their contents are still up to date, complement their contents with relevant sources not yet reported and check for additional approaches potentially set up in year since the publication of the existing inventories and add these to the inventory. The starting point of our inventory are the following three sources which focus on existing FPMM in the EU or the OECD:

- European Commission (2014c),
- OECD (2015a) and
- Eurostat (2017).

The FPMMA analysed by the study of Oosterkamp et al. (2013a, 2013b) consist of a subset of the ones covered by Eurostat (2017). While these sources only contain summarising characteristics of the existing FPMMA for certain groups of countries (OECD vs. EU), we merge and complement this existing information with a detailed and structured characterisation of each approach which is intended to serve to quantify the comprehensiveness and depth of each FPMMA.

The set of 45 countries and 6 international institutions considered for evaluation has been selected based on the following conditions:

- All member states of the EU (28 countries, Eurostat, 2017b),
- All member states of the OECD (35 countries, OECD, 2017a),
- Four selected major transition countries with substantial food demand/food production, namely China, India, Indonesia and South Africa and
- Six international institutions with major stakes in food market monitoring: EU, Food and Agricultural Organization of the United Nations (FAO), G20, International Food Policy Research Institute (IFPRI), World Food Programme (WFP) and World Bank.

As several countries are members of the EU as well as of the OECD, the total number of countries considered amounts to 45 as shown in Table 55: Overview of FPPM countries and institutions.

Table 55: Overview of FPPM countries and institutions

		OECD member countries			
		No	**Yes**	**Institution**	**Sum**
EU member countries	**No**	4	13		**17**
	Yes	6	22		**28**
	Institution			6	**6**
	Sum	**10**	**35**	**6**	**51**

Source: Authors of this study.

The following 33 characteristics (plus 5 additional qualitative categories 'other') belonging to the four categories shown in Table 56 are evaluated. For each of the existing FPMMA covered, it is evaluated whether each of these characteristics is implemented or not. That is, the inventory provides a quantitative overview analysis on the detail, extent and comprehensiveness of existing FPMMs putting emphasis on the clarity of presentation of results. The inventory presents quantitative count data based on the number of which and how many of the 33 characteristics are implemented/not implemented by a given FPMM initiative. (Sub-) categories A, B1, B2, B3 and D contain an characteristic 'other' which provides qualitative information in the form of keywords highlighting significant additional items not covered by the characteristics mentioned in Table 56.

Table 56: Evaluation categories and characteristics for the inventory of existing FPMMA

Evaluation category	**Evaluation characteristic**	**Comment**
A) Product coverage		Considers raw and processed foods of each characteristic
	a) Dairy	6.
	b) Meats	
	c) Crops	Includes cereals, protein crops, sugar, rice, maize etc.
	d) Fruits & vegetables	7.

Evaluation category	Evaluation characteristic	Comment
	e) Other	Additional product types
B) Monitoring focus	8.	9.
B1)Prices monitored	10.	Considers only selling prices at various levels of the food supply chain, see Figure 35 for details
	a) Farm gate price (p_{out}^{farm})	
	b) Processors selling price ($p_{out}^{processing}$)	
	c) Wholesale selling price ($p_{out}^{wholesale}$)	
	d) Retail selling price (p_{out}^{retail})	
11.	e) Other	Additional price types
B2)Price spreads monitored	12.	13.
	f) Retail-farm gate spread (s^{r-farm})	Considers any kind of measurement of price spreads or profits, see Figure 35 for details
	g) Spreads along the food processing chain (e.g., s_1^p)	
	h) Profits along the food processing chain (p^l)	
14.	i) Other	Additional spread types
B3)Other monitoring	15.	16.
17.	j) Farmers' costs (c^{farm})	Considers only costs of supply chain actors, see Figure 35 for details, along the chain may be processing or distribution costs
18.	k) Retailers' costs ($c^{retailing}$)	
	l) Other costs along the food supply chain (c^l)	
	m) Regionalised monitoring	Whether monitoring is done for various regions within a country by one national FPMM institution or for various countries by one international FPMM institution
	n) Reference price monitoring	Whether explicit reference or target prices are explicitly monitored

Evaluation category	Evaluation characteristic	Comment
	o) Other	Additional monitoring types
C) Monitoring outputs		
C1)Observed cross-section data		National or regional average prices measured in currency unit per quantity unit for various commodities, supply chain levels or regions at the same point of time
19.	a) Price tables	
20.	b) Price graphs	Any kind of graphical illustration
21.	c) Price indicator tables	Price indicators are defined as any calculations using the observed prices (except of indices)
22.	d) Price indicator graphs	
C2)Observed time series data		Same as C1) only observed for at least 6 subsequent and equally spaced points of time (i.e., at least half a year in the case of monthly observations)
23.	e) Price tables	
24.	f) Price graphs	Any kind of graphical illustration
25.	g) Price indicator tables	Price indicators are defined as any calculations using the observed prices (except of indices), see Figure 35
26.	h) Price indicator graphs	
C3)Cross-section price index data		Price indices for one point of time calculated in relation to a fixed reference period, see Figure 35 for details, price indices are one of the simplest forms of price indicators
27.	i) Price tables	
28.	j) Price graphs	Any kind of graphical illustration
C4)Time series price index data		Price indices for at least 6 subsequent points of time calculated in relation to a fixed reference period, see Figure 35 for details, price indices are one of the simplest forms of
29.	k) Price tables	

Evaluation category	Evaluation characteristic	Comment
		price indicators
30.	l) Price graphs	Any kind of graphical illustration
C5)Other monitoring outputs		
	m) Commented quantitative analyses	Whether the numbers and graphs presented are verbally explained and/or interpreted
	n) Qualitative analyses of supply chain structure	
D) Data frequency		
	a) Irregular, ad-hoc	
	b) Regular - annual	
	c) Regular - monthly	
	d) Other frequency	e.g., weekly or daily

Source: Authors of this study.
Note: The symbols mentioned in parentheses for various characteristics of category B refer to the symbols outlined below in Figure 35. Although that price indices are one of the simplest forms of price indicators, we consider them separately as they are a frequently used way to present price developments.

Additionally, we report the current name of the FPMM institution in English and the national language (if not English), the link to the website publishing the prices, possibly a link to a archived data, the status of the institution (whether public, run by an association or a private company), whether this institutions is indeed found to currently publish FPMM data and whether it has the explicit mandate to serve as a price and margin observatory.

The various monitoring focuses considered in category B) need varying gathering efforts by the affected stakeholders. The European Commission or Eurostat which are collecting the data would need to set up the necessary technological and legal frameworks to make the gathering happen. Various amounts of set-up investments, human capital and running costs would be needed on their side to continuously process, check, possibly process and publish the data. The higher the amounts of data being collected and the higher its level of detail, the more efforts for saving, checking, processing and publishing are needed. Additional costs might incur for the varying magnitudes of efforts to enforce the legal framework homogeneously across the EU. The more detailed the requirements for the data providers (actors along EU food supply chains such as farmers, processors, wholesale and retail traders) are, the higher will not only be the enforcement efforts and costs of the public actor, but also for these private companies. The higher the challenges are for the private actors, the more incentive will they have to either avoid compliance or reduce the requirements on legal ways. On the other hand, the more elaborate and detailed the data gathered is, the more insightful are the potential conclusions which can be drawn from it for the public monitoring of EU food supply chains. For example, collecting average farm gate

prices per MS for a number of raw commodities produced by agriculture entails relatively low gathering efforts and costs and also institutional challenges for implementing the data gathering are low. However, the insightfulness of only regarding farm prices is extremely limited if useful at all if the political goal is to gain insights into the structures of EU food supply chains. The opposite holds for gathering, for example, costs and profits along supply chains.

Similar thoughts hold for the various types of monitoring outputs considered in category C). They are connected with various levels of difficulty and costs of preparation. For example, publishing tables of average prices in a standardised format can be largely automatised with suitable IT technology and will therefore tend to be cheap and fast in implementation while qualitative analyses of the structures of selected national supply chains need much more time, effort and costs to be produced. Again, the latter are much more insightful for private and public stakeholders than the former. Additionally, the different types of outputs also differ in the amount of statistical and economic expertise contained in them on the one hand and their intelligibility for the stakeholders/users of the FPMM on the other. While the statistical and economic expertise contained in average prices is comparatively low, the amount if expertise needed to prepare qualitative supply chain structure analyses or commented quantitative analyses is much higher. This expertise which makes sense of the often confusingly many data points available (that is, the thousands of price observations) and helps the stakeholder deducing crucial information from it increases the intelligibility of the latter kinds of monitoring outputs also markedly in comparison with the former ones. When only average prices are published, then the isolation, the understanding and the interpretation of the crucial insights hidden in the data are left to the data user. However, most of the potential beneficiaries of FPMM lack the statistical and economic know-how and temporal resources for performing insightful data analysis themselves. The knowledge and the time to be invested to understand the many available data points, increase the efforts to be spent for the monitoring provider, but also raise the intelligibility the monitoring outputs have for the user of the FPMMI.

Table 57 gives an overview of the counts of the 33 characteristics distributed across the (sub-) categories on which the inventory is based upon. We consider four categories each of commodity groups and data frequency covered by the initiatives. 12 characteristics give a detailed insight in what type of prices or price spreads or other quantities are being monitored. 14 characteristics classify and structure the outputs of the monitoring. Evaluation categories A), B1), B2), B3) and D) have an additional category 'other' in order to capture additional qualitative information. This category has been added due to the substantial heterogeneity of the FPMMA covered.

Table 57: Numbers of evaluation characteristics per category

Evaluation category	Evaluation subcategory	Number of evaluation characteristics
A) Product coverage		**4**
B) Monitoring focus		**12**
	B1) Price monitoring	4
	B2) Spread monitoring	3
	B3) Further monitoring	5
C) Monitoring outputs		**14**
	C1) Observed cross-section data	4
	C2) Observed time series data	4
	C3) Cross-section price index data	2
	C4) Time series price index data	2
	C5) Further monitoring outputs	2
D) Data frequency		**4**
	Da) – Dc) Irregular, annual, monthly	3
Total		**33**

Source: Authors of this study.

Within the EU and beyond, FPMMI is being collected, processed, analysed and partly shared with the public by a number of actors. Depending on their interests, these actors engage in the collection, processing, analysing and communication of price and margin data to very different extents. The monitoring initiatives evaluated show therefore an enormous, almost confusingly wide heterogeneity in terms of their focus and procedure of analysis and the way, clarity and transparency of communication of results. This substantial range of implementation of food and margin price monitoring challenges the evaluation of all initiatives covered using a single evaluation scheme. The scheme presented in Table 56 is able to do so by providing quantitative insights on the frequencies of existence of separate characteristics among all FPMM initiatives evaluated.

Figure 35 appears to be useful to clarify the plethora of terms potentially relevant in the context of price and margin monitoring. It highlights key the value added and the temporal dimensions of the schematic structure of food supply chains (movements in space are neglected because not of relevance for the current analysis). It shows schematically how an agricultural raw product and its processed derivatives move through subsequent levels of the food supply chain in time. The food supply chain may be schematically classified to consist of six levels which are connected by transport and/or storage. With each stage more time passes (indicated on the abscissa) during which the commodity is being transformed as well as more and more value is added as indicated by the repeated physical flows of (processed) agricultural goods and additional production factors needed for realising these transformations. With the increase of the value added also the price of the good increases as indicated on the ordinate at the left-hand side. The width of the bold rectangles representing the various chain levels does not reflect average transporting and production times due to absence of empirical evidence of the average temporal dimension. However, the height of the rectangles in corresponds to the estimations of Canning (2011, page iv,

2008 industry group series) of average value shares of total food expenditures in the USA.[17]

The structure and the length of the chain differ strongly; they depend on the raw commodity, on the processed product produced from it as well as the relevant national or regional socio-economic and political framework. The supply chain of fresh fruit such as apples offered in a specific supermarket of a large supranational retail chain will in tendency be shorter and involve less steps (maybe skipping the wholesale level) than the supply chain of highly processed meat products offered by small high-priced speciality shops. Hence, Figure 35 serves for highlighting and illustrating crucial characteristics of food supply chain relevant for this analysis. On several of the six stages of the food supply chain various activities can potentially exist for the production (the transformation) of a food commodity finally offered to consumers. For the sake of parsimony and clarity of presentation, these are summarised into one level in the graph.

Figure 35 illustrates the production flow and the implied economic structure. Agriculture produces the raw form of the food commodity. For this, agriculture uses besides genuinely agricultural production factors (inputs) such as land and the knowledge and the labour of the farmer and farm workers a number of inputs generated by other industries, e.g., electric energy, fuel, machinery, IT services, seeds or plant protection technology, as well as – depending on the commodity considered - various inputs generated by other farmers such as straw or feed. Hence, the production of some agricultural commodities such as animals products needs several steps of agricultural production. The structure and the complexity of the agricultural production depends therefore on the commodity. The several potential steps of agricultural production potentially existing have been summarised into one level in Figure 35.

After the raw form of the commodity has been produced by agriculture, it moves along the supply chain being collected, cleaned, sorted, packaged, transported, potentially traded and/or processed (transformed) to a larger or smaller extent and potentially involving several steps. The structure, intensity and complexity of the (various) processing steps of the raw commodity depends at the one hand on the raw product as well as on the final product to be produced from (parts of) it. That is, also the processing and packaging level of the food supply chain may contain various steps which are again for the sake of parsimony summarised into one level in Figure 35.

After the consumer good has been produced and packaged in its final form, it mainly needs to be moved in space and brought to the various potential marketing outlets the consumer visits. For doing so, there might exist a wholesale level which helps distribution but purchasing large quantities of a good and re-selling it in smaller quantities to individual retail traders. Large retail chains often skip this level and source the goods they offer to consumers directly from companies doing the final processing before marketing. Retail trade can take place through a number of channels such as large supermarket chains or small individual food retailers. Its structure also depends on the good and the national context. Finally, food is also brought to consumers via food services. These services offer immediately ready to eat food to the consumer often accompanied by additional value added such as serving service or a special eating and/or drinking environment. Examples are fast food chains, kiosks, restaurants or bars. They might source the food the offer to the

[17] The estimates of Canning (2011) for energy, finance & insurance and other have been added up and are portrayed in Figure 35 as the input level. The share for transportation of Canning (2011) has been split into 5 parts connecting the six levels of Figure 35. The wholesale level of Figure 35 has been very roughly estimated by the authors and subtracted from the retail share reported by Canning (2011).

consumer either from retail stores or directly from wholesalers or the food processing industry[18]. For further details, see, e.g., Oskam and van Witteloostuijn (2011).

The ordinate shows the prices of a unit of a food product created by agriculture in its raw form and the price of the entire quantity of products and transformation steps and food chain levels which the product passes through before it is finally offered to the consumer. For example,
Table 58 illustrates that only about half a Cent of each Euro spent by consumers for a breakfast in a restaurant arrives at wheat farmers due to the multiple value added throughout the supply chain of rolls.

Table 58: Value chain of bread served for breakfast in a restaurant

Product and supply chain level	**Volume**	**Price in Euros**	**Farmer's share in price**
Wheat at farm gate	1000g	0.16	100%
Flour at mill gate	700g	0.25	64%
Rolls at supermarket	14 (number)	6.30	2.5%
Breakfast in restaurant	5 (about 3 rolls each)	40	0.4%

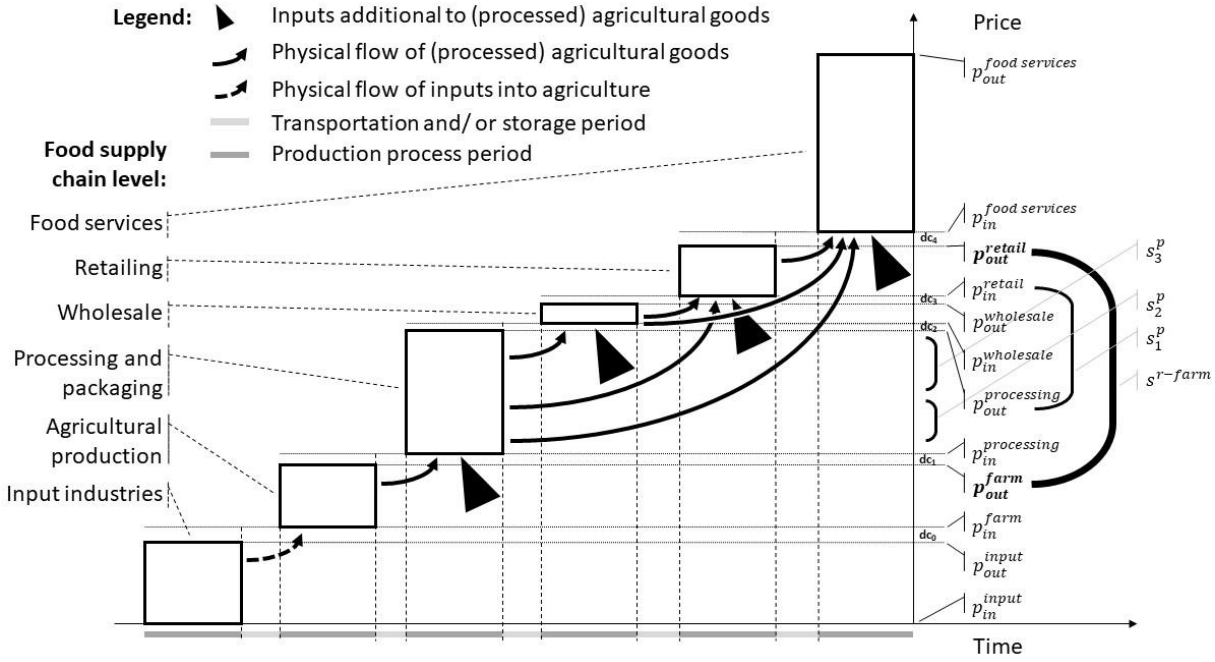
Source: Authors of this study.

According to the price levels prevailing in November 2017 in Germany, a farmer received for 1 kg of wheat grain about 0.16 euro. This wheat enters the processing level which is mainly grinding and packaging by mills. About 700g of wheat flour can be produced from 1kg of wheat grain. Wheat flour marketed at retail level in its simplest form costed in Germany in this month about 0.36 euro. That is, the 1 kg of wheat grain has been transformed into 700 g of flour (0.36*0.7). This quantity of flour has a price of about 0.25 euro after being processed, transported and put into the shelf in a supermarket.[19] Given that one can produce about 1.3 kg of bakery products from 1 kg of wheat flour, the 700 g of flour could be processed into about 900 g of rolls. Rolls in their simplest form were sold at retail level in Germany in November 2017 for 0.45 euro per piece each weighing 50g. Hence, one can produce about 18 rolls from the 700 g of wheat flour. The 18 rolls which can be produced from the 1 kg of wheat flour have a total value of 8 euros at retail level. The price of one roll, and thus for this quantity of rolls, for taking breakfast in a restaurant would even be higher and could easily reach the double of the supermarket price level or more. Assuming that one breakfast in a restaurant consists of 3 rolls, the 14 rolls produced from 1 kg of wheat could be used for serving 5 customers. If one breakfast costs 8 euros, the five breakfasts serving the 14 rolls would together have a price of 40 euros of which the farmer receives 0.16 euro for 1 kg of wheat needed for the production of the 14 rolls.

[18] There are also to some extent direct marketing relations between farmers and consumers (direct farm marketing), farmers and retailers (for example retails traders on open weekly markets) or between farmers and food services (for example high-price restaurants specialised on regional or speciality food) for a number of food products and national contexts. Since these channels are both in value as well as in quantity terms of negligible size, they are not considered in Figure 35.

[19] Bakeries will pay less for the same quantity because they do not buy the flour needed from retailers, but directly from mills of wholesale, however, not mill or wholesale wheat flour selling prices were available to the authors.

Figure 35: Elements of food supply chains



Source: Authors of this study.
Note: The graph does not explicitly account for taxes on sales, turnover or value added. These taxes are assumed to be one part of $p_{out}^{\bullet}$. In Chapter 2, distribution costs ***dc₀***, ***dc₁*** etc. are not distinguished, but summarised with the symbol $p_{out}^{distribution}$. The graph assumes on the abscissa that the time intervals the raw product needs for 'traveling' through the supply chain levels while being transformed are identical (as indicated by the equal-sized dark grey and light grey bars below the abscissa/time axis). However, in reality this temporal structure might be very irregular and will highly depend on the product considered.

The ordinate at the right-hand side illustrates that the value added contained in the food product offer to the consumer increases the more, the longer the chain is for a given good, that is, the more complex the processing is, which transforms the food commodity from its raw form created by agriculture to the final form offered to the consumer, and the more trade, transport and storage is involved in this process. That is, the value (and thus the price) of one unit of the raw product created by agriculture increases with each step of the food supply chain as more and more additional inputs are added which are needed to reach at the final product version offered to the consumer. This also means that the value share of the agricultural raw product decreases with the length of the chain, its contribution to the added value of the commodity gets 'diluted' the more value is added to the commodity from other production factors.

The quantity of (more or less processed) food goods corresponding to/produced from one unit of an agricultural raw product has a different price/value at the beginning and the end of each level of its food chain which it passes through before being finally offered to consumers. The farmer receives for this unit of the raw product – say 1t of wheat grain – the price p_{out}^{farm} which is highlighted in bold script in Figure 35. For producing this quantity, the farmer needs to purchase a certain quantity and number of production inputs for which she pays p_{in}^{farm}[20]. The input industries sell this quantity of inputs for the price p_{out}^{input}, which is slightly lower than p_{in}^{farm} because some distribution costs ***dc₀*** incur as shown at the ordinate at the right-hand side for

[20] This price p_{in}^{farm} is the total price of the exact quantities of inputs the farmer needs to produce exactly one unit of the agricultural product.

transporting, storing and trading these inputs (within as well across countries) until they reach the farmer. The input industries themselves need to purchase certain production factors at the total price p_{in}^{input}. The difference between the input price p_{in}^{input} and the output price p_{out}^{input} of the input industries is a price spread which corresponds to the value added to the production factors purchased by the input industries so that the output produced by them can serve as production factors (inputs) for the farmer to produce one unit of the agricultural raw product, that is,

$$p_{out}^{input} = p_{in}^{input} + value\ added\ by\ the\ input\ industries \quad (1)$$

and

$$p_{in}^{farm} = p_{out}^{input} + dc. \quad (2)$$

By combining the purchased production factors as well as the production factor the farmer owns, she again creates added value in the form of her production output which is the agricultural raw product sold for p_{out}^{farm} per unit. This output of this raw product is then collected with the outputs of other farmers and transported to the processing industry for which again distribution costs ***dc₁*** incur, that is,

$$p_{out}^{farm} = p_{in}^{farm} + value\ added\ by\ the\ farmer \quad (3)$$

and

$$p_{in}^{processing} = p_{out}^{farm} + dc_1. \quad (4)$$

This principle repeats itself until a level of the food supply chain is reached at which the good is offered to the consumer. As the consumers purchase most of their food at retail level, the price p_{out}^{retail} consumer are faced with, is most crucial to them and therefore also highlighted at the right-hand side. If consumers purchase the final good which is made based on the agricultural raw product from some food service, then the consumer needs to pay $p_{out}^{food\ services}$.

As the output price of a constant quantity of agricultural raw products and the corresponding quantities of processed goods at each level of the supply chain depends on the input price and the value added at this level, the retail price p_{out}^{retail} as well as $p_{out}^{food\ services}$ can be expressed as a function of the price p_{out}^{farm} the farmer receives, the distribution costs between all chain levels l connecting the retailer and the farmer and the values added at each of them in the following way (we only consider the retail price in the following, but corresponding statements can be made for the output price of food services):

$$p_{out}^{retail} = p_{in}^{retail} + value\ added\ by\ the\ retailer(p_{out}^{wholesale} + dc_3) + value\ added\ by\ the\ retailer = \cdots$$

$$p_{out}^{retail} = p_{out}^{farm} + \sum_{i=1}^{3} dc_i \quad _1 + \sum_{l=\{processor,wholesaler,retailer\}} value\ added\ by\ l. \quad (5)$$

Therefore the spread s^{r-farm} between the retail price and the farm gate price can be expressed as:

$$s^{r-farm} = p_{out}^{retail} - p_{out}^{farm} = \sum_{i=1}^{3} dc_i \quad _1 + \sum_{l=\{processor,wholesaler,retailer\}} value\ added\ by\ l. \quad (6)$$

This retail-farm gate price spread is also highlighted at the right-hand side of Figure 35. It can either be expressed as the price difference $p_{out}^{retail} - p_{out}^{farm}$ measuring the difference between both prices in monetary terms or some form of the price ratio $\frac{p_{out}^{retail}}{p_{out}^{farm}}$ measuring the difference between both prices in percentages[21]. Except of this spread,

[21] Some authors name this quantity also 'margin'. However, we prefer the term 'price spread' because 'margin' can be confused with profit margins.

one can calculate a number of spreads between other prices at various stages of the food supply chain. For example, the spread s_1^p in Figure 35 measures the distance between the purchase price of the retail level p_{in}^{retail} and the output price of the processing level $p_{out}^{processing}$. Moreover, one could be interested in other price spreads within the potentially multiple processing sub-stages within the processing level such as s_2^p or s_3^p shown in Figure 35. The value added at each level of the supply chain of a given food commodity consists of costs c incurring for using a certain number and quantity of production factors in the processing operations, but also profits p the entrepreneur expects to see in return for the investments made, that is, the return on investment. Hence, at each level l of the supply chain, that is,
$l \in$
$\{input\ industry, agricultural\ production, processing\ and\ packaging, wholesale, retailing, food\ services\}$
holds that

$$p_{out}^{l} - p_{in}^{l} = value\ added^{l} = c^{l} + p^{l}. \quad (7)$$

In other words, the price spread $p_{out}^{l} - p_{in}^{l}$ between the output and the input prices at level l of the supply chain is determined by the value added at this level. This value added splits into costs and profits. Plugging equation (7) into equation (5) leads to the insight that

$$p_{out}^{retail} = p_{out}^{farm} + \sum_{i=1}^{3} dc_i \; + \sum_{l=\{processor, wholesaler, retailer\}} value\ added\ by\ l\ =$$
$$= p_{out}^{farm} + \sum_{i=1}^{3} dc_i \; + \sum_{l=\{processor, wholesaler, retailer\}} c^{l} + p^{l}\,. \quad (8)$$

This shows that the retail price p_{out}^{retail} is a nested function of the farm gate price p_{out}^{farm} and costs for distribution dc_i and processing c^l incurring between and within all supply chain levels connecting the farmer and the consumer as well as the profits p^l realised at each level. Depending on the state of economic competition within each level and at the transitions between the levels, an economic actor at level l of a given food supply chain may possess market power for moving its output price p_{out}^{l} or its input price p_{in}^{l} in the interest of increasing its profits p^l or for covering (temporally) raised processing costs c^l to non-competitive levels. That is, an actor might succeed to push up its output price holding its input prices constant, to push down its input price holding the output price stable or to push both prices simultaneously in opposing directions. This would imply that the actors of chain level immediately prior to this actor (that is, being located to the left of this actor in Figure 35 are subject to a reduced output price. Similarly, the actors succeeding this actor in the chain (that is, being located to the right of this actor in Figure 35) would be faced with a higher price to be spent for its inputs. In either case the actor able exerting market power would increase its price spread at the expense of preceding and/or succeeding levels.
Equation (8) does not imply causality, but holds also in the opposite direction, that is, the farm gate price can also be expressed as a function of the retail price minus the transport costs and values added at each supply chain level in between. The difference between the retail price p_{out}^{retail} and the farm gate price p_{out}^{farm} is sometimes in the agricultural economics literature referred to as *marketing margin* between both prices (see, e.g., Drummond and Goodwin, 2011, p. 256) being identical to the spread s^{r-farm} between the retail price and the farm gate price. That is, equation (8) can also be rewritten as:

$$p_{out}^{farm} = p_{out}^{retail} - marketing\ margin^{r-farm} = p_{out}^{retail} - s^{r-farm}. \quad (9)$$

The causality of the mutual impact between the two prices or the simultaneity of it as expressed in equation (9) are crucial questions in empirical research.

A critical appraisal of Figure 35 in relation to reality

For the sake of parsimony, readability and intelligibility, Figure 35 is a simplified version of reality in several ways. However, it is useful for highlighting a number of concepts crucial for this report. First, the time axis with its distinctions in production process period and transportation periods is only schematic without correspondence to real processing and transporting times due to missing empirical evidence. Second, the various prices are assumed to be stable in time. Prices at any chain level are unlikely to be exactly stable in a market economy context – that is, when price formation is not interfered by policy, but completely left to the market forces in a competitive framework - during longer periods of, for example, several weeks. Prices as well as the elements of the price spread s^{r-farm} are usually subject to permanent shocks (see, for example, Ihle, 2010; Ihle et al., 2012; Busse et al., 2012; Würriehausen et al., 2014) caused by either demand or supply shocks or a combination of both yielding a larger or smaller extent of 'wiggliness' of the development of a price in time. Demand and supply chare determined at differing levels of the chain and then passed through it either until it reaches the level faced by the consumer or the level of the farm. For food supply chains holds that the demand for the final (processed) food commodity is determined at the consumer level, that is, mostly at retail level. Being determined by consumers it is then passed on along the levels of the specific supply chain at hand to farmers and therefore called *derived demand at farm level*. For food supply, the opposite holds as the production of the raw commodities takes place at farm level so that *supply at retail level is derived* from it.

For parsimony, prices have been assumed to be constant in Figure 35. This assumption seems reasonable if these constant prices are interpreted as (detrended and deseasonalised) averages of the observed wiggly prices. Depending on the length of the period used for calculating such price average, this approach can be an insightful perspective also for the purpose of this report. Third, as already mentioned above, each supply chain level can consist of various subsequent steps of processing which are all again potentially connected by transportation, trade and/or storage. They have been summarised into one supply chain level. Fourth, physical flows of (processed) agricultural goods between supply chain levels of minor importance have been omitted for the graph.

The public policy perspective

From a public policy perspective, a political decision maker might be interested in several aspects of the above-mentioned quantities and the comparison between two or more of them. For example, a policy maker might ask the following policy questions:

1. How large are input and output prices at various supply chain levels?
2. How large are price spreads at various supply chain levels?
3. How large are processing costs and profits at various supply chain levels?
4. How do profits at one level relate to profits at other levels?
5. (At which levels) Is there evidence for non-competitive supply chain structures?
6. How large are distribution costs at various supply chain levels?
7. Which supply chain actors profit most? Which are under most economic pressure?
8. How did the quantities of policy questions 1 to 6 develop during the past years?
9. How are they likely to develop during the coming years?

Policy makers may be interested in the absolute sizes of various quantities illustrated in Figure 35 and equations (1) to (9). Moreover, they may be interested in

proportional sizes of one quantity across various levels of a given supply chain as well as the temporal stability or the temporal development of some of these quantities.

AI.2 Methodology of Section 2.2

AI.2a Selection of national approaches reviewed in detail

The goal of Section 2.2 is the systematic and comprehensive qualitative analysis of a selected spectrum of existing FPMM approaches implemented by a number of EU MS, the EU and the US. The primary goal is highlighting the diversity and variation of currently implemented approaches independently of the geographic location of the country implementing them. Based on the inventory presented in Section 2.1, we in depth review selected FPMM approaches of the following FPMM countries and institutions:

- France and Spain
    - Justification: both countries have very comprehensive FPMM approaches developed that in detail analyse all levels of food supply chains and monitor besides prices also types of costs and profits along the stages of food supply chains
- Belgium, Bulgaria, Lithuania and the Netherlands
    - Justification: moderately comprehensive FPMM approach in place at some levels of food supply chains, mostly focused on prices only
- Economic Research Service of USDA
    - Justification: comprehensive and long-lasting monitoring and analyses of food prices and margins implemented
- Various FPMM approaches of the EU:
    - Eurostat's food price monitoring tool
    - Milk, Meat, Sugar and Cereals Market Observatories (European Commission, 2017i)
    - Dashboards (European Commission, 2017j)
    - Justification: comparing and highlighting selected currently implemented approaches at EU level

The analytical assessment is carried out using an identical set of evaluation criteria in form of a detailed rubric creating information which is comparable between the FPMM approaches analysed and enables a transparent and structured assessment.

Such a detailed analysis of specific FPMM approaches which aims at comparability faces two central challenges. The first challenge is to clearly define what exactly is an FPMM approach. Is it a method analysing a certain (set of) quantities of interest, such as, prices, price spreads or costs and profits at a certain level of food supply chains? Is it a certain output publication? Or is it all monitoring output publications of a given price and margin observatory? The second challenge is the enormous number of very heterogeneous practical implementations of FPMM.

Each definition of an FPMM approach has certain advantages as well as disadvantages. An FPMM approach can be defined either input-based or output-based. Input-based refers to a definition on the basis of the kind and the number of prices or other variables of interest being monitored in the context of the food supply chain(s) of interest. For example, all approaches that focus on monitoring only the farm gate price could be considered one FPMM approach. Alternatively, all approaches monitoring not only prices but also price spreads could be considered as another FPMM

approach. Such a definition has the advantage that it allows comparing the complexity of various approaches. However, it suffers from the challenge that the currently implemented monitoring initiatives use a given quantity of interest, e.g., the farm gate price, for producing more than one monitoring output, e.g., different kinds of reports or published analyses, each of which is based on a different methodological background. The analysis of central characteristics of FPMM approaches defined in this way would therefore lead a confusing number of approaches which might partly overlap in the quantities of interest they consider.

We therefore discard this perspective and apply an output-based definition. In particular, we define an FPMM approach as a single FPMM output publication produced by an FPMM initiative analysing a certain set of raw data by using a certain (set of) method(s). Such a single output publication of (a collection of) FPMM results regularly published in a fixed format can, thus, take various forms. Such an output publication can be a file of a fixed structure regularly published online in PDF, MS Excel or any other format. Such an output publication also can be a website which is successively updated with, say, on an annual basis. It can also be a regularly sent newsletter or magazine published or take other forms. This definition has the advantage that it is able to summarise the high number of quantities of interest as well as of methodological backgrounds used by currently implemented FPMM initiatives for producing a certain 'type' of output publication into a single unit of analysis and not only considers the particular statistical analysis applied, but also the way of communicating them in forms of illustrations etc.. This definition has the disadvantage that it aggregates a potentially large set of 'ingredients' (quantities of interest and methodological backgrounds) into a single product. However, it seems most appropriate for the analysis aimed at in this chapter.

To define all sorts of FPMM output publications produced by a certain FPMM initiative or even by a certain country as one FPMM approach is not helpful because single FPMM initiative often produce more than one type of output publication and one country may have more than one FPMM initiative (see the MS Excel table accompanying Section 2.1 for details). Thus, such a definition could have the advantage that it might enable to characterise 'national' FPMM approach. However, it suffers from the fact that for most FPMM countries and institutions evaluated in Chapter 2.1, there is no single output publication existing. In contrast, often a very heterogeneous set of various output publications based on often very differing methodological backgrounds is existing for a single country. Choosing this level for analysis is not appropriate because it would imply to conduct a comparative analysis between the various approaches at national level.

We define an FPMM approach as a single FPMM output publication produced by an FPMM initiative analysing a certain set of raw data by using a certain (set of) method(s). However, one initiative may implement more than one FPMM approach and in one country there might more than one public FPMM initiative except of the national statistics authority exist. The analysis of Section 2.1 confirmed that there are frequently more than one initiative existing in one country/at an international institution: for example, in Bulgaria four initiatives exist and at EU level five. Furthermore, Table 56 and Table 60 confirm that one FPMM initiative often uses more than one FPMM approach as defined in this study.

Table 56 shows all FPMM approaches of selected initiatives currently implemented by the selected EU MS, the US and at EU level as well as it indicates the FPMM approach that are analysed in detail in Section 2.2. Table 56 indicates that Belgium, France, Netherlands and Spain possess one FPMM initiative each which is a food price observatory explicitly established by each of these FPMM countries and institutions.

Bulgaria, the EU, Lithuania and the United States possess more than one initiative; none of the initiatives of these countries and institutions is an explicit food price observatory. These eight FPMM countries and institutions host in total 17 public FPMM initiatives which publish in total 43 FPMM approaches (Table 60). Of these 43 FPMM approaches we select 17 approaches to be analysed in detail in Section 2.2.

Table 59 gives an overview of all FPMM approaches of all entities covered for the analysis in Section 2.2. It reports the names of the entity (country or instition), mentions all existing FPMM initiatives operated by each of these entities as well as all the names of existing FPMM approaches of each of these entities in national and in English language. It furthermore points out which of these approaches have been chosen to be analyzes in detail Section 2.2 as well as their codes used in this analysis as well as in the FMPPA factsheets.

For the sake of clarity we emphasise the hierarchy of these terms and the relationships between them as used in the analysis of Chapter 2 also becoming visible in Table 59 (see also the glossary for the exact defintions of these terms):

1. An FPMM entity is either a country or an international institution (e.g. EU, World Bank etc.).
2. One entity may be operating one or more FPMM initiatives. For example, in Belgium two initiatives are existing: Belgian Price Observatory and the SPF Economy.
3. An FPMM initiative is defined as 'A specific institution or website/information offer in the internet provided by a country or an FPMM institution for the purpose of sharing FPMMI with the public. One country or institution may run more than one FPMM initiative. National statistical authorities are not considered to be a FPMM initiative in the scope of that analysis as each of them collects to some extent FPMMI for the purpose of the calculation of the national Consumer Price Index (CPI).'
4. One initiative may be implementing one or more FPMM approaches (FPMMA). For example, the Belgian Price Observatory currently implements the three approaches: annual and quarterly reports, market functioning and ad-hoc studies.
5. An FPMMA is defined as 'a single FPMM output publication produced by an FPMM initiative analysing a certain set of raw data by using a certain (set of) method(s).'

Table 59: Overview of all FPMM approaches selected for detailed analysis

Entity	Existing FPMM initiative	Existing FPMMA (in English)	Existing FPMMA (in national language)	Analysed in detail	Code
Belgium	Belgian Price Observatory	Annual and quarterly reports + focus in reports e.g. for butter, excise duties on alcoholic drinks and tobacco, beer chain, price transmission in food chain	Jaar- en kwartaalverslagen/Rapports annuels et trimestriels	X	BE1
		Market functioning	Marktwerking/Fonctionnement du marché	X	BE2
		Ad-hoc studies	Punctuele studies/Rapports ponctuels e.g. Beef meat chain, pork meat chain, sugar chain, dairy chain		
	SPF Economy	Indices on the evolution of profitability for beef meat producers and pork meat producers	Vereenvoudigde ratio van het rundvlees/Ratio simplifié de la viande bovine Varkensindex/Indice de la viande porcine		
Bulgaria	System for Agro-market information (SAPI)	Weekly retail price bulletin	СЕДМИЧЕН ИНФОРМАЦИОНЕН БЮЛЕТИ	X	BG1
		Annual consumer Easter basket cost	Великденска Кошница	X	BG2
	Ministry of Agriculture and Food	Weekly price analyses for basic food products (wholesale & retail)	Седмични ценови анализи за основни хранителни продукти		
	State Commission on Commodity Exchanges and Wholesale Markets (DKSBT)	Annual analysis of market price index	ДВИЖЕНИЕ НА ИНДЕКСА НА ТЪРЖИЩНИТЕ ЦЕНИ		
		Annual bulletin of wholesale price movements	Годишен бюлетин за движението на цените на едро		
		Information System of DKSBT (no free access)	Информационна система на ДКСБТ		
		Monthly and weekly bulletin of wholesale prices of basic food, fruit and vegetables, sold at commodity markets in Bulgaria	Седмични/месечен бюлетини		
	Center for Agri-Policy Analysis (CAPA)	Monthly bulletin	БЮЛЕТИН - Център за икономически изследвания в селското стопанство (CAPA)		

Entity	Existing FPMM initiative	Existing FPMMA (in English)	Existing FPMMA (in national language)	Analysed in detail	Code
EU	Food Price Monitoring Tool (FPMT)	FPMT Price trends along the food supply chain		X	EU1
		FPMT Price transmission along the food supply chain		X	EU2
	Market observatories[a]	Agricultural markets dashboards		X	EU3
		Further price reporting of the EU Milk Market Observatory		X	EU4
		EU Meat Market Observatory			
		EU Sugar Market Observatory			
		EU Crops Market Observatory			
	EU Agricultural Markets and Prices	Commodity price dashboard			
		EU prices for selected representative products			
	DG Agri data portal	Current and historical market price data provided by EU member states			
	Ad-hoc studies for/by EU institutions[b]	Various formats, e.g., European Commission (2017m) or Ihle et al. (2017)			
France	French observatory on prices and margins formation of food products	Retail price decomposition	Décomposition des prix au détail		
		Macroeconomic decomposition of food expenditure	Décompositions macroéconomiques de la dépense alimentaire	X	FR1
		Cost analysis in the agricultural, industrial and trade sectors	L'analyse des coûts dans les secteurs agricoles, industriels alimentaires et du commerce	X	FR2

Entity	Existing FPMM initiative	Existing FPMMA (in English)	Existing FPMMA (in national language)	Analysed in detail	Code
Lithuania	Lithuanian agricultural and food price monitoring	Prices of agricultural and food products	Maisto produktu kainos	X	LT1
	Lithuanian Agricultural and Food Products Market Information System (LŽŪMPRIS)c	Sector reviews and statistical information	Sektoriaus apžvalgos	X	LT2
		Semi-monthly publication Agro Market	Dvisavaitinis oficialusis informacinis statistinis leidinys-Agro RINKA		
		Semi-annual publication Lithuanian agriculture: facts and figures	Pusmečio statistinis leidinys 'Lietuvos žemės ūkis: faktai ir skaičiai'		
	Lithuanian Institute of Agrarian Economics	Agricultural and food price chains	Žemės ūkio ir maisto prodūktų kainų grandinė		
		Agriculture and food sector in Lithuania	Lietuvos žemės ir maisto ūkis		
Netherlands	Wageningen Economic Research (WEcR)	Agro & food portal	Voedselprijzenmonitor (Agrimatie)	X	NL
Spain	Spanish Food Price Observatory	Weekly prices farm gate - retail	Precios semanales origen – destino		
		Value chain analyses of fresh products	Cadenas de valor productos frescos	X	ES1
		Value chain analyses of oil, garlic, bread and milk	Cadenas de valor - aceite, ajo, pan y leche	X	ES2
United States	USDA Economic Research Service (ERS)	Food Price Outlook			
		Food Dollar Series		X	US1
		Food Expenditures			
		Price Spreads from Farm to Consumer		X	US2
		Quarterly Food-at-Home Price Database			
		Consumer and Producer Price Indexes			
	USDA National Agricultural Statistics Service (NASS)	Agricultural Prices			
		Agricultural Prices Summary			
		Prices Received by Farmers for Field Crops			
		Prices Received by Farmers, Historic Prices and Indexes			

Source: Authors of this study.
Notes:

[a] The various EU market observatories are to be considered separate FPMMA because their FPMM differs structurally in the sense of the definition of FPMMA used here.
[b] Price and margin monitoring is to a larger or smaller extent often a part of evaluation studies of the CAP or sectorial market analyses of the CAP.
[c] LZUMPRIS (Lietuvos žemės ūkio ir maisto produktų rinkos informacinė sistema) collects the data for the maisto produktu kainos. The sector reviews are based on the same data.

Each of countries and institutions mentioned in Table 56 typically[22] hosts between one and two initiatives (the median is 1.5). The highest number of initiatives among the selected countries and institutions is hosted by the EU (five initiatives). Each FPMM initiative publishes typically[22] two FPMMA. By each of these eight FPMM countries and institutions there are typically three FPMMA published. Some countries and institutions such as the EU or the United States implemented and publish more than 10 FPMMA while in the Netherlands only one is published.

Table 60: Numbers of FPMM approaches implemented by selected FPMM countries and institutions

Entity	Number of FPMM initiatives currently existing	Number of FPMMA currently implemented	Number of FPMMA analysed in detail
Belgium	1	3	2
Bulgaria	4	8	2
EU	5	11	4
France	1	3	2
Lithuania	2	3	2
Netherlands	1	1	1
Spain	1	3	2
United States	2	11	2
Sum	**17**	**43**	**17**

Source: Authors of this study.

AI.2b Methodology of the detailed characterisation of selected FPMMA

As the detailed qualitative analysis of each of these FPMMA aims at creating comparable information, we use the evaluation scheme outlined in Table 61. In total, we evaluate 37 characteristics of each FPMMA selected which are cover various aspects of the following six evaluation categories. Note that these evaluation categories differ from the ones used in Section 2.1 Inventory of existing FPMM initiatives because the analysis of this chapter is qualitative while the one of Section 2.1 Inventory of existing FPMM initiatives was quantitative based on counts.

- Institutional context: 6 characteristics evaluating the institutional background of the FPMMA
- Monitoring focus: 5 characteristics evaluating the precise focus of the FPMMA
- Data inputs: 4 characteristics summarising the types of data used as basis for the monitoring
- Monitoring results: 11 characteristics summarising the types of published monitoring results
- Results communication: 4 characteristics evaluating the form & extent of results communication

[22] The typical number of FPMMI and FPMMA per country is measured by the median.

- Robustness assessment: 7 characteristics evaluating various characteristics concerning the comprehensiveness, quality and applicability of the FPMMA in alternative contexts

Each of the characteristics mentioned in Table 61 is qualitatively assessed using this single evaluation scheme. This enables the direct comparison between specific characteristics or groups of characteristics of the FPMMAs evaluated. The evaluation of several crucial characteristics of these FPMMA are given in the form of justified expert ratings by the authors.

Table 61: Evaluation scheme for the qualitative in-depth analysis

	Characteristic	Explanation of evaluation characteristic
	Name of approach in English (code)	Abbreviation of the approach name which is used in Section 2.2 for the comparative analysis of the 17 FPMMA factsheets
Institutional context		
	Name of approach in nat. language & link	Name of approach in national language (if not English) Link to the website on which the outputs of the FPMMA are published
	Purpose/description	What is the intended output? Who is the target audience? brief explanation of content of the approach, if not mentioned: inferred from published information
	Name of the FPMM initiative	Which FPMM institution carries out and publishes the research?
	Output form(at)s	Which technical output formats are used? Examples: separate pdf files, continuously updated websites, continuously updated excel tables etc.
	Output frequency	How often is the output published?
	Duration of publication	How long has the FPMMA been published?
Monitoring focus		
	Commodities/sectors	Which commodities, commodity groups or sectors are monitored? Examples: Are only raw food products monitored? Or also processed products?
	Supply chain levels monitored	Which supply chain levels are monitored (level names as in Figure 35)? Examples: Agricultural production, retailing etc.
	Data frequencies	Which data frequencies are presented in the output? Examples: annual, quarterly, monthly, weekly, daily etc.
	Spatial disaggregation	Takes the monitoring place at sub-national administrative levels? If yes, at which? Examples: provinces, major cities etc.
	Conducive to purpose	**Justified expert rating** (fully – partly – barely): Does the monitoring focus correspond to the stated purpose?
Data inputs		
	Qualitative data used	Which types of qualitative data is the FPMMA based upon? Examples: survey data or case studied of supply chain structures, descriptions of product transformation at each chain level etc.
	Quantitative data used	Which types of quantitative data is the FPMMA based upon? Examples: cross-section price data, time series price data (we define a time series of longitudinal a regularly spaced observations of the same quantity having at least 6 observations), What kinds of data other than prices are used?
	Information sources	Is the data gathered by the FPMM institution (primary) or taken from somewhere else (secondary)? If yes, from where is it taken from? Examples: interviews, surveys, stakeholder discussion, national statistical offices etc.
	Data transparency	Are the raw data and numerical outputs made completely publicly available? Is all raw data published or only selected parts of it? Can the complete raw data be directly downloaded free of charge? If secondary data: Are the data sources explicitly specified so that they can be found again? Note: 'raw data' is understood here as, e.g., the average price reported for a given commodity (group), country/region and time (even if this may have been computed based on a number of regionally and temporally more disaggregated price observations)

	Characteristic	Explanation of evaluation characteristic
Monitoring results		
	Types of quantitative results	Which types of quantitative results does the FPMMA publish? Examples: nominal or real data, cross-section data, cumulatively updated time series etc.
	Types of qualitative results	Which types of qualitative results does the FPMMA publish? Examples: commented quantitative analyses, interpretation helps for non-specialists for better understanding numerical and graphical results
	Prices monitored	Which prices/price levels along food supply chains being monitored (explicit mentioning of exact prices as in Figure 35)? Examples: p_{out}^{farm}, $p_{out}^{processing}$, p_{out}^{retail}, etc.
	Further quantities monitored	What quantities of food supply chains other than prices are being monitored? Examples: Price spreads – between which prices? Costs – of which supply chain activities? Profits – of which supply chain activities? etc.
	Indicators published	Which indicators are calculated and published? Examples: indices, rate of change in comparison with previous month, rate of change in comparison with same month of previous year, maximum price ranges, etc. Note: An indicator is defined as any calculation based on observed prices or other quantities which goes beyond the mere reporting of these prices/quantities.
	Reproducibility of approach	Are the calculations transparently explained on the website? Is the terminology explicitly & exactly explained/defined, that is, is the meaning of the published information exactly defined? Is the raw data available?
	Calculation methods used	What is the formula(s) used for calculating each of the indicators published? Legend: ○ q_i quantity of commodity i ○ p_i^r price of commodity i at retail level per unit ○ i index for the commodities considered in the calculation ○ p_w^r price of commodity i at retail level per unit in week w
	Form(at)s of numerical results	What formats have the numerical results published? Examples: cross-section tables, time series tables, etc.
	Form(at)s of graphical results	What formats have the graphical results published? Examples: bar charts, time series charts, (detailed) supply chain structure diagrams, etc.
	Form(at)s of commented results	What forms/formats do the commented quantitative and qualitative analyses of supply chain structures and numerical results have? Examples: explanations of transformation processes per supply chain level, summarising interpretations, etc.
	Intelligibility of results	**Justified expert rating** (low – moderate - high): How insightful and intelligible are the results given the monitoring purpose?

	Characteristic	Explanation of evaluation characteristic
Results communication		
	User costs	Can users access the results free of charge or are fees required?
	Time lag	How much times passes approximately between the data gathering and the results publishing?
	Intuitiveness of presentation	**Justified expert rating** (low – moderate - high): How intuitively understandable are the presentations/graphics of results? (graphical summaries, explanatory texts, extent and informativeness of infographics, online resources etc.)?
	Knowledge transfer efforts	**Justified expert rating** (low – moderate - high): What extent of knowledge transfer efforts is made by the FPMMA? (quality and appropriateness of the visualisation and illustration of results, clarity and explicitness of insights and conclusions or the usefulness for non-specialist readers)
Robustness assessment		
	Effort	**Justified expert rating** (low – moderate - high): What effort needs to be invested for implementing the FPMMA?
	Applicability	**Justified expert rating** (low – moderate - high): To what extent is the FPMMA applicable to other sectors and periods?
	Reliability	**Justified expert rating** (low – moderate - high): Does the approach produce reliable (and complete) results? (amount, completeness & quality requirements of data, representativeness of data sources & extent of data gathering)
	Validity	**Justified expert rating** (low – moderate - high): Does the approach constitute a valid measurement of what it intends to measure?
	Flexibility	**Justified expert rating** (low – moderate - high): To what extent is the FPMMA flexible for application at EU or MS level? (topical focus, reaction time/time lags of data gathering and results publication – last visible output on website)
	Largest advantages	The three largest advantages of this FPMMA listed in decreasing importance.
	Largest disadvantages	The three largest disadvantages of this FPMMA listed in decreasing importance.
Comments		
		Further comments regarding external documents on the details of the FPMMA

Source: Authors of this study.

AI.3 Methodology of Section 2.3

Table 62 transparently describes the steps taken and the decision rules implemented in order to construct the typology contained in Table 20. As this systematic and reproducible typology is the result of the analysis process outlined in Table 62, it form depends on the following crucial aspects:

- What information is contained in the FPMM approach factsheets?
    - Which characteristics are assessed? (example: Is the quality of monitoring results assessed in detail? Which aspects will be considered for that? Will the reproducibility of approach be considered for that or not?)
    - How is each of them assessed? (example: is an unstructured qualitative assessment used or rubrics or justified expert ratings?)
- What process and decision rules are chosen to construct the typology?
    - How many typology criteria are selected from those contained in the factsheets to explicitly define the typology? (example: should it be 3 or 8 or 15 criteria?)
    - Which typology criteria are selected from those to explicitly define the typology? (example: should the assessment of the indicators published by the approach be considered to be a crucial characteristic for defining the typology?)
    - Which sub-classifications for each of those criteria are created? (example: Should the justified expert rating consider the categories low vs. moderate vs. high or only low vs. high or more than three?)
    - Which optimal types of each of these typology criteria are defined? (example: what is the optimal time lag of FPMM? Is it less than 6 months or less than a month or is it in-between one and two years?)
    - Which approach is chosen to construct the typology? (example: should the procedure outlined in Table 62 be used or some other procedure?)
    - Which decision rules are to be considered to construct the typology? (example: should the decision rules outlined in Table 62 be used or some others?)

Table 62: Methodology for constructing the FPMMA typology

Step	Sub step	Description
I Data gathering		
	Ia FPMMA factsheets	Each FPMMA is assessed in detail using 37 characteristics distributed over 6 evaluation categories (see Table 61: Evaluation scheme for the qualitative in-depth analysis) for an overview of the characteristics and the evaluation scheme, the resulting factsheets are located in Annex II: Food Price and Margin Monitoring Factsheets)
	Ib Factsheet analysis	Comparative analysis exclusively based upon the information contained in the factsheets located in Annex II: Food Price and Margin Monitoring Factsheets. This analysis summarising, structuring and classifying the factsheet information is contained in Section 2.2 Detailed characterisation of selected approaches.
II Creation of one sub-typology for each of the individual typology criteria		
	IIa Selection of typology criteria	Selection of eight equally weighted criteria (specified in Table 19) reflecting the five categories Institutional context, Monitoring focus, Data inputs, Monitoring results and Results communication (except category 'robustness assessment') which are used for constructing the typology based on the outcomes of step Ib. Hence, these typology criteria are a subset of the 37 characteristics of step I which the authors of this report deemed to be most important and most relevant for the multidimensional comparison of existing monitoring approaches. The characteristics 'largest advantages' and 'largest disadvantages' of the category 'robustness assessment' of all approaches belonging to each class are pooled after the establishment of the typology in step IIIb in order to deduce typical advantages and disadvantages of all FPMMA belonging to each class.
	IIb Creation of sub-typologies	For each criterion of IIa, a sub-typology consisting of 2 to 3 types is created (see Section 2.2 Detailed characterisation of selected approaches). The information on each criterion of IIa for all 17 FPMMA (contained in factsheets) is classified according to each sub-typology. One of the available types of each criterion is selected as the 'optimal type' based on the insights from the comparative analysis. It is likely that for each of the 8 criteria a different subset of the 17 FPMMA will belong to its 'optimal type'.
III Creation of final FPMMA typology		
	IIIa Combination of sub-typologies	For each of the 17 FPMMA it is indicated in Table 66 for which of the 8 criteria the FPMMA belongs to the optimal type.
	IIIb Categorisation of the 17 FPMMA into 4 typology classes	For each of the 17 FPMMA, it is counted how many times each belongs to the optimal type of all 8 criteria. The 17 FPMMA are then grouped into • Class 1 if they belong at most 1 time to the optimal type, • Class 2 if they belong 2 to 3 times to the optimal type or • Class 3 if they belong at least 4 times to the optimal type. To these three classes, the following class is added: • Class 4 consisting of the optimal FPMMA which belongs to the optimal type of each of the 8 criteria. The typology is contained in Table 20
	IIIc Characterisation of each typology class	Each typology class is characterised in terms of • its methodology using the 8 typology criteria as well as the three largest advantages and disadvantages of all FPMMA belonging to this class (this information can be found at the bottom of all 17 FPMMA factsheets) and • its implementation costs based on the survey

		conducted. Which of the eight criteria belongs to the most outstanding characteristics of a class is decided based on the rule that at least 50% or the approaches belonging to this class have to be of the optimal type of this criterion (second column of Table 20).

Source: Authors of this study.

In order to ensure utmost transparency of the construction of the typology presented in Table 20, we report in the following tables the results of the intermediate steps taken for constructing the typology as they are outlined in Table 62.

Example interpretation of Table 20

As it is important to understand the content of Table 20 correctly, we here provide an example interpretation. For example consider Class 3 to which the six monitoring approaches EU1, FR1, FR2, NL, ES1 and ES2 belong and which shows six of the eight optimal characteristics.

But Class 3 has no cross in the row 'Time lag < 6 months'. This indicates that at most 2 approaches (i.e., less than half) of the six belonging to Class 3 are optimal with respect to the criterion 'time lag'. This means that more than half of these six approaches have a time lag of at least 6 months. Therefore, the optimal characteristic 'Time lag < 6 months' is not a typical characteristic of Class 3. However, this does not mean that none of the approaches belonging to Class 3 has a time lag < 6 months. Table 69 outlines which of the six approaches satisfies which of the eight criteria. Thus, approaches EU1 and NL have actually a time lag < 6 months. But since the other four approaches belonging to Class 3 have a time lag of at least 6 months, the criterion 'Time lag < 6 months' cannot be considered to be a typical characteristic of Class 3.

Nevertheless, the characteristic 'Time lag < 6 months' is a typical characteristic of Class 2 as indicated by the 'X' because at least 3 of the 5 (i.e. at least 50%) approaches belonging to Class 2 are optimal with respect to this characteristic, that is, they have a time lag of less than half a year. Details are shown in Table 68 which indicates that the approaches EU2, EU4 as well as LT1 (that is, 3 of the 5 approaches belonging to Class 2) have actually a time lag < 6 months. Therefore, the characteristic 'Time lag < 6 months' appears to be an typical characteristic for the approaches belonging to Class 2.

The **justification of the selection of the eight typology criteria** of step IIa is outlined in Table 63. The basic approach was to select at least one criterion from each of the categories 'Institutional context', 'Monitoring focus', 'Data inputs', 'Monitoring results' and 'Results communication'. The category 'Robustness assessment' has not been considered as its criteria are only expert ratings which are intrinsically more subjective than tangible characteristics of the existing monitoring approaches.

Table 63: Justification for selection of typology criteria (result of step IIa of typology construction)

Category	Criterion	Justification for being selected as typology criterion
Institutional context	Output format (Which technical output formats are used?)	This criterion was chosen because it is a key characteristic determining the user-friendliness and the ease of processing of monitoring outputs for the user. Stakeholders/policy makers may wish for a high number of levels monitored.
Monitoring focus	Supply chain levels monitored (Which supply chain levels are monitored?)	This criterion was chosen because it quantifies the extent of the monitoring approach and therefore also its usefulness for users. Stakeholders/policy makers may wish for a high number of levels monitored.
Data inputs	Quantitative data inputs (Which types of quantitative data is the FPMMA based upon?)	This criterion was chosen because it measures the extent and the comprehensiveness of the quantitative (number-based) data the monitoring is based upon.
	Transparency of (raw) data (Are the raw data and numerical outputs made completely publicly available?)	This criterion was chosen because it is a key characteristic determining the transparency of the monitoring and the ease of accessing and processing raw data the monitoring is based upon.
Monitoring results	Quantitative results (Which types of quantitative results does the FPMMA publish?)	This criterion was chosen because it measures the comprehensiveness of monitoring results published, therefore it is a measure of the user-friendliness, intelligibility, intuitiveness of presentation and knowledge transfer efforts made by the monitoring approach.
	Indicators (Which indicators are calculated and published?)	This criterion was chosen because it measures the effort invested into creating easily understandable monitoring results, therefore it is also a measure of the user-friendliness, intelligibility, intuitiveness of presentation and knowledge transfer efforts made by the monitoring approach.
	Formats of graphical & commented results (What formats have the graphical results & commented qualitative analyses published?)	This criterion was chosen because it focuses on measuring the intuitiveness of presentation and knowledge transfer efforts made by the monitoring approach.
Results communication	Time lag (How much times passes approximately between the data gathering and the results publishing?)	This criterion was chosen because it quantifies the timeliness of results communication.

Source: Authors of this study.

In step IIb, one sub-typology for each of the eight criteria selected in step IIa is created based solely on the information contained in the factsheets. These eight sub-typologies are mostly contained as explicit tables accompanied by comprehensive explanations in Section 2.2 Detailed characterisation of selected approaches. Table 64 gives an explicit overview of where each of these 8 sub-typologies is located.

Table 64: Overview of sub-typologies (result of step IIb of typology construction)

Category	Criterion	Located in
Institutional context	Output format	Table 65: Grouping of FPMMA according their output formats
Monitoring focus	Supply chain levels monitored	Table 9: Supply chain levels monitored by FPMM approach
Data inputs	Quantitative data inputs	Table 10: Types of quantitative data used by the FPMM
	Transparency of (raw) data	Table 12: Public availability of raw data
Monitoring results	Quantitative results	Table 13: Types of quantitative results of the FPMMA analysed in detail
	Indicators	Table 15: Indicators published
	Formats of graphical & commented results	Table 17: Approaches grouped by formats of graphical and commented results
Results communication	Time lag	Figure 7: Time lags (months) between data gathering and results communication

Source: Authors of this study.

Table 65: Grouping of FPMMA according their output formats

Format	BE1	BE2	BG1	BG2	EU1	EU2	EU3	EU4	FR1	FR2	LT1	LT2	NL	ES1	ES2	US1	US2
Type 1: pdf format OR inter-active graphs only	X	X	X	X		X	X		X	X		X		X	X		
Type2: (exportable) data files only											X					X	
Type 3: pdf format OR inter-active graphs AND exportable data files					X			X					X				X
Type	1	1	1	1	3	1	1	4	1	1	2	1	3	1	1	2	3

Source: Authors of this study.

Table 66 shows the result of steps IIIa and IIIb of typology construction: which of the 17 FPMMA is optimal with respect to each of the eight typology criteria. The pre-last column 'Column count' counts for each of the 17 FPMM for how many of the 8 criteria it is of the optimal type. Table 62 outlines how the column 'Column count' is mapped into the last and most important column 'Typology class':

- column count 0 or 1, then class = Class 1,
- column count 2 or three, then class = Class 2 and
- column count 4 or more, then class = Class 3.

For example, the monitoring approach FR2 is optimal for 6 of the 8 criteria, while the approach BE1 is optimal only for 1 criterion. All of the 17 approaches are optimal at

least for one of the eight criteria, but none is optimal for all 8 criteria. This column, thus, provides information about which approach is optimal with respect to the criteria defined in Table 19.

The pre-last row 'Row count' counts for each of the eight typology criteria, how many of the 17 approaches fulfil its optimal type defined in Table 19. For example, only 4 approaches are optimal with respect of the criterion 'Output format', while 10 are optimal with respect to the criterion 'Indicators'. This column, thus, provides information about which optimal type of a criterion is more or less widespread among the 17 approaches. The row 'Source' connects each column to the source, this sub-typology is based upon.

Table 66: FPMMA meeting the optimal type of each of the 8 typology criteria (result of steps IIIa and IIIb of typology construction)

	Institutional context	Monitoring focus	Data		Monitoring results			Results communication	Column count	Typology class
FPMMA	Output format	Supply chain levels monitored	Quantitative data	Transparency of (raw) data	Quantitative results	Indicators	Formats of graphical and commented results	Time lag		
BE1								X	1	Class 1
BE2				X		X			2	Class 2
BG1						X			1	Class 1
BG2						X			1	Class 1
EU1	X	X	X					X	4	Class 3
EU2		X				X		X	3	Class 2
EU3								X	1	Class 1
EU4	X							X	2	Class 2
FR1		X	X	X		X	X		5	Class 3
FR2		X	X	X	X	X	X		6	Class 3
LT1		X						X	2	Class 2
LT2		X							1	Class 1
NL	X	X		X				X	4	Class 3
ES1		X			X	X	X		4	Class 3
ES2		X		X	X	X	X		5	Class 3
US1						X			1	Class 1
US2	X					X			2	Class 2
Row count	4	9	3	5	3	10	4	7		
Source	Table 65	Table 9	Table 10	Table 12	Table 13	Table 15	Table 17	Figure 7		

Source: Authors of this study.
Notes: The optimal type of each criterion is explained in Table 19. Table 67 shows only those FPMMA which belong to typology Class 1. Similarly, Table 68 and Table 69 show only the FPMMA belonging to Class 2 and Class 3, respectively. Each of these three tables gives a clear idea of to what extent the approaches belonging to each class are optimal with respect to the eight topology criteria. The approaches belonging to Class 1 are optimal with respect to the eight typology criteria in 6 cases (see the bottom of column 'Column count'). The approaches belonging to Class 2 and Class 3 are optimal in 11 and 28 cases, respectively. That is, the approaches belonging to Class 3 show much more often optimal characteristics than the approaches belonging to Class 1. Therefore, we have chosen the name Level I approaches for the ones of Class 1, Level II for the ones of Class 2 and Level II for the ones of Class 3 in Table 20.

Table 67: Optimal characteristics of FPMMA belonging to typology Class 1 (result of step IIIc of typology construction)

	Institutional context	**Monitoring focus**	**Data**		**Monitoring results**			**Results communication**	**Column count**	**Typology class**
FPMMA	Output format	Supply chain levels monitored	Quantitative data	Transparency of (raw) data	Quantitative results	**Indicators**	Formats of graphical and commented results	Time lag		
BE1								X	1	Class 1
BG1						X			1	Class 1
BG2						X			1	Class 1
EU3								X	1	Class 1
LT2		X							1	Class 1
US1						X			1	Class 1
Row count	0	1	0	0	0	**3**	0	2	6	
Share	0%	17%	0%	0%	0%	**50%**	0%	33%		

Source: Authors of this study.
Note: This table is just a part of Table 66. The column 'Column count' and the row 'Row count' have the same meaning as in Table 66: FPMMA meeting the optimal type of each of the 8 typology criteria (result of steps IIIa and IIIb of typology construction). The row 'Share' shows how many of the FPMMA belonging to this typology class are of the optimal type concerning each of the eight criteria. This row serves based on the rule mentioned in step IIIc to identify the 'most outstanding characteristics' of each class indicated in Table 20 with a 'X' (indicated in the column heading and the last two rows of this table in bold). These 'most outstanding characteristics' are the typical optimal characteristics of this class, at least 50% of the approaches belonging to it possess.

These three tables also indicate which of the eight criteria are the typical characteristics of each class, in the sense that at least half of the approaches belonging to it, are actually of the optimal type of this criterion (indicated in bold in the column head and at the column end). This information needs to be correctly understood. For example, Table 67 shows that the six approaches of class Class 1 have barely optimal in their characteristics as defined in Table 19. Only for the criterion 'Indicators', 3 of the six approaches (at least 50%) are optimal. Class 2 has - based on the same decision rule - two typical characteristics (namely the optimal types of 'Indicators' and 'Time lag' as defined in Table 19), while Class 3 has six typical characteristics.

Table 68: Optimal characteristics of FPMMA belonging to typology Class 2 (result of step IIIc of typology construction)

	Institutional context	**Monitoring focus**	**Data**		**Monitoring results**			**Results communication**	**Column count**	**Typology class**
FPMMA	Output format	Supply chain levels monitored	Quantitative data	Transparency of (raw) data	Quantitative results	**Indicators**	Formats of graphical and commented results	**Time lag**		
BE2				X		X			2	Class 2
EU2		X				X		X	3	Class 2
EU4	X							X	2	Class 2
LT1		X						X	2	Class 2
US2	X					X			2	Class 2
Row count	2	2	0	1	0	**3**	0	**3**	11	
Share	40%	40%	0%	20%	0%	**60%**	0%	**60%**		

Source: Authors of this study.
Note: This table is just a part of Table 66. The column 'Column count' and the row 'Row count' have the same meaning as in Table 66. The row 'Share' shows how many of the FPMMA belonging to this typology class are of the optimal type concerning each of the eight criteria. This row serves based on the rule mentioned in step IIIc to identify the 'most outstanding characteristics' of each class indicated in Table 20 with a 'X' (indicated in the column heading and the last two rows of this table in bold). These 'most outstanding characteristics' are the typical optimal characteristics of this class, at least 50% of the approaches belonging to it possess.

For example, the fact that the approaches of class Class 3 are not typically optimal with respect to the criterion 'Time lag', does not imply that none of the six approaches belonging to that class has a 'short to very short time lag of less than half a year between data gathering and monitoring results publication' (Table 19). The approaches EU1 and NL have actually such a short to very short time lag. However, the remaining four approaches do not fulfil this optimality criterion; therefore, having a short to very short time lag cannot be considered to be a typical characteristic of class Class 3. This rule that at least 50% of the approaches belonging to a class need to be optimal with respect to a given typology criterion in order allows to decide whether this optimal criterion needs to be considered to be a typical characteristics of this class or not.

Table 69: Optimal characteristics of FPMMA belonging to typology class Class 3 (result of step IIIc of typology construction)

	Institutional context	Monitoring focus	Data		Monitoring results			Results communication	Column count	Typology class
FPMMA	Output format	**Supply chain levels monitored**	**Quantitative data**	**Transparency of (raw) data**	**Quantitative results**	**Indicators**	**Formats of graphical and commented results**	Time lag		
EU1	X	X	X					X	4	Class 3
FR1		X	X	X		X	X		5	Class 3
FR2		X	X	X	X	X	X		6	Class 3
NL	X	X		X				X	4	Class 3
ES1		X			X	X	X		4	Class 3
ES2		X		X	X	X	X		5	Class 3
Row count	2	**6**	**3**	**4**	**3**	**4**	**4**	2	28	
Share	33%	**100%**	**50%**	**67%**	**50%**	**67%**	**67%**	33%		

Source: Authors of this study.
Note: This table is just a part of Table 66. The column 'Column count' and the row 'Row count' have the same meaning as in Table 66. The row 'Share' shows how many of the FPMMA belonging to this typology class are of the optimal type concerning each of the eight criteria. This row serves based on the rule mentioned in step IIIc to identify the 'most outstanding characteristics' of each class indicated in Table 20 with a 'X' (indicated in the column heading and the last two rows of this table in bold). These 'most outstanding characteristics' are the typical optimal characteristics of this class, at least 50% of the approaches belonging to it possess.

AI.3a Scenario analysis of the typology on the request of DG Agri

Request of DG Agri: On the ranking of monitoring schemes according to a subset of criteria (best-to-worst performing) – the point was made that several of these criteria have to do with 'communication' aspects (the EU was ranking very high, because in a sense it mostly does communication of data from MS). Request for the consultants to do the ranking again but without the communication elements (EU should then drop down the list or not be considered given different nature of the activities). We want to know which monitoring schemes do well regardless of communication aspects.

Response: Indeed, as we highlight in Annex AI.3: Example interpretation of Table 20. Therefore, we regard in this scenario analysis the following six of the eight typology criteria indicated in the last columns of Table 70. Table 75 shows that no changes in terms of classification class occur for the four EU approaches considered.

Table 70: Criteria considered in the scenario analysis vs. typology criteria

Category	Criterion	Optimal type	Part of Typology	Part of scenario analysis
Institutional context	Output format (Which technical output formats are used?)	Providing the monitoring results in pdf format OR interactive graphs AND exportable data files thereby combining information with interpretations of results or accessible information in a graphical form with data availability.	X	X
Monitoring focus	Supply chain levels monitored (Which supply chain levels are monitored?)	Monitoring at least three supply chain levels: farm, processing, and retail thereby providing insight by monitoring prices across all of them.	X	X
Data inputs	Quantitative data inputs (Which types of quantitative data is the FPMMA based upon?)	Using panel data for the analysis which is the optimal combination for being able to assess temporal changes as well as cross-section structures.	X	X
	Transparency of (raw) data (Are the raw data and numerical outputs are available?)	Making the raw data publicly available to the user which makes the monitoring transparent.	X	X
Monitoring results	Quantitative results (Which types of quantitative results are published?)	Publishing price margins and/or costs and profits along the supply chain either exclusively/additionally to prices, indices and/or simple indicators.	X	X
	Indicators (Which indicators are published?)	Calculating and publishing indicators based on more than a single price series (multivariate price indicators) or based on non-price quantities.	X	
	Formats of graphical & commented results (What formats have graphical results & commented qualitative analyses published?)	Providing comprehensive, detailed, qualitative and illustrative graphical and commented results on the supply chain structure helping the user to well understand it.	X	
Results com-munication	Time lag (How much times passes between the data gathering and publishing?)	Having a short to very short time lag of less than half a year between data gathering and monitoring results publication.	X	X

Source: Authors of this study.

Table 71: Scenario analysis: FPMMA meeting the optimal type of each of the 6 scenario criteria

	Institutional context	Monitoring focus	Data		Monitoring results	Results communication	Column count	Scenario class
FPMMA	Output format	Supply chain levels monitored	Quantitative data	Transparency of (raw) data	Quantitative results	Time lag		
BE1						X	1	SC1
BE2				X			1	SC1
BG1							0	SC1
BG2							0	SC1
EU1	X	X	X			X	4	SC3
EU2		X				X	2	SC2
EU3						X	1	SC1
EU4	X					X	2	SC2
FR1		X	X	X			3	SC2
FR2		X	X	X	X		4	SC3
LT1		X				X	2	SC2
LT2		X					1	SC1
NL	X	X		X		X	4	SC3
ES1		X			X		2	SC2
ES2		X		X	X		3	SC2
US1							0	SC1
US2	X						1	SC1
Row count	4	9	3	5	3	7		
Source	Table 65	Table 9	Table 10	Table 12	Table 13	Figure 7		

Source: Authors of this study.
Notes: Corresponds to Table 66.

Table 72 shows only those FPMMA which belong to scenario class SC1. Similarly, Table 73 and Table 74 show only the FPMMA belonging to SC2 and SC3, respectively. Each of these three tables gives a clear idea of to what extent the approaches belonging to each class are optimal with respect to the six scenario criteria. The approaches belonging to class SC1 are optimal with respect to the six scenario criteria in 5 cases (see the bottom of column 'Column count', corresponding to 10% of the possible total of 8 countries time 6 criteria = 48 criteria). The approaches belonging to SC2 and SC3 are optimal in 14 (39% of all possible cases) and 12 cases (67%), respectively. That is, the approaches belonging to SC3 show much more often optimal characteristics than the approaches belonging to SC1.

Table 72: Scenario analysis: Optimal characteristics of FPMMA belonging to scenario class SC1

	Institutional context	**Monitoring focus**	**Data**		**Monitoring results**	**Results communication**	**Column count**	**Scenario class**
FPMMA	Output format	Supply chain levels monitored	Quantitative data	Transparency of (raw) data	Quantitative results	Time lag		
BE1						X	1	SC1
BE2				X			1	SC1
BG1							0	SC1
BG2							0	SC1
EU3						X	1	SC1
LT2		X					1	SC1
US1							0	SC1
US2	X						1	SC1
Row count	1	1	0	1	0	2	5	
Share	13%	13%	0%	13%	0%	25%		

Source: Authors of this study.
Note: This table is just a part of Table 71. The column 'Column count' and the row 'Row count' have the same meaning as in Table 66 and Table 71. The row 'Share' shows how many of the FPMMA belonging to this scenario class are of the optimal type concerning each of the six criteria. This row serves based on the rule mentioned in step IIIc to identify the 'most outstanding characteristics' of each scenario class. These 'most outstanding characteristics' are the typical optimal characteristics of this class, at least 50% of the approaches belonging to it possess. Hence in contrast to typology Class 1, the approaches belonging to scenario class SC1 do not appear to have one typical optimal characteristic as all shares are below 50%.

These three tables also indicate which of the six criteria are the typical characteristics of each scenario class, in the sense that at least half of the approaches belonging to it, are actually of the optimal type of this criterion (indicated in bold in the column head and at the column end). This information needs to be correctly understood. For example, Table 72 shows that the six approaches of class SC1 are not in a single case optimal in their characteristics as defined in Table 70. Class SC2 has - based on the same decision rule - two typical characteristics (namely the optimal types of 'Supply chain levels monitored' and 'Time lag' as defined in Table 19/Table 70), while SC3 has five typical characteristics (all except 'Quantitative results').

Table 73: Scenario analysis: Optimal characteristics of FPMMA belonging to scenario class SC2

	Institutional context	**Monitoring focus**	**Data**		**Monitoring results**	**Results communication**	**Column count**	**Scenario class**
FPMMA	Output format	**Supply chain levels monitored**	Quantitative data	Transparency of (raw) data	Quantitative results	**Time lag**		
EU2		X				X	2	SC2
EU4	X					X	2	SC2
FR1		X	X	X			3	SC2
LT1		X				X	2	SC2
ES1		X			X		2	SC2
ES2		X		X	X		3	SC2
Row count	1	**4**	1	1	1	**3**	14	
Share	17%	**67%**	17%	17%	17%	**50%**		

Source: Authors of this study.
Note: This table is just a part of Table 71: Scenario analysis: FPMMA meeting the optimal type of each of the 6 scenario criteria. The column 'Column count' and the row 'Row count' have the same meaning as in Table 66 and Table 71. The row 'Share' shows how many of the FPMMA belonging to this scenario class are of the optimal type concerning each of the six criteria. This row serves based on the rule mentioned in step IIIc to identify the 'most outstanding characteristics' of each scenario class. These 'most outstanding characteristics' are the typical optimal characteristics of this scenario class, at least 50% of the approaches belonging to it possess.

For example, the fact that the approaches of class SC3 are not typically optimal with respect to the criterion 'Quantitative results', does not imply that none of the three approaches belonging to that scenario class publishes 'price margins and/or costs and profits along the supply chain either exclusively/additionally to prices, indices and/or simple indicators.' (Table 19/Table 70). The approach FR2 is actually optimal concerning this criterion. However, the remaining two approaches do not fulfil this optimality criterion; therefore, publishing price margins and/or costs and profits along the supply chain either exclusively/additionally to prices, indices and/or simple indicators cannot be considered to be a typical characteristic of scenario class SC3. This rule that at least 50% of the approaches belonging to a class need to be optimal with respect to a given scenario criterion in order allows to decide whether this optimal criterion needs to be considered to be a typical characteristics of a class or not.

Table 74: Scenario analysis: Optimal characteristics of FPMMA belonging to scenario class SC3

	Institutional context	Monitoring focus	Data		Monitoring results	Results communication	Column count	Scenario class
FPMMA	**Output format**	**Supply chain levels monitored**	**Quantitative data**	**Transparency of (raw) data**	Quantitative results	**Time lag**		
EU1	X	X	X			X	4	SC3
FR2		X	X	X	X		4	SC3
NL	X	X		X		X	4	SC3
Row count	**2**	**3**	**2**	**2**	1	**2**	**12**	
Share	**67%**	**100%**	**67%**	**67%**	33%	**67%**		

Source: Authors of this study.
Note: This table is just a part of Table 71: Scenario analysis: FPMMA meeting the optimal type of each of the 6 scenario criteria. The column 'Column count' and the row 'Row count' have the same meaning as in Table 66 and Table 71. The row 'Share' shows how many of the FPMMA belonging to this scenario class are of the optimal type concerning each of the six criteria. This row serves based on the rule mentioned in step IIIc to identify the 'most outstanding characteristics' of each scenario class. These 'most outstanding characteristics' are the typical optimal characteristics of this scenario class, at least 50% of the approaches belonging to it possess.

Table 75: Comparison of class affiliation of all 17 FPMMA for the typology vs. the scenario analysis

FPMMA	**Typology**	**Scenario**		**Typology**	
BE1	Class 1	SC1		Class	Count
BE2	Class 2	SC1		Class 1	6
BG1	Class 1	SC1		Class 2	5
BG2	Class 1	SC1		Class 3	6
EU1	Class 3	SC3			
EU2	Class 2	SC2		Scenario analysis	
EU3	Class 1	SC1		Class	Count
EU4	Class 2	SC2		SC1	8
FR1	Class 3	SC2		SC2	6
FR2	Class 3	SC3		SC3	3
LT1	Class 2	SC2			
LT2	Class 1	SC1			
NL	Class 3	SC3			
ES1	Class 3	SC2			
ES2	Class 3	SC2			
US1	Class 1	SC1			
US2	Class 2	SC1			

Source: Authors of this study.
Note: The table shows into which class each of the 17 FPMMA has been classified based on the criteria considered in the typology and in the scenario analysis, respectively. Approaches which were classified into another class in the scenario analysis are highlighted in light grey. Class 1 of the typology corresponds in terms of complexity of the approaches to class SC1 of the scenario analysis. The same correspondence holds for Class 2 and SC2 as well as Class 3 and SC3, respectively.

Annex II: Food Price and Margin Monitoring Factsheets

The following factsheets provide the raw data for the detailed characterisation of the 17 selected methodologies in Section 2.2 Detailed characterisation of selected approaches . Details of the methodology how these factsheets have been constructed and used can be found in Section AI.2 Methodology of Section 2.2. For the sake of clarity, the term Food Price and Marketing Approach is abbreviated as FPMMA in these factsheets.

	Name of approach in Engl. (code)	Annual and quarterly reports **(BE1)**
Institutional context		
	Name of approach in nat. language & link	Jaar- en kwartaalverslagen/Rapports annuels et trimestriels https://economie.fgov.be/nl/over-de-fod/structuur-fod-economie/observatoria/prijzenobservatorium
	Purpose/description	To investigate the different components of final consumer prices (including energy prices). To follow up the evolution of consumer prices and the level of consumer prices in Belgium, as compared to our main neighbouring countries. To provide better insights and necessary information about the functioning of the Belgian market and the profitability of Belgian economic sectors to the government, including potential distortions of competition on the market.
	Name of the FPMM initiative	Belgian Price Observatory
	Output form(at)s	Pdf files, updated quarterly
	Output frequency	Quarterly (data on the 4th quarter of the year is included in the annual report)
	Duration of publication	Since 2009, ongoing
Monitoring focus		
	Commodities/sectors	Processed (alcoholic and non-alcoholic beverages; bread and cereal products; dairy; oils and fats; sugar, jam and chocolate; tobacco; other food products) and non-processed food products (fish; meat; vegetables; fruits); energy; services; industrial goods
	Supply chain levels monitored	Retail; processing (note that for reasons of comparison, an index of international agricultural (raw materials) prices is also included); agricultural sector.
	Data frequencies	Quarterly
	Spatial disaggregation	n.a
	Conducive to purpose	Partly, changes in consumer prices (or relative changes in consumer versus selling prices at processing level) do not provide sufficient detail to gain insight in the components of consumer prices.
Data inputs		
	Qualitative data used	n.a
	Quantitative data used	Cross-section price data, averaged and compiled into an index
	Information sources	Secondary data sources: European Commission/Eurostat/Commodity price dashboard; IMF; DG Statistiek-Statistics Belgium; National Bank of Belgium Belgian Confederation of the Dairy Industry, European milk market observatory, …
	Data transparency	Raw data are not publicly available, only price indices are presented
Monitoring results		
	Types of quantitative results	Annual percentage price changes at consumer level (*p retail, out*); quarterly index of consumer prices (*p retail, out*) and of selling prices at processing level (*p processing out*) and of commodities (composite index); cross-section/time series
	Types of qualitative results	Graphical representation of changes in price indices over time; commented quantitative analyses including interpretation
	Prices monitored	p retail out, p processing out
	Further quantities monitored	None
	Indicators published	Annual percentage price changes at consumer level; quarterly index of consumer prices and quarterly index of selling prices at processing level and commodities (composite index)
	Reproducibility of approach	Terminology and methodology are not explained in detail; overall approach (for calculating index to base year and annual percentage changes) seems intuitive but underlying sector weights are needed and raw data.
	Calculation methods used	Index (base year, varies for different annual reports) based on a weighted average of processing prices (out) on the Belgian market and of processing prices in the Eurozone (available as Eurostat price statistic). The weighted average also takes into account the weights per sector within the Harmonized Index of Consumer Prices (HICP). Composite index for commodities.
	Form(at)s of numerical results	Cross-section tables in pdf file
	Form(at)s of graphical results	Time series graphs in pdf file
	Form(at)s of commented results	Written interpretation of tables and graphs in pdf file
	Intelligibility of results	Moderate - Easy to observe price changes over time; underlying calculations may not be obvious and not so easy to interpret

Results communication		
	User costs	Free of charge
	Time lag	Reports available within one month after data collection (e.g., report for the 3rd quarter of 2017 was published by the end of October 2017)
	Intuitiveness of presentation	High - clear graphical representations; concise, clarifying commented interpretation
	Knowledge transfer efforts	Moderate – graphs are beneficial for the visualisation of results; commented interpretations are clear, provide some insights beyond the quantitative data in the tables and graphs; non-specialist readers may find reports not very useful
Robustness assessment		
	Effort	Low – standard methodology; replicable within short time span; based on secondary data (collected by different institutes)
	Applicability	Low – all sectors are covered. If the question is to apply the methodology to other segments of the supply chain or to disaggregate further to specific food sub-sectors, then applicability may be low because of the absence of adequate raw data.
	Reliability	High – standard methodology
	Validity	High – standard methodology; secondary data collected in standardised way across sectors and regions in the country
	Flexibility	High – time lags limited, reports are available within one month after data collection
	Largest advantages	Standard methodology; replicability & validity
	Largest disadvantages	Focus on quantitative information; insights into market functioning/supply chain limited; reports targeted at specialist readers (because little background and insights beyond the quantitative information is provided)
Comments		

	Name of appr. in Engl. (code)	Market Functioning in Belgium – Horizontal Screening of the Sectors **(BE2)**
Institutional context		
	Name of approach in nat. language & link	Marktwerking in België. Horizontale screening van sectoren/Fonctionnement du marché en Belgique. Screening horizontal des secteurs In English : https://economie.fgov.be/en/publication/market-functioning-belgium In Dutch : https://economie.fgov.be/nl/publicaties/marktwerking-belgie-0 In French : https://economie.fgov.be/fr/publications/fonctionnement-du-marche-en-0
	Purpose/description	To provide better insights and necessary information about the functioning of the Belgian market to the government, including potential distortions of competition on the market. (annual report based on the methodology developed in the AGORA-MMS project. The first horizontal screening was published in 2014 as a part of the annual report. The following screenings are provided in separate documents. The annual report uses and quotes some results of the screenings).
	Name of the FPMM initiative	Belgian Price Observatory
	Output form(at)s	Pdf files
	Output frequency	annual
	Duration of publication	Since 2014, ongoing
Monitoring focus		
	Commodities/sectors	A.o. food processing (NACE 10xx and 11xx) and food retail (NACE 4622-4639x)
	Supply chain levels monitored	A.o. food processing and food retail
	Data frequencies	Annual (data for 2009, 2010, 2011 and 2012 are used and presented)
	Spatial disaggregation	n.a.
	Conducive to purpose	Yes: analysis targeted at providing insights in market functioning of different sectors
Data inputs		
	Qualitative data used	No
	Quantitative data used	Register of companies; NACE code per company; data from enterprise groups (EuroGroups Register); annual accounts of companies; turnover of companies based on VAT; import-export data; Structural Business Survey
	Information sources	DG Statistiek-Statistics Belgium; National Bank of Belgium; EUROSTAT
	Data transparency	Excel file is provided as Annex in which calculated indicators are provided but raw data are not accessible (for confidentiality reasons)
Monitoring results		
	Types of quantitative results	The report includes several (calculated) indicators on market functioning, among which, number of enterprises per industry; HHI; Import penetration; Capital Intensity; Price Cost Margin; weighted churn rate (exit and entry rate); survival rate; volatility of market shares; turnover rate of firms in the top eight of the sector. **In the rest of the table, the focus will be on the price cost margin indicator.**
	Types of qualitative results	Graphical representations
	Prices monitored	None
	Further quantities monitored	None
	Indicators published	Price cost margin (PCM) indicator
	Reproducibility of approach	Methodology is explained in detail; reproducibility depends on availability of underlying raw data
	Calculation methods used	The PCM indicator represents the profit margin of a sector. For an individual company, the price cost margin would be defined as the difference between the selling price (p) and the marginal cost of production (MC), divided by the selling price. To calculate the price cost margin at sector level, company-level price cost margins are weighted by market share (m) and summed over all companies in the sector. An approximation of this 'ideal' calculation is used in the screening report. Specifically, p is approximated by total company revenues (SALES) and MC is approximated by total variable costs of the company (COST), assuming constant returns to scale for all companies in the sector. COST includes the cost of purchasing traded and other goods and the cost of wages.
	Form(at)s of numerical results	Cross-section table, including descriptive statistics such as mean, median, min., max., std. deviation; cross-section table for most recent year in pdf document but for 4 years in excel file in Annex
	Form(at)s of graphical results	Cross-section graph (one for industrial, including food processing, and one for service, including food retail, sectors), 3-dimensional graph (including price cost margin; domestic turnover; international openness) for 30 sectors with highest

		price cost margin, only in pdf document
	Form(at)s of commented results	Interpretation and main observations of graphs and tables are included in the pdf document
	Intelligibility of results	Moderate – information density is high, interpretation of multi-dimensional graphs is complex; underlying calculation and hence interpretation of indicator is not straightforward
Results communication		
	User costs	Free of charge
	Time lag	Considerable: publication two years after period under analysis
	Intuitiveness of presentation	Moderate – information density is high, interpretation of multi-dimensional graphs is complex; underlying calculation and hence interpretation of indicator is not straightforward
	Knowledge transfer efforts	Low – usefulness to non-specialist readers is limited
Robustness assessment		
	Effort	High – especially in compiling underlying raw data
	Applicability	Low – all (food processing/retail) sectors are covered. If the question is to apply the methodology to other segments of the supply chain or to disaggregate further to specific food sub-sectors, then applicability may be low because of the absence of adequate raw data.
	Reliability	Moderate – indicator is calculated using an approximation of prices and (marginal) costs at company level because of the lack of the necessary micro-level data, approach is data intensive and requires company-level information about sales and (variable) costs
	Validity	Moderate – data intensive, secondary data collected (by different institutes) in a standardised way across sectors and companies
	Flexibility	Low – time lags considerable: more than two years (e.g. report published in February 2015 includes indicators for 2012 or earlier). Note: this time lag is due to the delay in data availability rather than in the complexity of the price cost margin calculations.
	Largest advantages	Methodology for price cost margin indicator is clearly elaborated; clear graphical representations; concise, clarifying commented interpretation
	Largest disadvantages	Data-intensive; time lag in reporting; results are not provided per sector but only for sectors with problematic market functioning
Comments		
		For details, see: https://economie.fgov.be/nl/publicaties/marktwerking-belgie-0 (in NL) or https://economie.fgov.be/nl/file/2836/download?token=9oxMOclo (in NL)

Source: Authors of this study.

	Name of approach in English (code)	Weekly Bulletin **(BG1)**
Institutional context		
	Name of approach in nat. language & link	Седмичен бюлетин http://sapi.bg/sedmichen-byuletin
	Purpose/description	Purpose of SAPI: 'collection, processing and provision of market price information throughout the food chain'/'collection and provision of objective information and the exclusion of the influence of private groups and interests in price formation', in particular of this approach: retail price reporting of selected commodities from 3 food commodity groups for selected regions
	Name of the FPMM initiative	System for Agro-Market Information (SAPI)
	Output form(at)s	PDF file of 1 page
	Output frequency	Weekly
	Duration of publication	Since January 2015
Monitoring focus		
	Commodities/sectors	Milk & dairy products, meat & processed meat products, fruits & vegetables
	Supply chain levels monitored	Retailing
	Data frequencies	Weekly
	Spatial disaggregation	28 provinces (post 1999 structure)
	Conducive to purpose	Partly as this FPMMA only considers retailing as the only food supply chain level
Data inputs		
	Qualitative data used	None
	Quantitative data used	Cross-section price data
	Information sources	Primary data collected by SAPI
	Data transparency	Raw data not publicly available, only parts published, raw data cannot be downloaded, no secondary data reported to be used
Monitoring results		
	Types of quantitative results	Per unit prices of selected commodities and regions and a range of indicators
	Types of qualitative results	None
	Prices monitored	p_{out}^{retail}
	Further quantities monitored	None
	Indicators published	Maximum ranges and average of per unit prices, province(s) with highest price increases/declines of selected commodities, percentage changes at regional and national level in comparison with preceding week, highlighting of positive and negative changes
	Reproducibility of approach	Exact calculations not explained, but intuitive, no exact terminology nor definitions, meaning of the published information not exactly defined
	Calculation methods used	Cumulatively moving price index comparing the current average price with the average price of the preceding week: $\frac{p_w^r}{p_{w-1}^r} - 1$
	Form(at)s of numerical results	Cross-section table
	Form(at)s of graphical results	'thumps up' vs. 'thumps down' for signalling increases vs. declines
	Form(at)s of commented results	Briefly commented most notable quantitative changes for selected commodities at national or selected regional level
	Intelligibility of results	High because price ranges and averages given as well as graphical emphasis
Results communication		
	User costs	Free of charge
	Time lag	Low because of weekly update
	Intuitiveness of presentation	High because limited information which is partly graphically
	Knowledge transfer efforts	High due to user-friendly, easily accessible and visually appealing results presentation
Robustness assessment		
	Effort	High - weekly monitoring for 28 regions including price ranges
	Applicability	Moderate - need of setting up comprehensive monitoring at regional level
	Reliability	Moderate - only selected results presented (information for non-mentioned regions and commodities missing)
	Validity	Moderate - only selective information
	Flexibility	Low - comprehensive and at relatively high frequency
	Largest advantages	Weekly publication; reduction of analysis scope by highlighting only selected products and regions; partly table, partly commented quantitative analysis

	Largest disadvantages	Incompleteness of results (selection of a few commodities and regions); only price changes at short-run assessed (from week to week), but no information of longer-run price trends; illustration via graphics could be improved, e.g., maps for regionalised monitoring
Comments		
		SAPI monitors prices of 900 products throughout the food chain on a weekly basis. Information is gathered on farm gate prices, wholesale prices and retail prices. Detailed prices are reported to the Ministry of Agriculture and Food, but to made publicly available.

	Name of approach in Engl. (code)	Easter basket/Christmas basket **(BG2)**
Institutional context		
	Name of approach in nat. language & link	Великденска кошница http://sapi.bg/potrebitelska-koshnitza
	Purpose/description	Purpose of SAPI: 'collection, processing and provision of market price information throughout the food chain'/'collection and provision of objective information and the exclusion of the influence of private groups and interests in price formation', in particular of this approach: average total consumer price of a typical food basket used by a family of 4 members during Easter
	Name of the FPMM initiative	System for Agro-Market Information (SAPI)
	Output form(at)s	PDF file of 1 page
	Output frequency	Not transparent
	Duration of publication	n.a.
Monitoring focus		
	Commodities/sectors	21 retail products (mostly food and drinks)
	Supply chain levels monitored	Retailing
	Data frequencies	Annual
	Spatial disaggregation	9 provinces (pre 1999 structure)
	Conducive to purpose	Partly as this FPMMA only considers consumer prices as the only level of the food supply chain
Data inputs		
	Qualitative data used	None
	Quantitative data used	Cross-section price data, assumed: consumption quantities
	Information sources	Primary data collected by SAPI
	Data transparency	Raw data not publicly available, only parts published, raw data cannot be downloaded, no secondary data reported to be used
Monitoring results		
	Types of quantitative results	Average nominal consumer expenditures, cross-section
	Types of qualitative results	None
	Prices monitored	p_{out}^{retail}
	Further quantities monitored	None
	Indicators published	Average price of total basket & basket constituents
	Reproducibility of approach	Exact calculations not explained, but intuitive, no exact terminology nor definitions, meaning of the published information not exactly defined
	Calculation methods used	Quantity-weighted sum of consumer expenditure: $\sum_i q_i p_i^r$
	Form(at)s of numerical results	Cross-section table
	Form(at)s of graphical results	n.a.
	Form(at)s of commented results	n.a.
	Intelligibility of results	High because very close to daily life
Results communication		
	User costs	Free of charge
	Time lag	Not transparent
	Intuitiveness of presentation	Moderate because of comprehensive table instead of graph
	Knowledge transfer efforts	High because closely corresponding to daily experience
Robustness assessment		
	Effort	Low - only annual frequency and 9 regions
	Applicability	High - simplicity and frequency of approach
	Reliability	High - simplicity of approach
	Validity	Moderate - quantities are stylised and consumption differences between provinces and wealth groups are not considered
	Flexibility	High - easily implementable
	Largest advantages	Small and intuitively understandable amount of information; flexible approach as implementable with low effort; direct comparison across regions easily possible
	Largest disadvantages	Only numbers without further explanations of graphical illustrations; consumption differences between provinces and wealth groups not considered; transparency of raw data not given
Comments		
		SAPI monitors prices of 900 products throughout the food chain on a weekly basis. Information is gathered on farm gate prices, wholesale prices and retail prices. Detailed prices are reported to the Ministry of Agriculture and Food, but to made publicly available.

Source: Authors of this study.

	Name of approach in Engl (code)	Value chain analyses of fresh products **(ES1)**
Institutional context		
	Name of approach in nat. language & link	Cadenas de valor productos frescos http://www.mapama.gob.es/es/alimentacion/servicios/observatorio-de-precios-de-los-alimentos/frescos.aspx
	Purpose/description	knowledge framework on the formation of prices along national food supply chains through the publication of objective data and the publication of reports enabling systematic price monitoring, final goal is favouring transparency and efficiency of food supply chains detecting possible supply chain imbalances
	Name of the FPMM initiative	Spanish Food Price Observatory
	Output form(at)s	Separate PDF reports of varying length (between 20 and 70 pages) consisting of a summary sheet, a base study and various updates
	Output frequency	Irregular
	Duration of publication	Base studies in 2009 for each selected product, since then 1 to 4 updates
Monitoring focus		
	Commodities/sectors	Supply chains of 36 specific fresh food products of varying quality, origin and supply chain position: 13 types of fish, 9 vegetables, 6 fruits, 5 types of meat, 2 types of seafood, eggs
	Supply chain levels monitored	All relevant supply chain levels for a given commodity from the production of the raw product until retail level, analyses for alternative supply chain channels
	Data frequencies	Weekly and annual
	Spatial disaggregation	No regionalised price information, analysis for nationally representative supply chain channels of a product only
	Conducive to purpose	Fully, exemplary analysis structure & results communication
Data inputs		
	Qualitative data used	Detailed supply chain structure analysis, in-detail descriptions of the product transformation processes and added value composition along the supply chain
	Quantitative data used	Cross-section and time series price data, cost and profit estimates
	Information sources	Interviews with supply chain actors, secondary data from various national statistics, own primary data collection (prices)
	Data transparency	Raw data not publicly available, data only published graphically, raw data cannot be downloaded, secondary data sources completely and explicitly mentioned
Monitoring results		
	Types of quantitative results	Nominal price & cost information, time series of average price, cross-section maximum-minimum ranges of prices, costs and profits
	Types of qualitative results	Supply chain structure for alternative most representative supply chain channels (often traditional vs. modern), explanations of the characteristics and functions of each level, explanations of the production/transformation processes of the food commodity and corresponding activities at each level, detailed descriptions of costs incurring along the supply chain, explicit study conclusions
	Prices monitored	Time series monitoring: farm gate and retail price, Cross-section: detailed structure of price formation constituents along the supply chain, output prices for each major step of the supply chain, prices per kg, prices per animal, retail price with & without VAT
	Further quantities monitored	Detailed monitoring of costs and profits for each supply chain level (including farm level), average weight of the (processed) raw product, aggregated national production, marketing and consumption data, s^{r-farm} , structure and average size of subsidies paid
	Indicators published	Total costs per supply chain level, shares of value added and cumulated costs along supply chain, profits in percentages, contrasting of total value increase vs. total profits along chain, average price of the production year and its relation to the average prices of previous production years, annual average price trends
	Reproducibility of approach	Data gathering, data processing, model calibration, calculation steps as well as model validation explained in detail, terminology exactly explained, meaning of the published information exactly explained
	Calculation methods used	Mostly straightforward percentage calculations or additions, formulas for calculating the physical product loss and the profit at each supply chain level defined
	Form(at)s of numerical results	All price & cost data illustrated in graphs
	Form(at)s of graphical results	Time series charts of weekly price with annual averages and inter-annual changes, detailed and summarised supply chain structure diagrams with

		plenty of adequately illustrated numbers
	Form(at)s of commented results	Exemplary comprehensive and detailed explanations of analyses of supply chain structures, comprehensively commented and interpreted quantitative analysis
	Intelligibility of results	High due to comprehensive and suitable illustration of numerical information
Results communication		
	User costs	Free of charge
	Time lag	One to three years
	Intuitiveness of presentation	High because of limited information presented which is adequately illustrated
	Knowledge transfer efforts	High because of comprehensive commenting and illustration of results
Robustness assessment		
	Effort	High – comprehensive and detailed supply chain structure analysis
	Applicability	Low - substantial data gathering needs and data gathering details not published, substantial effort for reproduction needed
	Reliability	Moderate - data gathering of low transparency
	Validity	High - explicit quality-ensuring data analysis plan
	Flexibility	Low - high data gathering effort and substantial time lag
	Largest advantages	Easily intelligible summary and illustration of complex economic relationships; insightfulness of the supply chain structure analysis; insightful combination of price, cost and profit ranges with temporal price development
	Largest disadvantages	For many commodities at most two study updates published; for several commodities no analyses available for last 5 years or more; limited set of specific food products covered due to the large effort needed for the analysis
Comments		

	Name of approach in Engl. (code)	Value chain analyses of oil, garlic, bread and milk **(ES2)**
Institutional context		
	Name of approach in nat. language & link	Cadenas de valor - aceite, ajo, pan y leche http://www.mapama.gob.es/es/alimentacion/servicios/observatorio-de-precios-de-los-alimentos/estudios-e-informes/default.aspx
	Purpose/description	Knowledge framework on the formation of prices along national food supply chains through the publication of objective data and the publication of reports enabling systematic price monitoring, final goal is favouring transparency and efficiency of food supply chains detecting possible supply chain imbalances
	Name of the FPMM initiative	Spanish Food Price Observatory
	Output form(at)s	Separate PDF reports of varying length (about 20 to 90 pages) consisting of a base study and various updates
	Output frequency	Annual
	Duration of publication	First base studies in 2009, since then annual updates until 2012 or 2013
Monitoring focus		
	Commodities/sectors	Olive oil, bread, liquid milk in bottles and garlic
	Supply chain levels monitored	All relevant supply chain levels of milk and garlic including agricultural production, All supply chain levels starting at the processing level for olive oil and bread
	Data frequencies	Annual
	Spatial disaggregation	No regionalised price information, analysis for nationally representative supply chain channels of a product only
	Conducive to purpose	Fully, exemplary analysis structure & results communication
Data inputs		
	Qualitative data used	Detailed supply chain structure analysis, in-detail descriptions of the product transformation processes and added value composition along the supply chain
	Quantitative data used	Cross-section price data, cost and profit estimates
	Information sources	Interviews with supply chain actors, secondary data from various national statistics, own primary data collection (prices)
	Data transparency	Raw data partly publicly available only for bread, data only published graphically, raw data only partly be downloaded, secondary data sources completely and explicitly mentioned
Monitoring results		
	Types of quantitative results	Nominal price & cost information, cross-section maximum-minimum ranges of prices, costs and profits
	Types of qualitative results	Detailed supply chain structure for alternative most representative supply chain channels, explanations of the characteristics, functions and types of involved businesses at each level, explanations of the production/transformation processes of the food commodity and corresponding activities at each level, detailed descriptions of costs incurring along the supply chain, explicit study conclusions, dairy farm production types, dairy processing chain, variability in dairy retail products
	Prices monitored	Detailed structure of price formation constituents along the supply chain, output prices for each major step of the supply chain, prices per kg, weighted average prices, retail price with & without VAT,
	Further quantities monitored	Detailed monitoring of costs and profits for each supply chain level (at farm level only for milk and garlic), aggregated national production, marketing, consumption and trade data, s^{r-farm}, structure and average size of subsidies paid,
	Indicators published	Total costs per supply chain level, shares of value added and cumulated costs along supply chain, profits in percentages, contrasting of total value increase vs. total profits along chain, annual average price trends, estimates of price spreads and added value shares of separate supply chain levels
	Reproducibility of approach	Data gathering, data processing, model calibration, calculation steps as well as model validation explained in detail, terminology exactly explained, meaning of the published information exactly explained
	Calculation methods used	Mostly straightforward percentage calculations or additions, formulas for calculating output prices at each supply chain level defined for olive oil and garlic
	Form(at)s of numerical results	For milk and bread cross-section as well as time series tables
	Form(at)s of graphical results	Detailed and summarised supply chain structure diagrams with plenty of adequately illustrated numbers
	Form(at)s of commented results	Exemplary comprehensive and detailed explanations of analyses of supply chain structures, comprehensively commented and interpreted quantitative analysis
	Intelligibility of results	High due to comprehensive and suitable illustration of numerical information
Results communication		

	User costs	Free of charge
	Time lag	One to two years
	Intuitiveness of presentation	High because of limited information presented which is adequately illustrated
	Knowledge transfer efforts	High because of comprehensive commenting and illustration of results
Robustness assessment		
	Effort	High – comprehensive and detailed supply chain structure analysis
	Applicability	Low - substantial data gathering needs and data gathering details not published, substantial effort for reproduction needed
	Reliability	Moderate - data gathering of low transparency
	Validity	High - explicit quality-ensuring data analysis plan
	Flexibility	Low - high data gathering effort and substantial time lag
	Largest advantages	Easily intelligible summary and illustration of complex economic relationships; insightfulness of the channel-based supply chain structure analysis; partly also development of supply chain and consumption analysed
	Largest disadvantages	Only two or three study updates published for each commodity; for several commodities no analyses available for last 5 years or more; very limited set of specific food supply chains covered (definition of a supply chain from the perspective of a given retail product such as bottled milk or bread in contrast to a raw-product based supply chain definition, e.g., analysis of all products produced from raw milk, wheat etc.)
Comments		

Source: Authors of this study.

	Name of approach in Engl. (code)	FPMT: Price trends along the food supply chain **(EU1)**
Institutional context		
	Name of approach in nat. language & link	FPMT: Price trends along the food supply chain http://ec.europa.eu/eurostat/cache/infographs/foodprice/
	Purpose/description	The Food Price Monitoring Tool focuses on the analysis of time series of prices throughout the food chain at a varying level of aggregation, at both Member State and European levels. The purpose is to provide higher transparency on price developments across the different stages of the food production chains. The tool reports on developments for agricultural commodity prices, producer prices, consumer prices and import prices.
	Name of the FPMM initiative	Eurostat
	Output form(at)s	Interactive graphs; Data also available in tables from the Eurostat website
	Output frequency	monthly
	Duration of publication	Info available since January 2005 for most of the data The extent grows over time (e.g., harmonised index of consumer prices not calculated from the very beginning) No pdf issues, only interactive figures; updated continuously (i.e., longer time series)
Monitoring focus		
	Commodities/sectors	14 commodities (bread and cereals, meat, beef and veal, pork, poultry, fish and seafood, milk, cheese and eggs, fresh whole milk, cheese and curd, eggs, oils and fats fruit, vegetables, potatoes)
	Supply chain levels monitored	Agricultural production, imports, processing and packaging, retailing
	Data frequencies	monthly
	Spatial disaggregation	EU-28, EU-27, EU-19, MS level
	Conducive to purpose	Partly. The purpose states monitoring of prices, but in reality only price indices are presented.
Data inputs		
	Qualitative data used	-
	Quantitative data used	Time series for each MS; unbalanced panel for the EU
	Information sources	Eurostat, although not explicitly stated, redirection from table to Eurostat data
	Data transparency	Raw data not publically available The underlying data for graphs downloadable for free from Eurostat Data sources not explicitly specified, but links are provided
Monitoring results		
	Types of quantitative results	Price indices with 2010=100 Annual rate of change in %
	Types of qualitative results	None
	Prices monitored	p farm out, p processing out, p retail out and other consumer prices, import prices
	Further quantities monitored	None
	Indicators published	Commodity price index, harmonised index of consumer prices, import price index and producer price index
	Reproducibility of approach	Limited as price indices 2010=100, but monthly data used. Not clear what the base is.
	Calculation methods used	Not clear if the base for the index is the simple average of 2010 prices Also not sure how the percentage changes are calculated
	Form(at)s of numerical results	Time series tables
	Form(at)s of graphical results	Time series graphs
	Form(at)s of commented results	n.a.
	Intelligibility of results	Moderate because not clear what the base for index is
Results communication		
	User costs	Free of charge
	Time lag	1 month
	Intuitiveness of presentation	Moderate because only graphical summaries, no commentaries
	Knowledge transfer efforts	Moderate because the not clear how the base for the index is calculated
Robustness assessment		
	Effort	Low - monthly monitoring for MS based on standardised data from Eurostat
	Applicability	High - already done for each EU MS
	Reliability	High - calculated directly from Eurostat data
	Validity	High - calculated directly from Eurostat data
	Flexibility	High - updated monthly; a wide range of commodities covered
	Largest advantages	Timely information due to monthly publication; consistent approach across all EU MS; a wide range of commodities covered

	Largest disadvantages	Not clear immediately what which year is the base for the indices is; for some commodities the annual percentage does not cover the same period as the indices; not clear is the percentage change measures the relative change in index or price
Comments		

	Name of approach in English (code)	FPMT: Price transmission along the food supply chain **(EU2)**
Institutional context		
	Name of approach in nat. language & link	FPMT: Price transmission along the food supply chain http://ec.europa.eu/eurostat/cache/infographs/foodprice/
	Purpose/description	To further enhance the Food Price Monitoring Tool by providing statistics and indicators for the assessment of the price transmission mechanism in the selected parts of the Food Monitoring Tool. The statistics and indicators will provide information on (1) magnitude of price transmission (2) speed of price transmission, and (3) asymmetry of price transmission
	Name of the FPMM initiative	Eurostat
	Output form(at)s	Interactive graphs;
	Output frequency	One-off (for now based on the period 2005-2014
	Duration of publication	Duration cannot be determined. Because the output is based on the 2005-2014 data, assume they started in 2016 The extent does not grow over time (for now) No pdf issues, only interactive figures No updates for now
Monitoring focus		
	Commodities/sectors	Transmission agricultural prices --> producer prices, food and 6 commodities Transmission agricultural prices --> consumer prices, food and 6 commodities Transmission producer prices --> consumer prices, food and 5 commodities
	Supply chain levels monitored	Agricultural production, imports, processing and packaging, retailing
	Data frequencies	One-off analysis
	Spatial disaggregation	MS level (not all MS). Number of MS differs depending on the indicator (e.g., Magnitude of price transmission (21 MS) vs Speed of price transmission (12 MS))
	Conducive to purpose	Fully. Unfortunately lack of data does not make it possible to do the analyses for all MS
Data inputs		
	Qualitative data used	None
	Quantitative data used	Nominal time series for each MS
	Information sources	Eurostat
	Data transparency	The data are not publically available Data sources not explicitly specified
Monitoring results		
	Types of quantitative results	% of commodity price change transmitted along the supply chain
	Types of qualitative results	None
	Prices monitored	p farm out, p processing out, p retail out and other consumer prices, import prices
	Further quantities monitored	None
	Indicators published	% of commodity price change transmitted along the supply chain
	Reproducibility of approach	Methodology documented, but underlying data not available
	Calculation methods used	Documentation of econometric models available here http://ec.europa.eu/eurostat/cache/infographs/foodprice/data_overview/overview.pdf
	Form(at)s of numerical results	n.a.
	Form(at)s of graphical results	Bar graphs
	Form(at)s of commented results	Only brief definitions/clarifications provided
	Intelligibility of results	High because results clear and brief explanation provided.
Results communication		
	User costs	Free of charge
	Time lag	One-off analysis (i.e., no time lag so far)
	Intuitiveness of presentation	High because graphical summaries as well as brief definitions/clarifications provided
	Knowledge transfer efforts	High because of simplicity and clarity of presentation
Robustness assessment		
	Effort	High - a lot of data are required and the analysis cannot be standardised for every MS because each model is likely to suffer from specific econometric problems that need to be solved separately
	Applicability	High - already implemented at EU level
	Reliability	Moderate - we do not know how well the econometric models predict (no goodness-of-fit of the models provided)
	Validity	Medium - of missing goodness-of-fit measure
	Flexibility	Medium - the same methodology has to be used for each MS and commodity

	Largest advantages	Clear presentation; consistent approach across all EU MS; provision of examples how to interpret the values
	Largest disadvantages	Only a few commodities covered; data for many MS missing; clear (and easy to find) definition of the price indices missing
Comments		

	Name of approach in Engl. (code)	Agricultural markets dashboards **(EU3)**
Institutional context		
	Name of approach in nat. language & link	Agricultural markets dashboards https://ec.europa.eu/agriculture/dashboards_en
	Purpose/description	In one screenshot, the dashboards gather all the useful available data important to farmers, producers, stakeholders and interested citizens in order to make informed choices. The dashboards offer full access to all available market data through a single page. It saves interested parties time. All the graphs are clickable in order to have a better view of the information given.
	Name of the FPMM initiative	EU Commission, DG Agriculture and Rural Development
	Output form(at)s	pdf files with dashboards
	Output frequency	weekly (but only some parts updated)
	Duration of publication	Info on duration not available The extent of the publication is most likely constant (hard to tell as no archive exists) Updated weekly
Monitoring focus		
	Commodities/sectors	Animal products (6), plant products (5), and fruit and vegetables (4)
	Supply chain levels monitored	Agricultural production, wholesale (depends on commodity
	Data frequencies	monthly
	Spatial disaggregation	EU-28, sometimes selected MS
	Conducive to purpose	Fully because the dashboards provide quick and easy to understand information.
Data inputs		
	Qualitative data used	-
	Quantitative data used	Time series for each EU as a whole
	Information sources	Under each dashboard.
	Data transparency	Raw data not publically available, and if they are, then they are in pdf files The underlying data for graphs not downloadable
Monitoring results		
	Types of quantitative results	Development of prices/quantities/self-sufficiency ratios
	Types of qualitative results	None
	Prices monitored	p farm out, export prices
	Further quantities monitored	None
	Indicators published	Percentage and absolute price changes
	Reproducibility of approach	Limited because the underlying data not directly available or clearly referred to
	Calculation methods used	Simple price changes calculation
	Form(at)s of numerical results	Cross-section and time series tables available in pdf
	Form(at)s of graphical results	Variety of time series/bar/pie graphs, tendencies, maps, changes coloured, focus on graphical illustration
	Form(at)s of commented results	n.a.
	Intelligibility of results	High because food price monitoring graphs are clear and self-contained. They are informative and understandable also for non-specialist audience.
Results communication		
	User costs	Free of charge
	Time lag	1 week/month, depending on the data type
	Intuitiveness of presentation	Moderate because only graphical summaries, no commentaries
	Knowledge transfer efforts	High because the content is just basic indicators for laymen
Robustness assessment		
	Effort	High - updates need to be done varying frequencies for different commodities. Very many types of graphs need to be produced.
	Applicability	High - already implemented at EU level
	Reliability	High - based on Eurostat data and industry sources
	Validity	High - the dashboards are likely to be used and checked by industry professionals daily
	Flexibility	Low - very detailed and relatively high frequency
	Largest advantages	Easy to understand; comprehensive; updated frequently
	Largest disadvantages	Information aggregated at the EU level but not provided by Member States; not clear how the EU aggregated prices/indices calculated; difficult to retrieve the background data from figures
Comments		

	Name of approach in Engl. (code)	EU Milk Market Observatory **(EU4)**
Institutional context		
	Name of approach in nat. language & link	EU Milk Market Observatory https://ec.europa.eu/agriculture/market-observatory/milk_en
	Purpose/description	The aim of the EU Milk Market Observatory (MMO) is to provide the EU dairy sector with more transparency by means of disseminating market data and short-term analysis in a timely manner.
	Name of the FPMM initiative	European Commission
	Output form(at)s	Dashboards; tables in pdf and Excel
	Output frequency	Updated continuously (daily, weekly)
	Duration of publication	The starting date of the Milk observatory not available. The data are updated continually (almost daily), but not regularly
Monitoring focus		
	Commodities/sectors	Milk and dairy products
	Supply chain levels monitored	Farm, Processing
	Data frequencies	weekly
	Spatial disaggregation	EU-28, and MS level
	Conducive to purpose	Fully because rich set of information and easy to understand
Data inputs		
	Qualitative data used	-
	Quantitative data used	Time series for each the EU as a whole
	Information sources	Source indicated under every table/graph, but links not provided
	Data transparency	Raw data not publically available Historical data downloadable for free from Eurostat
Monitoring results		
	Types of quantitative results	Simple indicators like % changes calculated. Nominal price and margin levels reported
	Types of qualitative results	Commentaries on the market outlook
	Prices monitored	$P_{out}^{processing}$, P_{out}^{farm}
	Further quantities monitored	None
	Indicators published	Percentage price changes
	Reproducibility of approach	Easy to reproduce if data were publicly available
	Calculation methods used	Simple percentage price changes
	Form(at)s of numerical results	Tables in pdf; time series data for the EU, in some cases also for individual MS
	Form(at)s of graphical results	Simple time series/bar graphs
	Form(at)s of commented results	Results presented as tables and figures in pdfs. No commentaries provided directly for the figures. General commentaries of the market situation provided in a separate files. However, these commentaries are very descriptive and reduce to the presentation of percentage changes of price and quantities.
	Intelligibility of results	Moderate because not clear what the base for index is
Results communication		
	User costs	Free of charge
	Time lag	1 month
	Intuitiveness of presentation	High because graphical summaries and tables presented
	Knowledge transfer efforts	High because the indicators are easy to understand
Robustness assessment		
	Effort	High - heterogeneous types of data need to be updated frequently
	Applicability	High - already done for EU
	Reliability	Medium - calculated at the EU level and various sources used
	Validity	Medium - calculated at the EU level and various sources used
	Flexibility	Low - very detailed and relatively high frequency
	Largest advantages	Easy to understand; comprehensive; updated frequently
	Largest disadvantages	Information aggregated at the EU level but not provided by Member States; not clear how the EU aggregated prices/indices calculated; difficult to retrieve the background data from figures
Comments		

Source: Authors of this study.

	Name of approach in Engl. (code)	Macroeconomic decomposition of food expenditure **(FR1)**
Institutional context		
	Name of approach in nat. language & link	Décompositions macroéconomiques de la dépense alimentaire https://observatoire-prixmarges.franceagrimer.fr/resultats/Pages/ResultatsFilieres.aspx?idfiliere=1
	Purpose/description	Decomposition of total annual food expenditures in France including or excluding food services
	Name of the FPMM initiative	French observatory on prices and margins formation of food products
	Output form(at)s	Continuously updated website including summary of selected results and insights in PDF reports and presentations
	Output frequency	Annual
	Duration of publication	Creation of observatory in 2010 and decomposition at annual level since then
Monitoring focus		
	Commodities/sectors	Total annual food expenditures in France
	Supply chain levels monitored	Agriculture, fishing and aquaculture, food industries and beverage manufacturing, other industries, food services, trade, other services including transportation, imported intermediate consumption, food imports, taxes
	Data frequencies	Annually
	Spatial disaggregation	No regionalised price information
	Conducive to purpose	Fully, exemplary analysis structure & results communication
Data inputs		
	Qualitative data used	Supply chain structure
	Quantitative data used	Secondary data in the form of input-output tables of domestic food production and food imports
	Information sources	National statistics institute (INSEE)
	Data transparency	Of high quality: raw data of each graph publicly available, raw data can be downloaded via copy & paste, secondary data sources not exactly mentioned, calculation rules explicitly explained; but raw data underlying the decomposition not available
Monitoring results		
	Types of quantitative results	Decomposition of total annual food expenditures according to type of value added by each supply chain level and according to agriculture, imports, food processing & distribution as well as taxes
	Types of qualitative results	None
	Prices monitored	None
	Further quantities monitored	None
	Indicators published	Value shares in total annual food expenditures
	Reproducibility of approach	Data processing, methodologies, calculation steps and assumptions explained in detail, terminology exactly explained, meaning and implications of the published information exactly explained, but raw data not available
	Calculation methods used	Explained in detail in the publications: Le partage de l'euro alimentaire: première estimation incluant la restauration. La Lettre de l'OBSERVATOIRE, n° 11, décembre 2016. And: L'euro alimentaire en France de 1995 à 2007 et le partage des valeurs ajoutées entre branches. (Butault°J.P., Boyer Ph.). 6èmes Journées de recherches en sciences sociales; Inra, Sfer, Cirad. Toulouse, décembre 2012.
	Form(at)s of numerical results	Time series tables
	Form(at)s of graphical results	Food Euro, stacked bar plots for repeated years
	Form(at)s of commented results	Very comprehensive and detailed explanations of analyses communicated in a variety of formats: parliament reports and letters, studies and presentations, detailed background information and definitions of all quantities monitored – however structured overview of commented results lacking
	Intelligibility of results	Low to moderate because explicit interpretations of the analysis results at national and annual level missing on the website although well-organised and structured website in comparison to other FPMMI and due to extremely high aggregation level of the analysis (total annual food expenditures in France including all kinds of food expenditures for all kinds of food products leading to a quite abstract analysis output)
Results communication		
	User costs	Free of charge
	Time lag	Three to five years
	Intuitiveness of presentation	High because illustration with a 100 Euro note and stacked bar plots
	Knowledge transfer efforts	Moderate because detailed interpretations lacking although combination of numerical results with adequately designed graphical illustrations

Robustness assessment		
	Effort	Moderate - based on I-O tables which have to be prepared by national statistical agencies for Eurostat
	Applicability	Moderate to high - very high aggregation level and therefore low data requirements (secondary data anyway prepared for Eurostat)
	Reliability	High - based on officially published I-O tables
	Validity	Moderate - high aggregation level of analysis (no statements for single food products/supply chains possible but only for all annual food expenditures)
	Flexibility	Low - substantial time lag which is created by the dependency on official statistics
	Largest advantages	Limited amount of analysis output which can be intelligibly illustrated (Food Euro); no extra data gathering needed due to dependency on secondary data; macro-economic indicator of the role of agriculture relative to other sectors
	Largest disadvantages	Extremely high level of aggregation only allowing very abstract statements; substantial time lag; only rough estimation of value shares in total national annual food expenditure
Comments		
		Comprehensive and detailed documentation: Observatoire de la formation des prix et des marges des produits alimentaires (2011). Construction de l'observatoire de la formation des prix et des marges des produits alimentaires - état d'avancement, méthodes, données - Rapport au Parlement, Juin, Paris, available at http://www.ladocumentationfrancaise.fr/rapports-publics/114000347/index.shtml. All reports of the observatory to the French parliament available at: https://observatoire-prixmarges.franceagrimer.fr/etranger/Pages/default.aspx and http://www.ladocumentationfrancaise.fr/ezexalead/search?SearchText=Observatoire+de+la+formation+des+prix+et+des+marges+des+produits+alimentaires+&cat%5BGroupeThematique%5D=&n=slDocFrancaise

	Name of approach in English (code)	Cost analysis in the agricultural, industrial and trade sectors - results by sector **(FR2)**
Institutional context		
	Name of approach in nat. language & link	L'analyse des coûts dans les secteurs agricoles, industriels et du commerce - résultats par filière https://observatoire-prixmarges.franceagrimer.fr/resultats/Pages/ResultatsFilieres.aspx?idfiliere=4
	Purpose/description	Evaluation of how total consumer expenditure for food products is distributed across the various supply chain level activities
	Name of the FPMM initiative	French observatory on prices and margins formation of food products
	Output form(at)s	Continuously updated website including summary of selected results and insights in PDF reports and presentations
	Output frequency	Annual
	Duration of publication	The observatory was created in 2010
Monitoring focus		
	Commodities/sectors	11 aggregated product categories covered: various sectors, fruits and vegetables, dairy products, beef, sheep meat, fresh pork, pork - ham, poultry, bread, pasta, fishery and aquaculture products
	Supply chain levels monitored	All relevant levels of one nationally typical supply chain of a given commodity category from the production of the raw product until retail level
	Data frequencies	Weekly, monthly and annually
	Spatial disaggregation	No regionalised price information
	Conducive to purpose	Fully, exemplary analysis structure & results communication
Data inputs		
	Qualitative data used	Supply chain structure
	Quantitative data used	Retail consumer prices, sales prices of food manufacturers, farm gate prices, data on industrial transformation, yields and loss rates in trade, accounting data of farms, agribusiness firms and trade and distribution enterprises
	Information sources	Primary data gathering by surveys and interviews; secondary data from various national statistics (INSEE), surveys and interviews of food retail markets, specific surveys and other data of FranceAgriMer, price observations of FranceAgriMer, Service des nouvelles des marchés/Réseau des nouvelles des marchés, Kantor Worldpanel
	Data transparency	Of exemplary quality: raw data of each graph publicly available, raw data can be downloaded via copy & paste, secondary data sources completely and explicitly mentioned, challenges of analysis and interpretation explicitly discussed, limitations of the analysis spelled out; but raw data underlying the decomposition not available
Monitoring results		
	Types of quantitative results	Nominal and cumulatively updated time series of price, cost items, price spreads; cross-section data of trade flows
	Types of qualitative results	Stylised supply chain structure (connections) modelling including product quantity flow graphs
	Prices monitored	Mostly p_{out}^{farm}, $p_{out}^{processing}$, p_{out}^{retail}, partly also $p_{in}^{wholesale}$, spread between p_{out}^{retail} and $p_{out}^{processing}$
	Further quantities monitored	Aggregated trade flows between supply chain actors, trade flow balances, number of actors at various chain levels, nominal average profits and cost structure of actors at various supply chain levels (partly for selected commodity sub-groups) including agricultural production costs of selected specific commodities, descriptive price transmission analysis
	Indicators published	Decomposition of total expenditures based on I-O analysis; gross and net margins (profits), costs by type and supply chain level, price indicators, cost and profit shares in final price
	Reproducibility of approach	Data processing, methodologies, calculation steps and assumptions explained in detail, terminology exactly explained, meaning and implications of the published information exactly explained, but raw data not available
	Calculation methods used	Explained in detail in the publications: Le partage de l'euro alimentaire: première estimation incluant la restauration. La Lettre de l'OBSERVATOIRE, n° 11, décembre 2016. And: L'euro alimentaire en France de 1995 à 2007 et le partage des valeurs ajoutées entre branches. (Butault°J.P., Boyer Ph.). 6èmes Journées de recherches en sciences sociales; Inra, Sfer, Cirad. Toulouse, décembre 2012.
	Form(at)s of numerical results	Cross-section and time series tables
	Form(at)s of graphical results	Time series charts, stacked bar plots for repeated years, flow charts, pie charts
	Form(at)s of commented results	Very comprehensive and detailed explanations of analyses communicated in a variety of formats: parliament reports and letters, results by sector, studies and presentations, details on national supply chain, its role in EU and its links

		to other EU countries, extensive and detailed background information and definitions of all quantities monitored – however structured overview of commented results lacking
	Intelligibility of results	High due to very well-organised and structured website combining numbers with graphs and extensive explanations
Results communication		
	User costs	Free of charge
	Time lag	Three to five years
	Intuitiveness of presentation	Moderate because conclusions about the structure of specific single food product supply chains are not straightforward although well-designed and insightful graphs used at aggregated product category level
	Knowledge transfer efforts	High because insightful combination of numerical results, adequately designed graphical illustrations and interpretations and commenting explanations
Robustness assessment		
	Effort	High - very structured, comprehensive and detailed approach
	Applicability	Low - very high and detailed data requirements
	Reliability	Moderate - data gathering of low transparency
	Validity	Moderate to high - detailed stylised price decompositions based on macroeconomic data, therefore only available at highly aggregated product category level
	Flexibility	Low - substantial time lag
	Largest advantages	Scope of the analysis: extremely comprehensive and detailed estimation of prices, costs and profits; exemplary results communication in terms of intuitive illustration, commenting interpretation and transparency of methods and sources; monitoring not only based on price data, but also on I-O data
	Largest disadvantages	Extremely high data requirements; high level of aggregation and abstractness of results: only average results for product groups available which raises the question how the results can be translated/extrapolated for specific product supply chains; substantial time lag between data gathering and results publication of three years or more
Comments		
		Comprehensive and detailed documentation: Observatoire de la formation des prix et des marges des produits alimentaires (2011). Construction de l'observatoire de la formation des prix et des marges des produits alimentaires - état d'avancement, méthodes, données - Rapport au Parlement, Juin, Paris, available at http://www.ladocumentationfrancaise.fr/rapports-publics/114000347/index.shtml. All reports of the observatory to the French parliament available at: https://observatoire-prixmarges.franceagrimer.fr/etranger/Pages/default.aspx and http://www.ladocumentationfrancaise.fr/ezexalead/search?SearchText=Observatoire+de+la+formation+des+prix+et+des+marges+des+produits+alimentaires+&cat%5BGroupeThematique%5D=&n=slDocFrancaise

Source: Authors of this study.

	Name of approach in Engl. (code)	Prices of agricultural and food products **(LT1)**
Institutional context		
	Name of approach in nat. language & link	Maisto produktu kainos, http://www.produktukainos.lt/ , http://www.vic.lt/?mid=341, http://www.vic.lt/?mid=134
	Purpose/description	n.a.
	Name of the FPMM initiative	Lithuanian agricultural and food price observatory
	Output form(at)s	Online tables
	Output frequency	Weekly updates
	Duration of publication	Accessible since 2016; in archive prices are available from year 2009.
Monitoring focus		
	Commodities/sectors	Dairy, meat, poultry, eggs, bakery products, potatoes, fruits, vegetables, fishery products
	Supply chain levels monitored	Retail, processor/distribution, farm
	Data frequencies	Weekly or monthly
	Spatial disaggregation	Survey concerning Food retail prices in selected EU capitals are published by each MS capital
	Conducive to purpose	n.a.
Data inputs		
	Qualitative data used	n.a.
	Quantitative data used	Cross-section price data (can be compiled into time series price data if consecutive tables are merged, manually)
	Information sources	Primary data collected from food retail stores, city markets, manufacturers/wholesalers, primary producers
	Data transparency	Moderate – raw data not available; for retail prices details are provided about frequency, cities and chains from which data are collected, for other supply chain levels (manufacturers/wholesalers, primary producers) this detail information is in harmonisation with the Statistics Department of Lithuania.
Monitoring results		
	Types of quantitative results	Average selling prices at retail (*p retail, out*), manufacturing/wholesale (*p processing or distribution, out*) and farm level (*p farm, out*); percentage change of prices; for some cases also prognosis of % price change for next month
	Types of qualitative results	None
	Prices monitored	(*p retail out*), (*p processing or distribution out*), (*p farm out*)
	Further quantities monitored	None
	Indicators published	None
	Reproducibility of approach	Methodology for data gathering is explained; methodology for calculating average selling prices is explained, f. e. http://produktukainos.lt/?mid=125,
	Calculation methods used	Methodology for calculating average selling prices is explained
	Form(at)s of numerical results	Cross-section tables
	Form(at)s of graphical results	n.a.
	Form(at)s of commented results	n.a.
	Intelligibility of results	High because the interpretation of the information that is presented is straightforward (product categories, units and time periods for which prices are provided are clearly indicated)
Results communication		
	User costs	Free of charge
	Time lag	Max. one month
	Intuitiveness of presentation	High because results contain: raw materials purchase prices, selling prices: manufacturers/wholesalers and retail market
	Knowledge transfer efforts	High because comparative illustrations are presented in semi-annual publication 'Lietuvos žemės ūkis: faktai ir skaičiai' *'Lithuanian agriculture: facts and figures'*, http://www.vic.lt/
Robustness assessment		
	Effort	Moderate – mainly primary data collection, minimal transformation of data
	Applicability	Moderate – substantial primary data gathering, methodology for data gathering and averaging is specified. The results are tailored to the needs of market analysts.
	Reliability	Moderate – methodology for data gathering is specified, representativeness of sample and methodology for averaging is verified
	Validity	Moderate – straightforward interpretation of presented data but data collection methodology can be assessed
	Flexibility	High – time lag almost non-existent
	Largest advantages	Detailed price data; practically no time lags so price data series are up-to-date; different supply chain segments are covered
	Largest disadvantages	No interpretation or background provided to the numerical information;

		methodology for data gathering and averaging cannot be assessed; substantial primary data gathering necessary
Comments		

	Name of approach in Engl. (code)	Sector reviews and statistical information **(LT2)**
Institutional context		
	Name of approach in nat. language & link	Sektoriaus apžvalgos ir statistinė informacija http://www.vic.lt/?mid=134
	Purpose/description	To implement the requirements of European Union legislation on the collection and reporting of information on the agri-food market to the European Commission and Eurostat; To meet the information needs of domestic consumers - state administration, municipal, statistical and other institutions and operators of the agri-food market; To monitor and analyse domestic and foreign markets (by sector: production, consumption, exports, imports, quantities and prices); To forecast situations in separate sectors on the domestic and foreign markets and to inform the state administration, municipalities and other institutions and the subjects of the agricultural and processing industry about the results.
	Name of the FPMM initiative	Agricultural Information and Food Market Information System
	Output form(at)s	Short (1 paragraph), ad hoc texts on website, summarising main developments in prices and other market developments for different supply chain levels as well as detailed statistical information compatible to FPMMA 'Prices of agricultural and food products'
	Output frequency	New entries are regular, according The publication of the statistical information calendar *(Statistinės informacijos skelbimo kalendorius) (published publicly),* http://www.vic.lt/?mid=53
	Duration of publication	Entries since 2004
Monitoring focus		
	Commodities/sectors	Meat, cereals and oilseeds, dairy, poultry, potatoes, fruits and vegetables, fishery products
	Supply chain levels monitored	Farm/producer, processor/retail
	Data frequencies	Several entries per year per sector
	Spatial disaggregation	No
	Conducive to purpose	Published information is conducive and meets the purpose. Published statistical information is based on data, collected to meet EU and national legal requirements as well as provide information for state administration. Disaggregation level of data and coverage of different market levels corresponds to other part of purpose related to market analysis and satisfaction of end user needs in statistical data.
Data inputs		
	Qualitative data used	n.a.
	Quantitative data used	Cross-section price information
	Information sources	Set by legislation and explained in methodical documents, data source is the same as in FPMMA 'Prices of agricultural and food products'
	Data transparency	According to national information security (confidentiality) legislation primary data cannot be published.
Monitoring results		
	Types of quantitative results	Nominal prices (*p farm, out*), (*p processing or distribution, out*), (*p farm, out*); price changes, price forecasts
	Types of qualitative results	Comments and interpretation provided with numerical information
	Prices monitored	Developments in prices [(*p retail, out*), (*p processing or distribution, out*), (*p farm, out*)] are summarised and discussed
	Further quantities monitored	Reviews also include other market/production indicators such as purchase or sales volumes/production volumes/imports & exports/consumption volume
	Indicators published	None
	Reproducibility of approach	Methodology for data gathering is explained; reviews provide summaries of main developments in the market, source for these summaries is provided
	Calculation methods used	n.a.
	Form(at)s of numerical results	Numerical results are presented in the web entries
	Form(at)s of graphical results	n.a.
	Form(at)s of commented results	1 paragraph texts including summary of main price developments but comments are limited in providing background
	Intelligibility of results	High because data tables have explanatory text below the table. All variables are explained, including specific information per variable. Market reviews include interpretations.
Results communication		
	User costs	Free of charge
	Time lag	Information published according to Statistical information calendar *(Statistinės informacijos skelbimo kalendorius) (published publicly),* http://www.vic.lt/?mid=53 https://osp.stat.gov.lt/informacijos-skelbimo-kalendoriai
	Intuitiveness of presentation	High because only main numbers are presented, main conclusions are already in the title, even without reading details the message is clear

	Knowledge transfer efforts	Moderate because main message is clear from title of web entry but developments are not expanded upon and no additional interpretation provided
Robustness assessment		
	Effort	Moderate – underlying raw data collection is probably extensive (see Lithuanian food price observatory) but web entries require little effort
	Applicability	Moderate –raw data not presented, according national information security (confidentiality) legislation
	Reliability	Moderate – depends on raw data collection, provided that underlying raw data are available, reliability is high because web entries merely summarise results.
	Validity	Moderate – depends on raw data collection
	Flexibility	High – although also depends on raw data collection but time lag is low
	Largest advantages	Short summary briefs; main message on recent market developments is immediately clear to interested parties; high reliability
	Largest disadvantages	Quality of the entries depends highly on the raw data collection; extensive raw data collection; raw data are not presented
Comments		

Source: Authors of this study.

	Name of approach in Engl. (code)	Food Price Monitor **(NL)**
Institutional context		
	Name of approach in nat. language & link	Voedselprijzenmonitor (Agrimatie) http://www.agrimatie.nl/Default.aspx?subpubID=2424
	Purpose/description	To publish research results with a focus on price developments of products at different levels of the food supply chain
	Name of the FPMM initiative	Wageningen Economic Research
	Output form(at)s	Website, including interactive graphs (Food price monitor) and exportable data files (Agrimatie – Data)
	Output frequency	Monthly
	Duration of publication	Since 2000 (variation possible depending on sector/commodity)
Monitoring focus		
	Commodities/sectors	Dairy, beef, pork, poultry, eggs (Food price monitor and Agrimatie – Data), bread, potatoes, fruits, vegetables (Food price monitor only);
	Supply chain levels monitored	Farm – processor/distribution – retail except for fruits and vegetables where only retail level is monitored
	Data frequencies	Monthly, quarterly, annually
	Spatial disaggregation	n.a.
	Conducive to purpose	Yes
Data inputs		
	Qualitative data used	n.a.
	Quantitative data used	Cross-section and time series data
	Information sources	Wageningen Economic research and CBS, raw data from farm accountancy network and monthly price observations among companies and institutions supplying goods and services to consumers
	Data transparency	Secondary data sources are mentioned; raw data can be downloaded to some extent (Excel tables with farm-level price data); exact methodology (weighting etc.) for calculation of price indices is not explained
Monitoring results		
	Types of quantitative results	Price indices (Food price monitor); farm gate prices (euro/unit) (Agrimatie – Data)
	Types of qualitative results	Commented interpretations of graphical representations
	Prices monitored	Agricultural price indices (API, *p farm out*); Producer price indices (PPI, *p processing out*); Consumer price indices (CPI, *p retail out*); farmgate prices (*p farm out*)
	Further quantities monitored	None
	Indicators published	Monthly and quarterly indices of consumer/producer/farmgate prices
	Reproducibility of approach	Not relevant for price data. For price indices: exact methodology (weighting etc.) is not explained.
	Calculation methods used	Not relevant for price data. For price indices: exact methodology (weighting etc.) for calculation is not explained.
	Form(at)s of numerical results	Downloadable excel tables (Agrimatie – Data)
	Form(at)s of graphical results	Interactive graphical presentations (food price monitor): time series data in both graphs and tables – only graphs are commented
	Form(at)s of commented results	Background information about chain and price formation beyond the quantitative information in the graphs
	Intelligibility of results	High – Food price monitoring graphs are clear and comments are informative and understandable also for non-specialist audience.
Results communication		
	User costs	Free of charge
	Time lag	Limited to max. two months
	Intuitiveness of presentation	High because interactive graphs give a clear picture of price developments across difference supply chain levels; comments provide additional background
	Knowledge transfer efforts	High because visualisation of results in graphs and additional comments given are useful; accessible to non-specialist audience
Robustness assessment		
	Effort	Moderate – calculation of price indices at different supply chain segments is data intensive
	Applicability	Moderate – main sectors are already covered, extension to other sectors may be difficult if necessary data are not yet collected
	Reliability	Moderate – methodologies can be replicated but ease of replication depends on data availability
	Validity	High – standard data and methodologies used (although information on exact calculation of indices is missing)
	Flexibility	High – time lag is limited

	Largest advantages	Intuitive representation of price information; concise provision of additional background for interpretation; price information provided for different supply chain levels
	Largest disadvantages	Price information across supply chain segments is limited to price indices; methodology for calculation of price indices is not explained; calculation of price indices at different supply chain levels is data intensive
Comments		

Source: Authors of this study.

	Name of approach in Engl. (code)	Food Dollar Series **(US1)**
Institutional context		
	Name of approach in nat. language & link	Food Dollar Series https://www.ers.usda.gov/data-products/food-dollar-series/
	Purpose/description	The food dollar series measures annual expenditures by U.S. consumers on domestically produced food. This data series is composed of three primary series—the *marketing bill* series, the *industry group* series, and the *primary factor* series—that shed light on different aspects of the food supply chain. The three series show three different ways to split up the same food dollar.
	Name of the FPMM initiative	United States Department of Agriculture (USDA)
	Output form(at)s	Figures, graphs, tables
	Output frequency	Once a year (or less, depending on commodity, e.g., fresh vegetables)
	Duration of publication	Since 1993, the same presentation format used over the whole period
Monitoring focus		
	Commodities/sectors	Various processed and raw commodities purchased by consumers, including fresh milk, processed dairy products, or sugar and sweets
	Supply chain levels monitored	Retailing
	Data frequencies	annual
	Spatial disaggregation	US as a whole
	Conducive to purpose	Fully
Data inputs		
	Qualitative data used	-
	Quantitative data used	• Annual input-output (IO) data published every even-numbered year by the Bureau of Labor Statistics; • Data from the 1997, 2002, and 2007 detailed U.S. benchmark IO accounts published by the Bureau of Economic Analysis (BEA); and • IO data published annually by the BEA.
	Information sources	Not provided under the figures/tables. They are provided in the 'Documentation section'
	Data transparency	Raw data not available
Monitoring results		
	Types of quantitative results	Nominal and real shares of individual supply chain stages in consumers' expenditures
	Types of qualitative results	None
	Prices monitored	None
	Further quantities monitored	Consumers' expenditures shares monitored
	Indicators published	Value shares in total annual food expenditures
	Reproducibility of approach	Methodology used is only generally described (e.g., IO analysis) with references to the articles used in the estimation technology. Therefore the results are not easy to reproduced
	Calculation methods used	No explicit formula; complex IO model estimations
	Form(at)s of numerical results	Recent time series data in tables; historical time series also downloadable
	Form(at)s of graphical results	Time series graphs and figures (not interactive)
	Form(at)s of commented results	Comprehensive, useful and easy to understand interpretations of the key values
	Intelligibility of results	High because food price monitoring graphs are clear and comments are informative and understandable also for non-specialist audience.
Results communication		
	User costs	Free of charge
	Time lag	2 years for most commodities
	Intuitiveness of presentation	High because clear and very intuitive presentation
	Knowledge transfer efforts	High because the results are presented intelligibly and are useful for non-specialist readers
Robustness assessment		
	Effort	Medium - annual data used. However, a lot of efforts needed to calculate the shares for different stages of the supply chain
	Applicability	Moderate - need of setting up comprehensive monitoring at EU level
	Reliability	Moderate - only results for the US as a whole presented. No regional details
	Validity	Moderate - missing regional disaggregation
	Flexibility	Moderate - comprehensive but calculated only annually (or even less frequent)
	Largest advantages	Intuitiveness; wealth of information; interpretations of the values provided
	Largest disadvantages	Aggregated results at the US level; annual updates might be too long for some sensitive commodities; there is a two-year delay in the published data

Comments

	Name of approach in Engl. (code)	Price Spreads from Farm to Consumer **(US2)**
Institutional context		
	Name of approach in nat. language & link	Price Spreads from Farm to Consumer https://www.ers.usda.gov/data-products/price-spreads-from-farm-to-consumer/
	Purpose/description	ERS compares prices paid by consumers for food with prices received by farmers for corresponding commodities. This data set reports these comparisons for a variety of foods sold through retail foodstores such as supermarkets and supercentres. Comparisons are made for individual foods and groupings of individual foods—market baskets—that represent what a typical U.S. household buys at retail in a year. The retail costs of these baskets are compared with the money received by farmers for a corresponding basket of agricultural commodities.
	Name of the FPMM initiative	United States Department of Agriculture (USDA)
	Output form(at)s	Excel tables; interactive charts also available
	Output frequency	Annual (either calendar or marketing year)
	Duration of publication	Generally from 2000, but there are also earlier editions for some commodities (e.g., fresh oranges since 1992/93)
Monitoring focus		
	Commodities/sectors	Various processed and raw commodities purchased by consumers, including e.g., orange juice, fresh broccoli or ice cream
	Supply chain levels monitored	Agricultural production and Retailing
	Data frequencies	Annual (calendar year or marketing year)
	Spatial disaggregation	US as a whole
	Conducive to purpose	Fully
Data inputs		
	Qualitative data used	-
	Quantitative data used	Under each table a list of SECONDARY sources provided
	Information sources	Sources documented, but links not provided
	Data transparency	Original data not available
Monitoring results		
	Types of quantitative results	retail price and farm value provided in nominal terms and indicators
	Types of qualitative results	None
	Prices monitored	p retail out, p farm out $P_{out}^{retail}, P_{out}^{farm}$
	Further quantities monitored	Retail – farm spread, and share of farmers $P_{out}^{farm} / P_{out}^{retail}$
	Indicators published	Farm share of consumers' expenditures (all commodities), farm to retail spread index relative to 2003 (some commodities such as milk and dairy basket)
	Reproducibility of approach	Low, because of unavailability of the underlying data
	Calculation methods used	No explicit formula; not clear what technical coefficients are used to break down the final product into farm inputs
	Form(at)s of numerical results	Time series data in tables
	Form(at)s of graphical results	Interactive time series graphs
	Form(at)s of commented results	No commented results, but explanatory notes provided at the end of tables
	Intelligibility of results	High because results clear and brief explanation provided.
Results communication		
	User costs	Free of charge
	Time lag	1 year
	Intuitiveness of presentation	High because clear and very intuitive presentation
	Knowledge transfer efforts	High because the results are presented intelligibly and are useful for non-specialist readers
Robustness assessment		
	Effort	Low - annual data used and the calculation procedures must be automated, biggest effort is data gathering
	Applicability	Moderate - need of setting up comprehensive monitoring at EU level
	Reliability	Moderate - only results for the US as a whole presented. No regional details
	Validity	Moderate - missing regional disaggregation
	Flexibility	Moderate - comprehensive but calculated only annually
	Largest advantages	Intuitiveness; wealth of information; a wide range of products (of different level of processing) covered
	Largest disadvantages	Aggregated results at the US level; no details provided how the aggregation to the US level is done; annual updates might be too long for some sensitive commodities

Source: Authors of this study.

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Annex IV: Overview of available data in the EU Food Price Monitoring Tool

Table IV.1 Availability of price indices (2010=100) in the FPMT at four stages in the supply chain for dairy products and pork, first observation to last observation, situation on August 10 2018

	Milk, cheese and eggs				**Whole milk**				**Cheese and curd**				**Pork**			
index 2010=100	agricultural commodity	processor	import	consumer	agricultural	processor	import	consumer	agricultural	processor	import	consumer	agricultural	processor	import	consumer
European Union (current composition)	10M01-17M12			05M01-18M03	10M01-17M12			16M12-18M03	10M01-17M12			16M12-18M03	10M01-17M12			16M12-18M03
European Union (before the accession of Croatia)	05M01-12M12			05M01-15M12	05M01-12M12				05M01-12M12				05M01-12M12			
Euro area (19 countries)				05M01-18M03				16M12-18M03				16M12-18M03				16M12-18M03
Belgium	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12			05M01-18M03	05M01-17M12			05M01-18M03	05M01-17M12			05M01-18M03
Bulgaria	06M01-17M12		05M01-18M03	05M01-18M03	06M01-17M12			12M12-18M03	05M01-17M12			12M12-18M03	06M01-17M12			12M12-18M03
Czech Republic	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12			14M12-18M03	05M01-17M12			14M12-18M03	05M01-17M12			14M12-18M03
Denmark	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12			09M12-18M03	05M01-17M12			09M12-18M03	05M01-17M12			09M12-18M03
Germany	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12		05M01-18M03	14M12-18M03	05M01-17M12		05M01-18M03	14M12-18M03	05M01-17M12		05M01-18M03	14M12-18M03
Estonia	05M01-12M12		05M01-18M03	05M01-18M03	05M01-12M12			15M12-18M03	05M01-12M12			15M12-18M03	05M01-12M12			15M12-18M03
Ireland	07M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12			16M12-18M03	05M01-17M12			16M12-18M03	05M01-17M12			16M12-18M03
Greece	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12			14M12-18M03	05M01-17M12			14M12-18M03	05M01-17M12			14M12-18M03
Spain	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12		05M01-18M03	15M12-18M03	05M01-17M12		05M01-18M03	15M12-18M03	05M01-17M12		05M01-18M03	15M12-18M03
France	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12		05M01-18M03	05M01-18M03
Croatia	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12			15M12-18M03	05M01-17M12			15M12-18M03	05M01-17M12			15M12-18M03
Italy	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12		05M01-18M03	09M12-18M03	05M01-17M12		05M01-18M03	09M12-18M03	05M01-17M12		05M01-18M03	09M12-18M03
Cyprus	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12			15M12-18M03	05M01-17M12			15M12-18M03	05M01-17M12			15M12-18M03
Latvia	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12				05M01-17M12			14M12-18M03	05M01-17M12			14M12-18M03
Lithuania	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12			15M12-18M03	05M01-17M12			05M01-18M03	05M01-17M12			05M01-18M03
Luxembourg	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12			14M12-18M03	05M01-17M12			14M12-18M03	05M01-17M12			14M12-18M03

Hungary	07M01-17M12		05M01-18M03	05M01-18M03	07M01-17M12			14M12-18M03	05M01-17M12			14M12-18M03	07M01-17M12			14M12-18M03
Malta	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12			15M12-18M03	05M01-17M12			15M12-18M03	05M01-17M12			15M12-18M03
Netherlands	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12			14M12-18M03	05M01-17M12			09M12-18M03	05M01-17M12			09M12-18M03
Austria	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12			12M12-18M03	05M01-17M12			12M12-18M03	05M01-17M12			12M12-18M03
Poland	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12			14M12-18M03	05M01-17M12			14M12-18M03	05M01-17M12			14M12-18M03
Portugal	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12			14M12-18M03	05M01-17M12			14M12-18M03	05M01-17M12			14M12-18M03
Romania	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12			16M12-18M03	05M01-17M12			16M12-18M03	05M01-17M12			16M12-18M03
Slovenia	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12			05M01-18M03	05M01-17M12			05M01-18M03	05M01-17M12			05M01-18M03
Slovakia	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12			15M12-18M03	05M01-17M12			15M12-18M03	05M01-17M12			15M12-18M03
Finland	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12				05M01-17M12			16M12-18M03	05M01-17M12			16M12-18M03
Sweden	05M01-17M12		05M01-18M03	05M01-18M03	05M01-17M12			13M12-18M03	05M01-17M12			13M12-18M03	05M01-17M12			13M12-18M03
United Kingdom	05M01-17M12		05M01-18M03	05M01-18M02	05M01-17M12		05M01-18M03	16M12-18M02	05M01-17M12		05M01-18M03	16M12-18M02	05M01-17M12		05M01-18M03	16M12-18M02

Annex V: Overview sources of price information used for Approach 1 and 2

Table V.1 Sources for monthly price indices (Approach 1 and 2)

		Farm level	Import/export	Wholesale	Processing	Retail
Bulgaria	Pigmeat	EU FPMT pork	Eurostat Comext	n.a.	n.a.	EU FPMT pork
	Dairy	EU FPMT Milk, cheese and eggs	Eurostat Comext	n.a.	estimated from import data	EU FPMT Milk, cheese and eggs
	Milk	EU FPMT Whole milk	Eurostat Comext	n.a.	estimated from import data	EU FPMT Whole milk
	Cheese	EU FPMT Cheese and curd	Eurostat Comext	n.a.	estimated from import data	EU FPMT Cheese and curd
	Apples	Eurostat Price indices of agricultural products, output (2010 = 100) - quarterly data [apri_pi10_outq]	Eurostat Comext	n.a.	n.a.	calculated from SAPI averages of weekly prices
France	Pigmeat	EU FPMT pork	Eurostat Comext	n.a.	Eurostat, Producer prices in industry, total - monthly data [sts_inpp_m]	EU FPMT pork
	Dairy	EU FPMT Milk, cheese and eggs	Eurostat Comext	n.a.	Eurostat, Producer prices in industry, total - monthly data [sts_inpp_m]	EU FPMT Milk, cheese and eggs
	Milk	EU FPMT Whole milk	Eurostat Comext	n.a.	Eurostat, Producer prices in industry, total - monthly data [sts_inpp_m]	EU FPMT Whole milk
	Cheese	EU FPMT Cheese and curd	Eurostat Comext	n.a.	Eurostat, Producer prices in industry, total - monthly data [sts_inpp_m]	EU FPMT Cheese and curd
	Apples	calculated from DG AGRI; EU prices for selected representative products	Eurostat Comext	Average of OFPM weekly data	n.a.	calculated from average of OFPM weekly data
Netherlands	Pigmeat	EU FPMT pork	Eurostat Comext	n.a.	Eurostat, Producer prices in industry, total - monthly data	EU FPMT pork

					[sts_inpp_m]	
	Dairy	EU FPMT Milk, cheese and eggs	Eurostat Comext	n.a.	Eurostat, Producer prices in industry, total - monthly data [sts_inpp_m]	EU FPMT Milk, cheese and eggs
	Milk	EU FPMT Whole milk	Eurostat Comext	n.a.	Eurostat, Producer prices in industry, total - monthly data [sts_inpp_m]	EU FPMT Whole milk
	Cheese	EU FPMT Cheese and curd	Eurostat Comext	n.a.	Eurostat, Producer prices in industry, total - monthly data [sts_inpp_m]	EU FPMT Cheese and curd
	Apples	calculated from DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	n.a.	n.a., EU FPMT data for Fruit used instead
Poland	Pigmeat	EU FPMT pork	Eurostat Comext	n.a.	n.a.	EU FPMT pork
	Dairy	EU FPMT Milk, cheese and eggs	Eurostat Comext	n.a.	estimated from import data	EU FPMT Milk, cheese and eggs
	Milk	EU FPMT Whole milk	Eurostat Comext	n.a.	estimated from import data	EU FPMT Whole milk
	Cheese	EU FPMT Cheese and curd	Eurostat Comext	n.a.	estimated from import data	EU FPMT Cheese and curd
	Apples	calculated from DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	n.a.	calculated from Statistics Poland monthly average prices

Table V.2 Sources for annual absolute prices (Approach 2)

		Farm level	Import/export	Wholesale	Processing	Retail
Bulgaria	Pigmeat	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	Eurostat Prodcom	Weighted average of Detailed average prices - 2015 [prc_dap15], 2016 and 2017 estimated with average annual price index 2016 and 2017 versus 2015
	Dairy	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	Eurostat Prodcom	Weighted average of Detailed average prices - 2015 [prc_dap15], 2016 and 2017 estimated with average annual price index 2016 and 2017 versus 2015
	Milk	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	Eurostat Prodcom	Detailed average prices - 2015 [prc_dap15], 2016 and 2017 estimated with average annual price index 2016 and 2017 versus 2015
	Cheese	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	Eurostat Prodcom	Detailed average prices - 2015 [prc_dap15], 2016 and 2017 estimated with average annual price index 2016 and 2017 versus 2015
	Apples	Bulgarian Statistical Institute; Prices of agricultural production (data series)	Eurostat Comext	n.a.	Eurostat Prodcom	Average of SAPI weekly data

France	Pigmeat	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	Eurostat Prodcom	Weighted average of OFPM prices, 2017 estimated with average annual price index 2017 versus 2015
	Dairy	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	Eurostat Prodcom	Weighted average of OFPM prices
	Milk	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	Eurostat Prodcom	OFPM; Lait 1/2 ecreme UHT
	Cheese	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	Eurostat Prodcom	OFPM; Emmental
	Apples	DG AGRI; EU prices for selected representative products, weighted with areas of apple orchards	Eurostat Comext	Average of OFPM weekly data	Eurostat Prodcom	Average of OFPM weekly data
Netherlands	Pigmeat	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	Eurostat Prodcom	Weighted average of Detailed average prices - 2015 [prc_dap15], 2016 adn 2017 estimated with average annual price index 2016 and 2017 versus 2015
	Dairy	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	Eurostat Prodcom	Weighted average of Detailed average prices - 2015 [prc_dap15], 2016 adn 2017 estimated with average annual price index 2016 and 2017 versus 2015
	Milk	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	Eurostat Prodcom	Detailed average prices - 2015 [prc_dap15], 2016 and 2017 estimated

						with average annual price index 2016 and 2017 versus 2015
	Cheese	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	Eurostat Prodcom	Detailed average prices - 2015 [prc_dap15], 2016 and 2017 estimated with average annual price index 2016 and 2017 versus 2015
	Apples	DG AGRI; EU prices for selected representative products, weighted with areas of apple orchards	Eurostat Comext	n.a.	Eurostat Prodcom	Detailed average prices - 2015 [prc_dap15], 2016 and 2017 estimated with average annual price index 2016 and 2017 versus 2015 for Fruit
Poland	Pigmeat	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	Eurostat Prodcom	Weighted average of Detailed average prices - 2015 [prc_dap15], 2016 adn 2017 estimated with average annual price index 2016 and 2017 versus 2015
	Dairy	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	Eurostat Prodcom	Weighted average of Detailed average prices - 2015 [prc_dap15], 2016 adn 2017 estimated with average annual price index 2016 and 2017 versus 2015

	Milk	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	Eurostat Prodcom	Detailed average prices - 2015 [prc_dap15], 2016 and 2017 estimated with average annual price index 2016 and 2017 versus 2015
	Cheese	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	Eurostat Prodcom	Detailed average prices - 2015 [prc_dap15], 2016 and 2017 estimated with average annual price index 2016 and 2017 versus 2015
	Apples	DG AGRI; EU prices for selected representative products, weighted with areas of apple orchards	Eurostat Comext	n.a.	Eurostat Prodcom	Statistics Poland

Table V.3 Sources for monthly absolute prices (Approach 2 when indices are lacking)

		Farm level	Import/export	Wholesale	Processing	Retail
Bulgaria	Pigmeat	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	n.a.	n.a.
	Dairy	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	n.a.	n.a.
	Milk	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	n.a.	n.a.
	Cheese	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	n.a.	n.a.
	Apples	n.a.	Eurostat Comext	n.a.	n.a.	SAPI
France	Pigmeat	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	n.a.	n.a.

	Dairy	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	n.a.	n.a.
	Milk	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	n.a.	n.a.
	Cheese	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	n.a.	n.a.
	Apples	DG AGRI; EU prices for selected representative products	Eurostat Comext	OFPM	n.a.	OFPM
Netherlands	Pigmeat	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	n.a.	n.a.
	Dairy	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	n.a.	n.a.
	Milk	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	n.a.	n.a.
	Cheese	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	n.a.	n.a.
	Apples	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	n.a.	n.a.
Poland	Pigmeat	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	n.a.	n.a.
	Dairy	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	n.a.	n.a.
	Milk	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	n.a.	n.a.
	Cheese	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	n.a.	n.a.

	Apples	DG AGRI; EU prices for selected representative products	Eurostat Comext	n.a.	Statistics Poland	Statistics Poland

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