Profit analysis in animal product supply chains

Exploratory research and proposal for a generic approach

Michiel van Galen and Robert Hoste

LEI
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In agricultural economic research, farm profitability is an ongoing area of research. Measuring farm profitability has been a concern for economists and policy makers, in relation to rural development and food security in both developing countries and developed economies. In the policy and public debate, developments at farm level are rightly linked to price and profit developments in other parts of the agricultural value chain. Frequently, questions are raised concerning the seemingly distorted relationship between price developments and income distribution at different stages of the supply chain. A number of studies have been performed into the relationship (transmission) of prices and the distribution of value added and profits. It is concluded that comparison of profit margins between different supply chains or products and/or product groups, between parts of a supply chain, between countries, and between companies is not a priori clear and unambiguous without a thorough analysis. This research aims to contribute to the development of a systematic approach for profitability analysis aiming to explain differences between countries, supply chains and supply chain stages. Insight into the relationship between supply chain structure and the level and distribution of profits in supply chains can be used to trace and remove bottlenecks in supply chains.

Key words: meat, dairy, eggs, supply chains, profit analysis

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Preface

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Comparison of profit margins between different supply chains or products and/or product groups, between parts of a supply chain, between countries, and between companies is not a priori clear and unambiguous without a thorough analysis.

This research contributes to the development of a systematic approach for profitability analysis aiming to explain differences between countries, supply chains and supply chain stages. Insight into the relationship between supply chain structure and the level and distribution of profits in supply chains can be used to trace and remove bottlenecks in supply chains.

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General Director Social Sciences Group - Wageningen UR

Summary

S.1 Key findings

From the analysis and literature we conclude that drafting a conceptual framework for profitability analysis in animal product supply chains is possible. It should include the following issues:

1. The choice of profit metric
2. The choice of data and sampling
3. The benchmark
4. The level of certainty required
5. The level of explanation required See Chapter 5.

S.2 Method

The basis for the analysis is a literature review. The literature review is intended to assess:

a. which measures of profitability are commonly used,
b. what the advantages and disadvantages of various profitability metrics are,
c. which factors may influence profits,
d. which data sources are available for analysing profitability in animal product supply chains.

Literature was collected from English and Dutch language online academic reference databases and internet searches, based on search terms like (but not limited to) ‘profitability’, ‘profit’, ‘performance’, ‘efficiency’, in combination with ‘meat’, ‘dairy’, ‘broiler’, and ‘eggs’, within the economic, business and social sciences domains. Some 50 references have been analysed. In addition we gathered data for a number of industries and countries to illustrate various aspects of profitability analysis using company financials databases. From the analysis we have abstracted a framework for profitability analysis in animal product supply chains. See Section 1.3.

1 Introduction

1.1 Background of the research

In agricultural economic research, farm profitability is an ongoing area of research. Measuring farm profitability has been a concern for economists and policy makers, in relation to rural development and food security in both developing countries and developed economies. It has been one of the reasons for the establishment of LEI Wageningen UR in 1940, and an important pillar of the European Union agricultural policy for decades. A major part of LEI work is related to the measurement of incomes at the farm level. Cost and revenue development and price developments are monitored to signal both temporary and structural problems at the farm level. In the policy and public debate, developments at the farm level are rightly linked to price and profit developments in other parts of the agricultural value chain. Frequently, questions are raised concerning the seemingly distorted relationship between price developments and income distribution at different stages of the supply chain. A number of studies have been performed into the relationship (transmission) of prices and the distribution of value added and profits. Since a few years, following EU recommendations and developments in a number of other EU countries, LEI and the Ministry of Economic Affairs in the Netherlands, have been monitoring price developments at different stages of the supply chain for a number of products in the Food Price Monitor (see: Food Price Monitor (LEI Wageningen UR, without year) and Oosterkamp *et al.*, 2013).

In the Netherlands, since 2000, a number of studies have been performed to measure profitability in agricultural production chains (Hoste *et al.*, 2004 for pig meat, Backus *et al.*, 2007; 2011 for pig meat, dairy, vegetables and fruit, and Baltussen *et al.*, 2014 for eight products including poultry meat and eggs). The aim of the analyses of Hoste *et al.* (2004) and Backus *et al.* (2007, 2011) was to determine differences in profitability between different stages of these supply chains. Backus *et al.* (2011) conclude that the primary production sector is characterised by a low return on equity capital. Except in the dairy supply chain, the returns on equity capital in the primary production stage in the considered time frame was negative. Profitability (measured as earnings before tax as percentage of the total turnover) in the other parts of the animal production supply chains amounted to 2 to 3%. Baltussen *et al.* (2014) analysed costs and margins in different stages of the supply chains and concluded that net margins in most stages of the supply chain were between 0 and 3%. They were not able to calculate net margins at the product level, as companies produce or trade different products, for which indirect costs are not easily separated.

In addition, Bunte *et al.* (2003, 2009), Bunte (2009), NMa (2009), and Baltussen *et al.* (2014) investigated price developments and price transmission in various food supply chains in the Netherlands. Baltussen *et al.* (2014) analysed price transmission in eight food product supply chains, of which poultry meat and eggs were animal product supply chains. The main research question was if price movements off-farm were transferred to the consumer and vice versa. In general, for most products relationships between price movements at different stages of the supply chain were established indicating at least partial price transmission. In a number of cases, prices are not fully transferred (e.g. price levelling at the supermarket) or not timely transferred. They also concluded that supermarkets react to each other's price movements rather than only react to price movements in other parts of the supply chain. This corresponds to findings of the Food Price Monitor.

In these and other studies of profitability of (groups of) companies in different parts of supply chains, several problems are encountered:

1. Data are often not publicly available, not complete or out-of-date;
2. Companies perform different activities in different branches, resulting in problems of attribution of costs and revenues to a specific branch of trade or product and/or product group;
3. Some of the company costs cannot be attributed to specific products (indirect or overhead costs), even if the company falls within a single branch of trade;

4. Companies are often part of larger groups, which do not report costs, revenues and profits at the level of the relevant company (consolidated accounts);
5. Vertically integrated supply chains aim to maximise profitability of the supply chain as a whole, rather than focusing on distribution of it within the supply chain, which could distort the analysis if compared with other companies that are not vertically integrated;
6. Representativeness of data for a specific branch (part of a supply chain) is often not clear.
7. The relevant measures of profitability may differ from one part of the supply chain to another. Usually at farm level, some measure of farmer income is evaluated whereas at the level of the wholesaler or retailer firm (net or before-tax) profits are evaluated. Often, there is no a priori reason to assume that these measures of profitability and income can be compared.

Interpretation of the results is therefore not unambiguous. After determining an average profit margin, it should be evaluated if such a margin is high or low, given the specific situation. For example, it cannot be expected that margins in breeding, with large investments in R&D and high risks of project failure, are equal to those in primary production or wholesale trade with a totally different risk profile. This results in the conclusion that comparison of profit margins between different supply chains or products and/or product groups, between parts of a supply chain, between countries, and between companies is not a priori clear and unambiguous without a thorough analysis.

1.2 Aim

The aim of this study is to suggest a framework for profit analysis in animal product supply chains. In order to develop this framework, we study the literature on (methods for) profitability analysis in animal products supply chains. The investigation leads to a) insights into used methods and parameters for profitability analysis, b) insights into opportunities and impossibilities of available data and methods, c) an approach towards systematic profitability analysis for different countries and supply chains, d) more insight into profitability levels in different parts of animal products chains.

Eventually this research contributes to the development of a systematic approach for profitability analysis, explaining differences between countries, supply chains and supply chain stages. Insight into the relationship between supply chain structure and the level and distribution of profits in supply chains can be used to trace and remove bottlenecks in supply chains.

1.3 Method

The basis for the analysis is a literature review. The literature review is intended to assess a) which measures of profitability are commonly used, b) what the advantages and disadvantages of various profitability metrics are, c) which factors may influence profits, d) which data sources are available for analysing profitability in animal product supply chains.

Literature was collected from English and Dutch language online academic reference databases and internet searches, based on search terms like (but not limited to) ‘profitability’, ‘profit’, ‘performance’, ‘efficiency’, in combination with ‘meat’, ‘dairy’, ‘broiler’, and ‘eggs’, within the economic, business and social sciences domains. Some 50 references have been analysed. In addition, we gathered data for a number of industries and countries to illustrate various aspects of profitability analysis using company financials databases. From the analysis we have abstracted a framework for profitability analysis in animal product supply chains.

1.4 Structure of the report

In Chapter 2 a brief summary of commonly used profitability metrics is given. In Chapter 3 the results of the exploratory data analysis using data from Orbis is presented. Chapter 4 gives a summary of the literature review. In the last chapter, the proposed profit analysis framework is presented.

2 Profitability as accounting metric

In accounting, profit (or (firm) income, earnings) is defined as the excess of revenues over expenses (Horngren *et al.*, 1993). Revenues are gross increase in assets (e.g. cash) from delivering goods or services. Expenses are gross decreases in assets from delivering goods or services. Profitability is defined as the ability of a company to earn profits. Companies generally aim to make a profit and companies that earn negative profits for sustained periods of time ultimately go out of business. In accounting there are numerous metrics of profitability. Some of the most widely used profit metrics are net income, operating profit and gross profit (margin), and associated ratios like profit margin, return on sales, return on equity, return on assets, and return on investment. These concepts are briefly described below.

Without going too much into detail we will give a short overview of several commonly used profitability metrics. In Figure 2.1 below a simplified income statement (profit and loss statement, statement of earnings) is given to illustrate the various metrics. Note that we sometimes use the terms costs and expenses interchangeably here, where formally they are not the same: Expenses are actual payments and costs could also be stored within the firm in the form of assets.

Revenues		Expenses		Profit metric
Sales or revenues [S]	-	*Costs of goods sold [COGS]*	=	**Gross earnings or gross profit**
	-	*Other indirect expenses [OC]*	=	**EBITDA** (earnings before interest, taxes, depreciation and amortisation)
	-	*Depreciation [D] and Amortisation [A]*	=	**Operating profit or EBIT** (earnings before interest and taxes)
+ Financial revenue [FR], including interest received	-	*Financial expenses [FE], including interest paid*	=	**Profit or earnings before tax (EBT)** (earnings before taxes)
	-	*Income Taxes [TAX]*	=	**Net income, net earnings or profit, profit or earnings after tax, net income after tax, 'Bottom Line'**

Figure 2.1 *Simplified overview of a profit and loss statement with several income or profit metrics. Sources: Bureau Van Dijk Orbis database user guide, Horngren et al. (1993), and http://www.investopedia.com/*

Net income (or net earnings or simply profit) is defined as all revenues minus all expenses. It is often called the 'Bottom Line' and refers to the money left to pay to the (common) shareholders. The *profit margin* is calculated as net income divided by sales (or operating revenue). Sales are identical to turnover minus other operating revenue minus stock variations. The terms sales, (operating) revenue and turnover are often used interchangeably. Profit margins indicate the company's net earnings per euro of sales. Other profit margin metrics include e.g. 'gross profit margin,' 'operating margin' (or 'operating profit margin'), and 'pre-tax profit margin'.

Gross profit at the other end of the table is a company's total operating revenue (or sales) minus the cost of goods sold. Gross profit is the profit a company makes after deducting the costs associated with making and selling its products or services. Gross profit is also called 'gross margin', 'sales profit' or 'gross income'. The *gross profit margin* is gross profit divided by sales (or operating revenue). Gross profit is a measure of the company's efficiency in using labour and intermediate supplies. Under variable costing (not allowed in external reporting), it looks only at variable costs, which vary with production volumes. Fixed costs or costs that must be paid regardless of the level of output are not included under variable costing. Such fixed costs include e.g. advertising, insurance, overhead costs of employees that are not involved in production, and other overhead costs. Under (local) GAAP

accounting rules, full costing or absorption costing is required for external reporting. Rent and other (fixed) period costs (fixed manufacturing overhead) are assigned to each unit of production under absorption costing. This can differ with IFRS accounting principles of the EU and other countries, where there is no fixed rule for the determination of the unit of accounting costs. In the Netherlands, a Dutch local GAAP set of rules is used, or companies can choose to apply IFRS. It must be noted that differences in accounting principles and costing methods can make comparisons between companies and sectors in different countries, based on gross profit and other profit metrics, a tricky undertaking. Most databases with company financial data, including Bureau van Dijk Orbis and Amadeus databases, indicate (whenever possible) which accounting practice is used, but that does not disclose all differences between systems of local GAAP.

Another profit metric is *operating profit or EBIT, earnings before interest and taxes*. This metric calculates the profit earned from the company's normal business operations. It does not include financial losses and profits or interest and taxes or subsidies. This metric is also known as operating income. Dividing EBIT by sales gives *Return on Sales (ROS).* Subsidies and taxes on products (output) are generally added to or deducted from revenues and subsidies (or taxes) on production costs or investments are deducted from costs and included in operating profit.

EBITDA is earnings before interest, taxes, depreciation and amortisation. EBITDA is an indicator of a company's financial performance which is calculated as revenue minus operating expenses and other costs. It is net income plus taxes, interest paid, depreciation and amortisation. This metric is often used to compare profitability between companies and industries because it eliminates (most of) the effects of financing and accounting decisions taken by companies. A drawback is that EBITDA is a non-GAAP measure which means that there is no fixed format regarding the choice of costs and revenues to be included. Companies may also change the way in which their EBITDA is calculated from one reporting period to the next, particularly with respect to non-recurring items. If, however, EBITDA (and EBID) are presented as the company's performance measure,

> 'EBIT or EBITDA should be reconciled to net income as presented in the statement of operations under GAAP. Operating income would not be considered the most directly comparable GAAP financial measure because EBIT and EBITDA make adjustments for items that are not included in operating income'.[1]

EBITDA is often used as an accounting gimmick to dress up a company's earnings. When using this metric, it is important to focus on other performance measures as well to make sure the company is not trying to hide something with EBITDA.

The above profit margins are expressed as a percentage of sales (total revenues). Another way of looking at firm profitability is looking at the profits in relation to capital invested or total assets. *Return on Equity (ROE)* is a measure of the amount of net income the firm generates with the money that shareholders have invested in the firm. Shareholder's equity is equal to the value of the firm's assets minus the value of the firm's liabilities. The shareholder's equity may in some cases be averaged over the fiscal year by added the beginning of the year and end of the year value of shareholder's equity and dividing by two, and hence calculating return on average shareholder's equity. In cases where the number of shares has changed, the weighted average of the number of shares times the beginning and end of period share price is used to calculate average shareholder's equity. Note that return on equity does not necessarily mean that shareholders are actually paid this return in dividend. Only preferred shares are paid fixed dividend, but these dividends are subtracted from net income before calculating ROE.

Return on Assets (ROA) (sometimes called return on investment, but not to be mistaken for Return on (Invested) Capital RO(I)C) is calculated as net income divided by total assets. Total assets are the sum of all capital invested in the company, either by borrowing (liabilities) or by shareholders (equity).

[1] https://www.sec.gov/divisions/corpfin/faqs/nongaapfaq.htm#ebit

ROA measures the efficiency of a company in the use of its assets. It can be used for comparing competing companies in the same industry, but it will vary a lot between industries. Return on assets gives an indication of the capital intensity of the company. Companies with larger initial investments often have lower return on assets. ROAs over 5% are generally regarded as good.

Numerous other measures of profitability can be constructed by dividing various profit metrics (whether or not including interest, taxes, depreciation and amortisation, dividends, fixed costs and other items of the income statement), by various components of the balance sheet or income statement like capital invested, common stock, current liabilities, total liabilities, etc.

3 Exploratory data analysis

3.1 High and low earning industries

Figure 3.1 shows weighted average 2009-2013 operating profit (EBIT) margin and pre-tax profit (EBT) margin in a large number of industries in the Netherlands. The chart shows that profit margins differ a lot between industries.

Research shows negative average profit margins for the whole period 2009-2013. Air transport showed negative profit margins in some years. Energy companies had negative pre-tax profit margins in 2012 and 2013, but positive (8 and 10%) operating profit margins in the same years. This indicates financial and/or extraordinary losses. The same picture of significantly lower pre-tax profits than operating profits is visible in telecommunications, waterworks, water transport services, waste treatment and recycling, publishers and graphical and paper industry, and tobacco companies.

Many of these industries are (former public) utilities companies. These companies often have to maintain large network infrastructures like e.g. power grids or water systems. Depreciation on these systems costs many resources, but that should already be excluded in operational profit. It seems that these companies have large financial losses or one-time costs, reservations or extraordinary losses in this period. Telecommunications companies have invested large amounts of money on purchasing frequencies for next generation mobile telephone networks.

This shows how the very nature of industries and extraordinary costs can have large effects on profit margins. These costs, however, are real and necessary. Based on the data for this period, we cannot conclude that (privatised) utilities companies have lower or higher profit margins than other industries. But we do conclude that their operating profit is much higher than their pre-tax profit or net income. Comparing them with other industries on the basis of operating profit would classify these industries as much higher earning industries then comparing them with other industries on the basis of pre-tax profit. In general, companies that have higher investments and depreciation or amortisation costs require higher gross profits to pay for these costs.

Publishers, the graphical industry and paper industry have seen a relatively large decrease in sales in the period 2009-2013. Such a prolonged decrease in sales is accompanied by losses on financial assets and extraordinary depreciation of capital assets. These examples show how a general decline (or growth) of an industry can cause large deviations between operating (and gross) profit and pre-tax income (and net income).

In the case of tobacco, industry turnover is decreasing considerably, with exceptionally high operating profits in 2009 (32%), and low pre-tax profits of 5% in the same year. Between 2010 and 2013 both average operating profit and pre-tax profit margins of tobacco companies were between 8% and 13% and increasing. Here, a change in accounting practices of levies on sales of tobacco is probably causing a large shift in operating profit.

The oil industry (cracking and processing of oil) reported very low to negative profits. However, oil extraction reported high average operating and before tax profit margins of about 18%. This example shows how vertically integrated companies in interrelated industries can shift profits from one activity to another. This is not just a temporary situation. In the period 2000-2005 the same differences in profits between oil extraction and oil industry are visible. Oil prices were increasing over both periods, with average oil prices more than twice as high in 2014 than in 2005. In both periods oil prices increased while average operating profit of oil extraction companies decreased from about 22% to 16%. This was largely due to the fact purchase costs of the oil (which are the largest part of costs of extracting oil) increased somewhat more than turnover. Probably some internal settlement occurs where oil extraction companies pay their parent company a rate for the oil they extract which is

coupled to the price of crude oil. Somehow between 2005 and 2009 oil extraction companies managed to increase operating profits back to 2000 levels even while oil prices were still increasing. These oil price increases did not really affect the distribution of profits between oil extraction companies and oil industry, which often are different parts of the same companies.

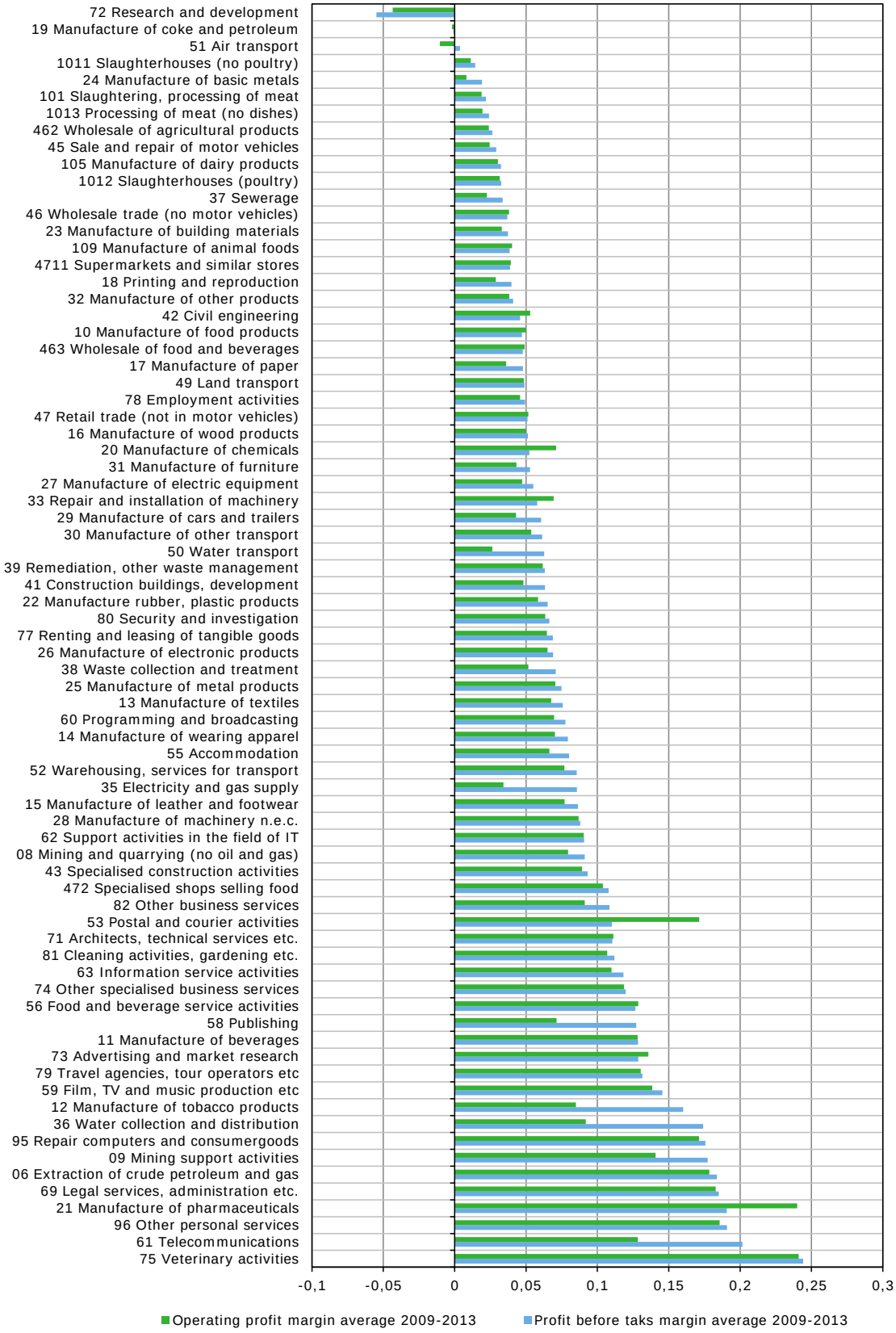

Figure 3.1 *Operating profit margin and before tax profit margin in the Netherlands, average of 2009-2012*

Source: CBS Bedrijfsleven; arbeids- en financiële gegevens, per branche, SBI 2008.

Average profit before tax was notably higher than operational profit margin in e.g. pharmaceutical industry, chemical industry and postal and courier services. The industries that reported the highest pre-tax profits were the pharmaceutical industry and veterinary services. Repair of consumer products, services for the extraction of minerals, legal services, and other personal services also reported relatively high pre-tax profit margins. Some of these industries are knowledge intensive and require relatively high research and development expenditures and investments. Also the structure of the industry in terms of ownership and personal investments of these owners will influence the profit structure. In veterinary services and legal services owner-managers will often work in relatively small partnerships and have generally invested personally in buy-in into the company, education and building the business. These investments are repaid from net income of the company. In larger companies managers are often just employees instead of owners and shareholders do not invest in education and building a business.

3.2 Variation across companies

If variation across industries is high, what about variation across companies within a single industry? From the Orbis database of Bureau van Dijk we extracted data for a number of industries including Production of meat and poultry meat products, Processing and preserving of meat (shortened to Processing and preserving of meat in the table below), Wholesale of meat and meat products and Retail sale of meat and meat products in specialised stores, for Brazil, the Netherlands, and Spain.

First, we must mention that the number of observations of companies with reported turnover and profits is very limited for Brazil and the Netherlands, specifically for retail trade. This is due to financial reporting requirements, where small companies are not required to file detailed financial data on profit and turnover. Table 3.1 shows descriptive statistics for turnover weighted pre-tax profit margins in 2013, as calculated from Orbis data.

Table 3.1
Descriptive statistics for pre-tax profit margin (in %) weighted by share in turnover, 2013

		Mean	Max.	Min.	S.D.	SE Mean	Unweighted Count
Brazil	Processing and preserving of meat	3.84	17.76	-76.66	3.28	0.77	18
	Wholesale of meat and meat products	-35.42	12.34	-54.85	33.00	16.50	4
	Retail sale of meat and meat products in specialised stores	3.01	3.01	3.01			1
Netherlands	Processing and preserving of meat	0.59	11.73	-5.92	1.90	0.51	14
	Wholesale of meat and meat products	2.63	23.33	-1.36	2.44	0.45	29
	Retail sale of meat and meat products in specialised stores	1.35	1.35	1.35			1
Spain	Processing and preserving of meat	1.41	90.79	-97.73	5.28	0.12	1943
	Wholesale of meat and meat products	0.93	86.68	-95.40	5.40	0.12	2052
	Retail sale of meat and meat products in specialised stores	0.02	96.67	-98.80	5.33	0.13	1571

Source: Orbis database Bureau van Dijk, calculations LEI. Observations were weighted by turnover as a fraction of total turnover reported in the country by industry subsample. In that way standard deviations and standard errors of the mean are not biased by weighting.

Profit margins can vary a lot. In theory, a company with zero turnover that makes an operational loss or financial profit or loss can have an infinitely high positive or negative profit margin. The number of observations for Spain is quite high, as many small companies are included in the Spanish data. These companies sometimes exhibit profits or losses close to 100% of turnover. By contrast, in Brazil, only 4 meat wholesale companies reported financial data (for a total of only 49 million euros turnover in 2013). The mean profit margin of -35% is presumably by no means representative for the whole meat wholesale industry in Brazil.

Standard errors of the mean are much smaller than standard deviations, but nevertheless can be quite substantial when the number of observations is small. Larger standard errors of the mean indicate uncertainty about the true mean of the population of firms. E.g. in 2013, the standard error of the mean of pre-tax profit for the meat processing industry in the Netherlands, as calculated from the available data in Orbis, was 0.51% (weighted by share in turnover of industry/country). This indicates that with 95% probability the true mean of the pre-tax profit margin in 2013 lies between 0.59 and +/- 1.96 x 0.51 = -0.41 and +1.58.

The number of companies varies greatly over the years. For the most recent year 2015, at the moment of writing, only a limited number of companies were present in the Orbis database. But also for 2014 many company data are still missing. It is known that some companies in some countries rather pay a fine than file financial statements that other companies can use to assess the competition. Therefore, databases with financial statements are always to some extent incomplete.

Differences between larger and smaller companies may exist. In theory, smaller companies may be more (or less) profitable because they are active in more (or less) profitable industries. They could be more profitable because they have fewer overhead costs of management and control. Start-ups are usually associated with lower profits as they generally have higher (start-up) costs and lower sales. On the other hand, larger companies may be more profitable because they can exploit economies of scale or e.g. exercise market power against suppliers and customers. From the data that we have analysed we found evidence of correlation between company turnover and profit margins in both directions. For the Dutch meat processing and preserving industry, correlation was predominantly negative in the 2010-2014 period, indicating that smaller companies (weighted by share in total turnover) had higher average profit margins.

We conclude from this section that variation in profits across companies is large. Variation can be extremely large when only a limited number of companies are included (as illustrated by the case of meat wholesaling for Brazil) or when a large number of relatively small companies are included (as illustrated by the case of Spain).

3.3 Variation across periods

In the figures below, average profit is reported for the meat processing industry in the Netherlands, from both Statistics Netherlands (CBS), and our own calculations from Orbis. On the whole, Orbis pre-tax profit (orange line) tracks CBS pre-tax profits for the whole meat processing and preserving industry (dark green line) quite well. We can see the differences between the processing industry excluding poultry (lower blue line) and poultry slaughtering (upper grey line). We did not calculate separate profits for these two branches from Orbis. Including or excluding one of these companies may however seriously affect our estimates. In 2013 our estimate is off by about 0.7%.

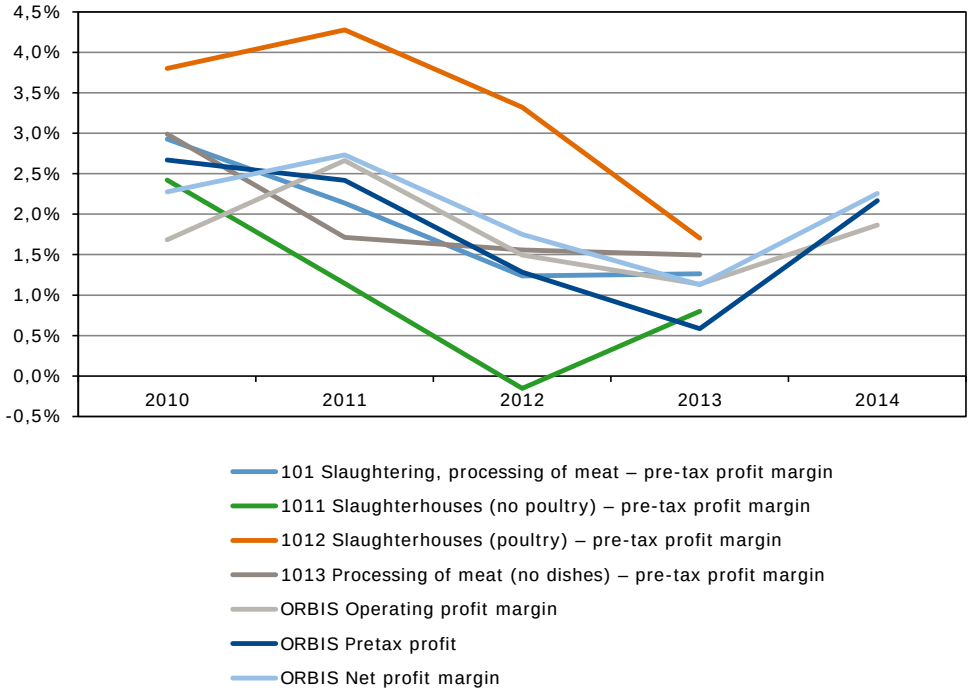

Figure 3.2 *Average pre-tax profit margin in the meat processing and preserving industry in the Netherlands*
Source: Statistics Netherlands (CBS), Orbis database Bureau van Dijk.

To see just how large variation across years is in the meat processing industry in comparison to variation across companies, we take a look at the variation within a year and see whether variation across years is significantly large. In Figure 3.3, the standard errors of the mean for the given years are plotted as error bars. This would represent a 67% confidence interval for the mean of the given year. The 95% confidence intervals are twice as large. We can now see that the drop in pre-tax profits in our calculations from Orbis is not significant as it does not fall outside the 95% confidence intervals for both years. Independent samples T-test between 2010 and 2013, and 2013 and 2014 confirm that these changes between the periods are not statistically significant.

The meat processing industry is not the most volatile industry in terms of profits. The pharmaceutical industry average pre-tax profits showed 42 times more variation (in terms of standard deviation) over the 2009-2013 period than the wholesaling industry, which is the least volatile industry (at 2-digit level). The meat processing and preserving industry's (industry code 101) profit margin was about 3 times more volatile than wholesaling.

OLS regression of average operating and pre-tax profit margin per industry (from CBS) and variation (standard deviation) over the years 2009-2013 reveals that higher variation of profits over the years is associated with higher average profits. This makes sense if we consider that firms that face higher risks suffer from larger swings in profits and at the same time require a higher average profit margin to attract investors. Pharmaceutical companies invest large amounts of money in research on new medicine without any guarantee of success.

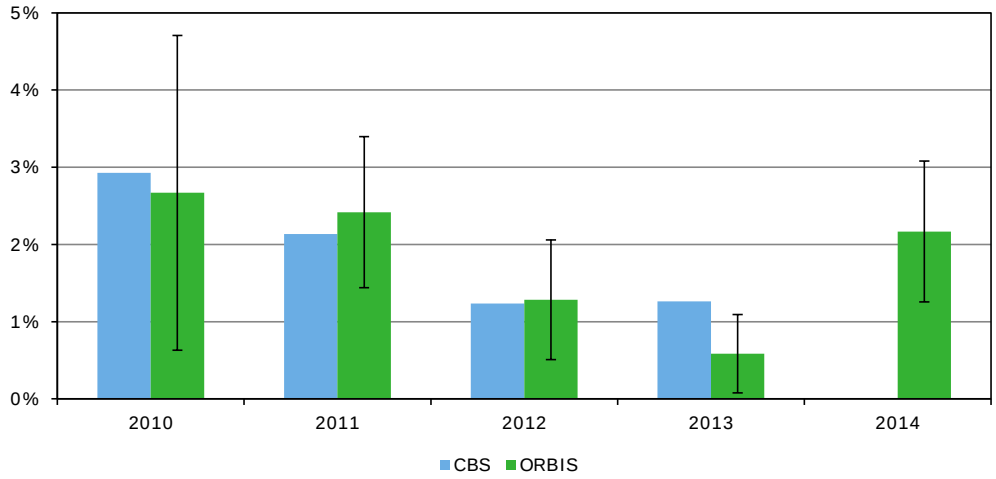

Figure 3.3 *Average pre-tax profit margins in the meat processing and preserving industry in the Netherlands, from Orbis and from CBS, and standard error of the mean for the Orbis data, weighted by turnover share*
Source: Statistics Netherlands (CBS), Orbis database Bureau van Dijk.

3.4 Conclusions

From the paragraphs above it is clear that taking one profit metric or another may have large implications, especially when comparing groups of companies from different industries. In general, companies in different industries often have very different business models and costs structures. A comparison of their profit margins is relatively meaningless without further reference to these differences or benchmarks for comparison. When comparing profits over time, it is always advised to assess both the profit itself (money value) and the margin (percentage). It is possible that profits are increasing while profit margins are decreasing and vice versa. The following conclusions can be drawn from the exploratory analysis above:

1. Regarding variation across industries:
    a. Higher investment costs (e.g. for network infrastructure) causes higher costs of depreciation and/or amortisation. This requires higher average gross profits. The amount of knowledge and specific investments needed to build a particular business is positively related to the amount of gross profit needed to cover for these costs.
    b. Industries in decline will generally have lower profit margins and also may exhibit larger differences between gross profits (and operating profit) and pre-tax profits (and net income), due to extraordinary reservations for company restructuring or losses on capital investments.
    c. Changes in tax policies or accounting practices may seriously affect the level of profits reported.
    d. Industries that are vertically integrated may lose money on one activity while making a profit on another activity. Internal settlement systems may seriously affect profits of these vertically integrated companies, making a comparison with other industries difficult.
    e. Industries that exhibit more risk e.g. due to high costs of research and development will generally require higher gross earning and operational profits to pay for such costs and attract investors.
    f. The ownership structure may also influence profits. In industries like personal, legal and veterinary services, owners are often also managers who work in small partnerships. Their personal investment in terms of education, buy-in in the company, and business development will have to be paid from net income of the company. One could argue that farmers are also owner-managers who often work in small partnerships in which they invest time and money. What discerns farmers from entrepreneurial lawyers and veterinarians may be that the latter have more distinctive features that set them apart from other market competitors. Another important difference may be in the way that profits are calculated, where in the farming sector

(often) the income of the entrepreneur is calculated in net income, whereas in net income of the legal services industry (often) net income is what remains as earnings for the entrepreneurs.

2. Regarding variation across companies:
   a. Profits can be infinitely positive to infinitely negative and everything in between. In reality profits do differ a lot between companies in the same industry. If the number of observations for a specific industry in a specific country is limited and there is a lot of variation between the companies, estimates of average company profits will probably be biased. Thorough analysis of the included firms, the confidence intervals and caution when reporting is required in such circumstances.
   b. When variation between companies is large, increasing the number of observations may be possible by searching for individual companies that should be included in a certain industry but may not have been classified right in the database.
   c. The number of observations in the Orbis database varies from one year to another. The most recent year is generally not complete enough to calculate accurate estimates. Nevertheless, these databases provide more recent data than aggregated data from statistics offices. In any case, individual company data provide better understanding of the variation in company profits and the causes of unusual deviations from the long-term trend or average.
   d. Extremely high or low profits are more often reported by smaller companies than by larger companies. Including smaller companies (e.g. because the data are available as it is for Spain) will then influence the variation and accuracy of the estimates. When comparing two or more countries with different sample populations, these effects should be taken into account.
   e. There may be a difference in the level of profit margins between larger and smaller companies. From the data that we have analysed we conclude that differences may exist in both directions. When comparing industries in different countries, thought will have to be given to the possibility that differences may be explained by a difference in the average size of companies. The same holds for comparing companies and industries from different stages of the supply chain.
3. Regarding variation across time:
   a. Industry and company profits may fluctuate, shift or gradually change over time. These changes may be caused by both demand and supply changes.
   b. For the case of meat processing and preserving industry in the Netherlands we were able to establish a good fit of profits estimated from just a limited number of individual company data from Orbis and official statistics from CBS. It is however not probable that such a close fit will be found for all industries and countries. Removing outliers and appropriate weighting schemes are required.
   c. Decreases or increases in profits over time are not always statistically significant, especially when the number of observations is low. However, if we have established that the calculated means are good approximations of historical official statistics, we can be quite confident that estimations of new periods will be fairly good estimates too.
   d. Higher variation in profits over time is associated with higher average profit margins. These industries tend to be more risky and require higher profits to attract investors.

4 Literature review: profits in animal products supply chains

The purpose of this research is to give an overview of how other researchers perform profit analyses and explore the options and best-practices of profit analysis for animal products value chains. From the literature we intend to find answers to the following research questions:

1. Which measures of profitability are commonly used?
2. What are the pros and cons of the various measures of profitability?
3. Which factors influence profitability and how are these factors measured?
4. Which data sources are available for profitability analysis in the various countries?

4.1 Profits and price spreads

A wide range of studies about profitability and related subjects of animal products (meat, eggs and dairy) have been performed in the past. In the references chapter a number of recent studies are presented that report profitability metrics in any of the industries (supply chain stages) of meat and animal product supply chains.

4.1.1 Profits in food supply chains

Almost all of the studies included in this literature review focus on profitability in one of the supply chain stages without comparing profitability between stages. Studies that report profitability in different stages of the supply chain focus e.g. on price transmission, supply chain efficiency or logistics. Scientific studies that focus solely on profitability are quite rare. Most research is related to the relationship between profitability and e.g. sustainability or various production systems.

Backus *et al.* (2007 and 2011) focus on calculating profitability in a number of food supply chains and calculate profitability on the basis of return on assets, return on equity, and (pre-tax) profit margin. For the primary sector, profit is calculated as family income from farm operations. Whether or not the labour hours of the farmer are included as costs, valued at the basis average wages of managers in collective wage agreements in the agricultural sector, does influence the results substantially. When labour costs of entrepreneurs are included as if they were employees, profitability is much lower and mostly negative for the primary sector. In general, return on equity of primary producers is much lower than of processors and distributors (wholesale and retail). However, this includes the costs of labour of the entrepreneurs in the primary sector. Pre-tax profit margins of processors, wholesalers and retail were around 2-3% in 2005-2009, while ROE were around 15-22%. The plant breeding sector has higher profit margins and ROE of 15% and 25% in the same period.

The difference in ROE between the primary sector and the other sectors, can to some extent be explained by a) including the cost of labour of the entrepreneur in the primary sector, b) the difference in costs of equity where shareholders in non-primary stages of the supply chain demand higher profitability, c) a difference in the riskiness of investments in R&D where e.g. plant breeding is characterised by much higher investments in R&D in which a higher net income is required to pay for future investments in R&D, d) differences in market structure and market power. The studies of Backus *et al.* (2007, 2011) do not investigate these differences further. The relatively low pre-tax profit margins of 1-3% for food retailers (supermarkets) were confirmed for the period 2011-2013 in Baltussen *et al.* (2014).

Keramidou *et al.* (2013) studied efficiency and profitability in a two-stage production system. In such a system, increased efficiency (and profitability) in the second stage could imply a reduction in outputs from the first stage. They study this interrelationship by performing DEA analyses where outputs from the first stage are inputs for the second stage.

Guillen *et al.* (2015) estimate profitability of the EU aquaculture sector. They explain that few studies have been performed that estimate profits in European aquaculture, with sometimes contradicting results. They use the Amadeus database to estimate profits and conclude that their method is simpler and more efficient than that of Ernst and Young in 2008, Framian in 2009, and European Commission's Scientific, Technical and Economic Committee for Fisheries (STECF) in 2012 and 2013. All studies use EBIT as a profitability metric. From the article it is clear however that there are differences in the way EBIT is calculated.

> 'The difference in the EBIT estimation is because the Amadeus database follows a firm financial accounting perspective (EBITFIN), while the STECF reports follow a more economic perspective (EBITECO), as it aims to know strictly the aquaculture sector's economic performance (EC 1998; STECF 2011).' (Guillen *et al.*, 2015)

They calculate average EBIT margins from Amadeus for EU countries for 2006, 2009, 2010 and 2011 for all companies available in the respective years and also for those years for only the companies that are present in the database for multiple years. The results are fairly robust. The estimates from Amadeus differ greatly from those of Ernst and Young, Framian, and STECF. A large part of the difference is attributed to the way EBIT is taking extraordinary profits and losses into account, which it does in Amadeus and does not in the data used by the other sources. Also, in Amadeus, the imputed costs of unpaid labour are not included in EBIT while they are calculated in the other sources.

Guillen *et al.* (2015) acknowledge that Amadeus only holds financial records for companies of a certain size and that smaller firms are misrepresented.

> 'Despite this limitation, the panel has an overall high coverage in terms of turnover (75%) and includes also freshwater aquaculture. The availability of data for individual companies over time also provides the unique opportunity of examining the performance trend during last years. Moreover, sometimes data from large companies cannot be reported inside the STECF statistics due to confidentiality issues or companies not willing to collaborate. Therefore, the consideration of data from the Amadeus panel while representing a large share of the EU aquaculture turnover could represent a bias if profitability is shown to be dependent (affected) from the turnover. There could be some economies of scale so that the largest companies with highest turnover could exploit and obtain larger profits.'

The authors check for this bias and conclude that there is no significant relation between turnover and profit margin for EU aquaculture (large and medium) companies. These findings are consistent with our own finding in chapter 3.

Guillen *et al.* (2015) note that the turnover of the Amadeus selected companies in many cases exceeds the value of production reported in FAO statistics. A relevant proportion of turnover is thus generated from other activities than aquaculture production. However, the profitability of the aquaculture sector is, according to the authors, to a large extent similar to other food production sectors. Most companies will exploit activities in broadly related industries.

Nikolik (2011) reported the average 2005–2010 EBITDA (earnings before interest, taxes, depreciation and amortisation) margin to be more than 16% for salmon farmers, around 15% for sea bass and sea bream farmers, more than 14% for wild catch fisheries, more than 10% for poultry, more than 8% for seafood processing, almost 7% for processed meat and almost 7% for red meat. An interesting finding from this research is that EBITDA margins are generally larger for companies that have lower asset turnover. Asset turnover is defined as net sales revenue divided by (average) total assets. It measures the ability of a company to generate revenues from its assets. Companies with lower asset turnover (asset heavy) generally have higher margins, which they require to attract capital. According to this rule, retail companies have high asset turnover and low profit margins. One way of increasing asset turnover is to minimise the amount of assets by lowering inventories. High stocks are a class of assets that yield very little returns. By lowering stocks, companies can increase asset turnover and free up working capital (see e.g. Deksnyte *et al.*, 2014).

Jackson and Valle (2015) look at rate of return on capital in the Australian farming. They focus on the farm level and on beef, sheep and crop specialists. Average rates of return fluctuate quite a bit in the 1977 tot 2013 period, between -2 and +6%, with two exceptional peaks to 11% and 8%. Wisman (2015) considers gross and net results of broiler and pig production in the Netherlands. Unlike the other studies he uses gross earnings and net earnings per animal instead of per euro of turnover as a profit measure. He shows that gross returns have remained relatively stable (despite large yearly fluctuations) while net returns per animal have decreased. This trend has been accompanied by scale increases. As farms become larger they can partly compensate for the decline in net earnings per animal.

4.1.2 Shares in consumer value or value added

In the US, the ERS has studied how the share of consumer spending is split between farmers and the other chain players over the 1970-1997 period (ERS, 1999) (see Figure 4.1). The marketing bill includes labour costs, packaging, transportation, energy, advertising, depreciation, rent, taxes, other costs, and profits. Profits in US food distribution were about 3.5% in 1997. Labour costs on the other hand were 38.5% - almost twice the farm value. The percentage of the consumer price that is attributed to the marketing bill is about 64% for meat products in the US in 1997. This figure is largely comparable to what Hoste *et al.* (2004) found for pig meat in the Netherlands. Roughly the same distribution of value is observed in the EU (see Figure 4.2). In Baltussen *et al.* (2014) shares of the various supply chain actors in consumer value were calculated for 8 products in the Netherlands. The results show that farmers have between 14% and 42%. Differences between products are largely explained by the amount of further processing. Eggs and sweet peppers for example are not further processed (just packed) and they have a higher producer share in consumer value. For poultry meat (chicken filet of 1 kg package) the share of the primary producer was about 21%, while for eggs this share was 42%.

The farm value as a percent of consumer expenditures in the US dropped from about 47% in 1947, to 37% in 1970, to 23% in 1997 (see Figure 4.1). The same pattern is visible in Europe. The change is visible in all product groups, except processed fruit and vegetables, where farm value share in retail price remained about 20%.[2] This shows that retail costs have increased relative to farm costs.

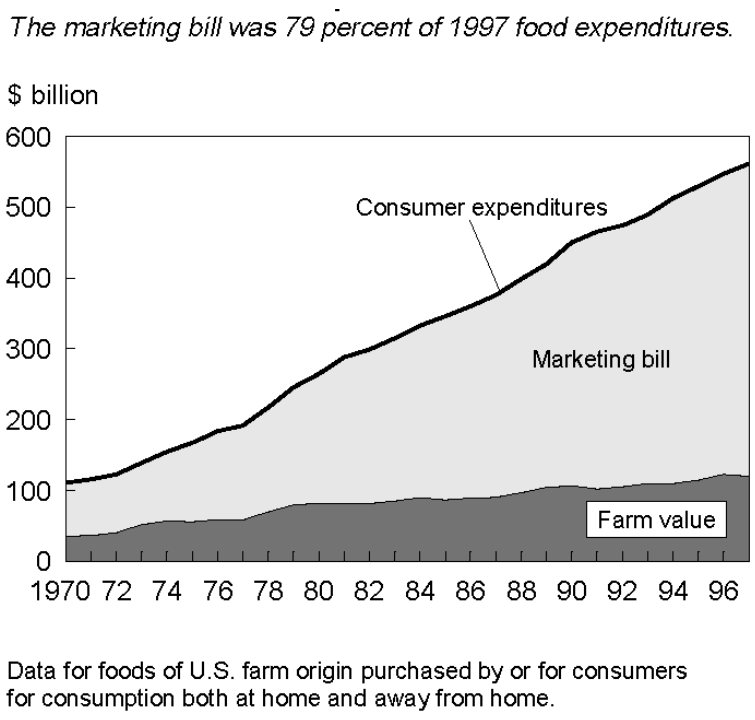

Figure 4.1 *Distribution of food expenditures in the US*
Source: Chart copied from ERS, 1999.

[2] http://www.ers.usda.gov/media/308011/aer780h_1_.pdf

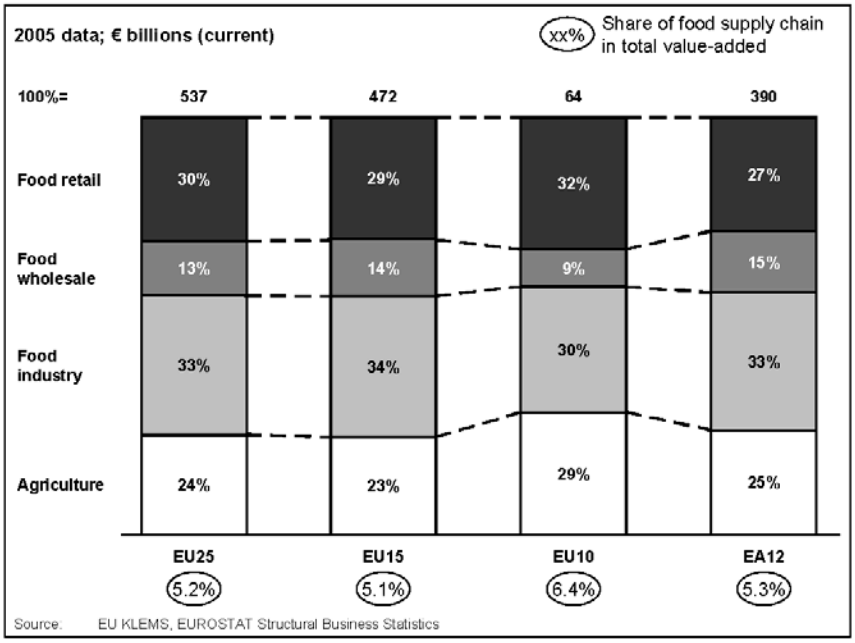

Figure 4.2 *Share of food supply chain in total value added*
Source: Chart copied from European Commission, 2009c.

A number of reports focus on the development of prices at various stages in the supply chain. E.g. AHDB Pork (Agriculture and Horticulture Development Board) (2015) in England publishes data on the producer share of retail pork prices. In their technical note (AHDB, without year) they highlight a number of cautions to the interpretation of the data. These price developments are only rough proxies for trends in margins. They do not take into account the costs of marketing and distribution, or any other costs developments besides the costs of purchasing the meat. Also, they do not take into account the prices and/or costs of selling/disposing of offal. In addition, retailers often do not buy primal cuts of meat, but rather smaller Controlled Atmosphere Packaging (CAP) meat.

> 'This means that for some operators a comparison of average producer prices and average retail prices may not reflect their actual trends in margins if the average prices of the various cuts move differently.' (AHDB, 2015)

Prices may also differ between market channels. Not all meat is sold to retailers, but instead a part goes to food service, manufacturing, or exports. If price developments in these market channels differ from the ones displayed in the price spread, they will not represent actual trends in profit margins.

> 'A higher proportion of hindquarter high value cuts than forequarter cuts go into retail. The higher value cuts carry more of the total return to cover lower returns in the highly price-sensitive catering and manufacturing meat markets where there are higher levels of import competition.' (Ibid.)

Furthermore, price promotions which can heavily distort the balance of cuts sold (i.e. more lower-priced cuts at the expense of higher-priced cuts) are not included in the presented price spreads. This will influence the average retail prices. Lastly,

> 'a higher proportion of the spread between farm and retail than formerly now sits at the abattoir stage. This reflects the additional costs associated with the Meat Hygiene Service, SRM disposal costs, etc. In addition, the big increase in central retail packaging and the costs associated with it has also been reflected in higher wastage rates.' (Ibid.)

BPEX (2011) uses AHBD price spreads and estimates of gross retail margins to show that gross margins are much higher in retailing than in processing and primary production for pork meat.

However, we have to keep in mind that the costs of distribution and marketing are not included in the gross margin. These costs are a prime part of the costs of retailing.

Prices at various stages of the food supply chain including meat, dairy and eggs are reported by national food prices observatories in a number of countries, including the Netherlands, France and Spain (see Oosterkamp *et al.*, 2013, France Agrimer website, Magrama website, and agrimatie.nl.)[3]

4.2 Factors that influence profit margins

4.2.1 Production costs and production technology

From the overview of various profit metrics and the exploratory analysis above, it is clear that production costs and the production technology (capital and labour requirements) have a large influence on the amount of gross profit the business requires to cover costs. Keramidou *et al.* (2013) explore the relationship between efficiency and profitability in the Greek meat processing industry in the 1994-2007 period. The meat production process is decomposed in two stages. The first stage concerns their own efficiency, namely the firm ability to achieve a minimum inputs cost for a given output. The second stage is devoted to their profitability, namely the firm capacity to generate the maximum profits, by the revenue it creates. The firm's overall performance is then measured as the weighted sum of the technical efficiency of the first stage and profitability. As a proxy for profit the authors used 'the total value added decreased by the total amount of expenditures for salaries and depreciations (as proposed by Boyer and Freyssenet (2000)', cited from Keramidou *et al.*, 2013). This proxy was taken in order to avoid a bias in measuring of profits owing to possible tax avoidance and tax-evading companies. Through DEA the profits of individual companies are transformed into scores, where the best performing company gets the value 1. A poor performance over the study period is observed in the sample companies. The low performance is mainly due to the low profitability (the ability to earn profits). The results do not confirm the existence of a strong positive correlation between efficiency and profitability. The companies that have the capability of producing their products with the best practices are not always capable of generating the maximum profits. The data for this decomposition and DEA analysis (Data Envelopment Analysis) was obtained from the annual balance sheets of companies published in the Greek Government Gazette. Further information on the number of employees, the cost of labour, and raw and auxiliary materials that was not readily available, was compiled by a questionnaire survey conducted from March to June 2009 by the Panteion University of Athens. The Ministry of Development's annual industrial bulletin statistics was used to draw evidence of companies that have either been purchased or merged with other firms or have been closed. Late entries and early exits from the market are the main reasons that we use an unbalanced panel data including 521 observations.

Valdes *et al.* (2015) examine the costs, returns, and profitability of commercial broiler production in Brazil taking into account the country's regional diversity in production, the size of operations, and the type of technology used. The results indicate the existence of economies of scale. They find differences in average production efficiency between farms with different production technologies and between farms in different regions. Only a part of the broiler operations earned positive returns, and returns per broiler vary widely between firms. Several other studies focus on different production technologies in animal product supply chains and profitability (e.g. Onono *et al.*, 2015; Ruviaro *et al.*, 2016; Thompson *et al.*, 2015; Nossal *et al.*, 2008).

[3] http://www.agrimatie.nl/ThemaResultaat.aspx?subpubID=2232&themaID=2263&indicatorID=2414

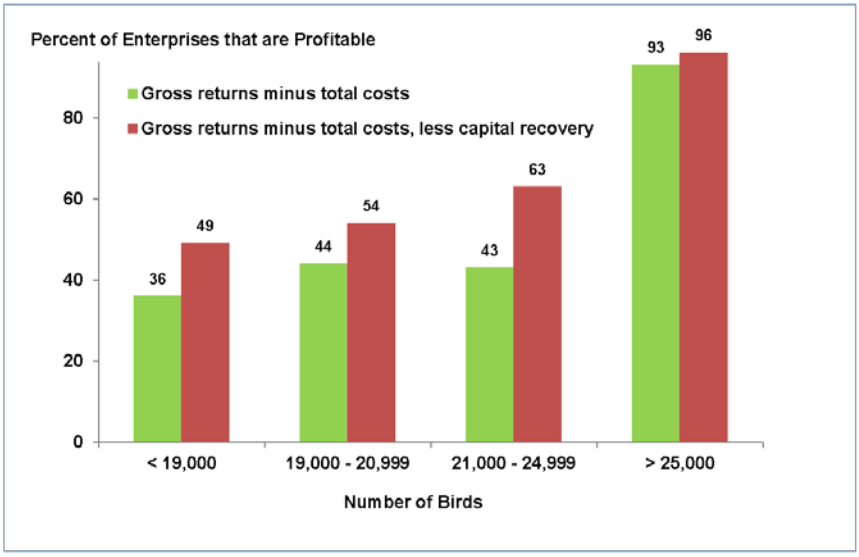

Figure 4.3 *Profitable broiler enterprises in Brazil, per size class, in 2010*
Source: Chart copied from Valdes et al. (2015).

Valdes *et al.* (2015) and Jackson and Valle (2015) show that farm profitability varies with size. Generally, larger farms are more profitable than smaller farms in Brazilian broiler production (Figure 4.3) and Australian beef, sheep and cropping specialists respectively. This finding is consistent with other studies in many industries. Larger firms are able to exploit economies of scale and reduce costs. Valdes et al also show that profitability in farming varies a lot between farms- not only with size but also within size groups.

Valdes *et al.* examined several studies on identifying factors for broiler industry's growth in countries like the United States, Thailand and Nigeria. These studies focused on the relationship between the industry organisation and the financial performance of broiler grow-out operations. The studies conclude that

> 'while the system of vertical integration organization had fuelled the industry's growth, other factors (i.e., production practices, size of operations, and technology), had been crucial for continuing gains in the industry's productivity and profitability. [...] Expanded production has been found to allow integrators to realise further costs saving through scale economies in larger facilities (Sandi *et al.*, 2011)'. (cited from Valdes *et al.*, 2015)

4.2.2 Transaction costs and supply chain governance

Transaction costs and supply chain coordination may be a significant part of supply chain costs. The effects of the introduction of e.g. traceability measures or regulatory standards may be profound (See e.g. Banterle *et al.*, 2006). Quality management systems (QMS) vary from broad baseline public systems to small-scale private systems. The type of system used is related to the inter-firm governance structures. Transaction costs economics is therefore linked to quality and performance in the supply chain. Attributes of the transaction that are determinant for transaction costs and appropriateness of different governance structures are asset specificity, performance measurement problems, and coordination/adaptation problems (see Wever *et al.*, 2010).

Jie *et al.* (2015) look into the information sharing (IS) paradigm, which is the belief that profitability can be enhanced through a high degree of cooperative behaviour (Brewer and Speh, 2000; Derocher and Kilpatrick, 2000; Mentzer *et al.*, 2001). In its ultimate version, supply chain participants voluntarily share operating information and jointly plan strategies. The level of IS refers to the extent to which critical and proprietary information is communicated to one's supply chain partner (Fawcett *et al.*, 2007; Olorunniwo and Li, 2010).

The ownership structure and the existence of contracts can influence profit distribution significantly. In integrated supply chains with production or marketing contracts, risks and responsibilities are redistributed between supply chain partners, leading to different distributions of profit. Property rights are quite different between production contracts and marketing contracts. (Miele, 2013; Miele and Waquil, 2007a and 2007b). Supply chain integration in Chinese pork supply chains is studied in Han *et al.* (2013). Not only vertical integration and contracts have influenced costs and profits in meat and dairy supply chains. Moreira de Brito *et al.* (2015) explain that dairy farmers in horizontal arrangements in the Brazilian dairy supply chain are potentially more competitive than those not engaged in such arrangements, specifically with respect to market relations and productivity and technology. No significant differences were found among competitiveness drivers institutional adequacy (the extent of use of specific cooling methods and compliance with Brazilian requirements for milk production) and farm management. Moreira de Brito *et al.* suggest that vertical coordination arrangements may be in place which substitute horizontal arrangements and cause the lack of correlation between these aspects and competitiveness. They point to the importance of contextualising competitiveness using a systemic approach.

4.2.3 Market power, normal profits and price transmission

Bunte *et al.* (2003) explain that market power can be measured in terms of excess profit (above normal profit), or the ability of firms to raise prices above marginal costs (over sustained periods of time). In such cases, profits exceed the costs of production and investments. But what constitutes normal profits? As we have seen, there are major differences in what costs are included in the various profitability measures. If we look only at net income (from which all costs have been deducted), what remains is the earnings for shareholders. The amount of normal compensation that shareholders require for their investment differs per industry. This has to do with a lot of factors, among which are the riskiness of the business, the overall image of the business (investor preferences), and access to capital. SMEs e.g. are generally not listed at the stock exchange and dependent on bank loans for investments and working capital. Banks do generally require higher risk premiums than the stock markets, making the costs of capital for smaller firms higher. Industries with smaller firms should therefore be expected to have a higher normal profit ratio. In practice however, other factors dominate and smaller firms do not have higher profit margins than larger firms.

Mohamed *et al.* (2015) find that decreased market concentration is correlated with decreased average profits in the Malaysian meat processing industry. This is consistent with general economic theory on markets. More competition leads to fewer profits. Less competition and higher profits do generally increase market entry and hence reduce concentration and profits. Smaller firms or firms in a more competitive market therefore have to cope with a situation with lower profit margins. They are the marginal producers.

Market power can be expressed vis-à-vis customers and vis-à-vis suppliers. In the first case companies are able to raise prices above marginal costs by setting a higher price then would have been necessary if competition was fierce. The excess profits are not competed and customers lose out by paying too much from a consumer welfare point of view. In the second case market power against suppliers means that companies can reduce their purchasing costs by decreasing input prices below the marginal costs of the suppliers, e.g. by threatening to switch to another supplier. Usually monopsony power is exercised by a reduction in purchases which leads to excess supply and lower prices and profit margins in the upstream market. E.g. Moroa *et al.* (2012) study market power in Italian fresh meat chain.

Market power is hence associated with price transmission. Cost increases in the upstream parts of the supply chain should in competitive markets be transmitted to downstream parts of the supply chain and consumers. Higher costs force marginal producers to leave the market, reducing supply and hence increasing prices. Changes in demand on the other hand should be transmitted to upstream parts of the supply chain. A decrease in demand leads to excess supply and lower prices. Prices will decrease at retail level, but also at processor, wholesale and farm level. The extent to which prices at various stages of the supply chain react is called price transmission.

In the past decades a large number of studies have been performed into price transmission in various supply chains (usually defined as consecutive stages in the production and distribution channel without actually including only the companies that supply and purchase products from each other), including animal product supply chains. In 2009, the EU looked into a number of supply chains (EC, 2009a). Bunte *et al.* (2003; 2009) and Baltussen *et al.* (2014) have studied price transmission in Dutch food chains. Chavas and Mehta (2004, butter in the US), Goodwin and Holt (1999, beef in the US), McCorriston *et al.* (1998, beef and pork in the US), have studied food chains in the US. Other studies of price transmission include e.g. Ben-Kaabia and Gil (2007, lamb in Spain), Hassouneh *et al.* (2010), Von Cramon-Taubadel (1998, pork in Germany), and Miller and Hayenga (2001, pork in the US), Palaskas (1995, pork and dairy in the EU), Sckokai *et al.* (2012, PDO cheese in Italy), Serra and Goodwin (2003, dairy in Spain), O'Connor *et al.* (2007, dairy in Ireland), Oliviera *et al.* (2014, milk in Portugal). Meyer and Von Cramon-Taubadel (2004), give a review of a large number of studies of price transmission in various food supply chains.

These studies generally rely on econometric modelling of prices at various stages of the supply chain. Focus is often on three aspects of price transmission in particular:

- The extent of the price transmission: how much of the price shock in one stage is transmitted to the other stages?
- The speed of the price transmission: the time necessary for the shock to be fully absorbed by the other stages;
- The existence and extent of asymmetry in the transmission: are positive shocks transmitted more or less or faster or slower than negative shocks.

For our study it is important to note that market power and price transmission are characteristics of industries and that they influence the amount of profit made in different stages of the supply chain and the way in which prices react and move together. Fully competitive and homogenous product markets are generally characterised by more complete price transmission, although there might be thresholds for price adaptations (menu costs). On the other hand, in more concentrated and differentiated product markets, prices may not be fully or speedily transmitted from one stage in the supply chain to another, leading to divergence of prices and profits. Furthermore, as with the presentation of price spreads, analysis of price transmission is always to some extent a partial analysis in which other costs than the purchasing of raw inputs are not fully taken into account.

4.2.4 Selling prices

Profits are directly determined by revenues and costs. Revenues in turn are determined by the amount of sales and the average selling price. Given variable and fixed costs of production and market characteristics, each firm decides to produce a certain amount of output at a certain price to maximise profits. The price setting strategy may differ from one industry to another and from one firm to another within the same industry or in different countries. In many meat and animal product supply chains, farm-gate prices are determined by market demand and supply and farmers only decide on their own amount of production. In such cases where production is fixed or limited due to e.g. contracts or investments barriers, firms may be operating at below optimal profits, while hoping for better prices in the future. Also, when repricing (changing prices for customers) is an option in the event of changing costs, as is mostly the case for retailers, in the face of repricing costs (menu costs), it may not be the optimal strategy to actually increase or decrease prices to adjust to costs changes or demand changes (Azzam, 1999). This creates rigidity in farm-retail price transmission.

One way of differentiating a product from the commodity competition is by branding. Branded products usually earn a premium depending on the range of other brands in the market. A popular brand can reduce competition and earn more profits. Some of these profits are necessary to cover investments in the brand. Pricing strategies in industries and firms may range from absorption pricing, mark-up pricing, predatory pricing, to value-based pricing, and many more. Depending on business model, capital requirements, the market structure, managerial choices, and other variables, pricing strategies and hence profit margins differ. In many occasions, reviewing the pricing strategy may significantly increase firms' profits, and the entry of a competitor with a different pricing strategy may completely overthrow an industries competitive landscape and profits (see e.g. Monroe, 2003). Pricing

strategies of cheese wholesalers in the US are studied in Bolotova and Novakovic (2015). Deksnyte *et al.* (2014) investigated the use of dynamic pricing which constitutes a form of discriminatory pricing where prices are dynamically adjusted to yield the maximum revenue from the current demand. Prices are generally influenced by demand and supply. Oversupply does decrease average prices and profits whereas excess demand tends to increase prices and profits. (e.g. Bahta and Baker, 2015).

4.2.5 Changing consumer preferences and local-for-local

Gwin *et al.* (2013) find that consumer demand for local food, including local meat and poultry, has risen in recent years. To sell meat, farmers need access to appropriately scaled processing facilities with the skills, inspection status, and reliability to prepare these products safely, legally, and to customer specifications. Farmers and others suggest that limited processing infrastructure restricts the supply of local meat and poultry. At the same time, existing small processors often lack the steady, consistent business required for profitability. This report explores this multi-faceted problem and identifies fundamental causes, drawing on a cost analysis of local processing. Case studies of seven successful local and regional processors illustrate strategies or best practices currently in place: farmers commit to providing consistent throughput of livestock to process, and processors commit to providing consistent, high-quality processing services. This long-term commitment, supported by coordination and communication between processors and their customers as well as along the entire supply chain, is essential to the persistence and expansion of local meats. Also, five public-private collaborations around the country demonstrate how to expand opportunities for local meat marketing by providing support and technical assistance to meat processors and their farmer customers. Other studies of changing consumer preferences for meat include e.g. Sheng *et al.* (2010).

4.3 Conclusions

From the brief literature review we conclude that there is not a lot of (English or Dutch language) scientific research that focuses on the level of profits in animal product supply chains and compares profits over various stages of the supply chain or between various countries. Bunte *et al.* (2009), NMa (2009) and Backus *et al.* (2007 and 2011) and Baltussen *et al.* (2014) look at profits in various animal product supply chains in the Netherlands. The limitations of the data and the comparability of profits between stages of the supply chain are however quite pronounced and not solved.

Valdes *et al.* (2015), Guillen *et al.* (2015), Nikolik (2011), Jackson and Valle (2015), Keramidou *et al.* (2013) and a number of other articles study profits in animal product supply chains in other countries but focus on one stage only (e.g. farming, or meat processing). The choice of profit metric is often not really explained, but rather chosen for comparison with other research or because available data limits the options. All kinds of profit metrics and proxies are used, ranging from value added minus salaries minus depreciation (in Keramidou *et al.*, 2013), to EBIT (in Guillen *et al.*, 2015) to return on capital (in Jackson and Valle, 2015). A number of studies or online reports (AHBD Pork, 2015) report price spreads between producer prices and retail prices as a proxy for (gross) profits. This approach is often taken in the absence of more detailed cost data. It does not provide enough insights to explain the level of prices or determine whether profits are actually high or low.

Most of the studies found focus on profits in relation to e.g. technical performance, governance or sustainability. These studies give some insights into the factors that explain differences in profits between firms. We did however not find any comprehensive study that explains why profits differ between various stages of the supply chain, between various meat and other animal products or between various countries.

The data used in the literature come from roughly three sources: 1) official statistics, 2) databases with company data such as Amadeus and Orbis (Bureau van Dijk), 3) specific surveys. The latter source does not provide enough consistent material for comparison between countries. This leaves the first two sources. The availability of profit metrics and related financial indicators in official statistics is often limited. In the case of the Netherlands, CBS reports gross profits, net income and various parts of costs from which a variety of profit metrics can be calculated for a variety of industries. This is

however not the case for all relevant countries. The official statistics do not give any insights into the variation in profits within the sample nor do they provide the means for testing relationships between profit levels and explanatory variables with the sample group unless individual company data are used at the statistics offices. Furthermore, official statistics can only be used when the relevant industries of study fit within the official classification of industries on which financials are reported (e.g. Nace R2). The second option (e.g. Amadeus and Orbis) provide the flexibility of creating specific samples of subsets of companies, provide the option of comparing companies from different countries and industries directly and also provides detailed financials to facilitate the choice of profit metric. A drawback of these databases is that financial details are often not provided for smaller companies and thresholds for reporting financials may differ between countries. For some industries – especially smaller industries and industries with smaller companies – specific surveys will still be necessary to obtain the relevant information.

Just comparing profit margins, price spreads or costs between industries, between countries or between firms does not provide insight into the reasons for any differences. It is important to analyse the factors that determine the level of profits and/or setting a suitable benchmark before arguing that profits are high or low.

Factors that determine the average level of profits in an industry include but are not limited to the following:

- Ownership structure and the cost of labour of the entrepreneurs;
- The costs of equity and access to capital;
- Cost structure (capital investments, labour intensity) and asset turnover;
- The riskiness of investments in e.g. R&D;
- Transaction costs and governance of the supply chain (contracting);
- (temporary or structural) Shortage or excess demand or supply;
- Competition within the industry (market structure and average firm size) and market power;
- Pricing strategies;
- Consumer preferences, changes and competition from other industries;
- Costs of legislation and regulation.

5 Conceptual framework for profit analysis in animal product supply chains

From the analysis and literature above we conclude that drafting a conceptual framework for profitability analysis in animal product supply chains is possible. It should include the following issues:

1. The choice of profit metric
2. The choice of data and sampling
3. The benchmark
4. The level of certainty required
5. The level of explanation required

Ad 1. The choice of profit metric

Given the level of variation in the cost structure of firms within the animal product supply chains from breeding, feed and veterinary services, to rearing and primary production, to processing, to wholesale and retail, it seems necessary to include the costs of capital (interest and depreciation) when comparing various stages of the supply chain. Nevertheless, even when comparing net income, the ownership structure and riskiness of companies in various stages may differ and therefore differences in profit margins require careful consideration. We propose to always calculate – when possible – gross profits, operating profit, pre-tax profit, net income margins, ROA and ROE. The last two metrics may especially be useful when turnover data are missing. In some countries smaller companies are not required to report turnover while they do report assets, shareholder funds and profit margins from which ROA and ROE can be calculated.

Because farms are often small companies, data on financials are often lacking in company financials databases such as Orbis and Amadeus. For EU countries the FADN (Farm Accountancy Data Network) may be used to obtain data on profits for farmers. In other countries, primary sector data will have to be obtained from specific sources within the country such as statistics offices or surveys. The choice of profit metrics may be limited.

Ad 2. The choice of data

For quick comparison of profit levels between officially classified industries (such as meat slaughtering), official statistics may suffice. However, feed companies, animal health pharmaceuticals (other than veterinary services), manufacturing and installing of various specific machines, installations and stables and a number of other parts of the supply chain of specific meat products are not classified as separate industries. In such cases additional data are required. Databases like Orbis (worldwide) or Amadeus (Europe) of Bureau van Dijk provide access to a lot of financial company data. Access to the databases is not cheap, but save costs of performing specific surveys. Surveys always suffer from non-response which may be quite substantial in the case of financial data. Orbis and Amadeus suffer from another sort of non-response in the sense that smaller companies are not required to provide detailed financial data in a lot of countries. Furthermore, companies may be part of larger conglomerates or perform different activities which are usually consolidated in financial statements. When it is necessary to separate such financial data per activity, specific surveys are always required unless annual reports provide these figures. The costs of the research will be significantly higher if specific company data need to be collected and processed outside a structured database such as Orbis or Amadeus. Most farms are small companies of which financial data will not be present in Amadeus and Orbis. For the agricultural production sector, estimates of profits will need to be based on other databases. For the EU, the FADN database can be used to which LEI has access (with permission of the European Commission DG Agriculture). For other countries, specific databases may be available but access to these databases will generally be more difficult to arrange. In other cases, where official statistics are lacking, specific surveys need to be held.

Ad 3. The benchmark

For a fair comparison of profits, even when the companies throughout the supply chain have similar costs structures, asset turnover and ownership structures, it seems recommendable to compare the various stages in the supply chain not only to each other but also to a benchmark industry. For meat wholesale e.g. such a benchmark could be the higher aggregate activity wholesaling. For slaughtering and meat processing it could be the higher aggregate Food and beverages manufacturing. For the primary sector the relevant benchmark could be the higher aggregate Agriculture.

In addition, when possible it is recommended to compare industry figures to medium to long term averages. In such a way, more insights into the development of profits is obtained which give a better basis for comparison of various stages in the supply chain or various countries than just one time observation.

Ad 4. The level of certainty

As with all statistics, the average or reported average of the sample may not be as accurate as one believes. Official statistics are also calculated from primary data and may suffer from e.g. selection bias, errors in reporting, human errors in calculations et cetera. In any case there is always a lot of variation in profits and related variables between firms within the same industry. Including or excluding one or several companies may seriously affect the averages. When working with official statistics, a review of the sample is often not possible.

When working with company databases such as Orbis or Amadeus or specific surveys we propose the following procedure:

1. Query data for all active companies with financials, with primary industry activity code within the industry of interest. If the companies of interest do not form an official classification subset, lists of company names may be used to obtain a reasonable sample. If company names are not known targeted search is required, but this does not guarantee full coverage to any degree and does require substantially more research effort.
2. Check with sector experts, internet search, or customer for the inclusion of the most important firms in the sample. Any missing important companies – e.g. because they are listed in another industry classification – must be added. There are no fixed rules to decide which firms are important and which are less important. As a rule of thumb we propose that a) a minimum of ten firms is included in each cell (industry branch, year) unless the industry consists of less than ten firms; and b) firms with 10% or more market share are included. In practice, industries can vary greatly in terms of industry concentration (e.g. combined market share of top-5 firms), numbers of firms, and variation in profits between firms. The larger the (expected) variation in firm profitability the larger the numbers of firms or share of firms in the industry should be included in the sample.
3. Check sample representativeness with official statistics or expert judgement of numbers of companies and total turnover. If the sample is too small to expect reasonable profitability estimates additional effort in finding and adding specific companies is required.
4. Check for equal basis of samples for different countries with respect to reporting requirements for firms of different sizes. In case there is no equal basis, check for size effects and harmonise sample boundaries if necessary.
5. Check for (statistical) outliers in the data on all metrics. Correct or omit outliers.
6. Calculate weights based on turnover.
7. Calculate annual weighted mean, minimum, maximum, standard deviation of gross profit margin, operational profit margin, pre-tax profit margin, net income margin, return on assets and return on equity for each group of companies (industry/country);
8. Calculate standard errors of the mean and perform ANOVA or T-test to detect significant differences between periods, between industries, and between countries;
9. Compare results with official statistics if possible.

Ad 5. The level of explanation

Besides comparing profits between supply chain stages, countries and animal products, a plausible explanation of the level of profits should be given. This sort of circumstantial evidence for the existence of any extraordinarily high or low profit margins should be analysed before judgement on the level of profits. We propose to look at the following factors that may explain average levels of profits in an industry:

- Ownership structure and the cost of labour of the entrepreneurs;
- The costs of equity and access to capital;
- Cost structure (capital investments, labour intensity) and asset turnover;
- The riskiness of investments in e.g. R&D;
- Transaction costs and governance of the supply chain (contracting);
- (temporary or structural) Shortage or excess demand or supply;
- Competition within the industry (market structure and average firm size) and market power;
- Pricing strategies;
- Consumer preferences, changes and competition from other industries;
- Costs of legislation and regulation.

References and websites

AHDB, 2015. *Producer share of retail pork price at 11-year low*. http://pork.ahdb.org.uk/prices-stats/news/2015/november/producer-share-of-retail-pork-price-at-11-year-low/

AHDB, without year. *Technical note on retail price spreads*.

Azzam, A.M., 1999. 'Asymmetry and rigidity in farm-retail price transmission.' American Journal of Agricultural Economics 81(3): 525-533.

Backus, G.B.C., J.A. Boone, E. ten Pierick, F.H.J. Bunte and K.J. van Calker, 2007. *Ketenrendementen in de Nederlandse Agribusiness; Varkensvlees, zuivel, groente en fruit*. Den Haag, LEI, Rapport 5.07.05. http://edepot.wur.nl/40754

Backus, G.B.C., E. ten Pierick, M. van Galen and J. Jager, 2011. *Actualisatie ketenrendement in de Nederlandse agribusiness: 2000-2009 : varkensvlees, zuivel, groente en fruit*. Den Haag, LEI, Nota 11-066. http://edepot.wur.nl/178540

Bahta, S. and D. Baker, 2015. 'Determinants of Profit Efficiency among Smallholder Beef Producers in Botswana'. International Food and Agribusiness Management Review. Volume 18 Issue 3, 2015.

Baltussen, W.H.M., M. Kornelis, M.A. van Galen, K. Logatcheva, P.L.M. van Horne, A.B. Smit, S.R.M. Janssens, A. de Smet, N.F. van Zelst, V.M. Immink, E.B. Oosterkamp, A. Gerbrandy, W.B. van Bockel and T.M.L. Pham, 2014. *Prijsvorming van voedsel; Ontwikkelingen van prijzen in acht Nederlandse ketens van versproducten*. Wageningen, LEI Wageningen UR (University & Research centre), LEI Nota 14-112.

Banterle, A., S. Stranieri, L. Baldi, 2006. 'Voluntary Traceability and Transaction Costs: an Empirical Analysis in the Italian Meat Processing Supply Chain'. Paper prepared for presentation at the 99th EAAE Seminar 'Trust and Risk in Business Networks', Bonn, Germany, February 8-10, 2006.

Ben-Kaabia, M. and José M. Gil, 2007. 'Asymmetric Price Transmission in the Spanish Lamb Sector'. European Review of Agricultural Economics, Vol. 34, No. 1, pp. 53-80, 2007

Bolotova, Y.V. and A.M. Novakovic, 2015. 'An Empirical Analysis of Wholesale Cheese Pricing Practices on the Chicago Mercantile Exchange (CME) Spot Cheese Market'. International Food and Agribusiness Management Review. Volume 18 Issue 3, 2015.

BPEX, 2011. *Profitability in the Pig Supply Chain*.

Brewer, P.C. and T.W. Speh, 2000. Using the Balanced Scorecard to Measure Supply Chain Performance. Journal of Business Logistics 21: 75–94.

Bunte, F.H.J., W.E. Kuiper, M.A. van Galen and S.T. Goddijn, 2003. Macht en prijsvorming in agrofoodketens. Den Haag, LEI Rapport 5.03.01, 73 pp.

Bunte, F., 2009. Prijsvorming glastuinbouw, LEI Wageningen UR, Den Haag, LEI Nota 09 02.

Bunte, F., J. Bolhuis, C. de Bont, G. Jukema and E. Kuiper, 2009. Prijsvorming van voedingsproducten, Den Haag, LEI Wageningen UR, Nota 09-074.

Bureau van Dijk, *Orbis database user guide*. https://help.bvdinfo.com/mergedProjects/68_EN/Home.htm

Boyer, R. and Freyssenet, M., 2000. *Les Modèles Productifs, Repères La Découverte*. Paris.

Chavas, J.P. and A. Mehta, 2004. 'Price Dynamics in a vertical Sector: The Case of Butter'. American Journal of Agricultural Economics 86 (4), pp. 1078–1093.

Deksnyte, I., Z. Lydeka and V. Pukeliene, 2014. 'Dynamic price as bargaining result for revenue maximization in retail'. Ekonomika 2014 Vol. 93(3), pp. 67-83.

Derocher, R.P. and J. Kilpatrick, 2000. 'Six Supply Chain Lessons for the New Millennium'. Supply Chain Management Review 3: 34–41.

ERS, 1999. 'Food Industry Costs, Profits, and Productivity'. In: Food Cost Review, 1950-97. US Department of Agriculture, Economic Research Service. Agricultural Economic Report No. (AER-780) 54 pp, June 1999. http://www.ers.usda.gov/publications/aer-agricultural-economic-report/aer780.aspx

European Commission, 2009a. *Analysis of price transmission along the food supply chain in the EU*. Accompanying document to the communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the regions. SEC (2009) 1450.

European Commission, 2009b. *The functioning of the food supply chain and its effect on food prices in the European Union*. Occasional Papers 47 May 2009.

European Commission, 2009c. *The evolution of value-added repartition along the European food supply chain*. Commission Staff Working Document. Accompanying document to the Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions: A better functioning food supply chain in Europe (COM(2009) 591).

Fawcett, S.E., P. Osterhaus, G.M. Magnan, J.C. Brau and M.W. McCarter. 2007. 'Information Sharing and Supply Chain Performance: The Role of Connectivity and Willingness'. Supply Chain Management: An International Journal 12: 358–368.

Goodwin, B.K. and M.T. Holt, 1999. 'Asymmetric Adjustment and Price Transmission in the U.S. Beef Sector'. American Journal of Agricultural Economics. 79: 630-637.

Guillen, J., F. Natale and J.M. Fernández Polanco, 2015. 'Estimating the economic performance of the EU aquaculture sector'. Aquacult Int (2015) 23:1387–1400.

Gwin, L., A. Thiboumery and R. Stillman, 2013. *Local Meat and Poultry Processing: The Importance of Business Commitments for Long-Term Viability*. ERR-150. US Department of Agriculture, Economic Research Service, June 2013.

Han, J., H. Lu, J.H. Trienekens and S.W.F. Omta, 2013. 'The impact of supply chain integration on firm performance in the pork processing industry in China'. Chinese Management Studies, Vol. 7 No. 2, 2013, pp. 230-252.

Hassouneh, I., T. Serra and J.M. Gil, 2010. 'Price transmission in the Spanish bovine sector: The BSE effect'. Agricultural Economics 41(1): 33-42.

Horngren, C.T., G.L. Sundem, F.H. Selto, 1993. *Introduction to management accounting*. Ninth Edition, Prentice-Hall International, Inc.

Hoste, R., N. Bondt and P. Ingenbleek, 2004. *Visie op de varkenskolom*. Wetenschapswinkel Wageningen UR, Report 207.

Jackson, T. and H. Valle, 2015. 'Profitability and productivity in Australia's beef industry'. Agricultural commodities, vol. 5 (1), March 2015.

Jie, F., K.A. Parton and Mustafid, 2015. 'Supply chain performance flexibility in the Australian beef industry'. International Journal of Logistics Research and Applications.

Keramidou, I., A. Mimis, A. Fotinopoulou and C.D. Tassis, 2013. 'Exploring the relationship between efficiency and profitability'. Benchmarking: An International Journal. Vol. 20 No. 5, 2013, pp. 647-660.

McCorriston, S., C.W. Morgan and A.J. Rayner, 1998. 'Processing Technology, Market Power and Price Transmission'. Journal of Agricultural Economics – Volume 49, Number 2, Spring 1998, pp. 185-201.

Mentzer, J.T., W. DeWitt, J.S. Keebler, S. Min, N.W. Nix, C.D. Smith and Z.G. Zacharia, 2001. 'Defining Supply Chain Management'. Journal of Business Logistics 22: 1–25.

Meyer, J. and S. von Cramon-Taubadel, 2004. 'Asymmetric Price Transmission: A Survey'. Journal of Agricultural Economics, Volume 55, Number 3, November 2004, Pages 581-611.

Miele, M., 2013. 'Contracts in Brazilian pork and poultry meat chains: implications for measuring agricultural statistics'. ICAS VI; Sixth international conference on agricultural statistics, 2013.

Miele, M. and P.D. Waquil, 2007a. 'Contracts structure in the Brazilian swine production'. VI International PENSA Conference; Sustainable Agri-food and Bioenergy Chains/Networks Economics and Management. October, 24-26th, 2007. São Paulo – Brazil.

Miele, M. and P.D. Waquil, 2007b. 'Swine production coordination in South Brazil'. VI International PENSA Conference 'Sustainable Agri-food and Bioenergy Chains/Networks Economics and Management'. October, 24-26th, 2007. São Paulo – Brazil.

Miller, D.J. and M.L. Hayenga, 2001. 'Price Cycles and Asymmetric Price Transmission in the U.S. Pork Market'. American Journal of Agricultural Economics, Vol. 83, No. 3 (Aug., 2001), pp. 551-562.

Mohamed, Z., N. Kasron, I. AbdLatif, J. Sharifuddin, G. Rezai and R. Terano, 2015. 'Structure, Conduct and Performance of the Malaysian Meat and Meat Preparation Industry'. Pertanika J. Soc. Sci. & Hum. 23 (S): 47 - 62 (2015).

Monroe, K.B., 2003. *Pricing; Making profitable decisions*. Third edition, international edition. McGraw-Hill/Irwin. New York.

Moreira de Britoa, M., F.I. Bánkuti, S.M.S. Bánkuti, G.T. dos Santos, J.C. Damasceno and E.M. Massuda, 2015. 'Horizontal Arrangements and Competitiveness of Small-Scale Dairy Farmers in Paraná, Brazil'. International Food and Agribusiness Management Review, Volume 18 Issue 4, 2015.

Moroa, D., P. Sckokai and M. Veneziani, 2012. 'Multi-stage Market Power in the Italian Fresh Meat Industry'. Transparency of Food Pricing (TRANSFOP), Working Paper No. 7.

Nikolik, Gorjan, 2011. *A banker's view on the dynamics, challenges and investment flows in the aquaculture industry*. Asset Class: Aquaculture. Food & Agribusiness Research and Advisory, Rabobank International. November 2011, Santiago, Chile.

NMa, 2009. *Prijsvorming in de agrifoodsector*. Nederlandse Mededingingsautoriteit.

Nossal, K., Y. Sheng and S. Zhao, 2008. *Productivity in the beef cattle and slaughter lamb industries*. ABARE research report 08.13 for Meat and Livestock Australia, Canberra.

O'Connor, D., M. Keane and M. Kenneally, 2007. 'Price transmission from market to farm gate: an Irish dairy study'. 16th International Farm Management Congress, 15th - 20th July 2007. Vol. 1.

Oliveira, M.F.L., M.L.S. Carvalho, M.R. Lucas, P.D. Henriques, 2014. *Price Transmission in the Milk Portuguese Market*. CEFAGE-UE Working Paper 2014/19.

Olorunniwo, F.O. and X. Li, 2010. 'Information Sharing and Collaboration Practices in Reverse Logistics'. Supply Chain Management: An International Journal 15: 454–462.

Onono, J.O., J.O. Amimo and J. Rushton, 2015. 'Constraints and efficiency of cattle marketing in semiarid pastoral system in Kenya'. Trop. Anim. Health Prod. 2015 Apr;47(4):691-7.

Oosterkamp, E., K. Logatcheva, M. van Galen and E. Georgiev, 2013. *Monitoring en observatoria van voedselprijzen; Een verkenning van kosten en effecten*. Den Haag, LEI Wageningen UR, LEI-rapport 2013-027.

Oosterkamp, E., K. Logatcheva, M. van Galen, E. Georgiev, 2013. *Food price monitoring and observatories: an exploration of costs and effects. Summary and Executive Summary*. LEI Memorandum 13-058, June 2013, LEI Wageningen UR, The Hague.

Palaskas, T.B., 1995. 'Statistical analysis of price transmission in the European Union'. Journal of Agricultural Economics, 46 (1), (1995), pp. 61-69.

Ruviaro, C.F., J.S. da Costa, T.J. Florindo, W. Rodrigues, G.I. Bom de Medeiros and P.S. Vasconcelos, 2016. 'Economic and environmental feasibility of beef production in different feed management systems in the Pampa biome, southern Brazil'. Ecological Indicators 60:930-939 January 2016.

Sandi, A.J., J.I. Dos Santos, M. Miele and F.M. Martins. 2011. *Consolidação do Custo do Avicultor para a Produção de Frango de Corte 'Griller' em Santa Catarina*. EMBRAPA Comunicado Técnico 495.

Sckokai, P., C. Soregaroli and D. Moro, 2012. *Estimating market power in a dynamic framework: the case of the Italian PDO cheese market*. Transparency of Food Pricing (TRANSFOP), Working Paper No. 3.

Serra, T. and B.K. Goodwin, 2003. 'Price transmission and asymmetric adjustment in the Spanish dairy sector'. Applied Economics, 35:18, 1889-1899.

Sheng, T.Y., M.N. Shamsudin, Z. Mohamed, A.M. Abdullah and A. Radam, 2010. 'Demand Analysis of Meat in Malaysia'. Journal of Food Products Marketing, 16:2, 199-211.

Thompson, B.R., D.R. Stevens, A.C. Bywater, J.M. Rendel and N.R. Cox, 2015. 'Impacts of animal genetic gain on the profitability of three different grassland farming systems producing red meat'. Agricultural Systems 141 (2015) 36–47

Valdes, C., C. Hallahan and D. Harvey, 2015. 'Brazil's Broiler Industry: Increasing Efficiency and Trade'. International Food and Agribusiness Management Review. Volume 18 Special Issue A, 2015.

Wever, M., N. Wognum, J. Trienekens and O. Omta, 2010. 'Alignment between chain quality management and chain governance in EU pork supply chains: A Transaction-Cost-Economics perspective'. Meat Science 84 (2010) 228–237.

Von Cramon-Taubadel, S., 1998. 'Estimating asymmetric Price Transmission with the Error; Correction Representation: An Application to the German Pork Market'. European Review of Agricultural Economics 25:1-18.

Wisman, A., 2015. *Economische marges van vleesvarkens en vleeskuikens in 1980 t/m 2013*. LEI Wageningen UR, Den Haag. Notitie voor Wakker Dier.

Websites

http://statline.cbs.nl/; CBS Bedrijfsleven; arbeids- en financiële gegevens, per branche, SBI 2008.

http://www.agrimatie.nl/Default.aspx?subpubID=2424; LEI Wageningen UR. Food price monitor (Voedselprijzenmonitor).

http://www.agrimatie.nl/ThemaResultaat.aspx?subpubID=2232&themaID=2263&indicatorID=2414

http://www.ers.usda.gov/media/308011/aer780h_1_.pdf

http://www.investopedia.com/

http://www.magrama.gob.es/es/estadistica/temas/estadisticas-alimentacion/observatorio-precios/#; Magrama. Observatorio de Precios de los Alimentos.

https://observatoire-prixmarges.franceagrimer.fr/resultats/Pages/ResultatsFilieres.aspx?idfiliere=15&sousmenuid=520; France Agrimer. Observatoire de la formation des prix et des marges des produits alimentaires.

https://www.sec.gov/divisions/corpfin/faqs/nongaapfaq.htm#ebit

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MEMORANDUM
LEI 2016-052

LEI Wageningen UR is one of the world's leading independent socio-economic research institutes. LEI's unique data, models and knowledge offer clients insight and integrated advice on policy and decision-making in an innovative manner, and ultimately contribute to a more sustainable world. LEI is part of Wageningen UR (University and Research centre), forming the Social Sciences Group together with the Department of Social Sciences and Wageningen UR Centre for Development Innovation.

The mission of Wageningen UR (University & Research centre) is 'To explore the potential of nature to improve the quality of life'. Within Wageningen UR, nine specialised research institutes of the DLO Foundation have joined forces with Wageningen University to help answer the most important questions in the domain of healthy food and living environment. With approximately 30 locations, 6,000 members of staff and 9,000 students, Wageningen UR is one of the leading organisations in its domain worldwide. The integral approach to problems and the cooperation between the various disciplines are at the heart of the unique Wageningen Approach.

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MEMORANDUM
LEI 2016-052

LEI Wageningen UR is one of the world's leading independent socio-economic research institutes. LEI's unique data, models and knowledge offer clients insight and integrated advice on policy and decision-making in an innovative manner, and ultimately contribute to a more sustainable world. LEI is part of Wageningen UR (University and Research centre), forming the Social Sciences Group together with the Department of Social Sciences and Wageningen UR Centre for Development Innovation.

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