Economic drivers in the poultry meat chain

Louise Manning

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Louise Manning, Royal Agricultural College, Stroud Road, Cirencester Gloucestershire, GL7 6AS

Corresponding Author

Louise Manning
l.manning@btinternet.com

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Abstract

The purpose of this paper is to analyse the economic trends in the poultry meat supply chain with a view to determining key drivers. The research included a literature review and evaluation of financial performance data to determine the factors that have impacted on the individual organisations studied. The financial data has demonstrated for the organisations studied a disparity between the US and Brazilian companies in terms of economic performance in 2009. Key drivers have been the impact of avian influenza in 2006, high feed prices in 2008 and the global economic downturn in 2009 and the differences in production costs between different locations. In Europe and the US there is an ongoing drive towards lower operating margins that reduces financial flexibility, the ability to invest in new technology and innovation, and ultimately creates a more brittle supply chain. This research is of academic value and of value to policy makers and practitioners in the food supply chain.

Key words: globalisation, poultry, meat, financial, supply, chain

1. Introduction

One of the key drivers of food security is the current and continued availability of resources such as land, energy and water in order to improve food yields and feed the growing human population in terms of both their calorific and nutritional needs. However, the financial stability of organisations, indeed the food supply chain itself, is also a key underpinning factor. The three factors are often called the triple bottom line (people, planet, profit). Sustainability can be described as offering, "*the potential for reducing long-term risks associated with resource depletion, fluctuations in energy costs, product liabilities, and pollution and waste management"* (Shrivastava, 1995). Resources in this context can be determined as natural, physical, financial, human and social capital assets. Carter and Rogers (2008) proposed that organisations that are dependent upon key external resources can improve their economic sustainability through vertical coordination. Increasing globalisation of the poultry-meat supply chain has led to consolidation and evolution of transnational companies, whether by vertical or horizontal integration, and the development of business clusters (Manning and Baines 2004). The development of contract farming is part of the process of integration. There are significant benefits in these economies of scale, especially improved purchasing power and greater intellectual, technological and production resources for organisations to draw upon to provide products that meet differentiated customer needs. The authors further asserted that the consumer has seen the benefit of globalisation in lower commodity food prices, wider product choice and the advent of "convenience" food. Francis and Van Wart (2009) argued that development of a sustainable agriculture and food system must be an essential part of our long term economic and environmental planning with a view to delivering global food security. Hanson and Hendrickson (2009) put forward that agricultural industrialisation in the United States (US) has replaced ownership and operational control by the farmer with

that of the investment community and that in the industrialisation model, the predominant decision-making criterion has become the economic bottom line.

There has been a significant global growth in poultry meat and egg production over the last forty years (Table 1). Table 2 illustrates the increase in the production of poultry meat and eggs by continent. The data shows that poultry meat production continues to grow in all continents but with only a small increase in Europe of 2%. To demonstrate this further the changing contribution of individual continents towards global meat production between 1970 and 2005 has been assessed (Table 3). The analysis shows that the influence of US and European production within the global production total is waning by -7.8% and -11.7% respectively with growth being seen in the proportion of global production in South America (9.9%) and Asia (16.1%). The contribution of African production has stayed fairly constant at around 4%.

Table 1: Development of global meat and egg production between 1970 and 2005 (in million tonnes)

Year	Beef and veal	Pig meat	Poultry meat	Hen eggs
1970	38.3	35.8	15.1	19.5
2005	60.4	102.5	81.0	59.2
Increase (%)	57.6	186.4	436.5	203.2

(Source: Daghir *et al.,* 2008)

Table 2: Global production of poultry meat and eggs between 1990 and 2005 (in million tonnes)

Continent	Egg			Chicken meat		
	1990	2005	% change	1990	2005	% change
Africa	1.4	2.2	+57	1.8	3.2	+78
North and Central America	5.8	8.1	+39	12.8	22.7	+77
South America	2.3	3.5	+52	3.8	13.7	+256
Asia	14.3	40.1	+181	9.4	22.0	+134
Europe including former USSR	11.7	10.0	-14	11.5	11.8	+2
Oceania	0.25	0.23	-9	0.48	0.94	+96
World	35.8	64.1	+79	39.9	74.3	+86

(Source: Daghir *et al.,* 2008)

Table 3: Changing contribution to global poultry meat production between 1970 and 2005 (%)

Continent	1970	1990	2005	Overall Change (%)
Africa	4.0	5.0	4.2	0.2
North and Central America	36.2	31.3	28.4	-7.8
South America	5.8	9.5	15.7	9.9
Asia	17.9	24.4	34.0	16.1
Europe	28.1	20.6	16.4	-11.7
USSR	7.1	8.0	-	-
Oceania	0.9	1.2	1.2	0.3
World	100	100	100	-

(Source: Daghir *et al.,* 2008)

The volume of the poultry meat production is predicted to reach 143 million tonnes by 2030 (Table 4). The market has seen a build up of poultry meat stocks and a general price decline. From 2005 to 2006 there was a reduction in poultry production of 1.1% and a reduction in poultry trade of 3% but this is forecast to recover through to 2010 having been static between 2007 and 2009 (Table 5). EU poultry meat production experienced a fall between 2002 and 2004 and another drop in 2006 although production came back in 2007/2008 (Table 6). Much of the reduction in the EU 2006 was due to the European H5N1 avian influenza outbreak.

Table 4: Poultry meat production past and projected

Year	1967/69[1]	1987/89[1]	1997/99[1]	Average[2] (2002-06)	2015[1] (projected)	2015[2] (projected)	2030[1] (projected)
Poultry production - liveweight (million tonnes)	12.9	37.2	61.8	79.9	100.6	101.7	143.3
Poultry trade (million tonnes)	-	-	-	7.6	-	10.5	-

(Source: [1]FAO, 2003 and [2]OEDC/FAO, 2008)

Table 5: Global poultry meat production (2004 – 2010)

Year	2004[3]	2005[3]	2006[3]	2006[4]	2007[4]	2008[4]	2009[4] forecast	2009[5]	2010[5]
Poultry production – liveweight (million tonnes)	79	82	81	69	73	77	76	77	79
Poultry trade (million tonnes)	7.5	8.3	8.0	7.1	7.9	9.0	8.5	-	8.3

(Source: [3]FAO, 2006; USDA[4], 2009 FAS/USDA[6], 2010)

Table 6: EU and Brazilian poultry meat production - liveweight million tonnes (2001 – 2010)

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
EU-25[6]	11.0	11.0	10.8	11.0	11.1	-	-	-		
EU-27[5]	-	-	-	-	8.2	7.7	8.3	8.6	8.6	8.7
Brazilian[5]	-	-	-	-	9.4	9.4	10.3	11.0	11.0	11.4
Thailand[5]	-	-	-	-	1.0	1.1	1.1	1.2	1.2	1.3
US[5]	-	-	-	-	15.9	15.9	16.2	16.6	16.0	16.2

(Source: [5]FAS/USDA, 2010 and [6]Poultry World, 2006)

The UK poultry industry grew significantly from the mid 1970s (NFU, 2009). In more recent times the UK chicken meat industry has seen a rise in production output from 2001 – 2005 of 5.2% from 1.21 to 1.28 million tonnes, and producer prices have fluctuated between 47.9 and 50.3 pence/kg liveweight with an increase between 2001 and 2005 of only 1.4% (Poultry World, 2006). Sheppard and Edge (2006) undertook a study in the UK in 2005 that built on earlier work in 2002 and determined the financial return for producing a broiler meat chicken in spring/summer 2005. The cost element that had increased most significantly was energy costs. It was estimated in this research that the financial return in terms of margin at farmer level was 1.9 pence/bird in 2005 compared with 3.0 pence/bird in 2002 before the cost of capital repayments. Analysis of the UK poultry meat supply balance demonstrates that between 1995 and 2004 poultry imports rose by 90%, however in 2005 import levels fell to below those in 2003 (Poultry World, 2006). Producer prices remained largely unchanged due in part to an increase in national output and a reduction in export levels. Analysis of the financial figures from Grampian Country Food Group (CGFG) financial statements (2000–2005) demonstrated that although the company's sales revenue increased (also in part due to acquisitions) there was a pressure on margins with operating income as a percentage of sales falling from 3.4 per cent in 2001 to 1.3 per cent in 2005 (Manning *et al.,* 2007).

At the end of 2008, average UK producer price was 68 pence/kg liveweight; the wholesale price was 126 pence/kg liveweight and the retail price 279 pence/kg liveweight (NFU, 2009). The NFU report concluded, from the data

they had analysed, that the average poultry grower had a gross margin of 85 pence/m^2 of floor area/week with an average operating cost of 55.35 pence/m^2/wk. With capital costs and finance charges being a further 39.07 pence/m^2/wk this left a net margin deficit of 9.43 pence/m^2/wk. In the NFU study, feed costs represented 65% of total growing costs excluding capital whereas in the Sheppard and Edge study, feed cost was determined as being 57% of overall growing costs. The cost of chicks was 20.5% in the 2008 study and 19.7% in the 2006 study showing very little difference as with the cost of energy 2.3% in 2008 compared with 3.5% in the 2006 study. This data demonstrates the significance of commodity volatility on low margin meat production. With feed as one of the biggest costs, fluctuations in price can have a direct impact on profitability if those costs cannot be passed down the supply chain. The NFU study concluded that "*producers have had to rely on efficiency gains to support their margins as the price they receive has declined in real terms... investment in broiler sheds is relatively high risk. Based on our model there is currently no return for risk or for entrepreneurial investment.*"

World production data is not the only indicator of global activity in the poultry meat supply chain and Tables 7 and 8 compare global poultry meat production and consumption between 2005 and 2008. The US continues to be the biggest producer and consumer of poultry meat with China, Brazil and then the EU-27 trading group. Production in China continues to keep pace with consumption and as such China is not currently a significant importer of poultry meat neither is the US which is the biggest exporters of poultry meet on a par with Brazil in 2008. The Russian Federation is one of the largest importers of poultry meat as is Japan. The figures do not compare the proportions of white and dark meat sold in the US for example white meat is predominantly eaten and brown, lower value meat exported. In Brazil, white breast meat is predominantly exported.

Table 7: World poultry meat production and consumption (2005 – 2008)

Country/ poultry meat production (million tonnes)	2005	2006	2007	2008
US	15.9 (13.4)	15.9 (13.7)	16.3 (13.6)	16.6 (13.4)
China	10.2 (10.1)	10.4 (10.4)	11.3 (11.4)	11.9 (12.0)
Brazil	9.4 (6.6)	9.4 (6.9)	10.3 (7.4)	11.0 (7.8)
EU-27	8.2 (8.1)	7.7 (7.7)	8.3 (8.4)	8.6 (8.5)
Mexico	2.5 (2.9)	2.6 (3.0)	2.7 (3.1)	2.8 (3.2)
India	1.9 (1.9)	2.0 (2.0)	2.2 (2.2)	2.5 (2.5)
Total	63 (62)	64 (64)	68 (68)	71 (71)

(Source: USDA, 2009) Consumption in brackets

Table 8: World Broiler meat exports and imports (2005 – 2008)

Country/ poultry meat production (million tonnes)	2005	2006	2007	2008
US	2.4 (0.02)	2.4 (0.02)	2.7 (0.03)	3.2 (0.04)
Brazil	2.7	2.5	2.9	3.2
EU-27	0.7 (0.6)	0.7 (0.6)	0.6 (0.7)	0.7 (0.7)
Thailand	0.2	0.3	0.3	0.4
Russian Federation	(1.2)	(1.2)	(1.2)	(1.2)
Japan	(0.7)	(0.7)	(0.7)	(0.7)
Total	6.8	6.6	7.4	8.4

(Source: USDA, 2009) Imports in brackets

Increasing globalisation of the poultry meat supply chain has led to consolidation and the evolution of trans-national corporations (TNC) whether by vertical or horizontal integration (Manning and Baines, 2004). The development of organisational structures, trade policy and the development of contract farming was discussed by Manning and Baines (2004) who concluded that there were significant advantages in these economies of scale especially improved purchasing power and greater intellectual, technological and production resources for organisations to draw upon to provide products, which meet differentiated customer needs. Manning *et al.,* (2007) proposed that the global model relies upon the ongoing reduction of costs whilst maintaining supply and profitability. The authors argued that integration within the poultry supply chain has led to the development of power bases at integrator and retailer level with a dependence on technology and administrative resource to drive such strategies as centralised buying and product distribution. This has led to an increase in costs that to date have been met by expansion and increasing business turnover often being financed by external capital sources. The increasing costs of implementing additional food safety, welfare and environmental legislation, and market requirements as well as the direct, or indeed indirect, costs of disease outbreaks also influence supply chain viability. Although the supply chain can carry a reduction in margin for a period of time, ultimately it will have a detrimental financial impact. It is this financial resilience factor that determines the nature of the supply chain and how flexible, or opposing brittle, it becomes when margins are under threat. The degree of brittleness will depend on an individual organisation's capital reserves, on profitability, cash flow, the ability to meet any loan repayments and to continue capital investment plans.

Table 9: Broiler costs in USD

Country	Broiler feed (USD/ton)	Cost live broiler (USD/kg)	Processing wage (USD/month)
US	240	0.77	2500
Brazil	260	0.71	400
Argentina	240	0.69	440
EU-27	390	0.92	3,000
Russia	380	0.91	440
China	410	0.96	220
Thailand	340	0.86	250
India	300	0.85	100

(Source: Boloh, 2009)

Table 10: Global ranking of meat companies

Ranking	Company	Meat sectors (predominant sector in bold)	Country
1	Tyson	Beef, Pork, **Poultry**	US
2	JBS	**Beef**	Brazil
3	Cargill	**Beef**, Pork, Poultry	US
4	Smithfield	Beef, **Pork**, Poultry	US
5	Pilgrims Pride	**Poultry**	US
6	Vion	Beef, **Pork**, Poultry	Holland
7	Danish Crown	Beef, **Pork**	Denmark
8	Sadia	Pork, **Poultry**	Brazil
9	Marfrig	**Beef**, Poultry	Brazil
10	Perdigao	Pork, **Poultry**	Brazil
11	Dous	Pork, **Poultry**	France (with plants in Brazil and Europe)
12	Perdue	**Poultry**	US

(Source: Boloh, 2009)

Indeed, Manning *et al.,* (2007) argued that one of the greatest influences on the future financial stability of the poultry meat supply chain is that of perceived investment risk and the ability of the organisations to service their long-term debt liabilities. The variance in growing and production costs is examined in Table 9. This data clearly demonstrates the un-competitiveness of EU production on a global scale in terms of feed costs and processing wages. Boloh (2009) also ranked the major global meat companies (Table 10) showing the dominance of US and Brazilian TNC in the top twelve organisation.

2. Analysis of the performance of poultry meat integrators

Within this context. the financial performance of three TNC was discussed by Manning and Baines (2004) and Manning *et al.,* (2007). These organisations were originally chosen for analysis because of their ranking in global meat companies where poultry is the primary sector (Table 10). Further research has been undertaken to assess ongoing financial performance since the previous research was undertaken. This is now discussed for three organisations: two from the US, Tyson Foods Inc., and Pilgrim's Pride Inc., and from the UK, Grampian Country Food Group Ltd which is now owned by Vion and Sadia S.A.

2.1 Tyson Foods Inc., (US)

The sales figures and operating income for the poultry segment have been analysed from 2000 – 2009 based on Tyson Foods Inc., annual reports, and show that although sales have increase year on year (YOY) between 2000 and 2009, with a fall in 2006, the operating income as a % of sales has fluctuated between (1.6) and 7.0 (Table 11).

Table 11: Chicken segment financial figures from Tyson Foods Inc., (2000 - 2009)

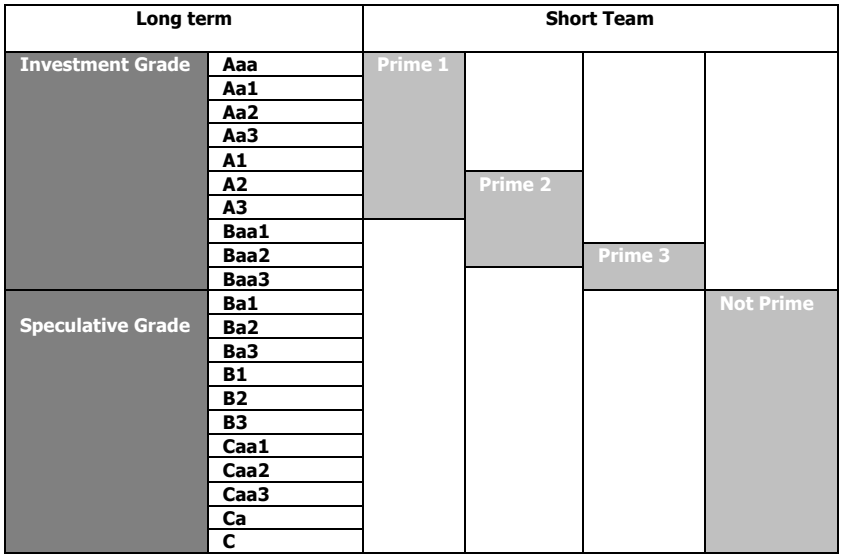
Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Sales ($ million)	6907	7057	7222	7427	8397	8295	7928	8210	8900	9600
Operating income ($ million)	315	249	428	158	548	582	94	325	(118)	(157)
Operating income (% of sales)	4.6	3.5	5.9	2.1	6.5	7.0	0.1	4.0	(1.2)	(1.6)
Operating income – whole business (% of sales)	-	-	-	-	-	-	-	-	-	4.6

(Source: Tyson, 2010)

Whilst the overall financial performance for Tyson Foods Inc for 2006 has been reported as a net loss of $293 million compared to a profit of $528 million in 2005, the performance of the poultry segment fell from a profit of $582 million in 2005 to $53 million (Tyson, 2010). During the 2006 financial year, Tyson Foods Inc. announced a range of cost cutting measures designed to save around $200 million within the year. These measures included reducing staffing levels, especially in middle management and management support, minimising recruitment and reducing consultancy fees, relocation costs and sales related expenses (MeatPoultry, 2006). The reasons put forward for this action were market volatility and an excess amount of protein in the US. Moody's Investment Service downgraded Tyson Foods Inc.,

from Baa3 to Ba1 (see Figure 1) suggesting that this reflected Tyson's operating performance and debt protection measures and the challenges of cost reduction (MeatPoultry, 2006).

Figure 1: Moody's rating system (Manning *et al.,* 2007)



Manning *et al.,* (2007) determined that if the credit rating falls further this could potentially affect the ability of Tyson Foods Inc., to finance their current debt levels. In 2007, operating income rose in the poultry segment of the business to $325 million and despite a rise in sales in 2008 the chicken segment suffered an operating loss of $118 million. The operating loss included $26 million of charges relating to restructuring – closing plants, impairments of unimproved real property and software and severance pay. The increase in sales was due to an increase in price as production volumes fell due to the sale of two poultry plants. Input costs increased in 2008 as a result of increased feed ingredient and grain costs and increases in labour and logistics costs as well as other costs associated with general administration. In May 2009, Tyson Foods Inc reported for the first six months of the trading year an operating loss of the chicken segment was $46 million, an improvement of $240 million on the first quarter of 2009 (Tyson, 2010). In 2009 the chicken segment had an increased trading loss of $157 million and the Moody's rating has been further downgraded to Ba3 (Figure 1).

2.2 Pilgrims Pride Inc., (US)

Pilgrim's Pride Inc., financial figures demonstrated (Table 12) a downward trend in operating profit in 2002 that was reversed from 2003 to 2005. During this period the organisation developed the added value rather than the "commodity" frozen product sector of their business. In the context of the global spread of H5N1 AI Pilgrim's Pride Inc., issued amended guidance on its financial forecast for the second quarter of 2006 (Manning *et al;* 2007). This stated that the selling price for chicken leg quarters had declined from an average selling price of $0.33 per pound in the first quarter of fiscal 2006 to approximately $0.15 per pound. In the third quarter of 2006 Pilgrim's Pride Inc., who had at that time a Moody's Investment Service rating of Baa2, said that the then net loss of approximately $15 million was largely due to

weak pricing and high inventory levels (MeatPoultry, 2006) and they implemented a programme of cost reductions and focused on improving efficiencies.

Table 12: Financial figures from Pilgrim's Pride Inc., (2001 – 2009)

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009* 3Q
Sales & other revenues ($ million)	1976	2186	2314	5077	5461	5153	7499	8525	7088
Operating income ($ million)	198	154	249	603	751	297	593	(163)	(20)
Operating income (% of sales)	10	7.0	10.8	11.9	13.8	5.8	7.9	(1.9)	(0.3)

(Source: Pilgrims Pride, 2010 *part)

For the fiscal year 2005, which ended October 1, 2005, Pilgrim's Pride reported record net income of $265.0 million. In the 2006 fiscal year this fell to a net loss of $7.5 million that rose again to a net income of $47 million in 2007. On July 29th 2008 Pilgrim's Pride reported a third quarter loss from operations at $48.3 million and a net loss from the first nine months of the fiscal year of $193.0 million. The feed ingredient costs in the 3rd quarter climbed $266 million (41%) when compared to the same period the year before. The report stated that "*based on the actual costs incurred for the first three quarters of the fiscal year and current commodity futures markets for the remaining quarter, the company's total feed-ingredient costs for fiscal 2008 would be up an estimated $900 million from last fiscal year*". In the previous six months they had restructured their operational base including closing a processing plant and seven distribution centres; reduced the work force by 1,700 (approximately 3.5%); and reduced chicken production in order to "*better balance supply and demand at appropriate selling prices to cover input costs*". On December 1st 2008, Pilgrim's Pride Corporation together with certain of its wholly owned subsidiaries announced that "*in an effort to address certain short-term operational and liquidity challenges, it filed voluntary petitions for relief under Chapter 11 of the United States Bankruptcy Code in the United States Bankruptcy Court for the Northern District of Texas*". The Company's operations in Mexico and certain operations in the US were not included in the filing and it was intended that they would continue to operate outside of the Chapter 11 process. The organisation determined that the significant challenges that it had faced included high feed-ingredient costs, an oversupply of chicken, weak market pricing and softening demand. The business restructured in 2009 and has seen a further reduction in the work force of approximately 4000 and the idling or selling off of processing plants to other integrators (Pilgrim's Pride, 2010). The Moody rating has become grade D and at the end of the third quarter of 2009 the operating loss stood at $20 million.

2.3 Grampian Country Food Group Ltd (UK)

Grampian Country Food Group Ltd was the biggest UK poultry producer and the 12th largest global meat company in 2003 (MeatPoultry, 2006) In the UK, the increasing cost of compliance with environmental legislation including IPPC and animal by-product disposal has meant that there is a legislative driver for the industry to move live bird production to the commodity whole bird and portion market rather than manufacturing deboned meat products. The competitiveness of the cost of processing labour in the UK has also has influenced this trend (Table 9). Analysis of the data from Grampian Country Food Group Ltd financial statements 2000-2005 demonstrated that although the company's

sales revenue was increasing (in part due to acquisitions) there was a pressure on margins with operating income as a percentage (%) of sales falling from 3.4% in 2001 to 1.3% in 2005 (Manning *et al.,* 2007). The figures did not differentiate between sales of poultry, pork beef or lamb so it was not possible to analyse the operating profit of the poultry segment of the business directly. In May 2006, Grampian Country Food Group Ltd reduced their UK output by around 40 million birds a year, 5% of the total UK output, also reducing the numbers employed at two factories (Poultry World, 2006). Grampian Country Food Group Ltd reported a net loss of £2.8 million in 2005 as compared to a net profit of £12.3 million in 2004. Vion NV acquired Grampian Country Food Group Ltd in June 2008 approximately nine months after a buyer was originally sought.

The financial performance data for Sadia S.A (Table 13) and the financial data from the two US organisations have been summarised (Table 14). The reduction in financial performance in 2006 for the US organisations resulted from the impact of avian influenza on the export markets on which US companies depended. The Brazilian organisations were not looking to supply these markets and so were largely unaffected. The performance of Sadia S.A outstrips that of Tyson and Pilgrim's Pride and as shown in Table 9 labour costs in Brazil are 16% of those in the US. This is further supported by other meat supply companies based in Brazil, Marfrig with an operating profit of 30% total sales in 2008 (Marfrig, 2010) and Perdiago with an operating profit of 24.2% (Perdiago, 2010). Even comparing the whole business for Tyson Foods Inc. the operating profit is still well below that of the Brazilian companies at 4.6%.

Table 13: Financial figures from Sadia S.A Inc., (2004 – 2009)

Year	2004	2005	2006	2007	2008	2009* 2Q
Sales & other revenues (R$ million)	7317	8328	7940	9910	12192	2975
Domestic market	3732	4252	4482	5320	6607	1740
Export market	3585	4076	3458	4500	5585	1235
Operating income (R$ million)	1845	2007	1691	2396	2619	570
Operating income (% of sales)	25.2	24.1	21.3	24.2	21.5	22.2

(Source: Sadia, 2010 * part to third quarter)

Table 14: Analysis of operating income as a percentage of sales

	Operating income (% of sales)									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tyson Foods Inc., (poultry segment)	4.6	3.5	5.9	2.1	6.5	7.0	0.1	4.0	(1.5)	(1.6)
Tyson Foods Inc	-	-	-	-	-	-	-	-	-	4.6
Pilgrim's Pride Inc.,	-	10	7.0	10.8	11.9	13.8	5.8	7.9	(1.9)	(1.3)
Sadia S.A	-	-	-	-	25.2	24.1	21.3	24.2	21.5	22.2

Moody's credit ratings represent a rank-ordering of creditworthiness (Figure 1). The rating system differentiates between organisations that are deemed to be investment grade and those that are seen as speculative investments. A speculative grade (Ba1 to C) means that there is deemed to be a higher risk of default by the organisation. An organisation's ability to access credit markets in order to borrow money is based on this rating system. The Moody's

credit rating has been used to compare the credit risk for the companies examined where data was available as well as retailers and key brands Coca Cola and Pepsi (Tables 15 and 16).

Table 15: Range of credit ratings for food manufacturing and processing organisations

Company	Cargill	Tyson Food Group	JBS	Smithfield	Pilgrim's Pride	Sadia	Marfrig	Perdigao
Rating	A2	Ba3	B1	B2	D	Ba1	B1	Ba1
Long term rating (I or S)	I	S	S	S	-	S	S	S
Short term (Prime 1,2,3, not prime)	Prime 1	Not Prime			-	Not Prime		

(Source: Moodys, 2010) I = Investor; S = Speculative

Table 16: Range of credit ratings for food retailers and brand owners

Company	Coca Cola	Pepsi	Tesco	Sainsbury's	Walmart	Ahold	Morrisons	Asda
Rating	A3	Aa2	A3	Baa3	Aa2	Baa3	A3	Aa3
Long term rating (I or S)	I	I	I	I	I	I	I	I
Short term (Prime 1, 2, 3, not prime)	Prime 1			Prime 3	Prime 1	Prime 3	Prime 1	

(Source: Moodys, 2010) I = Investor; S = Speculative

The factors that will impact on this rating are the brand value, market dominance including the degree of customer loyalty, and the debt: value ratio i.e. the ability of an organisation to service debts on a short and long term basis as well as the impact of current financial markets and the perceived viability of the individual organisational models. The supply chain is "zoned" with the retailers sitting firmly in the prime financial investment position, and the commodity meat suppliers excepting Cargill seen as speculative grade. This demonstrates the variance in credit worthiness in different sectors of the supply chain.

3. Discussion

The financial data has shown, for the organisations studied, a significant reduction in financial performance in 2008/2009 in the US compared to Brazil. The data also demonstrates the extent of consequential loss that can occur as a result of market fluctuation, disruption and the impact of supply exceeding demand either as a result of oversupply, a loss of consumer confidence in traded products or the impact of concern over avian influenza and market volatility affecting feed prices. Labour costs have been a driver too within the US and the EU when competing with Brazilian imports. The NFU (2009) stated with regard to the UK industry that: "*After decades of expansion, UK broiler production has fallen in response to poor grower returns, with investment in new housing significantly reduced. Broiler grower productivity growth has been hindered, with an ageing production base*." Investor returns and the degree of risk is therefore a major market driver in the poultry supply chain. Credit risk is an important aspect and in capital markets credit ratings, such as those provided by Moody's Investment Services, will influence credit availability in order to develop and expand global businesses.

Another driver that impacts on commodity food prices is "commodity speculation". The OEDC/FAO report (OEDC/FAO, 2008) stated that "*a particular uncertainty on the demand side of agricultural markets is the growing presence and investments of non-commercial interests, such as financial funds, in futures trading on commodity*

markets". Further the report determined that the turmoil in commodity markets occurred "*against the backdrop of a severe world financial crisis that is widely believed to have sparked a substantial increase in speculative interest in agricultural futures markets*". The degree of interest in commodity products is a mark of the activity in the sector and the OEDC/FAO report defined the following:

- Total open interest in maize has increased from 0.66 million contracts in February 2005 to 1.45 million in February 2008 and the non-commercial traders' share in opening interest increased from 17% to 43%;
- Wheat contracts increased from 0.22 million to 0.45 million between February 2005 and February 2008 with non-commercial traders' share of opening long interest rising from 28% to 42%; and
- Monthly trading volumes have increased during this period by 85% for maize, 125% for wheat and 56% for soybeans.

These three commodities are key components of animal feed and the volatility in prices, indeed rising prices means that the cost of production increases irrespective of the actual physical availability of the commodities themselves. Commodity traders or manufacturers/processors seek to protect themselves against short term price volatility (IATP, 2008). Poultry companies who require commodities for feed processing will seek to gain some price insurance by buying forward to agreed contracts. However, non-commercial speculation takes place not to protect against price risk but rather to benefit by "betting" that prices will go up or go down in the short or long term. This requires a level of volatility in the market and in April 2008 maize (corn) volatility was 30% higher and soybean volatility 40% higher than what would be expected by market fundamentals (IATP, 2008 citing FAO, 2008). The IATP (2008) determined that by July 2008 price volatility had become so extreme that "*some commercial or traditional speculators could no longer afford to use the market to hedge* [offset] *risks effectively*." They argued that the commodity market is particularly vulnerable when supply and demand is closely aligned as a result of production failures, high demand and/or lack of supply management mechanisms.

The US Congress created the Commodity Futures Trading Commission (CFTC) in 1974 as an independent agency with the mandate to regulate commodity futures and option markets in the United States (CFTC, 2009). The organisation's mission is to protect market users and the public from fraud, manipulation, and abusive practices related to the sale of commodity and financial futures and options, and to foster open, competitive, and financially sound futures and option markets. In the September 2008 CFTC report on Commodity Swap Dealers & Index Traders with Commission Recommendations the organisation determined that there had been major changes in the composition of futures market participants have developed over the last 20 years and "*specifically, there has been an influx of new traders into the market – commodity index traders (including pension and endowment funds) that seek exposure to commodities through passive long-term investment in commodity indexes, and swap dealers that seek to hedge price risk resulting from their over-the-counter (OTC) activity.*" The IATP (2008) concluded that: "*There are many elements of the food crisis other than commodities speculation that require urgent attention. But if deregulated speculation continues to induce artificial volatility in agricultural markets, it will be very difficult to finance innovative investments in rebuilding*

domestic agricultural production and distribution capacity in net food import dependent countries." Further the report argued that it will make it more difficult to internalise the costs of natural resource remediation and climate change effects on commodity prices and concluded that further regulation/control should be put in place. Historically, food security data has been based on production and trade figures as well as consumption which has value in itself but this model does not address the emerging volatile financial drivers due to speculation that have the potential in the short term to cause acute food price variations.

One concern within global food supply chains is the so-called "pollution-haven effect". Levinson and Scott Taylor (2008) developed a model to determine that those "*industries whose [pollution] abatement costs increased most experienced the largest increases in net imports. For the average industry, the change in net imports we ascribe to regulatory costs amounting to 10% of the total increase in trade volume over the period*". Within regard to the US and EU poultry supply chains increasing worker welfare and environmental legislation can be shown to have such an effect in this research (Table 9). It could be further argued that a compliance haven can arise where welfare, worker legislation and environmental constraints differs between countries, where investment is flexible and where the products are ultimately sold to the same customers and not differentiated at the point of sale. Bommer (2002) concluded that trade liberalisation increases the probability of strategic relocation on these grounds. Faisal *et al.,* (2007) considered the importance of supply chain agility suggesting that it was important as it provides the capability to quickly adapt to changing market requirements. However, they argued that not all the variables require the same focus; instead there was a set of variables known as driver variables that needed maximum attention. Indeed, whilst this may not affect global food security as a whole, sufficient natural capital is not the only driver to consider when determining how to feed a burgeoning population. Financial sustainability of global supply chains is critical and whilst in some regions of the world the supply chain can drive innovation and new technologies through the operating and net profits that they derive, in other regions there is ever reducing return on the financial and human capital employed. Ultimately lower operating margins reduce financial flexibility and create a more brittle supply chain that is susceptible to major risks such as animal disease, volatility in commodity markets and the cost of legal compliance. Waters (2007) determined that "*by removing slack from supply chains, managers are making them more vulnerable – sometimes described as "taut" or "brittle*". Significant focus has been placed in the industry on sustainability goals such as improving food safety, welfare, reducing environmental impact and embedding social requirements into quality assurance standards but the flexibility, or rather the degree of supply chain brittleness this creates also needs to be considered. New technologies in terms of enhanced welfare, food safety and environmental impact require significant ongoing investment and if that investment cannot be met by operating profitability it will ultimately impact on the poultry supply chains ability to meet such challenges into the future.

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