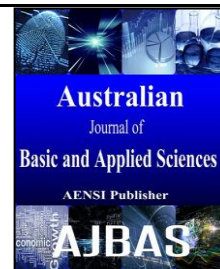




ISSN:1991-8178

Australian Journal of Basic and Applied Sciences

Journal home page: www.ajbasweb.com



Market Concentration: An Analysis of U.S. Cow Milk Industry

¹Everton Anger Cavalheiro, ²Luis Antonio dos Santos Franz, ³Rogério Royer, ⁴Alexandre Xavier Vieira Braga, ⁵Ariane Ferreira Porto Rosa

¹Federal University of Pelotas, Pelotas, Brazil

²Federal University of Pelotas, Pelotas, Brazil

³Federal University of Pelotas, Pelotas, Brazil

⁴Federal University of Pelotas, Pelotas, Brazil

⁵Federal University of Pelotas, Pelotas, Brazil

ARTICLE INFO

Article history:

Received 12 July 2015

Accepted 28 August 2015

Available online 15 September 2015

Keywords:

Milk; Industry; Market concentration

ABSTRACT

In this paper, we analyzed the American industry of milk. The production is concentrated in four U.S. states: California, Wisconsin, Idaho and New York, who produces 47% of all American cow milk. Between 2002-2013 the number of cows increased 10% (794,000 cows). This growth is implicated in increased 15.87 billions of pounds of milk for this period. In other hand, in this period, the production per cow increased 18%. This growth was responsible by 28.23 billions of pounds of milk and represented 61% of total variation in this period. Also, we analyzed the market concentration of four American biggest milk processors from 2002 to 2013. The results suggest a moderate concentration in this market, who four processors (Dairy Farmers America, Dean Foods, California Dairies Inc. and Land O' Lakes Inc.) processes 48% of all American cow milk.

© 2015 AENSI Publisher All rights reserved.

To Cite This Article: Everton Anger Cavalheiro, Luis Antonio dos Santos Franz, Rogério Royer, Alexandre Xavier Vieira Braga, Ariane Ferreira Porto Rosa., Market Concentration: An Analysis of U.S. Cow Milk Industry. *Aust. J. Basic & Appl. Sci.*, 9(27): 732-736, 2015

INTRODUCTION

Milk is a one of the most important foods for the man and is a very important industry for society in actuality. According to FAOSTAT (2015), the world produced 1.4 trillion of pounds of cow's milk in 2013, and the world production increased 37,80% in the last 20 years. The U.S. was the largest cow's milk producer in the world in 2013, producing 201 billions of pounds, accounting for 14.3% of world production, an increase of 31% when compared to 1994.

In the U.S., the farmer-owned cooperatives have an important role in this industry. For example, Severson (2015) quotes that the top 50 dairy cooperatives represent almost 80 percent of the milk market in this country. The American milk industry is highly competitive, although the federal government establishes minimum prices that we must pay to producers.

In this sense, Mansfield & Yohe (1988), quotes that the market is classified in economics as perfect competition, regarding any condition: i) the product sold by any salesman is the same as any other's; and ii) each participant in the market is so small when compared to the market that he cannot affect the product's price. Or yet, in a simpler manner, as stated by Wessels (1997): this is a market that owns a well

standardized commodity that is produced by many companies, with no barrier into the market, information equality and identical firms.

The point now is to verify some of the have conditions that make the milk market of this country being classified as competitive and, as such, having an auction-like features. Wessels (1997) adds that in market analysis, there is a key-distinction, in order to identify the cause and the resulting effect; and he adds that in perfect competition its elementary behavior is price - determining both the offer and the demand of such commodity.

In other hand, we can analyze the milk market through of the lenses of Industrial Organization (that was also called Industrial Economy, in Great Britain and Europe). This vision is not recent, where the central focus of this study is: (i) competitive, as the engine of most modern markets, and (ii) the power of monopolies, that interfere with the good results of competition (de Jong & Shepherd, 2007). The Industrial Organization also focuses on the study of public policies, where the first studies analyzed the governmental policies, in order to prevent the existence of monopolies, to eliminate, or at least restrict, the effects of the existing monopolies. The public policy studies mainly include: antitrust policies, in order to prevent or reduce the power of monopoly; regulation, so as to contain the natural

Corresponding Author: Everton Anger Cavalheiro, Federal University of Pelotas, Pelotas, Brazil.

Tel: +55-055-91018865; E-mail: eacavalheiro@hotmail.com

monopolies; deregulation, which removes restrictions, hoping that the competition will grow, and the creation of estates that seek to support the public interest when competition does not work.

However, a growing research area, within the Industrial Organization, is identifying the industrial concentration level, where one seeks understanding the relationship between the concentration level and this industry's price/profitability ratio, where much evidence point to a positive relationship between market concentration and the sector's profitability (Peltzman, 1977). The basic assumption for this purpose is that high concentration enables collusion and, as a consequence, the manipulation of market prices.

The author quotes that the relationship between the market structure and production costs is long known. In this sense, a technological breakthrough in a not concentrated industry can produce a natural monopoly since there will be an increase of the operational efficiency through time, generating competitive advantages for a specific organization. On the other hand, according to the author, the process through which old technology becomes economically obsolete also implies a reduction (or at least no increase) of the offered goods. Whatever force is operating this system, it is crucial to understanding what the concentration level is, so as to control the excessive power of some firms within its industry.

Industrial structure and industrial concentration issues have concerned economists and politicians for at least a century (Jacquemin & Slade, 1989), while the industrial concentration level is tightly connected to the margins firms keep in the market, since competitiveness drops according to the increase of concentration level, creating opportunities for firms to price in a differentiated manner. The market concentration analysis, on the other hand, of a specific industry, stems from the idea of how it is distributed in terms of production and participation of their firms, in a determined market. In this context, Bain & Qualls (1968) define industrial concentration according to property, considering the control of a great proportion of aggregates of economic resources or activities, by a small companies' proportion.

George (1983) states that the industrial concentration regards the size distribution of firms that sell a specific product, with a significant dimension of the market structure, for having an important role regarding a company's behavior and performance. Besides, the number and size distribution of these firms influence the expectations regarding the competitors' behavior. In this context, Possas (1985) comments that the industrial concentration is closely linked to the internal profit accumulation and corporate technical progress.

According to Bain & Qualls (1968) the market structure regards the organizational features that

determine the relationships with the agents, being an important part of the competitive environment of firms, in order to influence the competitors' pattern. For the author, this means that the market structure features have a strategic influence on the nature of competition and in determining prices in the market

Considering this problem, and considering the hypothesis that the concentration level increases represent a decrease in the industry competitiveness, creating opportunities for firms to price differently, we established the following research problem: what is the value of industrial concentration of major American milk processors?

Material And Methodology:

Measuring concentration is necessary to analyze the market structure in an industry and, thus, to identify relevant elements in this structure, such as competitiveness and barriers to entrance, among others. These elements interfere in the conduct and performance of these firms, as well as in the structuring of the market itself. In order to address the problem of this research, we analyzed the data using two methods that demonstrate the concentration level of companies in their markets: the Partial Concentration Rate (CR) and the Hirschman-Herfindahl Index (HHI).

Partial Concentration Rate (CR):

According to Barthwal (2007), market concentration is an important element of market structure which plays a dominant role in determining the behavior of a firm in the market. By market concentration we mean the situation when an industry or market is controlled by a small number of leading producers who are exclusively or at least very largely engaged in that industry. Two variables that are of relevance in determining such situation are: (i) the number of the firms in the industry, and (ii) their relative size distribution. How these two dimensions cause different form of the market structure having vital consequences for the pricing and output decisions of the firms. In this sense, the partial concentration rate index measures the proportion represented by a fixed number of the largest companies of an industry when compared to the total of such an industry. Its calculation is as follows:

$$Cr(k) = \sum_{i=1}^k Pi \quad (1)$$

where k is the number of companies that are part of the calculation and Pi = participation of the i -th company in the market.

The index is easy to interpret since it varies from 0 (zero) to 100. The closer it gets to 100, the higher the industry concentration is, i.e., if a small number of companies responsible for a big proportion of production, sales, or employment in the industry, that means that the concentration will be higher. In this

research, we will use the measure Cr (4), where the four largest companies will be considered in this analysis. In this context, Bain & Qualls (1968), analyzes the market concentration classifying markets into: Cr (4) equals or higher than 75%: highly concentrated oligopoly; Cr (4) between 50% and 74%: moderately concentrated oligopoly; Cr (4) between 25% and 49%: weakly concentrated oligopoly; and Cr (4) lower than 25%: atomistic.

Herfindahl-Hirschman Index (HHI):

HHI is defined by the sum of squares of the participation of each company when compared to the industry's total size. This index considers all the companies in the industry and is calculated as follows:

$$HHI = \sum_{i=1}^n P_i^2 \quad (2)$$

where P is the market share of firm i in the market, and n is the number of firms.

The Herfindahl Index (H) ranges from $1/N$ to one, where N is the number of firms in the market. Equivalently, if percents are used as whole numbers, as in 75 instead of 0.75, the index can range from $10,000/n$, when companies have an egalitarian participation in the market, up to 10,000 (monopoly). The HHI increases, according to the increase of inequality among the companies belonging to the industry, thus being a good indicator of the market

situation. Do note that the company size is considered by its squared participation (P_i), i.e., smaller companies have a smaller role in this index.

Thus, the higher the index, the more concentrated the market is, and, as a consequence, smaller the competition among companies is. According to Cetorelli (1999), the market is not concentrated when the HHI value is below 1,000, it is moderately concentrated between 1,000 and 1,800, and it is highly concentrated when it reaches a value higher than 1,800.

In order to answer this research's problem, we carried out a time descriptive research where we used the average prices paid to milk to producers in The USA, deflected by the Consumer Price Index. Another variable of this study was the participation of each firm in the national offer for milk, on a yearly basis from January 2002 to December 2014..

RESULTS AND DISCUSSION

Using the information of USDA/NASS (2015), we obtained the cow milk production in billions of pounds, per State, as shown on Table 1. We can see in this table that only four states (California, Wisconsin, Idaho and New York) produces around 50% of the United States, showing that production is concentrated in these states.

Table 1: Cow milk production, in million pounds, per state between January 2002 and December 2014 and Herfindahl-Hirschman Index and Cr (4) for the cow milk production in the four biggest producers.

State	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002
CA	42	42	42	41	40	40	41	41	39	38	36	35	35
WI	28	27	27	26	26	25	24	24	23	23	22	22	22
ID	14	14	14	13	13	12	12	12	11	10	9	9	8
NY	13	13	13	13	13	12	12	12	12	12	12	12	12
USA	206	201	199	196	193	189	189	185	182	176	171	169	170
CR (4)	47%	46%	48%	48%	48%	47%	48%	48%	47%	47%	46%	46%	46%
HHI	694	665	668	669	665	654	680	730	658	654	651	633	617

CA=California; WI=Wisconsin; ID=Idaho; NY=New York ;
Source: USDA/NASS. (2015)

Table 1 shows that both indexes (HHI and Cr (4)) point to a high concentration of the milk production in California, Wisconsin, Idaho and New York, these four states are accounted for 46% of the total cow milk production in 2002, remaining at a level close to 47% in the following years. The Table 1 shows that the cow milk production has grown 21.16% between 2002 and 2014 (from 170 billion pounds to 206 billion pounds in 2014). This growth can be partially explained by the increase of exports. According to USDEC (2014), exports were equivalent to 15.5% of U.S. milk production in 2013, thus implying more pressure on milk demand.

In order to verify the causes of that grown of milk production, we separated in growing productivity and growing of a number of cows, as showed in Table 2. To separate both effects we use the information of 23 selected states and equations (3), (4) and (5):

$$\Delta P = \Delta PPC + \Delta QC \quad (3)$$

$$\Delta PPC = (PPC_t - PPC_{t-1}) \times QC_{t-1} \quad (4)$$

$$\Delta QC = (QC_t - QC_{t-1}) \times PPC_t \quad (5)$$

where ΔP is the variation of the production total in a year, ΔPPC is the effect of variation in productivity per cow and ΔQC is the effect of variation of the quantity of head of cows.

Table 2 shows that the number of cows for 23 selected states (Arizona, California, Colorado, Florida, Idaho, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, New Mexico, New York, Ohio, Oregon, Pennsylvania, Texas, Utah, Vermont, Virginia, Washington and Wisconsin) increased 10% (794,000 cows) between 2002 and 2014. This growth is implicated in increased 15.87 billions of pounds of milk for this period (sum of Δ per number of cows for this period). The same table

shows that the production per cow increased 18% between 2002 and 2014, this growth was responsible by 28.23 billions of pounds of milk and represented

61% of total variation in this period. In Table 3 we show the production of the four largest companies.

Table 2: Number of cows, production, and productivity per cow, by year, to the 23 selected states between 2002-2014.

	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003*	2002*
Cow (thousands)	8,567	8,551	8,500	8,449	8,355	8,409	8,495	8,322	8,246	8,138	8,081	7,775	7,773
Production per cow***	22.3	22.3	22.0	21.6	21.4	20.8	20.7	20.5	20.2	19.9	19.2	19.0	18.9
23 states production	193.2	190.6	186.6	182.7	179.1	175.3	175.9	170.7	166.6	161.6	155.4	147.9	146.6
USA production	206.0	201.0	199.4	196.2	192.8	189.3	189.0	185.6	181.8	175.8	170.8	169.3	170.1
% 23 states in The USA	94%	95%	94%	93%	93%	93%	93%	92%	92%	92%	91%	87%	86%
Δ of total production	2.5	4.0	3.9	3.6	3.9	-0.6	5.1	4.1	5.1	6.2	7.5	1.3	nd**
Δ per number of cows	0.3	1.1	1.1	2.0	-1.1	-1.8	3.5	1.5	2.1	1.1	5.8	0.1	nd**
Δ per productivity	-0.3	2.9	2.8	1.6	5.0	1.2	1.6	2.5	2.9	5.1	1.7	1.2	nd**
* for 20 selected states ** data not available *** in thousands													
Source: USDA (2015)													

Table 3: Production of the 4 largest milk companies in billions of pounds.

Company	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002
Dairy Farmers America	39.4	39.2	39.0	37.8	37.7	37.6	37.6	36.7	35.9	36.0	35.8	35.1
Dean Foods	26.7	26.5	26.0	26.0	26.0	26.0	26.7	25.3	24.8	24.9	24.9	24.5
California Dairies Inc.	16.9	16.9	16.8	16.9	16.9	17.6	16.9	16.1	15.2	15.2	14.5	14.6
Land O' Lakes Inc.	12.9	13.0	13.0	12.9	12.7	12.5	12.3	12.3	11.9	11.9	12.2	12.2
Total	95.9	95.5	94.8	93.6	93.3	93.7	93.5	90.4	87.8	88.0	87.5	86.5
Data not available for 2014.												
Source: IFCN Dairy Report (2014)												

On Table 3 we can see that three of four companies (Dairy Farmers America, California Dairies Inc. and Land O' Lakes Inc.) are cooperatives. On the same table, we can see that the four companies were responsible for to process 95.9 billions of pounds of cow milk in 2013 (increased

11% between 2002 and 2013). These results point to a possible moderate concentration in this industry. In table 4 we showed the market share and Herfindahl-Hirschman Index and the international prices paid to producers

Table 4: Market share and Herfindahl-Hirschman Index of the 4 largest milk companies and U.S. and Europe's price paid to producers.

Company	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002
DFA*	20%	20%	20%	20%	20%	20%	20%	20%	20%	21%	21%	21%
Dean Foods	13%	13%	13%	13%	14%	14%	14%	14%	14%	15%	15%	14%
California**	8%	8%	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%
Lakes Inc.***	6%	6%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%
Total Share	48%	48%	48%	49%	49%	50%	50%	50%	50%	52%	52%	51%
HH-Index	673	676	689	688	710	715	745	725	736	784	790	760
International Price	20.69	16.08	19.37	16.30	12.82	18.14	20.97	10.61	10.28	9.82	8.10	6.35
U.S. Price	19.61	18.52	20.14	16.10	12.27	17.55	19.20	12.64	14.88	15.86	12.10	12.05
* DFA=Dairy Farmers of America ** California = California Dairies Inc. ***Land= O' Lakes Inc.												
Data not available for 2014												
Source: IFCN (2013)												

On Table 4 we evaluate the market participation of the 4 largest firms for milk processors, from 2002 to 2013, where these firms kept 51% in 2002. In this table, we can see that the industrial concentration level (HH-Index) decreased significantly in this period. In this period (2002 – 2013), the market showed to be moderately concentrated, since in 2013, the four companies represented around 48% of the volume produced. This decreased occurs during the increased of the price paid to milk producers, potentially influenced by the decreased of the power of the companies.

Conclusion:

In this paper, we analyzed the American industry of milk. The production is concentrated in four U.S. states: California, Wisconsin, Idaho and New York, who produces 47% of all American cow milk.

Between 2002-2013 the number of cows increased 10% (794,000 cows). This growth is implicated in increased 15.87 billions of pounds of milk for this period. In other hand, in this period, the production per cow increased 18%. This growth was responsible by 28.23 billions of pounds of milk and represented 61% of total variation in this period.

Also, we analyzed the market concentration of four American biggest milk processors from 2002 to 2013. The results suggest a moderate concentration in this market, who four processors (Dairy Farmers America, Dean Foods, California Dairies Inc. and Land O' Lakes Inc.) processes 48% of all American cow milk. During this period, the market concentration of this firm was decreased. This decreased occurs during the increased of the price paid to milk producers, potentially influenced by the decreased of the power of the companies.

REFERENCES

Bain, J. S., P.D. Qualls, 1968. *Industrial organization*. New York: Wiley.

Cetorelli, N., 1999. Competitive analysis in banking: appraisal of the methodologies. *Economic Perspective - Federal Reserve Banco of Chicago*, 23: 2-15.

de Jong, H.W., W.G. Shepherd, 2007. *Pioneers of industrial organization: How the economics of competition and monopoly took shape*: Edward Elgar Publishing.

FAOSTAT, 2015. Website: <http://www.igc.int/en/downloads/gmrsummary/gmrsomme.pdf> (accessed 26 July 2015)

George, K.D., 1983. *Organização industrial: concorrência, crescimento e mudança estrutural*. Rio de Janeiro: Zahar.

IFCN-DairyReport, 2014. World Dairy Map - various years, from <http://www.ifcndairy.org/media/pdf/Dairy-Map-09-english-lowres.pdf> (accessed)

Jacquemin, A., M.E. Slade, 1989. Cartels, collusion, and horizontal merger. *Handbook of industrial organization*, 1: 415-473.

Mansfield, E., G.W. Yohe, 1988. *Microeconomics: theory, applications*: Norton New York.

Peltzman, S., 1977. The Gains and Losses from Industrial Concentration. *Journal of Law and Economics*, 20(2): 2.

Possas, M.L., 1985. *Estruturas de mercado em oligopólio*. São Paulo: Hucitec.

Severson, R.M., 2015. Cooperatives. In S. C. Kyle (Ed.), *New York Economic Handbook* Ithaca: Cornell University

USDA/NASS, 2015. Annual Milk Production, Disposition, and Income (PDI) and Milk Production, various years., from <http://www.nass.usda.gov/> (accessed)

USDEC, 2014. USDEC Export Profile, from <https://www.usdec.org/newsroom/news-releases/news-releases/news-release-2/6/2014> (accessed)

Wessels, W.J., 1997. *Microeconomics the Easy Way*: Barron's Educational Series.