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Main Impacts on Value of Milk Production in Different Regions from Rio Grande Do Sul, Brazil

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Abstract

This paper analyzed the main impacts on the value of milk production in different regions (Development Councils) of Rio Grande do Sul, Brazil. For that, we used the structural-differential method known as method Shift Share effects with production, productivity, price of milk and production values. It is relevant to note that, as well as production, the dairy herd and the productivity underwent positive and significant changes in the analyzed period, in both federal and state level. The impact each variable causes on the total amount produced defines whether what is occurring is the use of resources or just an increase in the matrices. The main results show that some Councils, such as Fronteira Oeste, whose price-effect corresponds to in 40.65%, the lowest amongst all and denotes a lower market dependence. The most satisfactory productivity effect occurs in the Sul Council with 48.98%, inferring a higher production efficiency. For the herd effect, the highest matrices growth rate in production were found in the Metropolitano Delta Jacuí Council, with the value of 30.09%. However, for the purpose of value of production, the Rio da Várzea Council obtained the most significant value of 117.94%. Thus, the results enable understanding the bottlenecks and state regional needs in the sector, influencing economic decisions. The effect of the milk price was critical to increasing the value of milk production in the analyzed periods and the productivity effect showed mild effect on the value of milk production. Likewise, the herd effect was found in the analysis to generate less impact than other effects.

Keywords: milk, shift share, herd, productivity, price

1. Introduction

The agribusiness goes through daily challenges to maintain its quality and sustainability. The opening of the international trade in the 1990's caused the insertion of foreign industries in Brazil, and thus, facilitated the processing of primary products such as those produced by the agribusiness and enabled global price competition, quality and production. For the dairy sector, it was no different, new market determinations required that all the links within the production chain reduce costs and the use of capital. Continuous internal and external demand for dairy products moved the level of the domestic prices.

According to Ferreira and Teixeira (2005, p. 194), "[...] on the one hand, favored imports of milk, and on the other, it helped create the culture of competition". At that time of national economy there was the incentive for companies to invest in capital in order to compete with the multinationals settled in Brazil, which were making the market more competitive with foreign milk.

The supply chain has significant economic and social importance in the development of a country. The importance of the agro-industrial sector in the generation of the family farm income can be observed in the production of milk which contributes to increases in the income, generating production, employment, and thus avoiding the rural exodus.

So, with national incentives for the domestic market to become competitive, the dairy companies have become large and concentrated, with the capacity to serve the entire internal market and have surplus for exportation (Marion Filho et al., 2011, p. 234), leaving Brazil among the world's largest dairy exporters.

According to Carvalho (2002, p. 2), the opening of the Brazilian economy, [...] and the increase in foreign direct investment flows, provided a change of position of resident companies in the country, after a period of accommodation, they had to adapt to the new market conditions. The search for competitive advantages caused companies to seek an increase in scale, thus enabling larger amounts of investments to happen. This process led to the establishment of large industrial firms.

The changes in the dairy sector were positive. It is stated that the new policies, against the divergent picture to live in the country before trade liberalization, enabled productivity gains, and that the integration of industry and producer, formerly little worked on, coordinated and assisted the primary sector to achieve productive and qualitative improvements, providing higher economic returns to the producer, where it, in turn, seeks to industrialize the product with the same industries, fortifying those links in the production chain (Finamore & Montoya, 2005, p. 214).

These interactions between the segments of the chain can be demonstrated by the increase of 78% in the domestic production of milk, going from 880.5 million liters in 1997 to 1.5 billion liters in 2012, as shown by the data from the Instituto Brasileiro de Geografia e Estatística (IBGE, 2013). Yet, according to the Food and Agriculture Organization (FAO, 2012), the world's dairy herd in 2000 was close to 221.3 million heads and in 2010, 258.14 million, showing a percentage increase of, approximately, 16% in the period. In 2000, India, Brazil, Russia, Sudan and United States, respectively, composed the world's largest dairy herds. Though in 2010, the biggest herds were located in the India, Brazil, Sudan, China and Pakistan.

When comparing the evolution of herds to the productivity, it turns out that there was a higher productivity growth when compared to the growth of cattle. This growth can be attributed to the intensification of production systems, especially the use of new technologies, among them the genetic improvement of livestock through artificial insemination (Coimbra Filho, 1981).

The increased domestic production developed through the major participation of the Southeast and South regions of Brazil, concurrently, concentrating in these regions the largest domestic milk and derivatives producers, as well as the processing industries. In the state of Rio Grande do Sul, the increase in milk production quadrupled during the period examined, from 1998 to 2012, according to IBGE (2013).

It is highlighted that as well as production, the dairy herd and productivity suffered positive and significant changes in the period analyzed, both at country level and in the state of Rio Grande do Sul, as shown in the data from IBGE (2013). The impact each variable causes on the total amount produced defines whether what is occurring is the use of resources or just an increase in the matrices.

In this context, the main objective of this article is to decompose the impacts of productivity; herd and price in the milk production value in the different regional development council (Councils (Note 1)) in the state of Rio Grande do Sul, Brazil.

2. Agribusiness

The food industry has always played an important role in the Brazilian economy, representing one of the oldest existing production structures in the country. The agro-market can be considered the engine of Brazilian trade, having a major share in employment and income generation.

Barbosa (2009) conceptualizes agribusiness as the idea of a productive chain with its interaction and interdependence. The author highlights that the sector's high employment capacity as well as its income generation. He explains that the agricultural sector exceeded the industrial sector, demonstrating its influence and importance in the growth and development of the nation. However, playing and seeking participation in the national economy, the dairy sector has strong personality and is rapidly developing, translating thus positive outlooks for the production chain.

The milk and milk products agribusiness plays an important role in food supply and the generation of employment and income for the population (IBGE, 2011). Regarding the world's milk production, according to FAO (2012), China holds the fourth largest herd of dairy cattle, moving from tenth place in 2000 to the current position in 2010. Pakistan was the sixth in the world ranking in 2000, rising to fifth place in 2010. In the ten years under review, the country with the largest herd growth rate was China with a growth of 8.96% per year; followed by Sudan, with an annual growth rate of 4.42%; Pakistan, 3.65% per year and India, 2.42% per year. Despite holding the world's second largest dairy herd, Brazil achieved an annual growth rate of 2.28%.

Corroborating the data of FAO (2012), the data from Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA, 2012) shows that milk production in Brazil increased from 19.767 million to around 30.715 million tons between 2000 and 2010. The data shows an increase in its growth of nearly 35.64%. According to Carvalho et al. (2007),

the outlook is optimistic and the dairy business will continue to grow, approximately, 3.4% per year, reaching 40.25 billion liters in 2020.

After an unusual year, with low domestic and external consumption, and consequence high drop in commodity prices started in 2007, with a high demand for milk and dairy products, which generated an increase in international trade, exporting, approximately, 80% of milk powder, between December 2006 and November 2007. The Ultra High Temperature (UHT) and the pasteurized milk achieved high growth in the first half, and a loss in the second half due to the increase in prices and supply. This set of situations led to an increase in producer revenue of, approximately, 28% when compared to the previous period.

2.1 Production

The dairy sector remained for a long period of time under a controlled prices system. According to Ferreira and Teixeira (2005), the deregulation of the activity in 1991 resulted in the liberation of the prices and, consequently, in their drop. They also point out that the trade liberalization and the implementation of the MERCOSUL favored milk importation and created a culture of competition. Through the Brazilian economic stability, positive changes occurred in the milk agribusiness.

The world supply and demand greatly impact the prices and the direction of the national production. It is relevant to highlight that the European Union has the largest volume of production of the liquid, and that the production is spread in several countries. Its production remained with little quantitative change, going from 132.5 million tons to 135.5 million tons.

The world's second largest producer – the United States – in face of its high productivity and advanced genetics had a production in 2010 of, approximately, 87.5 million tons, presenting a more significant variation of 6.1% when compared to its 2006 production, which reached 82.5 million tons.

Internally, Brazil has a strong consumer market and the ability to qualify and produce greater quantities of milk, despite the country's only ranking fifth in the worldwide production. In 2006, Brazil produced 25.2 million tons of liquid milk and, in 2010, the production rose to 30.0 million tons, reaching a positive variation of 18.7% (Milk Point, 2012).

The analysis of the data of IBGE (2014) points out that the domestic production in the dairy chain has an uptrend. In the analyzed period, between 2002 and 2012, a change in the productivity led to a growth of 49.26%, demonstrating a specialization, higher productivity and hence the inclusion of a new economic activity in the country. The increased domestic production has been developed through the broad participation of the Southeast and the South regions, where the largest domestic producers of milk and milk derivatives are located, as well as the processing industries.

It is important to highlight the need for costs and production management due to devaluation of the exchange rate in the preceding periods, which caused a production improvement in the country. In Brazil, the productivity per cow in 2002 reached 1152 liters/year, reaching 1417 liters/year in 2012. In contrast with Rio Grande do Sul, where the productivity in 2002 was already higher than the national average in 2012, with an amount of 1964 liters/year, rising to 2670 liters/year in 2012. These data denotes that even with a high disparity in productivity at national and state level, the state of Rio Grande do Sul has a lot to improve, since it is far from Europe and USA in productivity.

In the state of Rio Grande do Sul the production is dynamic. According to Barros et al. (2010), the state has an atomized market structure, because the production is widespread with the participation of small, medium and large producers. It is important to mention that the participation of a large number of small producers stems from the profitability that the industry provides, an effect due to the high demand and low supply of the product and its derivatives.

Gomes (2008) states that eleven of the fourteen agro industries being deployed in southern Brazil have chosen the regions of predominance of family agriculture to settle: the southwest of the state of Paraná; the west of Santa Catarina and the northwest of Rio Grande do Sul. For the author, it is not difficult to understand the reasons for the settling of so many dairy industries in these three regions, as they have the decisive factors for the consolidation of the dairy business, which are: fertile soil, temperate climate, good water availability, small farms, family labor, production of milk-based pasture and an easier access to credit.

Such important representation is due to the good performance of some states such as Rio Grande do Sul, which ranks second amongst the states in milk production, accounting for 12% of the national production. This position is due to the creation of new industries and the expansion of the existing ones. The dairy sector of the state has,

approximately, 232 industrial plants, distributed throughout the Councils, generating around 300.000 direct and indirect jobs (Colussi, 2007).

The development of the activity attenuates is growing even with bottlenecks to be resolved, according to the analysis of the production data from the Fundação de Economia e Estatística (FEEDADOS, 2014). There is also the participation of each of the twenty-eight Councils for title for the state, the second largest national milk producer.

Some Councils contribute too much of the production, and the Produção Council accounts for 10.49% of total production, equivalent to 31 million liters. It also highlights the importance of Fronteira Oeste e Vale do Taquari Councils, which have a share of 9.58% and 9.09% respectively, corresponding to 186 and 160 million liters of milk. Together they produce 29.16% of the milk of the state, 579 million liters.

The analysis of the data from FEEDADOS (2014) highlights the more intensive participation of Fronteira Noroeste, Produção and Vale do Taquari Councils, assigning the participation of 10.06%, 9.78% and 9.10%, respectively. It highlights the low influence of the production value of Litoral, Centro-Sul, and Vale do Rio dos Sinos Councils, representing a share of 0.21%, 0.32% and 0.42%, respectively.

During the analyzed period, it was possible to observe that the Councils had high positive changes in the productive value, such as the Council of Médio Alto Uruguai, Produção, Nordeste and Alto da Serra do Botucaraí Councils which varied 599.10%, 463.20%, 451.20% and 431.40%, respectively. These variations gathered an amount of R$ 577 million, representing 25.40% of monetary growth in the state, which reached a value of R$ 2.272 million.

It is important to highlight that the activity is developed heterogeneously in the state. An example of that is in the analysis of the Litoral Council, which obtained a reduction of 12.20% in the analyzed period. This is due to population densities, but above all to the geographical position, which enables the execution of differentiated activities that are more viable for the location in which it is inserted.

Regarding the state of Rio Grande do Sul, Fernandes (2008) analyzes that the volume of milk received by state's industries is higher than the state's domestic production, taking advantage of commodity imports to supply the business plans. Thus, Rio Grande do Sul plays an important role in the national scenario of the dairy sector and the role that each region of the state has to contribute to income generation for the local population.

2.2 Demand for Dairy Products

Maintaining the national performance, the state's dairy sector is strengthening and has been gaining ground in the state's economy. The Balance of Trade of Rio Grande do Sul in the dairy products sector (US$) in the period from jul.2001 to jul.2012 (FEE, 2012) shows that from 2004 to 2008 the participation of dairy products in the balance of trade increased 110 times, from R$ 0.6 million to R$ 62.8 million, respectively.

In the following years, due to the international crisis and, later, the exchange rate appreciation, there was a sharp drop in the state's exports and a large increase in imports, a variation equal to 91.7%, reaching, in the years from 2010 to July 2012, a trade deficit in the sector of R$ 3.2 million and R$ 27.6 million, respectively.

A surprising fact that occurred in the national dairy chain, as described by Ponchio and Silva (2005), is due to the increased domestic demand for milk in 2004, in which it absorbed the increased supply of 2.8%. The increase of domestic demand along with the new external performance, increase in exports and trade surplus, provided an increase in the price of the commodity for the producer.

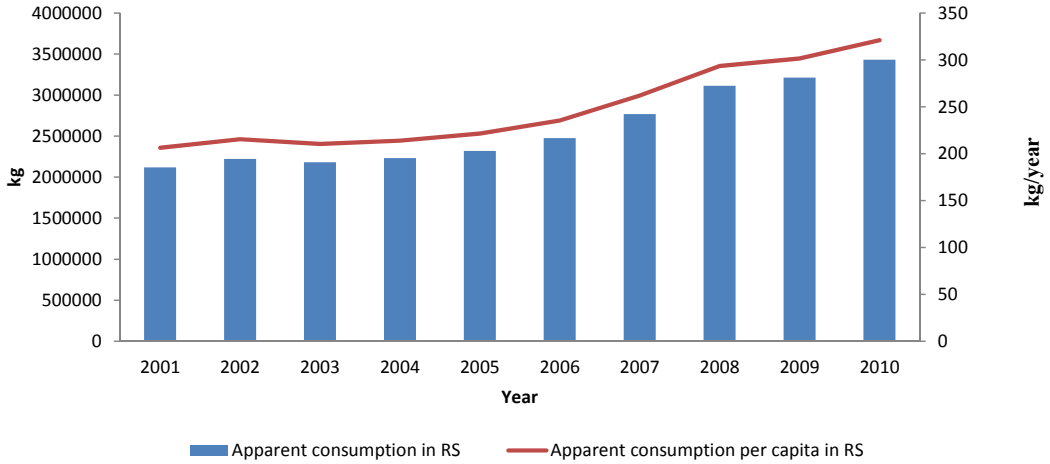

Figure 1. Apparent consumption of dairy in the state in the 2001-2010 period

Source: Prepared by the author with data from FEE (2012).

As Figure 1 shows, the apparent consumption in Rio Grande do Sul has an uptrend in the period between 2001 and 2010, however no homogeneity can be observed. The increased state production in the period was of 63.5%. Exports rose 92.2% and imports ranged -68.4%, in other words, imports decreased when compared to 2001. The importance that the milk production from Rio Grande do Sul has on the national production is noteworthy. The increase in the apparent consumption, in an overall analysis between the initial and the final periods is sustained by the domestic production, once that the increase in exports and decrease in imports negatively impact the apparent consumption.

3. Materials and Methods

3.1 Shift Share Methods

The state of Rio Grande do Sul currently holds the second largest milk production nationwide, attributing to this, the need to understand the bottlenecks and needs that the state has. Through this design, an analysis by means of the differential-structural method is performed, in order to verify within the Councils, the intensity with which the variables productivity, price and herd affect the value of production in the period 2002-2012.

The shift share model is a statistical analysis that can be used in various fields of knowledge. The analysis decomposes the rates of variation in sources of knowledge, that is, the model seeks to illustrate the behavior of the agricultural production through the decomposition of the factors responsible for the variation in the production.

To separate the herd effect, productivity effect and growth rate of the price of the milk production value the shift share model, also known as differential-structural model, was used. Thus, it will enable estimating the relative importance of each component on the increases or decreases in production value. The model used is analyzed in three different effects: (i) Herd Effect caused by a variation in number of milked animal; (ii) Productivity Effect, which contains a modification in milk productivity through new technologies and genetic improvement of the herd; (iii) Price Effect, analyzing the effect of the price on the value of production.

This model seeks, through the shift share model, to determine the variation between two annual parameters being determined as an initial period (t_0) and the final period (t_1), production value (V), dairy herd (A), the average milk production of the state (R) and the average price paid for the states. Thus, by the decomposition of the equations obtain the herd effect, effect productivity and price effect, both expressed in annual growth rates (%).

Seeking to infer the effects described, the value of production is incurred that ($Vt_1 - Vt_0$), giving up the difference between the value of final output and the value of the initial production, in others words, indicates the change in the total value of production comprised in the period.

Faced with this explanation, it is inferred in effect, for better understanding and interpretation of data, the insertion of the growth rate (r) of the value of milk production. Thus, by the decomposition of the equations we obtain the following effects, expressed in annual growth rates (%):

$$\text{Herd Effect} = \left[\frac{\left(Vt_1^A - Vt_0\right)}{\left(Vt_1 - Vt_0\right)}\right] r \quad (1)$$

The equation of the herd effect ($Vt_1^A - Vt_0$) is the participation of the herd (A) in the final period of the production value by comparing it with the original, which captures the herd variable.

$$\text{Productivity Effect} = \left[\frac{\left(Vt_1^{AR} - Vt_1^A\right)}{\left(Vt_1 - Vt_0\right)}\right] r \quad (2)$$

In this equation, following the same reasoning, however part of the total equation ($Vt_1^{AR} - Vt_1^A$) depicts the variation due production value (A) and productivity (R) in the final period with the value of the included producing the herd, having, with this, the correspondence to the significance of productivity in production value.

$$\text{Price Effect} = \left[\frac{\left(Vt_1 - Vt_1^{AR}\right)}{\left(Vt_1 - Vt_0\right)}\right] r \quad (3)$$

At the price effect, the determination of its characteristic discusses the difference between the value of production at the end of time by subtracting the value of production built the flock and productivity, in the same period, where "*r*" measures the growth rate between the two periods. To obtain the growth rate between two periods (*r*) the equation used is as follows:

$$r = \left(\sqrt[t1]{Vt_1 / Vt_0} - 1\right) \times 100 \quad (4)$$

However, according Pospiesz, Souza and Oliveira (2014), the shift share model has some limitations that need to be taken into account: a) there may have been changes in economic variables during the analysis; b) the analysis of the differences between regions becomes unstable to these changes; c) there are difficulties in separating the different effects. Furthermore, it is a descriptive tool, requiring other elements to be analyzed in order to have a more detailed explanation of reality.

Bastos and Viggiano (2014) applied the Shift Share Analysis in the dairy sector in the state of Minas Gerais, which is the state with the largest dairy production in the country. The same, by analyzing the variables: herd productivity and price, the fluctuation of the value of milk production mining possible an individual and global market analysis.

3.2 Materials

This is a survey with secondary data, stemmed from the database of the Fundação de Economia e Estatística (FEEDADOS, 2014), for the state of Rio Grande do Sul, as well as for twenty-eight Councils of the state. The gathered data for the state and the Councils were analyzed and validated so they could be used in the Shift Share model in order to decompose the effects that can justify the behavior of the dairy economy of the regions within the state.

It is highlighted that the absence of the price to the producer practiced in the Councils, enabled the application of a simple calculation dividing the milk production by the milk production value to the counties and, in order to homogenize the variable, we used the same procedure for the price in the state level.

We obtained the productivity variable, using the procedures that were used for the price, through a simple equation of quotient, using the data of the herd milk production, both at the state and the Council level.

4. Results and Discussion

Through the analysis of data obtained by means of the application of the structural-differential method, it is observed that the constant productive improvement in some more intensive regions in the activity impacts on improvements of the results achieved by the state and Councils.

Applying the Shift-Share Model for the variables, we obtained an increase in the value of the state production of 142.21%, which can be decomposed into three effects, where the herd effect increases 19.15% in the variation of the production value. In turn, the productivity effect adds 31.83%, and the price effect, acting as a major reason for the increase of production value adds 91.23% to the growth rate.

Through the analysis we note that the proportion of participation of each effect in the growth rate of production value corresponds to 13.47% for the herd effect, 22.38% for the productivity effect, showing a difference in the growth of 8.91 percentage points. The price effect has the largest share with 64.15%.

It is observed that the increase in the herd effect in such proportion, 19.15% and 31.83% in productivity implies a low efficiency in the chain. Even with a production improvement, the price effect has high importance, leaving the chain vulnerable to market fluctuations, concomitantly, exposing the productive sectors to external and internal risks.

Analyzing the data of the dairy herd, available in the database of FEEDADOS (2014), it was found that in 2002 the state dairy herd was of 1.173.139 heads, and in 2012 it jumped to 1.492.584 heads, corresponding to an increase of 27.23%. It is also verified that the quantity produced in the state jumped from 2,290 million liters to 3,949 million liters per year, with an increase of 72.49% in the period between 2002 and 2012, corresponding to 1,659 million liters. However, the state's productivity increased 35.57%, from 1952 liters/year/cow in 2002 to 2646 liters/year/cow in 2012.

It is observed that the increase of 1.659 million liters of milk within the analyzed period, accounting for an increase of 319.445 dairy heads in the same period, corresponds to a variation of 5190 liters/year. It is noted based on this that the analyzed period went through major advances in the productive sector, since productivity approached twice the state's average productivity in 2012.

For Finamore and Montoya (2005) structural changes provide productivity gains in the dairy sector. The authors also report that the integration of the industry with the producer provides productive and qualitative improvement, streamlining the state's milk production.

As already mentioned above by Barros et al. (2010), the state's production is widespread, for the most part, produced by small farmers, who see in the activity an addition to their income, and even as a main activity, better productive exploitation, since it comprises small properties, which require spatial organization and high productivity per hectare. This dedication focuses on the qualitative and productive improvements that take advantage of strong demand and low quality of the product in other markets.

FEE (2014) reinforces the arguments of Barros et al. (2010) regarding the productive decentralization of the dairy chain, where the five Councils whose milk production stood out represent 40.24% of the total milk production in the state. At the same time, it is emphasized that these councils correspond to 28.57% of the cities in the state, corresponding to the amount of 142 counties, as shown in Table 1.

Table 1. Major producers (Councils) and participation in the State in 2012

Council	Milk production (one thousand liters)		RS Counties	
	Amount	% production	Towns	% production
Rio Grande do Sul	3.948.993	100.00%	497	100.00%
Produção	414.151	10.49%	21	4.23%
Vale do Taquari	358.830	9.09%	36	7.24%
Celeiro	298.896	7.57%	21	4.23%
Serra	271.143	6.87%	32	6.44%
Norte	246.035	6.23%	32	6.44%
Total	1.589.055	40.24%	142	28.57%

Source: Compiled from data FEEDADOS (2014).

The Produção Council accounts for 10.49% of the total produced in the state of Rio Grande do Sul. Along with that, this Council has 21towns in its territorial delimitation. Subsequent to this council, in the proportion of participation of each Council in the production share, the Celeiro Council has a participating of 7.57% of the milk produced in the state. Respectively, the two Councils have a country participation in the production of 0.50% and 0.36%, respectively.

Producing 9.09% of the national milk, Vale do Taquari Council, accounts for a country participation in the production of approximately 0.26%, as it comprises 36 cities. Unlike the first two Councils, Vale do Taquari Council has a lower average production per town in the Council.

Serra and Norte Councils have similar participation. Assigning a productive participation in the state of 6.87% and 6.23%, respectively, both have 32 towns in their territorial coverage. Together, they represent 12.88% of the

cities and 13.10% of the total production. The Councils' share on the country's production is, approximately, 0.21% and 0.20%, respectively.

Since the state has a high territorial dimension, it is emphasized that the Councils analyzed have a productive intensification in different regions, which causes certain changes since the state cultivates several cultures, focusing on the viability of the production.

Proceeding the analysis, it is observed that the observed increase in production during the period, equivalent to 1.660 million liters, in relation to the increase in herd of 319.445 heads and an increase of 694 liters/year/cow, analyzed growth so, it is presented in relation to productivity, short in relation to the increase of the herd, since the use of productive capital is far from American and European production yields.

According CEPEA (2012), the Effective Operating Cost (COE) in Rio Grande do Sul, in others words, the owner's cost with food, handling, care, staff and other expenses increased significantly along with that, a decrease of 6% in domestic exports and the difference of 20% to 30% between the Brazilian and the Argentinean commodity, caused the imports to rise. The high domestic prices reduced competitiveness in the international market.

Because of the dependence of the price effect, as found in the shift-share analysis, in the competitive market in which the chain is inserted, the use of resources, genetic investment and technology seeking productivity improvements becomes a necessity, in order to reduce the proportion of the price effect on the growth rate of production value in order to strengthen the productive, industrial and services sectors, protecting them from market fluctuations.

For Ponchio and Silva (2005), the increase in domestic consumption and the continued rise in export volumes, altered the difference between supply and demand of the product. Consequently, it caused a rise in commodity prices. The market downturn caused by the international crisis and currency appreciation, affected the exports, but the domestic market has been supplying the production, keeping prices at current levels.

4.1 Herd Effect

Through the Shift-Share Analysis, the extreme results obtained by the analysis of twenty-eight state Councils are observed. The value of the effects that impact in a positive or negative way are analyzed for the five councils that presented the major and minor effects. The study analyzed the four effects involved, namely: production, herd, productivity and price effects.

In Table 2, the Litoral Council's different effect can be observed sue to its magnitude of -231.99%, representing a negative variation in relation to the value of production of -33.00%, which is equivalent to a reduction in matrices in 3.322 units, with a herd of 6740 dairy cows in 2012.

On the other hand, the Sul Council has a negative effect of -33.76%. This effect represents -35.41% effect value of production in Council. The decrease from the year 2002 takes 21.00%, a decrease of 16.694 dairy matrices, focusing of 79.662 in 2002 to 62.968 in 2012.

Analyzing the Centro-Sul Council a negative herd effect was also observed, however with a lower impact than the second and especially the third Councils. A -17.73% effect was obtained by the Council, compared to the effect production value, equivalent to 94.45% of the Council, a participation -18.38% is denoted. Closing the year of 2012 with a herd of 9150 heads, a reduction compared to 2002 of 12.30%, corresponding to 1.289 dairy cows.

Next in the analysis, there are the Central and Paranhana-Encosta da Serra Councils, whose effects are close, -13.97% and -13.39%, respectively. It is noted here that the degree of physical loss of the herd has a larger variation, with 7241 heads in the Central Council to a decrease of 988 heads in Paranhana-Encosta da Serra Council. This is equivalent to, on a temporal analysis of 14.8% and 8.7%, respectively.

Table 2. Major and minor impacts of the herd effect between the Councils

Council	Herd Effects (%)	Council	Herd Effects (%)
Litoral	-231.99	Metropolitano Delta do Jacuí	30.09
Sul	-33.76	Vale do Caí	29.22
Centro-Sul	-17.73	Nordeste	26.57
Central	-13.97	Vale do Taquari	26.45
Paranhana Encosta da Serra	-13.39	Rio da Várzea	23.04

Source: Compiled from the data of FEEDADOS (2014).

It is emphasized that the participation of the herd effect on the value effect of production for the Central and Paranhana-Encosta da Serra Council, reached -13.89% and -13.98%, the production effect 114.72% and 114 75%, respectively. The symmetry of both Councils holds true for other effects and participations.

On the other hand, the Metropolitano Delta do Jacuí Council has a herd effect of 30.09%, in relation to its effect on the production. The participation of the analyzed effect, on the independent effect - value of production effect occurs in 28.96%. Contrary to the data analyzed in other Councils, the positive variation acquired from the analyzed period accounts fora 44.10% increase, in others words, an increase of 7119 in the amount of cows .

Next in the analysis, the Vale do Caí Council, where the effect is of 29.22%, representing 26.31% of the value of production effect in the same Council. The increase in the matrices adds 15840 cows, equivalent to a temporal variation of 83.60% in the period analyzed. The quantity jumped from 2002 to 2012, from 18948 to 34788 heads.

The proportion of the effect of Nordeste e Vale do Taquari Councils (Table 2) shows the elevation of the dairy herd in both, with a herd effect of 26.57% and 26.45%, respectively. The largest difference occurs in the growth rate between the two Councils, where the Nordeste Council obtained a variation of 79.70%, above the variation obtained by Vale do Taquari - 50.40%. The participation of the herd at the state level, respectively, occurs in 4.93% and 7.15%, it is possible to note that, a greater effect, analyzed along with other analyses, may incur from the macro reality, that is, its effect, within a more intense cluster, may be less salient.

Finally, the Rio da Várzea Council, accounting for 23.04% of the effect, in face of the 117.94% of the production value effect, this council infers a participation equal to 19.54%. In this council, the participation in relation to the state accounts for 6.10%, along with that, an increase in the analyzed period, from 41.416 to 91.102, reflected on an increase of 49686 milk matrices, causing a variation equivalent to 120%.

In the analysis of the herd effect, it is noted that the decrease in the proportion of this effect on the effect of production value causes an improvement in regional production quality, resulting in an improvement in the proprietary management, wealth creation and an increase in cost-benefit activity.

Through the analysis of the herd effect, the next step will verify the collaboration of the productivity on the development of the dairy activity and its continuous coverage, in the Council and the in the state.

4.2 Productivity Effect

The importance of positive effects on productivity is highlighted, reducing the dependence of other effects, enabling profitability gains. It is observed that the Sul, Fronteira Oeste, Produção, Serra and Celeiro Councils were responsible for the more positive effects. Opposing to these are the Vale do Rio dos Sinos, Centro-sul, Hortênsias, Jacuí-centro and Paranhana-Encosta da Serra Councils with negative effects.

The Sul Council achieved the highest productivity effect, 48.98%, representing 51.37% of the production value effect. The increase in the productivity effect and the decrease of -33.76% in the herd effect, as seen above, attenuate a production increase. Table 3 shows the a production increase of 631.53 liters/cow/year, equivalent to a positive oscillation of 38.50%. Therefore, there is a significant improvement in the Sul Council, with an efficient use of the dairy activity developed (Table 3).

The productivity effect of 42.55% of the Fronteira Oeste Council represents 42.58% of the total production value effect. The production increase occurs at 465 liters/cow/year, representing an improvement of 36.30% in productivity. Along with this Council, the Produção Council holds 42.37% of the productivity effect, in relation to the effect of its particular production value. The participation is equivalent to 39.10%, increasing to 1841.79 liters/cow/year and therefore a variation of 68.40%.

The Serra Council obtained a 38.71% effect, as shown in Table 3, in which it participates in 38.46% of the total value of production effect. Productivity increased in 941 liters/cow/year meaning an approximate production variation of 40% between 2002 and 2012.

Celeiro Council achieved a productivity effect of 31.57%, an increase of 1100 liters/cow/year in the sector's productivity. This variation has incorporated an increase of 49.60% within the analyzed period. The increase of the effect is equivalent to 29.08% of the total production effect value.

Table 3. Major and minor impacts of the productivity effect between the Councils

Council	Productivity Effect (%)	Council	Productivity Effect (%)
Sul	48.98	Vale do Rio dos Sinos	-17.10
Fronteira Oeste	42.55	Centro-Sul	-10.90
Produção	42.37	Hortênsias	-7.39
Serra	38.71	Jacuí-Centro	-6.96
Celeiro	31.57	Paranhana-Encosta da Serra	-5.58

Source: Compiled from the data of FEEDADOS (2014).

In this situation, Vale do Rio dos Sinos Council, whose productivity effect reached -17.10%, demonstrated productive and financial insufficiency. The participation in the major effect is equivalent to -16.79%. Consequently, the local productivity decreases, in a decrease rate of 513 liters/cow/year, a variation of negative 20.70%.

With a reduction of 128 liters/cow/year, equivalent to a decrease of 8.70% in the productivity, in smaller proportions, is linked to the decrease of the herd effect in Centro-Sul Council. The reduction of matrices impacted the decrease of milk productivity of the sector in milder dimensions. The sector represents in the major effect, a dimension of -11.30%.

Finally, the results of -7.39%, -6.96% and -5.58% due to the productivity effects in Hortensias, Jacuí-Centro and Paranhana-Encosta da Serra Councils, all of them with reduced effects. The first presents a share of -7.28% in the production value effect, resulting in a production decrease of 9.70%, equivalent to 100 liters/cow/year. Subsequently, the decrease in the Jacuí-Centro Council accounts for 102 liters/cow/year, in others words, a reduction of 9.40% in the productivity in sector. Finally, having a reduced relation, equivalent to -5.83%, on the production value effect, the Paranhana-Encosta da Serra Council achieved a reduction of 988 liters/cow/year, resulting in a loss of 8.70% of productivity.

4.3 Price Effect

Table 4 shows the disparity between the Councils regarding the price effect, describing the dependence of the Councils of market changes and fluctuations, reducing the profitability and productive sector's stability.

It can be observed that the Litoral Council has a price effect of 154.44%, imposing a share of -185.26% in the production value effect. The increase in the commodity prices of R$ 0.19 in the analyzed period shows an increase of 31.80%. It is noted in the analysis the decrease of the production value effect of -82.29%. Subsequently, in the Centro-Sul Council, the effect reached values of 125.07%, causing an impact on the production value effect of 129.68%, which highlights that the impact of the effect corresponds to 96.45%. An increase of 90.70% in milk price was observed, that is, the price almost doubled between 2002 and 2012, ending with an increase of R$ 0.37 per liter.

We describe below the price effect of 120.01% for the Vale do Rio dos Sinos Council, where the price appreciation reached 124.60%, an increase of R$ 0.45 per liter, from R$ 0.36 to R$ 0.81 between 2002 and 2012. The influence exerted on the production value effect reached 117.89%, with an emphasis for the values of -1.10% and -16.79%, which are the impacts that the herd and the productivity effects cause on the production value. It is noted here a marketing dependence and consequently a productive inefficiency, given the low productive effects.

Keeping the price effect high, the Hortênsias and Paranhana-Encosta da Serra Councils, whose values correspond to 118.68% and 114.75%, resulting in an increase of R$ 0.47 and R$ 0.29 per liter of milk, these councils correspond to a range of 146.20% and 77.70%, respectively. The great participation of the price effect on the production value effect for both corresponds to 116.89% and 119.81%.

The Fronteira Oeste Council added during the analyzed period R$ 0.29 to the liter of milk, corresponding to a 70.90% increase in the analyzed period. Its impact on the production value happens in a milder way, corresponding to 40.67%. The Metropolitano Delta do Jacuí Council, responsible for a 44.58% price effect, caused a price of R$ 0.30, corresponding to 75.10% of the total adjustment. The effect by itself, accounts for 42.91% of the production value effect.

Table 4. Major and minor impacts of the Price Effect between the Councils

Council	Price Effect (%)	Council	Price Effect (%)
Litoral	152.44	Fronteira Oeste	40.65
Centro-Sul	125.07	Metropolitano Delta do Jacuí	44.58
Vale do Rio dos Sinos	120.01	Vale do Taquari	49.60
Hortênsias	118.68	Produção	49.85
Paranhana-Encosta da Serra	114.75	Celeiro	58.74

Source: Compiled from the data of FEEDADOS (2014).

Vale do Taquari and Produção Councils have symmetrical price effects, although with different realities in the other independent effects. It is found an increase of 101.10% and 149.00% in the milk price, corresponding to an increase of R$ 0.38 and R$ 0.42 per liter of milk, respectively. It is also assumed that the participation of the effects for both Councils account for 46.51% and 46.14%, compared to the production value effect.

The Celeiro Council, on the previous analysis, presents an increase in relation to the Fronteira Oeste Council of 18.09 percentage points, increasing the price effect on the production value. An increase of R$ 0.47 per liter corresponded to the current Council, an increase of 142.30% in the price of the product. The price effect in this council represents 54.28% of the value effect.

4.4 Production Value Effect

Table 5 analyzes what influences these values, which are arranged in order to understand how the value generation behaves in the dairy chain in the regional development councils, with the values that stood out in the methodology.

In the Litoral Council, the production value is 82.29% negative, indicating a decrease in value, which caused, as its effect, a decrease of R$ 873 mil. Thus, it is observed that the herd effect presented a significant decrease of -231.99%, as seen in Table 5 of the effect itself, followed by a productive reduction. It is highlighted that the price effect, even high, made it impossible to maintain the growth rate of the production value. The reduction intensity of the herd, supported by the production decrease, caused significant loss to the chain.

For the following effects, the Sul Council presents a decrease in the herd effect of 33.76%, accommodated by the production increase of 48.98%. This shows that with the significant reduction in dairies matrices, the Council obtained a positive and high reaction in the production, strongly impacting the productivity inherent to the local chain. It is highlighted that the price effect - 80.13% - predominated in the analysis, however, the efficiency gains enabled most part of the gains.

In the Paranhana-Encosta da Serra Council it is observed that the result obtained for the production value effect is strongly linked to the price effect - 114.75%, since the herd and productivity effects are negative, attenuating the following values -13.39% and -5.58%, respectively. In this Council, it is observed the high correlation with the price effect, causing great dependency to the chain, given the inexistence of production efficiency.

The divergences in the analysis of the Paranhana-Encosta da Serra Council are also present in the Centro-Sul Council. The impact of the strong presence of the price effect, of 125.07%, on the production value effect, enabled an effect of 96.45%. It is highlighted the reduction of the other effects, corresponding to -17.73% and -10.90%, respectively, in the herd and productivity effects. On this result, it is possible to find the dependence of the price on the chain and the production inefficiency.

To the Fronteira Oeste Council, even with a production effect close to the former Councils, it is observed that the impact the independent effects have is more cohesive than the previous ones, where the differences in values and impacts strongly affected. Among the effects, the productivity effect is emphasized, whose value is of 42.55%, followed by the price, 40.65% and, finally, 16.74% for the herd effect in relation to the production value effect.

The lowest share/impact of the price effect in the analysis is viewed in herd effect, however, its participation is still of high importance.

Forming the largest production value effect, 117.94%, Rio da Várzea Council accounted for an increase of R$ 202.2 mil, tenuously influencing the price effect of 86.69%, generating a participative impact of 73.51% in increasing the value. The herd effect is highlighted with a participation of 19.54% of the total and the productivity effect with timid 6.95% of impact.

Table 5. Major and minor impacts of the Production Value Effect between Councils

Council	Production value Effect (%)	Council	Production value Effect (%)
Litoral	-82.29	Rio da Várzea	117.94
Sul	95.34	Médio Alto Uruguai	115.18
Paranhana-Encosta da Serra	95.78	Nordeste	111.61
Centro-Sul	96.45	Vale do Caí	111.08
Fronteira Oeste	99.94	Norte	109.56

Source: Compiled from the data of FEEDADOS (2014).

Subsequently, the Médio Alto Uruguai Council has a total effect of 115.18%, decomposed into 82.57%, 22.36% and 10.24% to the respective effects of price, herd and productivity. It appears that the importance of 71.69% of the total derives from the influence of the price, making the production vulnerable to economic variations. An increase of 599.10% in the production value in the analyzed period is observed in this Council, accounting for a value in 2012 of R$ 130 million, an increase of R$ 111 million.

The Nordeste Council consists of a price, herd and productivity effects of 68.98%, 26.57% and 16.05%, respectively, adding up to 111.61% of the production value effect. An increase of R$ 148 million, corresponding to a variation of 451.20% is verified. The price variation for the analyzed period was of 141.90%, increasing R$ 0.44 to the price of the liter. Along with this, the variation in the herd during the analyzed period of 79.70%, and in the productivity of 26.80%, added an increase in the production of 127.80%, resulting in the major increase in the production value.

In Vale do Caí Council, the ascending order of the effects remains unchanged, that is, 86.46% correspond to the price effect, 29.22% to the herd effect and only 1.40% to the productivity effect. The sum of these effects results in a production value effect of 111.08%. The elevations of the effects together generated an increase of R$ 45 million, a variation of 327%. Where, within the analyzed period, the price variation accounted for 127.60% and the herd effect, 83.60%. The variation in productivity was of 2.20%.

Finally, the Norte council, which holds a production value effect of 109.56%, had a variation of 393.20%, causing a monetary increase of R$ 139 million between the periods of 2002 to 2012. The price effect prevailed in the council, with a value of 67.71%, followed by a herd effect and a productivity effect of 19.96% and 18.24% respectively. It is found here, a bigger participation of the productivity effect, though still short, impacting during the period on an increase of 32.20%. However the price variation corresponds to 141.40% and 54.50% and represents the set of herd oscillations, increasing the production to 104.30%.

5. Conclusions

Analyzing the effects individually in the Councils, the herd effect in the Councils has the greatest impact on the value of production, remaining mild for the positive results, enabling a value and income aggregation.

Yet, it is emphasized that the negative effects, with the exception of the Litoral Council, whose impact on the herd reduction caused a decrease in the value effect, for the other Councils, there is a continuous increase in the effect of the production value, impacting both the analyzed Councils on the price effect, which greatly impacts the chain.

In the productivity effect, the positive effects analyzed are mitigated, high proportions compared to other Councils in the state. It is noted, however, that the price effect exerts, in turn, a high influence even in regions where there is a better utilization of resources, demonstrating a better production efficiency.

In another extreme end, there is the productive inefficiency of the Councils. Negative effects impact the consistency and profitability of the activity. The continuous rise of costs linked to low productivity rates,

followed by the herd and price effects, distort the financial capacity of the agricultural company, increasing the risks and uncertainties of the business, compressing the innovative capacity through the limitation and financial dependence to which the activity undergoes.

It is agreed, through the analysis of the price effect, what has been reported in the mentioned results. It is possible to observe, regardless of the extremity analyzed, the intense presence of the price effect in the dairy activity. The participation of the price in the production value incurs on the financial and capital dependence, financial instability, uncertainties and high risks in face of an economic scenario in which a degree of monetary stability for maintenance and investments in the activity are inhibited.

Thus, by means of the global analyses, it is possible to state that the increase in the production value in the Councils in the dairy chain of Rio Grande do Sul occurs through the strong presence of the price effect, which allocates a very high participation and proportion, even in the Councils where the price effect has a lower value, and tenuously influences the result of the production value.

The need for amnesty in the relation between price effect and production value is emphasized, in order to provide safety, stability, income and enable future investments in the activity, with reduced risks and uncertainties.

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Notes

Note 1. The experience and the trajectory of the Regional Development Councils (Corede's) started in the mid-1990s in the state of Rio Grande do Sul is configured as a pioneering strategy of regional organization in Brazil, where the institutional structure, mechanisms of social participation, the means of transportation of regional demands, the maturation processes and the relationships between government and society were being perfected over time. Built from an articulated initiative of the state's government with the respective regions, the Councils are defined as plural and open spaces for the construction of social and economic partnerships at the regional level through the political articulation of local and sectoral interests around proper specific development strategies for the regions (COREDES, 2010a).