

ANALYSIS OF ITALIAN DAIRY EXPORT OVER 18 YEARS IN THE EUROPEAN UNION MARKET AND IN THE WORLD USING THE MEDIAN APPROACH

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Abstract

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The dairy Italian production is prevalently located in some regions of North Italy; where there are several dairy cooperatives specialized in cheese production or in other dairy activities. This analysis has valued, using some statistical time series over 18 years, the monthly and yearly effect of Italian milk exportations in the world and in the European Union market in quantity and in monetary value. The monthly and yearly effects have been estimated throughout a quantitative approach based on the median, which has an important function in order to reduce some distorted effects due to outliers in statistical data. The monthly time series, both in terms of constant currency value and in quantity, in the world and in the European Union, have pointed out cyclical fluctuations due to seasonal effects in milk production. The yearly effect about the Italian milk exports in the European Union market has underlined a constant growth. In general, the median approach was a good statistical tool to analyse commercial flows, emphasizing the effect of a structural break in Italian milk exportations after the adherence to the World Trade Organization (WTO) and due to structural changes in Italian dairy sector. For the next future, Italian dairy productions should be able, thank to a high diffusion and distribution of certified quality foods, to boost profits throughout promotional actions towards not consolidated markets of the European Union.

Key words: median, monthly effect, cycle trend, Italian milk production

Introduction

The Italian production of milk is located in a very significant percentage, more than 60%, in the North of Italy, where it is possible to find out several dairy cooperatives, able to sell and to process in cheeses and yogurt approximately 35% of overall Italian milk production. In particular, in these northern regions (Piemonte, Lombardia, Veneto, Trentino, Emilia Romagna) it is possible to come up with many dairy cooperatives competent in producing Protected Designation of Origin cheese, such as Grana Padano, Parmigiano Reggiano, Asiago, Provolone and Gorgonzola, largely widespread

and sold in the domestic market and exported in a significant percentage, more than 20%, towards different Member States of the European Union. Nevertheless, in other cases, dairy certified quality foods are located in few niches and regional markets, thus they are not so common outside the Italian area of production as, for example, Toma Piemontese, Murazzano, Raschera, etc. In general, in Italy, there are more than 229 certified quality foods and cheeses and dairy products (Inea, 2011) constitute 41 of these.

Analysing recent results of the 6th National Agricultural Census in Italy in 2010 (Istat, 2012), the statistical data have pointed out a strong drop of Agricul-

tural Usable Surface, that from 13 million of hectares, evaluated ten years ago, is decreased in 12.8 million of hectares; according to Italian Statistical National Institute (ISTAT), in the same time, the drop of agricultural surface was tightly connected to a strong decline of farms (-32.2%), that shifted the amount of Italian farms from 2.4 million of units to 1.6 million (Istat, 2012). The positive aspect of this decrease in active workforce in the primary sector, in terms of farmers, has had the consequence to expand the average agricultural surface of Italian farms that reached the value of 7.9 hectares from 4.95 hectares observed in 1982. In this case, it is helpful and strongly important to mention as a strong decrease of cultivated surface by farmers is not homogenous; in fact, in some regions located in the South and in the Centre of Italy, in specific in these rural zones situated close to the mountain areas, the decline has been more vigorous than in other Italian rural territories.

The total amount of livestock, in terms of cows, calves, heifers and bulls, to produce both beef and milk, is strongly decreased by 53% during the last 30 years, and in the same way, from 1982 to 2010, the number of farms specialised in bovine productions is diminished more than 300% (Figure 1). The specialized dairy farms in Italy are dropped in the last 30 years by 500% and the number of farmers specialised exclusively in dairy production is nowadays equal to 54 000 units (Figure 2).

The dairy productions are very important for the Italian primary sector; in 2010 more than 14,000 million of Euro were obtained by milk, other products, such as cheese and yogurt, and sub products as ricotta and lactose with a percentage of incidence of dairy products on the total agro-industrial productions greater than 10% and an overall dairy production that in quantity was above 10 millions of tonnes (Inea, 1998; Inea, 2005; Inea, 2011). From 1997 to 2010 it was possible to observe in Italy an increase in milk productions; in particular, over the time 2006-2010, after the mid term review of Common Agricultural Policy in 2003, there has been a significant and constantly expansion of milk production due to a growth of the national quota (Figure 3).

Aim of the research

The main objective of this research was to analyse, from 1993 to 2010, Italian commercial flows of milk,

both in terms of quantity (kg) and also in monetary value (€), inside the European Union and in the world, using a quantitative methodology based on the median approach. The principal aim of this study was to describe the evolution of Italian dairy exportation flows over the years and over the months during the time of observation and to find out if there have been fluctuations and cyclical effects.

Material and Methods

The analysis has appraised over 18 year's time some statistical series of dairy monthly exportation published by the Italian National Statistical Institute in the interval of time 1993 to 2010. To estimate the cycle trend or yearly effect and some changes in exports due to a monthly effect, inside the Europe Union and in the world, it has used the median quantitative analysis. This methodology has some elements in common with the median polish, which is an useful tool to analyze the export trends in specific agricultural products (Galluzzo, 2008), estimating the noise, which could interfere on the signal that is the total effect, made by a year effect, a monthly effect and the residue or error term in the time series (Hoaglin et al., 1983). The main characteristic of the median is to eliminate some distorted effects that instead the average can amplify, thus the estimated model can be a good unbiased explanation of the annual effect and of the monthly effect. The main aim of this statistical model was to find out a linear model in which there is a row effect, that is the annual median and a column effect, made by median value analysed during different months over the time of study of milk Italian exportations (Tukey, 1977).

In statistics, the median is a numerical value able to separate and to divide the higher half of a sample or a huge population from the lower, half part (Everitt, 1998). To estimate the median of a list of numbers it is important to arrange some finite observations, from the lowest value to the highest one, defining the exact middle value of them. The result depends on the number of observations that is a function of an even number of observations in the sample or not (McClave and Sincich, 2009). Throughout the median it is possible to find an half of population that have values less than the median, and an another half that has values greater than the median.

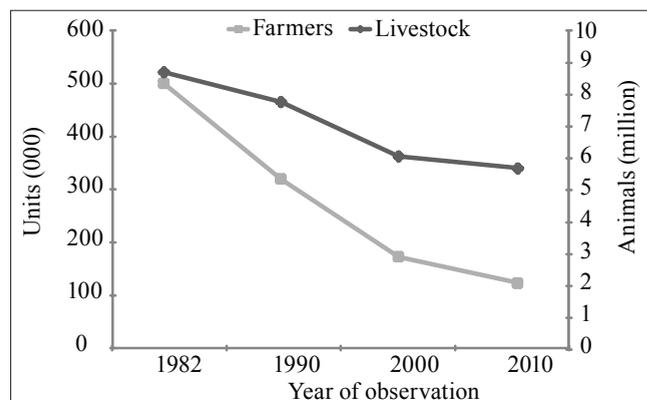


Fig. 1. Main results of Agricultural Census in Italy during the last 30 years
(Source: our elaboration on data Istat, 2012)

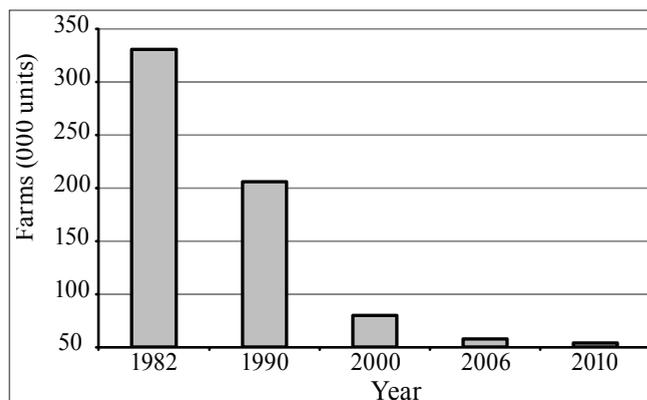


Fig. 2. Number of Italian specialized dairy farms
(Source: our elaboration on data Istat, 2012)

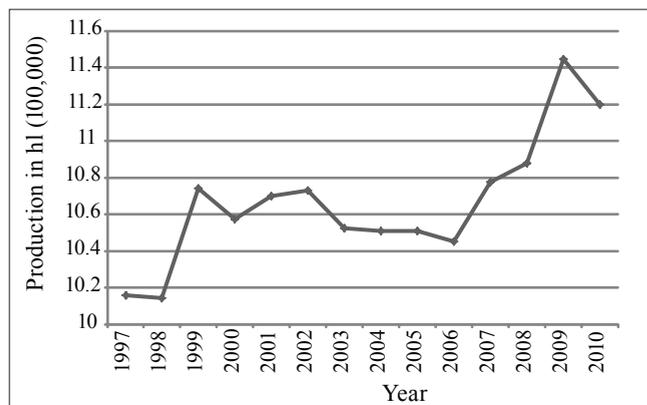


Fig. 3. Milk production in Italian dairy farms
(Source: our elaboration on data Inea, 2011)

The median is a statistical tool able to guarantee a good indication of the central value and its position; in fact, it is defined as a robust and unbiased statistical index or parameter because it is not sensitive, compared to average, to some outliers or to the tight of a distribution; sometimes it is so common and suitable for analysis of time series of exportations to use the median approach to calculate the general tendency, thus to generate a function able to describe the monthly and yearly effects.

Given a statistical dataset $Z(x)$, the median of x is $Z(x) = \frac{1}{2}$, that is a statistical operator able to divide the dataset in two equal parts; the median, to define in symmetric and asymmetric order statistical distributions $F(x)$, can be written in this way (Hogg and Craig, 1995):

$$x = Y_{(n+1)/2} \text{ if } n \text{ is odd}$$

$$x = (\frac{1}{2})(Y_{n/2} + Y_{1+n/2}) \text{ if } n \text{ is even}$$

$$Y_n = \max_j(x_j)$$

The median approach can be considered a robust methodology because it has the great advantage to clean all the irregular effects and to evaluate in an unbiased way the cycle trend or annual effect of a seasonal time series. This methodology has pointed out the values for each column (year) and for each lines (month) with the purpose to estimate a linear function which is very important to study the cycle trend from 1993 to 2010 and the monthly effect about Italian milk exports. Furthermore, the column effect was important to obtain a linear estimation of the seasonal nature of statistical data during each month. The value of monthly effects and annual effects of Italian dairy exportations were in constant monetary value in order to eliminate the effect of inflation and to transform the value of time series expressed in Italian lire in Euro, using a specific coefficient able to convert the different annual amount in Euro or in Italian lire into the same constant monetary value in 2010.

Results and Discussion

The analysis of monthly Italian milk commercial flows inside the European Union market has pointed out a strong increase in the 1990s and over the years 2006 and 2007 in which exportations reached the peak

of 2 million of Euro in current monetary value (Figure 4); the statistical data has emphasized in 2009 and 2010 a drop in terms of exported value and a cyclical fluctuation in milk exportations during the analysed time. The monthly export of Italian milk in the world in current value has underlined same seasonal fluctuations during the analysed years (Figure 5), even if it has reached a peak in 1996 and another one in 2006 and in 2007 levelling off in the last two years of observation of time series such as 2009 and 2010.

In term of quantity of milk exported from Italy towards the world market, the analysis has highlighted out a seasonal effect of exportations. In particular, during Spring and in Summer time it was possible to observe a strong growth of milk export; instead, in Winter and in Autumn there was a drop in exportations due to a physiological contraction of production in cows and to an increase in demand of milk inside the domestic market by many Italian agro-industrial firms to prepare several food productions. During Spring and Summer there is an high availability of pasture and silage for calves, cattle and cows with the consequence to better the milk production to supply towards external markets (Figure 6). The yearly effect, throughout the median quantitative approach, has pointed out a constant drop in milk exports from Italy towards all different

countries in the world in the first seven year of observation (Figure 7). In particular, from 1993 to 1999, the fall of milk export was very significant because of a structural change in the primary sector and due to an upgrade in Italian agricultural sector by a new legislation and some specific actions to modernize it. Since 2000, it was possible to point out a positive structural break in Italian milk export time series due to the adhesion to Euro zone. This has demonstrated that there has not been a strong decrease in Italian dairy exportations after the decision of Italian government to become one of the first Member State of Euro zone; furthermore, a complete reconstruction of dairy sector, due to a severe and strictly application of super levy, throughout the milk quota system in many Italian farms, has improved the quantity level of dairy production. Moreover, the analysis of time series has underlined from 2007 until 2010 an increase of exports in quantity towards the world because of the reduction of barriers and tariffs in the international market due to WTO agreements signed by European Union.

Italian milk exportations, in constant monetary value, inside the international market during the analysed years, have highlighted, as the median was able to describe the existence of a cycle trend function with good performances over six months and in

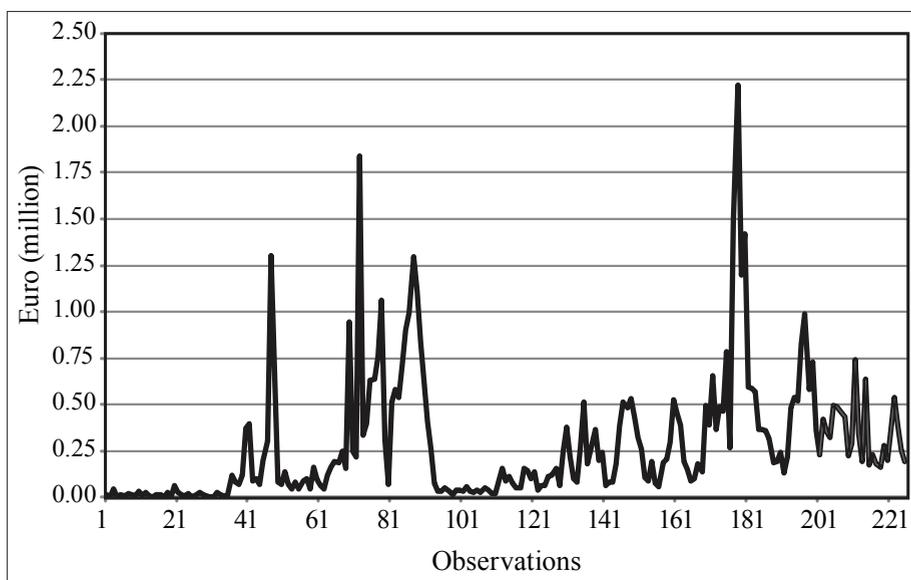


Fig. 4. Monthly time series of Italian milk export in the European Union market in current monetary value from 1993 to 2010 (Source: Istat, 2011)

specific from March to October and bad performances in January and February (Figure 8). In Summer time, despite in Italy there is generally a structural decline of productivity in different economic sectors, due to the monthly closing for holidays in many factories, there has not been a contraction of milk exports towards the world market. In this season, in fact, climatic conditions very hot and from time to time with an high percentage of humidity can be a severe constraint for the welfare of cows and this two variables relating to general weather conditions can be a critical factor to use silage and grazing lands but, according to the results presented in this research, climatic variables have not caused a contraction of milk production in Summer time. In conclusion, the monthly time series, using the median approach, have pointed out the existence of a seasonal effect in Italian milk production. The yearly effect of Italian milk export time series has highlighted a drop in milk export in constant currency value from Italy towards the world (Figure 9). The analysis of the yearly effect or cycle trend has underlined a drop of Italian milk export in the world market with different fluctuations over the years. Despite the cycle trend had underlined a negative trade-off, Italian dairy productions pointed out a growth from 2007 to 2010, with a shortening of cyclical fluctuations, and thus the statistical data has been able to demonstrate a high use of

Italian milk productions inside the international dairy chain.

The monthly effect of Italian milk export in quantity inside the European Union has underlined, the existence of seasonal effects with good performances over six months from January to June and bad performances in August and September and in autumn (Figure 10). In Summer time, due to adverse climatic conditions and to managerial problems and decisions, it was possible to observe a strong decrease in Italian milk productions and consequently a drop of export inside the European Union market. The monthly statistical data of milk exportations inside the European Union market has showed a decrease during Summer time, due to a reduction in dairy production because of a high level of temperature that lowers the animal welfare and reduces the ingestion of protein and energy, thus the milk production in cows dropped significantly. In the same time, the national milk production is used to satisfy the domestic demand in order to produce fresh cheeses, such as mozzarella, ricotta, etc. with the consequence to lessen the export of Italian milk in the European Union market. In October, there is a strong growth of exportations inside the European market followed by a drop in autumn, due to a reduction of national milk productions and to a different use of milk to produce other agro-food products.

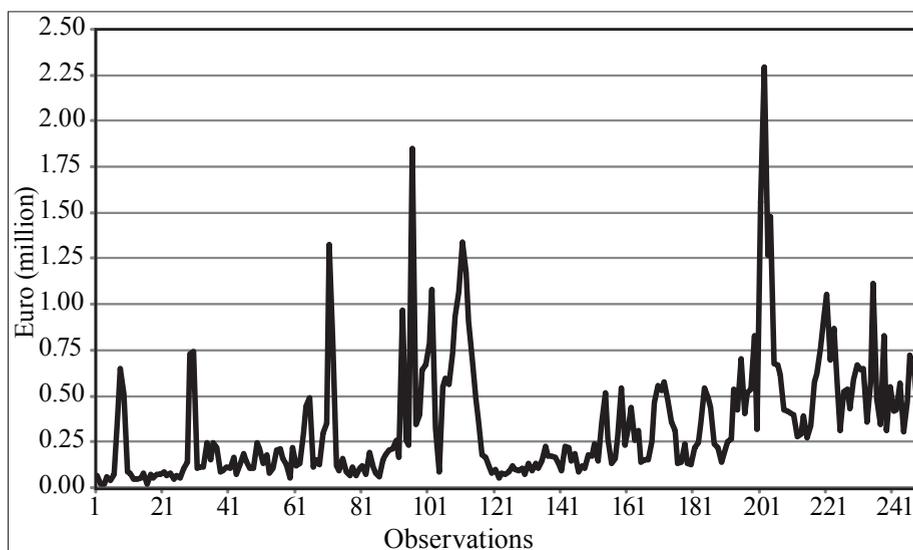


Fig. 5. Monthly time series of Italian milk export in the world in current monetary value from 1991 to 2010 (Source: Istat, 2011)

The analysis of the yearly effect or cycle trend has underlined an increase of Italian milk export towards the European Union market (Figure 11) with different fluctuations over the years. The cycle trend over the years has highlighted a positive trade-off, even if dairy productions have been able to demonstrate a high use of milk inside the European Union dairy chain, which demands almost 5% of overall Italian milk production. The median approach, used to describe the yearly effect of dairy export in the European Union market in quantity, has pointed out a constant increase with some positive peaks in 1999 and in 2007.

In terms of constant monetary value, the monthly effect of Italian dairy export in the European Union market

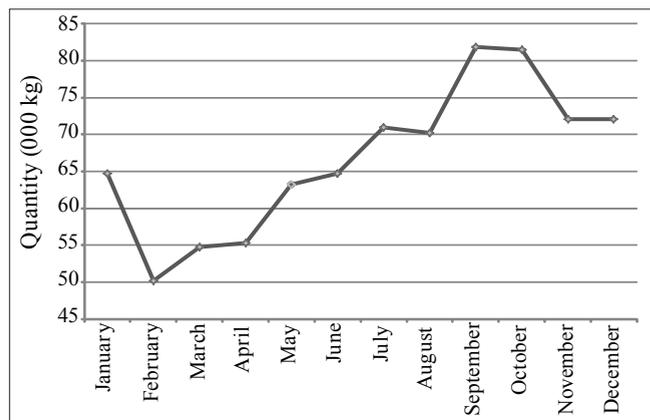


Fig. 6. Monthly effect of Italian dairy export in the world in quantity
(Source: our elaboration on data Istat, 2010)

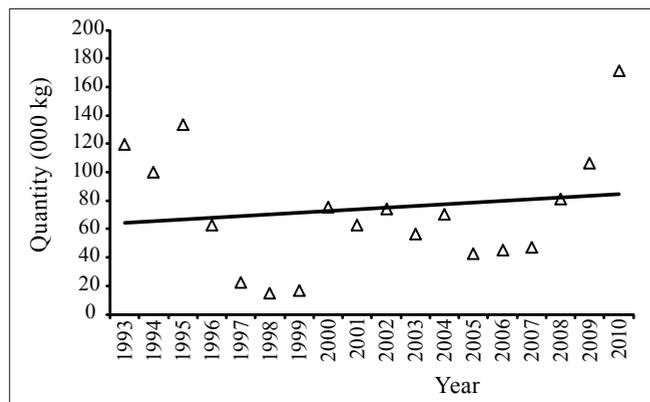


Fig. 7. Annual Italian milk export in the world in quantity
(Source: our elaboration on data Istat, 2010)

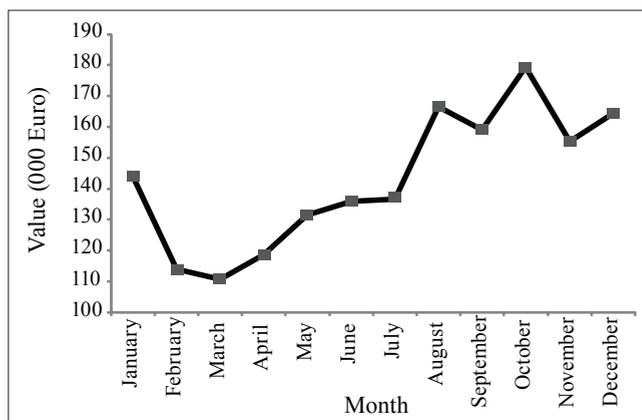


Fig. 8. Monthly effect of Italian milk export in constant monetary value in the world
(Source: our elaboration on data Istat, 2010)

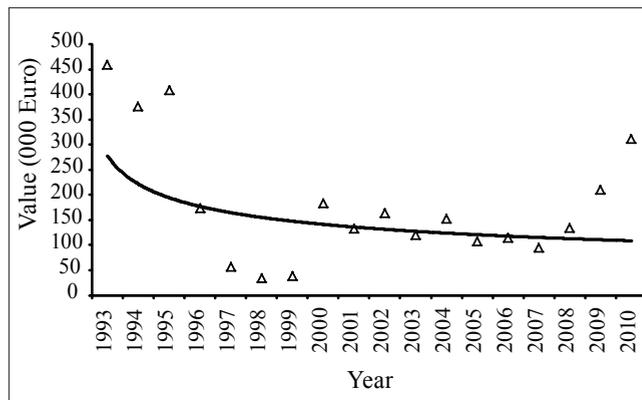


Fig. 9. Cycle trend effect of Italian milk export in constant monetary value in the world
(Source: our elaboration on data Istat, 2010)

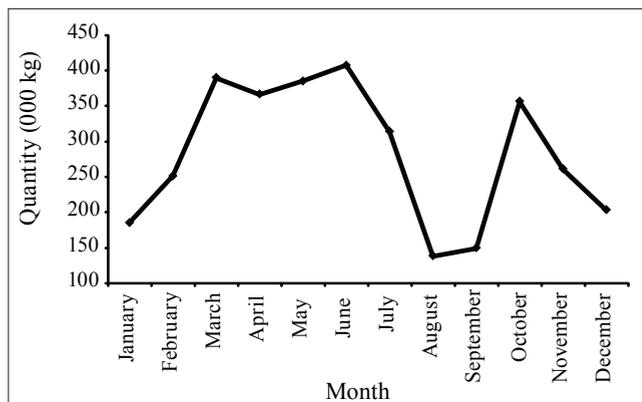


Fig. 10. Monthly effect of Italian milk export in quantity in the European Union market
(Source: our elaboration on data Istat, 2010)

seems to improve from January to April and to decrease, instead, during spring, in summer time and in October (Figure 12). In autumn there is a general fall in exportations towards European countries of Italian milk, due to management techniques useful to concentrate the production in winter and in spring with the aim not to sacrifice the biological production of milk during the summer, when the high level of temperature associated to an high level of humidity thus the Temperature and Humidity Index (THI) is greater than 91, could cause problems and illness in cows. Overall, the monthly effect, using the median approach, both in quantity and in constant value in Euro, has pointed out different productive scenarios in particular from January to April (growth) and from May to August (fall). Differences not significant have been found out comparing the yearly trend in constant monetary value of Italian milk exported inside the European Union market. The cycle trend, using the median approach in constant monetary value, has showed a constant expansion. This last aspect, associated to a reduction of dairy farms, has had two positive effects: to improve the average milk production in Italian milk farmers and to make better milk exportations in quantity (Figure 13). To sum up, it is very interesting to underline from 2001 to 2010 a constant growth of milk export inside European countries, which can be put in relation to a structural break due first of all to the adhesion of Italy to the Euro zone, secondly due to several positive effects of WTO agreements signed by European Commission and first and foremost due to the rationalization and modernisation of Italian primary sector throughout European Community funds and a new legislation able to better general conditions and to improve some managerial aspects in many Italian farms.

Conclusion

The Italian milk production, compared to the international context, has a significant percentage of incidence in commercial and economic terms inside the European Union market; this means over the time, considering that the price is not so different in all European Nations and it is not a main variable to act on buyer power of food chain, there has been an appreciation of the quality of this Italian dairy commodity by European agro-industrial sector.

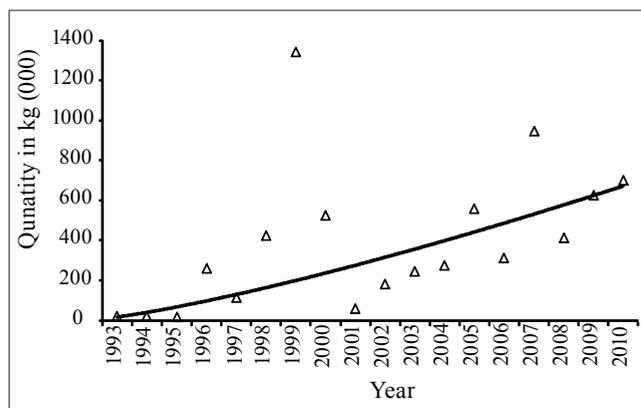


Fig. 11. Annual effect of Italian milk exportations in the European Union market
(Source: our elaboration on data Istat, 2010)

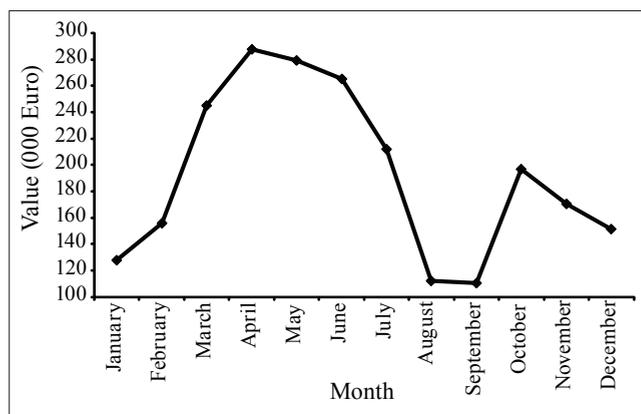


Fig. 12. Monthly effect of Italian milk export in constant monetary value in the European Union market
(Source: our elaboration on data Istat, 2010)

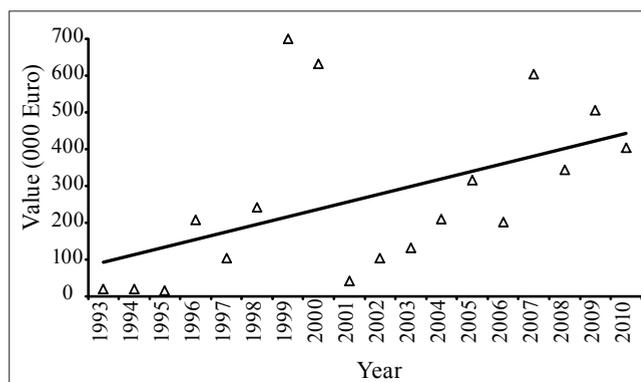


Fig. 13. Annual effect of Italian dairy export in constant value in Euro in the European Union market
(Source: our elaboration on data Istat, 2010)

The analysis has pointed out important prospective for the future inside the European Union market but unfortunately not positive towards international contexts. In fact, there has been an increase in exportations in the European market and a fall of Italian milk export towards international markets due to a perish ability of dairy productions, that need a lot of special precautions during the export phases to prevent the development of bacteria or other chemical alterations. Milk is a commodity with a low benefit able to get opportunities and high incomes to the retailers and wholesalers. The foremost strategy to better a dairy commodity is to increase its benefit following two techniques: the first should improve export flows bringing down both costs of shipping and decreasing costs of production upgrading the economic efficiency in bovine farms; the second technique should diversify milk productions throughout certified quality products. The pivotal concept is to expand the export of cheese that is easier to transport than liquid milk and it is richer in benefit than a dairy commodity. The Italian dairy market needs milk and cream with a percentage of fat of 5% in particular period of time in winter and in summer time to produce sweets and other foods typical of Italian gastronomic tradition. However, some results have demonstrated that there are severe difficulties to find new market inside the European Union due to costs of research and development, dedicated marketing actions and low profits; in this case the transformation of milk in certified foods can ameliorate economic opportunities to farmers to increase the value of their product inside the food chain and shortening it.

In conclusion, this research has demonstrated as the median approach is a good methodology to analyse commercial flows of monthly time series because it has

a significant capacity to find out fluctuations typical of seasonal effects and yearly effects, reducing some misinterpretations and misjudgements due to some outliers in time series and getting an unbiased and robust model to describe Italian milk exportations.

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