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Dairy Price commodity in Italy: volatility and forecast after milk quotas

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ABSTRACT

The EU dairy industry is facing an unprecedented change since the removal of milk quotas has exposes the sector to the world competition with strongly organized multinational traders. The basic question of this paper is if the milk quota expiration will have any impact on market equilibria and decisions of agents operating at various market levels. This paper has been preceded by two other papers discussing various issues about dairy market in Italy: market asymmetries and consequences for price transmission and presence of oligopoly competition and consequences for price setting. The present analysis uses the time series analysis of weekly dairy prices to test the market behavior before and after quota regime. Volatility was tested with simple CV, SD indexes and more complexes Arch-Garch models including the breaks and changes in market regime correlated to policy adjustments. Results suggest a moderate change in volatility; our explanation is the Italian dairy sector was for long time protected from world market competition and a consistent amount of raw milk processed for cheese production was managed by the coop organization that transferred to the dairy farms the margins realized at other market levels. The future scenario is more pessimistic in absence of any protection: some structural changes needed to face the world competition could have been postponed in this protected market with the OCM. The expected growth of milk supply after quota will determine a decline in the raw milk price becoming closer to the marginal costs of the most efficient dairy farms in the world. This will cause the exit of a great number of dairy farms, the restructuring of the dairy industry and more concentration at retail level.

Introduction

The highest EU-28 cow milk production was reached in 2014 with 159.6 million tons; The rise in milk production is the result of the 'soft landing' policy introduced by the Common Agricultural Policy (CAP) in 2007 to minimize the impact of the removal of the EU milk quotas. Around 68.8 million tons of raw milk were used to produce 5.5 million tons of cheese in the EU-28 in 2014, 31.0 million tons of raw milk were turned into a similar amount (30.4) of drinking milk; 23.1 million tons of raw milk were converted into 2.5 million tons of milk powder and 43.9 million tons of whole milk were transformed into an estimated 2.2 million tonnes of butter, skimmed milk and buttermilk. Between 2013 and 2014 the production of cows' milk on farms in the EU-28 increased by almost 5.8 million tons (3.8 %), while the number of dairy cows increased by 0.4 %. Average yields of milk per cow varied considerably between regions of the EU Member States in 2014. The apparent yield was highest between 8 400 kg and 9 600 kg per cow per year in the most productive regions of Italy, Denmark, Finland and Sweden (Nuts2 regions). At the present time are active 650 000 specialized dairy farms in the EU, half of them located in Poland, Romania, Germany and France. The growing price volatility observed in the world dairy prices may be justified by growing competition and markets thinness, as only the 7% of output was traded by smaller companies and four major exporting countries (New Zealand, EU, Australia and US) controlled with oligopoly strategies more than 80% of the total dairy market traded. The future suggests an increasing price volatility as the EU prices will align more closely to the prices of the major world milk market organizations. This paper is dedicated to the dairy price analysis, and forecast in the next five years after milk quota regime using the time series analysis to observe a connection between price behavior and policy decisions culminated in 2015 with the abolition of the milk quota regime in the EU.

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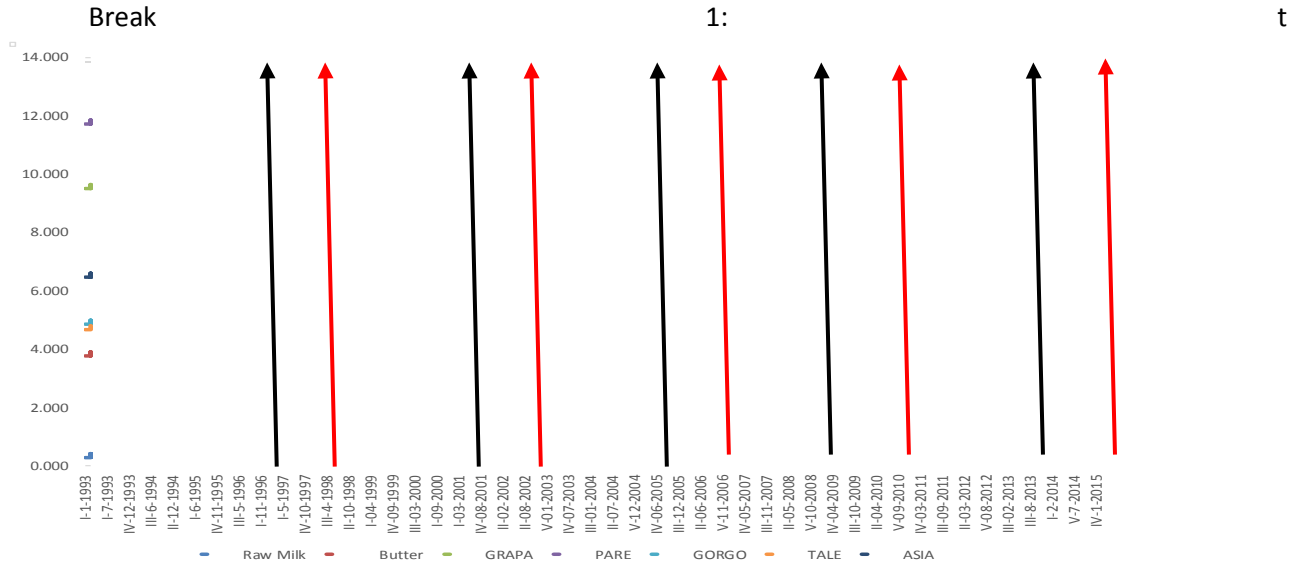
Agricultural dairy policies and structural changes in the Dairy sector

The Agenda 2000 introduced a consistent change in dairy policy: the Luxembourg agreement in June 2003 caused price movement with the reduction of the intervention prices partially absorbed with the introduction of the single farm payment in April 2005, and cross compliance measures. The reform of the milk quota regime continued with the "2008 Health Check" that fixed the end of the milk quota regime by April 2015; from that time outward the milk quotas were increased by 1% every year campaigns. The Milk Package, drafted by a special High Level group set up after the 2009 milk market crisis became operative in 2012, with a series of measures aimed at boosting the competitive position of the dairy producers to prepare the sector to the world market. It is hypothesized that policy and structural breaks could be related together[1] and the main responsible of the price breaks is the changes in OCM milk regulation. Prior to 2003, the dairy system operated in a quite reasonable stable environment; after 2003, the reform named "Luxembourg agreement" introduced the single farm payment that may have caused a substantial change in dairy market regime. The statistical evidence is given with the global Bai–Perron (1998) test that found five significant breaks close to changes in political measures reported In figure 1.

Fig 1 – Description of the dairy price trends and break lines*



Comment: the first break period is spanning from 01/05/1996 to 01/03/1997 (44 week lenght). Most of the series break at the first week of May 1996 (01/05/96), other two breaks occurred later in January (Gorgo) and march (Grapa). Break 2: the break period is spanning from 04/08/1999 to 04/09/2000 (56 weeks). In 1999 started the discussion about the CAP reform (Agenda 2000). Break 3: the break period is spanning from 03/12/2002 and 04/06/2004 (79 weeks). The Luxembourg agreement introduced consistent changes in market regulation with the decoupling of direct payments together with a stepwise reduction of intervention prices for butter and SMP and a cut in intervention prices.

Break 4: the break period is spanning from 02/04/2006 to 04/09/2007 (63 week). In 2007 the EC reg 1234/2007 established a common organization of agricultural markets and specific provisions for certain products including the dairy ones. (Single CMO Regulation). This is also the worse period for price volatility induced by financial instability and market speculation. Break 5: this is the longest break period extended from 01/02/2010 to 11/05/2011 (90 weeks). Intense policy arbitrage following the market regime change generated market expectations by the operators. The Health Check EC reg No 72/2009 amending the Regulation (EC) No 1234/2007 and the 2009 - EC reg No 73/2009 establishing common rules for direct support

[1] Structural breaks that are unexpected shift of the prices and cause forecasting errors and unreliability of the model in general. Structural breaks occurs for increasing industry concentration, changes in government policy that affect market outcomes leading to changes in structural relationships among prices at various levels of the market chain

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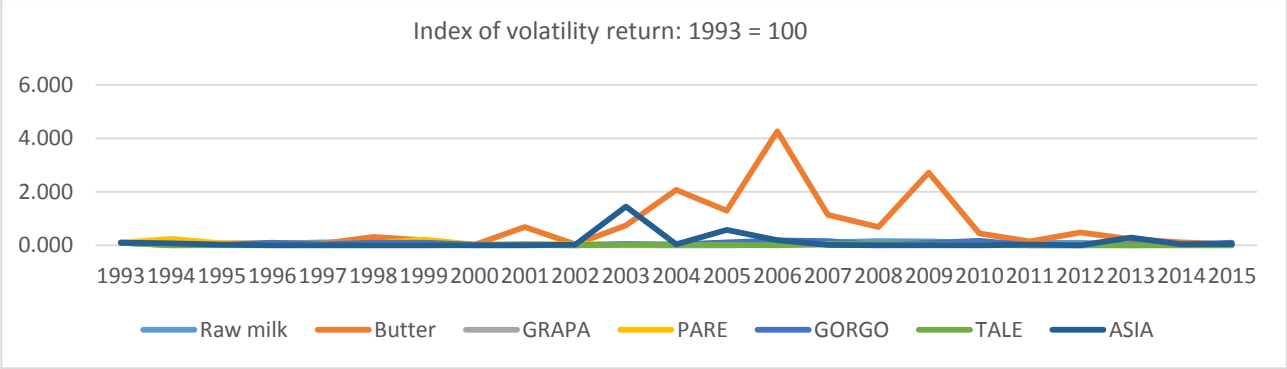
schemes for farmers under the common agricultural policy and different support schemes for farmers. In this period the UE allowed to start the increase of 1% annual quota (Italy + 5%) that will continue until 2015.

Price volatility

Measuring volatility is not straightforward and results depend on the time intervals, frequency selected, marketing shocks and other causes. We used three methods to determine volatility. The 1.st method: frequent standard measures of volatility are the standard deviation (SD) and Coefficient of Variation (CV) the ratio SD/Mean. The positive advantage of these indicators are that they are quite simple to be calculated but they do not account for the conditional heteroscedasticity.

2.nd method: **standard deviation of returns. The formula is:**

st dev $(r_t) = (\Sigma\ 1/n\text{-}1\ (r_t - r_m)^2)^{1/2}$ with $r_t = \Delta \ln (P_t) = \ln (P_t) - \ln (P_{t-1}) = \ln (P_t / P_{t-1})$; $r_m = \Sigma\ 1/n * r_t$



3.rd method: **ARCH-GARCH models**

This analysis is performed for GRAPA price series. The contribution of the exogenous variables is very limited in terms of model explication and the values suggest that the variability of Grapa is well explained by the GARCH (1,1) model. The goodness of fit is explain a good adaptability of the model to the data and the Durbin –Watson test suggest the presence of correlation in the errors, then the residual distribution is examined with the histogram normality test, the heteroscedasticity ARCH test and the residual graphic representation. The histogram normality test indicate long right tail, the skeweness is close to the normality value zero. The Jacques Bera test suggest that the hypothesis of normal distribution can be accepted at 5% level. The heteroscedasticity ARCH test is performed with the squared residuals and OLS estimation; in this case the DW test is close to 2 signaling absence of residual autocorrelation. The improvement of DW value is due to the squared residuals to reduce the effect of ACR. Finally the picture of residual actual and fitted suggest an evolution in a restricted band and no great differences between actual and fitted values.

Forecast

Starting with longer time memory using the entire sample composed of 1154 observations the price forecast shows a slight ascending trend and the price at 2020 is 33 cent/liter. The 2.nd sample starts from 1996 and includes 981 observation. The forecast show a declining trend but the price at 2020 is not significantly different from the previous forecast. The third sample start in 1999 and includes 808 observations. The forecast show an almost constant line then the price level remains at 33 cent/liter and is not different from the other forecasts. The fourth sample forecast start with 2003 and includes 628 observations. The forecast follow an ascending trend and starting with the value 33 cent/l arrive to 35 cent/liter The fifth forecast uses a sample with 397 observation from 2007 ahead; the forecast align to the value 35 cent/liter. The forecasting accuracy is given by the root men squared error (RMSE) and mean absolute error (MAE) and mean absolute % error (MA%E). RMSE - There are not significant changes except for the 4th forecast with value passing from 0,04 to 0,03; the highest RMSE is for the longest series used to forecast. The MAE tend to show a decline in the magnitude passing from longer to shorter series used for forecasting. This is explained by the changing behavior of milk prices becoming more volatile by approaching to the quota expiration and last observation explain better the future price evolution. The MA%E doesn't add further information to the previous indicators.

Conclusion

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The main purpose of this analysis was to use the historical price series analysis of dairy sector to evaluate the effects of political intervention ended by quota release in 2015 on market volatility and forecast the future raw milk price in an unregulated market environment for five years after quota release. How will the farmers adjust to this new situation? They will use the tools provided by the milk package and organize in dairy cooperatives, they will integrate in big international groups, they will start to use the forward contracts and other financial instruments to hedge against the risk? It is also possible that the various EU government will elaborate new policies for intervention (buffer stocks, export stimuli in selected countries, help to farmers. To provide some answer to these questions we have used the price analysis with weekly time series of dairy milk prices and we investigated the price volatilities to draw future scenarios of the dairy industry. Price volatility increased for almost all markets with some caveat related to the specific market intervention. Harvey (1977) said "Although a freer world market is expected to be less volatile than one characterized by high insulation rates, it is unlikely to be as stable as the protected domestic market it replaces". It is remarkable to notice that volatility if moderate (inflation in this case) is desirable because determined by price adjustment in an enlarged marketing contest. However, if volatility is not offset by suitable risk management strategies it can be disruptive for its consequences on farm management and thin markets. The decline in dairy prices seems unavoidable in a complete market liberalization due to two factor: the competition of dairy producers that face also in the EU countries lower costs and the growing oligopolistic competition due to the presence of big international groups. The change in the EU and WTO policies will cause shorter and deeper cycles may be expected in future.

Bibliography

BAI J., PERRON P.,(2003). Computation and Analysis of Multiple Structural change Models. J. Appl. Econ. 18: 1–22

Bollerslev, T. 1986. Generalized Autoregressive conditional heteroscedasticity. Journal of Econometrics 31, 307-327

Engle, R. F. 1982. Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation. Econometrica 50: 987–1007.

Keane M., O'Connor D. (2009). Price volatility in the EU dairy industry: causes, consequences and coping mechanisms. Brussels: European Dairy Association

Rosa F., Weaver R.D., & Vasciaveo M., 2015. Structural Changes and Dairy Chain Efficiency in Italy Int. J. Food System Dynamics 6 (3), 2015, 191-211

Rosa F., M. Vasciaveo, R. Weaver. (2014). "Agricultural and oil commodities: price transmission and market integration between US and Italy" BAE 3, n° 2, 2014 pp. 93-117.

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