Annex 1 – Extended abstract for Contributed Paper session

Paper Title	Efficiency of Prosecco grape growers: a panel data quantile regression approach

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Abstract	*200 words max*

The objective of this paper is to evaluates the technical efficiency of Prosecco grape producers during the period 2008 – 2014 by employing the panel data quantile regression with non-additive fixed effects approach. The QR approach, has become an alternative tool for efficiency measurement because a) it is robust to non-normal errors and outliers, and b) it has been found to yield more reliable estimates of efficiency than either DEA or SFA.

These considerations motivated us to exploit the panel data QR approach with Non-additive Fixed Effects (Powell, 2016) to estimate efficiency of Prosecco growers. We exploit the data collected by the Italian Farm Accountancy Data Network survey to estimate a Cobb-Douglas production function of prosecco growers on a log transformation of both output and inputs. Our findings show there is a non-neutral relationship between output response to input changes and efficiency.

Keywords	technical efficiency; quantile regression; technological heterogeneity;
JEL Code	C21, Q12

Introduction	*100 – 250 words*

Prosecco is currently the sparkling wine with the fastest growing demand worldwide. The grape used to produce Prosecco is grown in farms operating in a small area under different production environment that result in a large heterogeneity in production technology used across Prosecco growers. In consideration of such heterogeneity in production we employ the approach to efficiency measurement based on panel data Quantile regression (QR) estimates. The QR approach allows efficient, or almost efficient firms, to employ production technologies that may differ strongly from the ones of average or low efficiency firms. The present article adds to the literature on efficiency measurement based on QR estimates by estimating a panel data QR (QRPD) with non-additive fixed effects. The QRPD enables us to take into account some heterogeneity that may exist beyond what is possible to control using a cross-sectional approach

and that we do not wish to include in our efficiency measures.

The remainder of the article is organized as follows. In the next section, we provide a brief overview of the prosecco market and growing conditions. We then present the methodological framework employed, followed by a description of the data and the empirical model. A discussion of the major results follows, and the article ends with some concluding remarks.

Methodology   *100 – 250 words*

The two most common empirical methods of measuring technical efficiency are the parametric approach, such as stochastic frontier analysis (SFA), and non-parametric approach such as data envelopment analysis (DEA). These two approaches are based on specific assumptions and have been criticized on several grounds.

Hendricks and Koenker in their 1992 article first suggested that QR may be a substitute for SFA. The QR approach to model production frontiers and to measure productive efficiency has been originally proposed by Kokic et al (1997). This approach is based on the quantile regression of Koenker and Bassett (1978). QR generates a whole spectrum of lines which give a much broader picture of production technology. The top-quantile τ^b of the dependent variable is usually chosen as a benchmark to describe the production process of firms representing the efficient production frontier. The observations lying below it are likely to be inefficient, and we can use some measure of the distance from observations below the frontier to the frontier itself as the measure of their inefficiency. In this paper we estimate a quantile regression model for panel data with non-additive fixed effects (Baker Powell, 2014 and 2016), maintaining the non-separable disturbance term commonly associated with quantile estimation. A Cobb-Douglas production function is estimated for different quantiles τ between 0.10 and 0.90, using panel data QR with non-additive fixed effects (QRPD) on a log transformation of both output and inputs, and with two endogenous treatment variables.

Results   *100 – 250 words*

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Our findings show there is a non-neutral relationship between output response to input changes and efficiency. We find that output response to labour changes are statistically significant only across farms operating close to the frontier, changes in capital are found to produce a significant change in output only at 75th quantile while changes in other inputs have a significant response

in the lower and upper tails of the output distribution. As for the location of farms in the hilly area covered by the DOCG protection we find it has a negative impact which is statistically significant only in the middle part of the output distribution. The efficiency of farms operating in the area covered by DOCG in more concentrated in the lower tail than farms operating in the area covered by DOCG.

Discussion and Conclusion	*100 – 250 words*

The differences in the environmental conditions in which grapes used to produce the Prosecco wine are grown result in variations in local-specific technology. In consideration of the large heterogeneity in grape growing, we estimate efficiency using panel data fixed effect quantile regression models. First, the availability of panel data enables us to take into account some heterogeneity that may exist beyond what is possible to control using a cross-sectional approach. This is achieved by introducing a farm-specific unobservable effect, which is uncorrelated with other explanatory variables. Second, QR allow us to focus our interest on the impact of input changes in the low tail of efficiency, that is on farms of interest for extension and policy intervention.