

Area response in wheat production: The Australian wheat-sheep zone: Reply

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Abstract: This paper is my reply to the comment (Parton, 2012) on my original paper (Culas, 2011). The issues pointed out in the comment are the circumstances under which the econometric method that I employed is applicable. My reply suggests the econometric techniques that could be more appropriate in various circumstances.

Introduction

I take it as a privilege to receive a comment on my paper from the editor of this journal (Parton, 2012). I welcome the opportunity to further explain the methods I employed in Culas (2011).

The issues concerned are worthy of examination in order to obtain appropriate estimating procedures for econometric models. Parton raises some fundamental issues about employing estimation methods in circumstances where they are not applicable. This is mainly related to *"where there are lagged dependent variables the estimation of the other dependent variables can be affected" (*Parton, 2012, p.57*).*

The other related issue is the presence of heavy trending in the exogenous variables and disturbances: *"are the disturbances in the Culas (2011) estimation likely to be autocorrelated? The paper itself does not provide enough direct evidence to make the judgement"* (Parton, 2012, p.57).

My reply to the issues is as follows:

Testing autocorrelation in the presence of lagged dependent variables

In the original paper, I considered a partial adjustment model of the general form:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 X_t + u_t \quad (1)$$

In which the dependent variable Y_t is a function of itself lagged one period and other exogenous variables X_t. This model was estimated as an AR1 regression by the Prais-Winston method to account for first-order autocorrelation:

$$u_t = \rho u_{t-1} + e_t \quad (2)$$

An explanation for autocorrelation in the model is that the factors omitted from the time-series regression are correlated across periods. This may be due to serial correlation in factors that should be in the regression model. "*Failing to account for autocorrelation when it is present is almost surely worse than accounting for it when it is not"* (Greene, 1993, p. 424).

As I analysed a relatively small sample (1991-2004), the Prais-Winston method was favoured over the Cochrane-Orcutt method. The Cochrane-Orcutt method is more appropriate for estimating models with lagged dependent variables. However, as this procedure involves omitting the first observation in the dareta, a larger sample size is required (usually, over 30 degrees of freedom (d.f.)).

While there was no evidence of autocorrelation in the estimated model according to the Durbin-Watson Statistics (and also from the statically insignificant autocorrelation coefficients), provided the sample size is large enough (usually, over 30 d.f.), it is preferred that the Durbin *h-test* or Breush-Godfrey test should be used for testing for autocorrelation when a lagged dependent variable is present in the model (Greene, 1993, p. 428). Unfortunately, my sample size was not this large so I could not reach a definite conclusion about autocorrelation.

Estimating models with lagged dependent variables and presence of trending in the exogenous variables

The model was estimated with exogenous variables that are trending, such as the expected relative price between wheat and wool and the time-trend. It is a valid concern that when there is heavy trending in the exogenous variables and disturbances, the lagged dependent variable may dominate the regression and destroy the effect of other variables, whether they have true causal power or not (Achan, 2001). This means the lagged variables can artificially dominate the regression whether it has a great deal of explanatory power or not.

In fact, the model has been tested for different specifications as Regression 1, Regression 2, Regression 3 and Regression 4

(Culas, 2011, p. 47). In Regression 4, one of the exogenous variables (time-trend) was omitted. Leaving this out made little difference to the estimation of the coefficient on lagged dependent variable, which remained close to one (i.e., between 0.95 and 0.99) in all the regressions. Taken at face value this means that the area of wheat grown in the past predicts the future area very well.

The abovementioned results suggest that the presence of trending in the relative price does not invalidate the model. Hence, the estimates are valid, even though the model was estimated by the Prais-Wiston method that involves a GLS procedure. If the sample size had been larger, it would have been preferable to use the Cochrane-Orcutt procedure to minimize the effect of the lagged dependent variable in the regressions (Ramanathan, 2002, p. 450).

Conclusion

Parton (2012) has raised a valid point. This reply hopefully clears up the estimation methods that I followed in Culas (2011), considers the issues raised in Parton (2012) and provides some suggestions on the econometric methods that may be more applicable in the presence of autocorrelation, lagged dependent variables, and smaller sample size.

References

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