

Causality Testing in Models of Spatial Market Integration: A Comment on an Article by Stefan Dercon

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In his article Stefan Dercon makes a number of comments on an earlier article by Alexander and Wyeth [1994], the most important of which is that part of the testing procedure proposed by Alexander and Wyeth is statistically incorrect. In fact the authors were aware of this, as they show by using the correct methods explained by Stefan Dercon in all their other work published in the area, both prior and subsequent to the *JDS* article (see, for example, Alexander [1993], Alexander and Barrow [1994], Alexander and Rendall [1995] and Alexander and Wyeth [1995]). The real error in the article referred to by Stefan Dercon was that it failed to clarify why the authors went ahead and used unrestricted VARs for causality testing even though the procedure was not strictly correct.

The answer, of course, is that the article took as its starting point the seminal work of Ravallion and the authors wanted to follow in his footsteps as much as possible in order to maintain accessibility to those familiar with Ravallion's work, simply highlighting the most important modifications that were required. The results in Table 3 of Alexander and Wyeth [1994] are based on F-tests for the joint significance of variables relating to the row variable in the *unrestricted* VAR for the column variable. The authors did this because it is the *unrestricted* VAR which corresponds to the Ravallion model and which was the central theme of the article. Thus statistical precision was sacrificed to maintain consistency in the economic model. Otherwise it would have been necessary to use the *restricted* VAR for the causality test in order to have a precise F distribution. In fact the authors have also performed the causality tests on the *restricted* VAR and there is very little difference in the results. Table 1 reports the 'old' F-statistics (as reported in Alexander and Wyeth [1994: Appendix 2]) based on the *unrestricted* VAR, and below these the 'new', and statistically correct, F-

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TABLE 1
F-STATISTICS FOR GRANGER CAUSALITY BASED ON UNRESTRICTED AND RESTRICTED VARS

From↓	To→	JAK	BAN	SUR	UJU	MED	BJN	JAY
JAK	OLD		2.18	0.14	1.87	2.53	4.70	5.01
	NEW		3.12	0.17	1.95	3.99	5.53	6.32
BAN	OLD	2.46		1.75	3.13	4.75	2.65	4.23
	NEW	2.74		1.83	3.72	5.28	3.45	5.52
SUR	OLD	3.51	2.94		*	2.85	2.83	1.36
	NEW	3.88	3.24			3.38	3.63	2.28
UJU	OLD	3.38	1.58	*		2.27	8.75	2.74
	NEW	3.68	1.82			2.64	9.61	3.59
MED	OLD	2.33	2.61	1.87	1.33		2.93	2.99
	NEW	2.52	2.87	1.90	1.64		3.57	3.98
BJN	OLD	0.86	1.21	0.42	0.35	1.01		4.29
	NEW	1.02	1.59	0.41	0.17	1.29		4.95
JAY	OLD	0.78	0.37	0.79	0.11	1.67	1.60	
	NEW	0.95	0.66	0.86	0.36	1.88	2.07	

* - No significant cointegration

statistics based on the restricted VAR.

Most of the new F-statistics are a little larger than the old ones and this reflects the fact that zero restrictions on the lagged level of the dependent rice price do not generally hold. As a result most of the series show serial correlation over and above any seasonal effects.

Stefan Dercon's point is that the old 'F-statistics' do not really follow an F-distribution and this is correct, but the point made by the authors is that the differences which arise from using the alternative procedure are extremely small. Furthermore, as is clear from the table below, exactly the same conclusions can be drawn from the 'new' F-statistics as from the old.

In any case a much more important question that could more usefully be dealt with here relates to whether F-tests should be used at all! Lagrange Multiplier and Likelihood Ratio tests might also be used for the causality tests and they would be much more powerful (see Alexander [1993]). The authors were well aware of this but decided to use F-tests in the *JDS* article because they are easier to calculate than the alternatives and would be accessible to the widest possible readership. It should be emphasised,

however, that the gains from using the more robust and powerful LM or LR tests would be much greater than any gains to be had from making refinements to the F-tests. As an example of the gains to be had, for the causal relationship from Jakarta to Medan in Alexander and Wyeth [1994] the F-statistic of 3.99, which is significant at one per cent, can be compared with LR and LM statistics of 13.16 and 12.56 respectively. Both these are χ^2 distributed and so have probability values of 0.004 and 0.006 respectively. In fact *none* of the classical tests are really appropriate for the data since the Jarque-Bera procedure actually rejects the null hypothesis of normality in almost all the regressions. The authors believe that this would also prove to be true for Stefan Dercon's data, although he has not mentioned the issue in his paper. The real problem is that there are a multitude of statistical issues that could be addressed in respect of any single study and it makes no sense to try to deal with them all in a single paper and so obscure the main points being made.

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