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Guest editorial

Endogeneity, instruments and identification

The papers brought together in this special issue originate from the 14th $(EC)^2$ Meeting held on December 12th and 13th, 2003 at the Centre for Microdata Methods and Practice in London. The programme of the Meeting was constructed around the theme: *Endogeneity*, *Instruments and Identification*. The Programme Chair was Geert Dhaene, Andrew Chesher managed the local organisation and financial support was generously provided by the European Central Bank, the Journal of Applied Econometrics and the Centre for Microdata Methods and Practice, the latter through its grant from the Leverhulme Trust.

There were over 40 papers on the conference programme, around 20 given in plenary sessions. The main themes addressed at the meeting are well represented in the papers that appear in this issue.

There are two primary focuses: *identification and estimation in weakly restrictive models*, and *weak instruments*. The papers by Chernozhukov, Imbens and Newey; Chesher; Frölich; and Magnac and Maurin study identification and estimation in structural models under semi- or non-parametric restrictions. Closely related, and focused on the issue of decision making when a model does not have point identifying power, is the paper by Manski. The other distinct group of papers focuses on various aspects of inference in models with linear structural functions with particular attention to the impact of weak instruments on inference. In this group fall the papers by Andrews, Moreira and Stock; Dufour and Taamouti; Hoogerheide, Kaashoek and van Dijk; Kleibergen; and Poskitt and Skeels.

1. Identification and estimation in weakly restrictive models

The papers by Chernozhukov, Imbens and Newey and by Chesher deal with models in which a scalar outcome Y is a function of observed (X) and unobserved (U) random variables and the latter may not be additively separable from the structural function, that is $Y = h(X, U)$. Nonseparable models are interesting from an applied economic perspective because they allow the possibility that there is a distribution of responses to a policy intervention. The papers propose different types of restriction sufficient to identify features of the structural function.

In the model of Chernozhukov, Imbens and Newey the function h is monotonic in scalar U which is independent of instruments Z. Additional restrictions are developed sufficient to identify the entire function h. A consistent IV-type estimator is proposed.

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In the model of Chesher $U = (U_1, U_2)$, the function h is monotonic in U_1, and U_2 is responsible for stochastic variation in the endogenous elements of X. The paper develops additional restrictions sufficient to identify local features of the structural function h. These include local joint independence of U and instruments Z. Control-function-type estimators can be constructed using standard quantile regression estimation procedures.

Frölich provides an estimator of the local average treatment effect (LATE) in a model in which instrumental variables satisfy the classical exclusion restriction conditional on covariates but perhaps not otherwise. The proposed estimator of the LATE with covariates is nonparametric and conditions are provided under which it is root-n consistent, asymptotically normal and efficient.

Magnac and Maurin focus on binary outcomes and specifically on threshold crossing models $Y = 1(X'\beta + V + U > 0)$ in which unobservable U is uncorrelated with instruments Z and there is a conditional independence restriction requiring U to be independent of V given X and Z. They show that a "large support" restriction on the continuous special regressor V which does lead to identification of β, can only be employed when $P[Y = 1 | X, Z, V]$ increases from 0 to 1 over the support of V. Noting that this may not be appropriate in some applications they propose an alternative condition on the tails of the distribution of U and establish a semi-parametric efficiency bound for β under conditional independence (with respect to V) and uncorrelated instrument restrictions.

The practical aim of econometric analysis is often to provide information to guide choice amongst alternative actions. The interplay between the way in which a process is observed, the degrees of identifiability provided by alternative models and the decision process and the way data bear on it is an under-researched area. The paper by Manski contributes by studying decision making in a problem in which there is missing data and a model which partially identifies but does not point identify treatment responses. A minimax-regret criterion is employed in this problem of decision making under ambiguity.

2. Weak instruments

The papers that fall under this heading study various aspects of inference about coefficients, β, of a linear structural equation

$$y = Y'\beta + X'\gamma + U$$

involving endogenous variables Y which are only weakly related to the available instruments.

Andrews, Moreira and Stock study the power of alternative tests of hypotheses about the coefficient of a single endogenous variable. The tests use critical values that are conditional on a statistic sufficient for a "concentration parameter", which measures the strength of the instruments that feature in the model. This conditioning strategy is expected to give tests with superior size properties when instruments are weak. The paper proposes a new algorithm for computing conditional tests and shows that various conditional Wald-type tests have low asymptotic power relative to a conditional likelihood ratio test.

Dufour and Taamouti propose a family of Anderson–Rubin type tests which are robust to weak instruments and develop exact finite sample inference under Gaussianity assumptions. Their procedures make fewer demands on structural information about the genesis of endogenous variables than other procedures and so possess a variety of

robustness properties not enjoyed by other procedures though at a possible cost in terms of power.

The Bayesian analysis of Hoogerheide, Kaashoek and van Dijk produces exact inference under the normality assumptions used in a number of the other papers. The paper reveals the highly nonelliptical shape of highest posterior density credible sets in the sorts of weak instrument settings studied in other papers in this collection. Developing these results presents formidable computational challenges and the paper presents a new class of neural network sampling methods suitable for sampling from a posterior distribution which may be skewed and multimodal.

Kleibergen studies various test statistics designed to be robust to weak instruments, including a conditional LR statistic of the type considered by Andrews, Moreira and Stock. The paper extends these procedures to cases in which there are multiple parameters under test and the error covariance matrix does not take the simple Kronecker product form. Exact distributional results are obtained for the case in which errors are normal and all coefficients in the structural equation are under test. The results prepare the ground for analysis of cases in which parameters are estimated by GMM.

Poskitt and Skeels develop a novel approximation to the distribution of the 2SLS estimator built around a central Wishart approximation to a noncentral Wishart distribution that plays a critical role in determining the exact distribution of the 2SLS estimator under Gaussianity. The approximation is accurate when the noncentrality parameter of the Wishart distribution is small, which occurs when the concentration parameter that measures the strength of instruments is small. Thus their approximation works well when instruments are weak.

3. $(EC)^2$ Meetings

As in the past the 14th $(EC)^2$ meeting of 2003 stimulated fine papers and presentations and excellent and informed discussion. The series continued with the 2004 meeting on the *Econometrics of Industrial Organisation* in Marseille, the 2005 meeting on the *Econometrics of Financial and Insurance Risks* in Istanbul and the 2006 meeting on the *Econometrics of Monetary Policy and Financial Decision Making* in Rotterdam. The $(EC)^2$ meetings go from strength to strength—details of upcoming meetings are available at http://www.core.ucl.ac.be/EC2/ecsquare.html.

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