Finite-sample inference, weak identification and macroeconometrics *

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1. **Finite-sample inference in econometrics**

   General objective: to developing reliable tests and confidence sets (or intervals) in econometrics in situations which involve test statistics:

   1. complex finite-sample distributions;
   2. nuisance parameters.
1.1. **Monte Carlo test methods**

Monte Carlo tests allow one to control perfectly the size of a test, even with a **small** number replications [Dwass (1957), Barnard (1963)].

- Kiviet and Dufour (1997a, Journal of Econometrics)
- Dufour and Khalaf (2001, Baltagi, eds, Blackwell)
1.2. **Nuisance parameter elimination**

1. Transformations

2. Conditioning

- Campbell and Dufour (1991, Economics Letters)
- Kiviet and Dufour (1997b, Journal of Econometrics)
- Dufour and Torrès (1998, Dekker)
1.3. **Bound procedures**

1.3.1. **Bounding the statistic of interest by other statistics**

- Dufour (1989, Econometrica)

- Dufour (1990, Econometrica)


1.3.2. **Bounding tail areas by some function**

Exponential inequalities, Chebyshev inequalities, Berry-Esséen bounds

- Dufour and Mahseredjian (1993, Econometric Theory)
- Dufour and Hallin (1991, Econometric Theory)
- Dufour and Hallin (1992a, Econometric Theory)
- Dufour and Hallin (1992b, Journal of Statistical Planning and Inference)
- Dufour and Hallin (1993, JASA)
1.3.3. **Projection techniques**

- Dufour (1990, Econometrica)

- Dufour (1997, Econometrica)


- Dufour and Khalaf (2002)

- Dufour and Taamouti (2005b, Econometrica)

1.3.4. **Sequential confidence procedure**

- Dufour (1990, Econometrica)


2. Weak identification

**Identification failure**: situation where several values of model parameters correspond to the same data DGP.

**Weak identification**: situation where we are close to identification failure.

Several authors in the past have noted that usual asymptotic approximations are not valid or lead to very inaccurate results when parameters of interest are close to regions where these parameters are not anymore identifiable.

Surveys:


- Dufour (2003, Canadian Journal of Economics)
1. Theoretical results show that the distributions of various estimators depend in a complicated way upon unknown nuisance parameters. So they are difficult to interpret.

2. When identification conditions do not hold, standard asymptotic theory for estimators and test statistics typically collapses.

3. With weak instruments,
   
   (a) 2SLS becomes heavily biased (in the same direction as OLS),
   
   (b) distribution of 2SLS is quite far the normal distribution (e.g., bimodal).

4. Standard Wald-type procedures based on asymptotic standard errors become fundamentally unreliable or very unreliable in finite samples.


   329000 observations;
replacing the instruments used by Angrist and Krueger (1991, QJE) with randomly generated instruments (totally irrelevant) produced very similar point estimates and standard errors; indicates that the instruments originally used were weak.
Crucial to use finite-sample approaches to produce reliable inference.

Finite-sample approaches to inference on models involving weak identification

- Dufour (1997, Econometrica)
- Dufour and Taamouti (2005b, Econometrica)

1. Procedures robust to lack of identification (or weak identification)

2. Limited information methods which do not require a complete formulation of the model [robustness to missing instruments]
Applications

1. Education and labour economics
   (a) Students’ achievements and self-esteem
   (b) Education and earnings

2. Financial econometrics
   (a) Black’s CAPM
       [Beaulieu, Dufour, and Khalaf (2005)]
   (b) Stochastic volatility models
       [Dufour and Valéry (2005)]

3. Macroeconomics
   (a) Tobin’s $q$
   (b) Trade and growth
(c) New Keynesian Phillips curves
3. Macroeconometrics

3.1. Distribution-free inference in models with regressors involving feedback

- Campbell and Dufour (1991, Economics Letters)
- Coudin and Dufour (2005a)
- Coudin and Dufour (2005b)
3.2. Causality analysis, VAR and VARMA models

- Boudjellaba, Dufour, and Roy (1992, JASA)
- Dufour and Tessier (1993)
- Dufour and Tessier (1997)
- Dufour and Renault (1998, Econometrica): causality at various horizons
- Dufour and Pelletier (2005): VARMA identification and modelling
- Dufour and Taamouti (2005a): causality measures (bootstrap)

3.3. **New Keynesian Phillips curves**


- Dufour, Khalaf, and Kichian (2006b): Calvo

- Dufour, Khalaf, and Kichian (2006c): Lindé model
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