Available online at www.sciencedirect.com

SCIENCE DIRECT

Journal of Econometrics 133 (2006) 779–806

JOURNAL OF Econometrics

www.elsevier.com/locate/jeconom

Bootstrap conditional distribution tests in the presence of dynamic misspecification

Valentina Corradi[a,*], Norman R. Swanson[b]

[a]Department of Economics, Queen Mary-University of London, London E14NS, UK
[b]Department of Economics, Rutgers University, New Brunswick, NJ 08901-1248, USA

Available online 10 August 2005

Abstract

In this paper, we show the first order validity of the block bootstrap for Kolmogorov-type conditional distribution tests under dynamic misspecification and parameter estimation error. Our approach is unique because we construct statistics that allow for dynamic misspecification under both hypotheses. We consider two tests; the CK test of Andrews [1997. A conditional Kolmogorov test, Econometrica 65, 1097–1128], and a version of the DGT test of Diebold, Gunther and Tay [1998a. Evaluating density forecasts with applications to finance and management. International Economic Review 39, 863–883]. Test limiting distributions are Gaussian processes with covariance kernels that reflect dynamic misspecification and parameter estimation error. Critical values are based on an extension of the empirical process version of the block bootstrap to the case of nonvanishing parameter estimation error. Monte Carlo experiments are also carried out.

JEL classification: C12; C22

Keywords: Block bootstrap; Conditional distributions; Conditional Kolmogorov tests; Dynamic misspecification; Parameter estimation error

*Corresponding author. Tel.: +44 20 7882 5087
E-mail addresses: v.corradi@qmul.ac.uk (V. Corradi), nswanson@econ.rutgers.edu (N.R. Swanson).

0304-4076/$ - see front matter
doi:10.1016/j.jeconom.2005.06.013

1. Introduction

In recent years, there has been growing interest in providing tests for the correct specification of conditional distributions. One reason for this is that testing for the correct conditional distribution is equivalent to jointly evaluating many conditional features of a process, including the conditional mean, variance, and symmetry. Along these lines, Bai and Ng (2001) construct tests for conditional asymmetry. Just as importantly, these sorts of tests allow for the evaluation of predictive densities, thus generalizing the evaluation of point and interval forecasts.[1]

In this paper, we show the first order validity of the block bootstrap in the context of Kolmogorov-type conditional distribution tests when there is dynamic misspecification and parameter estimation error. Our approach differs from the literature to date because we construct a bootstrap statistic that allows for dynamic misspecification under both hypotheses, rather than assuming correct dynamic specification under the null hypothesis. This difference between our approach and that taken elsewhere can be most easily motivated within the framework used by Diebold et al. (DGT) (1998a), Hong (2002) and Bai (2003).[2] In their paper, DGT use the probability integral transform (see e.g. Rosenblatt, 1952) to show that $F_t(y_t|\Im_{t-1},\theta_0)$, is identically and independently distributed as a uniform random variable on [0, 1], where $F_t(\cdot|\Im_{t-1},\theta_0)$ is a parametric distribution with underlying parameter θ_0, y_t is the random variable of interest, and $\Im_{t-1}$ is the information set containing all "relevant" past information (see below for further discussion). They thus suggest using the difference between the empirical distribution of $F_t(y_t|\Im_{t-1},\widehat{\theta}_T)$ and the 45°-degree line as a measure of "goodness of fit", where $\widehat{\theta}_T$ is some estimator of θ_0. This approach has been shown to be very useful for financial risk management (see e.g. Diebold et al. (1999)), as well as for macroeconomic forecasting (see e.g. Diebold et al., 1998b; Clements and Smith, 2000, 2002). Likewise, Bai (2003) proposes a Kolmogorov-type test based on the comparison of $F_t(y_t|\Im_{t-1},\widehat{\theta}_T)$ with the CDF of a uniform on [0, 1]. As a consequence of using estimated parameters, the limiting distribution of his test reflects the contribution of parameter estimation error and is not nuisance parameter free. To overcome this problem, Bai (2003) uses a novel approach based on a martingalization argument to construct a modified Kolmogorov test which has a nuisance parameter free limiting distribution. This test has power against violations of uniformity but not against violations of independence. Two features differentiate our approach from that taken in the above papers. First, we assume strict stationarity, while they do not. Second, we allow for dynamic misspecification under the null hypothesis, while they do not. While our approach is clearly less general because of the first feature, the second feature allows us to obtain asymptotically valid critical values even when the

[1]A few recent contributions in the area of predictive evaluation include: Diebold and Mariano (1995), West (1996), Christoffersen (1998), McCracken (2000), White (2000), Chao et al. (2001), Corradi et al. (2001), and Clark and McCracken (2001).

[2]Other contributions in this area include Bontemps and Meddahi (2005), Duan (2003), and Corradi and Swanson (2004a,b,c).