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Reply to B.M. Pötscher's comment on 'Adaptive estimation in time series regression models'

Douglas G. Steigerwald

Department of Economics, University of California, Santa Barbara, CA 93106, USA

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Nearly all of Pötscher's comment on my 1992 paper is taken up with three accusations, each of which is wrong and easily dismissed. Pötscher also finds and reports two typographical errors. As well, the reviewer of Pötscher's comment finds two typographical errors and one substantive but minor error, which I correct below. For brevity (P) refers to Pötscher's comment and (S) to my original paper.

First, and to set the record straight, the two typographical errors Pötscher noted are that a superscript T was omitted from α in Definition 2.1 and that a bracket was misplaced in Eq. (2.2). The reviewer of Pötscher's comment also noted that: (i) the quantity 2 was omitted from the right-hand side of the equation for the log-likelihood ratio; (ii) the incorrect words 'and only if' appeared in the sentence immediately preceding Definition 2.1; and (iii) my treatment of initial values in constructing the nonparametric density estimator was flawed. To correct the flaw, the definition of the estimator should be changed so that the support of the estimator includes the actual initial values. In the case of an AR(p) process, this means that (4.3) should be defined only for residuals from $p+1, \ldots, T$ rather than from $1, \ldots, T$ as written.

Turning to Pötscher's three accusations, he first asserts that the principal theorem of (S), Theorem 4.1, is incorrect as it stands and that '(S) does not come close to providing a rigorous proof' of the theorem. Pötscher bases this on the observation that if one assumes the true order of the process is *unknown*, and estimates an ARMA model with $p \geq 1$ and $q \geq 1$ when the true order is $p = 0$ and $q = 0$ (that is, white noise), then the information matrix for α would be singular. This observation is certainly true but it has no bearing on Theorem 4.1, which is derived under the assumption that the true order of the process is *known*. Thus estimators of the ARMA model using values other than the true values of p and q are ruled out by assumption. That Theorem 4.1 takes p and

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q to be known is obvious. First, I follow the assumptions and notation used in Kreiss (1987), which is the seminal article on adaptive estimation in ARMA models. In particular, Kreiss and I treat ARMA(p, q) to mean an ARMA model with known order p and q. Second, the structure of the paper is such that I state in the introduction that I 'explicitly consider both the case in which the order is known and in which it is unknown', and at the beginning of Section 5, which follows Theorem 4.1 directly, I state that the 'theoretical results derived above require that the order of the ARMA process be known'.

Pötscher's second accusation is that my results on adaptive estimation when the order of the ARMA process is unknown are 'less than clear' and that 'it is not clear what his [my] claim in Theorem 5.3 really is'. Pötscher bases this on the observation that my definition of an adaptive estimator is not consistent with the definition of a *uniformly* adaptive estimator. This observation is also certainly true, but it again has no bearing on my results. Adaptive estimators are a different notion from uniformly adaptive estimators (the two differ in the underlying definition of asymptotic convergence in distribution). I study adaptive estimators, *not* uniformly adaptive estimators. Adaptive estimators were first studied by Bickel (1982) and Kreiss (1987), on whose work I build; there is now a substantial literature on adaptive estimation. At no point do the words uniformly adaptive occur in my paper; the word adaptive occurs throughout – for instance, in the title.

Pötscher's final accusation is that 'some of the material in Section 5 of (S) has been taken from published work without proper citation' and specifically 'the discussion on p. 260 of (S) is taken from Pötscher (1985, pp. 135–136)' and 'a misleading reference is made to Pötscher (1990)', with a footnote adding that a 'copy of Pötscher (1985) had been sent to Steigerwald upon his request'. Pötscher did send me his 1985 and 1990 papers, along with five other papers he had written, and I chose to reference the 1990 paper because, in my judgement, it provided the most useful source for readers. Indeed, I cite Pötscher four times in the paper, and twice in the paragraph in question.

References

Bickel, P., 1982, On adaptive estimation, Annals of Statistics 10, 647–671.

Kreiss, J., 1987, On adaptive estimation in stationary ARMA processes, Annals of Statistics 15, 112–133.

Pötscher, B., 1995, Comment on 'Adaptive estimation in time series regression models' by D.G. Steigerwald, Journal of Econometrics, this issue.