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A Lagrange multiplier approach to testing for serially dependent error terms

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Abstract: Testing for first-order auto-regressive errors in a linear regression model is considered. It is found that the L_1-norm based Lagrange multiplier test avoids computational difficulties caused by the dependency among the errors. Furthermore, the Lagrange multiplier test has the advantage that estimation of the error term density at zero is not required. As the error term variance increases and the error term density at zero becomes larger the asymptotic relative efficiency becomes more favorable for the L_1-norm based test relative to the corresponding least squares test.

Key words: Auto-regressive errors, L_1-norm estimation, Lagrange multiplier test.

AMS subject classification: 62J05, 62M10.

1 Introduction

The existence of serially dependent error terms when a linear regression model is used for analyzing time series data has attracted the attention of recent research. Elimination of estimation problems caused by the dependence involves both the detection of the dependence and the selection of an appropriate estimation technique for the model in question if dependence is found.

It is also well recognized in the literature that many data sets contain outliers or, alternatively, are well represented by distributions with fat tails. This has motivated the introduction of robust estimators, including the L_1-norm estimator. Simulation experiments of L_1-norm based estimators of models with serially dependent error terms are reported in e.g. Coursey and Nyquist (1983 and 1986). These experiments indicate that L_1-norm