# The Fiction of Full BEKK: Pricing Fossil Fuels and Carbon Emissions

**Michael McAleer**

**Department of Finance, Asia University, Taiwan**

**Email: Michael.mcaleer@gmail.com**

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Abstract: The purpose of the paper is to (i) show that univariate GARCH is not a special case of multivariate GARCH, specifically the Full BEKK model, except under parametric restrictions on the off-diagonal elements of the random coefficient autoregressive coefficient matrix, that are not consistent with Full BEKK, and (ii) provide the regularity conditions that arise from the underlying random coefficient autoregressive process, for which the (quasi-) maximum likelihood estimates (QMLE) have valid asymptotic properties under the appropriate parametric restrictions. The paper provides a discussion of the stochastic processes that lead to the alternative specifications, regularity conditions, and asymptotic properties of the univariate and multivariate GARCH models. It is shown that the Full BEKK model, which in empirical practice is estimated almost exclusively compared with Diagonal BEKK  (DBEKK), has no underlying stochastic process that leads to its specification, regularity conditions, or asymptotic properties, as compared with DBEKK. An empirical illustration shows the differences in the QMLE of the parameters of the conditional means and conditional variances for the univariate, DBEKK and Full BEKK specifications.