Research article

Wavelet-based systematic risk estimation: application on GCC stock markets: the Saudi Arabia case

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Supplementary

In this appendix we provide the empirical results due to the 3-scale law. The new approach in estimating the systematic risk of an asset in the CAPM is based on the application of a wavelet multi-scaling by decomposing a given times series on a scale by scale basis. At each scale, we estimated the wavelet variance of the market return and the wavelet covariance between the market return and a return stock to estimate next the stock’s beta. We have applied two different scales, a first one consisting of the 2-scale law which is always used in wavelet analysis even in other fields and a second one consisting of a 3-scale law to reinforce the results obtained with the 2-scale and thus confirm the role of the time factor in the analysis of markets. Recall that all the studies applying wavelets especially in financial and economic fields restrict to the 2-scaling wavelets. However, splitting the whole period for studying markets into sub-periods of the form $2^j$ may not be always adequate. Recall that the size of the time series whenever being different from the 2-scale form yields generally real problems at the boundaries. For this reason, we thought to test a different scale. To avoid the divisibility by 2 again, we thought that prime scales will be adequate. In fact, we prepare in the present study the arguments to develop as future direction a random time scale to express more adequately the uncertainty in markets movement. We also provide the estimation of the determination coefficient $R^2$ as for the previous cases in Table b.
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Table a. Estimations of the return excess of actions on the market for 3-scale law.
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Beta for scales 1 to 6
Table b. The determination coefficient $R^2$ relative to the 3-scale law.

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In Figure A we test as for the 2-scale law the linearity between the market return and the actions. It shows here also some linearity between the individual stock and the market portfolio where on the horizontal axis the excess of the market return is assigned versus the excess of the stock return assigned to the vertical axis. We notice that the linear relationship is particularly strong at the high scales especially scale 5 and 6. Medium and low scales show some perturbation in the movement of the market.
**Figure A.** Excess market return (horizontal axis) versus excess return of the action (vertical axis) for different time scales with the 3-scale law.