

# Investigating the Leverage Effect on the Polish Stock Market Using Principal Regression Analysis

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Understanding how past market movements affect future volatility and asset correlations is key to risk management and portfolio optimization. Among the well-studied phenomena in this context is the leverage effect—where declining asset prices are followed by increased volatility. Contribution of time-varying correlations to this effect have also been widely explored [1, 2], but their behaviour in smaller markets like Poland remains relatively unknown. In this study, we analyse daily data from the Polish stock market (2010–2024), constructing a synthetic index by averaging individual stock prices. We regress index volatility, average component volatility, and average inter-stock correlations on lagged index returns to investigate their predictive relationships across various time lags. Additionally, we apply principal regression analysis and model matrix correlations dependence on lagged index returns [1]:

$$\mathbf{C}(I) = \mathbf{C} + I\mathbf{D}.$$

Lastly, we examine the structure of  $\mathbf{D}$  matrices through eigenvalue decomposition to better understand the dynamics of market movements. Preliminary observations suggest that the Polish market exhibits distinct behaviours compared to more established foreign markets, with lower—but still influential—correlations. These insights help highlight differences in market dynamics and can inform Polish investors on how standard models perform for local conditions.

## References

- [1] P.-A. Reigner, R. Allez, and J.-P. Bouchaud, *Physica A* 390, 3026–3035 (2011).
- [2] A. Karami, R. Benichou, M. Benzaquen, and J.-P. Bouchaud, *Wilmott* 2021, 63–73 (2021).