

## Testing for Martingale Property in the Egyptian Exchange: Do Regulatory Policies and Size Matter?

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### Background

Testing whether the dynamics of equity prices satisfy the martingale property has received considerable attention in finance due to its theoretical importance (because of the close relationship between the martingale property and the efficient market hypothesis) and practical implications (e.g. potential trading rules). Empirical research examined the weak-form-efficiency for the Egyptian Exchange (EGX) reached inconclusive conclusion [e.g. Al-Khazali *et.al* (2007), Smith (2008) and Lagoarde-Segot and Lucey (2008)]. These studies did not use the non-overlapping subsamples to capture the effect of expanding price limits imposed on the daily movements of listed shares, coupled with applying trading halts for few minutes if prices hit the new limits, on the efficiency of the EGX. The inverse relationship between the magnitude of price limits and efficiency has been confirmed by other studies [e.g. Ryoo and Smith (2002) for Korea and Chen and Ting (2000) for Taiwan]. Imposition of price limits is thought to hinder price discovery as equity prices are prevented from efficiently reaching to their equilibrium levels (the delayed price discovery hypothesis). In addition, the relation between efficiency and firm size, which is well documented for developed exchanges [e.g. Tokyo and London exchanges (Hung *et.al*, 2009) and South African Exchange (Jefferis and Smith, 2004)], has not been addressed for the EGX. In this regard, the argument is that: large-capitalised stocks, with the availability of more information, tend to follow martingale property whereas small-capitalised stocks require more time to incorporate new information into prices inducing strong positive autocorrelation in small-sorted portfolios (LOMAC, 1988).

### Objective

The objective of the current empirical paper is to address the issue of whether the efficiency of the EGX is related to size and regulatory changes. This objective is achieved through (i) employing eight indexes tracking the performance of different assets (e.g. large, medium, and small-capitalized firms), and (ii) dividing the period under consideration into two non-overlapping periods: the first one, in which a narrow price limits of  $\pm 5\%$  imposed on daily movements of listed shares, extends from 2nd of February 1997 to 21st of July 2002, whereas the second period stretches from 22nd of July 2002 to 29th of June 2007 where the price boundaries were expanded and accompanied by applying trading halt for a period of 30 minutes, 45 minutes or until the end of the trading session if the weighted average price of stocks hit the limits of  $\pm 10\%$ ,  $\pm 15\%$  or  $\pm 20\%$  respectively, when compared to their opening prices.

### Data and Methodology

Weekly data of CMAI, HFI, EFGI,PIPIO, MSCI-Egypt, MSCI-L Cap, MSCI-M Cap, and MSCI-S Cap has been employed. A battery of variance ratio (VR) tests have been used which makes it possible to compare their inferential outcomes. The intuition behind the VR test is the following: if the logarithm of equity price forms a martingale then the variance of its q-differences grows proportionally with the difference q. Accordingly,

$$\frac{Var(a_t^q)}{Var(a_t)} = q \quad \longrightarrow \quad VR(q) = \frac{1}{q} \frac{Var(a_t^q)}{Var(a_t)} = 1$$

The following VR tests have been used: (1) single VR of LOMAC (1988), (2) multiple VR of CHODE(1993), (3) the wild bootstrap of CHODE test introduced by Kim (2006), and (4) the multiple exact VR – based on ranks and signs – developed, independently, by Blaire-Franch and Contreras (2004) and Kim and Shamsuddin (2008) as refinements of exact single rank and sign VR tests of Wright (2000).

### Results

- For the first sub-period:** All multiple VR tests reject the null hypothesis. Positive serial correlation has been detected for returns of all employed indexes, including that index tracking the performance of large capitalised-firms [VRs > one].
- For the first sub-period :** Generally speaking, equity prices of all indexes-excluding that tracking the performance of small-capitalised firms- follow martingale property.
- The CHODE test highlights inferential errors arisen from using the single LOMAC tests.

### Conclusion

To conclude, it is more likely that the change in policy regulation (i.e. shift from narrow price boundaries to wide ones coupled with trading halt for few minutes) and improvements in the trading infrastructure and environment (e.g. the adoption of an electronic trading system )have led the exchange, as a whole, to be more liquid and efficient. The claim that prices of large-capitalized firms tend to follow martingale property whereas those of small-capitalized firm do not has been approved in the second sub-period.