Manuscript Draft

Manuscript Number:

Title: Gain-loss asymmetry for emerging stock markets

Article Type: Research Paper

Section/Category: Econophysics

Keywords: stock, indices, investment horizon approach, inverse time distribution

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Manuscript Region of Origin:

Abstract:

Gain-loss asymmetry for emerging stock markets.

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Abstract

Stock indices for European emerging markets are analyzed using investment horizon approach. Gain-loss asymmetry, originally found for American DJIA index, is observed for all analyzed data. It is shown, that this asymmetry has different character for emerging and for established markets. Austrian ATX index and Dow Jones have been studied and compared with several emerging European markets. When optimal investment horizon is plotted as a function of absolute return value, for established markets gain curve lies typically above loss curve, whereas in the case of emerging markets the situation is opposite. In the latter case one has to wait longer for loss than for gain of the same return value. We propose a measure quantifying the gain-loss asymmetry that clearly exhibits a difference between emerging and established markets.

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PACS: 89.65.Gh, 02.50.–r, 89.90.+n

Tools and approaches that have been worked out to describe physical phenomena became a source of new methods used in analysis of economical data. It seems that there are many analogies between statistics of physical and economical systems [1–3]. In this work an analysis of stock index data for several European markets follows recently proposed method called investment horizon

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approach [4–8]. Usual analysis of economic data relies on the distribution of returns corresponding to a fixed time window. Investment horizon approach is an adaptation of inverse statistics concept. It gives new, time dependent measure of asset performance, an alternative to the classical approach. Instead of distribution of returns for a given time window we analyze here a distribution of time periods, that one has to wait before getting assumed return value. This waiting time is our investment horizon at assumed return level ρ. It has been shown that such a distribution may be described by a universal curve [4–7], with power decay law for large times, given by the universal exponent $\alpha \approx 1.5$. For each return value the maximum of the distribution t_{max} can be found, and is called optimal investment time. It appears that t_{max} increases as a power of return values. The value of the exponent γ of this power growth has been shown to be $\gamma \approx 1.8$ for Dow Jones Industrial Average (DJIA) [6,7]. This value is smaller than the analogical parameter for the random-walk first-passage-time behavior $\gamma_0 = 2$.

Such analysis repeated by other authors gave even smaller value of this exponent for DIJA $\gamma \approx 1.6$ [9]. They studied many emerging and established markets, and calculated parameter γ for all analyzed data. They conclude that this parameter measures maturity degree of a given market. In general, values of γ are much lower for emerging markets than those found for developed markets. In what follows we will show, that investment horizon approach provides even more evident measure of the market maturity. For DJIA it has been shown that loss and gain curves are not symmetric with respect to the change of the sign of return value [7]. We compared behavior of such curves for emerging and for developed markets. It appears that the difference is not only quantitative, but also qualitative. Gain and loss curves, when plotted as a function of absolute return value lay one above the other in the order that depends on the character of the market. Exponent $\gamma\prime$, that describes slope of loss curve is much higher than γ for gain curve in the case of emerging markets, and this relation is opposite for developed markets. Below, we shortly characterize method, discuss distribution, and parameters of the fit, and then we show results of our analysis. Finally we propose a parameter that can be used as the market maturity characteristics.

Let $S(t)$ denote the asset price. Returns are defined as $s(t) = \ln S(t) - \ln S(t-1)$, the difference of logarithms of successive asset prices. The input data for further study are obtained by subtracting mean time trend of returns. The mean trend of data is evaluated by moving average over 100 points. This number of data to calculate an average has been taken after many trials, and it was found to be the best choice for emerging markets. All European emerging markets exist for quite short time. Because of this it was not possible to take 1000 points to the average, like it has been done in the previous analysis of DJIA [7].The currently invested capital in such emerging markets is relatively small thus they are more susceptible on influences of global economic situation and the mean trend of data shall be evaluated taking into account less number of points. We checked, however, that the results for DJIA do not change much when an average over 100 samples is taken.

Period of time that goes by until we get given return value depends on the moment, when we invest our money. When we repeat procedure starting at distinct moments, we get distribution of possible investment horizons for given ρ. If the process is completely random and uncorrelated, like Brownian motion, the distribution of such periods of time, known here as a first passage time, is given by:

$$p(t) = a\frac{\exp(-\frac{a^2}{t})}{\sqrt{\pi}t^{3/2}}, \tag{1}$$

where a is a variable, an analogue of return value and t is time. This distribution for large values of t scales as

$$p(t) \approx t^{-3/2}. \tag{2}$$

It has been shown [6,7] that distribution of investment horizons for DJIA has well defined maximum, called optimal investment time, followed by power-like tail scaling $\approx t^{-3/2}$. Formula (1) can be fitted to the obtained distributions, but to reach better agreement, the modified version of the above formula can be used

$$p(t) = \frac{\nu}{\Gamma(\frac{\alpha-1}{\nu})}\frac{\beta^{2(\alpha-1)}}{(t-t_0)^{\alpha}}\exp\{-(\frac{\beta^2}{t-t_0})^{\nu}\}, \tag{3}$$

where ν, β, α and t_0 are fitting parameters. The function above has been postulated in Ref. [7], and it describes very well the character of the obtained distribution.

Note, that position of the maximum of (3) is given by

$$t_{max} = t_0 + \beta^2(\frac{\nu}{\alpha+1})^{1/\nu}, \tag{4}$$

and is not equal to t_0. For our distributions value of t_{max} is far from the value t_0, differently than in the case of DJIA, hence we use rather t_{max} as fitting parameter.

Applying this method we have reproduced results from Ref. [7] for DJIA. Then we started analysis of Slovak SAX, Hungarian BUX, Polish WIG, and Czech PX50, i.e., analogs of Dow Jones for emerging markets. As it is shown below, the obtained results are essentially different from those for DJIA. To check whether this difference is not just the scale effect, we have chosen Austrian ATX as an example of European relatively small but established market. It appeared that gain-loss curves for ATX resemble DJIA data. In general, distributions for emerging markets, when compared with those for established ones, are shifted towards zero; their optimal investment horizons are lower. This is

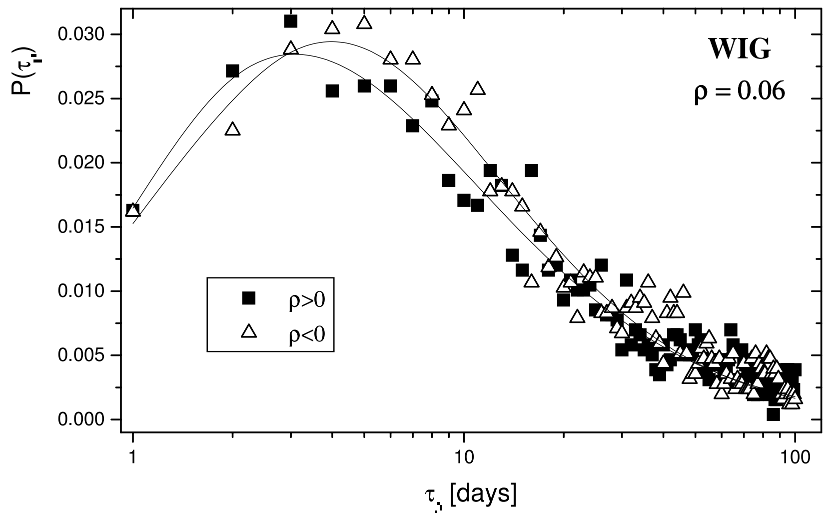


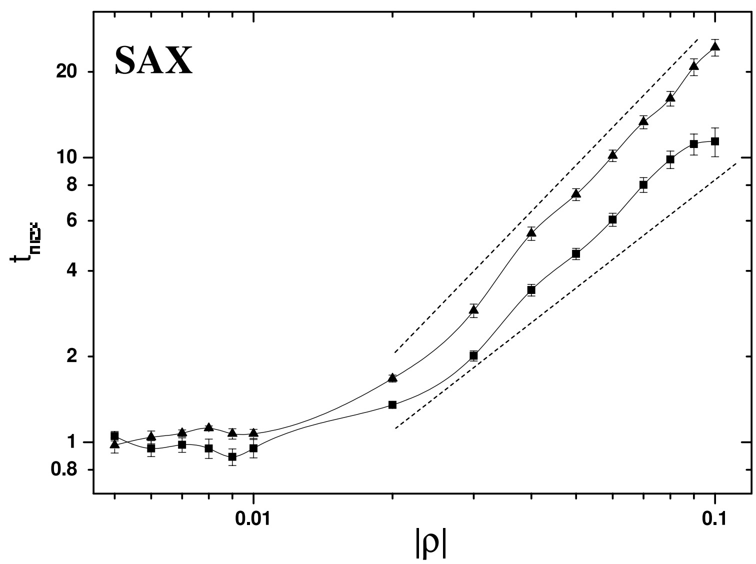
Fig. 1. WIG investment horizon distribution calculated for return values $\rho = 0.06$ - closed squares and $\rho = -0.06$ - open triangles.

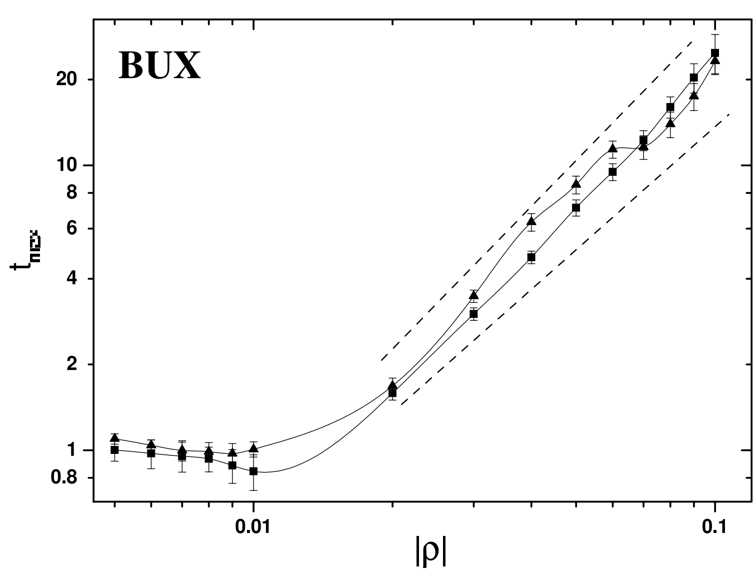
a sign of large volatility of the data, and seems to be very characteristic feature of emerging markets. Such behavior suggests that the optimal investment horizon is located within the small time window, dominated by short time, volatile processes. Observed long time tails of distributions decay with typical values $\alpha = 1.5$. When we compare distributions for the same absolute values of return but with negative and positive sign, it is obvious that they differ essentially (Figure 1).

In all examined cases gain-loss asymmetry is evident. It can be already seen comparing the shape of distributions plotted for ρ and $-\rho$. When we plot t_{max} as a function of absolute value of returns, curves plotted for positive and negative returns are separated. In the case of DJIA loss curve lies below gain curve; this reflects situation where usually you wait longer for gain than for loss of the same return value. In the case of emerging markets this is no longer true. It can be seen, that the ordering of curves depends on the character of the market. In Figure 2 gain-loss curves for several East-European markets are plotted in double logarithmic scale. In all these plots optimal investment time changes within the range of 1 up to 20 days, and not up to 100 days as in the DJIA, or 40 days for ATX. This reflects volatile character of these markets. In the case of Polish WIG and Slovak SAX loss and gain curves clearly separate, but loss curve is located above gain curve, which suggests that opposite to the American market, waiting time for loss is longer than for gain at the same absolute return value.

The distance between two curves depends on the data. For Czech PX-50 and

Hungarian BUX both curves are very close together but with some tendency of the loss curve to be above gain curve, which can by observed by comparing their slopes. The situation is different for Austrian ATX, presented in Fig. 3. Here loss curve is the lower one, like for DJIA. All discussed plots have characteristic shape: they stay close to the value of one day up to some return value, and then start to grow as ρ^{γ} with different values of the coefficient γ. To characterize difference between curves more precisely, we analyzed values of γ for gain curve and of $\gamma\prime$ for loss curve given by mean slope of plotted curves. Lines with fitted slopes are shown in figures. We have: for SAX $\gamma = 1.27$ (gain curve) and $\gamma\prime = 1.67$ (loss curve); for BUX $\gamma = 1.44$ and $\gamma\prime = 1.81$; for WIG





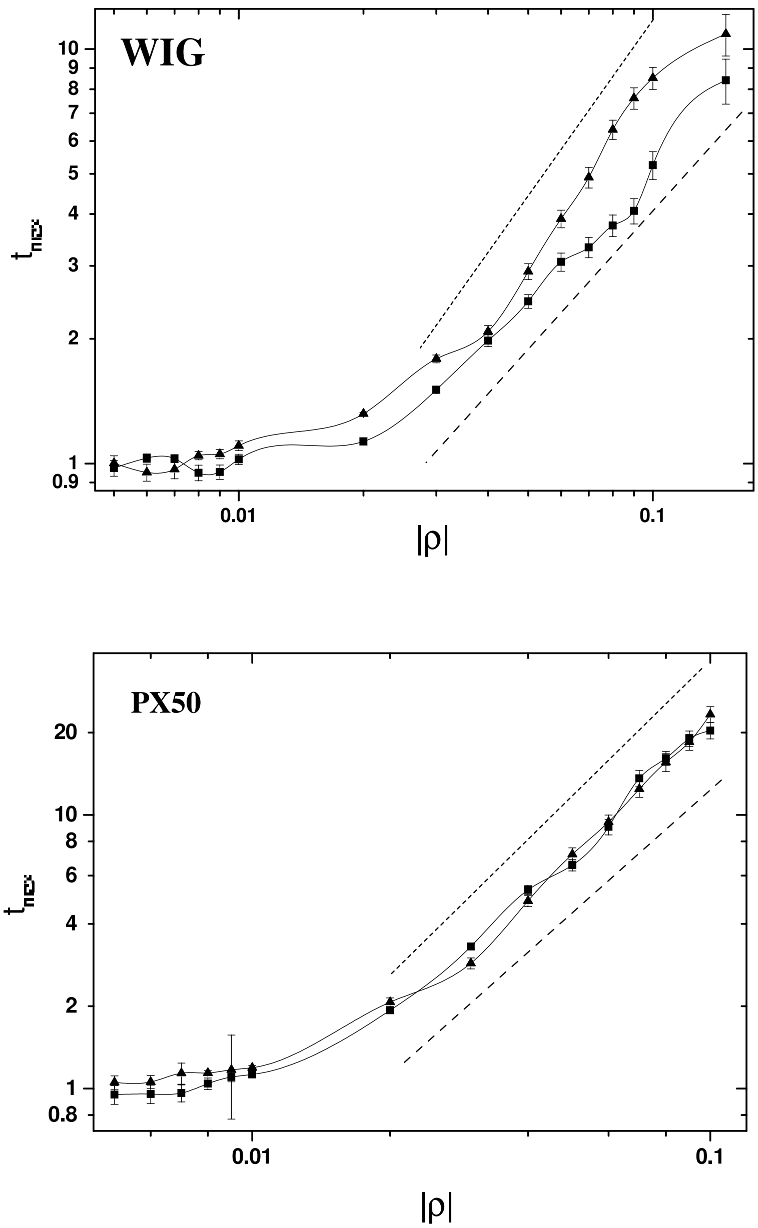


Fig. 2. Optimal investment horizon plotted as a function of absolute return value for a)SAX, b)BUX, c) WIG and d)PX50. Data for $\rho > 0$ are marked by squares, and for $\rho < 0$ by triangles. Dashed lines show average slope of gain and loss curves.

$\gamma = 1.11$ and $\gamma\prime = 1.42$; for PX50 $\gamma = 1.48$ and $\gamma\prime = 1.65$; and for ATX $\gamma = 1.54$ and $\gamma\prime = 1.44$.

We can define now measure of the market "maturity" by the difference of the values above. Let $\kappa = \gamma - \gamma\prime$. Then for corresponding markets (in the same order as in the above discussion) we have: $\kappa = -0.40, -0.37, -0.31, -0.17$, and 0.10. We can see, that the value of κ is negative for emerging and positive

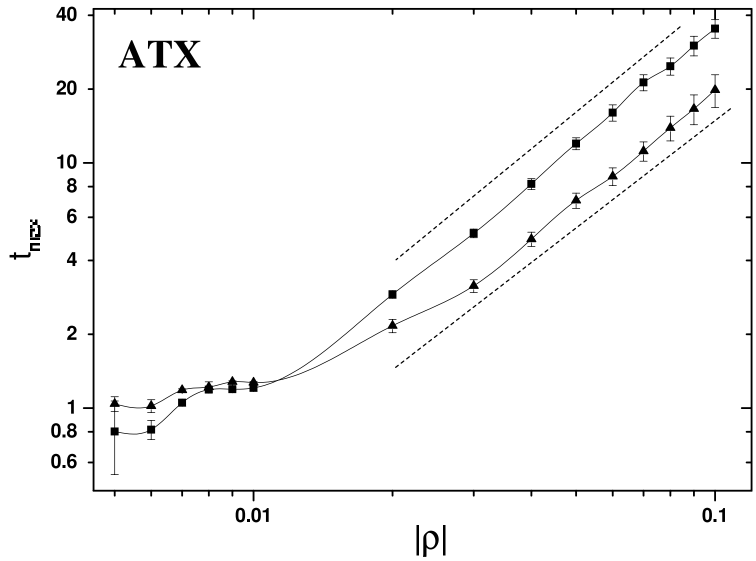


Fig. 3. Optimal investment horizon plotted as a function of absolute return value for PX50. Data for $\rho > 0$ are marked by squares, and for $\rho < 0$ by triangles. Dashed lines show average slope of gain and loss curves.

for developed markets. This property systematically divides markets into two groups according to sign of κ.

For the first type of the market, the established one, you wait on average shorter time for loss of given value than for gain of the same amount. Investing in markets of second type, the emerging ones, you wait shorter time for gain. Thus they in general seem to be more promising markets to invest.

Comparing with Ref [7], we didn't find that individual stocks behave essentially in different way than index of the market. There were some differences in behavior, but we observed the same gain-loss asymmetry for most of them. This means that hypothesis that the asymmetry is caused by some correlation between different objects is not true for emerging markets. It is rather simple sum of the behavior of individual stocks.

In summary, we have found that gain-loss asymmetry is present also for emerging markets, but it is inverted as compared to developed markets. We proposed a simple and useful measure of the observed asymmetry as a difference between the exponents γ and $\gamma\prime$. Such a parameter has negative values for emerging markets and stays positive for developed ones.

This work was partially supported by research grants for the Polish State Committee for Scientific Research (Grant no. 2 P03B 048 24 – MZK).

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