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A Neglected Semi-Stylized Fact of Daily Stock Returns

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A Neglected Semi-Stylized Fact of Daily Stock Returns

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A Neglected Semi-Stylized Fact of Daily Stock Returns

Abstract

We plot aggregated daily stock returns with absolute value less than $x$ against $x$ and show empirically that this produces a typical spoon-shaped pattern which indicates a special type of asymmetry which has not been discussed before. This pattern disappears when individual returns are averaged; it is also absent in stock price indices, which points to explanations based on firm-specific drivers of returns.

JEL-Codes: C580, G100, G150.

Keywords: financial economics, empirical finance, stylized facts, stock returns, spoon effect.

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1 Introduction and Summary

Let \( r_t \) be some (time-continuous) daily stock return (adjusted for dividends, stock-splits and so on). This paper is concerned with distributional (as opposed to time-series) properties of \( r_t \). Typical among these are heavy tails as evidenced by a curtosis larger than 3, i.e. larger than for normality, or the near independence of \( r_t \) and \(|r_t|\), see e.g. Granger and Ding (1995), Granger et al. (2000), Rydén et al. (1998), Cont (2001) or Teräsvirta and Zhao (2011), among many others.

Below we are concerned with the relationship between \( r_t \) and \(|r_t|\). That these cannot be exactly independent follows at once from the fact that \( \sum_{t=1}^{T} r_t > 0 \) for large \( T \) and almost all stocks (otherwise, there would be no incentive to hold them). In technical terms,

\[
E(r_t) = \mu_t > 0
\]

where, for daily data, \( \mu_t \) is small and often neglected, but still positive.

The present paper argues that, even after taking (1) into account and considering \( r_t - \mu_t \) and \(|r_t - \mu_t|\) instead, independence does not obtain in practice; in fact, it is violated in a very peculiar fashion. For instance, if the unconditional density of \( r_t \) were time invariant, unimodal and symmetric, it is immediately obvious from the form of the density function that

\[
0 < E(r_t | |r_t| < x) < \mu
\]

and that \( E(r_t | |r_t| < x) \) is increasing in \( x \). Therefore \( E \left( \sum_{t=1}^{T} r_t I_{|r_t| \leq x} \right) \) is likewise increasing in \( x \) and, by plotting

\[
\sum_{t=1}^{T} r_t I_{|r_t| < x}
\]

for selected values of \( x \), one should, on average, obtain a monotonically increasing function. In practice, however, what one observes, more often than not, looks like this:
Figure 1: Aggregated stock returns of Bayer and Deutsche Bank plotted against maximum absolute value.
Or more formally: The distribution of \( r_t \) cannot be exactly symmetric around \( \mu_t \). And the spoon shaped-pattern from figure 1 indicates a particular form of asymmetry; it repeats itself for many other constituents of the German stock price index DAX, for some constituents of the Dow Jones Industrial average and for many other individual stocks. In particular, the sum of all returns less than 1% in absolute value is very often negative. We call this a semi-stylized fact because it is not as universal as excess kurtosis but too frequent to be explainable by chance.

2 Empirical evidence

Figure 2 plots 256,356 daily returns, covering the years 1973-2015 of all companies which are currently covered by the German stock price index DAX, from 1973 to 2015.

![Figure 2: 256,356 daily German stock returns.](image)

The pattern shown above for Bayer and Deutsche Bank persists, albeit less pronounced. Figure A1 in the appendix repeats this exercise for the remaining 28 DAX-constituents. It is seen that for 21 of the remaining 28 companies, cumulated returns with absolute value less than \( x \) are negative for \( x \) in same
range between 0.5 and 2.

The general impression conveyed by figure A1 is reflected in a count of positive and negative returns reported in table 1:

**Table 1:** Positive and negative returns with absolute value less than some thresholds

<table>
<thead>
<tr>
<th>Company</th>
<th>0.5%</th>
<th>1%</th>
<th>2%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+</td>
<td>-</td>
<td>%</td>
</tr>
<tr>
<td>Adidas</td>
<td>596</td>
<td>892</td>
<td>0.60</td>
</tr>
<tr>
<td>Allianz</td>
<td>1600</td>
<td>2511</td>
<td>0.61</td>
</tr>
<tr>
<td>BASF</td>
<td>1691</td>
<td>2410</td>
<td>0.59</td>
</tr>
<tr>
<td>Bayer</td>
<td>1678</td>
<td>2337</td>
<td>0.58</td>
</tr>
<tr>
<td>Beiersdorf</td>
<td>1564</td>
<td>3280</td>
<td>0.68</td>
</tr>
<tr>
<td>BMW</td>
<td>1444</td>
<td>2330</td>
<td>0.62</td>
</tr>
<tr>
<td>Commerzbank</td>
<td>1434</td>
<td>2217</td>
<td>0.61</td>
</tr>
<tr>
<td>Continental</td>
<td>1244</td>
<td>2086</td>
<td>0.63</td>
</tr>
<tr>
<td>Daimler</td>
<td>482</td>
<td>648</td>
<td>0.57</td>
</tr>
<tr>
<td>Deutsche Bank</td>
<td>1676</td>
<td>2373</td>
<td>0.59</td>
</tr>
<tr>
<td>Deutsche Boerse</td>
<td>485</td>
<td>639</td>
<td>0.57</td>
</tr>
<tr>
<td>Deutsche Post</td>
<td>499</td>
<td>668</td>
<td>0.57</td>
</tr>
<tr>
<td>Deutsche Telekom</td>
<td>626</td>
<td>885</td>
<td>0.59</td>
</tr>
<tr>
<td>E.ON</td>
<td>1711</td>
<td>2521</td>
<td>0.60</td>
</tr>
<tr>
<td>Fresenius Medical Care</td>
<td>661</td>
<td>916</td>
<td>0.58</td>
</tr>
<tr>
<td>Fresenius</td>
<td>639</td>
<td>1294</td>
<td>0.67</td>
</tr>
<tr>
<td>HeidelbergCement</td>
<td>1206</td>
<td>2988</td>
<td>0.71</td>
</tr>
<tr>
<td>Henkel</td>
<td>638</td>
<td>979</td>
<td>0.61</td>
</tr>
<tr>
<td>Infineon Technologies</td>
<td>330</td>
<td>516</td>
<td>0.61</td>
</tr>
<tr>
<td>K+S</td>
<td>1186</td>
<td>2433</td>
<td>0.67</td>
</tr>
<tr>
<td>Lanxess</td>
<td>266</td>
<td>357</td>
<td>0.57</td>
</tr>
<tr>
<td>Linde</td>
<td>1683</td>
<td>2655</td>
<td>0.61</td>
</tr>
<tr>
<td>Deutsche Lufthansa</td>
<td>1038</td>
<td>2179</td>
<td>0.68</td>
</tr>
<tr>
<td>Merck</td>
<td>664</td>
<td>998</td>
<td>0.60</td>
</tr>
<tr>
<td>Munich Re</td>
<td>1357</td>
<td>2850</td>
<td>0.68</td>
</tr>
<tr>
<td>RWE</td>
<td>1791</td>
<td>2706</td>
<td>0.60</td>
</tr>
<tr>
<td>SAP</td>
<td>830</td>
<td>1285</td>
<td>0.61</td>
</tr>
<tr>
<td>Siemens</td>
<td>1772</td>
<td>2465</td>
<td>0.58</td>
</tr>
<tr>
<td>ThyssenKrupp</td>
<td>1301</td>
<td>2139</td>
<td>0.62</td>
</tr>
<tr>
<td>Volkswagen</td>
<td>1267</td>
<td>2076</td>
<td>0.62</td>
</tr>
</tbody>
</table>
Because of the well known HARKING effect (Hypothesing after effects are known see Krämer (2011)), it does not make much sense to formally test for statistical significance. However, according to conventional criteria, the effect is highly significant whenever it is observed.

We also checked the spoon effect for an independent data set composed of the constituents of the Dow Jones Industrial Average. Figure A2 in the appendix shows the results: It is seen that there exists a spoon effect for may shares, but less than for the constituents of the DAX. This might point to liquidity - which is larger for constituents of the Dow Jones than for constituents of the DAX - as a possible explanation; see below.

3 Possible explanations

The major purpose of the present note is to point out the effect as such. Among possible explanations, a very simple one that comes to mind is what in marketing is called a threshold effect (Bemmaor (1984)): If we keep to the basic assumption that stock prices are moved by news (plus some noise trading, which does not affect prices very much), then it is well-known that information pertaining to the value of a stock has to cross some importance-threshold to be recognized in the first place by either the media or the investor or both. However according to the old saying ”only bad news is good news”, this threshold might be lower for bad news on the margin of general importance. A really important event such as 9/11 or the outbreak of a war will make headlines anyway, and it will affect the whole market. But news on the borderline of attracting attention will more often then not only affect individual firms. This might then explain why among relatively unimportant news the negative ones might outnumber the positive ones and so explain the spoon effect.

Some empirical evidence that this spoon effect is indeed firm specific is provided by taking the average return of Bayer and Deutsche Bank. Each individual return exhibits a marked spoon effect, but the average return does not (figure 3). This failure of the average returns to show the spoon effect might then be attributed to the fact that marginal news often affect only one of the firms, but not both.
A cursory perusal of two leading German business papers, Frankfurter Allgemeine Zeitung and Handelsblatt, provides some empirical evidence that borderline-news - defined as appearing in only one of the papers, but not in both - are predominantly negative. Some examples:

- "Racism at Deutsche Bank" (Feb. 26, 2014, only HB)
- "Lawsuit against Deutsche Bank" (March 3, 2014, only FAZ)
- "Top trader leaves Deutsche Bank" (April 29, 2014, only HB)
- "Possible downgrading for Deutsche Bank" (May 5, 2014, only FAZ)

and so on. A more thorough investigation of this effect is on the way.

Similarly, the returns of the German stock price index DAX do not show any spoon effect (see figure 4).
Another possible explanation are market microstructure specifies such as short selling restrictions and/or transaction costs, along the lines of Diamond and Verrechia (1991). Traders might for instance accept small losses rather than incur transaction costs to buy the shares. Given a "true" price that has not changed (i.e. given a return of zero), this might then keep the market price slightly below, so small negative returns are more frequent than they otherwise would be. Or else traders who perceive a slight reduction in "true" prices might be prohibited to sell (and thus generate a small negative return) due to short selling restrictions. An in-depth discussion of such issue is however beyond the scope of the presented paper. Finally, it might be worth noting that the spoon effect presented here is not an artifact of using discrete time returns: If time-continuous returns are symmetric and normal with mean zero, it is easily seen that the discrete-time returns must then exhibit some spoon effect due to the skewness of the lognormal distribution. But returns used in the examples above are already in continuous time.

**Figure 4:** 6350 daily DAX stock returns.
References


Appendix

Figure A1: Daily stock returns for remaining DAX-constituents, where $x$ denotes the returns (in %) and $S$ the sum of all returns less than $x$ in absolute value (also in %).
Figure A2: Daily stock returns for the Dow Jones-constituents, where $x$ denotes the returns (in %) and $S$ the sum of all returns less than $x$ in absolute value (also in %).