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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 $\sum_1^T r_t > 0$ for large T and almost all stocks (otherwise, there would be no incentive to hold them). In technical terms,

$$E(r_t) = \mu_t > 0 \tag{1}$$

where, for daily data, μ_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

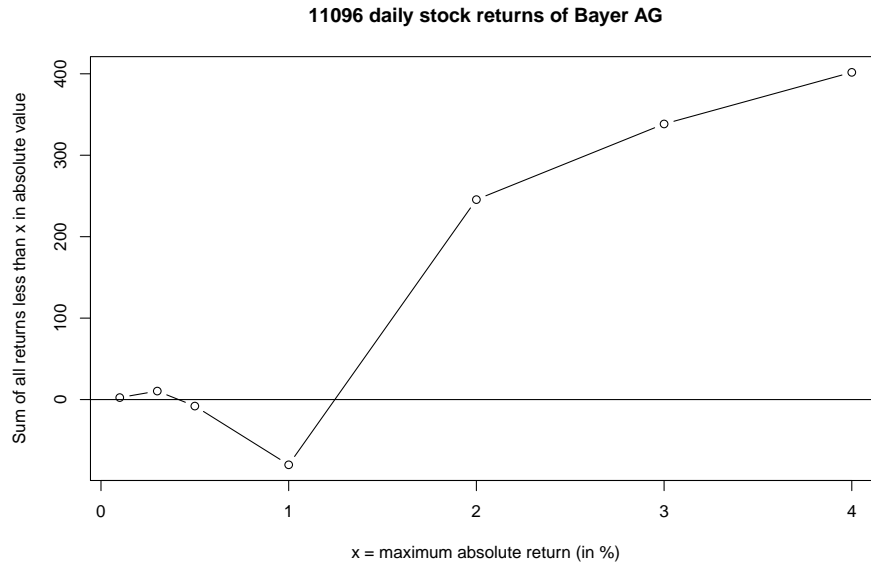
$$0 < E(r_t | |r_t| < x) < \mu \tag{2}$$

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

$$\sum_{t=1}^T r_t I_{|r_t| < x} \tag{3}$$

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:

a)



b)

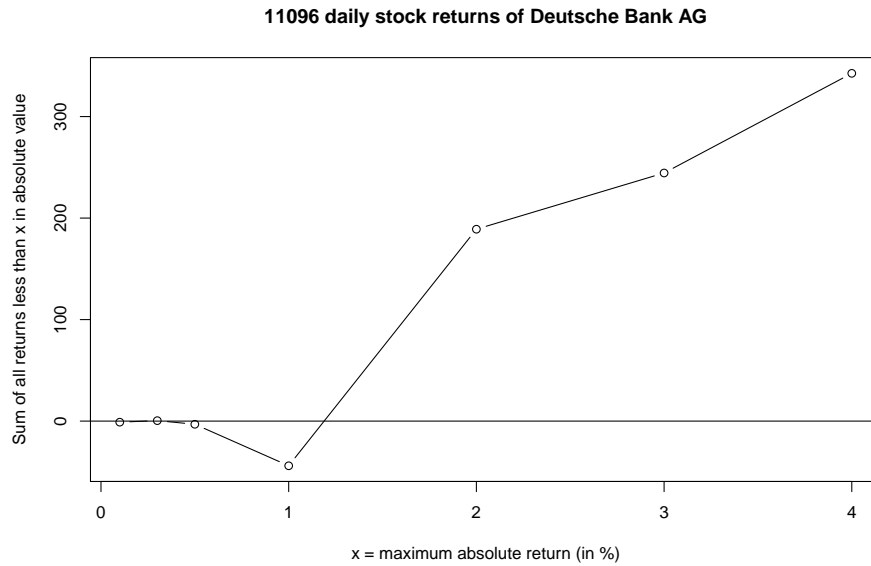


Figure 1: Aggregated stock returns of Bayer and Deutsche Bank plotted against maximum absolute value.

Or more formally: The distribution of r_t cannot be exactly symmetric around μ_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.

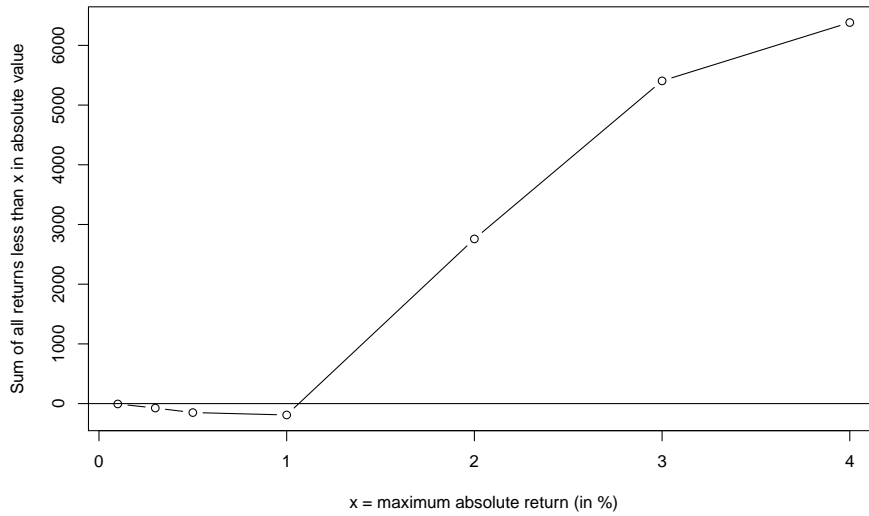


Figure 2: 256356 daily German stock returns.

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

Company	threshold								
	0.5%			1%			2%		
	+	-	%	+	-	%	+	-	%
Adidas	596	892	0.60	1137	1462	0.56	1809	2144	0.54
Allianz	1600	2511	0.61	2843	3705	0.57	4204	4952	0.54
BASF	1691	2410	0.59	3062	3779	0.55	4522	5002	0.53
Bayer	1678	2337	0.58	2998	3754	0.56	4441	4974	0.53
Beiersdorf	1564	3280	0.68	2848	4491	0.61	4015	5607	0.58
BMW	1444	2330	0.62	2676	3535	0.57	4122	4875	0.54
Commerzbank	1434	2217	0.61	2642	3513	0.57	3981	4818	0.55
Continental	1244	2086	0.63	2333	3254	0.58	3739	4672	0.56
Daimler	482	648	0.57	926	1068	0.54	1551	1670	0.52
Deutsche Bank	1676	2373	0.59	2888	3661	0.56	4295	4930	0.53
Deutsche Boerse	485	639	0.57	892	1036	0.54	1389	1524	0.52
Deutsche Post	499	668	0.57	942	1091	0.54	1480	1601	0.52
Deutsche Telekom	626	885	0.59	1153	1435	0.55	1754	1992	0.53
E.ON	1711	2521	0.60	3060	3808	0.55	4487	5064	0.53
Fresenius Medical Care	661	916	0.58	1241	1491	0.55	1854	2114	0.53
Fresenius	639	1294	0.67	1297	1917	0.60	2050	2615	0.56
HeidelbergCement	1206	2988	0.71	2274	4129	0.64	3474	5309	0.60
Henkel	638	979	0.61	1190	1534	0.56	1846	2200	0.54
Infineon Technologies	330	516	0.61	653	825	0.56	1114	1315	0.54
K+S	1186	2433	0.67	2376	3669	0.61	3741	5030	0.57
Lanxess	266	357	0.57	490	633	0.56	856	994	0.54
Linde	1683	2655	0.61	3021	4015	0.57	4333	5248	0.55
Deutsche Lufthansa	1038	2179	0.68	2115	3315	0.61	3596	4781	0.57
Merck	664	998	0.60	1187	1535	0.56	1885	2152	0.53
Munich Re	1357	2850	0.68	2562	3989	0.61	3855	5187	0.57
RWE	1791	2706	0.60	3100	3958	0.56	4369	5155	0.54
SAP	830	1285	0.61	1612	1979	0.55	2527	2763	0.52
Siemens	1772	2465	0.58	3105	3712	0.54	4502	4917	0.52
ThyssenKrupp	1301	2139	0.62	2437	3284	0.57	3953	4746	0.55
Volkswagen	1267	2076	0.62	2449	3278	0.57	3958	4766	0.55

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 many 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 than 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.

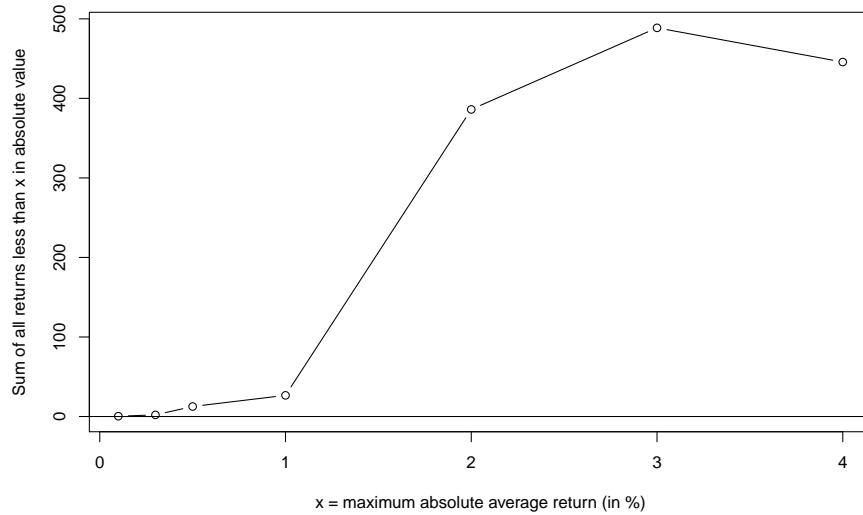


Figure 3: Average of 11096 daily stock returns for Deutsche Bank and Bayer.

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).

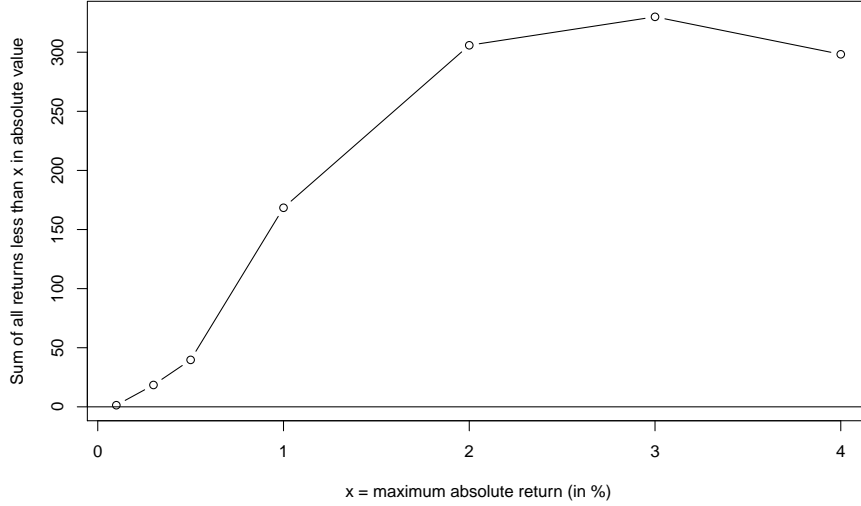


Figure 4: 6350 daily DAX stock returns.

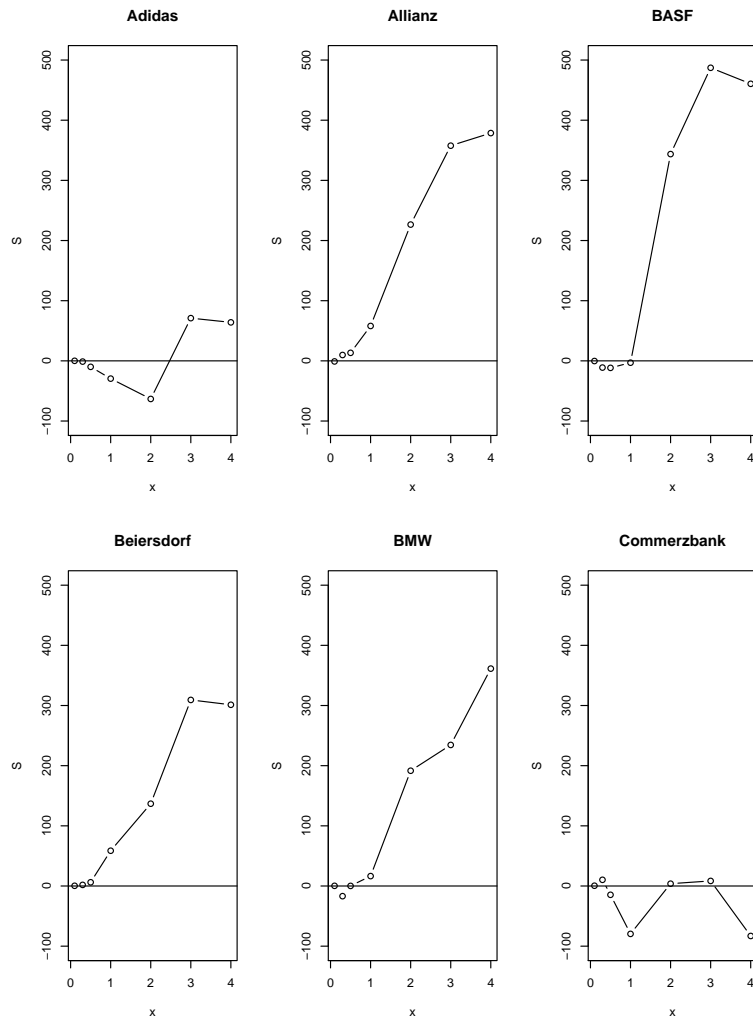
Another possible explanation are market microstructure specifics such as short selling restrictions and/or transaction costs, along the lines of Diamond and Verrechia (1991). Traders might for instance accept small losses rather than incur transaction costs to buy the shares. Given a "true" price that 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.

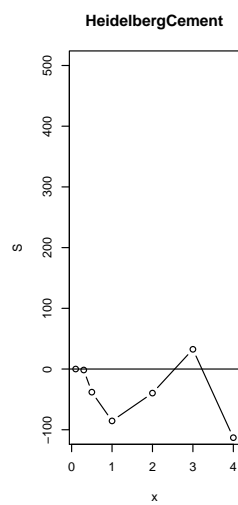
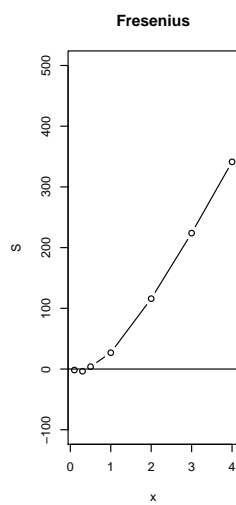
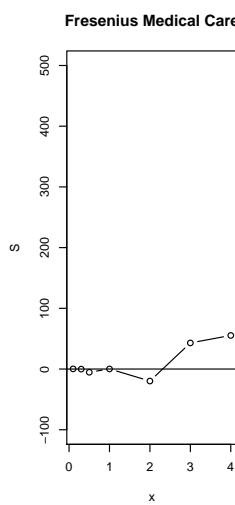
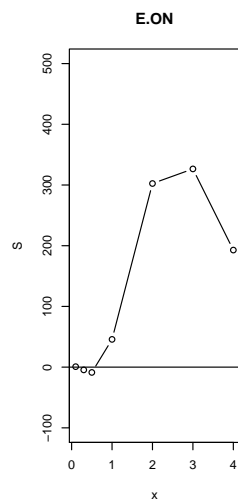
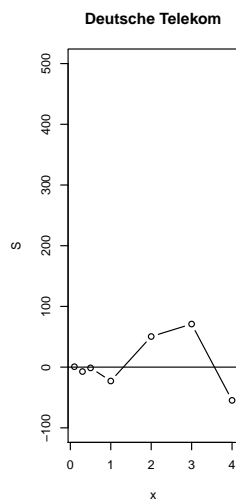
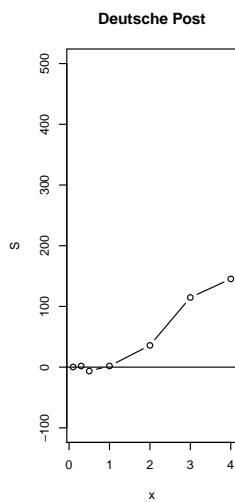
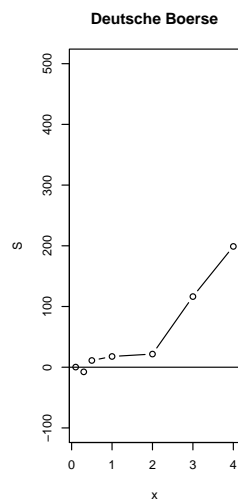
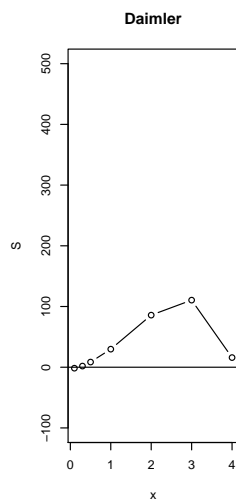
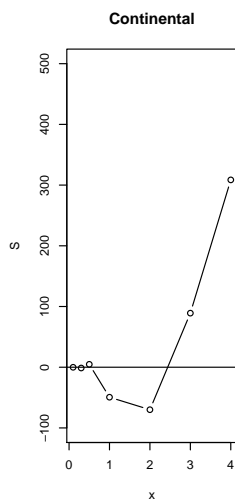
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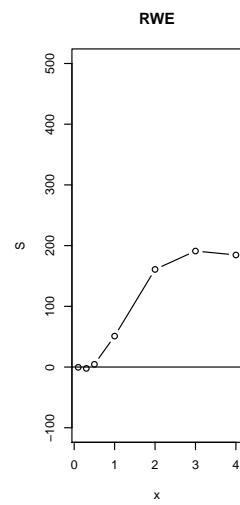
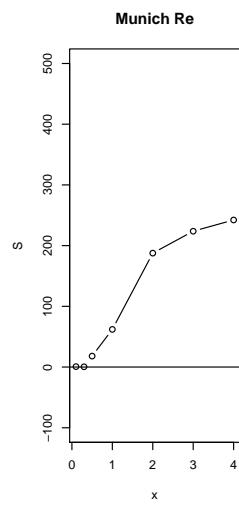
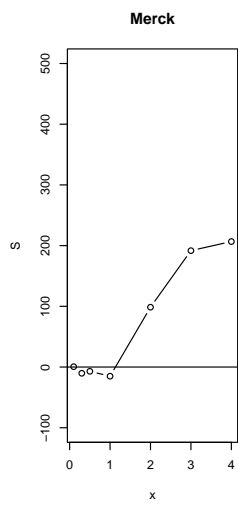
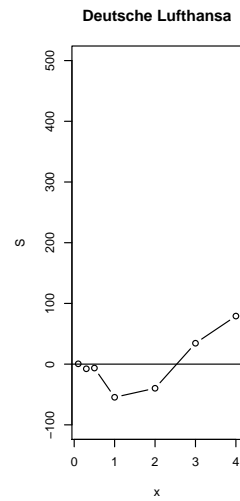
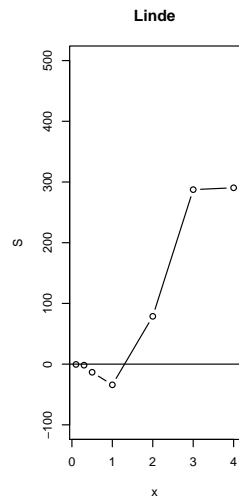
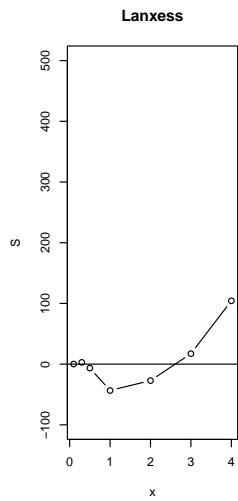
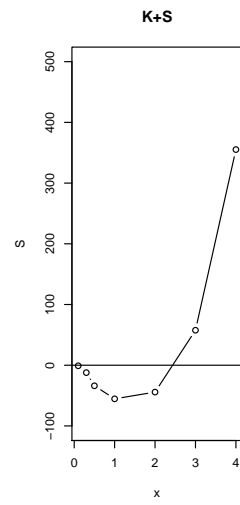
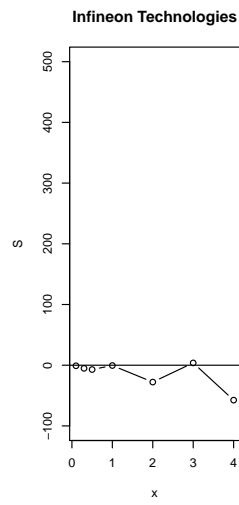
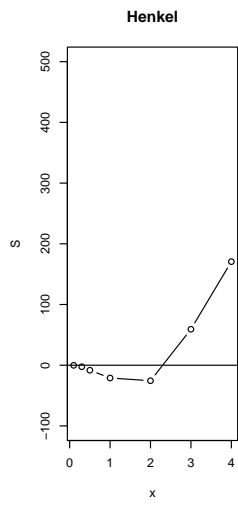
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Appendix

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 %).







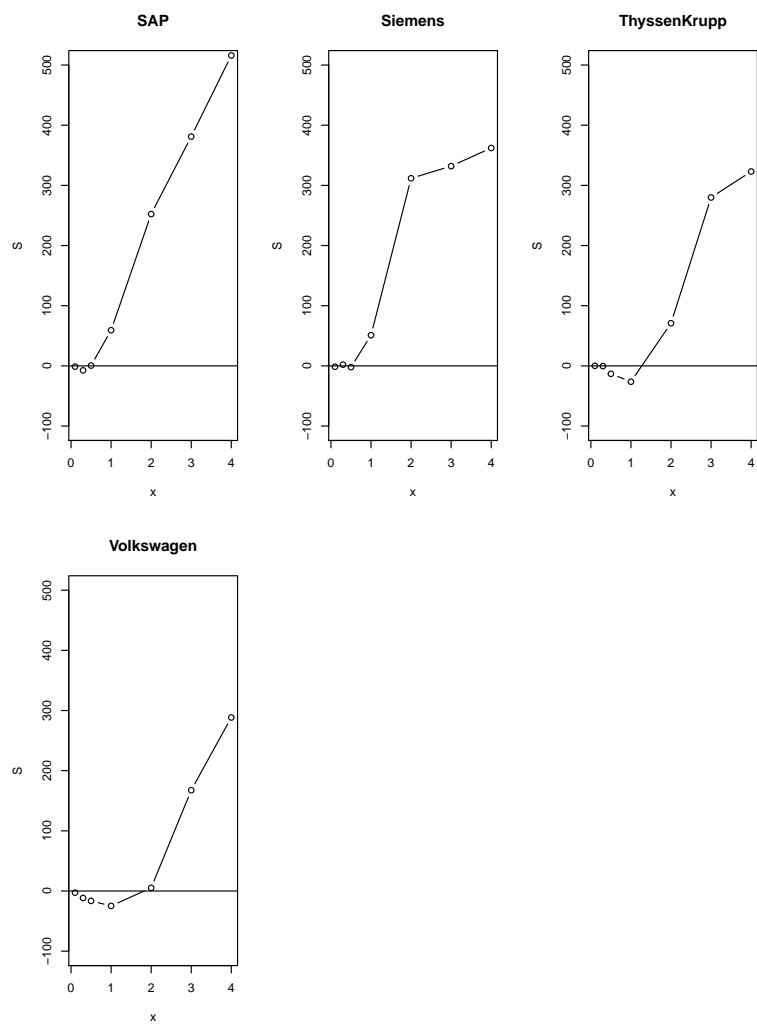


Figure A2: Daily stock returns for the Dow Jones-constituents, where x denotes the returns (in %) and S the sum of all returns less than x in absolute value (also in %).

