

Matematika ir statistika prekyboje

raudys.com/kursas

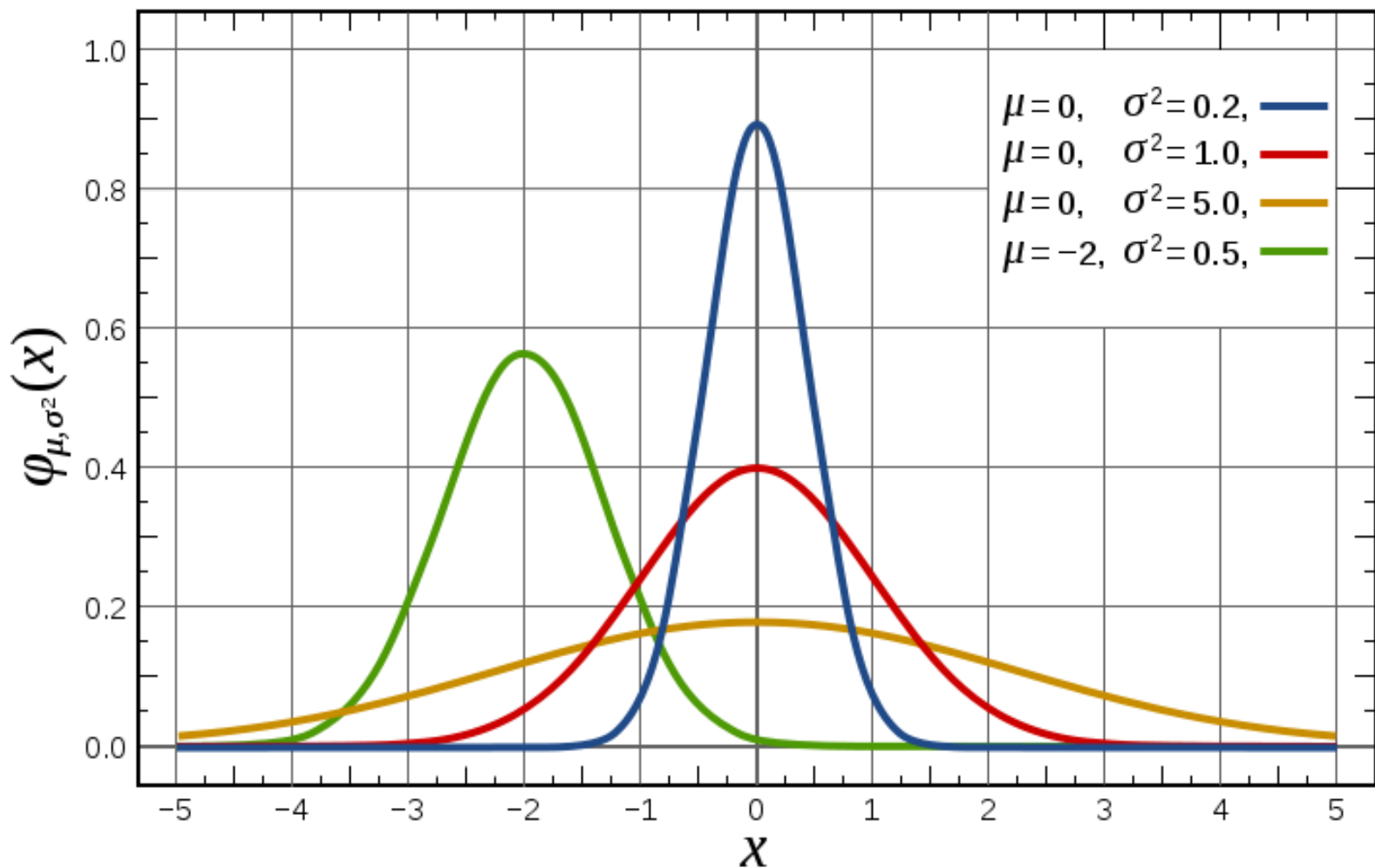
Dr. Aistis Raudys

Vilnius 2017

Turiny

- Susipažinsime su skaičiavimais, dažnai atliekamais prekyboje
- Vidurkis ir standartine deviacija
- Šarpo santykis
- Praradimai
- Koreliacijos
- FIFO / LIFO skaičiavimo metodikos

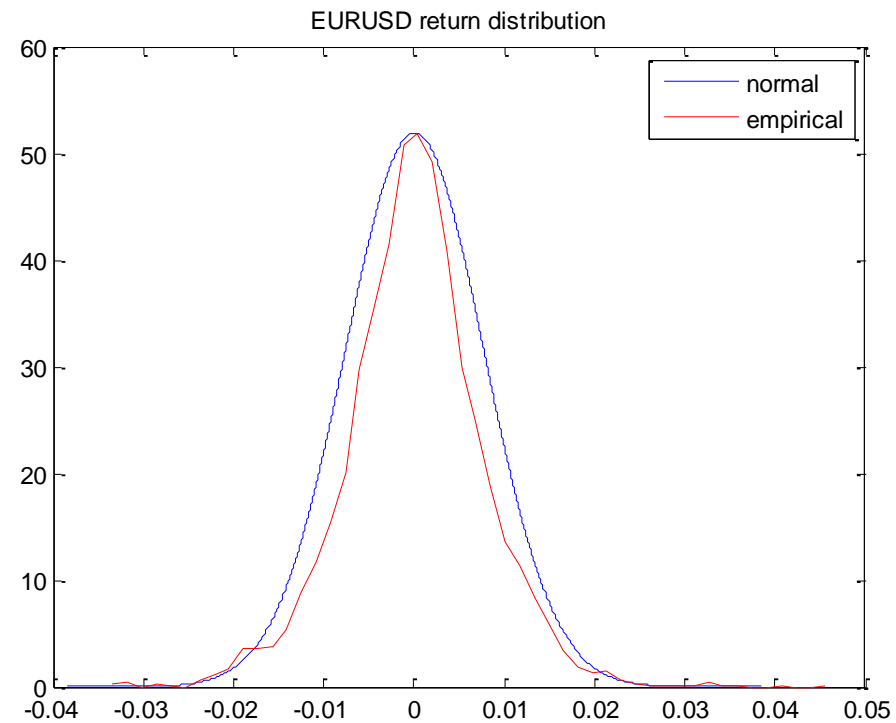
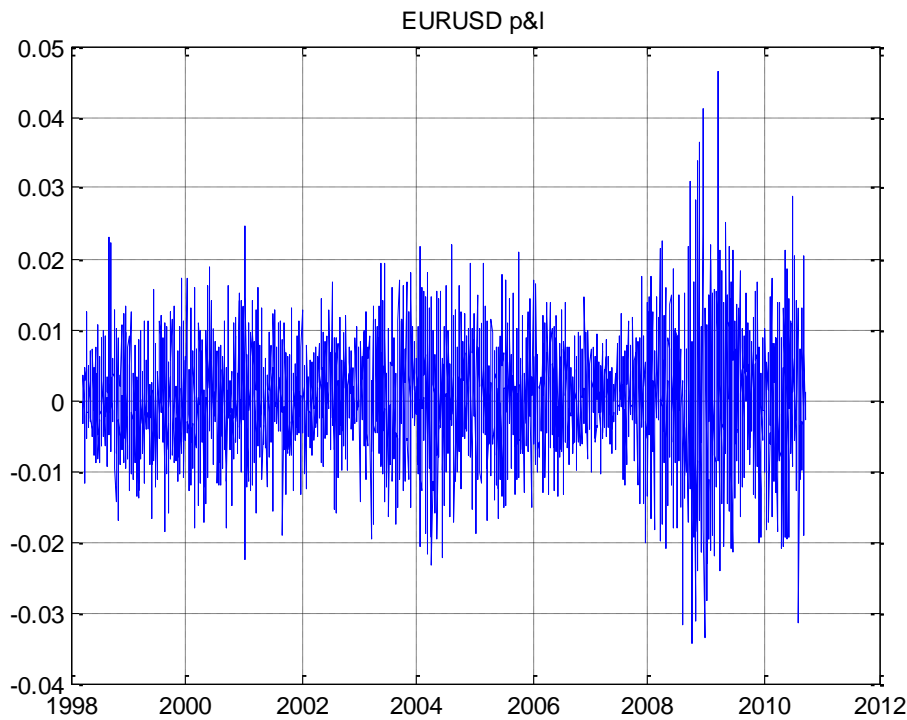
Normalinis pasiskirstymas



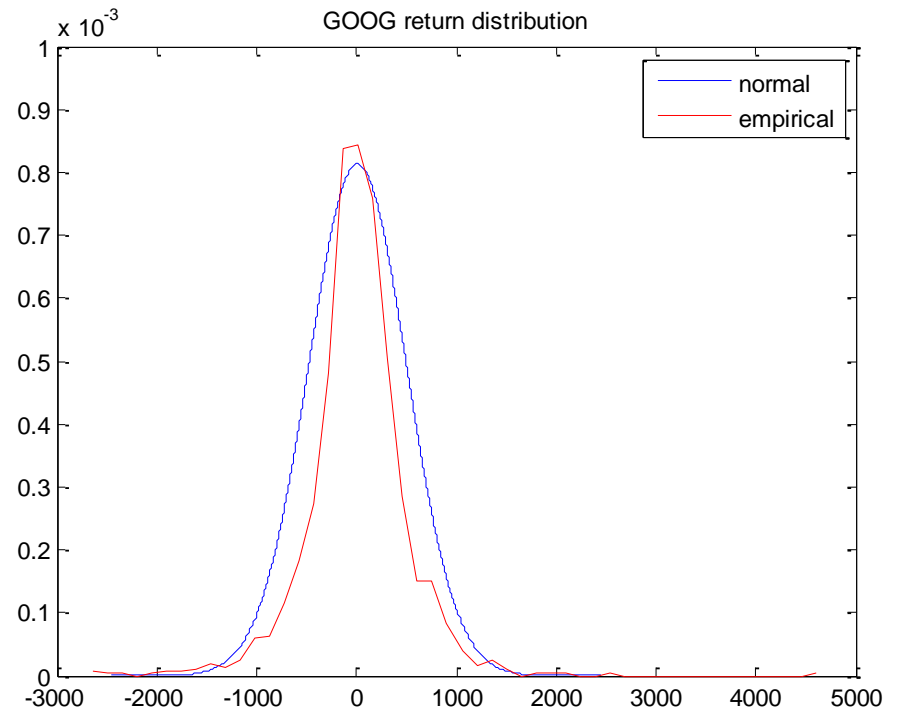
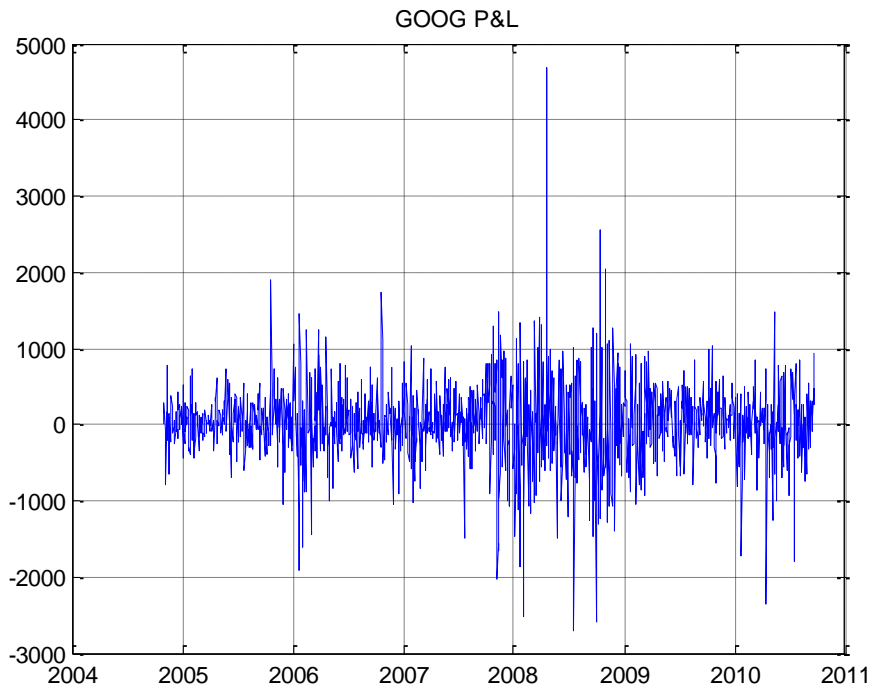
Momentai

1. Vidurkis
2. Standartinis nukrypimas
3. Asimetriškumas (angl. skewness)
4. Kurtosis

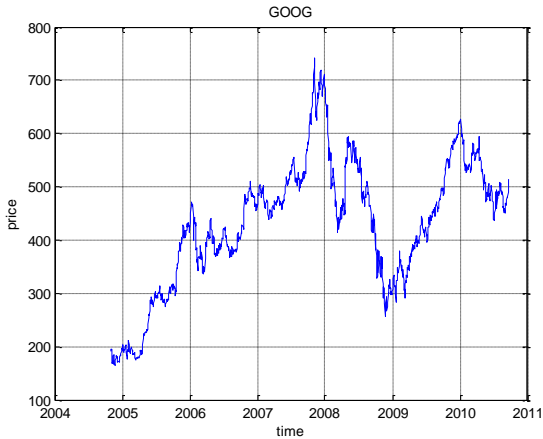
Pasiskirstymai



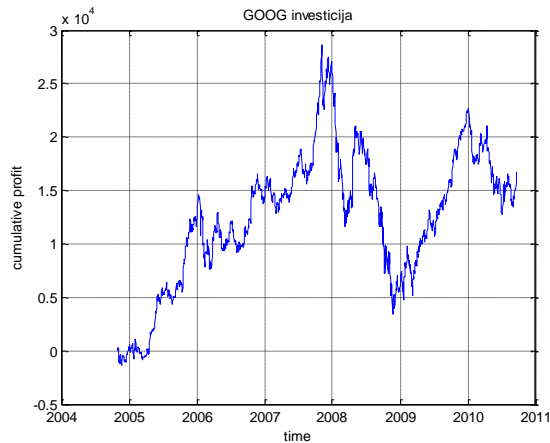
Pasiskirstymai



PVZ



```
round(10000 ./ d.close(1)) = 52  
pnl = (d.close - d.close([1 1:end-1]))*52  
mean(pnl) = 11.31  
std(pnl) = 490.62
```

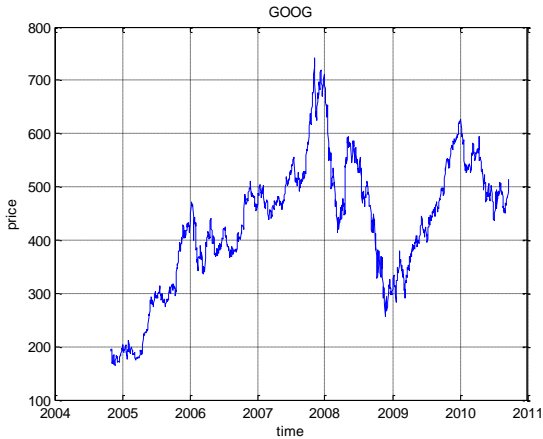


```
m = sum(pnl) / length(pnl);  
s = sqrt(sum((pnl - m).^2) /  
length(pnl));
```

Konvertavimas į metinius rezultatus

- Prekybos ataskaitose rezultatai yra metiniai
- Dažnai reikia konvertuoti iš dieninių/mėnesinių į metinius
- Vidurkis dauginamas iš laiko vienetų metuose
- STD – dauginama iš SQRT LVM
- Nėra tikslu, nes laiko eilutės nėra normalinės
- Bet taip jau visi daro 😊

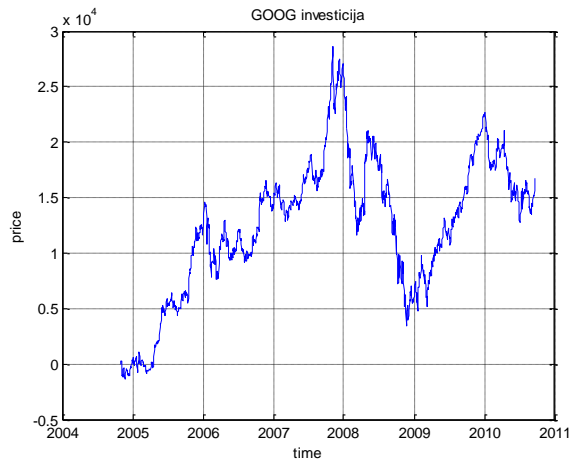
PVZ.:



$\text{round}(10000 ./ \text{d.close}(1)) = 52$

$\text{mean}(\text{pnl}) = 11.31$

$\text{std}(\text{pnl}) = 490.62$



METINIS:

$\text{mean}(\text{pnl}) * 252 = 2850.56$

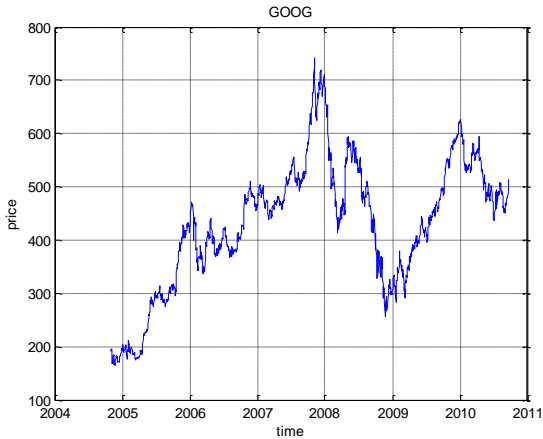
$\text{std}(\text{pnl}) * \text{sqrt}(252) = 7788.42$

Šarpo santykis

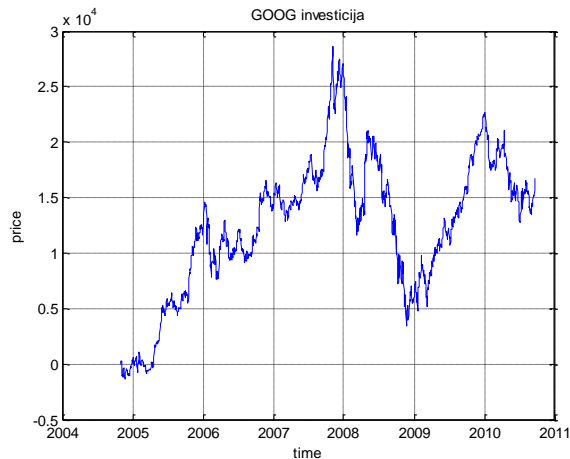
- AKA Information ratio
 - Labai populiarius
 - Santykis tarp grąžos ir standartinio nuokrypio
 - Nesikeičia, jei kinta svertas
-
- Sharpe = 1 - gerai
 - Sharpe = 2 – labai gerai

$$S = \frac{R - R_f}{\sigma} = \frac{E[R - R_f]}{\sqrt{\text{var}[R - R_f]}}$$

PVZ

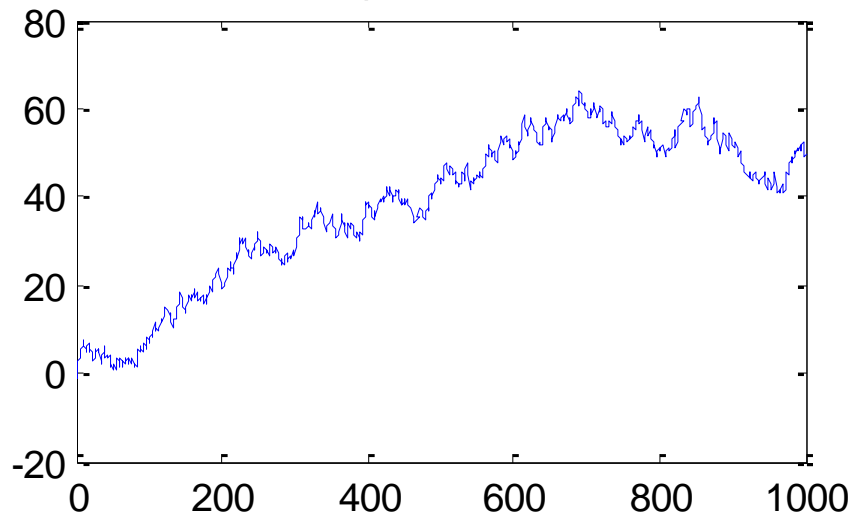


$\text{round}(10000 ./ \text{d.close}(1)) = 52$
 $\text{mean}(\text{pnl}) = 11.31$
 $\text{std}(\text{pnl}) = 490.62$

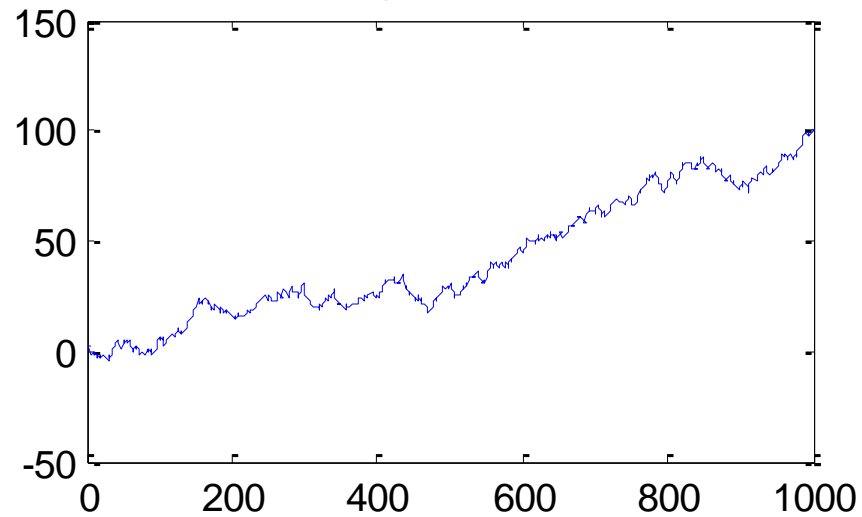


METINIS:
 $\text{mean}(\text{pnl}) * 252 = 2850.56$
 $\text{std}(\text{pnl}) * \text{sqrt}(252) = 7788.42$
 $\text{sharpe}(\text{pnl}) = 0.3659$

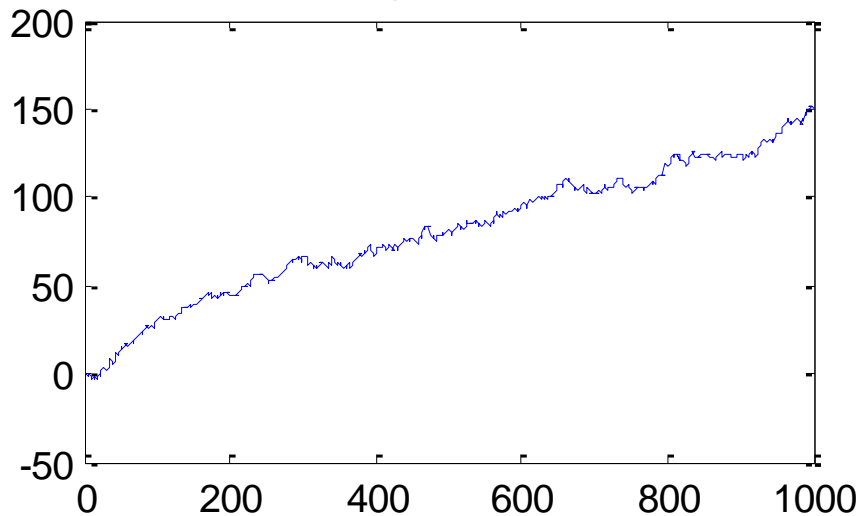
sharpe = 0.80184



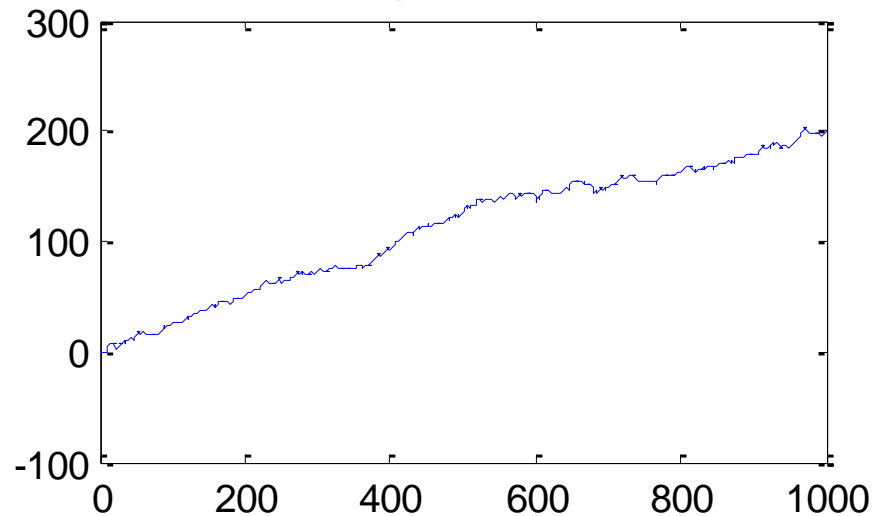
sharpe = 1.5854



sharpe = 2.434



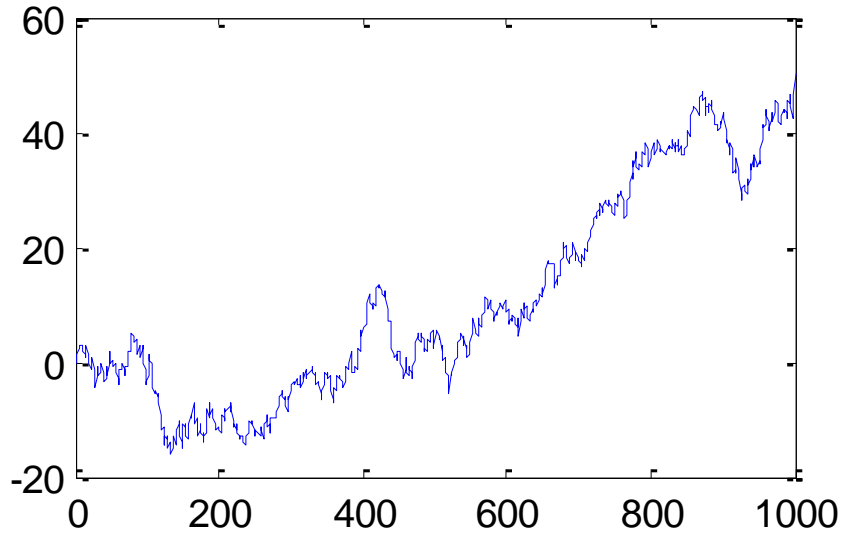
sharpe = 3.1549



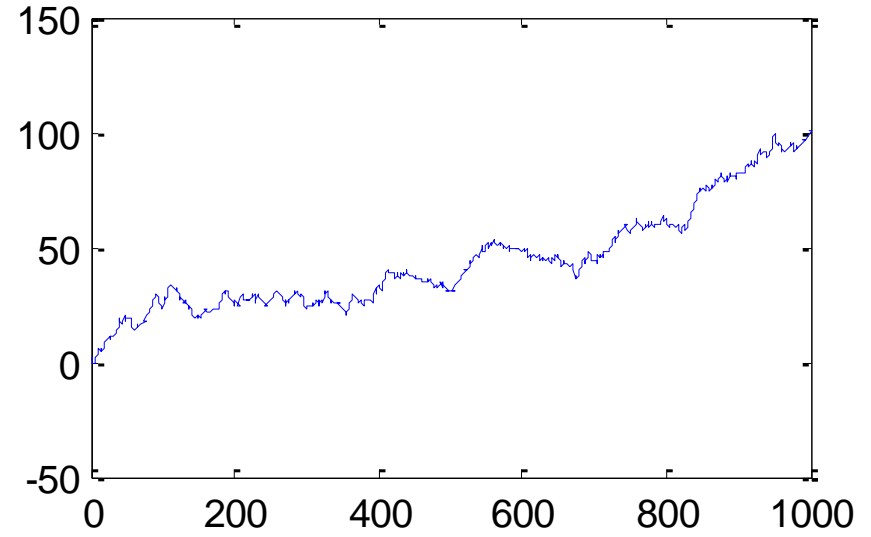
Kiti rodikliai

- Pelno faktorius (angl. Profit factor)
 - Pelningi sandoriai / nuostolingi sandoriai
- Sortino santykis (angl. ratio)
 - Graža / negatyvaus nukrypimo $S = \frac{R - T}{DR}$
- DD grįžtamasis santykis (angl. return ratio)
 - Kiek sugeneruota pelno lyginant su didžiausiu praradimu

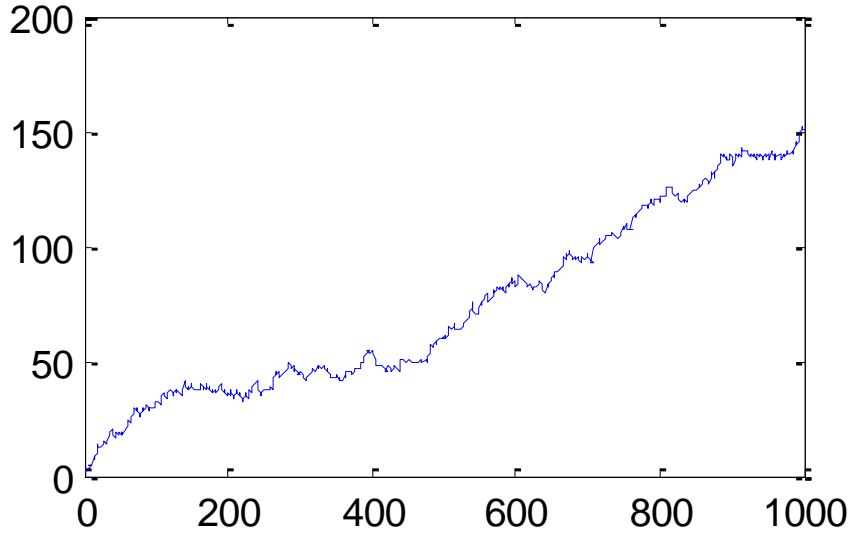
pf = 1.1379



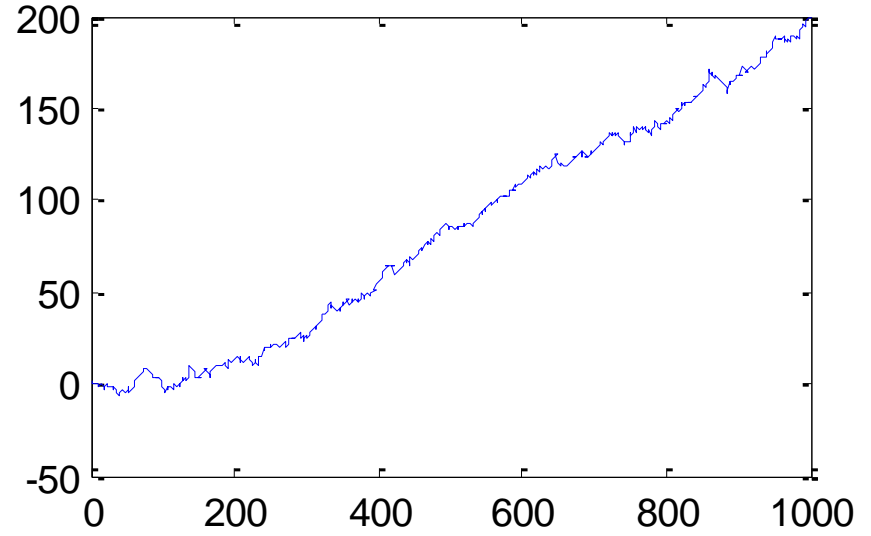
pf = 1.2967



pf = 1.4816



pf = 1.6534



Praradimas (angl. drawdown)

- Svarbus faktorius prekyboje
- Dažniausiai vartojami terminai:
 - Maksimalus praradimas (procentais)
 - Laikas iki atsistatymo (mėnesiais)

Winton Capital Management Ltd
Diversified Trading Program

Performance Statistics

Date Range: 09/97 - 02/14

	Program	SP500 TR	Altegris 40
Total Return	646.69%	179.53%	137.46%
Annualized Return	13.03%	6.43%	5.38%
Annualized Std. Deviation	16.82%	15.82%	10.26%
Correlation		-0.03	0.77
Sharpe Ratio (rf=2.5%)	0.63	0.25	0.28
Worst Month	-12.97%	-16.80%	-7.77%
Date of Worst Month	10/1997	10/2008	11/2001
Worst Drawdown	-25.73%	-50.95%	-15.74%
Date of Worst Drawdown	10/01 - 2/02	10/07 - 2/09	4/11 - 9/13

Note: Estimates appear in italics. All performance data is since program inception.

Manager Rankings**

Show Programs Ranked By **> RANK**

DATE RANGE:
10/09 - 09/14

		Program	Inception	Snapshot	AROR	YTD	WDD	AUM (\$M)
1		E Transtrend B.V.: Diversified Trend Program - Enhanced Risk USD	01/1995		1.75%	10.60%	-13.61%	5,191.00
2		E Aspect Capital Limited: Aspect Diversified Program *QEP*	12/1998		1.59%	6.68%	-22.21%	4,711.00
3		E Campbell & Company, Inc.: Campbell Managed Futures	04/1983		4.42%	6.77%	-12.26%	3,409.00
4		E Quantitative Investment Management, LLC: Global Program *QEP*	10/2003		-0.86%	-5.95%	-12.71%	1,546.00
5		E Amplitude Capital AG: Amplitude Dynamic Trading Fund *QEP* *CLSD*	06/2005		1.37%	0.00%	-12.81%	985.57
6		E Millburn Corporation: Diversified Program	02/1977		1.25%	14.08%	-22.84%	755.00
7		E FORT LP: FORT Global Contrarian *QEP*	10/2002		13.23%	7.41%	-8.67%	657.25
8		E Amplitude Capital AG: Amplitude Klassik Fund *QEP*	09/2009		1.65%	7.68%	-15.32%	629.60
9		E ISAM - International Standard Asset Management: ISAM Systematic USD CLASS A *FRN* *PROP*	06/2001		2.15%	28.01%	-34.79%	590.00
10		E Quantica Capital AG: Quantica Managed Futures*FRN*	01/2005		5.40%	6.21%	-6.83%	561.00
11		E Welton Investment Corporation: Global Directional Portfolio *QEP*	06/2004		0.84%	18.06%	-33.18%	411.00
12		E DUNN Capital Management, Inc.: World Monetary and Agriculture (WMA) Program *QEP*	11/1984		11.09%	11.30%	-27.49%	379.00
13		E Alder Capital Limited: Global 20 Program	02/2001		2.08%	-12.67%	-22.51%	372.00
14		E Revolution Capital Management, LLC: Mosaic Institutional Program *QEP*	09/2009		-2.24%	-4.79%	-22.34%	362.00
15		E Trigon Investment Advisors, LLC: Trigon Discretionary Macro Program *QEP*	08/2007		0.56%	5.67%	-13.10%	359.79
16		E Rhicon Currency Management (Pte) Ltd.: Rhicon Strategic Currency Program *FRN*	01/2004		2.73%	6.68%	-8.57%	325.00

Didžiausias praradimas



Kaip lengviau skaičiuoti

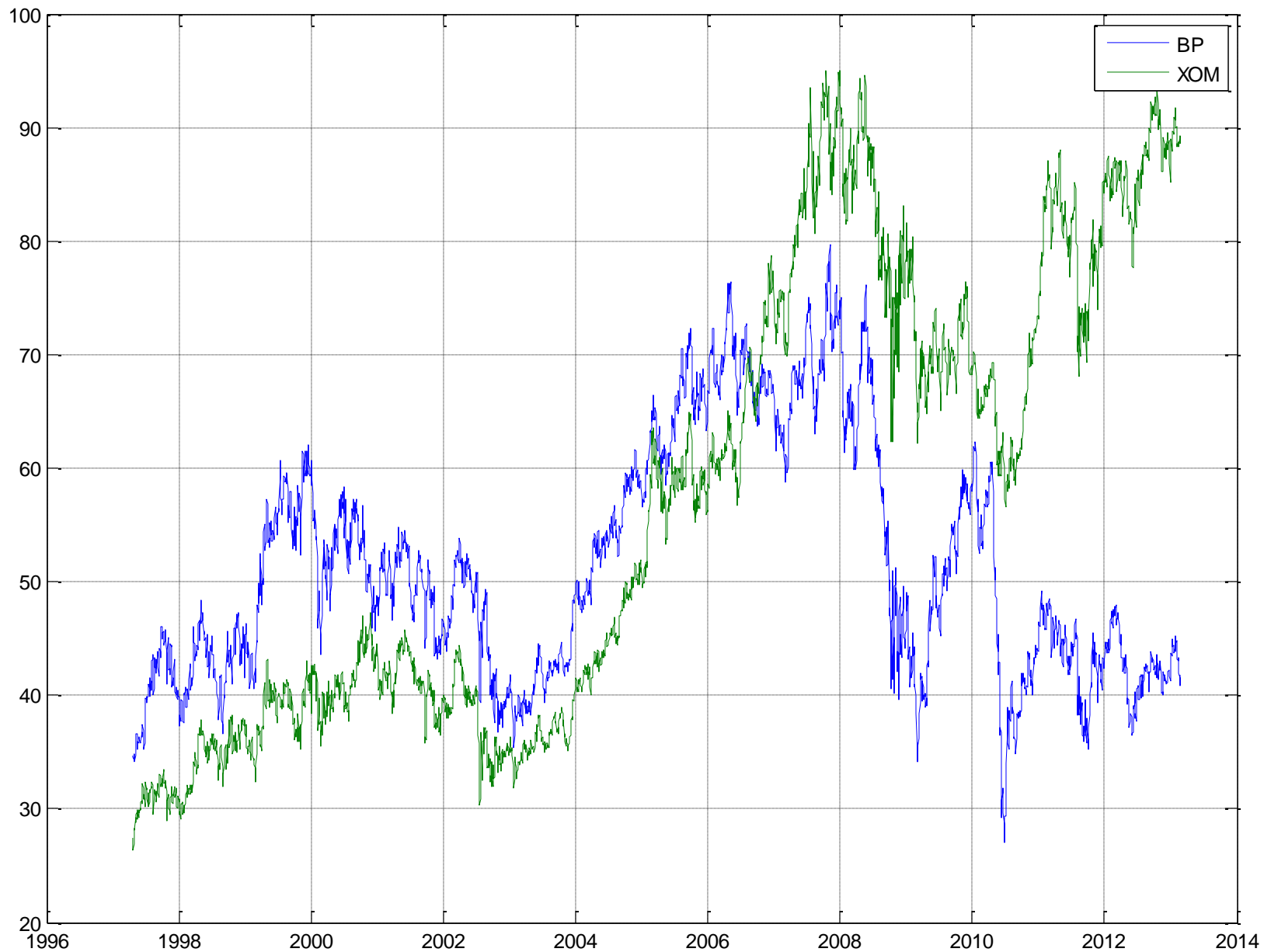


Koreliacijos koeficientas

$$\rho_{X,Y} = \text{corr}(X, Y) = \frac{\text{cov}(X, Y)}{\sigma_X \sigma_Y} = \frac{E[(X - \mu_X)(Y - \mu_Y)]}{\sigma_X \sigma_Y}$$

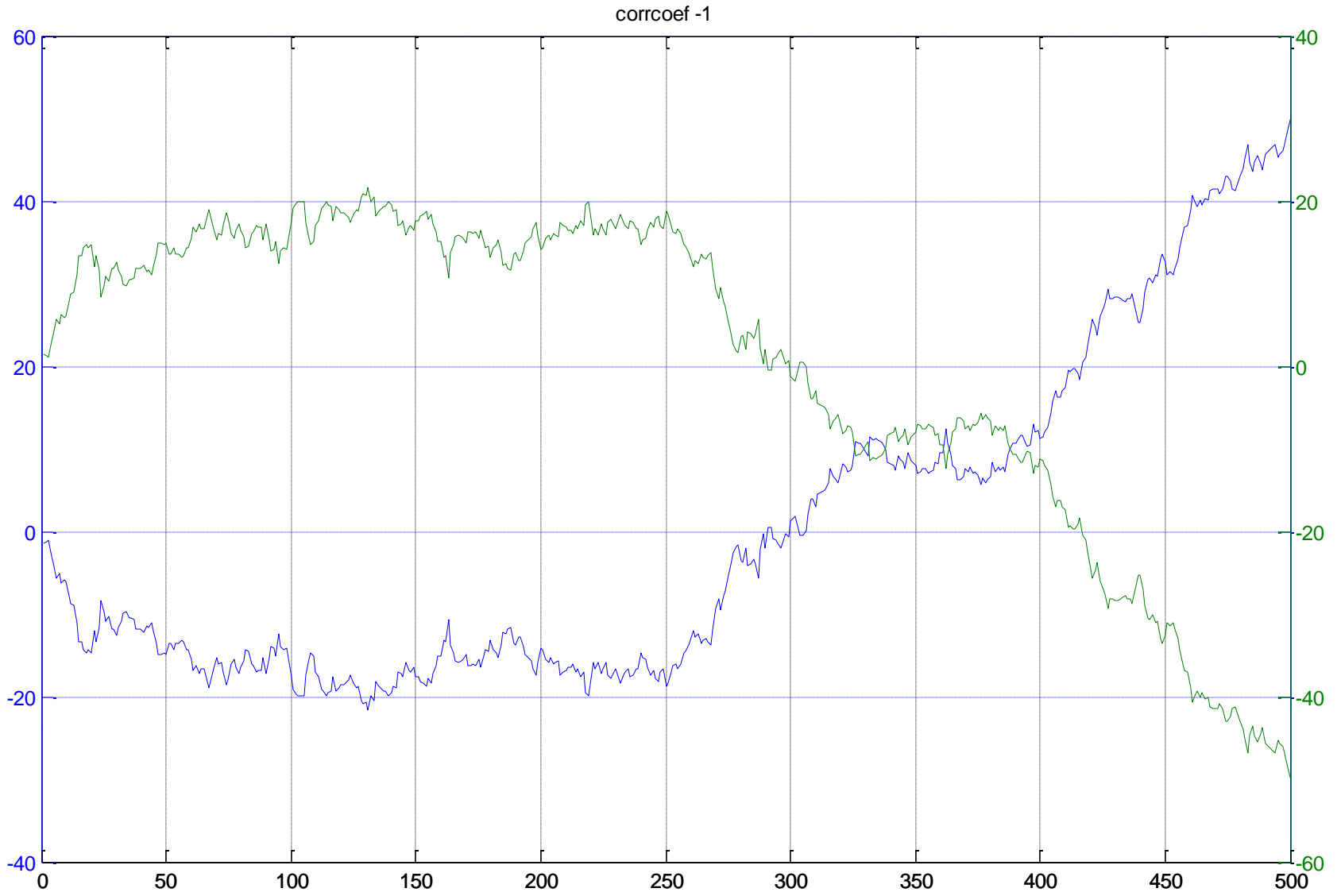
- Parodo, kaip panašios laiko eilutės
- Dažniausiai siekiama sukurti portfelį su kuo mažiau koreliuojančiais instrumentais
- Atsiranda kur nebuvo
- Pradingsta kur buvo

BP, XOM correlation
0.675429

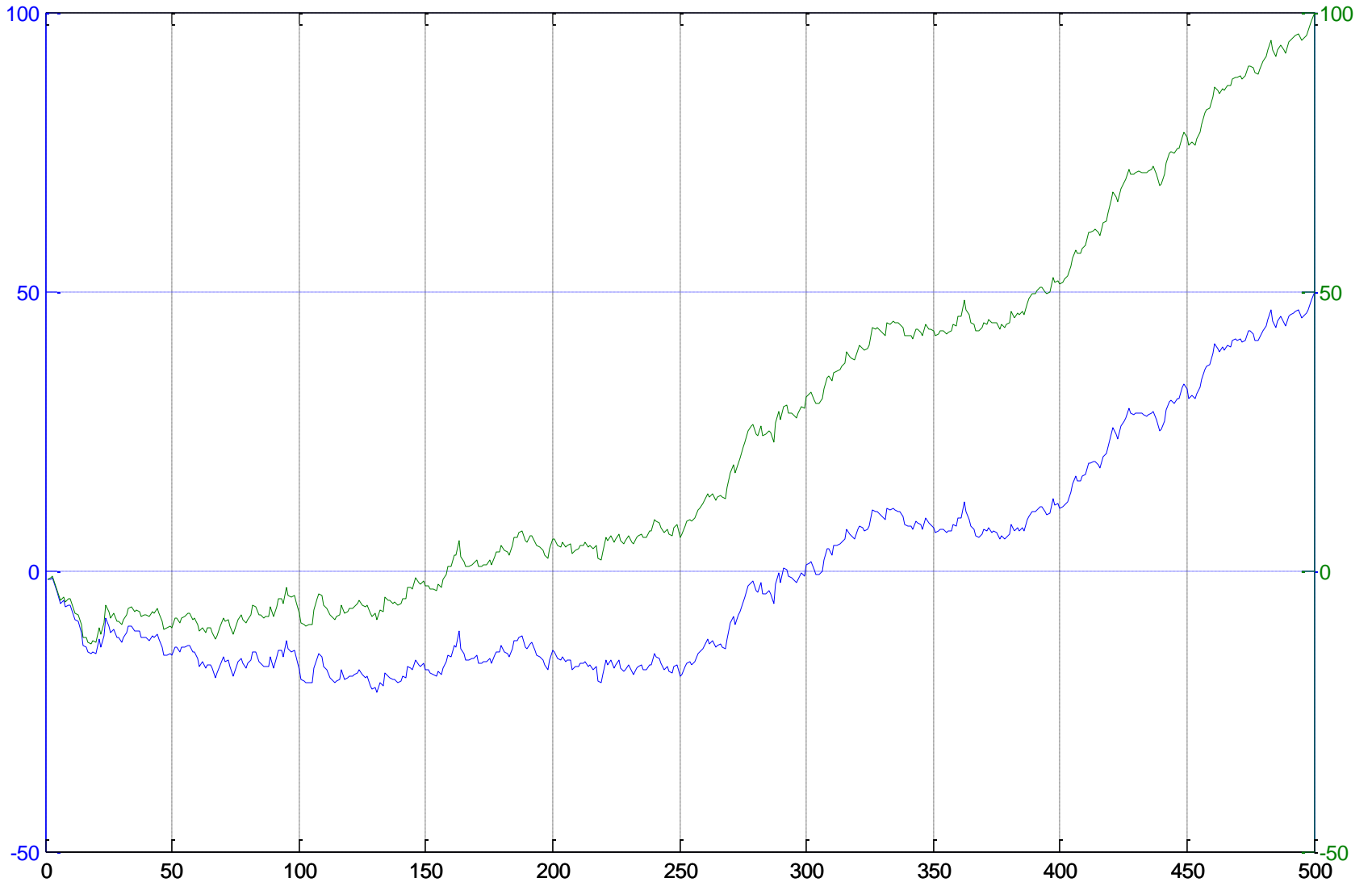


Koreliacijos koeficientas

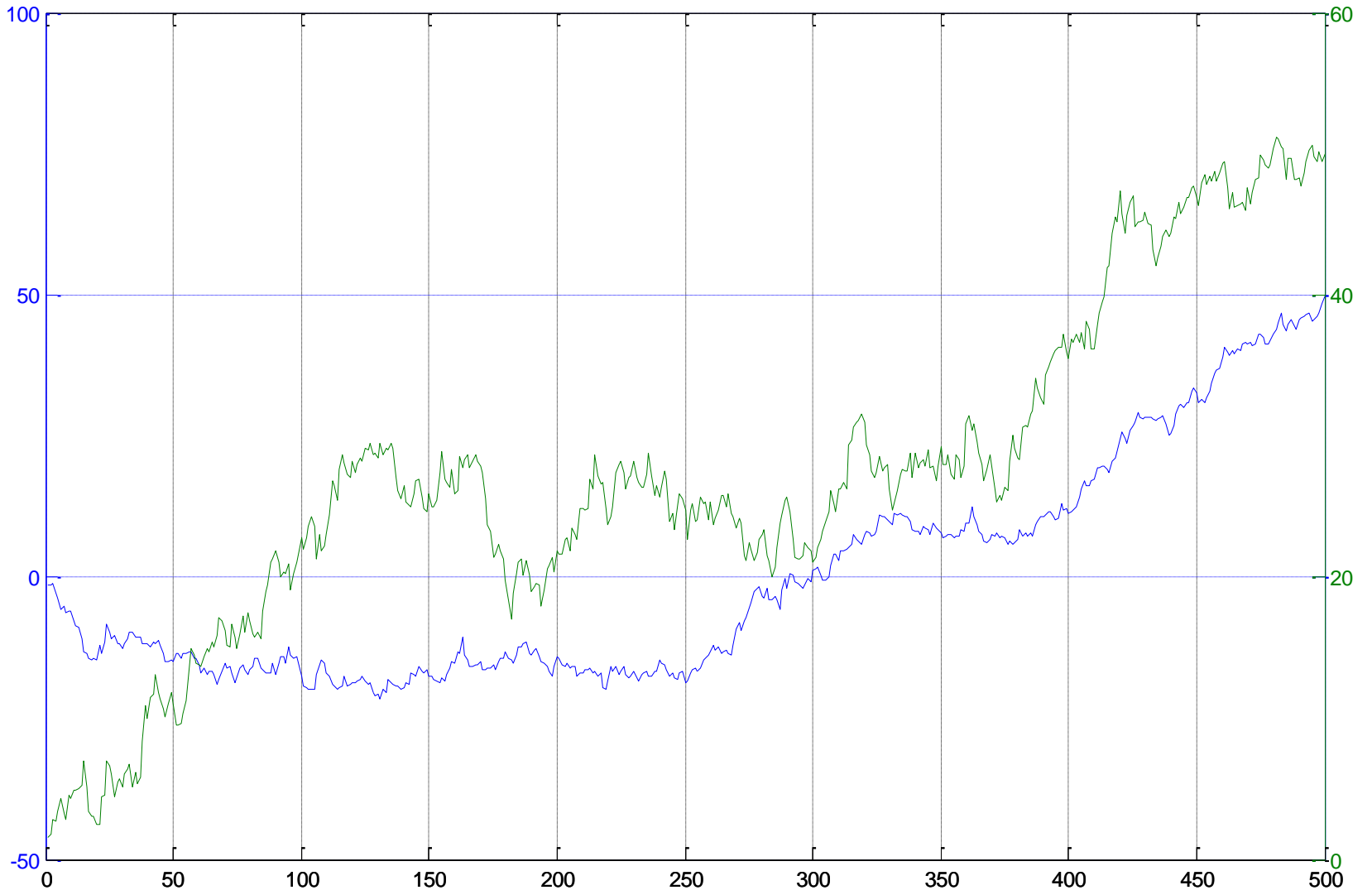
- Nurodo kaip juda 2 instrumentai vienas kito atžvilgiu
- Jeigu juda
 - sinchroniškai = 1
 - atvirkščiai vienas kitam = -1
 - nepriklausomai = 0
- SVARBU: paprastai koreliacija matuojama nuo kainų pokyčių



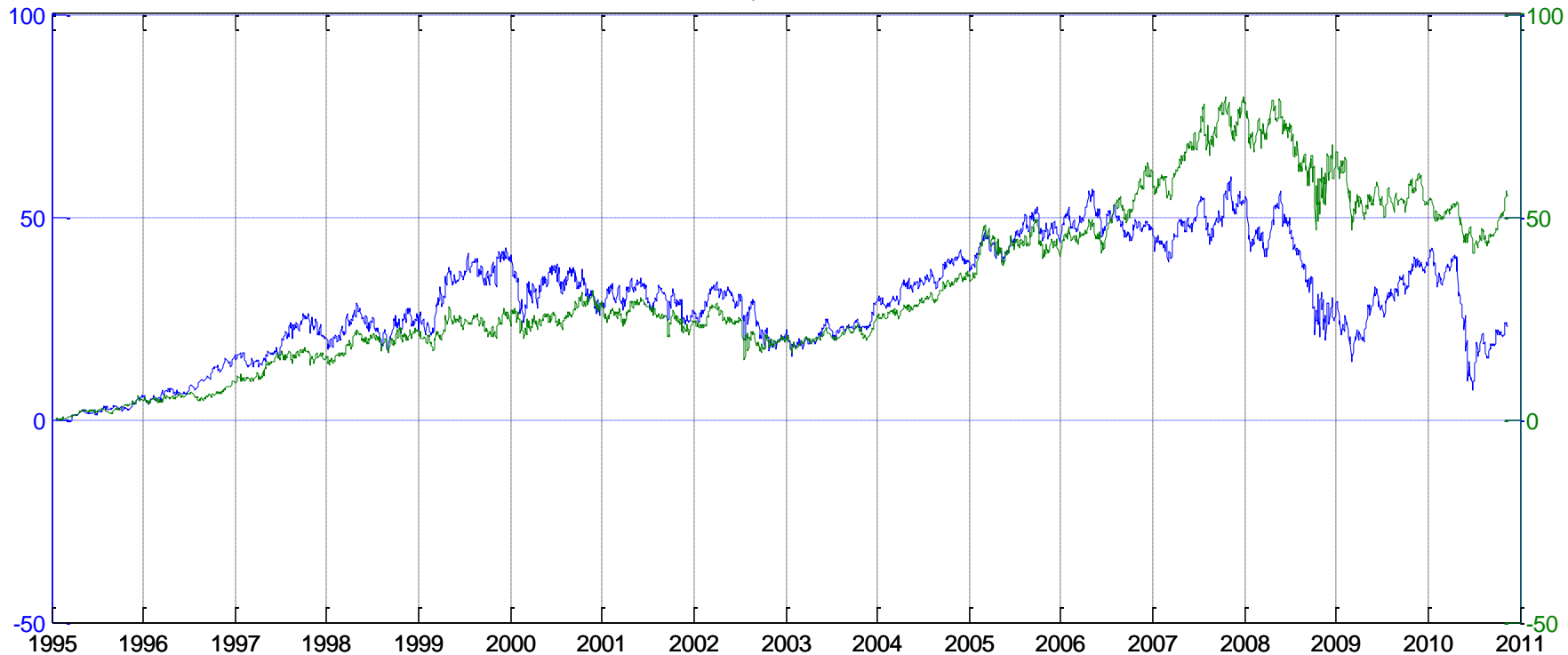
corrcoef 1



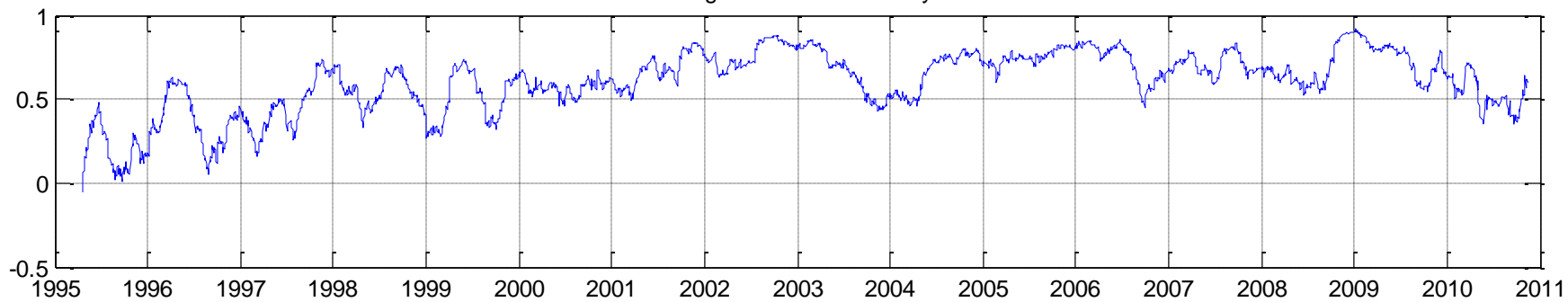
corrcoef 0.049055



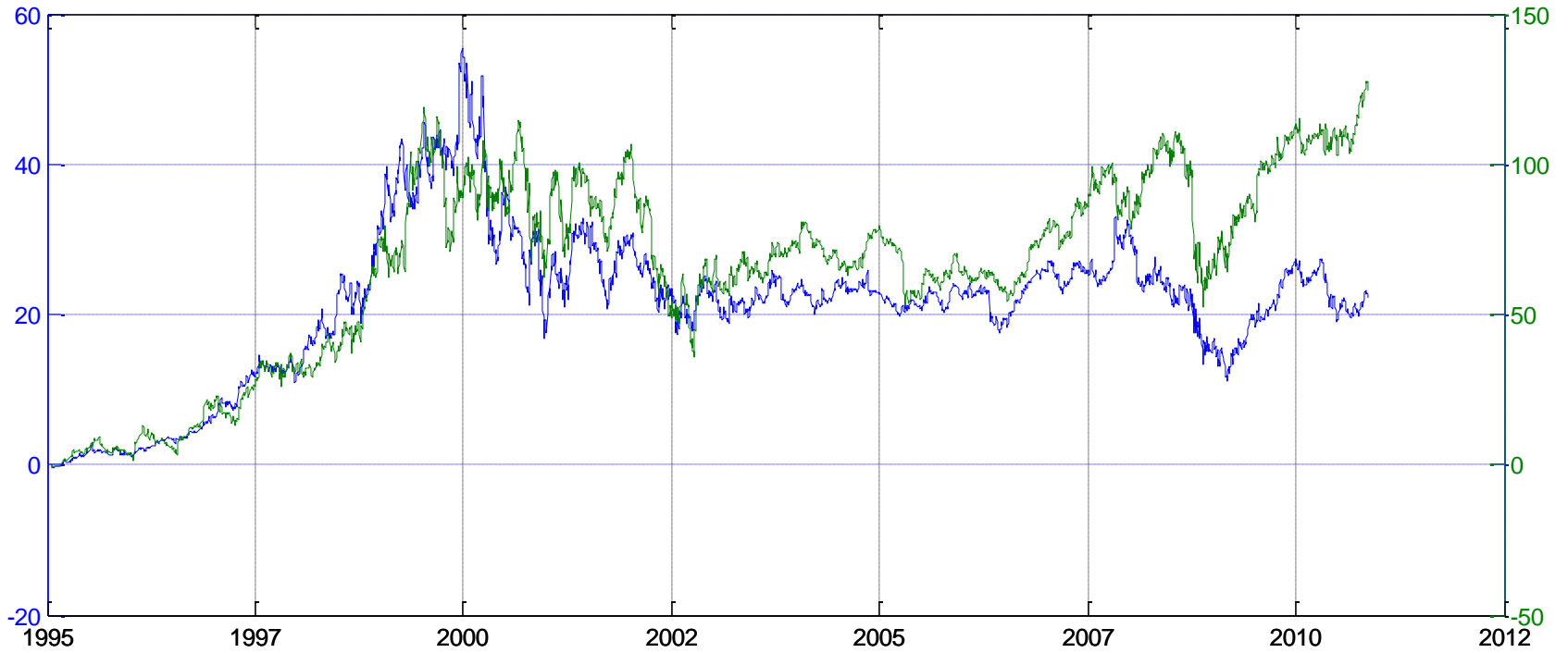
BP vs XOM, corrcoef 0.66992



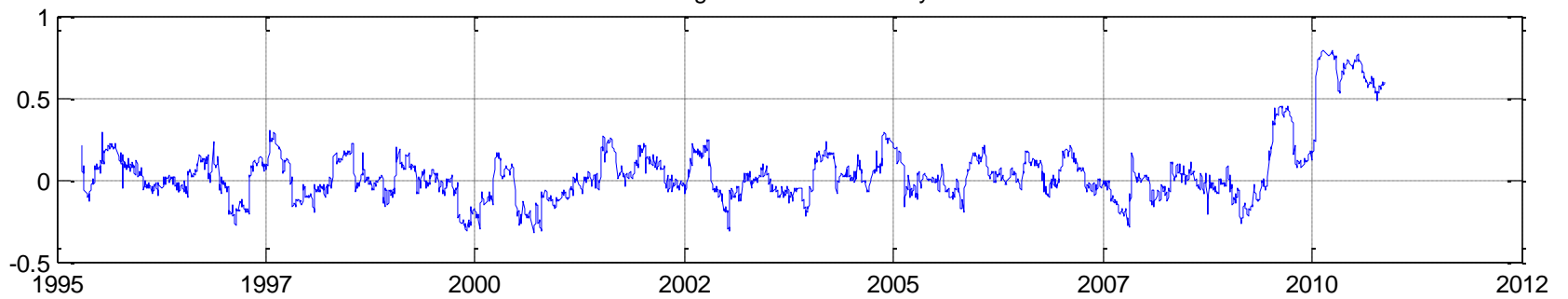
moving correlation of 63 days



MSFT vs IBM, corrccoef 0.0001728



moving correlation of 63 days



Kiek uždirbo

- Pirkau 200 akcijų už 100, pardaviau už 150,
Komisiniai - 0,01 dolerio
 $(150-100-0,01*2)*200 = 9996$
- Pirkau sausio pradžioje už 100 pardaviau kovo pabaigoje už 110, koks metinis pelningumas?

Ateities pinigų vertė

- Kiek vertas 100 USD už 1 metų, kai LIBOR=5% ?
(paskolink 100 USD metams)
- $100/(1 + 0.05) = 95.2381$
- Gerai, skolinu 95.24 o atiduosi 100

- Kiek bus vertas 100 USD už 1 metų, kai LIBOR=5% ?
- $100*(1 + 0.05) = 105$
- Arba skolinu 100 o atiduosi 105

Palūkanos per 6 metus

- Padējau j bankā 100 USD su 5 proc. palūkanom su reinvestavimu
- Po šešių metų gausiu
 $100 * (1.05)^6 = 134.0095640625$

Kiek pinigų reikia prekybai

- Kai galimas svertas/prekyba su marža, galima didinti pelną tik nežinia, kiek lenkti lazda
- Tenka matyti pagyru su 1000 proc. pelno
 - Parodo apie prastą rizikos valdymą
- Kur yra svertas, reikia mokėti valdyti riziką (neveltui ateities sandoriai yra prof. invest.)
 - Galima apriboti svertą pagal didžiausią praradimą
 - Galima apriboti svertą pagal STD
 - Margin to equity (ateities sandoriuose)

Kiek pinigų reikia prekybai

- Standartinis „Hedge Fond“ lygis yra 10-15% STD, svertas 4
- 10 % STD PVZ: jei sistema rodo, kad metinis STD yra 100k tai tokiai sistemai reikia 1m
- 5% DD PVZ: jei max DD yra 46k tai reikia 920k

Skaičiavimo metodika

- LIFO
- FIFO
- Pagal rinką (angl. Mark to market)
- Compounded return – su reinvestavimu

Pabaiga