Predictability

Facts

Regression of returns on lagged returns
Annual data 1927-2008
$R_{t+1} = a + bR_t + \varepsilon_{t+1}$

	b	t(b)	R^2	E(R)	$\sigma(E_t(R_{t+1}))$
Stock	0.04	0.33	0.002	11.4	0.77
T bill	0.91	19.5	0.83	4.1	3.12
Excess	0.04	0.39	0.00	7.25	0.91

New Facts

Table 20.1. *OLS regressions of percent excess returns (value weighted NYSE − treasury bill rate) and real dividend growth on the percent VW dividend/price ratio*

Horizon k (years)	$R_{t\to t+k} = a + b(D_t/P_t)$			$D_{t+k}/D_t = a + b(D_t/P_t)$		
	b	$\sigma(b)$	R^2	b	$\sigma(b)$	R^2
1	5.3	(2.0)	0.15	2.0	(1.1)	0.06
2	10	(3.1)	0.23	2.5	(2.1)	0.06
3	15	(4.0)	0.37	2.4	(2.1)	0.06
5	33	(5.8)	0.60	4.7	(2.4)	0.12

$R_{t\to t+k}$ indicates the k-year return. Standard errors in parentheses use GMM to correct for heteroskedasticity and serial correlation. Sample 1947–1996.

Financial markets and the real economy update

Horizon k (years)	$R^e_{t\to t+k} = a + b\frac{D_t}{P_t} + \varepsilon_{t+k}$			$\frac{D_{t+k}}{D_t} = a + b\frac{D_t}{P_t} + \varepsilon_{t+k}$		
	b	t(b)	R^2	b	t(b)	R^2
1	4.0	2.7	0.08	0.07	0.06	0.0001
2	7.9	3.0	0.12	-0.42	-0.22	0.001
3	12.6	3.0	0.20	0.16	0.13	0.0001
5	20.6	2.6	0.22	2.42	1.11	0.02

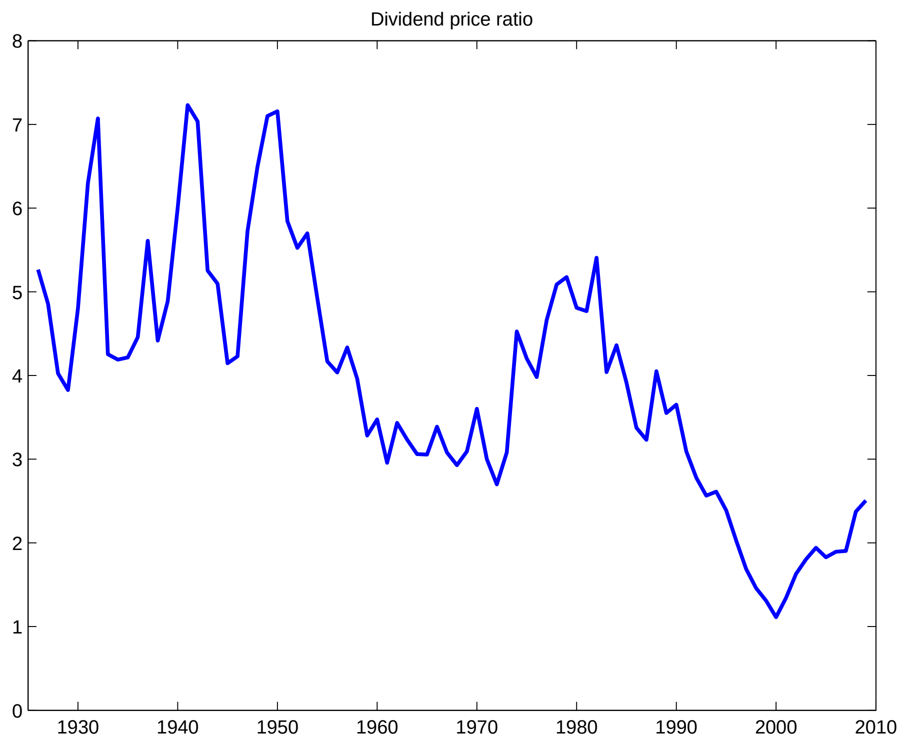
Table 1. OLS regressions of excess returns (value weighted NYSE - treasury bill) and real dividend growth on the value weighted NYSE dividend-price ratio. Sample 1927-2005, annual data.

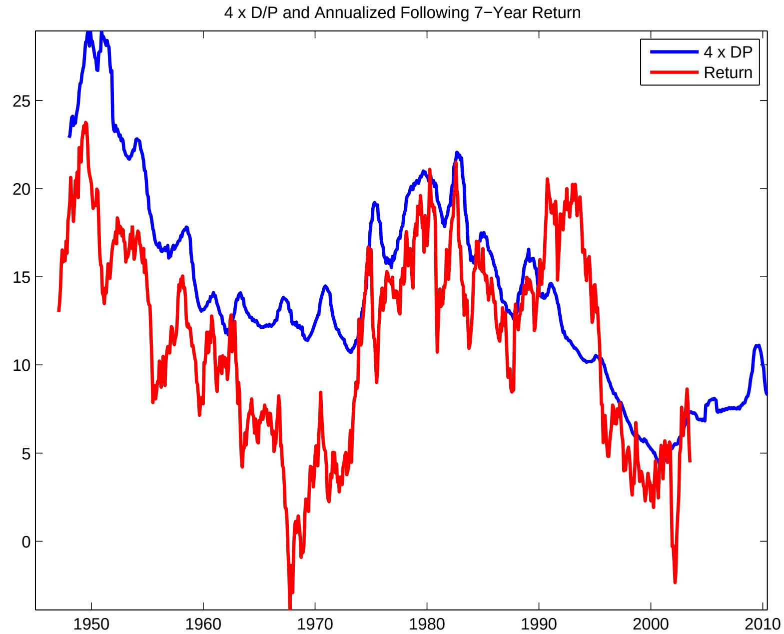
Barking dog update :

Regression	b	t	$R^2(\%)$	$\sigma(bx)(\%)$
$R_{t+1} = a + b(D_t/P_t) + \varepsilon_{t+1}$	3.39	2.28	5.8	4.9
$R_{t+1} - R_t^f = a + b(D_t/P_t) + \varepsilon_{t+1}$	3.83	2.61	7.4	5.6
$D_{t+1}/D_t = a + b(D_t/P_t) + \varepsilon_{t+1}$	0.07	0.06	0.0001	0.001
$r_{t+1} = a_r + b_r(d_t - p_t) + \varepsilon^r_{t+1}$	0.097	1.92	4.0	4.0
$\Delta d_{t+1} = a_d + b_d(d_t - p_t) + \varepsilon^{dp}_{t+1}$	0.008	0.18	0.00	0.003

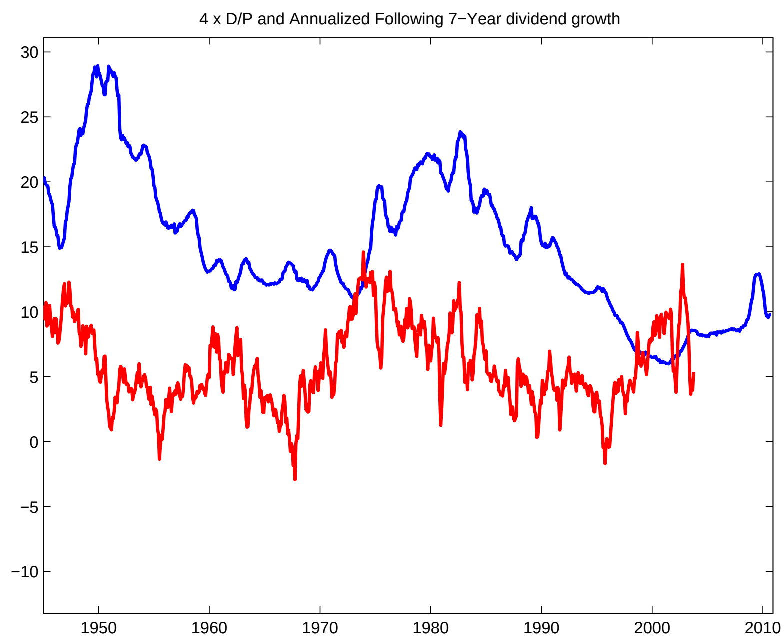
	$R^e_{t\to t+k} = a + b\frac{D_t}{P_t} + \varepsilon_{t+k}$				
Horizon k	b	t(b)	R^2	$\sigma\left[E_t(R^e)\right]$	$\frac{\sigma[E_t(R^e)]}{E(R^e)}$
1 year	3.8	(2.6)	0.09	5.46	0.76
5 years	20.6	(3.4)	0.28	29.3	0.62

Table 1. Return forecasting regressions $R^e_{t\to t+k} = a + b\frac{D_t}{P_t} + \varepsilon_{t+k}$ using the dividend yield. CRSP value weighted return 1947-2009.

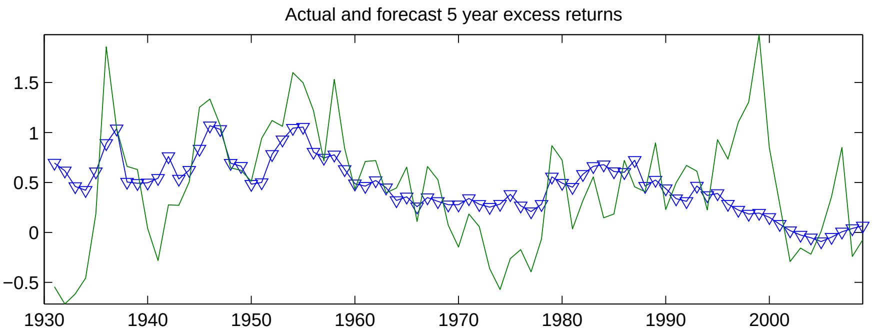


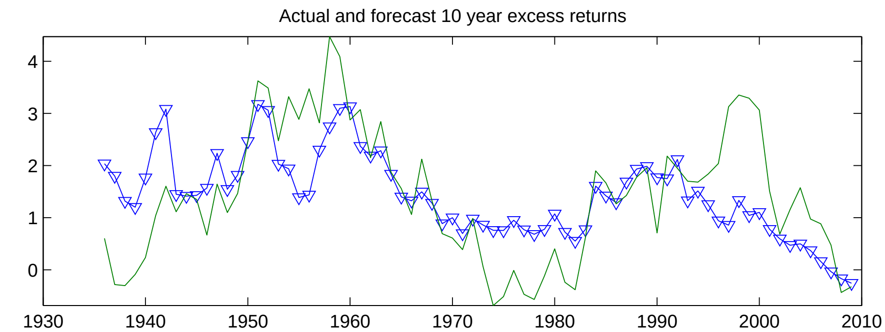


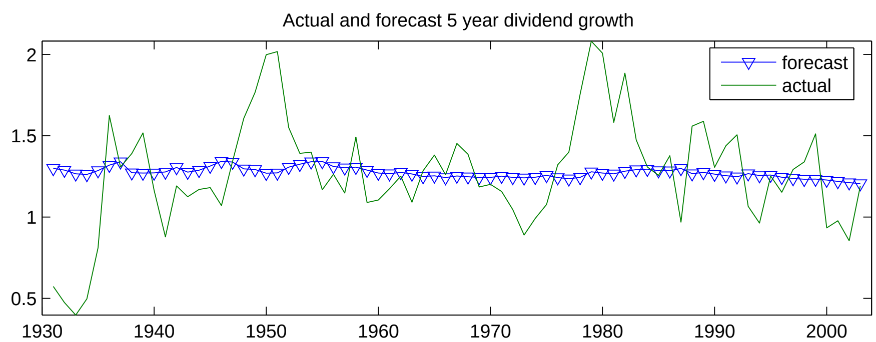
Dividend yield (multiplied by 4) and following 7 year return. CRSP VW market index.

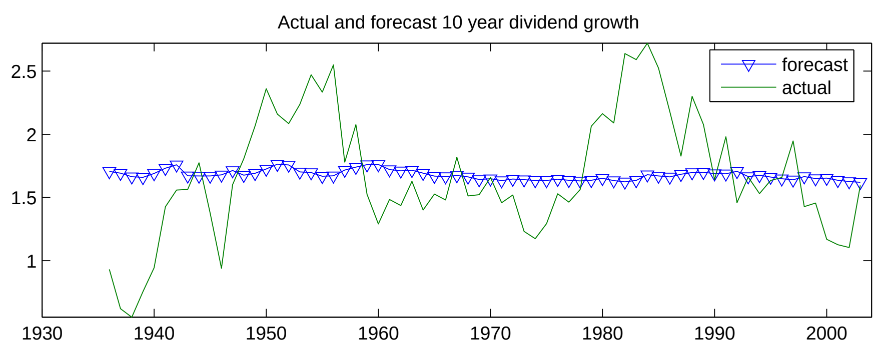


DP and following 7 year dividend growth


Actual and forecast 5 year excess returns
1.5
1
0.5
0
−0.5
1930
1940
1950
1960
1970
1980
1990
2000


Actual and forecast 10 year excess returns
4
3
2
1
0
1930
1940
1950
1960
1970
1980
1990
2000
2010


Actual and forecast 5 year dividend growth
forecast
actual
2
1.5
1
0.5
1930
1940
1950
1960
1970
1980
1990
2000


Actual and forecast 10 year dividend growth
forecast
actual
2.5
2
1.5
1
1930
1940
1950
1960
1970
1980
1990
2000

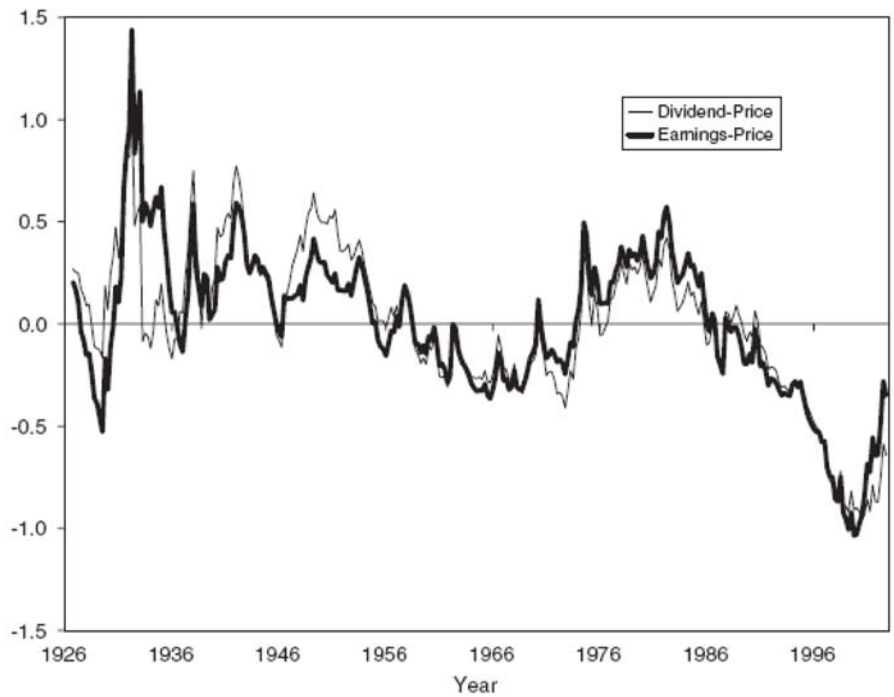
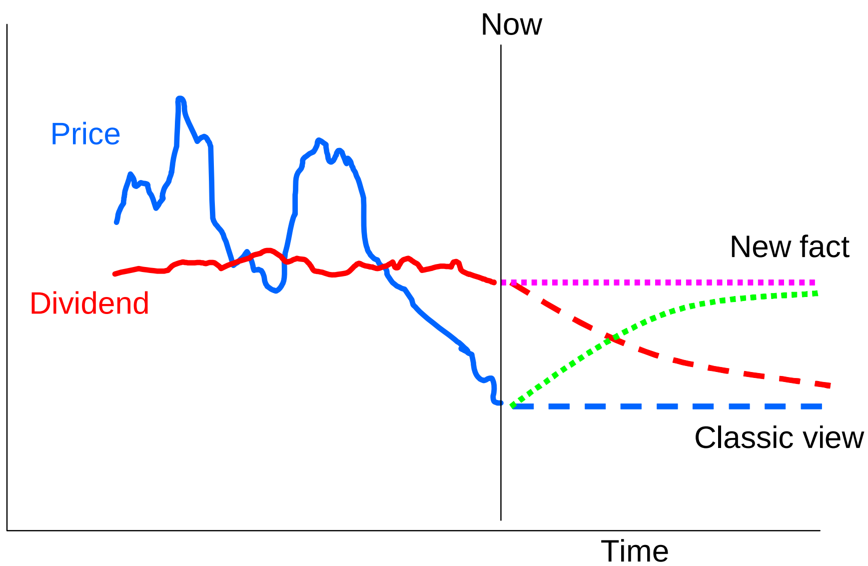
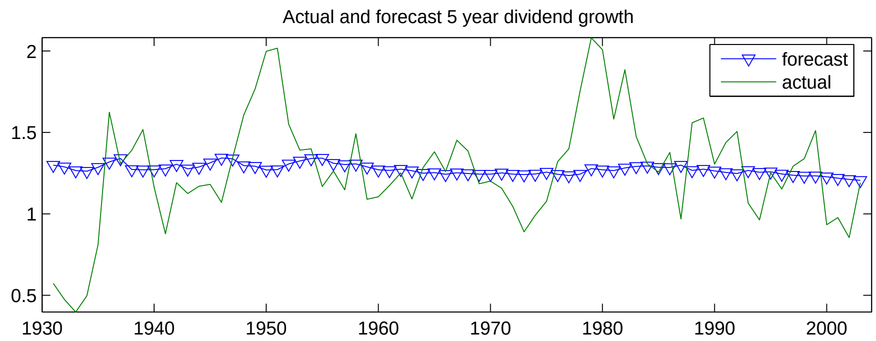
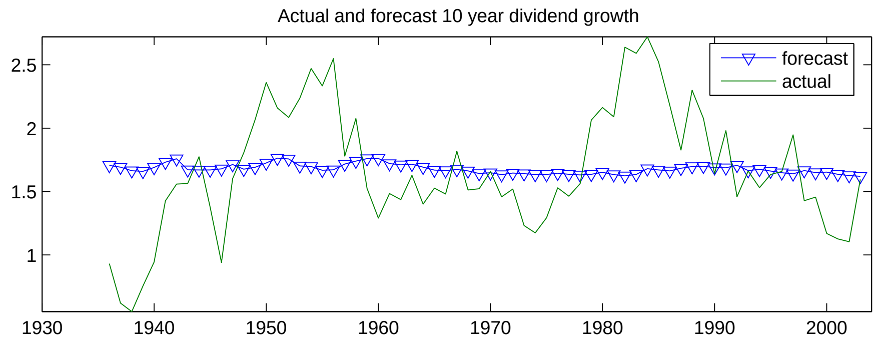


Fig. 1. Time-series plot of the valuation ratios. This figure plots the log dividend–price ratio for the CRSP value-weighted index and the log earnings–price ratio for the S&P 500. Earnings are smoothed by taking a 10-year moving average. The sample period is 1926:4–2002:4.




Actual and forecast 5 year dividend growth
forecast
actual
2
1.5
1
0.5
1930
1940
1950
1960
1970
1980
1990
2000


Actual and forecast 10 year dividend growth
forecast
actual
2.5
2
1.5
1
1930
1940
1950
1960
1970
1980
1990
2000

Volatility question

- Related question: why do prices vary so much?

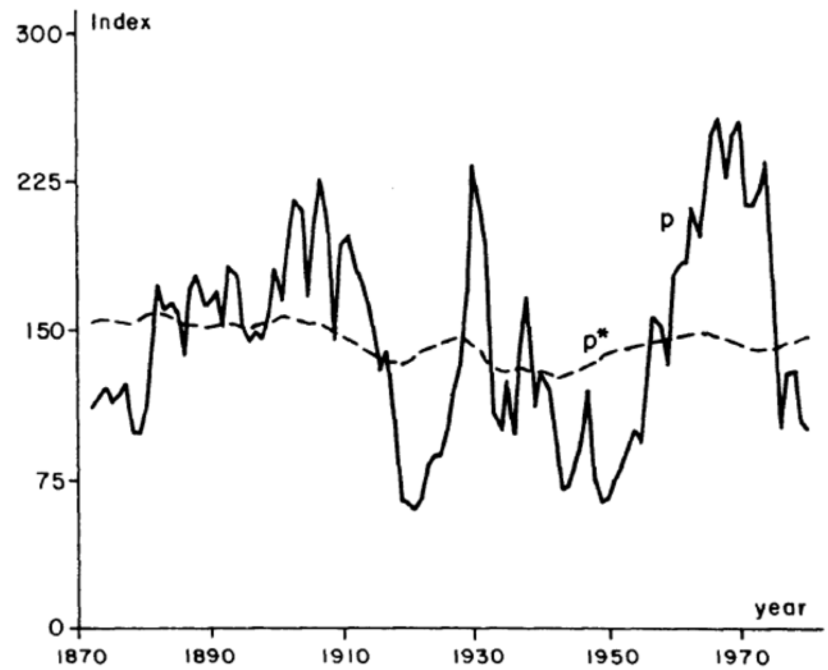


FIGURE 1

Note: Real Standard and Poor's Composite Stock Price Index (solid line p) and *ex post* rational price (dotted line p^*), 1871–1979, both detrended by dividing a long-run exponential growth factor. The variable p^* is the present value of actual subsequent real detrended dividends, subject to an assumption about the present value in 1979 of dividends thereafter. Data are from Data Set 1, Appendix.

Shiller 1981 AER

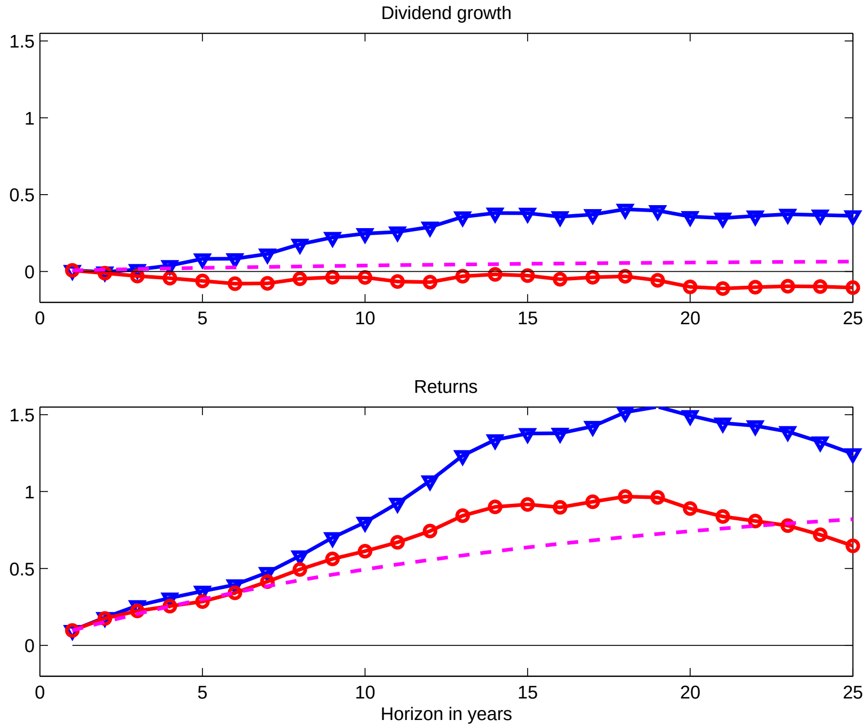
Volatility answers

Table 20.3. *Variance decomposition of value-weighted NYSE price/dividend ratio*

	Dividends	Returns
Real	−34	138
Std. error	10	32
Nominal	30	85
Std. error	41	19

Table entries are the percent of the variance of the price/dividend ratio attributable to dividend and return forecasts, $100 \times \text{cov}(p_t - d_t, \sum_{j=1}^{15} \rho^{j-1} \Delta d_{t+j}) / \text{var}(p_t - d_t)$ and similarly for returns.

Left hand variable:	$\sum_{j=1}^{k} \rho^{j-1} r_{t+j}$	$\sum_{j=1}^{k} \rho^{j-1} \Delta d_{t+j}$	$\rho^k dp_{t+k}$
Direct, $k = 15$	1.01	-0.11	-0.11
VAR, $k = 15$	1.05	0.27	0.22
VAR, $k = \infty$	1.35	0.35	0.00



Regression forecasts of discounted dividend growth $\sum_{j=1}^{k} \rho^{j-1} \Delta d_{t+j}$ (top) and returns $\sum_{j=1}^{k} \rho^{j-1} r_{t+j}$ (bottom) on the log dividend yield $d_t - p_t$, as a function of the horizon k. Triangles are direct estimates: I form the weighted long-horizon returns and run them on dividend yields, e.g. $\beta\left(\sum_{j=1}^{k} \rho^{j-1} \Delta d_{t+j}, d_t - p_t\right)$. Circles sum individual estimates: I run dividend growth and return at year $t+j$ on the dividend yield at t and then sum up the coefficients, e.g. $\sum_{j=1}^{k} \rho^{j-1} \beta\left(\Delta d_{t+j}, d_t - p_t\right)$. The dashed lines are the long-run coefficients implied by the VAR, e.g. $\sum_{j=1}^{k} \rho^{j-1} \phi^{j-1} b_d$.

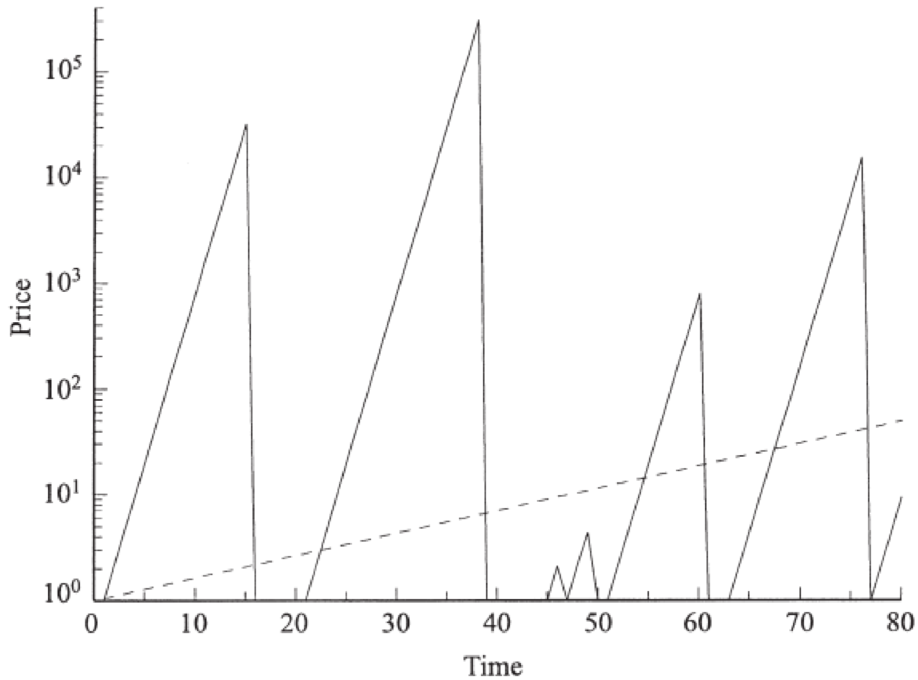


Figure 20.2. *Sample path from a simple bubble process. The solid line gives a price realization. The dashed line gives the expected value of prices as of time zero, i.e.,* $p_0 R^t$.

A simple VAR

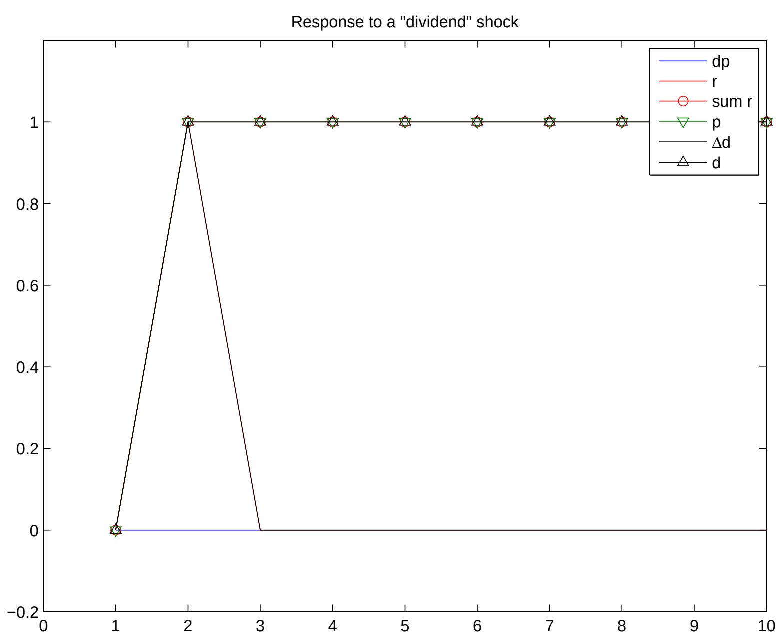
Estimates and identity

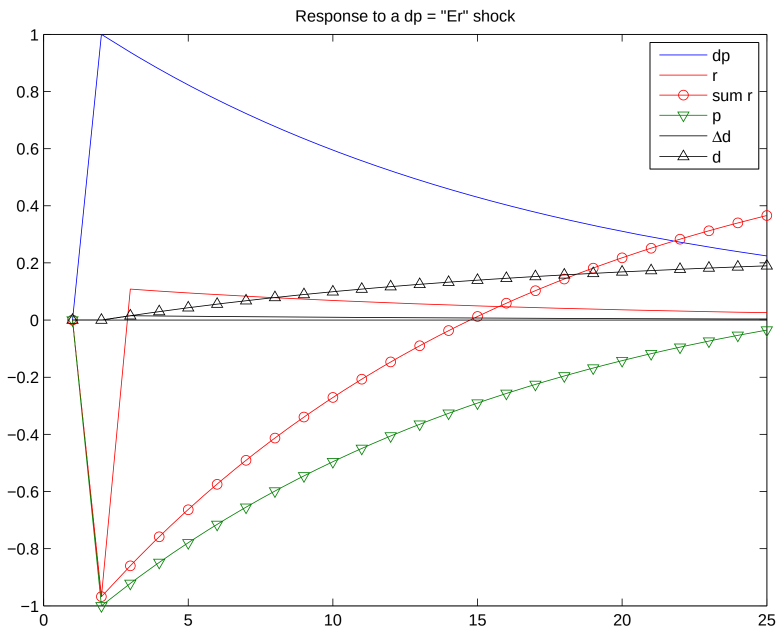
$$
\begin{aligned}
r_{t+1} &= b_r(d_t - p_t) + \varepsilon^r_{t+1} \\
\Delta d_{t+1} &= b_d\,(d_t - p_t) + \varepsilon^d_{t+1} \\
(d_{t+1} - p_{t+1}) &= \phi(d_t - p_t) + \varepsilon^{dp}_{t+1}
\end{aligned}
$$

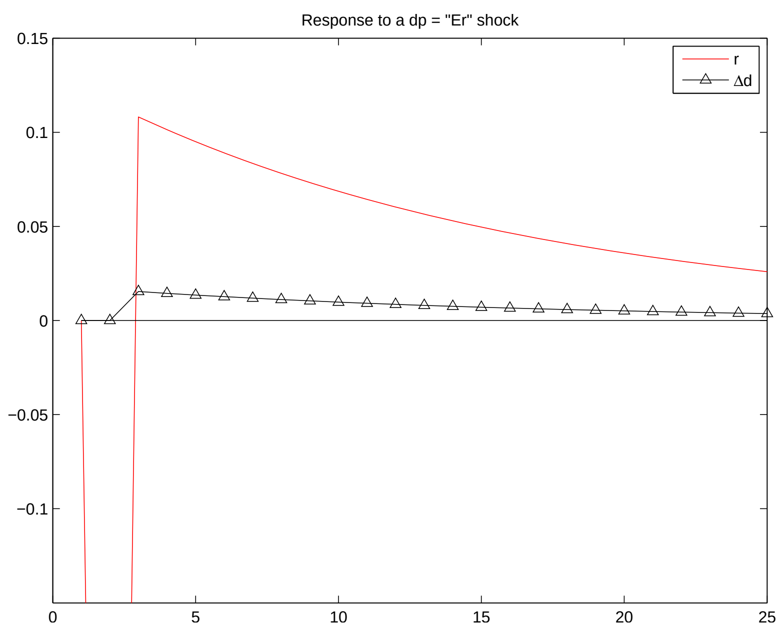
	Estimates		ε s. d. (diagonal,%) and correlation.		
	$\hat{b}, \hat{\phi}$	$\sigma(\hat{b})$	r	Δd	dp
r	0.108	0.050	19.8	0.67	-0.69
Δd	0.015	0.040	0.67	14.3	0.06
dp	0.937	0.042	-0.69	0.06	15.1

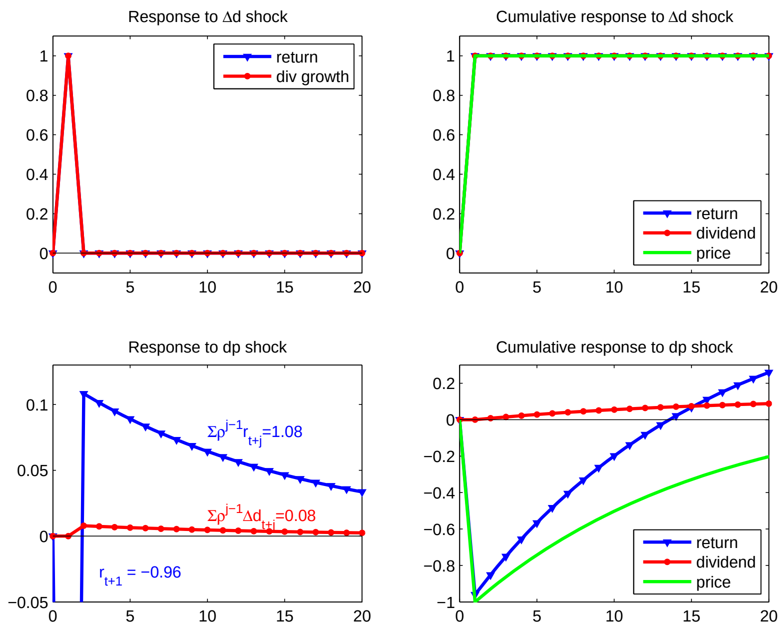
	Estimates	ε s. d. (diagonal) and correlation.		
	$\hat{b}, \hat{\phi}$	r	Δd	dp
r	0.1	16-20	+big	-big
Δd	0		10-14	0
dp	0.94			15

3.

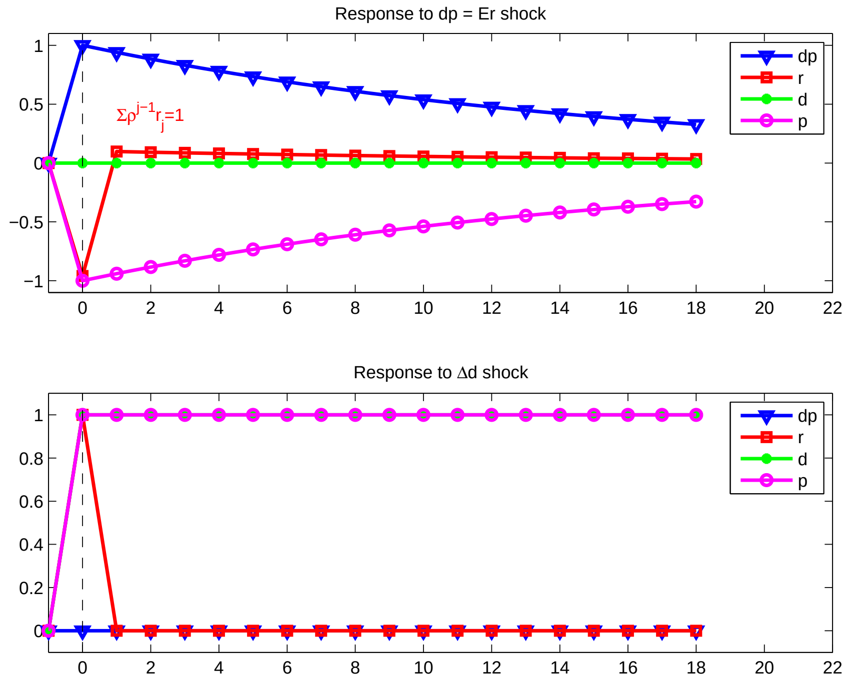


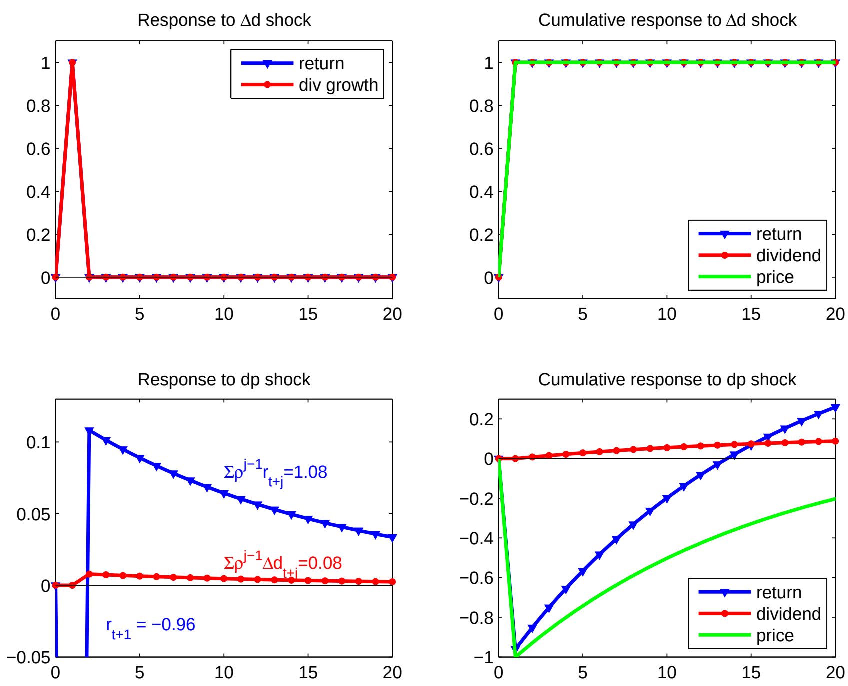

Response to a dp = "Er" shock
dp
r
sum r
p
Δd
d
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
0
5
10
15
20
25


Response to a dp = "Er" shock
r
Δd
0.15
0.1
0.05
0
−0.05
−0.1
0
5
10
15
20
25


Response to Δd shock
return
div growth
Cumulative response to Δd shock
return
dividend
price
Response to dp shock
Σρ^{j−1}r_{t+j}=1.08
Σρ^{j−1}Δd_{t+j}=0.08
r_{t+1} = −0.96
Cumulative response to dp shock
return
dividend
price

Impulse-response function in stylized VAR.





State-space models

$$
\begin{aligned}
x_t &= \phi(0.94) x_{t-1} + \varepsilon_t^x \\
r_{t+1} &= x_t + \varepsilon_{t+1}^r \\
\Delta d_{t+1} &= (0+)\ \varepsilon_{t+1}^d
\end{aligned}
\qquad (1)
$$

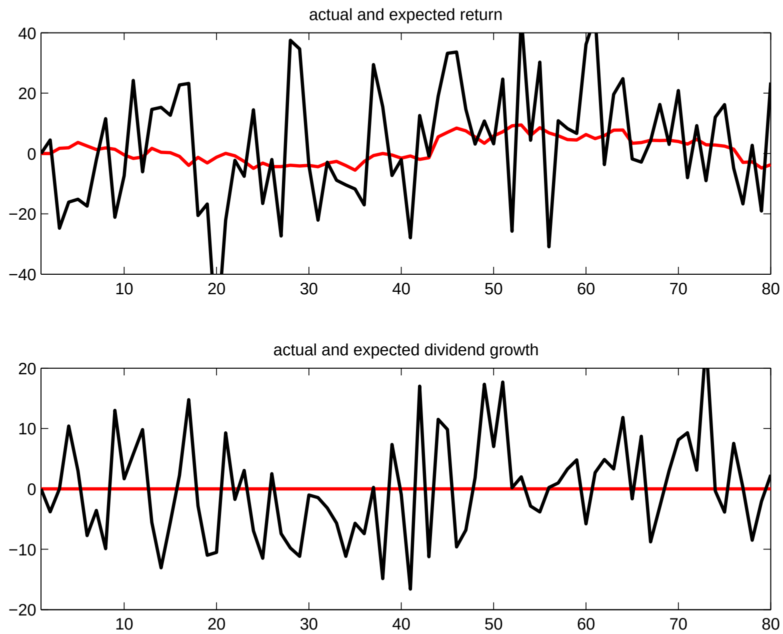
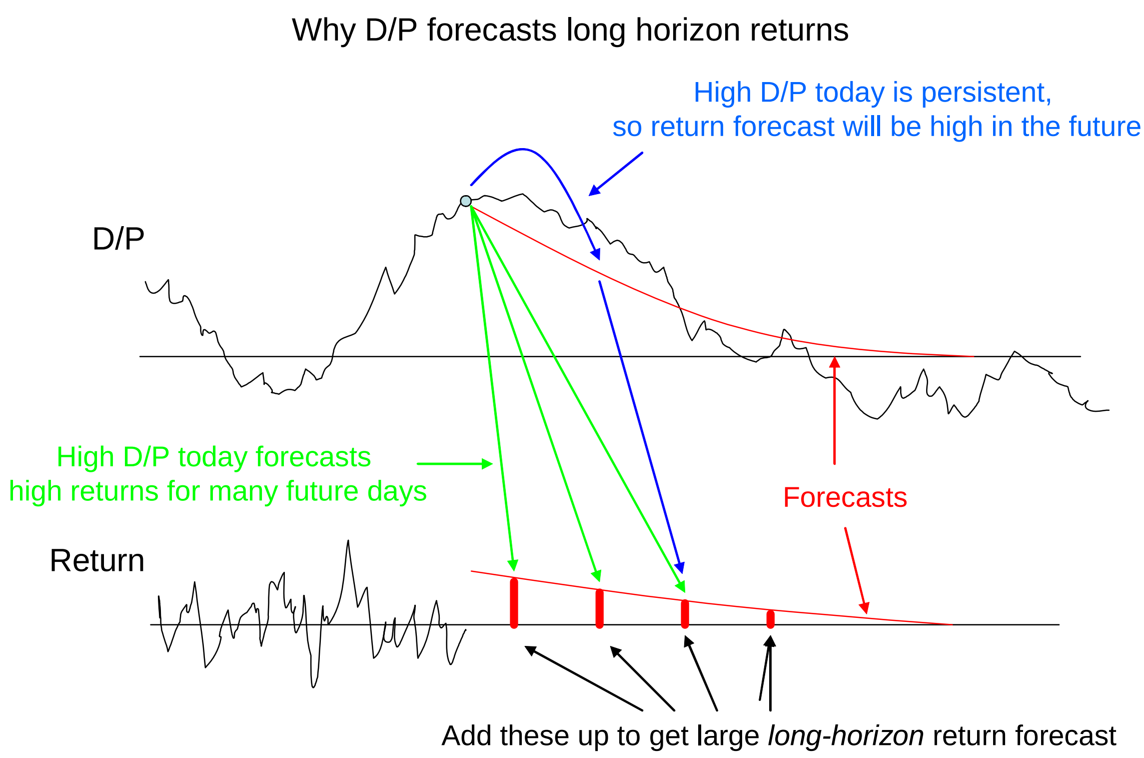


Figure 1: Actual and expected return, and dividend growth. Simulation.

Rise of coefficients, R2 with horizon



Mean Reversion

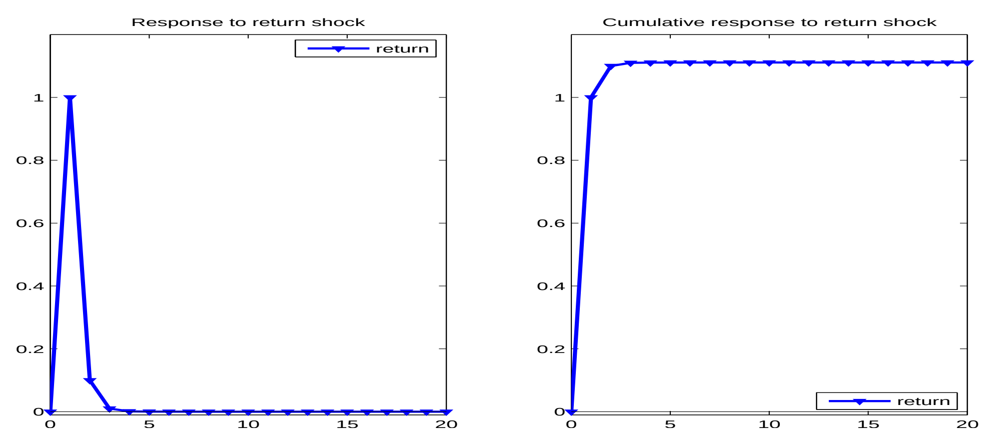


Table 20.5, 20.6, 20.7.

Table 20.5. *Mean-reversion using logs, 1926–1996*

	Horizon k (years)					
	1	2	3	5	7	10
$\sigma(r_k)/\sqrt{k}$	19.8	20.6	19.7	18.2	16.5	16.3
β_k	0.08	−0.15	−0.22	−0.04	0.24	0.08
Sharpe$/\sqrt{k}$	0.31	0.30	0.30	0.31	0.36	0.39

r denotes the difference between the log value-weighted NYSE return and the log treasury bill return. $\sigma(r_k) = \sigma(r_{t\to t+k})$ is the variance of long-horizon returns. β_k is the long-horizon regression coefficient in $r_{t\to t+k} = \alpha + \beta_k r_{t-k\to t} + \varepsilon_{t+k}$. The Sharpe ratio is $E(r_{t\to t+k})/\sigma(r_{t\to t+k})$.

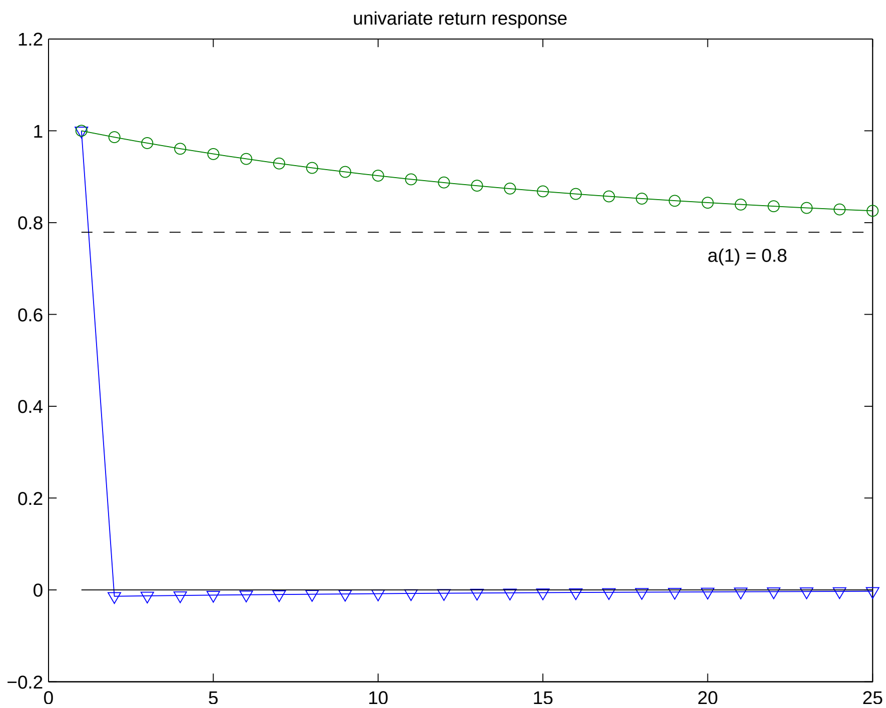
Table 20.6. *Mean-reversion using gross returns, 1926–1996*

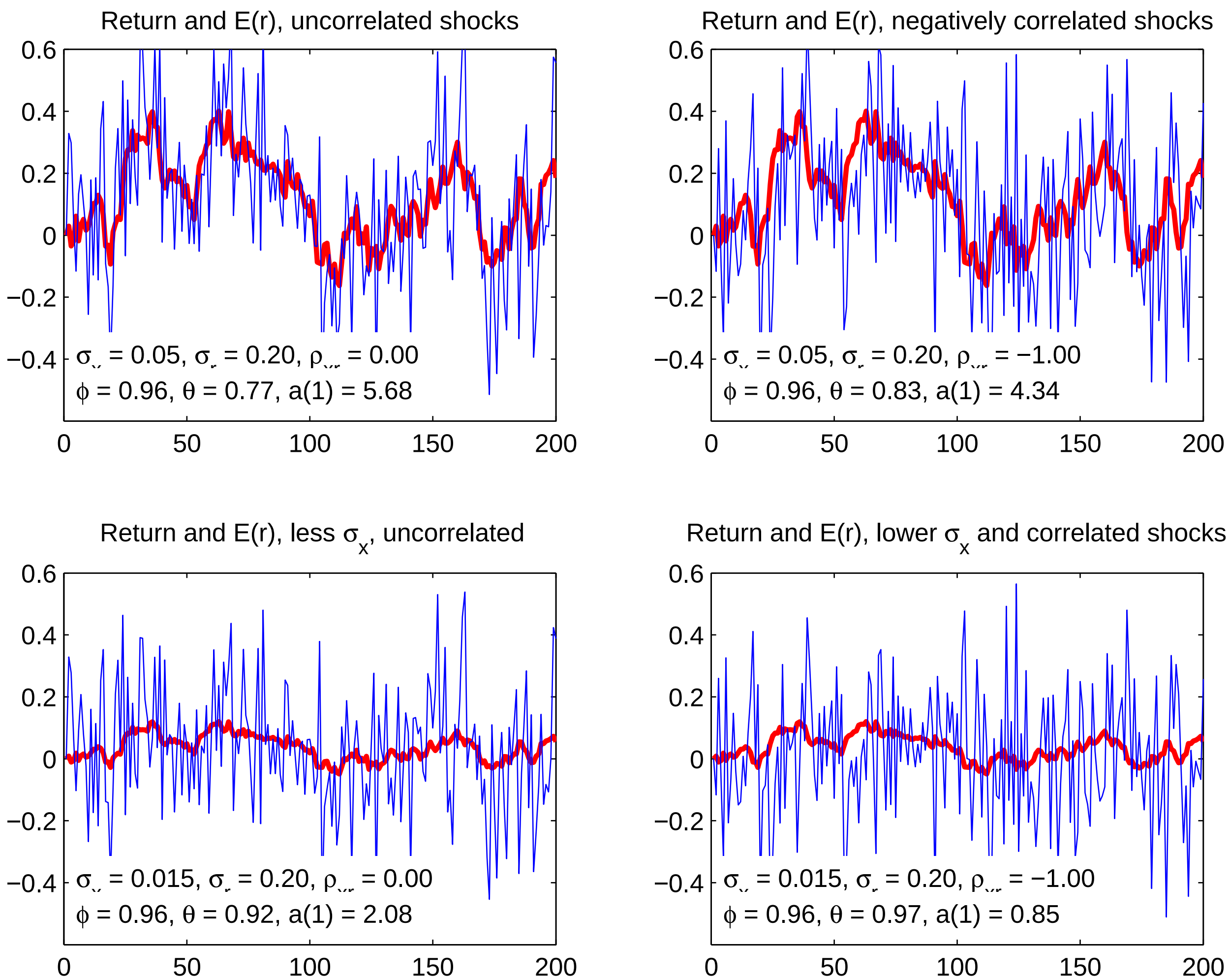
	Horizon k (years)					
	1	2	3	5	7	10
$\sigma(r_k)/\sqrt{k}$	20.6	22.3	22.5	24.9	28.9	39.5
β_k	0.02	−0.21	−0.22	−0.03	0.22	−0.63
Sharpe$/\sqrt{k}$	0.41	0.41	0.41	0.40	0.40	0.38

r denotes the difference between the gross (not log) long-horizon value-weighted NYSE return and the gross treasury bill return.

Table 20.7. *Mean-reversion in postwar data*

	Horizon k (years)					
1947–1996 logs	1	2	3	5	7	10
$\sigma(r_k)/\sqrt{k}$	15.6	14.9	13.0	13.9	15.0	15.6
β_k	−0.10	−0.29*	0.30*	0.30	0.17	−0.18
Sharpe$/\sqrt{k}$	0.44	0.46	0.51	0.46	0.41	0.36
1947–1996 levels	1	2	3	5	7	10
$\sigma(r_k)/\sqrt{k}$	17.1	17.9	16.8	21.9	29.3	39.8
β_k	−0.13	−0.33*	0.30	0.25	0.13	−0.25
Sharpe$/\sqrt{k}$	0.50	0.51	0.55	0.48	0.41	0.37




Return and E(r), uncorrelated shocks
σx = 0.05, σr = 0.20, ρxr = 0.00
ϕ = 0.96, θ = 0.77, a(1) = 5.68
Return and E(r), negatively correlated shocks
σx = 0.05, σr = 0.20, ρxr = −1.00
ϕ = 0.96, θ = 0.83, a(1) = 4.34
Return and E(r), less σx, uncorrelated
σx = 0.015, σr = 0.20, ρxr = 0.00
ϕ = 0.96, θ = 0.92, a(1) = 2.08
Return and E(r), lower σx and correlated shocks
σx = 0.015, σr = 0.20, ρxr = −1.00
ϕ = 0.96, θ = 0.97, a(1) = 0.85

What's new

More variables, cay

T20.2 Lots of variables beyond dp .

Table 20.2. *Long-horizon return forecasts*

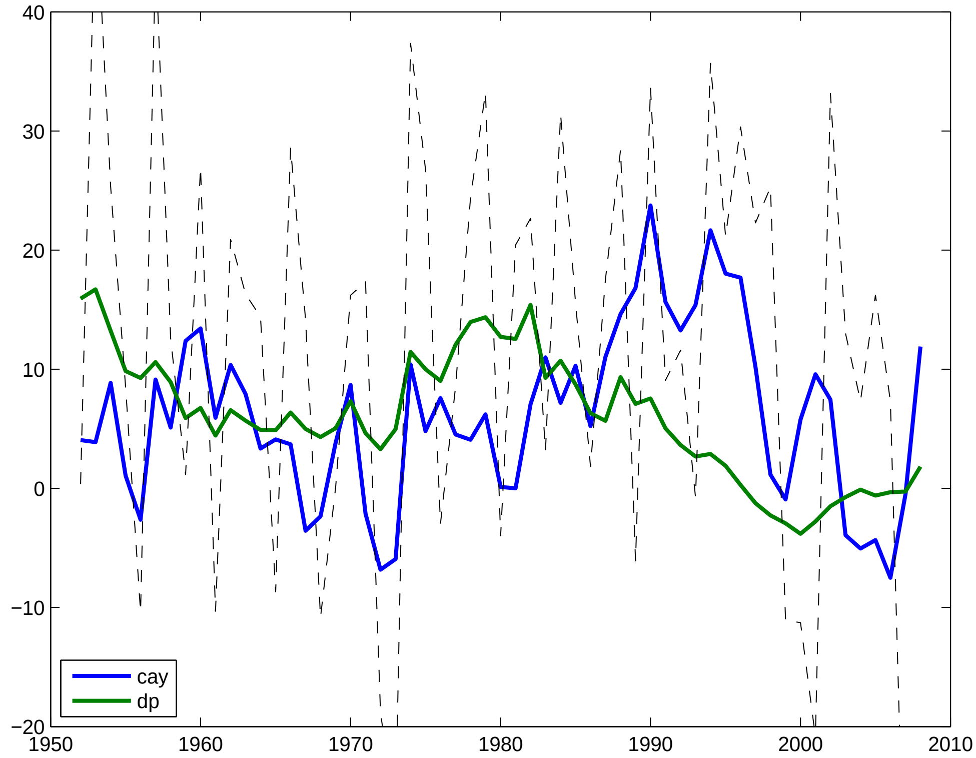
Horizon (years)	*cay*	$d-p$	$d-e$	*rrel*	R^2
1	6.7				0.18
1		0.14	0.08		0.04
1				−4.5	0.10
1	5.4	0.07	−0.05	−3.8	0.23
6	12.4				0.16
6		0.95	0.68		0.39
6				−5.10	0.03
6	5.9	0.89	0.65	1.36	0.42

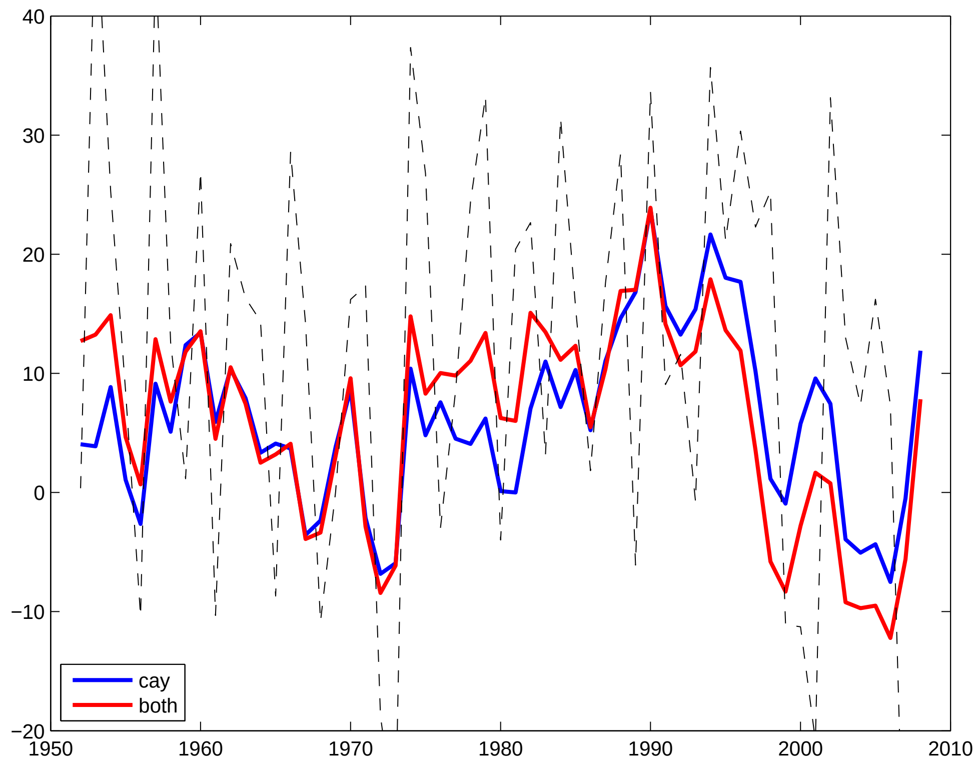
The return variable is log excess returns on the S&P composite index. *cay* is Lettau and Ludvigson's consumption to wealth ratio. $d-p$ is the log dividend yield and $d-e$ is the log earnings yield. *rrel* is a detrended short-term interest rate. Sample 1952:4–1998:3.
Source: Lettau and Ludvigson (2001b, Table 6).

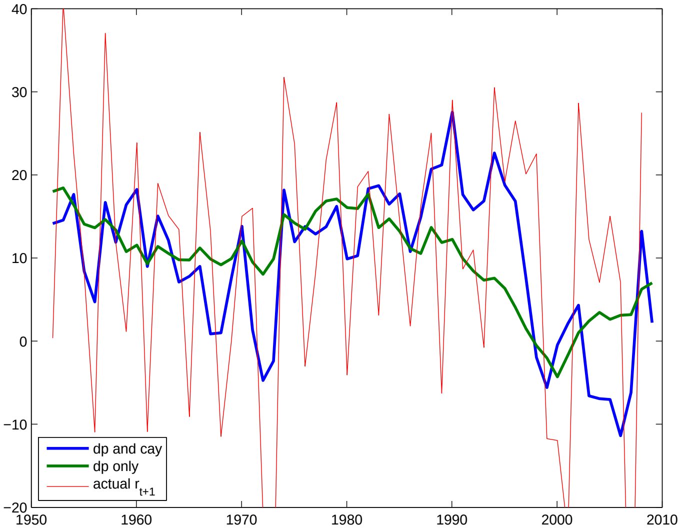
More recent data:

		cay	t	dp	t	R^2
Excess Return	cay only	6.06	3.10			0.156
	dp only			3.82	1.74	0.062
	cay, dp	5.55	2.72	2.80	1.26	0.188
Return	cay only	6.11	3.37			0.168
	dp only			4.56	2.16	0.094
	cay, dp	5.46	2.86	3.56	1.67	0.224

$R_{t+1} = a + b \times cay_t + c \times dp_t = \varepsilon_{t+1};$ VW returns (-TB)


40
30
20
10
0
−10
−20
1950
1960
1970
1980
1990
2000
2010
cay
dp

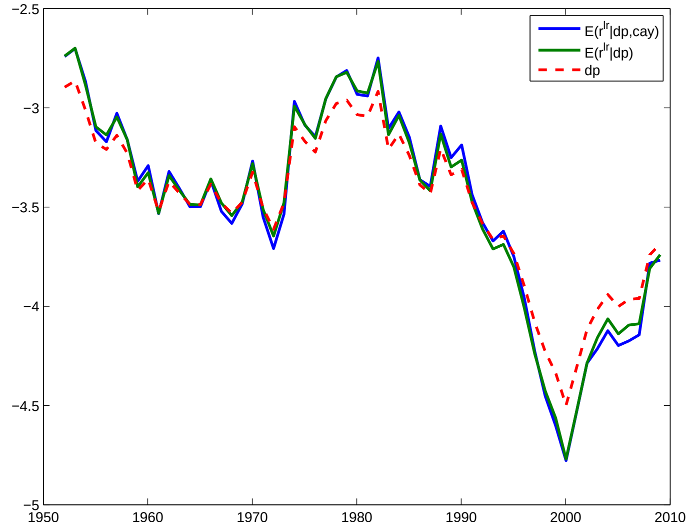

40
30
20
10
0
−10
−20
1950
1960
1970
1980
1990
2000
2010
cay
both



Fitted values of return-forecast regressions using dp only, and dp together with cay, along with the actual (ex post) return. Actual return r_{t+1} is graphed at time t along with its predictors.

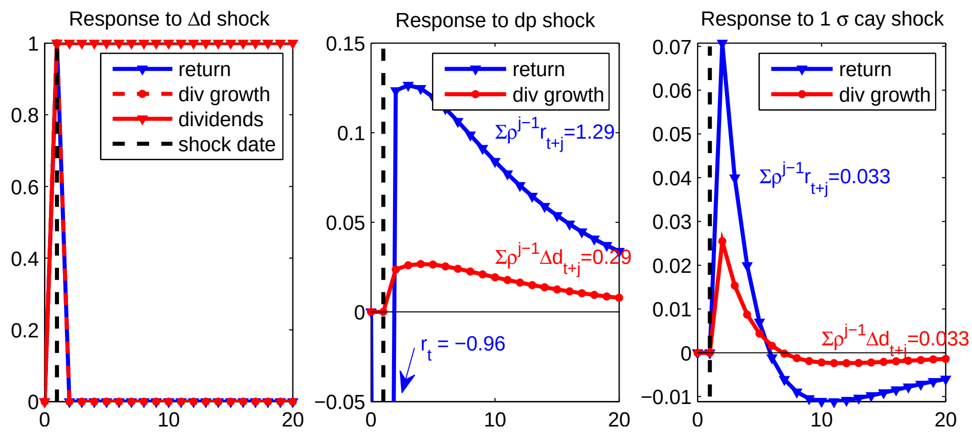
"Discount rates"

	Coefficients		t-statistics		Other statistics		
	dp_t	cay_t	dp_t	cay_t	R^2	$\sigma\left[E_t(y_{t+1})\right]\%$	$\frac{\sigma[E_t(y_{t+1})]}{E(y_{t+1})}$
r_{t+1}	0.12	0.071	(2.14)	(3.19)	0.26	8.99	0.91
Δd_{t+1}	0.024	0.025	(0.46)	(1.69)	0.05	2.80	0.12
dp_{t+1}	0.94	-0.047	(20.4)	(-3.05)	0.91		
cay_{t+1}	0.15	0.65	(0.63)	(5.95)	0.43		
$r^{lr} = \sum_{j=1}^{\infty} \rho^{j-1} r_{t+j}$	1.29	0.033					
$\Delta d^{lr} = \sum_{j=1}^{\infty} \rho^{j-1} \Delta d_{t+j}$	0.29	0.033					



Dividend yield and expected long horizon returns, $E_t r_t^{lr} = E_t \sum_{j=1}^{\infty} \rho^{j-1} r_{t+j}$.

Impulse response



	Only dp			dp and cay		
	σ^2	σ	% σ^2(dp)	σ^2	σ	% σ^2(dp)
var(dp)	0.123	0.351	100	0.124	0.352	100
var$\left[E_t(r_t^{lr})\right]$	0.223	0.472	180	0.224	0.473	181
var$\left[E_t(\Delta d_t^{lr})\right]$	0.015	0.120	12	0.015	0.122	12
-2*cov$\left[E_t(r_t^{lr}), E_t(\Delta d_t^{lr})\right]$	-0.114		-92	-0.115		-92

What about Repurchases?

(Boudoukh et al.).

Gross = (Dividends + Repurchases)/Price;

Net: (Dividends + Repurchases - Issues) / Price (net).

CF= based on cash flows, TS = based on treasury stock data.

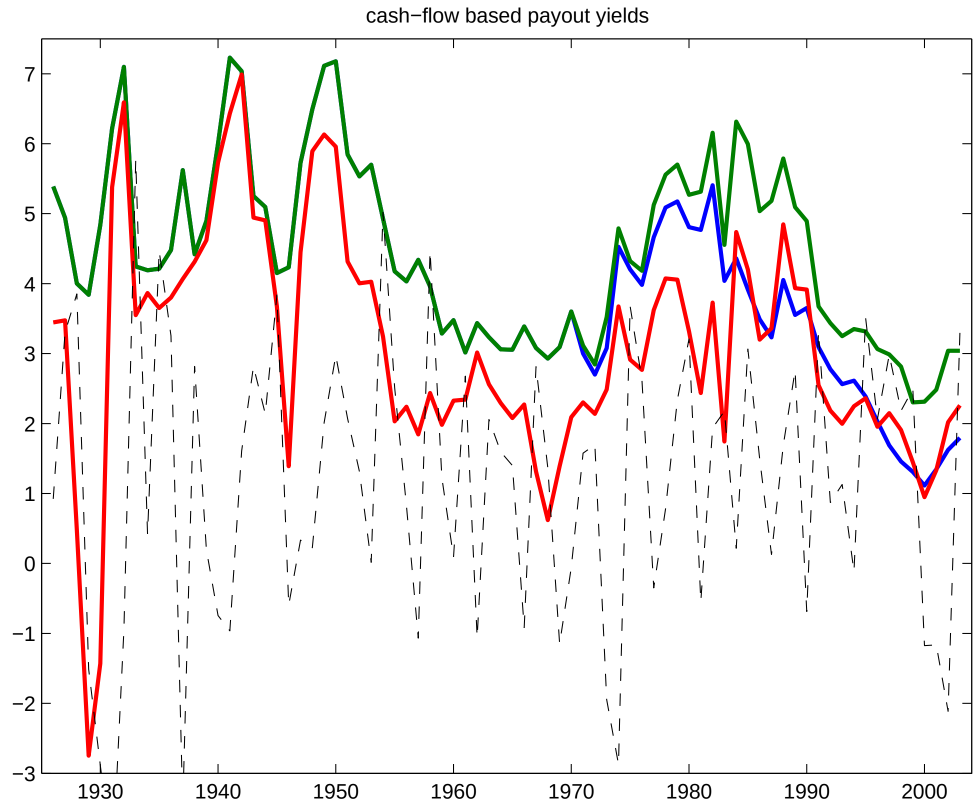
Table 2:

Panel A: Univariate Predictive Regressions

	Log(Dividend Yield)	Log(Payout (CF) Yield)	Log(Payout (TS) Yield)	Log(0.1 + Net Payout Yield
Full Sample: 1926 - 2003				
Coefficient	0.116	0.209	0.172	0.759
SE	0.052	0.062	0.060	0.143
t-statistic	2.240	3.396	2.854	5.311
P-Value	0.014	0.001	0.003	0.000
Sim Pval	0.170	0.045	0.080	0.000
R^2	0.055	0.091	0.080	0.262

Panel B: Multivariate Predictive Regressions

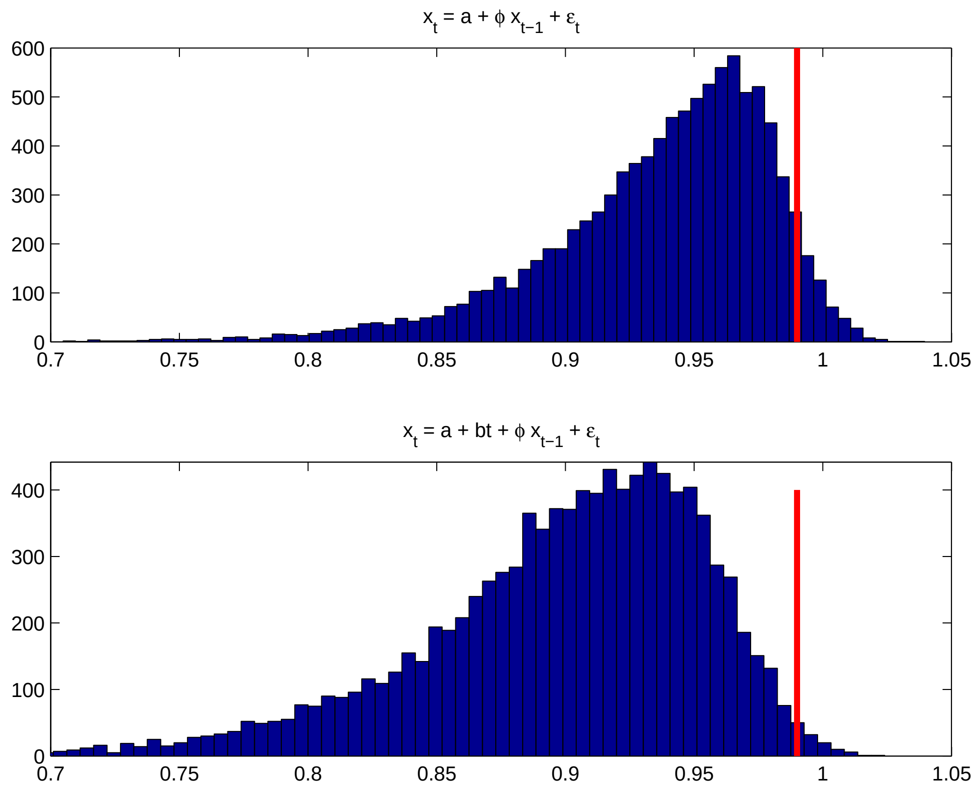
	Log(Dividend Yield)	Log(Payout (CF) Yield)	Log(Payout (TS) Yield)	Log(0.1 + Net Payout Yield	R^2
Coefficient	-0.088	0.318			0.098
SE	0.111	0.129			
Coefficient	-0.394		0.641		0.112
SE	0.216		0.251		
Coefficient	-0.042			0.830	0.267
SE	0.064			0.108	



Blue: D/P. Green: Payout/P. Red: (Net Payout)/P. Dashed: Return/10

variable	b	t	R^2
1926-2003			
DP	4.11	2.70	0.08
payout	5.25	3.46	0.10
net	5.88	5.05	0.22(!)
1931-2003			
DP	4.04	2.69	0.09
payout	4.91	3.23	0.11
net	4.57	3.25	0.12

Statistics and the dog



Distribution of estimates from an AR(1), with true coefficient = 0.99. T = 100.

	mean	median
b1	0.94	0.95
b2	0.90	0.91