

Table I

**Summary Statistics for Monthly Estimates of the Standard Deviations of
Stock Returns, Bond Returns, and Growth Rates of the Producer Price Index,
the Monetary Base and Industrial Production, 1858-1987.**

The summary statistics are the means, standard deviations, skewness, kurtosis and autocorrelations at lags 1, 2, 11 and 12 of the monthly standard deviation estimates and the Box-Pierce (1970) statistic for 24 lags of the autocorrelations, $Q(24)$. A 12th-order autoregression with different monthly intercepts is used to model the growth rates, then the absolute values of the errors from this model estimate the monthly standard deviations. The exception is the estimate of stock market volatility based on daily stock returns within the month. For further details, see equations (3a,b) in the text and the data appendix.

<u>Volatility Series</u>	<u>Sample Period</u>	<u>Sample Size</u>	<u>Mean</u>	<u>Std Dev</u>	<u>Skew</u>	<u>Kurt</u>	<u>Autocorrelations</u>					<u>Q(24)</u>
							<u>r₁</u>	<u>r₂</u>	<u>r₃</u>	<u>r₁₁</u>	<u>r₁₂</u>	
Monthly Stock Returns	1858-1987	1560	.0444	.0435	3.06	17.59	.21	.19	.24	.19	.16	913
Monthly Stock Returns	1885-1987	1235	.0455	.0450	3.16	18.43	.20	.20	.25	.18	.17	807
Daily Stock Returns	1885-1987	1235	.0415	.0272	3.16	14.29	.69	.58	.51	.44	.44	5711
Monthly Short-term Interest Rates	1858-1987	1560	.0010	.0141	5.42	53.21	.43	.34	.19	.14	.16	1053
Monthly High-quality Long-term Bond Returns	1858-1987	1560	.0084	.0116	3.25	13.76	.42	.32	.34	.25	.22	2589
Monthly Medium-quality Long-term Bond Returns	1920-1987	816	.0163	.0223	5.25	47.94	.40	.25	.33	.26	.24	1256
PPI Inflation Rates	1858-1987	1560	.0127	.0161	3.33	16.46	.48	.37	.28	.25	.24	2586
Monetary Base Growth Rates	1879-1987	1302	.0080	.0102	3.36	16.01	.43	.34	.24	.30	.29	1549
Industrial Production Growth Rates	1890-1987	1175	.0184	.0202	2.20	6.67	.41	.31	.30	.20	.19	1486

Table II

Summary Statistics for Autoregressive Predictive Models for the Volatility of Stock Returns, Bond Returns, and the Growth Rates of the Producer Price Index, the Monetary Base and Industrial Production, 1859-1987.

A 12th-order autoregression with different monthly intercepts is used to model the growth rates or returns, then the absolute values of the errors from this model $|u_t|$ estimate the monthly standard deviations. The exception is the estimate of stock market volatility based on daily stock returns within the month. The 12th-order autoregression for the volatility estimates is

$$|u_t| = \sum_{j=1}^{12} \alpha_j D_{jt} + \sum_{i=1}^{12} \alpha_i |u_{t-i}| + u_t \quad (3b)$$

This table shows the sum of the autoregressive coefficients ($\alpha_1 + \dots + \alpha_{12}$), indicating the persistence of volatility. A 't-test' for whether the sum equals unity, indicating non-stationarity, is in parentheses below the sum. It also shows an F-test for the equality of the 12 monthly intercepts ($\alpha_1 = \dots = \alpha_{12}$) and its p-value. Finally, it shows the coefficient of determination R^2 , and the Box-Pierce (1970) Q(24) statistic for the residual autocorrelations (which should be distributed as $\chi^2(24)$ in this case).

<u>Volatility Series</u>	Sum of AR Coefficients (t-test vs 1)	F-test for Equal Monthly Intercepts (p-value)	<u>R²</u>	<u>Q(24)</u>
Monthly Stock Returns	.8471 (-3.72)	0.97 (.475)	.132	45.8
Daily Stock Returns	.9634 (-1.07)	0.59 (.838)	.524	60.2
Monthly Short-term Interest Rates	.7925 (-4.40)	1.96 (.028)	.371	19.5
Monthly High-quality Long-term Bond Returns	.8376 (-4.20)	0.59 (.835)	.260	59.4
Monthly Medium-quality Long-term Bond Returns	.7769 (-3.47)	6.78 (.000)	.280	16.6
PPI Inflation Rates	.8438 (-4.29)	0.39 (.961)	.271	53.1
Monetary Base Growth Rates	.7918 (-4.74)	0.65 (.787)	.220	37.0
Industrial Production Growth Rates	.8336 (-3.82)	0.42 (.948)	.219	46.9

Table III

F-tests from Vector Autoregressive Models for Stock, Bond and Interest Rate Volatility, Including PPI Inflation Volatility, 1859-1987.

A four variable, 12th-order vector autoregressive (VAR) model is estimated for stock, bond, interest rate and PPI inflation volatility, including dummy variables for monthly intercepts. The F-tests reflect the incremental ability of the column variable to predict the respective row variables, given the other variables in the model. Measures of stock return volatility based on monthly data are used in the first four columns, and measures of stock return volatility based on daily data are used in the last four columns. The .05 and .01 critical values for the F-statistic with 12 and 200 degrees of freedom are 1.80 and 2.28, respectively. F-statistics greater than 2.28 are indicated with an asterisk"*".

Dependent Variable	<u>F-tests with Monthly Stock Volatility</u>				<u>F-tests with Daily Stock Volatility</u>			
	<u>Stock</u>	<u>Bond</u>	<u>Interest</u>	<u>PPI</u>	<u>Stock</u>	<u>Bond</u>	<u>Interest</u>	<u>PPI</u>
				<u>1859-1987</u>				
Stock	2.07	1.46	1.30	0.50				
Bond	0.80	10.82*	0.94	1.36				
Interest	0.86	2.65*	12.68*	0.94				
PPI	1.93	6.42*	0.68	5.70*				
				<u>1885-1987</u>				
Stock	9.33*	2.89*	0.89	0.95	67.92*	6.77*	1.65	2.10
Bond	5.83*	15.74*	1.98	1.14	2.83*	14.06*	3.75*	1.27
Interest	1.67	3.87*	21.99*	0.65	0.84	2.29*	21.39*	0.61
PPI	2.16	1.04	0.60	31.91*	1.04	1.13	0.83	28.83*
				<u>1885-1919</u>				
Stock	1.16	1.24	0.41	0.72	8.86*	4.31*	2.99*	1.26
Bond	1.41	8.05*	1.25	0.51	0.71	6.03*	1.20	0.86
Interest	2.41*	1.51	3.34*	0.48	0.94	1.20	4.57*	1.95
PPI	1.33	1.04	1.65	3.67*	1.14	0.70	0.59	3.29*
				<u>1920-1952</u>				
Stock	3.35*	3.07*	0.36	0.51	22.03*	3.52*	0.62	0.35
Bond	9.27*	4.49*	0.26	1.95	5.92*	4.09*	0.28	1.82
Interest	0.48	0.51	11.92*	0.21	0.61	0.31	11.81*	0.21
PPI	1.04	0.85	0.54	13.05*	0.88	1.03	0.56	12.55*
				<u>1953-1987</u>				
Stock	1.26	1.05	1.63	3.65*	6.50*	1.51	0.72	1.55
Bond	2.00	3.17*	3.20*	1.36	3.27*	3.09*	3.97*	1.52
Interest	1.67	5.23*	5.25*	1.99	0.99	5.04*	4.39*	1.90
PPI	0.63	0.35	0.76	19.16*	0.96	0.41	0.87	16.72*

Table IV

F-tests from Vector Autoregressive Models for Stock, Bond and Interest Rate Volatility, Including Monetary Base Growth Volatility, 1885-1987.

A four variable, 12th-order vector autoregressive (VAR) model is estimated for stock, bond, interest rate and monetary base growth volatility, including dummy variables for monthly intercepts. The F-tests reflect the incremental ability of the column variable to predict the respective row variables, given the other variables in the model. Measures of stock return volatility based on monthly data are used in the first four columns, and measures of stock return volatility based on daily data are used in the last four columns. The .05 and .01 critical values for the F-statistic with 12 and 200 degrees of freedom are 1.80 and 2.28, respectively. F-statistics greater than 2.28 are indicated with an asterisk "*".

Dependent Variable	<u>F-tests with Monthly Stock Volatility</u>				<u>F-tests with Daily Stock Volatility</u>			
	<u>Stock</u>	<u>Bond</u>	<u>Interest</u>	<u>Base</u>	<u>Stock</u>	<u>Bond</u>	<u>Interest</u>	<u>Base</u>
				<u>1885-1987</u>				
Stock	7.85*	2.60*	0.78	0.93	62.39*	5.83*	1.00	4.83*
Bond	5.36*	16.92*	1.79	2.25	2.76*	15.88*	3.39*	1.36
Interest	1.41	3.50*	22.30*	1.07	0.88	2.04	22.61*	0.60
Base	4.80*	1.26	0.55	21.72*	1.40	1.79	0.85	18.73*
				<u>1885-1919</u>				
Stock	1.19	0.92	0.44	0.79	8.80*	3.83*	2.95*	2.28*
Bond	1.63	3.52*	1.53	3.71*	1.04	3.09*	1.17	0.85
Interest	2.26	1.23	3.43*	0.82	0.96	1.54	4.61*	1.28
Base	1.98	0.87	1.46	2.96*	0.92	3.21*	1.03	2.47*
				<u>1920-1952</u>				
Stock	2.82*	3.16*	0.40	0.88	23.21*	3.64*	0.86	2.44*
Bond	7.80*	4.03*	0.26	1.11	4.78*	3.60*	0.27	1.16
Interest	0.40	0.38	11.99*	0.39	0.56	0.22	12.08*	0.42
Base	4.05*	1.64	0.41	5.23*	3.11*	1.72	0.52	6.22*
				<u>1953-1987</u>				
Stock	1.55	0.96	1.93	0.95	9.22*	1.02	0.68	1.15
Bond	2.00	3.38*	3.20*	1.08	3.11*	3.53*	3.45*	1.08
Interest	1.25	4.82*	6.31*	0.63	0.94	4.77*	5.36*	0.90
Base	0.83	0.68	1.43	1.63	1.11	0.85	1.26	1.74

Table V

F-tests from Vector Autoregressive Models for Stock, Bond and Interest Rate Volatility, Including Industrial Production Growth Volatility, 1891-1987.

A four variable, 12th-order vector autoregressive (VAR) model is estimated for stock, bond, interest rate and industrial production growth volatility, including dummy variables for monthly intercepts. The F-tests reflect the incremental ability of the column variable to predict the respective row variables, given the other variables in the model. Measures of stock return volatility based on monthly data are used in the first four columns, and measures of stock return volatility based on daily data are used in the last four columns. The .05 and .01 critical values for the F-statistic with 12 and 200 degrees of freedom are 1.80 and 2.28, respectively. F-statistics greater than 2.28 are indicated with an asterisk"*".

Dependent Variable	<u>F-tests with Monthly Stock Volatility</u>				<u>F-tests with Daily Stock Volatility</u>			
	<u>Stock</u>	<u>Bond</u>	<u>Interest</u>	<u>IP</u>	<u>Stock</u>	<u>Bond</u>	<u>Interest</u>	<u>IP</u>
				<u>1891-1987</u>				
Stock	9.47*	2.66*	0.85	1.03	64.93*	6.25*	1.25	2.24
Bond	5.12*	15.66*	1.85	0.49	2.68*	14.41*	3.43*	0.99
Interest	1.43	3.63*	21.87*	0.51	0.81	2.11	21.92*	0.62
IP	3.18*	0.76	0.75	24.07*	1.33	0.89	0.55	19.79*
				<u>1891-1919</u>				
Stock	0.98	1.59	0.60	0.98	7.38*	3.57*	2.70*	0.35
Bond	1.26	6.30*	1.24	1.24	0.96	4.29*	1.20	0.70
Interest	2.25	1.46	2.88*	0.37	0.72	1.22	3.97*	0.58
IP	0.95	0.85	0.66	3.27*	1.72	1.70	0.67	2.73*
				<u>1920-1952</u>				
Stock	3.82*	3.32*	0.39	1.29	22.36*	3.74*	0.65	0.72
Bond	8.46*	4.20*	0.27	0.79	5.18*	3.50*	0.23	0.66
Interest	0.52	0.38	12.25*	0.48	0.72	0.20	12.21*	0.56
IP	2.65*	1.31	0.57	5.60*	1.08	1.23	0.58	4.80*
				<u>1953-1987</u>				
Stock	1.72	0.92	1.64	1.21	9.77*	1.08	0.72	0.70
Bond	1.85	3.54*	2.88*	0.49	3.08*	3.66*	3.31*	0.61
Interest	1.22	4.70*	6.65*	1.14	0.71	4.42*	5.67*	1.20
IP	1.42	0.79	0.22	3.48*	0.77	1.02	0.29	3.37*

Table VI**Estimates of the Relations Between Business Cycles and Financial and Macroeconomic Volatility, 1859-1987.**

Estimates of dummy variable coefficients added to the autoregressive model for volatility. The t-statistics in parentheses () use White's (1980) heteroskedasticity consistent standard errors. A dummy variable equal to 1 during months designated as recessions by the National Bureau of Economic Research is added to a regression containing 12 monthly dummy variables and 12 lags of volatility. The estimates represent the increase in average volatility during periods of recession. The percentage increase in volatility during recessions relative to expansions is in braces { } below the standard errors. The estimates in the first two columns use as much data as are available for the respective series. Coefficient estimates more than two standard errors from zero are indicated with an asterisk "*".

Dependent Variable	1859-1987	1859-1919	1920-1952	1953-1987
Monthly Stock Returns	.0063* (2.93) {61%}	-.0014 (-.55) {-6%}	.0195* (3.09) {234%}	.0139* (3.12) {68%}
Daily Stock Returns	.0038* (3.05) {99%}	.0014 (0.92) {8%}	.0077* (2.55) {277%}	.0037 (1.81) {45%}
High-grade Long-term Bond Returns	.00065 (1.21) {42%}	.00019 (0.39) {14%}	.00234 (1.68) {161%}	.00160 (0.99) {70%}
Short-term Interest Rates	.00008 (1.22) {29%}	.00007 (0.88) {15%}	.00004 (0.33) {16%}	.00031 (1.41) {134%}
PPI Inflation Rates	.00024 (0.31) {10%}	-.00070 (-.58) {-13%}	-.00067 (-.64) {-15%}	-.00052 (-1.16) {-57%}
Monetary Base Growth Rates	.0015* (2.47) {125%}	.0017 (1.77) {54%}	.0010 (0.81) {42%}	-.0002 (-.51) {-11%}
Industrial Production Growth Rates	.0032* (2.58) {83%}	.0011 (0.48) {8%}	.0022 (0.96) {30%}	.0026* (2.35) {52%}

Table VII

Estimates of the Relation Between the Standard Deviation of Stock Returns and the Corporate Bond Quality Yield Spreads, 1920-1987.

The previous month's spread between the Moody's Baa long-term corporate bond yield and the Aa yield, $(y_{Baa} - y_{Aa})_{t-1}$, is included in an autoregressive model for volatility,

$$s_{st} = \sum_{i=1}^{12} a_i + \sum_{j=1}^{12} \beta_j s_{st-j} + ? (y_{Baa} - y_{Aa})_{t-1} + u_t.$$

Only the coefficient of the yield spread ? is shown. Asymptotic standard errors are in parentheses under the coefficient estimates. Coefficient estimates more than two standard errors from zero are indicated with an asterisk "*" .

Estimates of the Coefficient of the Yield Spread, ?

<u>Sample Period</u>	<u>Standard Deviation from Monthly Stock Returns</u>	<u>Standard Deviation from Daily Stock Returns</u>
1920-1987	14.83* (5.82)	3.937* (1.85)
1920-1952	18.07* (8.00)	4.256 (2.15)
1953-1987	5.649 (8.29)	3.950 (3.14)

Table VIII

Estimates of the Relation Between the Standard Deviation of Stock Returns and Leverage, 1901-1987.

Regressions of stock volatility on debt/equity ratios,

$$s_{st} = a_0 + a_1 (B/S)_{t-1} + u_t, \quad (5)$$

where $(B/S)_{t-1}$ is an estimate of the debt/equity ratio for the aggregate stock market portfolio at the end of month $t-1$. Generalized least squares estimates include an ARMA (1,3) process for the errors. Asymptotic standard errors are in parentheses under the coefficient estimates. $S(u)$ is the standard deviation of the errors, R^2 is the coefficient of determination including the effects of estimating the ARMA (1,3) process for the errors, and $Q(24)$ is the Box-Pierce (1970) statistic for 24 lags of the residual autocorrelations, which should be distributed as $\chi^2(20)$. The t-test for $a_0 = a_1$ tests whether the riskless debt model is an adequate approximation to the effect of leverage on stock return volatility, where $a_0 > a_1$ is implied by the risky debt model. Coefficient estimates more than two standard errors from zero are indicated with an asterisk "*". The p-values for the Box-Pierce statistic and for the two-sided alternative $a_0 \neq a_1$ are in parentheses under the test statistics.

Sample Period	\underline{a}_0	\underline{a}_1	$\underline{S(u)}$	$\underline{R^2}$	$\underline{Q(24)}$	t-test $\underline{a_0 = a_1}$
<u>Standard Deviation from Monthly Returns</u>						
1901-1987	.0269* (.0101)	.0512* (.0193)	.0424	.165	56.2 (.0000)	-.87 (.383)
1901-1952	.0232 (.0157)	.0700* (.0300)	.0475	.194	50.3 (.0002)	-1.08 (.279)
1953-1987	.0315* (.0066)	.0221 (.0146)	.0336	.055	16.9 (.657)	0.45 (.651)
<u>Standard Deviation from Daily Returns</u>						
1901-1987	.0376* (.0093)	.0154 (.0147)	.0187	.571	24.6 (.216)	1.01 (.311)
1901-1952	.0402* (.0135)	.0168 (.0225)	.0205	.606	35.0 (.020)	0.71 (.479)
1953-1987	.0317* (.0073)	.0101 (.0147)	.0157	.296	12.7 (.890)	1.03 (.301)

Table IX**Estimates of the Relation Between the Standard Deviation of Stock Returns and the Square Root of the Number of Trading Days, 1885-1987.**

Regressions of stock volatility on the square root of the number of trading days per month,

$$s_{st} = a_0 + a_1 \sqrt{\text{Days}_t} + u_t, \quad (6)$$

where $\sqrt{\text{Days}_t}$ is the square root of the NYSE trading days in the month. Generalized least squares estimates include an ARMA (1,3) process for the errors. Asymptotic standard errors are in parentheses under the coefficient estimates. $S(u)$ is the standard deviation of the errors, R^2 is the coefficient of determination including the effects of estimating the ARMA (1,3) process for the errors, and $Q(24)$ is the Box-Pierce (1970) statistic for 24 lags of the residual autocorrelations, which should be distributed as $\chi^2(20)$, with the p-value in parentheses under the test. Coefficient estimates more than two standard errors from zero are indicated with an asterisk "*".

<u>Sample Period</u>	<u>a_0</u>	<u>a_1</u>	<u>$S(u)$</u>	<u>R^2</u>	<u>$Q(24)$</u>
<u>Standard Deviation from Monthly Returns</u>					
1885-1987	-.0276 (.0357)	.0152* (.0073)	.0418	.142	56.1 (.0003)
1885-1919	-.0703 (.0612)	.0224 (.0122)	.0347	.028	16.1 (.708)
1920-1952	.0224 (.0764)	.0065 (.0152)	.0545	.194	45.7 (.0009)
1953-1987	-.0514 (.0567)	.0202 (.0124)	.0336	.055	16.3 (.697)
<u>Standard Deviation from Daily Returns</u>					
1885-1987	.0341* (.0150)	.0018 (.0029)	.0186	.538	21.9 (.347)
1885-1919	.0251 (.0231)	.0027 (.0046)	.0157	.226	10.9 (.950)
1920-1952	.0632 (.0318)	-.0025 (.0056)	.0231	.622	38.7 (.007)
1953-1987	-.0038 (.0225)	.0087 (.0048)	.0157	.300	13.1 (.872)

Table X

Estimates of the Relation Between the Standard Deviation of Stock Returns and Stock Market Trading Volume, 1885-1987.

Distributed lag regressions of stock volatility on the growth rate of NYSE share trading volume (Vol_t),

$$s_{st} = a_0 + \frac{\beta}{(1 - dL)} \text{Vol}_t + u_t. \quad (7)$$

Generalized least squares estimates include an ARMA (1,3) process for the errors. Asymptotic standard errors are in parentheses under the coefficient estimates. The distributed lag model for the effect of current and lagged share volume growth on the monthly standard deviation of stock returns implies geometric decay. The implied coefficient for lag k is βd^k . L is the lag operator, $L^k X_t \equiv X_{t-k}$. S(u) is the standard deviation of the errors, R² is the coefficient of determination including the effects of estimating the ARMA (1,3) process for the errors, and Q(24) is the Box-Pierce (1970) statistic for 24 lags of the residual autocorrelations, which should be distributed as $\chi^2(20)$, with the p-value in parentheses under the test. Coefficient estimates more than two standard errors from zero are indicated with an asterisk "*".

<u>Sample Period</u>	<u>a₀</u>	<u>β</u>	<u>d</u>	<u>S(u)</u>	<u>R²</u>	<u>Q(24)</u>
<u>Standard Deviation from Monthly Returns</u>						
1885-1987	.0454* (.0049)	.0473* (.0038)	.1561 (.0800)	.0394	.237	55.4 (.0000)
1885-1919	.0410* (.0023)	.0331* (.0047)	.3484* (.1320)	.0328	.127	19.2 (.509)
1920-1952	.0545* (.0150)	.0629* (.0074)	.0597 (.1188)	.0502	.316	40.9 (.004)
1953-1987	.0395* (.0025)	.0539* (.0092)	.3061 (.1684)	.0324	.124	19.9 (.462)
<u>Standard Deviation from Daily Returns</u>						
1885-1987	-.0246 (.0560)	.0168* (.0019)	.9984* (.0012)	.0179	.568	21.9 (.346)
1885-1919	.0372* (.0020)	.0123* (.0023)	.9536* (.0299)	.0151	.281	13.7 (.845)
1920-1952	.0484* (.0165)	.0203* (.0037)	.9007* (.1002)	.0223	.650	36.0 (.016)
1953-1987	.0351* (.0041)	.0182* (.0044)	.5952* (.2431)	.0154	.324	14.0 (.832)

Table XI

F-tests from Vector Autoregressive Models for Stock, Bond and Interest Rate Volatility, Including Growth in NYSE Share Trading Volume, 1885-1987.

A four variable, 12th-order vector autoregressive (VAR) model is estimated for stock, bond and interest rate volatility, and NYSE share trading volume growth (Vol), including dummy variables for monthly intercepts. The F-tests reflect the incremental ability of the column variable to predict the respective row variables, given the other variables in the model. Measures of stock return volatility based on monthly data are used in the first four columns, and measures of stock return volatility based on daily data are used in the last four columns. The .05 and .01 critical values for the F-statistic with 12 and 200 degrees of freedom are 1.80 and 2.28, respectively. F-statistics greater than 2.28 are indicated with an asterisk"*".

Dependent Variable	<u>F-tests with Monthly Stock Volatility</u>				<u>F-tests with Daily Stock Volatility</u>			
	<u>Stock</u>	<u>Bond</u>	<u>Interest</u>	<u>Vol</u>	<u>Stock</u>	<u>Bond</u>	<u>Interest</u>	<u>Vol</u>
				<u>1885-1987</u>				
Stock	10.29*	2.75*	0.84	1.55	77.94*	6.97*	1.38	7.65*
Bond	5.26*	17.70*	2.01	0.87	2.59*	17.37*	3.47*	0.86
Interest	1.62	3.68*	22.33*	0.70	0.87	2.22	22.36*	0.45
Vol	1.97	1.11	0.63	11.25*	1.30	1.60	0.66	10.94*
				<u>1885-1919</u>				
Stock	1.42	1.37	0.38	1.11	9.40*	4.35*	2.29*	3.97*
Bond	1.37	8.78*	1.22	0.83	1.09	6.14*	1.17	0.90
Interest	2.05	1.48	3.24*	0.96	0.87	1.18	4.45*	0.98
Vol	1.42	1.36	0.97	4.12*	1.86	1.10	0.76	3.55*
				<u>1920-1952</u>				
Stock	4.07*	3.80*	0.54	2.13	22.39*	3.35*	0.63	1.01
Bond	8.88*	4.06*	0.33	1.14	6.08*	3.40*	0.30	1.48
Interest	0.51	0.52	11.87*	0.52	0.62	0.35	11.87*	0.51
Vol	2.28*	2.13	0.62	4.20*	2.71*	0.99	0.59	3.53*
				<u>1953-1987</u>				
Stock	2.18	1.06	2.23	1.58	10.10*	1.18	0.75	0.54
Bond	1.87	3.57*	3.20*	0.39	2.85*	3.58*	3.58*	0.36
Interest	1.59	5.15*	6.02*	1.17	0.84	5.17*	5.66*	0.99
Vol	0.50	0.46	0.64	7.25*	1.58	0.49	0.82	7.50*

Table XII

Estimates of the Relation of the Standard Deviation of Stock Returns to the Predicted Volatility of Macroeconomic Variables, and the Effect of Leverage, 1900-1987

The regression model,

$$\ln s_{st} = a_e + a_r D_{rt} + \beta_1 \ln |s_{pt}| + \beta_2 \ln |s_{mt}| + \beta_3 \ln |s_{it}| + \gamma \ln (V/S)_{t-1} + u_t \quad (8)$$

includes a constant a_e (not shown in this table), a dummy variable D_{rt} equal to unity during N.B.E.R. recessions, the logarithms of the predicted standard deviations of PPI inflation $|s_{pt}|$, of money base growth $|s_{mt}|$, and of industrial production $|s_{it}|$, and the logarithm of leverage $(V/S)_{t-1}$. The predicted standard deviations are fitted values from the autoregressive models in Table II. The logarithm of the stock return volatility measures are the regressands. Asymptotic standard errors are in parentheses under the coefficient estimates. All tests use Hansen's (1982) heteroskedasticity and autocorrelation consistent covariance matrix, using 12 lags and leads and a damping factor of .7. R^2 is the coefficient of determination and $Q(24)$ is the Box-Pierce (1970) statistic for 24 lags of the residual autocorrelations, which should be distributed as $\chi^2(24)$ in this case, with the p-value in parentheses under the test. The column labeled Sum contains the sum of the coefficients of predicted volatilities. Coefficient estimates more than two standard errors from zero are indicated with an asterisk "*".

Sample Period	Recessions a_r	PPI β_1	Base β_2	IP β_3	Predicted Macroeconomic Volatility			R^2	Q(24)
					Sum	Leverage γ			
<u>Standard Deviation from Monthly Returns</u>									
1900-1987	.256* (.120)	-.035 (.076)	.103 (.072)	.079 (.059)	.147 (.088)	.275 (.440)	.022	70.5 (.000)	
1900-1952	.193 (.148)	-.035 (.096)	.261* (.088)	.145 (.079)	.371* (.131)	-.370 (.634)	.027	44.7 (.006)	
1953-1987	.479* (.082)	.112 (.128)	-.183 (.133)	.180* (.083)	.109 (.179)	.256 (.644)	.050	38.1 (.034)	
<u>Standard Deviation from Daily Returns</u>									
1900-1987	.182 (.096)	.087 (.045)	.210* (.062)	.031 (.043)	.328* (.068)	.091 (.316)	.208	2905 (.000)	
1900-1952	.177 (.125)	.077 (.057)	.273* (.080)	.099 (.052)	.450* (.116)	-.273 (.465)	.168	1795 (.000)	
1953-1987	.248* (.109)	.151* (.053)	.119 (.111)	-.009 (.052)	.262 (.137)	.047 (.316)	.120	540 (.000)	

Table A1**Variables Used in This Paper**

Series	Description (Source)	Sample Period, Size
Stock	Monthly return to a value-weighted portfolio of New York Stock Exchange stocks (CRSP/Cowles/Macaulay/Smith&Cole)	1/1857 - 12/1987 T=1572
s_t	Volatility of monthly stock returns from daily returns in the month (Dow Jones/Standard & Poor's)	2/1885 - 12/1987 T=1235
Interest	Short-term interest rate on low risk debt instrument (CRSP/Macaulay)	1/1857 - 12/1987 T=1572
y_{Aa} , Bond	Yield or return on high-grade long-term corporate debt (Moody's Aa/Macaulay)	1/1857 - 12/1987 T=1572
y_{Baa}	Yield on medium-grade long-term corporate debt (Moody's Baa)	1/1919 - 12/1987 T=828
PPI	Inflation of producer price index for all commodities (BLS/Warren & Pearson)	1/1857 - 12/1987 T=1572
Base	Growth rate of monetary base (high-powered money) (Friedman & Schwartz/NBER/Federal Reserve)	7/1878 - 12/1987 T=1314
IP	Growth rate of the index of industrial production (seasonally adjusted - Federal Reserve)	2/1889 - 12/1987 T=1187
V/S	Market value of firm divided by the value of stock for S&P composite (Holland and Myers)	1/1900 - 12/1987 T=1056
Vol	NYSE share trading volume (S&P/NYSE)	4/1881 - 12/1987 T=1280
Days	Number of NYSE trading days per month (Dow Jones/S&P)	2/1885 - 12/1987 T=1235

Table A2
Synopsis of US Economic History -- 1867-1986

<u>Dates</u>	<u>Important Event</u>
7/1857-12/1858	recession
11/1860-1/1861	recession
early 1862 --	convertibility of Union currency into specie suspended (not resumed until January 1, 1879); flexible exchange rates; 'greenback standard'; UK on gold standard during this period
5/1865-12/1867	recession
1869	Open Board of Stock Brokers and Stock and Exchange Board merge to form NYSE
7/1869-12/1870	recession
2/12/1873	law discontinues silver dollar
9/1873	Bank panic
11/1873-3/1879	recession (severe)
2/28/1878	Bland-Allison Act resumes silver dollars
1/1/1879	resumed gold standard/fixed exchange rates with UK
4/1882-5/1885	recession (mild)
5/1884	Bank panic (NY) - no suspension of convertibility
4/1887-4/1888	recession (mild)
8/1890-5/1891	recession (mild)
11/1890	Bank panic
7/14/1890	Sherman Silver Purchase Act (bimetallism)
2/1893-6/1894	recession (severe)
5/4/1893	Bank panic (suspension of convertibility of deposits into currency -- ends in Sept) -- stock market collapse (Erie RR in receivership in late July)
6/1893	President announces will repeal Sherman Silver Act
1/1896-6/1897	recession (mild)
4/1898	declare war on Spain
7/1899-12/1900	recession (mild)
10/1899	Boer War (South Africa)
3/14/1900	Gold Standard Act (killed bimetallism)
11/1899	Bank panic
5/9/1901	Morgan/Harriman fight for North Pacific collapses (more stock sold than issued)
9/1901	President McKinley assassinated
10/1902-8/1904	recession (mild)
6/1907-6/1908	recession (severe)
10/1907	Bank panic (suspension of convertibility of deposits into currency -- lifted in early 1908)

<u>Dates</u>	<u>Important Event</u>
5/30/1908 Commission	Aldrich-Vreeland Act - led to Federal Reserve in 1914 created National Monetary
2/1910-1/1912	recession (mild)
2/1913-12/1914	recession
12/23/1913	Federal Reserve Act
7/31/1914	NYSE closed due to World War I (under Aldrich-Vreeland Act) (trading resumed on 12/12/1914)
4/6/1917	US enters World War I
11/1918	World War I Armistice
9/1918-3/1919	recession (mild)
2/1920-7/1921	recession (severe)
early 1920	Fed reverses monetary expansion (raised discount rates in Jan and June)
6/1923-7/1924	recession (mild)
11/1926-11/1927	recession (mild)
10/29/1929	S&P falls to 162 (245 on 10/10)
10/1930-12/1930	first banking crisis
3/1931	second banking crisis
9/1931	UK leaves gold standard
9/1929-3/1933	crash (severe)
1/1933	banking panic
3/1933	National Banking Holiday 3/6-3/13 (US off gold standard)
1/31/1934	US sets official \$33 price for gold
6/1937-6/1938	recession (severe)
8/1939	World War II starts in Europe
12/7/1941	Pearl Harbor
early 1942	prices controls imposed (withdrawn in mid-1946)
5/8/1945	VE day
9/2/1945	VJ day
3/1945-10/1945	recession (mild)
12/1948-10/1949	recession (mild)
6/26/1950	Korean War starts
3/1951	Fed-Treasury accord (abandoned in 1953)
8/1953-5/1954	recession (mild)
9/1957-4/1958	recession (mild)
5/1960-2/1961	recession (mild)

<u>Dates</u>	<u>Important Event</u>
1/23/1962	Cuban missile crisis
11/22/1963	President Kennedy assassinated
1/1970-11/1970	recession (mild)
8/16/1971	Nixon price controls
12/1973-3/1975	recession (mild)
10/6/1979	Federal Reserve announces major policy changes
2/1980-7/1980	recession (mild)
8/1981-11/1982	recession (mild)

Sources: Friedman and Schwartz (1963) and the *Wall Street Journal*.