Stock market dispersion and business cycles

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Do stock market movements predict business cycles? Opinions differ. Focusing on the link between movements in the Standard and Poor's (S&P) 500 and the economy, Fisher and Merton (1984, p. 72) find that "stock price changes are the best single variable predictor of the business cycle." And Barro (1988, p. 1) concludes that "considering how difficult it is to make accurate macroeconomic forecasts, the explanatory power of the stock market is outstanding." Other economists are not so impressed. Samuelson (1966) aptly sums up the opposing view: "The stock market has predicted nine of the last five recessions." More recently, Stock and Watson (1988) find the forecasting ability of aggregate stock market indices to be uneven and they exclude them from their new index of leading economic indicators.

This article looks at another way to analyze stock price data that can help forecast business cycles. This kind of analysis is motivated by Black (1987, p. 113-114) who argued that the behavior of an industry's stock price can be used to forecast the industry's subsequent investment expenditures. Increases in an industry's stock price are generally followed by an increase in that industry's expenditures on plant and equipment. If stock prices are increasing in some industries but declining in others, it suggests that in subsequent years capital and labor will have to be reallocated from the contracting industries to the expanding ones. While beneficial in the long run, this reallocation of resources imposes short-run costs, that is, temporary declines in real activity as the resources move across industries. The greater the divergence in the fortunes of different industries, the more resources must be moved, and so the larger will be the resulting unemployment and fall in output.

As Black suggests, stock market data provide a way of measuring the extent of this divergence, or dispersion, in industry fortunes. In a well-functioning stock market, stock prices represent the discounted sum of present and expected future industry profits. As stock market participants forecast the contraction of some industries and the expansion of others, the price of stocks in the contracting industries will fall, while stock prices in the expanding industries will rise. The greater the predicted difference in the industries' prospects, the greater will be the dispersion in these industries' stock prices. Thus, an increase in the dispersion of stock prices should be followed by an increase in unemployment and a decline in real economic activity.

The stock market dispersion index

The stock market dispersion index measures the divergence in industrial fortunes. The basic data we used to construct the index are

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yearly average indices of various industries' stock prices, as constructed by S&P (1988).[1] We calculate the growth rate (g) of each industry's stock price, and then define the dispersion index as

$$SW = [(\Sigma\, c_i(g_{it} - g_t)^2\,)/n_t]^{1/2}$$

where g_{it} is the growth rate of stock prices for industry i at time t, g_t is the average growth rate of the whole set of stock prices at time t, n_t is the number of industries in the sample period, and the summation is taken over all the industries in the sample period. The weights, c_i, are based on the average share of industry i's employment in average total employment.[2]

Obviously, SW is simply the standard deviation of the growth rate of the industries' stock prices. If the stock prices of all industries rose (or fell) by the same amount in a given year, SW for that year would be zero. Similarly, a high value for SW in a given year would reflect uneven growth in stock prices across industries that year.

Our analysis shows that stock market dispersion was generally high in the 1970s, a decade of high unemployment and below-normal GNP (see Figure 1). This gives us some preliminary evidence that dispersion is negatively correlated with economic activity.

Relationship to other measures of dispersion

Our work is closely related to earlier work by Lilien (1982). In particular, our stock market dispersion index is motivated by Lilien's innovative use of cross-industry *employment* dispersion to capture the divergence in industry fortunes. Lilien constructed an index of employment dispersion as

$$\sigma_t = [\Sigma\, c_i(e_{it} - e_t)^2]^{1/2}$$

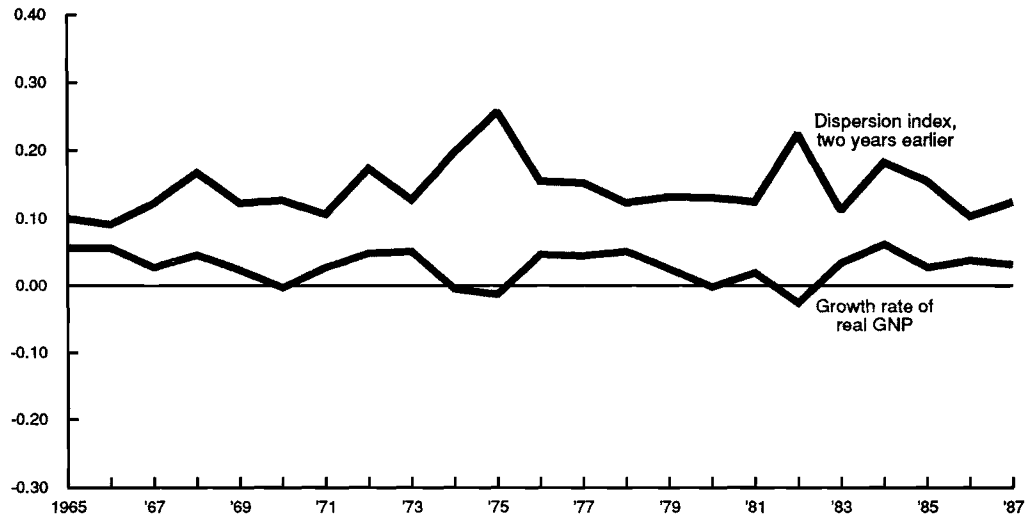
where e_{it} is the growth rate of employment in industry i at time t, e_t is the growth rate of aggregate employment at time t, and c_i is the weight attached to industry i. Lilien found a strong positive correlation between σ_t and the aggregate unemployment rate, U_t.

Rissman (1986) extended Lilien's analysis by constructing a dispersion measure that distinguishes *permanent* shifts in the distribution of employment across industries from temporary shifts. Her point was that the reallocation of labor across industries was more likely to occur in response to permanent shifts in the fortunes of industries.

We follow an alternate, but complementary, strategy by using stock market data. The use of stock market data provides a natural way of separating temporary shocks to an

FIGURE 1

Stock market dispersion and real GNP growth



industry's fortunes from permanent ones. The industry stock price represents the present value of expected profits over a long horizon. The impact of an innovation in industry profits on its stock price will depend on the persistence of the shock. If the shock is purely temporary—in the sense that it will soon be reversed—the innovation will have little impact on the present value of expected profits and, hence, will have little impact on the industry's stock price. On the other hand, if the shock is expected to persist for a long time, the innovation will have a significant impact on expected future profits and will lead to a large change in the industry stock price. Furthermore, it is these sorts of persistent shocks that motivate reallocations of labor and capital across sectors. Hence, a dispersion index constructed from industries' *stock prices* automatically assigns greater weight to permanent shifts over temporary shifts.

The dispersion index and the S&P 500: which moves first?

We next investigate the relationship between the stock market dispersion index and the S&P 500.[3] From Figure 2, it appears that increases in the dispersion index tend to predict declines in the S&P 500 by two years.

To do a formal test of whether the dispersion index leads the aggregate index, or vice versa, requires regression analysis. The results reported in Table 1 are based on annual observations from 1948 to 1987. Equation (1) regresses the growth in the S&P 500, which we label ΔSP, on three lags (that is, past values) of SW. This regression tells us the extent to which movements in the S&P 500 are *preceded* by movements in the dispersion index. As shown by the R^2 statistic, past values of SW account for nearly 30 percent of the variation in ΔSP. The impact of $SW2$ on ΔSP is particularly strong, suggesting that an increase in the dispersion index is followed by a marked decline in the S&P 500 two years later. In equation (2) we add three lags of ΔSP to the equation. This allows for the possibility that movements in the S&P 500 are due to its own past movements. The relationship between $SW2$ and ΔSP continues to hold.

Equations (3) and (4) are analogous to (1) and (2), but test the reverse relationship, namely, whether movements in the S&P 500 lead to any significant movements in SW. As our results indicate, there is no evidence that the reverse relationship holds. Thus, our dispersion index is *not* preceded by a general movement of stock prices. This suggests that any correlation between the dispersion index and real GNP must arise from an economic channel *separate* from the more conventional effects measured by the aggregate index.

Predicting real GNP movements: is dispersion better than the S&P 500?

To examine the relationship between stock market dispersion and economic activity

FIGURE 2

Stock market indicators: Dispersion index and S&P 500

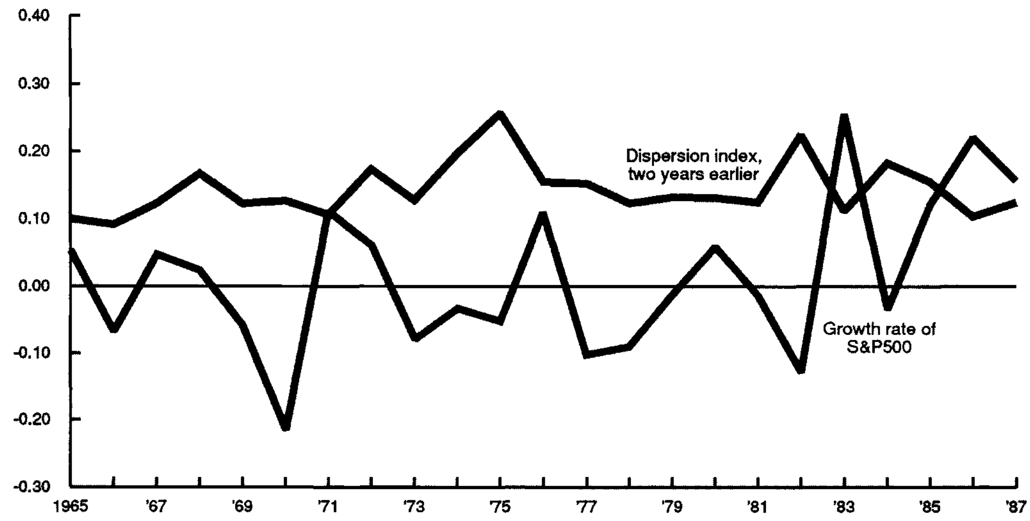


TABLE 1

Relationship between dispersion index and S&P 500

	(1) ΔSP	(2) ΔSP	(3) SW	(4) SW
Constant	0.268**	0.260	0.138**	0.116*
	(0.106)	(0.135)	(0.006)	(0.042)
SW1	-0.804	-0.785	.	0.133
	(0.535)	(0.554)		(0.080)
SW2	-1.723**	-1.716**	.	0.080
	(0.536)	(0.578)		(0.179)
SW3	0.802	0.832	.	0.051
	(0.528)	(0.618)		(0.191)
ΔSP1	.	0.093	-0.039	-0.032
		(0.162)	(0.042)	(0.050)
ΔSP2	.	-0.144	-0.021	-0.018
		(0.148)	(0.042)	(0.046)
ΔSP3	.	0.056	-0.064	-0.060
		(0.150)	(0.042)	(0.046)
R^2	0.2974	0.3235	0.0877	0.1137
D.W.	1.715	1.889	1.723	2.017

NOTE: *Denotes that the coefficient is significant at a 5% level.
**Denotes that the coefficient estimate is different from zero at a 1% level of significance.
D.W. = Durbin-Watson statistic.

formally, we start with the simplest framework. The first equation in Table 2 regresses the annual growth rate of real GNP, which we call ΔY, on three lags of *SW* and three lags of ΔY.[4] This simple specification can explain roughly 19 percent of variation in output growth. Moreover, the coefficient on dispersion lagged two years, *SW2*, is negative, and has a p-value of 0.01. This means that an increase in the dispersion index is followed by a statistically significant decline in real GNP growth two years later.

We next compare the ability of the dispersion index to predict real GNP growth with that of the S&P 500. The results are shown in equation (2). Here we see that the coefficient on $\Delta SP1$ is positive and has a p-value of 0.03. This means that an increase in the S&P 500 is followed a year later by a statistically significant decline in real GNP growth.[5] This equation explains about 22 percent of the variation in output growth, slightly more than the amount explained by the dispersion regression. The results from equations (1) and (2) suggest that if we wanted to use a *single* indicator to predict real GNP growth, the S&P 500 and the stock market dispersion index perform about equally well. Of course, the dispersion index offers the advantage that it predicts real GNP growth two years in advance.

Obviously, there is no reason not to use both stock market indicators simultaneously. As shown in equation (3), by doing so we can explain 34 percent of the variation in real GNP growth. When compared to equation 2, the coefficient estimate of $\Delta SP1$ drops considerably (accompanied by a slight rise in its standard error) so that it is no longer significantly different from zero at conventional levels of significance: the p-value is 0.11. On the other hand, the coefficient on *SW2* still has a p-value of 0.03. Hence the relationship between the aggregate stock market index and output growth is attenuated by the inclusion of the dispersion index.

The remaining two equations in Table 2 re-examine the conclusions reached in Table 1 about the relationship between the S&P 500 and dispersion. Equation (4) shows that the inclusion of past values of GNP growth does not alter the conclusion that an increase in the dispersion index has a dampening effect on the S&P 500 after a lag of two years. Equation (5) shows that, as before, movements in the S&P 500 do *not* lead to significant movements in dispersion.

To summarize, the analysis reported in Tables 1 and 2 suggests:

(1) Stock market dispersion measures explain a significant fraction of the variance of output growth. The increase in dispersion occurs two years in advance of the decline in output growth.

TABLE 2

Dispersion, S&P 500, and real GNP growth

	(1) ΔY	(2) ΔY	(3) ΔY	(4) ΔSP	(5) SW
Constant	0.056 (0.007)	0.031** (0.029)	0.057 (0.030)	0.348* (0.140)	0.117* (0.046)
SW1	0.028 (0.127)	.	0.008 (0.127)	-1.087 (0.561)	0.131 (0.185)
SW2	-0.331** (0.129)	.	-0.290* (0.127)	-1.782** (0.588)	0.094 (0.194)
SW3	0.103 (0.135)	.	0.087 (0.140)	0.634 (0.648)	-0.074 (0.214)
ΔSP1	.	0.080* (0.034)	0.060 (0.038)	0.191 (0.170)	-0.033 (0.056)
ΔSP2	.	-0.030 (0.036)	-0.038 (0.036)	-0.033 (0.164)	-0.023 (0.054)
ΔSP3	.	-0.034 (0.036)	-0.038 (0.034)	-0.046 (0.159)	-0.060 (0.052)
ΔY1	0.190 (0.176)	-0.016 (0.186)	0.072 (0.192)	-1.783* (0.888)	-0.008 (0.294)
ΔY2	-0.149 (0.104)	-0.033 (0.097)	-0.100 (0.102)	0.172 (0.470)	0.052 (0.155)
ΔY3	0.051 (0.096)	0.029 (0.095)	0.064 (0.094)	0.127 (0.432)	-0.028 (0.143)
R^2	0.1899	0.2232	0.3434	0.4122	0.1176
D.W.	1.998	1.920	1.946	1.878	2.009

NOTE: *Denotes that the coefficient is significant at a 5% level.
**Denotes that the coefficient estimate is different from zero at a 1% level of significance.
D.W. = Durbin-Watson statistic.

(2) Movements in the dispersion measure cannot be attributed to past movements in the S&P 500; on the other hand, a significant fraction of the variation in the S&P 500 can be attributed to changes in dispersion.

(3) Additionally, movements in dispersion are unrelated to past output growth. Thus, there is little evidence in favor of the "reverse causation" argument that aggregate business cycle factors, by affecting industries differentially, lead to increases in dispersion.

Controlling for policy influences on real GNP growth

Finally, we augmented the regressions reported above by extending the analysis to include the effects of fiscal and monetary policy variables. To capture the impact of variations in government spending, the equation includes the growth rate of real federal purchases, ΔLF and two lags of this variable. To capture the impact of monetary policy, we use the growth rate of the monetary base, ΔB, and two lags of this variable.[6]

The first equation in Table 3 is a regression of real GNP growth on three lagged values of the growth rate of the S&P 500 and the monetary and fiscal variables. Although none of the variables quite attains standard levels of statistical significance, several of the variables—ΔSP, ΔB, and $\Delta B1$—are close to significance with p-values of about 0.09. Moreover, the regression explains a large fraction of the variance in output growth, slightly over 40 percent.

The second equation replaces the S&P 500 by the dispersion index. We see that this does not lead to any loss of explanatory power, with the R^2 remaining about .41. Also, as in Table 2, *SW2* is highly significant with a p-value of 0.01.

Equation (3) is our most general specification. It allows for both stock market indicators as well as monetary and fiscal policy to influence growth. Once again we obtain results similar to those from Table 2: When both the S&P 500 and the dispersion index are included simultaneously, only the dispersion effect remains statistically significant.

Finally, there may be concerns about the possible endogeneity of the contemporaneous values of the monetary and fiscal variables; in view of this, we exclude them from the regression. As shown in equation (4), this has no appreciable impact on our results.

TABLE 3

Controlling for policy influences on real GNP growth

	(1) ΔY	(2) ΔY	(3) ΔY	(4) ΔY
Constant	0.033**	0.067**	0.080**	0.063*
	(0.007)	(0.023)	(0.026)	(0.029)
SW1	.	0.016	0.001	0.002
		(0.116)	(0.107)	(0.122)
SW2	.	-0.324**	-0.327**	-0.252**
		(0.118)	(0.113)	(0.125)
SW3	.	0.043	-0.023	0.075
		(0.125)	(0.137)	(0.141)
ΔC1	0.057	.	0.025	0.059
	(0.033)		(0.036)	(0.040)
ΔC2	-0.029	.	-0.044	-0.041
	(0.030)		(0.029)	(0.034)
ΔC3	-0.044	.	-0.055	-0.044
	(0.029)		(0.029)	(0.032)
ΔB	0.286	0.246	0.280	.
	(0.168)	(0.184)	(0.175)	
ΔB1	-0.335	-0.182	-0.237	-0.104
	(0.194	(0.203)	(0.191)	(0.161)
ΔB2	-0.005	-0.065	-0.067	-0.042
	(0.171)	(0.161)	(0.162)	(0.186)
ΔLF	0.036	0.078	0.063	.
	(0.045)	(0.048)	(0.044)	
Δ LF1	-0.004	-0.041	-0.026	-0.024
	(0.044)	(0.049)	(0.045)	(0.042)
Δ LF2	0.006	0.020	0.013	0.004
	(0.023)	(0.022)	(0.021)	(0.022)
R^2	0.4143	0.4126	0.5572	0.3641
D.W.	2.149	2.062	2.281	1.746

NOTE: *Denotes that the coefficient is significant at a 5% level.
**Denotes that the coefficient estimate is different from zero at a 1% level of significance.
D.W. Durbin-Watson statistics.

Conclusion

We interpret our results as providing support for the contention that stock market dispersion is a potentially important factor for predicting business cycles. Our confidence in this claim is bolstered by results in a series of related papers: Our 1990a paper uses a long sample period, 1926 to 1987, and shows that increases in dispersion are followed by increases in unemployment two or three years later. In Loungani, Rush and Tave (1990b) we extend the analysis to quarterly data for the post-WWII period. The evidence in that work is broadly consistent with the annual results reported here and in the 1990a paper. Finally, Loungani and Rush (1990) examine the very high unemployment that Britain experienced between 1920 and 1938, a period that is widely regarded as constituting a macroeconomic puzzle. But, it turns out that stock market dispersion can resolve part of the puzzle since a dispersion index explains a fairly large fraction of the unemployment over this period.

FOOTNOTES

[1]The industries, which are defined by S&P, range in size from 2 firms to 14 firms and the indices are computed by weighting each firm's stock price according to the firm's market value. S&P began compiling these data in 1926; at various times additional industries have been added (and others subtracted) so that currently S&P compiles indices for about 85 industries. We used a subsample of 45 indices, including virtually all that start before 1943. The list of industries used, the motivation for selecting them, and additional details on constructing the index are provided in Loungani, Rush, and Tave (1990a).

[2]The weights are from the period 1968 to 1972, which is roughly the mid-point of our sample.

[3]To control for the effects of inflation, the S&P 500 is deflated by the GNP deflator.

[4]Results similar to those reported in Table 2 (and later in Table 3) hold if we regress the log of real GNP on a time trend, a lagged dependent variable, and the other variables of interest.

[5]There is a lack of consensus on why this correlation arises. One explanation, consistent with the work of Fama (1981), is the movements in the stock market index proxy for underlying shifts in the economy-wide prospective return to capital. Thus a decline in the stock market signals a reduction in the return to investment in new capital equipment. This leads to a fall in investment, which, subsequently, lowers GNP. Other explanations, however, do not assign any such structural interpretation but simply treat stock market movements as a leading indicator of economic activity.

[6]The lagged output growth variables were always insignificant in these regressions and their inclusion did not affect the other coefficient estimates. Thus, we exclude them from the regressions that follow. Our results are also insensitive to the choice of the monetary policy variable. In other papers we have used the unexpected component of the monetary base as well as interest rate spreads to capture the impact of monetary policy and obtained results similar to those reported here.

REFERENCES

Barro, Robert J. 1988. "The stock market and the macroeconomy: implications of the October 1987 crash." Working paper. Harvard University.

Black, Fisher. 1987. *Business cycles and equilibrium.* New York: Basil Blackwell.

Fama, Eugene. 1981. "Stock returns, real activity, inflation and money." *American Economic Review* 71 (September) pp. 545-565.

Fisher, Stanley, and Robert Merton. 1984. "Macroeconomics and finance: the role of the stock market." *Carnegie-Rochester Conference Series on Public Policy* 21 pp. 57-108.

Lilien, David. 1982. "Sectoral shifts and cyclical unemployment." *Journal of Political Economy* 90 (August) pp. 777-793.

Loungani, Prakash, and Mark Rush. 1990. "Sectoral shifts in interwar Britain." Working Paper # 90-7. Federal Reserve Bank of Chicago.

Loungani, Prakash, Mark Rush, and William Tave. 1990a. "Stock market dispersion and unemployment." *Journal of Monetary Economics* 25 (June) pp. 367-388.

Loungani, Prakash, Mark Rush, and William Tave. 1990b. "Stock market dispersion and real economic activity: evidence from quarterly data." Working Paper # 90-15. Federal Reserve Bank of Chicago.

Rissman, Ellen. 1986. "What is the natural rate of unemployment?" Federal Reserve Bank of Chicago, *Economic Perspectives* (September/ October) pp. 3-17.

Samuelson, Paul. 1966. "Science and stocks." *Newsweek* (September 19).

Standard & Poor's. 1988. *Security price index record.* New York.

Stock, James, and Mark Watson. 1988. "A new approach to the leading economic indicators." Working Paper. Northwestern University.