STOCK MARKET DISPERSION AND REAL ECONOMIC ACTIVITY: EVIDENCE FROM QUARTERLY DATA

Prakash Loungani, Mark Rush and William Tave

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Prakash Loungani
University of Florida
and
Federal Reserve Bank of Chicago

Mark Rush
University of Florida

and

William Tave
Brown University

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ABSTRACT

We conduct an empirical investigation into the effects that stock market dispersion has on real economic activity. The results from fairly standard reduced-form equations suggest that, controlling for the effects of monetary and fiscal policy, stock market dispersion leads to a significant increase in unemployment and a decline in real GNP and investment. We also report results from including our stock market measure and a Lilien-type employment dispersion measure [see Lilien (1982)] in several VAR systems in which unemployment is used as the indicator of real economic activity. The performance of the employment-based measure turns out to be very sensitive to the ordering of the variables in the system. The stock market dispersion measure always explains a larger fraction of the variance of unemployment than does the employment dispersion measure, and the fraction explained is not sensitive to the ordering of the variables. Even after the inclusion of an interest rate variable and the Standard & Poor's 500 in the VAR system, stock market dispersion accounts for between 26% and 33% of the variance of unemployment at long horizons.

Prakash Loungani
Economic Research
Federal Reserve Bank of Chicago
230 S. LaSalle St.
Chicago, IL 60690
312-322-8203

Mark Rush
Department of Economics
University of Florida
Gainesville, FL 32611
904-392-0318

William Tave
Department of Economics
Brown University
Providence, RI 02912

1. Introduction

David Lilien's (1982) paper has sparked a debate on the extent to which fluctuations in the aggregate unemployment rate may be attributed to the reallocation of labor across sectors. The voluminous literature that has followed Lilien can be divided into two groups: (1) time-series studies which test whether proxies for the amount of sectoral labor reallocation are correlated with the aggregate unemployment rate, and (2) studies which attempt to measure labor reallocation and its contribution to unemployment directly by using panel data sets. While this paper belongs to the first group, it is useful to briefly review the evidence from the second group of studies.

Lilien appears to have had in mind a model--such as that of Lucas and Prescott (1974)--where the time required to switch sectors is fixed exogenously, but downturns are marked by an increase in the number of workers who experience unemployment as they switch between sectors. Using data from the Current Population Survey, Murphy and Topel (1987) present evidence against this early ("search") version of the sectoral shifts hypothesis.

However, one can consider alternate models where the impact of sectoral shocks is not just on the number of workers who experience unemployment as they switch sectors, but also on the time it takes workers to switch sectors. This feature is likely to emerge in models that assign a prominent role to sector-specific human capital. For instance, Topel and Weiss (1985) present a model where some periods--such as the 1970's and early 1980's--are marked by increased uncertainty about the relative returns to sector-specific human capital investment, leading to an increase in the time that displaced workers take to switch sectors. In Rogerson's (1989) model, the impact of sectoral shocks leads to very high durations of unemployment among older workers who are displaced from their jobs: The basic idea is that these workers are at an disadvantage relative to younger workers in that they do not have as long to reap the benefits of (new) human capital accumulation and hence require higher wages than do otherwise identical younger workers. Using the Michigan Panel Study of Income Dynamics, a longitudinal data set that enables researchers to observe workers' mobility and unemployment experience over several consecutive years, Loungani and Rogerson (1989a) and Loungani, Rogerson and Sonn (1989b) present evidence consistent with these broader views of the sectoral shifts hypothesis that stress the importance of sector-specific human capital accumulation.

Since most of the panel data sets start around the late 1960's or early 1970's, they do not offer any evidence on the contribution of sectoral reallocation to unemployment prior to that period. Hence, time-series studies--which typically construct *cross-industry dispersion* indices to proxy for the amount of sectoral reallocation of resources--are a useful source of complementary evidence. As discussed in Davis (1985, p.32) and Barro (1986, p.138), the use of a dispersion index offers some advantages to researchers who are interested primarily in determining the impact of sectoral shocks on broad macroeconomic aggregates such as the aggregate unemployment rate. Barro states that the use of the dispersion index circumvents "the need to isolate a detailed array of many--mostly unobservable--disturbances to technology and preferences (that) motivate reallocations of resources across sectors." Davis points out that "allocative disturbances from any particular source are likely to occur rather infrequently over available sample sizes," which makes it difficult to explicitly incorporate variables that capture the effects of allocative disturbances into an aggregate unemployment equation.

In this paper we construct a measure of the cross-industry dispersion in stock price growth to proxy for the amount of sectoral reallocation of capital and labor undertaken by the economy. In a well-functioning stock market, the industry stock price represents the present value of expected future industry profits. An increase in the dispersion of stock prices across industries reflects the occurrence of shocks that are expected to have differential impacts on industries' profits. If these shocks are expected to be persistent, productive resources, such as capital and labor, will be displaced from the industries that are expected to be adversely affected. To the extent that these resources are not immediately absorbed into more profitable industries, the dispersion in stock prices will be followed by a decline in real economic activity. In Section 2 of the paper, we present a brief theoretical framework along these lines. We also present details on the construction of the stock market dispersion index.

While previous studies have focused on the impact of labor reallocation on unemployment, it is likely that the reallocation of capital across sectors is also fairly costly. It is therefore plausible that the adjustment costs associated with capital reallocation lead to declines in other macroeconomic aggregates. In Section 3 we show, using quarterly data for the period 1947 to 1987, that an increase in stock market dispersion leads not only to a statistically significant increase in unemployment but also to a decline in output and investment.

The results for unemployment bolster our preliminary work on the relationship between stock market dispersion and unemployment. Loungani, Rush and Tave (1990) present evidence on the determinants of U.S. unemployment over a long time period, 1929 to 1987. Using annual data, we find that unemployment depends on up to three lags of a stock market dispersion measure. Loungani and Rush (1990) construct a stock market dispersion measure using British data for the period 1912 to 1938. This measure appears to reflect fairly well the decline of the traditional export industries and the rise of newer industries and turns out to explain a large fraction of British interwar unemployment.

Our stock market dispersion index is clearly motivated by Lilien's use of cross-industry *employment* dispersion to proxy for the intersectoral flow of labor. Many researchers, most notably Abraham and Katz (1984, 1986), have questioned Lilien's use of employment dispersion as a measure of labor reallocation. Their basic point is that movements in employment dispersion may simply be reflecting the well-known fact that the business cycle has non-neutral effects across industries. The increase in the dispersion of employment growth rates could reflect, not increased labor reallocation, but simply the uneven impact of aggregate demand shocks on temporary layoffs in different industries. Hence there is an observational equivalence between the predictions of the sectoral shifts hypothesis and the more traditional "aggregate demand hypothesis."

The main advantage of a stock market dispersion measure relative to Lilien's measure is that stock prices respond more strongly to disturbances that are perceived to be permanent than to temporary disturbances, which need not be true of employment changes. The industry stock price represents the present value of expected profits over a long horizon. The impact of innovations in industry profits on its stock price will therefore depend on how long the shocks are expected to be persist. If the shocks are purely temporary, the innovations will have little impact on the present value of expected profits and, hence, will have little impact on industries' stock prices. On the other hand, if the shocks are fairly persistent, the innovations will have a significant impact on expected future profits and will lead to large changes in industries' stock prices. Furthermore, it is these sorts of persistent shocks that will cause productive resources, such as capital and labor, to be displaced from the adversely affected industries. Hence, a dispersion index constructed from industries' *stock prices* automatically assigns greater weight to permanent structural changes rather than temporary cyclical shocks. We conjecture, therefore, that a stock market based dispersion measure is less likely than an employment-based measure to reflect changes in temporary layoffs; this implies that our stock market dispersion variable is less sensitive than employment dispersion measures to aggregate demand disturbances that result in large swings in temporary layoffs.

Rather than rely solely on these conjectures, we put them to the test in Section 4 of the paper. Abraham-Katz suggest two methods of resolving the observational equivalence problem that they identify. The first is to test whether the correlation between the dispersion index and the aggregate vacancy rate is positive or negative. Abraham-Katz argue that if the dispersion index is a good proxy for sectoral shifts this correlation should be positive, since the reduced labor demand in some sectors will be matched by increased hiring in other sectors. On the other hand, if dispersion is attributable to aggregate demand shocks, then this correlation should be negative since all sectors will reduce their hiring. The empirical relationship between dispersion and a proxy for the vacancy rate has been investigated in independent work by Brainard and Cutler (1989) using a stock market dispersion index similar to ours.[1] They find that the impulse response of the vacancy rate proxy to innovations in their stock market dispersion "is not consistently of one sign, and the standard errors are large relative to the coefficients."

This method of resolving the observational equivalence problem suffers from the lack of availability of adequate vacancy data for the U.S. Instead, researchers are forced to use an index based on help-wanted advertising in newspapers in 51 cities. An additional problem is that recent work by Hosios (1988) implies that sectoral shifts models that allow for both capital and labor mobility generate a negative correlation between dispersion and vacancy rates. Hence in his model information on vacancy rates cannot be used to distinguish the aggregate demand hypothesis from the sectoral shifts hypothesis.

The second method--which is essentially the one we follow in this paper--involves "purging" the dispersion index of movements that can be attributed to aggregate demand disturbances and then testing if the residual measure of dispersion is still significantly correlated with economic activity. This method requires a careful specification of a list of regressors that adequately capture aggregate demand. Recognizing that stock prices are forward-looking, we include in our list not only standard aggregate demand shifters such as money growth and government spending shocks, but also "information" variables, such as interest rate spreads and mean stock returns, that have emerged in recent studies as strong predictors of future economic activity. However, even after controlling for the effects of these current and potential aggregate demand shifts, innovations in our stock market dispersion index explain nearly 33% of the variance of unemployment at long horizons. On the other hand, a Lilien-type *employment* dispersion measure explains less than 5% of the variance of unemployment once the aggregate demand shifters are included. To summarize, the empirical evidence strongly supports our conjecture that the stock market dispersion index is less susceptible to the Abraham-Katz critique than Lilien's measure.

2. Stock Market Dispersion and Economic Activity

A. Theoretical Framework

We begin by presenting a theoretical framework that is consistent with the key ideas in Lilien (1982), Black (1982) and Davis (1987). For convenience we refer to this framework as the costly sectoral mobility model.

Consider a n-sector economy with each sector producing a distinct product using a vector of productive resources or inputs, Z_{it}. Profits in each sector are given by,

(1) $\pi_{it} = \pi(Z_{it})\varepsilon_{it}$

where the ε_{it}'s are uncorrelated across sectors, with mean ε and (cross-sectional) standard deviation σ. Not much significance should be attached to the particular way in which we specify the stochastic shocks to the profit function; this framework can be modified to distinguish among shocks to the sectoral price ("taste shocks"), shocks to the marginal physical product of inputs ("productivity shocks") and shocks to the cost function.

The sectoral stock price equals the sum of discounted expected future profits over an infinite horizon,

(2) $S_{it} = (1/\beta)\{\Sigma E_{t-1}\pi_{it+k}\}$

where β is the discount factor and E_{t-1} is the expectations operator conditional on information available in period t-1.

Long-run equilibrium is characterized by the equality of stock returns across sectors,

(3) $R_{it}^{*} = R_{t}^{*}$ for all i

where $R_{it}=\log(S_{it}/S_{it-1})$ and R_t is a weighted average of the sectoral stock returns. We denote the allocation of inputs across sectors associated with this long-run equilibrium by Z_{it}^{*}. Note that this target allocation of resources changes over time in response to realizations of the ε_{it}'s.

In the short-run, productive resources move across sectors towards this target allocation as follows:

(4) $$Z_{it} - Z_{it-1} = \alpha_1(Z_{it}^{*} - Z_{it-1}), \quad \text{if } Z_{it-1} > Z_{it}^{*}$$

$$Z_{it} - Z_{it-1} = \alpha_2(Z_{it}^{*} - Z_{it-1}), \quad \text{if } Z_{it-1} < Z_{it}^{*}$$

$$\text{with} \quad 0 < \alpha_2 < \alpha_1 < 1$$

The partial-adjustment reflects the assumption that both capital and labor are partly specialized to a sector and hence the reallocation process is costly and/or time-consuming. The role of adjustment costs for capital is emphasized in early work by Eisner and Strotz (1963), while the quasi-fixity of labor was highlighted in seminal work by Oi (1962) and Becker (1964). Also reflected above is the assumption that the adjustment mechanism is asymmetric.[2] In particular, contracting sectors are assumed to reach their long-run equilibrium input levels faster than the expanding sectors, so that $\alpha_1 > \alpha_2$.

Two recent empirical studies provide indirect evidence of the sector-specificity of labor and capital. Topel (1990, p.17) states that "when human capital is 'general' in the sense of being portable among activities, a job loss should imply fairly minor and transitory effects on earning capacity. But with specific capital, initial losses may be large and persistent." Using data from the PSID and the Displaced Worker Survey, Topel finds evidence of large short-run reductions in earnings--40 percent for the typical manufacturing worker--following job loss. Moreover, workers who change industry or occupation following the job loss have atypically large short run reductions in earnings.[3] Grossman and Levinsohn (1989) study the impact of exogenous changes in the prices of competing import goods on stock returns in six U.S. industries. They state (p. 1065) that "when factors are mobile, .. individual returns may respond little or even positively to adverse shocks to the particular sectors in which the factors are employed." They find however that for five of the six industries in their study, lower-than-expected import prices lead to substantial declines in stock returns, suggesting that capital is highly immobile between sectors in the short run.

We next consider the impact on real economic activity of changes in σ, the (cross-section) standard deviation of the realizations of the sector-specific shocks. In the Lucas and Prescott (1974) model σ is assumed to be constant over time and hence the reallocation of product demand across sectors leads to a time-invariant natural rate of unemployment. In contrast, Lilien, Black and Davis suggest that σ may vary over time, depending on the nature of the shocks to the economy. In the framework developed above, an increase in σ reflects the arrival of shocks that are expected to have differential impacts on sectoral profits. This leads to an increase in the stock prices of sectors that investors believe are going to expand and a decline in the stock prices of sectors that are expected to contract, thereby causing dispersion in the realizations of the stock returns. The greater the difference foreseen in the sectors' prospects, the larger is the dispersion in stock returns and the larger is the reallocation of productive resources across sectors that is required to attain the (new) long-run equilibrium. Given our assumptions about the adjustment mechanism, this reallocation involves an increase in unemployment, and a decline in aggregate output and investment. As discussed in the introduction, the evidence from panel data suggests that it is necessary to think of the reallocation process not just in terms of the *amount* of resources that have to switch sectors but also in terms of the *time* it takes resources to switch sectors.

Topel and Weiss (1985) present an alternate theory which relates the dispersion in stock market returns to economic activity. They assume, as we do, that human capital is partly sector-specific. However, they interpret an increase in stock market dispersion as reflecting an increase in uncertainty about the relative returns to sector-specific human capital investment. In the face of this increased uncertainty about which sectors are going to prosper and which ones are going to decline, "individuals with less experience and those with greater costs of acquiring sector-specific human capital will rationally and optimally postpone employment and human capital investment until uncertainty has been resolved." We refer to the Topel-Weiss framework as the sectoral uncertainty model.

While the theory underlying their work is distinct from the costly sectoral mobility model outlined above, Topel and Weiss point out that it may be difficult to distinguish between the two empirically (p. 348):

> "In contrast to Lilien, who implies that the *occurrence* of a sectoral shock that requires labor to be reallocated raises unemployment, we argue that *the prospect of future shocks* is a likely candidate for explaining the observed rise in unemployment, especially among younger individuals. Of course, to the extent that the occurrence of sectoral shocks is correlated over time, a sectoral shock may increase expectations of future shocks, so it may be difficult to completely separate the two theories empirically. In this sense, models of costly sectoral mobility and sectoral uncertainty are complementary theories of rising unemployment."

B. Construction and Properties of the Stock Market Dispersion Index

This section of the paper describes the construction of the empirical analog to σ. The basic data we used to construct our measure of the dispersion of stock prices were monthly average indices of various industries' stock prices, as constructed by Standard and Poors (1988). The industries, which are defined by Standard and Poors, range in size from 2 firms to 31 firms and the indices are computed by weighting each firm's stock price according to the firm's market value. Standard and Poors began compiling these data in 1926; at various times additional industries have been added (and others subtracted) so that currently Standard and

Poors compiles indices for about 85 industries. We used a sample of 60 indices, including most industries with a complete data series from 1947 through 1987 as well as a few shorter series deemed important. A list of the industries we used, together with their starting date, ending date (if relevant), and weight in our index is given in the appendix.

In calculating the index, we first deflated each index using the GNP price deflator and then used quarterly averages of the monthly data. Then we calculated each indices' growth rate and defined our dispersion measure as

(5) $$S_t = [\Sigma\, w_{it}(r_{it} - r_t)^2]^{1/2}$$

where r_{it} is the growth rate of industry i's stock at time t, r_t is the growth rate of Standard and Poor's composite listing, and w_{it} is a weight based on the industry's employment. Due to the changing number of industries for which Standard and Poor's data are available, the w_{it} weight given an industry changed as the industries included in our dispersion index changed. w_{it} equals the over-all weight for industry i, based on its share of employment from the entire sample, (called W_i; see the Appendix) divided by the sum of the W_i weights used in period t. Thus we compensated for the varying number of industries in different years and so S is an employment-weighted standard deviation of the growth rate of the industries' stock prices.

3. Empirical Results from Reduced-Form Equations

To determine the role our dispersion index plays in affecting aggregate economic activity, we start by specifying a set of conventional reduced-form regressions of the type estimated by Lilien (1982). Our hypothesis is that the greater the difference foreseen in the industries' prospects, the larger will be the divergence in their stock prices, which will be reflected in an upward movement in the dispersion index. Moreover, the greater the difference foreseen in the industries' prospects, the more resources must be moved and so the larger will be the resulting unemployment and decline in real activity. Under both versions of the sectoral shifts hypothesis, there is reason to expect that an increase in dispersion will have a persistent impact on economic activity, i.e., that *lagged* values of dispersion will be correlated with economic activity. Under the costly sectoral mobility model, this reflects the fact that the reallocation of resources will be staggered over time due to adjustment costs. Under the sectoral uncertainty model, the lag length reflects the time it takes for the uncertainty about sectors' relative prospects to be resolved.

We use changes in government spending and money growth to capture shocks to aggregate demand. To control for the effects of changes in government spending, the unemployment regression includes the ratio of federal government purchases of goods and services to trend GNP, called GY, while the output and investment equations include the log of federal purchases, called LF.[4] We use the actual growth rate of the base money supply, called DB, as the monetary variable.[5]

Unemployment rates trended upwards during the late 1960's and the 1970's and demographic changes are often thought of as an important factor in accounting for this rise. To capture this we include a variable DEMO, which equals the percentage of women in the total labor force, in the unemployment equation. To account for the trend growth in output and investment, we include a time trend, T.[6]

For all the variables, except the trend, we included lags. Clearly there is no theoretical basis for the number of lags to be included. The trade-off between more versus fewer lags hinges on the point that including more lags than justified lowers efficiency but including fewer biases the results. We expect that the relative price effects for which we are searching will occur with a fairly long lag, so at the risk of losing efficiency we included two years worth of lags for S. We also used eight lags for DB, one lag for the government spending variables and the demographic variable in the unemployment equation and, to capture any inertia that we failed to explicitly model, two lags of the dependent variables in each regression. Our main results are robust to several alternate lag structures.[7] In summary, we estimated the following reduced form regressions:

$$LY = a_1 + \sum_{i=0}^{8} b(i)DB_{t-i} + \sum_{i=0}^{8} c(i)S_{t-i} + \sum_{i=0}^{1} d(i)LF_{t-i} + eT + \sum_{i=1}^{2} fLY_{t-i}$$

$$LI = \mu_1 + \sum_{i=0}^{8} \xi(i)DB_{t-i} + \sum_{i=0}^{8} \phi(i)S_{t-i} + \sum_{i=0}^{1} \tau(i)LF_{t-i} + \omega T + \sum_{i=1}^{2} \psi LI_{t-i}$$

$$UN = \alpha_1 + \sum_{i=0}^{8}\beta(i)DB_{t-i} + \sum_{i=0}^{8}\gamma(i)S_{t-i} + \sum_{i=0}^{1}\delta(i)LF_{t-i} + \sum_{i=0}^{1}\kappa DEMO_{t-i} + \sum_{1}^{2}\pi UN_{t-i}$$

where UN = Log(U/[1-U]), with U being the unemployment rate, LY is is log of real GNP and LI is the log of real investment in producers' durable equipment and structures. We hypothesize that the β's and δ's generally should be negative and the b's, d's, ξ's, τ's, and κ's should be positive. More important, though, are the c's, ϕ's, and γ's which indicate the effect from dispersion. Since we expect increased dispersion will lower output and investment, while raising unemployment, the c's and ϕ's should be negative and the γ's positive. For two reasons, though, we examine mainly the lagged values of the dispersion variables. First, the effects of the more contemporaneous dispersion variables may be reflecting effects from other, omitted, aggregate variables that differentially affect industries. This is, of course, the point made by Abraham and Katz. Second, as discussed above, dispersion in the stock market should *lead* movements in real economic activity.

Unconstrained Equations

We estimated these regressions for the period 1950-I to 1987-IV. The results from this are reported in Table 1. [In the table, S6 indicates the estimated coefficient for S_{t-6}. The other variables have similar interpretations.] The results from Table 1 show that the effect of dispersion on output, investment and unemployment is fairly clear cut. The stock dispersion variables are significantly negative in the output regression at lags two, six and eight, in the investment regression at lags one and eight, and significantly positive in the unemployment equation at lags one, five, and seven. The only puzzle is that the contemporaneous S is significantly positive in the investment regression at the 10% level of significance. The failure of more individual coefficients to attain significance may well be because of collinearity because in all cases the sum of the coefficients is highly significant at over the 99% confidence level. These results, especially the significance of the longer lagged variables, provides evidence in favor of the sectoral shifts hypothesis.

Constrained Regressions

Because multicollinearity amongst the variables is clearly a problem, we re-estimated our regressions constraining the coefficients for DB and S to lie along a second order polynomial. The results from this estimation are reported in Table 2.

Although this procedure does not change the sums of the coefficients on DB and S by much, it does sharpen our interpretation of the regressions. For instance, looking at the effects from changes in the base money supply, we see that all the coefficients the regressions have the expected sign and many are now significantly different from zero. Moreover, all lags of S now have the "correct" sign and most are significantly different from zero even up to lags of two years. It is particularly noteworthy that in the investment and unemployment regressions, the cumulative effect from S lagged six, seven and eight quarters are larger than for any other three consecutive quarters. This large impact for what seems *ex ante* to be quite long lags appears to us as strong support for the sectoral shocks hypothesis.

4. Sectoral Shifts or Aggregate Demand?

This section is devoted to determining the extent to which our stock market dispersion index is subject to the same criticisms that Abraham and Katz (1984, 1986) aimed at Lilien's empirical work. In the interests of brevity we focus largely on the unemployment equation, though similar considerations would hold for the output and investment equations.

Our empirical work thus far rests on the assumption that the shocks to sectoral profits--the ε_{it}'s in equation (1)--are uncorrelated across sectors. Hence, movements in the dispersion index are assumed to be driven by sectoral shocks alone. However, as Abraham-Katz point out, this assumption is unlikely to be satisfied in practice. Aggregate demand shocks which have differential impacts on sectoral profits will also lead to movements in the dispersion index. Under certain conditions--which are spelled out in their paper--aggregate demand shocks can also lead to a positive correlation between the dispersion index and aggregate unemployment.

The Abraham-Katz critique points out that treating movements in dispersion as exogenously given--as was assumed in the reduced-form equations estimated in the previous section--may be incorrect under certain circumstances. In this section we show that by estimating VAR systems, and by imposing alternate orderings on the contemporaneous innovations, we can gauge the extent to which their critique is applicable in practice.

A. Comparison with Employment Dispersion

We begin by illustrating the Abraham-Katz critique in a VAR framework. We construct an alternate measure of denoted SIG; the difference between S and SIG is that the latter is a measure of the dispersion of *employment* growth rates across sectors. We then add SIG to a VAR system in which the other variables are unemployment (UN) and two aggregate demand proxies, the growth rate of the monetary base (DB) and the ratio of federal government purchases to trend GNP (GY). That is we estimate a m-th order autoregression,

(6) $X_t = A_1X_{t-1} + \ldots\ldots + A_mX_{t-m} + e_t$

where X_t is a vector of all the variables in the model (4x1 in this case). As a first step, this allows us to ascertain if movements in SIG are Granger-caused by other variables in the system.

The results of this estimation are contained in Table 3. The sample period is 1951:2 to 1987:4. The lag length is picked to be 8 quarters, which is a more generous lag length than that used in most VAR studies; however, pruning the lags does not affect our results in this table. Panel A shows that lags of SIG are highly significant in the unemployment equation. However, it is also the case that lags of the aggregate demand proxies, DB and GY, are fairly significant in the employment dispersion equation; the first few lags of unemployment are also significant in this equation though the sum does not attain significance at conventional levels. Hence, there appears to be clear evidence of "reverse causality" running from the other variables in the system to employment dispersion.

The Granger-causality tests would be sufficient in detemrnining the extent of the "reverse causality" problem if the contemporaneous innovations in different variables, i.e., the e_t's in equation (6) above, were independent. However, Panel B--which reports the contemporaneous correlation matrix of the e_t's--shows that there is that there is a strong, positive correlation between innovations unemployment and innovations in SIG. In light of this, Panel C reports results of the decomposition of variance for the unemployment and employment dispersion equations using the standard Choleski factorization under two alternate orderings. Ordering 1 places SIG first in the system, followed by GY, DB and UN. (This, of course, keeps SIG independent of the contemporaneous values of UN, GY and DB but allows UN to be affected not only by lags of SIG, GY, and DB but also by the contemporaneous values of these variables.) Hence, with only minor modifications, this equation is similar to the reduced-form equation reported earlier. Not surprisingly, the results support our earlier conclusions and the views espoused by Lilien. Employment dispersion explains close to 20% of the variance of unemployment, whereas unemployment explains only about 10% of the variance of dispersion.

This pattern is dramatically altered when SIG is placed last in the system, as shown in the results for Ordering 2. Now the results are closer to the Abraham-Katz view: SIG explains less than 5% of the variance of unemployment while nearly 25% of the variance of SIG is attributable to unemployment. To summarize, these results confirm the Abraham-Katz argument that it is difficult to distinguish the view that exogenous sectoral shifts cause some part of unemployment fluctuations from the view that unemployment causes increases in dispersion.

Next, we consider the extent to which similar problems arise when our stock market measure, S, is used as the measure of dispersion. Once again, the sample period is 1951:2 to 1987:4 and eight lags of each variable are included. The results are reported in Table 4. Panel A shows that the sum of the lags of S is significantly different from zero in the unemployment equation; as we found in the reduced-from equations, it is the higher-order lags of S, particularly lags seven and eight in this case, that are highly significant. The evidence for "reverse causality" is much weaker, with only the GY variable being significant in the S equation. Panel B shows that there there is very little contemporaneous correlation between the residuals. Panel C presents variance decompositions for two different orderings, one in which S is placed first in the system and one in which it is placed last. The key finding is that the fraction of the variance of unemployment explained by S is not very sensitive to the ordering: S explains 32% of the variance (at step 20) if placed last and 38% if placed first in the system. Also, less than 2% of the variance of S is attributable to innovations in unemployment. These results constitute preliminary evidence that S may be less vulnerable than employment dispersion to the Abraham-Katz critique.

B. Results with Mean Stock Price Growth

Stock prices are forward-looking and should respond to expected changes in aggregate demand that may not be reflected in current money growth or current government spending. Hence we cannot rule out the possibility that the stock market dispersion index is driven by imminent aggregate demand shocks that we have omitted that differentially affect industries' fortunes. To explore this possibility, we augment both our reduced form regressions and the VAR systems discussed above to include the real growth rate of the Standard & Poor's 500. The idea is that if movements in the stock market dispersion index are largely in expectation of imminent aggregate shocks, then those expectations should also be reflected in movements in the mean stock price growth. Thus, if omitted aggregate shocks are the factor driving our dispersion index, the inclusion of the mean stock price growth should eliminate the impact of stock dispersion on aggregate activity.

Table 5 presents the results from augmenting the system to include mean stock price growth, DSP. Before we discuss the results, several points should be noted. First, it turns out that the government spending variable, GY, is no longer significant in the unemployment equation in the augmented system and hence we exclude this variable from the system. In any case, including GY does not affect our main conclusions. Second, in the interest of brevity, we only report the results for a system in which both S and SIG are included simultaneously. Third, we continue to use the monetary base as the measure of money whereas many VAR studies use M1; however, we obtain qualitatively similar results if we replace the base by M1 (a change which also involves starting the sample in 1959 rather than 1948). Hence the estimated system consists of unemployment, UN, the monetary base, DB, mean stock price growth, DSP, and the two dispersion measures, S and SIG. The lag length is set at eight for the S variable and four for all the other variables.

Panel A shows that lags of stock market dispersion continue to be significant at about a 5% level. Panel B shows that the inclusion of DSP does not eliminate the importance of S for unemployment. While the stock market mean is fairly important at the shorter forecast horizons, stock market dispersion continues to account for between 34% and 39% of the variance of unemployment at the longer horizons.

Barro (1989) has recently investigated the relationship between mean stock price growth and aggregate investment using reduced-from equations similar to those we use in Section 3. He finds that lagged stock price growth has strong explanatory value for the (growth rate of) investment and, moreover, that this variable dominates other predictors of investment such as q and measures of cash flow.[8] In a companion paper, Barro (1988b) also provides recent evidence confirming the well-known link between mean stock price growth and subsequent movements in output. In light of these results, it is interesting to briefly return to the reduced-form framework and see whether the inclusion of stock market dispersion has any impact of Barro's findings for output and investment. Table 6 presents the results from augmenting the unconstrained reduced form regressions to include the growth rate of the S&P 500; Table 7 presents similar results from a constrained system, where the coefficients for DB, DSP, and S are constrained to lie along a second order polynomial. In both Tables we see that mean stock price growth has a strong effect on output, investment and unemployment: Many of the individual coefficients are significantly different from zero and, except for output, so too are the sums of the coefficients.

Including the growth rate of stock prices seemingly reduces the impact of our dispersion variable. In particular, for both the unconstrained investment and unemployment regressions the sum of our dispersion variables is no longer significantly different from zero at conventional levels. However, it is important to notice that this reduction takes place among the contemporaneous and first few lags of dispersion. If we examine only the last four lagged coefficients we again find that the sums are significantly different from zero: In the investment regression, the F-statistic for the sum of the last four dispersion coefficients is 2.43 and in the unemployment regression the F-statistic is 2.29. Given our emphasis on the lagged coefficients, we find the point that the lags remain significant reassuring. Looking now to the output regression, we can see that the sum of all the coefficients--as well as the sum of just the last four coefficients--is significantly different from zero. Moreover, when we constrain the coefficients in Table 7, the sums as well as the last several coefficients again emerge as significant.

C. The Role of Interest Rate Spreads

Following the work of Sims (1980), who drew attention to the strong predictive power of the commercial paper rate for output, it has become customary to include some measure of interest rates in VAR systems that attempt to test whether movements in money affect real activity. Sims (1982) and McCallum (1986) suggest that it is interest rates rather than monetary growth rates that properly capture Federal Reserve actions, which may account for their being informative about the future of the real economy. However, a flurry of recent papers has shown that measures of interest rate *spreads*--differences between interest rates on alternative financial assets--dominate measures of the *level* of interest rates as robust predictors of economic activity.[9] While the measure of the spread used differs across studies, the measure that appears to perform the best is the difference between the short-term commercial paper rate and the short-term Treasury bill rate. In prediction equations for real GNP, Friedman and Kuttner (1989) find that the sum of the interest rate spread variables is significant at the .001 level or better in all their specifications. Stock and Watson (1989)--who examined the information contained in a wide array of variables in constructing a new index of leading indicators--find that the spread outperforms nearly every other variable in forecasting the business cycle. Bernanke (1990) provides preliminary evidence that the reason the spread works so well in predicting economic activity is that it combines information about the stance of monetary policy and, to a lesser extent, expected default risk.

To the extent that the stock market dispersion index is also responding to information about the future course of monetary policy, including the interest rate spread in the VAR system should weaken its correlation with unemployment. Table 8 reports results obtained by adding the measure of the spread used by Friedman and Kuttner, the difference between the 4-to-6 month commercial paper rate and the 3 month Treasury Bill rate, which we call IRS, to the VAR system discussed earlier.

Panel A reports the F-tests for the unemployment equation. All the variables included in the system are significant and, as in Friedman and Kuttner's work with output, the interest rate spread is significant at better than a .001 level. Panel B reports the variance decomposition of unemployment for two different orderings. Ordering 1 places the employment dispersion first in the system and the stock dispersion last whereas Ordering 2 reverses these positions. Several conclusions are apparent. First, the interest rate spread explains a much larger fraction of the variance than the monetary base. Second, the contribution of employment dispersion is relatively modest, ranging from 3% to 9% at step 20. The most important conclusion, from our perspective, is that stock market dispersion continues to account for a large fraction of the variance of unemployment; at step 20, for instance, between 25% and 33% of the variance is attributable to movements in S.

D. Have We Adequately Controlled for Aggregate Demand ?

In the preceding sections we have used four variables--monetary base growth (DB), government spending changes (GY), mean stock price growth (DSP) and the interest rate spread (IRS)--to capture the state of current and future aggregate demand. In this section we conduct some tests suggested by Abraham and Katz (1984, pp. 17-20) to detemine whether these variables adequately control for the impact of aggregate demand fluctuations on sectoral stock price growth.[10]

As before, let S_{it} denote the stock price index for industry i at time t and define $r_{it} = \log(S_{it}/S_{it-1})$. We regress r_{it} on the aggregate demand variables:

(7) $$r_{it} = \gamma_0 + \gamma_1 DB_t + \gamma_2 GY_t + \gamma_3 DSP_t + \gamma_4 IRS_t + \eta_{it}$$

where the η_{it}'s are residuals. We then construct a stock market index based on the residuals from equation (x):

(8) $$S_{purged,t} = [\Sigma\ w_{it}(\eta_{it} - \eta_t)^2]^{1/2}$$

where η_t is a weighted average of the η_{it}'s.

We also estimate these equations allowing *lagged* values of the aggregate demand proxies--as well as current values--to affect sectoral stock price growth:

(9) $$r_{it} = \gamma_0 + \Sigma\gamma_{1i}DB_{t-i} + \Sigma\gamma_{2i}GY_{t-i} + \Sigma\gamma_{3i}DSP_{t-i} + \Sigma\gamma_{4i}IRS_{t-i} + \eta'_{it}$$

We picked two alternate lag lengths, 4 and 8. The two S_{purged}

measures corresponding to these lag lengths turn to be highly correlated with the one constructed using the residuals from equation (7). This is shown in Panel A of Table 9. Hence the subsequent work only uses the estimated equations (7) and the S_{purged} measure given in (8).

If the four variables--GY, DB, DSP and IRS--do a good job of capturing the common factors that underlie variations in stock market returns then the correlation among the η_{it}'s should be much lower than the correlation among the r_{it}'s. Whether or not this is indeed the case is investigated in Panel B of Table 9.

The top number in each cell of the table gives the simple correlation between the r_{it}'s for eight industries which were randomly chosen from our set of 60 industries. The bottom number gives the corresponding correlation between the η_{it}'s. As shown, the correlation between the r_{it}'s is uniformly positive--the average correlation is 0.42--which indicates that some common factors do underlie the variations in sectoral stock price returns. However the correlation between the η_{it}'s is almost always close to zero, suggesting that the four variables adequately control for aggregate demand. The cases where the correlation between the e_{it}'s is non-zero tend to be cases where the two industries belong to the same broader industry group, e.g., "Aluminum" and "Copper." Note that the residual returns for "Auto" and "Oil" are negatively correlated, as one might expect in a period dominated by strong oil price shocks.

Finally, we present results obtained from including S_{purged}

instead of S in the VAR system. Panel A of Table 10 shows that the sum of the lagged values of the "purged" dispersion index is significant at a 2% level of significance. Panel B shows that S_{purged} explains 22% of the variance of unemployment if placed last in the system and 33% if placed first.

Figure 1 plots the impulse response of unemployment to innovations in the other variables of the system. As shown, S_{purged} has a strong impact on unemployment with the peak occurring around lag 10. The impact is also fairly persistent; for instance, at lag 12 the impact of monetary base innovations is essentially zero but the impact of S_{purged} is still at half its peak effect.

V. CONCLUSIONS

A multi-sector economy is subject to a variety of shocks that--initially at least--affect only one or a few sectors. Many recent papers investigate the impact of such sector-specific shocks, a prominent example being Grossman and Levinsohn's (1990) careful empirical study of the impact of variations in the prices of competing import goods on returns to capital in six U.S. industries. Their study complements Grossman's (1987) earlier work on the employment and wage effects of variations in import competition. While our focus is also on the impacts of such sectoral shocks, our goal in this paper is different: We are interested in determining the extent to which sectoral shocks can lead to changes in broad macroeconomic aggregates such as real GNP, aggregate investment and aggregate unemployment. Recent theoretical work emphasizes two channels through which this can occur. First, if physical capital and human capital are sector-specific, the reallocation of resources out of industries that are adversely affected by sectoral shocks can be costly. Second, if there is uncertainty about the *relative* returns to sector-specific investment, firms and workers may delay making any investment until the uncertainty is resolved.

Instead of explicitly modelling specific shocks, we follow Lilien's (1982) innovative use of a dispersion index to proxy for the intensity of sector-specific shocks. Unlike Lilien, however, we use the dispersion in stock price growth across industries--rather than employment growth dispersion--to measure the intensity of sectoral shifts. The results from fairly standard reduced-form equations suggest that, controlling for the effects of monetary base growth and fiscal policy, stock market dispersion leads to a significant increase in unemployment and a decline in real GNP and investment.

While these initial results give strong support for a sectoral shifts explanation of unemployment, it is necessary to test their robustness, particularly in light of Abraham and Katz's (1984, 1986) critique of Lilien's employment dispersion index. Our principal empirical findings are as follows:

(i) Using a VAR framework, we find that there is a strong contemporaneous correlation between the innovations in unemployment and innovations in *employment* dispersion. This makes it very difficult to distinguish empirically a model in which exogenous shifts in employment dispersion cause unemployment from a model in which the causality runs the other way. Hence we confirm the basic Abraham-Katz finding, albeit in a different empirical framework.

(ii) When *stock* market dispersion is used as the measure of sectoral reallocation, there is little evidence that unemployment Granger-causes movements in the stock dispersion index. On the other hand, after controlling for the effects of standard aggregate demand shifters such as monetary base growth and changes in government purchases, innovations in stock market dispersion account for between 32% to 38% of the variance of unemployment at long horizons.

(iii) We recognize that stock prices are forward-looking and hence our dispersion index may be influenced not only by the current state of aggregate demand, as reflected in money growth and government spending, but also by the future state of aggregate demand. This leads us to expand our VAR system to include two "information" variables that have emerged in recent studies as robust predictors of economic activity. These variables are the mean return on the stock market [see Barro (1988, 1989), Fischer and Merton (1984)] and an interest rate spread--the differential between the short-term commercial paper rate and the short-term month Treasury bill rate [see Friedman and Kuttner (1989), Stock and Watson (1989)]. As discussed in Bernanke (1990), the spread appears to reflect largely the stance of monetary policy. However, even after controlling for the effects of these additional variables on unemployment, innovations in stock market dispersion account for between 25% and 33% of the variance of unemployment at long horizons.

(iv) The set of four variables--DB, GY, DSP and IRS--does a good job of capturing the common factors that underlie sectoral stock price movements. Regressions of sectoral stock price growth on these variables yield residuals that are virtually uncorrelated across industries.

(v) Finally, we construct a proxy for sectoral shifts, S_{purged} that is purged of the influence of aggregate demand. This measure continues to account for between 22% and 31% of the variance of unemployment.

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Table 1: UNCONSTRAINED REGRESSIONS

OUTPUT			INVESTMENT			UNEMPLOYMENT		
	COEFFICIENT	STANDARD ERROR		COEFFICIENT	STANDARD ERROR		COEFFICIENT	STANDARD ERROR
C	.82***	.22	C	.83***	.16	C	-.88***	.26
DB	.15	.13	DB	-.01	.30	DB	-2.29***	.81
DB1	.18	.13	DB1	1.20***	.32	DB1	-.58	.88
DB2	-.12	.14	DB2	-.88**	.33	DB2	2.12***	.86
DB3	.11	.14	DB3	.15	.32	DB3	-2.63***	.87
DB4	-.05	.13	DB4	.40	.31	DB4	-.14	.84
DB5	.11	.12	DB5	-.25	.29	DB5	.47	.79
DB6	-.02	.12	DB6	-.06	.29	DB6	.62	.80
DB7	.11	.12	DB7	.96***	.28	DB7	-3.62***	.77
DB8	.13	.10	DB8	-.24	.25	DB8	.80	.66
Σ	**.62****	**.25**	**Σ**	**-1.26*****	**.48**	**Σ**	**-5.25*****	**1.40**
S	-.014	.037	S	.16*	.09	S	.12	.24
S1	-.050	.043	S1	-.30***	.10	S1	.46*	.27
S2	-.097**	.045	S2	.05	.11	S2	-.11	.29
S3	.031	.047	S3	-.12	.11	S3	.21	.29
S4	-.075	.046	S4	.05	.11	S4	-.18	.29
S5	.034	.046	S5	-.12	.11	S5	.52*	.30
S6	-.078*	.045	S6	-.06	.11	S6	-.19	.29
S7	.001	.043	S7	-.06	.10	S7	.69**	.28
S8	-.066*	.038	S8	-.19**	.09	S8	.15	.24
Σ	**-.312*****	**.086**	**Σ**	**.60*****	**.21**	**Σ**	**1.67*****	**.54**
LF	.014	.025	LF	-.029	.057	GY	-1.57	1.14
LF1	-.035	.025	LF1	-.014	.056	GY1	1.68	1.17
T	.0008***	.0002	T	.0012***	.0002			
						DEMO	.045**	.020
						DEMO1	-.039**	.020
LY1	1.14***	.09	LI1	1.30***	.08	UN1	1.48***	.07
LY2	-.24***	.08	LI2	-.42***	.08	UN2	-.66***	.07
R^2=.9994		SE=.0091	R^2=.9976		SE=.0217	R^2=.9708		SE=.0584

*** indicates significance at the 1% level; ** at the 5% level; and * at the 10% level.

Table 2: CONSTRAINED REGRESSIONS

OUTPUT			INVESTMENT			UNEMPLOYMENT		
	COEFFICIENT	STANDARD ERROR		COEFFICIENT	STANDARD ERROR		COEFFICIENT	STANDARD ERROR
C	.87***	.21	C	.94***	.17	C	-1.04***	.27
DB	.16*	.08	DB	.40**	.19	DB	-1.41***	.52
DB1	.10*	.05	DB1	.25**	.11	DB1	-.91***	.30
DB2	.05	.03	DB2	.14*	.07	DB2	-.54***	.21
DB3	.02	.03	DB3	.07	.08	DB3	-.31	.22
DB4	.02	.04	DB4	.04	.09	DB4	-.22	.25
DB5	.02	.03	DB5	.05	.08	DB5	-.26	.24
DB6	.05*	.03	DB6	.10	.07	DB6	-.43**	.21
DB7	.09***	.03	DB7	.19**	.08	DB7	-.75***	.23
DB8	.15***	.06	DB8	.33**	.14	DB8	-1.20	.38
Σ	**.66****	**.24**	**Σ**	**1.56*****	**.51**	**Σ**	**-6.01*****	**1.47**
S	-.047**	.024	S	-.061	.063	S	.33**	.16
S1	-.040**	.016	S1	-.052	.041	S1	.22**	.11
S2	-.035***	.013	S2	-.049	.033	S2	.15***	.09
S3	-.032**	.014	S3	-.052	.036	S3	.11	.09
S4	-.030**	.014	S4	-.061*	.037	S4	.11	.09
S5	-.031**	.013	S5	-.076**	.035	S5	.14	.09
S6	-.034***	.012	S6	-.098***	.031	S6	.22***	.08
S7	-.039***	.014	S7	-.125***	.037	S7	.33***	.10
S8	-.046**	.022	S8	-.159***	.059	S8	.48***	.16
Σ	**-.334*****	**.084**	**Σ**	**-.732*****	**.219**	**Σ**	**2.09*****	**.56**
LF	.017	.023	LF	-.089	.058	GY	-1.57	1.16
LF1	-.040*	.024	LF1	.034	.058	GY1	1.75	1.19
T	.0008***	.0002	T	.0013***	.0003			
						DEMO	.029	.020
						DEMO1	-.022	.020
LY1	1.10***	.08	LI1	1.21***	.08	UN1	1.40***	.07
LY2	-.20***	.08	LI2	-.34***	.08	UN2	-.59***	.07
R^2=.9994		SE=.0091	R^2=.9970		SE=.0234	R^2=.9638		SE=.0621

*** indicates significance at the 1% level; ** at the 5% level; and * at the 10% level.

Table 3
VAR System: SIG GY DB UN
Sample Period: 1951:1 to 1987:4

Key:
SIG = employment dispersion
GY = govt. purchases/trend GNP
DB = monetary base growth
UN = unemployment rate

Panel A

VARIABLE	F-TESTS: UN F-STAT.	F-TESTS: UN SIGN. LVL.	F-TESTS: SIG F-STAT.	F-TESTS: SIG SIGN. LVL.
SIG	4.70	.00005	3.18	.0027
GY	1.94	.05946	2.71	.0089
DB	3.75	.00003	2.63	.0110
UN	189.45	.00000	1.62	.1275

Entries are F-statistic values and significance levels of the hypothesis that 8 lags of the variable can be excluded from the unemployment and employment dispersion equations.

Panel B CORRELATION MATRIX OF RESIDUALS

VARIABLE	SIG	GYI	DB	UN
SIG	1.000	0.026	- 0.114	0.313
GY	.	1.000	- 0.005	- 0.128
DB	.	.	1.000	- 0.091
UN	.	.	.	1.000

Panel C DECOMPOSITION OF VARIANCE: ORDERING 1

	UN				SIG			
STEP	SIG	GY	DB	UN	SIG	GY	DB	UN
2	15.8	1.4	2.2	80.5	95.9	1.0	0.1	3.0
4	10.9	4.0	3.2	82.0	83.7	7.9	2.5	5.9
8	16.6	7.5	6.9	68.9	80.6	9.0	3.4	7.0
12	18.3	11.6	7.2	62.8	76.7	8.6	5.1	9.5
20	17.7	13.5	7.4	61.4	74.9	8.6	5.1	11.3

DECOMPOSITION OF VARIANCE: ORDERING 2

	UN				SIG			
STEP	GY	DB	UN	SIG	GY	DB	UN	SIG
2	1.2	3.7	94.2	0.8	0.8	1.7	16.5	81.0
4	3.6	4.6	91.4	0.3	7.4	3.7	19.4	69.4
8	6.9	9.3	80.7	3.1	8.6	4.5	19.3	67.6
12	10.9	9.8	74.8	4.5	8.2	6.1	21.2	64.9
20	13.0	9.9	72.7	4.6	8.2	6.1	22.5	63.1

Entries show percentage of forecast variance of unemployment and employment dispersion at different horizons attributable to innovations in the variables of the system. Ordering is as shown.

Table 4
VAR System: S GY DB UN
Sample Period: 1951:2 to 1987:4

Key:
S = stock market dispersion
GY = govt. purchases/trend GNP
DB = monetary base growth
UN = unemployment rate

Panel A **F-TESTS: UN** **F-TESTS: S**

VARIABLE	F-STAT. (UN)	SIGN. LVL. (UN)	F-STAT. (S)	SIGN. LVL. (S)
S	2.61	.0116	4.31	.0001
GY	1.24	.2807	3.21	.0025
DB	3.04	.0038	0.69	.6942
UN	165.29	.0000	0.98	.4522

Entries are F-statistic values and significance levels of the hypothesis that 8 lags of the variable can be excluded from the unemployment and stock dispersion equations.

Panel B **CORRELATION MATRIX OF RESIDUALS**

VARIABLE	S	GYI	DB	UN
S	1.000	- 0.022	0.046	0.101
GY	.	1.000	- 0.044	- 0.131
DB	.	.	1.000	- 0.085
UN	.	.	.	1.000

Panel C **DECOMPOSITION OF VARIANCE: ORDERING 1**

	UN				S			
STEP	S	GY	DB	UN	S	GY	DB	UN
2	4.9	1.0	2.0	92.1	97.5	1.2	0.8	0.5
4	11.5	1.6	3.3	87.8	92.9	4.9	1.7	0.5
8	25.1	1.9	8.2	64.8	84.6	10.3	3.0	0.9
12	37.5	3.9	7.5	51.1	80.9	13.9	3.9	1.3
20	36.7	7.5	7.6	48.1	75.2	16.6	6.7	1.5

DECOMPOSITION OF VARIANCE: ORDERING 2

	UN				S			
STEP	GY	DB	UN	S	GY	DB	UN	S
2	1.0	1.7	95.4	1.8	1.5	0.7	0.9	97.0
4	1.8	2.8	88.9	6.4	5.0	1.7	1.0	92.3
8	2.2	7.0	71.0	19.8	10.4	2.7	1.2	85.6
12	4.4	6.2	56.7	32.7	14.0	3.8	1.7	80.6
20	8.1	6.4	53.6	31.9	16.5	6.2	1.8	75.5

Entries show percentage of forecast variance of unemployment and stock market dispersion at different horizons attributable to innovations in the variables of the system. Ordering is as shown.

Table 5
VAR System: S SIG DSP DB UN
Sample Period: 1951:2 to 1987:4

Key: S = stock market dispersion index
SIG = employment dispersion index
DSP = growth rate of S&P 500
DB = monetary base growth
UN = unemployment rate

Panel A F-TESTS: UN

VARIABLE	F-STATISTIC	SIGNIF. LEVEL
S	1.96	.0576
SIG	4.96	.0010
DSP	4.05	.0041
DB	2.58	.0408
UN	496.57	.0000

Entries are F-statistic values and significance levels of the hypothesis that 4 lags of the variable (8 in the case of S) can be excluded from the unemployment equations.

Panel B

DECOMPOSITION OF VARIANCE: ORDERING 1 (SIG DSP DB UN S)

STEP	S	SIG	DSP	DB	UN
2	1.7	12.0	4.0	0.8	81.5
4	4.4	5.3	25.2	1.6	69.9
8	11.4	5.7	32.2	5.5	45.2
12	27.1	6.2	28.8	4.6	33.3
20	33.8	5.6	27.5	4.4	28.6

DECOMPOSITION OF VARIANCE: ORDERING 2 (S DSP DB UN SIG)

STEP	S	SIG	DSP	DB	UN
2	2.6	0.4	2.5	2.4	92.2
4	6.1	1.1	15.6	3.3	73.8
8	14.3	1.5	26.1	9.8	48.3
12	31.1	1.9	21.8	9.6	35.5
20	39.0	2.0	20.2	8.4	30.4

Entries show percentage of forecast variance of unemployment at different horizons attributable to innovations in the variables of the system. Ordering is as shown in parenthesis (...).

Table 6: UNCONSTRAINED REGRESSIONS WITH STOCK PRICE GROWTH

	OUTPUT			INVESTMENT			UNEMPLOYMENT	
	COEFFICIENT	STANDARD ERROR		COEFFICIENT	STANDARD ERROR		COEFFICIENT	STANDARD ERROR
C	.45**	.23	C	.74***	.17	C	-1.07***	.26
DB	.01	.13	DB	-.11	.31	DB	-2.20**	.84
DB1	.22*	.13	DB1	1.22***	.31	DB1	-.98	.86
DB2	-.12	.13	DB2	-.70**	.33	DB2	1.96**	.84
DB3	.10	.13	DB3	.12	.31	DB3	-2.49***	.85
DB4	-.07	.13	DB4	.36	.31	DB4	-.44	.82
DB5	.11	.12	DB5	-.24	.29	DB5	.30	.77
DB6	.03	.12	DB6	-.02	.29	DB6	.65	.79
DB7	.06	.11	DB7	1.01***	.28	DB7	-3.53***	.75
DB8	.07	.11	DB8	-.16	.26	DB8	.42	.69
Σ	**.39**	**.25**	**Σ**	**1.48*** **	**.51**	**Σ**	**-6.31*** **	**1.61**
DSP	.004	.011	DSP	-.019	.027	DSP	.02	.07
DSP1	.032***	.012	DSP1	.035*	.027	DSP1	-.22***	.07
DSP2	.034***	.012	DSP2	.087***	.028	DSP2	-.18**	.08
DSP3	-.002	.012	DSP3	.037	.029	DSP3	-.19**	.08
DSP4	.007	.012	DSP4	.023	.029	DSP4	-.09	.08
DSP5	-.007	.012	DSP5	.033	.028	DSP5	-.11	.08
DSP6	-.001	.012	DSP6	.028	.029	DSP6	-.03	.08
DSP7	-.012	.011	DSP7	.032	.028	DSP7	-.10	.08
DSP8	-.004	.012	DSP8	.018	.029	DSP8	-.08	.08
Σ	**.050**	**.041**	**Σ**	**.275*** **	**.098**	**Σ**	**-1.00*** **	**.30**
S	.006	.037	S	.208**	.089	S	-.08	.24
S1	-.060	.042	S1	-.256**	.101	S1	.41	.26
S2	-.093**	.043	S2	.062	.107	S2	-.19	.28
S3	.015	.046	S3	-.097	.107	S3	.14	.28
S4	-.063	.045	S4	.079	.108	S4	-.33	.28
S5	.028	.045	S5	-.056	.107	S5	.34	.29
S6	-.090**	.044	S6	-.073	.106	S6	-.17	.29
S7	.003	.043	S7	-.040	.101	S7	.53**	.27
S8	-.068*	.037	S8	-.166	.089	S8	.15	.24
Σ	**-.323*** **	**.094**	**Σ**	**-.340**	**.233**	**Σ**	**.80**	**.59**
LF	.036	.026	LF	-.044	.058	GY	-1.62	1.13
LF1	-.061**	.026	LF1	-.001	.056	GY1	2.09*	1.16
T	.0004*	.0002	T	.0009***	.0003			
						DEMO	.042**	.019
						DEMO1	-.034*	.019
LY1	1.08***	.09	LI1	1.22***	.09	UN1	1.36***	.08
LY2	-.12	.08	LI2	-.32***	.09	UN2	-.50***	.08
	R^2=.9995 SE=.0087			R^2=.9980 SE=.0209			R^2=.9755 SE=.0555	

*** indicates significance at the 1% level; ** at the 5% level; and * at the 10% level.

Table 7: CONSTRAINED REGRESSIONS WITH STOCK PRICE GROWTH

OUTPUT			INVESTMENT			UNEMPLOYMENT		
	COEFFICIENT	STANDARD ERROR		COEFFICIENT	STANDARD ERROR		COEFFICIENT	STANDARD ERROR
C	.63***	.22	C	.92***	.17	C	-1.23***	.27
DB	.10	.08	DB	.48***	.20	DB	-1.79***	.56
DB1	.07	.05	DB1	.29**	.11	DB1	-1.16***	.33
DB2	.04	.03	DB2	.16**	.07	DB2	-.71***	.21
DB3	.03	.03	DB3	.07	.08	DB3	-.43**	.21
DB4	.03	.04	DB4	.04	.09	DB4	-.32	.24
DB5	.03	.03	DB5	.07	.08	DB5	-.38	.23
DB6	.05*	.03	DB6	.15**	.07	DB6	-.61***	.21
DB7	.08**	.03	DB7	.29***	.09	DB7	-1.01***	.25
DB8	.12*	.06	DB8	.48***	.16	DB8	-1.59***	.43
Σ	**.55****	**.24**	**Σ**	**2.05*****	**.53**	**Σ**	**-8.00*****	**1.67**
DSP	.018**	.009	DSP	.002	.022	DSP	-.08	.06
DSP1	.016**	.006	DSP1	.022*	.015	DSP1	-.12***	.04
DSP2	.014**	.005	DSP2	.038***	.013	DSP2	-.14***	.04
DSP3	.011*	.006	DSP3	.048***	.014	DSP3	-.16***	.04
DSP4	.007	.006	DSP4	.053***	.015	DSP4	-.16***	.04
DSP5	.003	.005	DSP5	.053***	.015	DSP5	-.15***	.04
DSP6	-.002	.005	DSP6	.047***	.014	DSP6	-.14***	.04
DSP7	-.007	.006	DSP7	.036**	.017	DSP7	-.11**	.05
DSP8	-.013	.009	DSP8	.020	.024	DSP8	-.07	.07
Σ	**.046**	**.041**	**Σ**	**.32*****	**.10**	**Σ**	**-1.11*****	**.30**
S	-.041*	.024	S	-.017	.062	S	.21	.16
S1	-.036**	.016	S1	-.006	.042	S1	.08	.10
S2	-.033**	.014	S2	-.002	.036	S2	.01	.09
S3	-.031**	.014	S3	-.006	.038	S3	-.04	.10
S4	-.032**	.015	S4	-.019	.039	S4	-.03	.10
S5	-.033**	.014	S5	-.039	.036	S5	.02	.09
S6	-.037***	.013	S6	-.067**	.032	S6	.11	.09
S7	-.042***	.014	S7	-.102***	.037	S7	.25**	.10
S8	-.049**	.022	S8	-.146***	.057	S8	.44***	.15
Σ	**-.333*****	**.093**	**Σ**	**-.403***	**.242**	**Σ**	**1.06****	**.62**
LF	.026	.023	LF	-.120**	.057	GY	-1.29	1.13
LF1	-.051**	.024	LF1	.064	.057	GY1	1.70	1.16
T	.0005**	.0002	T	.0011***	.0003			
						DEMO	.034*	.019
						DEMO1	-.024	.019
LY1	1.06***	.08	LI1	1.11***	.08	UN1	1.27***	.08
LY2	-.12*	.08	LI2	-.24***	.07	UN2	-.46***	.07
R^2=.9994		SE=.0088	R^2=.9973		SE=.0226	R^2=.9674		SE=.0596

*** indicates significance at the 1% level; ** at the 5% level; and * at the 10% level.

Table 8
VAR System: S DSP SIG IRS DB UN
Sample Period: 1951:2 to 1987:4

Key: S = stock market dispersion index
DSP = growth rate of S&P 500
SIG = employment dispersion index
IRS = interest rate spread
DB = monetary base growth
UN = unemployment rate

Panel A F-TESTS: UN

VARIABLE	F-STATISTIC	SIGNIF. LEVEL
S	2.00	.0520
DSP	2.10	.0838
SIG	5.52	.0004
IRS	3.14	.0171
DB	3.35	.0122
UN	532.60	.0000

Entries are F-statistic values and significance levels of the hypothesis that 4 lags of the variable (8 lags in the case of S) can be excluded from the unemployment equations.

Panel B

DECOMPOSITION OF VARIANCE: ORDERING 1 (DSP SIG IRS DB UN S)

STEP	S	DSP	SIG	IRS	DB	UN
2	1.2	3.6	10.7	5.9	0.7	77.9
4	2.7	18.1	4.6	12.9	1.8	59.9
8	8.9	29.6	5.4	12.9	5.8	37.4
12	20.3	26.8	5.6	14.5	14.5	27.9
20	24.6	26.2	4.9	16.1	16.1	23.5

DECOMPOSITION OF VARIANCE: ORDERING 2 (S DSP IRS DB UN SIG)

STEP	S	DSP	SIG	IRS	DB	UN
2	2.0	3.1	0.4	4.5	1.6	88.3
4	4.9	16.4	0.7	10.7	2.8	64.4
8	12.8	26.1	1.2	9.7	9.0	41.1
12	27.0	22.5	1.8	9.6	8.9	30.3
20	33.1	21.5	1.9	10.4	7.6	25.5

Entries show percentage of forecast variance of unemployment at different horizons attributable to innovations in the variables of the system. Ordering is as shown in parenthesis (...).

Table 9

Panel A: Correlation matrix of alternate S_{purged} measures

	S_{purged} (4 lags)	S_{purged} (8 lags)
S_{purged} (no lags)	0.936*	0.902*
S_{purged} (4 lags)	..	0.972*

Panel B: Correlation matrix of r_{it}'s and η_{it}'s

	Entr.	Copp.	Alum.	Oil	Coal	Drug	Media
Auto.	.47*	.44*	.53*	.21*	.44*	.30*	.57*
	.01	-.01	.13	-.41*	-.09	-.07	.11
Entr.	..	.43*	.40*	.33*	.47*	.39*	.63*
	..	.12	.05	-.11	.02	.07	.30*
Copp.	..	..	.63*	.42*	.52*	.23*	.47*
	..	..	.40*	.09	.25*	-.03	.11
Alum.	..	..	..	.37*	.42*	.24*	.43*
	..	..	..	-.06	.09	-.07	.00
Oil	..	..	..	..	.48*	.21*	.29*
	..	..	..	..	.25*	-.11	-.20*
Coal	..	..	..	..	..	.26*	.47*
	..	..	..	..	..	-.05	.05
Drug	..	..	..	..	..	..	.36*
	..	..	..	..	..	..	-.01

* denotes that the null hypothesis that the correlation is zero can be rejected at a significance level of .01

<u>Key to abbreviated industry names</u>:
Auto.= Automobiles; Entr.= Entertainment; Copp. = Copper;
Alum.= Aluminum; Oil = Domestic Oil; Media = Broadcast Media

Table 10
VAR System: S_{purged} DSP SIG IRS DB UN
Sample Period: 1951:2 to 1987:4

Key: S_{purged} = "purged" stock market dispersion index
DSP = growth rate of S&P 500
SIG = employment dispersion index
IRS = interest rate spread
DB = monetary base growth
UN = unemployment rate

Panel A F-TESTS: UN

VARIABLE	F-STATISTIC	SIGNIF. LEVEL
Spurged	2.39	.0207
DSP	3.30	.0137
SIG	5.52	.0004
IRS	2.78	.0307
DB	5.16	.0007
UN	426.53	.0000

Entries are F-statistic values and significance levels of the hypothesis that 4 lags of the variable (8 lags in the case of S) can be excluded from the unemployment equations.

Panel B

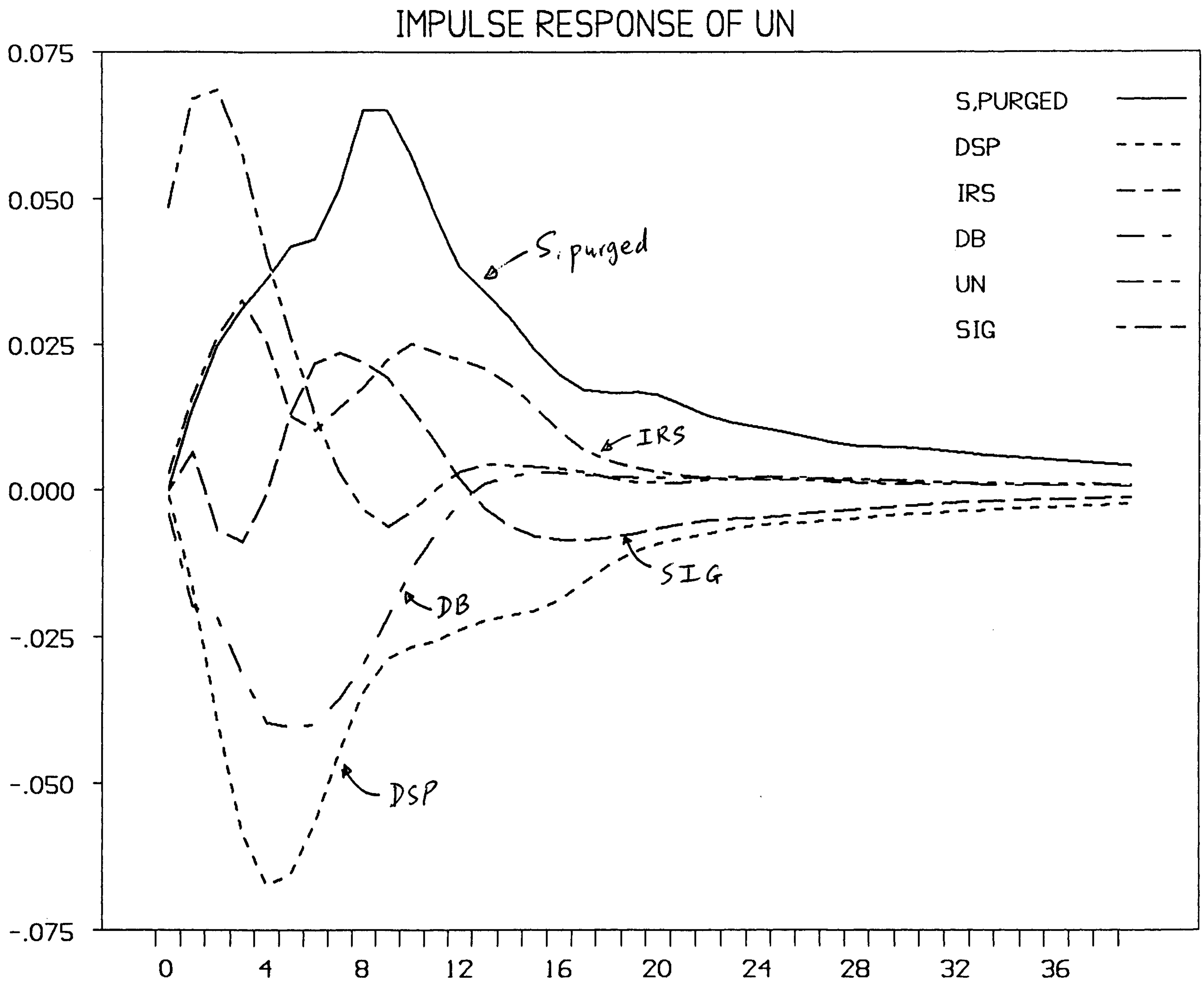
DECOMPOSITION OF VARIANCE: ORDERING 1 (DSP SIG IRS DB UN S_{purged})

STEP	Spurged	DSP	SIG	IRS	DB	UN
2	1.3	4.7	9.6	4.5	3.1	76.7
4	3.6	23.2	3.7	10.0	5.3	54.1
8	10.6	38.9	5.4	8.1	9.5	27.4
12	20.5	34.8	5.6	11.0	7.7	20.3
20	22.1	34.8	5.3	12.6	6.9	18.2

DECOMPOSITION OF VARIANCE: ORDERING 2 (S_{purged} DSP IRS DB UN SIG)

STEP	Spurged	DSP	SIG	IRS	DB	UN
2	2.4	3.4	0.5	3.3	5.1	85.2
4	6.8	20.3	0.7	7.7	7.2	57.3
8	16.0	33.1	2.3	5.3	13.7	29.7
12	28.9	28.2	3.1	6.3	11.9	21.6
20	31.4	28.2	3.1	7.4	10.6	19.3

Entries show percentage of forecast variance of unemployment at different horizons attributable to innovations in the variables of the system. Ordering is as shown in parenthesis (...).


IMPULSE RESPONSE OF UN
0.075
0.050
0.025
0.000
-.025
-.050
-.075
0
4
8
12
16
20
24
28
32
36
S,PURGED
DSP
IRS
DB
UN
SIG
S, purged
IRS
SIG
DB
DSP

APPENDIX I: CONSTRUCTION OF THE DISPERSION INDEX

To assemble our measure of the dispersion of stock market prices, we used 60 industrial indices compiled by Standard and Poor's. The following listing, arranged by length of the data series, gives the starting and, if relevant, ending dates as well as the employment weight for each industry used:

INDUSTRY	START YEAR	END YEAR	W_i
OIL-COMPOSITE	1926	--	.004614
MACHINERY (AGRICULTURAL)	1926	1985	.007786
AUTOMOBILES	1928	--	.048679
COMPUTER SYSTEMS	1930	--	.026044
ENTERTAINMENT	1930	--	.008573
INVESTMENT COS (CLOSED END)	1930	--	.001387
RETAIL STORES (DEPARTMENT STORES)	1930	--	.044414
RETAIL STORES (FOOD CHAIN STORES)	1930	--	.023748
COPPER	1930	1986	.009005
MACHINERY (CONSTRUCTION & MAT. HAND.)	1930	1985	.007786
OIL (CRUDE PRODUCERS)	1930	1985	.004614
BUILDING MATERIALS	1932	--	.009658
COAL	1932	--	.000850
DRUGS	1932	--	.032236
FINANCIAL (PROPERTY-CASUALTY INSURANCE)	1932	--	.000669
HOUSEHOLD PRODUCTS	1932	--	.032236
MACHINERY (DIVERSIFIED)	1932	--	.007786
MONEY CENTER BANKS	1932	--	.021462
PAPER	1932	--	.012355
RETAIL STORES (COMPOSITE)	1932	--	.044414
SHOES	1932	--	.002114
STEEL	1932	--	.009005
TIRES AND RUBBER GOODS	1932	--	.019075
TRANSPORTATION (RAILROADS)	1932	--	.017221
MACHINE TOOLS	1933	--	.007786
CHEMICALS	1934	--	.032236
CONTAINERS (METAL & GLASS)	1934	--	.011508
FOODS	1934	--	.014427
HEAVY DUTY TRUCKS & PARTS	1934	--	.048679
TEXTILE PRODUCTS	1934	--	.010624
TRANSPORTATION (AIRLINES)	1934	--	.013094
UTILITIES (ELECTRIC POWER COMPANIES)	1934	--	.013124
ELECTRONIC MAJOR COMPANIES	1934	1986	.026044
AEROSPACE/DEFENSE	1936	--	.048679
BEVERAGES (SOFT DRINKS)	1936	--	.014427
TEXTILES (APPAREL MANUFACTURERS)	1936	--	.010188
BEVERAGES (DISTILLERS)	1936	1986	.014427
FINANCIAL (PERSONAL LOAN)	1939	--	.001387
BEVERAGES (BREWERS)	1940	--	.014427
ALUMINUM	1941	--	.009005
DOMESTIC OILS	1943	--	.031571
INTERNATIONAL OILS	1943	--	.031571

OIL WELL & EQUIPMENT SERVICE	1943	--	.007786
ELECTRICAL EQUIPMENT	1945	--	.026044
GOLD MINING	1945	--	.004582
HOUSEHOLD FURNISHINGS & APPLIANCES	1945	--	.026044
MAJOR REGIONAL BANKS	1945	--	.021462
METALS MISCELLANEOUS	1945	--	.009005
NATURAL GAS PIPE LINES	1945	--	.013124
PAPER CONTAINERS	1945	--	.012355
NATURAL GAS DISTRIBUTORS	1945	1984	.013124
PUBLISHING	1946	--	.011392
BROADCAST MEDIA	1947	--	.005688
TRANSPORTATION (TRUCKERS)	1957	--	.011936
FINANCIAL (SAVINGS & LOAN HOLD. COS.)	1959	--	.001387
HOMEBUILDING	1965	--	.001766
TRANSPORTATION (AIR FREIGHT)	1965	--	.013094
ELECTRONICS (SEMICONDUCTORS)	1970	--	.026044
COMPUTER SOFTWARE & SERVICES	1978	--	.025904
HOSPITAL MANAGEMENT	1978	--	.020130

The weights used to construct S were derived from the Standard and Poor's Compustat II 1968-1987 Annual Aggregate Industrial File computer data tape. This tape lists, among other data, annual employment for each industry. The industries are organized by four-digit codes similar to the SIC codes, though the industry break-down is not exactly the same as in the Standard and Poor's Security Price Index, from which the stock data were obtained. However, the composition of these industries were the same for two-digit industries. Thus, we needed to make some approximations. We wanted weights based on data near the center point of our sample period. Thus, we started by using the four digit industries and calculated the industry's average employment figure using data between 1968 to 1972. If all of these years were missing data, we used the employment figure from the year closest to 1972. These four-digit industry weights were then grouped into the two-digit industry and the share of employment accounted for by each two-digit industry was calculated. Finally, to give our W_i, this share was divided by the number of our sixty industries that fell within each of the two-digit categories. Thus, similar industries that fall within the same two digit classification, eg FOOD and BEVERAGES, have the same employment weight.

FOOTNOTES

1. Brainard and Cutler (1989) regress industry stock growth on mean stock price growth and use the residuals from these regressions to construct their stock market dispersion index. However, despite this difference, the correlation between their index and ours is high: 0.66 in levels and 0.74 in logs.

2. For a discussion of asymmetries in adjustment costs of quasi-fixed factors, see Nickell (1978), Leban and Lesourne (1980), Weiss (1986) and Courtney (1989).

3. The losses are actually larger for occupational change than for industry change, which is consistent with the comments of Oi (1987). See Loungani, Rogerson and Sonn for evidence on the contribution of occupational mobility to total weeks of unemployment.

4. Two points about our specification deserve mention. First, since we include time trends in the output and investment regressions, which is equivalent to detrending all the independent variables, the specification of the government spending variable is actually quite similar to that in the unemployment regression. Second, the distinction between permanent and temporary changes in spending is important in theory [see Barro (1981 and 1988a), Denslow and Rush (1989) and Aiyagari, Christiano and Eichenbaum (1990)] and empirical applications that include major wars. However, our sample period includes only the Korean and Vietnam wars; neither of these seemed sufficiently important relative to total output to enable us to distinguish between temporary and permanent government spending.

5. Our choice of the base as the measure of money is motivated by the possible endogeneity of broader monetary aggregates such as M1. See King and Plosser (1984) and Rush (1986) for a further discussion of this issue. Studies that use quarterly data, starting with Barro and Rush (1980) and up to the more recent Frydman and Rappoport (1987), tend to find that all changes in the money supply--not just unexpected changes--matter for real activity. Hence we do not pursue a decomposition of base growth into expected and unexpected components.

6. There is still a lot of dispute over whether macro aggregates such as GNP are difference-stationary, as suggested by Nelson and Plosser (1982), or trend stationary, as suggested in many other studies such as Diebold and Rudebusch (1988). Faced with this uncertainty, we opted for the traditional approach of assuming

trend stationarity.

7. For instance, we increased the number of lags for S and DB to twelve and sixteen; increased the lags for government spending and DEMO to four; and increased the lags for the dependent variable to three and four. Individually and jointly the added lags rarely attained standard levels of significance.

8. For alternate views of the investment process that stress the role of cash flow variables, see Fazzari, Hubbard and Petersen (1988).

9. In addition to the studies cited in the main text of the paper, the role of interest rate spreads is investigated in Laurent (1988, 1989), Estrella and Hardouvelis (1989) and Strongin (1990).

10. It is quite likely that variables such as DSP are responding to events such as oil price shocks, which are <u>not</u> pure aggregate demand shocks. In fact, Davis (1985), Loungani (1986), Hamilton (1988) and Kowalczyk and Loungani (1990) provide theoretical and empirical evidence on the impact of oil price shocks on the sectoral reallocation of resources. However, in order to be as fair as possible to the Abraham-Katz view, we prefer to "over-control" for the effects of aggregate demand on sectoral stock returns by treating all movements in DSP as being "aggregate-demand-driven."

Working Papers and Staff Memoranda

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