SECTORAL SHIFTS IN INTERWAR BRITAIN

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I. INTRODUCTION

The period of persistent mass unemployment in Britain over the interwar years ranks among the important macroeconomic events of the twentieth century. Between 1920 and 1938 the average unemployment rate in Britain was nearly 10%. It was this extended period of high unemployment that provided the economic and intellectual backdrop against which John Maynard Keynes wrote his General Theory in which he proposed that deficient aggregate demand could cause equilibrium unemployment. For this reason among others, the question of why unemployment was so high in Britain during this interwar period has long interested economists. A provocative paper by Benjamin and Kochin (1979) led to a resurgence of interest in this issue. They presented evidence suggesting that the cause of the high unemployment was a substantial boost in benefits paid to unemployed workers. Their results stimulated an immense number of comments: see Collins (1982), Cross (1982), Metcalf, Nickell, and Floros (1982), Ormerod and Worswick (1982), and Broadberry (1986) and the rebuttal by Benjamin and Kochin (1982). While the comments were critical of Benjamin and Kochin's contention that generous unemployment benefits were the primary cause of the high British unemployment, they nonetheless conceded that unemployment benefits are at least part of the explanation for the experience with high unemployment.[1]

Most other researchers have suggested that aggregate demand factors were the major cause of British inter-war unemployment. Metcalf, Nickell, and Floros (1982) and Dimsdale, Nickell, and Horsewood (1989) are recent examples. Generally, these aggregate demand factors are assumed to work through some sort of ad hoc effects on the real wage, making the standard Keynesian

assumption [as in, for example, Fischer (1977)] that employment is determined along the labor demand curve. In our empirical work we do control for factors that affect aggregate demand, but we do not try to specify how their effect operates.

Finally, a somewhat neglected strand of the literature has emphasized the role played by structural adjustments resulting from changes in Britain's industrial structure. Our main goal is to combine this older approach, exemplified by the work of Clay (1930), Richardson (1961) and Aldcroft (1967), with the insights gained from more modern work on sectoral shifts, pioneered by Lilien (1982). The term "sectoral shifts" refers to a shift in the composition of demand among different sectors of the economy, holding the level of aggregate demand fixed. Consider, for example, the relative decline of one industry accompanied by the relative rise of another. As pointed out by Aldcroft, Richardson, and Lilien the declining industry will release resources to be absorbed by the expanding industry. However, this switching takes time and during this interval these resources--in particular labor--will be unemployed.

Lilien tested his sectoral shifts hypothesis using post World War II US data. The variance of employment growth among different industries was used as a proxy for the dispersion of the shifts in demand for various industries. His results showed a significant correlation between the contemporaneous measure of dispersion and unemployment. Other economists, however, have questioned Lilien's interpretation of the correlation. Abraham and Katz (1986) pointed out that aggregate demand shocks with an uneven impact across sectors could increase dispersion of employment growth rates so that the relationship

between employment dispersion and unemployment could be the result of aggregate demand.

To help overcome this identification problem, we use another dispersion proxy. Basically we use the dispersion of the growth rate of real stock prices for different industries as our measure of dispersion. The idea is that the stock prices for an industry represent investors' expectations of the industry's future. If investors predict that an industry will decline, its stock price will be bid down; conversely, the belief that an industry will prosper will lead to an increase in share prices. Given that investors' expectations are rational, and hence on average correct, we expect that an increase in dispersion of share prices signals an increase in the dispersion of industries' futures. This will lead eventually to an increase in unemployment as the declining industries release resources to the advancing industries.[2]

A measure of dispersion based on stock price data has two essential advantages over a measure based on employment growth. First, stock prices depend in large part on expectations about the future. Information bearing on the structure of labor demand will be rapidly incorporated into stock prices, whereas the response of sectoral employment is likely to be spread out over time. Hence, stock price dispersion should be correlated with unemployment with a significant lag. Given that we control for factors affecting aggregate demand, this lag helps surmount the identification problem raised by Abraham and Katz (1986). Second, more resources will be transferred between sectors the more permanent the divergence in the sectors' fortunes, so that more permanent sectoral shifts create higher unemployment. Because stock prices react more strongly to a given sized shock the more permanent the shock, our

index correctly weights shocks according to their permanence. Indices based on employment growth variance weight temporary shocks the same as permanent changes. Stated differently, a stock price dispersion measure is less likely than an employment dispersion measure to reflect changes in the pattern and magnitude of temporary layoffs and more likely to reflect the magnitude of permanent separations between workers and their jobs. This second advantage implies that the stock price dispersion measure is less sensitive than Lilien's measure to aggregate demand disturbances that result in large swings in temporary layoffs. Once again, this feature makes our measure less vulnerable to the Abraham and Katz critique[3].

Most of the work testing the sectoral shifts approach has been conducted using post-war, US data[4]. Dimsdale, Nickell and Horsewood (1989) are a partial exception. Among other variables, they include a "mismatch" variable, which is fairly similar to the employment growth dispersion measure constructed by Lilien. Dimsdale, Nickell and Horsewood find that this variable has a significant effect on unemployment during the inter-war period in Britain. However, they do not test the sensitivity of this result nor do they use the preferable stock price based measure of dispersion[5].

Given the success the sectoral shifts hypothesis has enjoyed in other research[6], we believe the failure to apply it to this period of British history is a serious omission. The inter-war period of unemployment is important historically and, to the extent to which lessons learned from it can be transferred to the current situation in Europe, the inter-war period also may have important current policy ramifications.

The second section of the paper reviews some of the descriptive evidence on the importance of sectoral shifts in interwar unemployment. Section 3

explains the construction of our proxy for measuring the intensity of sectoral shifts, viz., the stock price dispersion measure. Section 4 discusses the specification of our basic regression and reports the results of the estimation. Section 5 highlights some of the important conclusions we obtain.

II. DESCRIPTIVE EVIDENCE

Henry Clay (1930) was perhaps the first to suggest that sectoral shifts must be an important part of any explanation of British unemployment in the 1920's. Clay began by stating the basic sectoral shifts hypothesis (p. 2-4):

> "The *aggregate* demand for labour might not vary...but, being made up of discontinuous and dispersed demands for particular kinds of labour, leave always a part of the population unemployed....Similarly labour is only imperfectly mobile...Quite apart, therefore, from fluctuations in the aggregate volume of employment, there must always be some loss of work, due to the impossibility of fitting workers, whose mobility and range of capacity are limited, to the kinds of work available."

Clay pointed out that the high unemployment of the period could not simply be attributed to deficient aggregate demand (p. 24):

> "This underlying problem has persisted so long that there is no warrant for attributing it to ordinary trade depression and expecting it to be relieved by unaided trade recovery. Trade has recovered; 1924 was a boom year, if the characteristics of a boom year are a peak in prices, production and employment. But abnormal unemployment persisted."

Clay then proceeded to examine the behavior of unemployment in the major industries of the time. One of the key pieces of evidence he produced was a figure (Fig. 4 on p.43 of his book) which was a time-series plot of the divergence of unemployment in different industries from the average unemployment rate.

> "A study of this figure brings out clearly the fact that divergent and compensating movements have been important. With the exception of building, none of the industries represented has followed the

> general trend of employment; all have been subject to influences that affected them alone or in a peculiar degree."

Finally, Clay pointed out the geographic concentration of unemployment made the process of reallocating labor from declining industries to expanding ones a particularly difficult one.[7]

Later analyses by Richardson (1961) and Aldcroft (1967, 1983) have demonstrated that the high unemployment of the inter-war period coincided with normal growth in output. The annual growth rate of industrial production was 2.8% over the 1920-29 period and 3.3% over the 1929-37 period [Aldcroft (1967, p. 315)]. Much of this growth in industrial production came from the rapid expansion of newer industries. Aldcroft also attributed the slowness of labor to move out of the depressed industries to the uneven incidence of unemployment[8] (1983, p. 135-6):

> "..throughout the period there was a hard core of unemployment of between 1-1$_{1/2}$ million which was caused by the process of structural change taking place at this time. The big staple trades of the nineteenth century .. suffered sharp and permanent contractions in demand for their products, especially from overseas .. These large five groups accounted for around one-half of the insured unemployed in 1929, .. and a similar proportion in the later 1930's. Given the strong geographic concentration of the staple trades in the North it is easy to see why this part of the country suffered so much more than the South.

To summarize, there is a lot of descriptive evidence that "the slow adjustment of labor to shifts of employment demand between sectors of the economy" [Lilien (1982, p.778)] may be an important element in explaining inter-war unemployment. However, while there is much descriptive evidence, there is little in the way of more rigorous econometric evidence. This is an important gap. In the next section we describe the construction of an index to measure the intensity of these sectoral shifts and fill this gap.

III. CONSTRUCTION OF THE DISPERSION INDEX

We needed an index of stock prices in different sectors of the economy over the time period in which we were interested. Since no such index was available, we constructed one. The basic source of the stock market data was the January 3 (or January 4 if January 3 was a Sunday) issue of the Financial Times. The Times classifies companies' stocks according to industry, e.g., "Gas and Electric Light", "Motors and Cycles", "Banks", and so on. From time to time, the Times added and deleted industrial sectors. Thus, while we ultimately used data from 17 sectors in total, on average for each observation we used data from 11 sectors. The list of sectors used together with the starting and ending date as well as more details about the construction of the index is given in Appendix I.

From each sector we used a sub-sample of companies to include in our index.[9] Each industry was represented by an average of approximately 7 companies. Using the price index we deflated each company's stock price and calculated its real growth rate from the previous year. Next we averaged the growth rates within each industrial sector to get that sector's average real stock price growth rate for the year.[10] Finally we calculated the standard deviation of these growth rates and it is this standard deviation--reported in Appendix I--that served as our dispersion index.[11]

Our index is unweighted. That is, we were unable to weight a particular company's stock price by, say, its market capitalization nor were we able to weight an industry's index by, say, its share of employment.[12] We view each of these as a drawback, since each weighting scheme seems desirable. However, this was unavoidable because the data necessary to allow us to weight our

index simply do not exist. Given these data limitations, we view our index as a noisy proxy for a more appropriately weighted index. Notice that this error in measurement should work *against* our hypothesis that sectoral shifts from one industry to another influenced inter-war unemployment in Britain.

IV. ESTIMATION

(a) Results for the 1912-38 period:

We wish to determine if our measure of dispersion significantly affects unemployment. Hence, we will use unemployment as the dependent variable in a regression with the current and lagged values of the dispersion measure as independent regressors. Our emphasis on sectoral shifts suggests that increases in the stock market based measure of dispersion lead increases in unemployment. Thus, we will center our attention on the *lagged* dispersion variables.

Sectoral shifts are obviously not the only factors affecting unemployment. Following long-standing tradition, we will focus primarily on aggregate demand factors, in particular, money supply changes and changes in government spending.[13] As in Barro (1981) and Barro and Rush (1980), we measure the impact of government spending through the ratio of real government purchases of goods and services to trend real GNP. A preliminary look at the data revealed that this ratio is fairly constant over the sample period with the exception, of course, of a sharp increase during the World War I years. Hence, in the regression to be discussed below, this variable serves largely as a 'dummy' for the war years.

While macroeconomists all tend to agree that government spending matters for real activity, there is more debate about the role of changes in the money

supply and monetary policy. Some real business cycle models abstract completely from monetary influences on real activity, while new classical theories [Lucas (1975), Barro (1976)] assign a central role to unexpected changes in the money supply, and Keynesian and New Keynesian adherents argue that both expected and unexpected changes in the money supply affect real activity. Answering this debate is far from the main topic of our work. Because the decomposition of money growth into expected and unexpected components is controversial, we will use simply all changes in the base money supply.[14] However, we also examine the sensitivity of our results by reporting some specifications that omit all changes in the money supply. Covering these two "extreme" views is an important check on the robustness of our results.

Finally, while past work has generally focused only on the nineteen year period between 1920 to 1938, we present results for both the strict interwar period as well as for a longer period 1912 to 1938.[15] We believe incorporating the earlier years is important because it provides a "control period" of a few years during which unemployment was not deemed extraordinarily high. Of course, estimating over this sample period has its risks because of the impact of World War I on the economy. For instance, Britain levied an excess profits tax during the war. Presumably this tax would cause stock prices to react differently to a sectoral shock during the war than the same shock after the war. Therefore we deemed it vital to also estimate regressions using only the inter-war period. In addition to providing a check on the sensitivity of our results to the choice of sample period, using this shorter period allows us to use the replacement ratio (the ratio of unemployment benefits to wages) stressed by Benjamin and Kochin as a major determinant of British unemployment.[16] We can thus provide a little further evidence on whether

unemployment benefits remain significant, once the impact of sectoral shifts is controlled for.

Estimating our unemployment regression for the period 1912 to 1938 yields:

$$(1)\ UN = 2.92 - 5.57DM - 1.97DM1 - 9.30GY - .04S + 3.08S1 + 4.83S2 \quad R^2 = 0.82$$
$$\qquad (1.93)\ (2.30)\quad (2.17)\quad (2.71)\ (1.25)\ (1.36)\quad (1.26)\quad DW = 1.50$$

where UN = Log(U/[1-U]), and U is the unemployment rate, DM is the growth rate of the base money supply, DM1 is DM lagged a period, GY is the ratio of real government purchases of goods and services to real trend GNP, and S is the dispersion index with S1 and S2 the one and two period lags of the index. We tried increasing the number of lags for each of the variables, but further lags were not significantly different from zero. Including the additional lags did not change any of our results. The Durbin Watson statistic is in the "inconclusive" range; we estimated the regression including a lagged dependent variable and with an AR correction, but neither the lagged dependent variable nor the autocorrelation coefficient were significantly different from zero. Moreover, our results were broadly unaffected by these changes.[17] The regression also "passed" the CUSUM and CUSUMSQ tests for structural stability.

Looking now at equation (1), we see that this regression is generally quite satisfactory. For instance, the contemporaneous impact of an increase in the growth rate of the base money supply and of an increase in government spending is to lower unemployment. More important for our purposes, however, are the coefficients on the dispersion index. While the sign of S is not what we expected, it is virtually equal to zero. However, both S1 and S2 are positive, as predicted by the theory, and both are highly significant.[18] This

seems strong evidence in favor of the view that the intensity of sectoral shifts contributes to aggregate unemployment.[19]

To check the significance of the dispersion variables, we estimated a regression that omitted them. This gave

$$UN = 4.32 - 2.56DM - 2.58DM1 - 9.31GY \qquad R^2 = 0.66$$
$$\quad (2.41)\ (2.56)\quad (2.49)\quad (3.33) \qquad DW = 0.92$$

Relative to equation (1), we see that omission of our dispersion variables dramatically degrades the regression: the fit is substantially poorer and serial correlation emerges as a serious problem. A standard F-test for the significance of the dispersion variables confirms these qualitative results. We calculated F(3, 20) = 4.67, which is well above the 95% critical value of 3.10. Hence, as expected, we can formally reject the hypothesis that the dispersion variables are jointly insignificant.

Given the significance of DM in regression (1), it is probably incorrect to omit the monetary variables form the regression. However, this change does serve as a check on our results. Thus, dropping DM and DM1 we estimated

$$(2)\quad UN = 7.45 - 15.60GY + 1.19S + 2.44S1 + 3.53S2 \qquad R^2 = 0.73$$
$$\quad\ (1.47)\ (2.03)\quad (1.39)\ (1.37)\quad (1.40) \qquad DW = 0.95$$

While this regression is much less satisfactory than the first, it is important to note that S1 is significant at a p-value of .09 and S2 retains its significance at p equal to .02.[20] Thus, even in the face of what we believe is a major misspecification error, S1 and particularly S2 still have the predicted signs and are significantly different from zero.

Returning to equation (1), we can calculate the effect on unemployment from, say, a purely temporary one-standard deviation increase in dispersion. This works out to a 9 percentage point increase in dispersion. Assuming that

the other variables in (1) stay at their sample means, the increased dispersion has no immediate impact on unemployment since the coefficient of S is virtually zero. However, after one year unemployment rises by 1.60 percentage points and after two years it rises by 2.67 percentage points. Thus it seems that the effect of dispersion is not only statistically significant but also significant in an economic sense.

Using equation (1) Figure 1 plots the actual and predicted unemployment rates. We see in the figure that our regression has two years with major errors, 1923 and 1931. In 1923 the predicted value for unemployment was 14.6% while the actual level was only 8.1%. Then, in 1931, the regression misses the onset of the worst years of the Great Depression in Britain. The actual unemployment rate was 15.1% while the predicted rate was only 7.1%. But notice that in 1932 the prediction is back on track and actually slightly over-predicts unemployment. In any case, aside from these two years, we can see that the regression performs well, accounting for the relatively low unemployment from 1912 to 1920, the higher unemployment from 1921 to 1930 and finally the period of even higher unemployment from 1931 to 1938.

(b) Results using mean stock returns:

Our work thus far has suggested one link between developments in the stock market and real economic activity. There are other links between the stock market and the economy, the most well known of which is the positive correlation between the mean return on stocks and subsequent changes in the level of real economic activity. As summarized most recently by Barro (1988, 1989), there are several theories which generate a correlation between mean stock returns and economic activity. The most prominent of these theories,

which is consistent with the work of Fama (1981), suggests that stock returns are a proxy for shifts in the prospective economy-wide real rate of return on capital.[21] An upward shift in the economy-wide return to capital boosts stock returns as well as subsequent economic activity, largely through a positive impact on investment. This theory suggests that the mean stock return should be included as an additional explanatory variable in our unemployment regression.

It turns out that including the mean return on stocks, SMEAN, as an additional variable has very little impact on our results. The regression below augments equation (1) by SMEAN and two lags of this variable:

(3) UN = 2.01 - 4.79DM - 3.88DM1 - 8.59GY +.95S + 4.05S1 + 5.34S2 R^2= 0.86
(2.05) (2.26) (2.31) (2.81) (1.42) (1.38) (1.50) DW= 1.94
- 1.17SMEAN - 1.01SMEAN1 + 0.68SMEAN2
(0.95) (0.84) (1.08)

The variables SMEAN and SMEAN1 have the predicted sign and are close to significance but their inclusion affects neither the signs nor the significance of the dispersion variables S1 and S2. Deleting the lagged SMEAN variables brings the coefficient estimate of SMEAN closer to significance but, once again, has no impact on our central results:

(4) UN = 1.56 - 5.34DM - 4.01DM1 - 7.84GY +.81S + 3.47S1 + 5.69S2 - 1.66SMEAN R^2= 0.85
(1.93) (2.15) (2.28) (2.63) (1.24) (1.28) (1.25) (0.84) DW= 1.97

In view of the lack of consensus on whether stock returns play a causal role or are merely a leading indicator, we exclude this variable from subsequent regressions. However, it seems apparent that the impact on stock market dispersion on economic activity is distinct from any links between mean stock returns and economic activity.

(c) Results for the interwar period:

We next turned to the inter-war period, 1920 to 1938, and estimated a regression similar to (1).[22] This yielded:

(5) UN= -3.63 - 4.43DM - 1.85DM1 + 3.10S + 1.17S1 + 2.99S2 R^2=0.75
(0.28) (2.41) (1.46) (0.83) (0.91) (1.14) DW=1.75

Overall this regression performs well: it explains a relatively high fraction of the variance of unemployment and judging by the Durbin Watson statistic has little residual serial correlation. DM remains significant and DM1 now approaches conventional levels of significance. For our purposes, though, we are more interested in the performance of the dispersion variables. We see that relative to regression (1) for the entire sample period, S is now "correctly" signed and gains in significance while S1 falls in significance. But note that S2 remains highly significant. Given that we expect the sectoral reallocation to *follow* an increase in stock market dispersion, we see the significance of S2 as an important point confirming this hypothesis.

Now that we restrict our attention to the inter-war period, we next wanted to explore how including the unemployment insurance replacement ratio would affect our results. Thus we included as an additional regressor Benjamin and Kochin's benefit to wage ratio, which we called BW. Estimating over the period 1920 to 1938 yielded:

(6) UN = -4.4 - 6.94DM - 0.07DM1 + 2.64S + 0.85S1 + 2.89S2 + 1.81BW R^2=.85
(0.3) (2.13) (1.33) (0.75) (0.78) (0.91) (0.63) DW=2.3

The benefit to wage ratio is significantly different from zero with a p-value of .01. Including it has a negligible effect on the size and significance of the coefficients on the dispersion variables. Thus, our

conclusions about the effect of dispersion on interwar unemployment are robust to this change.[23]

Ormerod and Worswick (1982) have noted that the benefit to wage ratio has a dramatic upward jump after 1920 and have suggested that Benjamin and Kochin's results may be sensitive to the exclusion of the 1920 observation. Thus, we also experimented with estimating a similar equation over the sample period 1921 to 1938. This gave us:

$$\begin{array}{lllllllll} (7)\ UN= & -3.1 & -2.29DM & +1.65DM1 & +2.66S & +1.22S1 & +1.57S2 & -0.43BW & R^2=0.86 \\ & (0.4) & (1.71) & (0.93) & (0.47) & (0.48) & (0.65) & (0.65) & DW=2.09 \end{array}$$

We can see that the coefficient on the benefit to wage ratio switches signs and becomes insignificant over this shorter sample. The coefficients on the dispersion index remain positive and are all significantly different from zero.

We hasten to add that we do not think omitting 1920 from the sample period is the correct procedure. The large jump in BW from 1920 to 1921 is probably a major reason why unemployment also rose between these years and so deleting this year omits important information. Still, we do find it reassuring that our dispersion index is not much affected by experimenting with different sample periods.

Finally we again wanted to check the significance of the dispersion variables, so we estimated an equation similar to (6) that omitted these variables. This yielded

$$\begin{array}{llllll} UN = & -3.5 & -3.29DM & -1.45DM1 & +2.72BW & R^2 = 0.49 \\ & (0.5) & (2.95) & (2.10) & (1.00) & DW = 1.13 \end{array}$$

Just as was the case over the entire sample, the regression without the S variables has a much poorer fit and a lot more serial correlation among the

residuals. A standard F-test decisively rejects the exclusion of the dispersion variables, with F(3, 12) = 9.81 while the 5% significance level equals 3.49.

(d) Employment Dispersion vs. Stock Market Dispersion

Finally, we wanted to compare the performance of the stock market dispersion measure with that of an alternate, more "conventional" measure of dispersion, σ, which measures the variance in *employment* growth across industries.[24] Although for reasons stated above we believe that this is an inferior measure of sectoral dispersion, it is useful to directly examine this issue. Since we do not have employment data prior to 1920, we estimated an equation using current and two lagged σ's for the interwar period:

$$\underset{(1.8)}{\text{UN} = -4.5} + \underset{(3.19)}{1.94\text{DM}} + \underset{(3.13)}{0.06\text{DM1}} + \underset{(7.50)}{7.16\sigma} + \underset{(6.58)}{7.92\sigma 1} + \underset{(5.52)}{0.75\sigma 2} + \underset{(3.49)}{3.30\text{BW}} \quad R^2=.37,\ \text{DW}=0.6 \tag{8}$$

Comparing this equation with (4), it is clear that replacing the S variables by the σ's leads to a marked deterioration in the fit of the equation (the R^2 of the equation drops from 0.85 to 0.37 and serial correlation becomes a problem). The coefficient estimates on the σ's are positive but not significantly different from zero. Also, the estimate of the DM coefficient switches sign and becomes insignificant. We tried other specifications of this equation but the coefficients of the lagged σ variables were never significantly different from zero.[25] As stated earlier, Abraham and Katz (1986) have argued that employment-based dispersion measures such as σ are likely to be contaminated by aggregate demand influences. Indeed, a regression of σ on DM and DM1 yields an R^2 of 0.37; on the other hand, a

regression of S on DM and DM1 yields an R^2 of only 0.02. These results clearly support our argument that sectoral dispersion is best measured using stock market prices.

VI. CONCLUSION

We have provided evidence in favor of an older strand of literature that suggested that structural changes were a large cause of British unemployment after World War I. Adopting a modern sectoral shifts point of view, we constructed a dispersion index from stock market prices based on average stock prices for different industries. We expected that increases in dispersion would lead increases in unemployment. To test this, we estimated regressions explaining unemployment from 1912 to 1938 as well as over the sub-period comprising the strict inter-war period, 1920 to 1938. For both sample periods and for a variety of specifications the dispersion index--particularly the dispersion index lagged for 2 years--emerged as significantly related to unemployment.

We do not claim that all unemployment results from simple switching of resources from one sector to another. Indeed, in our regressions we included conventional aggregate demand shifters such as the growth rate of the money supply and a fiscal policy variable. These variables were also often significantly different from zero. Nonetheless, the point remains that our results suggest that sectoral reallocation from declining sectors to expanding ones also significantly influenced interwar British unemployment.

APPENDIX I

To assemble our dispersion index we used stock prices from 17 sectors of the British economy. Below we list the sectors, the starting and ending date for inclusion in our index as well as any years the sector was omitted from the index. Sectors were omitted either when The Financial Times did not report their stock price on either January 3 or January 4 or when the number of companies within the sector fell to one.

Sector	Starting Date	Ending Date	Years Omitted
Iron, Coal, Steel and Engineering	1910	1938	
Theaters	1910	1938	1914 to 1929
Textiles	1910	1938	1915 to 1919
Electric Light	1910	1938	1921 to 1923
Telephones and Telegraph	1910	1938	1929
Breweries	1910	1938	
Homerails	1910	1934	
Hotels	1910	1938	
Motors and Cycles	1910	1938	1914
Banks	1915	1938	
Shipping	1915	1938	
Insurance	1920	1938	1929 to 1934
Newspapers	1925	1938	
Cements	1930	1934	
Groceries and Provisions	1930	1938	
Electric Equipment	1930	1938	
Dry Goods and Stores	1930	1938	

For each company we calculated the growth rate of its real stock price and then averaged these growth rates within each sector. In two instances we did not use a company within a sector when calculating the average growth

rate. In 1913 the growth rate of a share of Allsop Breweries was 8.4 standard deviations above the mean for the rest of the brewery stocks and in 1922 the growth rate of a share of National Discount was 6.5 standard deviations from the mean of the other bank stocks. We suspect that in each instance the companies changed the par value of their stock, but we could find no concrete evidence of this. Thus, we arbitrary excluded the companies in those years. It is important to note that we made this decision *before* calculating our dispersion index, so there was no "pre-testing" occurring.

After computing the average growth rate within each sector, we then calculated the standard deviation of the industry growth rates for each year. It is this standard deviation that we used as our dispersion index. The dispersion index is reported below:

YEAR	DISPERSION, S	YEAR	DISPERSION, S
1910	10	1925	19
1911	14	1926	11
1912	11	1927	14
1913	33	1928	23
1914	9	1929	11
1915	27	1930	21
1916	12	1931	41
1917	41	1932	25
1918	10	1933	28
1919	15	1934	22
1920	11	1935	19
1921	17	1936	23
1922	23	1937	12
1923	14	1938	15
1924	10		

The dispersion is in terms of percent, that is, a dispersion of "10" is 10%.

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FOOTNOTES

1. This conclusion has been reinforced by Eichengreen (1987) who used a survey conducted around London beginning in 1928. Looking only at males, Eichengreen found that the replacement ratio seemed to have a measurable impact on the decisions of nonhousehold heads. The effect on household heads, though, was not statistically significant at conventional levels.

2. It may be that declining regions (or occupations) releasing resources to advancing regions (or occupations) would be economically a more relevant division than declining industries in a sectoral shock story. Of course, to the extent that industries use industry-specific human capital, declining industries and occupations would be correlated. Additionally, to the extent that an industry is concentrated in a certain region, again there would be a high correlation between changes in industrial fortunes and changes in regional outlooks. In any case, we can only obtain stock price data by industry, so we are unable to carefully examine this question. We owe these observations to comments made by Levis Kochin.

3. Loungani, Rush and Tave (1990a, 1990b) find that stock market dispersion is a significant determinant of U.S unemployment. The first paper presents direct evidence that suggests that aggregate demand factors are *not* the prime determinants of movements in our stock market dispersion index.

4. Exceptions are Samson (1985) and Neelin (1987) who test the hypothesis using Canadian data and Blanchard (1989) who presents some evidence for the U.K and Germany. All of these papers use post-WWII data.

5. A similar critique applies to the work of Matthews, Feinstein and Odling-Smee (1982) who construct a cross-industry dispersion index using output growth instead of employment growth.

6. Time-series studies which find reallocative factors to be important in explaining unemployment include Davis (1987a, 1987b), Lilien and Hall (1986), Blanchard (1989) and Mork (1989). The evidence from micro data is mixed [see Murphy and Topel (1987), Loungani and Rogerson (1989) and Loungani, Rogerson and Sonn (1990)]. Critical reviews of the sectoral shifts hypothesis appear in Katz (1988) and Johnson and Layard (1986).

7. Booth and Glynn (1975, p. 208) present evidence that labor mobility during the inter-war period was low by historical standards.

8. In addition, Aldcroft argued that the expanding industries were more capital intensive than the old staple industries and that this factor also made it difficult to absorb the labor released from the old industries. However, Von Tunzelmann (1982) presents evidence against this argument.

9. Basically, we were limited by our need to use common stock rather than preferred. A large fraction of the stocks reported upon by the Times were preferred issues. In addition, the number of companies within each sector also changed from year to year. Because of these changes, we constructed our dispersion index in 5-year increments. Within each 5-year period we kept the

number of sectors constant and used the same companies within each sector. At the end of each 5-year period, we added as many more sectors and companies within each sector as possible and then calculated the index for the next 5 years.

10. We adjusted for stock splits and changes in par values.

11. Growth rates of stock prices rather than levels seem to be the appropriate component for the dispersion index. Suppose, for instance, a permanent shock hit the economy that affected all industries equally, say, raising their profits permanently by 10%. The equality of the influence implies that we expect no dispersion induced unemployment. To a first approximation, as investors become aware of the shock, the (permanent) 10% increase in profits causes all stock prices to jump upward 10%. Thus, our growth rate based dispersion index will (correctly) show no dispersion. However, a measure based on the level of the stock prices would (incorrectly) show increased dispersion as long as the initial stock prices were not equal. This would be especially a problem because the prices of the stocks that were used varied widely.

12. Our inability to weight by share of employment may not be too important for in previous work using US data from 1930 to 1987 we found little difference between such a weighted and unweighted index. See Loungani, Rush, and Tave (1990a) for details.

13. Some previous work (eg, Broadberry (1986) and Dimsdale, Nickell, and Horsewood (1989) has focused on the behavior of the real wage as a factor explaining unemployment. We, however, believe it is not correct to regard the real wage as exogenous. We look at the real wage as being determined along with the unemployment rate. Thus, in our work we focus on factors that can more correctly be characterized as exogenous.

14. We use the base money supply rather than a broader measure of money because broader measures of the money supply likely are endogenous. King and Plosser (1985) have a recent demonstration of this point.

15. Our S index determines the maximum sample period we can use. We constructed S for the period 1910 to 1938. However, using lags in the regression leads to a "loss" of the 1910 and 1911 observations. Thus, 1912 to 1938 is the longest sample period.

16. Data for the replacement ratio are available only for the period between 1920 to 1938. Thus we are unable to include it in our regressions beginning in 1913.

17. For instance, when we included a lagged dependent variable the major change was to S1. The estimated coefficient fell in size to 2.08 and was significantly different from zero at a p-value of .16. However, the significance of S2 was unaffected (it remained significant at a p-value of .01) and the lagged dependent variable did not attain standard levels of significance. When we estimated the regression allowing for the residuals to be serially correlated S1 remained significant at a p-value of .06 and S2 at a

p-value of .01. The serial correlation coefficient though had a p-value of only .53.

18. Clearly statements about the significance of the coefficients depend on the distribution of the error term. Using an LM test based on the skewness and kurtosis of the estimated residuals, we were unable to reject the hypothesis of normality with a test statistic of $X^2(2) = .45$.

19. Robert Clower suggested that the effects from dispersion may be asymmetric; dispersion above the average might lead to increased unemployment while dispersion lower than the average might have no effect. We examined this hypothesis by estimating a regression separating the dispersion indices into separate series for above- and below-average dispersion and then testing whether the coefficients on above-average dispersion were the same as those on the below-average dispersion. A standard F-test fails to reject the hypothesis of equality, with a calculated F-statistic of $F(3,17) = .79$. We performed a similar test for the restricted sample period 1920-1938 and obtained comparable results. Thus, we find no evidence for asymmetry.

20. If we include a lagged dependent variable to take account of the serial correlation, the lagged dependent variable is highly significant. S1 becomes no longer significantly different from zero. S2's estimated coefficient falls to 2.38 with a standard error of 1.25, which is significantly different form zero at a p-value of .07. Thus, our results about the dispersion index, especially about S2, are not affected in a major way by this set of changes.

21. In other theories, however, stock returns are not assigned a causal role, but merely act as a leading indicator of the future course of the economy.

22. However, GY is excluded. Including it does not affect the significance of the other variables in the regression. The coefficient on GY has an estimate of 8.07 with a standard error of 4.35. The lack of significance is perhaps not too surprising because the ratio of government purchases to GNP has little variation over this sample period. However, this does not explain the perverse sign.

23. Once again we were unable to reject the hypothesis of structural stability using CUSUM and CUSUMSQ test. In addition, an LM test fails to reject normality for the estimated residuals.

24. This variable is analogous to that used by Lilien. We constructed σ using the 23-industry decomposition of employment used in Feinstein (1972).

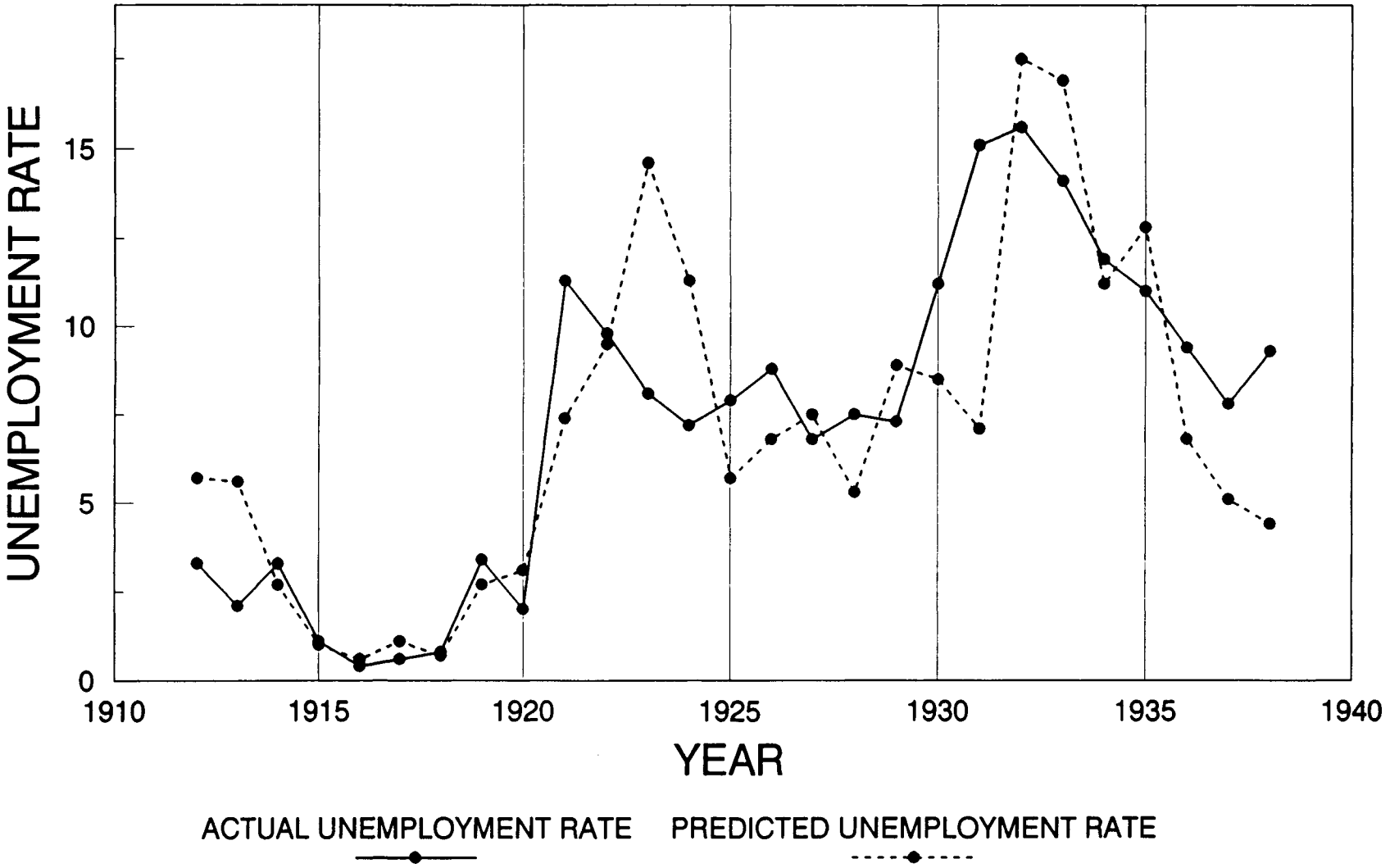
25. About the only specification in which *any* of the σ's were significant was:

$$UN = -0.84 + 0.04DM + 0.49DM1 + 8.76\sigma + 0.76UN1 \qquad R^2=.37$$
$$\qquad (0.44)\ (1.80)\quad (1.49)\quad (4.40)\ (0.18) \qquad DW=0.6$$

Even here, notice the very low R^2 and low Durbin Watson statistic. The DM's, however, remained perversely signed.

FIGURE 1

ACTUAL AND PREDICTED UNEMPLOYMENT RATES



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