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What is the natural rate of unemployment?

Ellen R. Rissman

The unemployment rate is the composite of three distinct types of unemployment: frictional, cyclical, and structural. This fact poses a potentially serious problem for government policymakers because high unemployment rates are not necessarily indicative of a slack economy. Structural change as well as cyclical factors affect the unemployment rate. If policymakers are not able to distinguish higher unemployment rates due to a change in the structure of employment from higher unemployment rates due to a weak economy, then they run the risk of implementing expansionary policies at the wrong time, thereby creating or adding to inflationary pressures. Hence, to adequately gauge the state of the economy, it is necessary to know what portion of the current unemployment rate is due to purely cyclical phenomena as opposed to structural and frictional.

The natural rate of unemployment is defined simply as the rate of unemployment that is compatible with a steady inflation rate. The natural rate can therefore be thought of as the rate of unemployment that would occur in the absence of cyclical fluctuations. In other words the natural rate is essentially the sum of structural and frictional unemployment. Because structural and institutional factors change over time, the natural rate of unemployment will also vary. However, the need to understand the determinants of the natural rate and its relation to the actual rate of unemployment is quite real as the cost of error may be accelerating inflation or deflation.

The purpose of this article is to answer the question: What is the natural rate of unemployment? The answer relies heavily on the pioneering work of Lilien (1982) and is in two parts. First, a working definition of the natural rate of unemployment is developed. Second, with this definition, estimates of the natural rate of unemployment are calculated.

The analysis indicates that the natural rate of unemployment has been quite variable over the last 27 years, reaching a high of 7.01 percent in the third quarter of 1981 and attaining a low of 3.48 percent in the first quarter of 1966. But to understand the performance of the economy, it is the difference between the natural rate and actual rate of unemployment that is significant. This difference has varied widely over time. From 1958 through 1966 the natural rate was well below the actual; the reverse held from 1967 to 1973. From 1974 through 1976 the actual rate again exceeded the natural rate although in more recent years the reverse appears once more to be the case.

Because the difference between the natural and actual rates of unemployment is thought to be indicative of the degree of tightness in the labor market, this measure should be positively correlated with the inflation rate. Indeed, the correlation coefficient between the difference and the inflation rate as measured by the Consumer Price Index is 0.46. This compares with an almost zero correlation of inflation with the actual unemployment rate.

Categories of unemployment

In general it is useful to distinguish conceptually among three distinct types of unemployment in analyzing the historical pattern of the unemployment rate.[1] First, there is frictional unemployment. Frictional unemployment arises as a result of the normal labor turnover that occurs in a healthy dynamic economy. At any given time employed workers change jobs, lose jobs, or leave the labor force. Similarly, unemployed workers may find employment or may decide to stop seeking employment, while still others may enter or reenter the labor force. Even in the best of times there is some unemployment that arises from this dynamic friction in the economy.

The type of unemployment that is perhaps perceived and felt most acutely is cyclical unemployment. As its name suggests, it is the type of unemployment that is associated with business cycles. Decreases in aggregate demand such as occur during recessions cause a general overall decline in labor demand. The real wage rate is relatively unresponsive to

Ellen R. Rissman is an economist at the Federal Reserve Bank of Chicago.

these changing conditions, that is, real wages do not decline as labor demand declines.[2] As a result, unemployment occurs. If real wages were free to adjust to these changed conditions in the labor market, then recessions would not produce any noticeable increase in the unemployment rate. Cyclical unemployment is temporary and when demand conditions return to their previous level, the excess labor supply disappears. Even permanent declines in aggregate demand result in only temporary unemployment because sooner or later wages in a competitive economy must adjust so as to equate labor supply and labor demand, though now at a lower equilibrium wage rate.

The third type of unemployment is probably the least understood and also the most traumatic to endure. Unlike cyclical unemployment, structural unemployment is the result of shifts in the *relative* demand for different types of labor. Whether these relative shifts in labor demand are caused by changes in relative factor prices (e.g., an oil price shock), technological innovations, changes in tastes and preferences, or perhaps changes in institutional or other characteristics of the economy, is not important. The essential point is that as labor demand for one type of labor falls relative to another, a temporary mismatch occurs between the skills that employers desire and those that the work force actually possesses. This produces only temporary unemployment because in time those who are structurally unemployed will either retrain to find employment in the now higher labor demand industries, relocate to find jobs requiring the types of skills they already have, or perhaps leave the labor force altogether, in which case they are not counted as unemployed. How long this process takes depends upon the costs of education, the costs associated with relocating or finding employment further from one's original location, and the costs of job search, and, of course, additional opportunity and psychological costs.

In terms of these three components, the natural rate of unemployment is simply the rate that would occur in the absence of cyclical fluctuations. It is the sum of frictional and structural unemployment.

Historical perspective

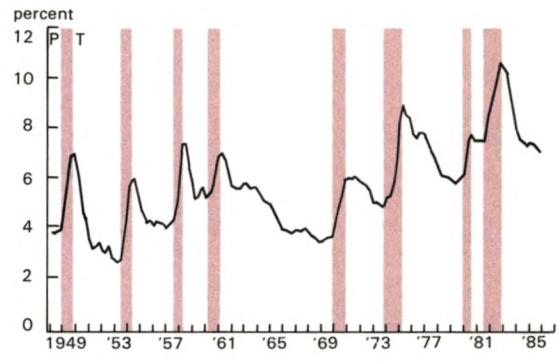
Figure 1 presents the civilian unemployment rate quarterly from 1948 through 1985 with the periods between business cycle peaks and troughs shaded for reference. There appear to be three distinct phases. The decade of the 1950s is characterized by three recessions, with unemployment peaking at each economic downturn. Between these periods, the unemployment rate hovered somewhere between four and five percent. Even when the unemployment rate reached its highest value of 7.37 percent, it was substantially below the two-digit unemployment rates of recent years.

The decade of the 1960s was one of economic growth with no major recessions recorded after 1961. And as a result, the unemployment rate drifted downwards from a high at the depth of the recession of 7.00 percent to a low in 1969 of 3.40 percent.

Unsurprisingly, structural unemployment was not an issue at this time. Indeed, the pattern of unemployment is very well explained by two components: cyclical and frictional. The business cycles of the 1950s and early 1960s attest to the significance of the cyclical element, while the relatively economically calm remainder of the 1960s underscores the importance of frictional unemployment.

Economists and policymakers of the time alike recommended a seemingly reasonable unemployment rate target for policy of around three percent. This three percent level was called, with perhaps unconscious irony, the full employment rate of unemployment. While the nomenclature is unfortunate, the term was meant to indicate the level of unemployment that would occur in the absence of cyclical factors. From the perspective of the 1950s and 1960s, then, the full employment level of un-

Figure 1
Civilian unemployment rate



employment was essentially the frictional level of unemployment.

The 1970s and 1980s to date exhibit a much different unemployment rate pattern. Over this time the unemployment rate rose from a low of 4.17 percent in the first quarter of 1970 to a high of 10.60 percent in the fourth quarter of 1982. As in previous years, the unemployment rate responded to cyclical factors, peaking in the trough of each of the four major recessions. But, the unemployment rate appears to be trending upwards during the period so that the average unemployment rate from 1970 through 1985 was 6.94 percent as compared to 4.51 percent and 4.78 percent respectively for the 1950s and 1960s. In addition, the unemployment rate appears to be much more volatile in these later years: The calculated standard deviation is 1.50, compared to standard deviations of 1.28 and 1.08 in the two earlier decades.

Demographic change

This abrupt change in the pattern exhibited by the unemployment rate suggests that there were factors involved other than merely frictional and cyclical unemployment. One possible explanation is that the underlying labor force demographics changed, thereby adversely affecting the unemployment rate. Specifically, the labor force composition changed over the 1970s relative to what it was in the 1960s in such a way that the labor force now contains a significantly higher proportion of individuals subject to higher unemployment rates, such as nonwhites, females, and youths.

A simple way of testing the effects of the changing demographic composition of the labor force on the unemployment rate is to compare the actual civilian unemployment rate (UR) with a fixed-weight unemployment rate (WUR). Specifically, the unemployment rate is calculated as:

$$UR_t = \sum_{i=1}^{I} \gamma_{it}\ UR_{it} \qquad i = 1, \ldots, I \qquad [1]$$

where UR_t is the unemployment rate at time t, i indexes the I demographic groups, γ_{it} is the fraction of the total labor force in group i at time t, and the sum of the γ_{it}'s equals one.

The fixed-weight unemployment rate at time t is calculated as:

$$WUR_t = \sum_{i=1}^{I} \gamma_{i\tau}\ UR_{it} \qquad i = 1, \ldots, I \qquad [2]$$

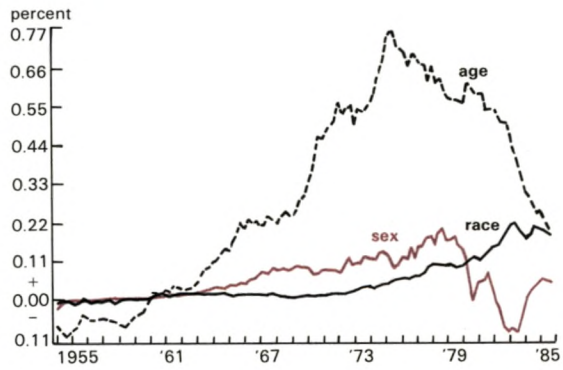
where τ is some pre-assigned base period. Thus, the fixed-weight unemployment rate computes what the civilian unemployment rate would have been if the demographic composition of the labor force had remained as it was in base period τ.

Figure 2 plots the differences between the actual quarterly unemployment rate and various fixed-weight measures where the base period τ is selected to be the first quarter of 1960.[3] Positive values indicate that the demographic changes that have occurred relative to the first quarter of 1960 unfavorably affect the unemployment rate while negative values indicate that the unemployment rate would have been higher if the demographic composition of the labor force had been the same as in the base period. The calculations were done for race, sex and age categories.[4]

As is obvious from Figure 2, the increase in the proportion of females, nonwhites, and young people in the labor force resulted in a small increase in the unemployment rate. The most important effect occurred as a result of changes in the age distribution. At its peak in 1975, the changing age distribution contributed around three quarters of a percentage point to the overall unemployment rate. However, this effect has been decreasing as the labor force has aged.

In contrast, the changing racial composition of the labor force tended to increase the

Figure 2
Effect of changing demographics on the unemployment rate



unemployment rate at an accelerating rate over the 1970s and early 1980s, reaching its maximum effect in 1983. But race never contributes more than one quarter of a percentage point to the aggregate unemployment rate.

Finally, the increased labor force participation of women relative to 1960 has for the most part adversely affected the unemployment rate, contributing approximately an additional two tenths of a percentage point in 1978. However, since 1979 the relation between the sex composition of the labor force and the unemployment rate has become less marked due to a decline in the unemployment rate of females relative to males.

This change is not necessarily attributable to lower levels of sex discrimination. An alternative explanation may be that women are clustered in jobs that are relatively more protected from market forces. For example, blue collar jobs are more frequently filled by men than women. Those blue collar jobs that are located in declining industries would contribute to a higher unemployment rate for males than for females, all other things equal.

Thus, it seems that the changing demographic composition of the labor force has resulted in an increase in the civilian unemployment rate since 1960, but the magnitude of the effect is quite modest—adding less than one percentage point to the total unemployment rate. Even after controlling for changes in the demographic composition of the labor force, the unemployment rate of the 1970s and early 1980s is still significantly higher and more volatile than in the previous two decades.

Changing industrial composition

Just as the demographic distribution (and possibly the geographic distribution) of the labor force provides clues to analyzing the more recent behavior of the unemployment rate, the distribution of employment across industries also plays a role. It is the changes in the distribution of employment across industries that is most closely related to the concept of structural unemployment. As noted previously, structural unemployment arises due to relative shifts in the demand for different types of labor causing a period of economic adjustment during which time some displaced labor will be temporarily unemployed. Changes in the relative demands for labor will be accompanied by changes in the distribution of employment across industries.

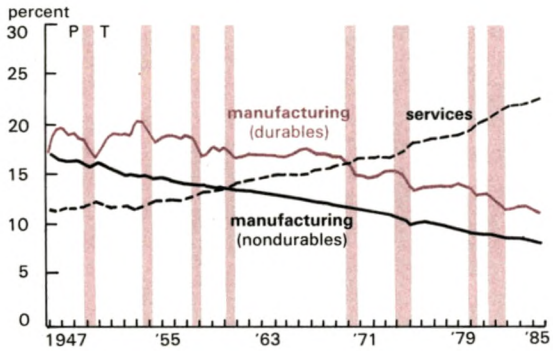
Perhaps the most prominent movement in the employment profile in recent history is the change of the private economy from one based upon manufacturing and other traditional industries to one based upon services and service-related industries.[5] Figure 3 presents this trend for selected industries, and prompts important observations. First, the decline in manufacturing and concurrent rise in the share of employment in services are not recent phenomena. The graph shows that these adjustments have been occurring almost continuously throughout the post-World War II period.

Secondly, even within manufacturing there are notable differences between the behavior of employment shares in durable and nondurable goods. The decline in nondurable goods has proceeded much more smoothly than the decline in employment share in durable manufacturing.

This steady decline in the relative importance of nondurable manufacturing is not necessarily an indication of structural change in the sense that it documents the ebb and flow of the fortunes of the industry in question. *The historical pattern is also consistent with a steady stream of technological innovation which enables production to remain unchanged while employment levels decline.* While the steady decline in employment share is almost certain to contribute to the flow of unemployment, it may well be that the unemployment generated is much less in volume and of shorter duration than that which would occur in industries experiencing a more sporadic, volatile decline such as durable manufacturing. The reason is that rational workers are more likely to be able to predict and therefore cushion or even avoid the blow of unemployment altogether by preparing for the event sufficiently in advance.

The third observation concerning the patterns seen in Figure 3 pertains to the effect of business cycles on the distribution of employment across industries. Recessions clearly and consistently are associated with declines in employment share in durable goods manufacturing. It is well known that business cycles have a differential impact across industries, affecting some more adversely than others.[6] Just why this occurs depends upon the nature of the demand for the good as well as the costs of in-

Figure 3
Share of total employment in selected industries



ventorying. If the good is viewed as a luxury item or requires a relatively large expenditure, then purchases are more likely to be postponed during periods of low aggregate demand, when discretionary income falls. For example, housing starts and new construction are particularly susceptible to changes in the economic outlook. In addition, those industries with high inventory costs are less able to smooth production and are therefore more susceptible to the vagaries of the market.

The post-World War II era has seen considerable change in the distribution of employment across industries. Such shifts in employment are likely to generate unemployment temporarily as displaced workers search for employment. Large movements in employment across industrial sectors are likely to be associated with temporary increases in the unemployment rate because these movements signify a change in the underlying structure of the economy. However, change in and of itself does not cause unemployment. The unemployment arises because of friction or inertia in the economy which make it difficult for individuals to adapt instantaneously. Given these frictions, the larger is the flow of workers into and out of the various industries, the more likely it is that a larger volume of unemployment will be generated.

One way of measuring these flows is to define a variable $\hat{\sigma}_t^2$ where:

$$\hat{\sigma}_t^2 \equiv \sum_{i=1}^{I} s_{it-1} \left[g_{it} - g_t\right]^2, \qquad [3]$$

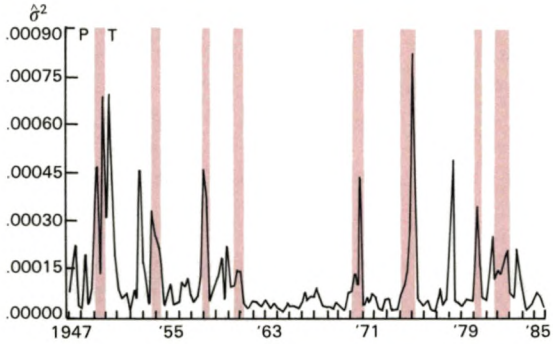
s_{it} is the share of total employment in industry i at time t, g_{it} is the growth rate of employment in the i^{th} industry between period t and period $t-1$, and I is the number of industries. Thus, $\hat{\sigma}_t^2$ is the weighted sum of squared deviations of industry growth from average aggregate growth where the weights are given by the employment share of the i^{th} industry.

This measure captures those employment flows that are associated with changes in the distribution of employment across industries and not those changes in employment that occur as a result of economic growth. Furthermore, those industries experiencing a large deviation in employment growth relative to the average growth rate of employment are given more weight in the calculation due to the squaring of the term in parentheses. Such a weighting scheme is appropriate if, for example, large deviations in employment growth from the average are associated with disproportionately large increases in unemployment. For further details on the interpretation of $\hat{\sigma}_t^2$ see Box, *Measuring employment flows*.

Figure 4 displays the measure of employment adjustment $\hat{\sigma}_t^2$ from the first quarter of 1947 through 1985.[7] There appear to be many periods of rapid employment adjustment across industries during the post-war period. Frequently, these adjustments are coincidental with business cycles as noted in the preceding discussion of industry employment shares. The period from 1947 to 1960 is marked by three episodes of employment adjustment corresponding roughly with the recessions in 1950, 1954, and 1958. The more stable 1960s exhibit very little change in the distribution of employment across industries. The 1970s and early 1980s in contrast indicate a pronounced change in employment shares occurred in late 1970 and again in 1975 and 1978. The 1980s are surprisingly stable in comparison to the experience of the 1970s, providing preliminary evidence that structural change was perhaps not a major contributing factor to the historically high unemployment observed in the 1982 recession.

The effect of employment adjustment across industries on the civilian age-weighted unemployment rate is analyzed over the period from 1954 through the third quarter of 1985.[8] The results of the analysis are found in Table 1, which presents the estimates and associated

Figure 4
Measure of employment adjustment across industries



standard errors of the parameters of interest as well as some additional descriptive statistics.

Other variables included in the analysis are measures of unanticipated changes in real Gross National Production (GNP) and unanticipated money growth (M). Unanticipated real GNP is calculated as the residuals from the estimated ARIMA process generating real GNP where the estimates are obtained by the maximum likelihood method. Unanticipated money growth is computed as discussed in Barro (1978).

Columns (1) through (3) of Table 1 present estimates of ordinary least squares regressions on various sets of variables including two lagged dependent variables.[9]

All three models reported in Table 1 indicate that unanticipated movements in real Gross National Product are negatively associated with the age-weighted unemployment rate. Thus, realizations of real GNP above trend tend to decrease the unemployment rate while realizations below trend tend to increase the unemployment rate.

Intuition suggests that unanticipated money growth should also be negatively associated with the unemployment rate if unanticipated positive changes in monetary growth signal expansionary monetary policy. As seen in columns (2) and (3) of Table 1, the coefficient on unanticipated money growth is negative only for current realizations and positive for lagged values. However, the magnitude of the effect is imprecisely determined as seen by the large associated standard errors.

Finally, the inclusion of current and lagged values of the measure of employment

Table 1
The effect of employment adjustment on the unemployment rate

	(1)	(2)	(3)
GNP_t	−0.018 (0.002)	−0.019 (0.002)	−0.016 (0.002)
GNP_{t-1}	−0.011 (0.003)	−0.012 (0.003)	−0.008 (0.003)
GNP_{t-2}	−0.005 (0.002)	−0.005 (0.003)	−0.004 (0.002)
M_t	—	−3.215 (3.556)	−2.551 (3.312)
M_{t-1}	—	2.444 (3.700)	1.054 (3.417)
M_{t-2}	—	3.313 (3.946)	2.721 (3.619)
$\hat{\sigma}^2_t$	—	—	790.443 (212.599)
$\hat{\sigma}^2_{t-1}$	—	—	393.051 (234.715)
$\hat{\sigma}^2_{t-2}$	—	—	−387.709 (234.671)
$\hat{\sigma}^2_{t-3}$	—	—	106.700 (215.610)
$\hat{\sigma}^2_{t-4}$	—	—	−603.343 (199.532)
UR_{t-1}	1.387 (0.074)	1.385 (0.076)	1.308 (0.086)
UR_{t-2}	−0.406 (0.076)	−0.402 (0.079)	−0.319 (0.086)
C	0.093 (0.087)	0.078 (0.091)	0.030 (0.083)
R^2	0.976	0.977	0.982
Q	5.74	5.43	3.80

adjustment has a clear and significant effect on the unemployment rate. Increases in the amount of interindustry employment adjustment have an initial adverse affect upon the unemployment rate, as expected. Thus, the larger are the changes in the distribution of employment across industries, the higher is the unemployment rate. The long term effects of such shifts in employment are not immediately obvious, however, due to the inclusion of the two lagged dependent variables in the regression model. The difficulty arises because current changes in $\hat{\sigma}^2$ affect not only the current unemployment rate but also future unem-

Measuring employment flows

To further motivate the use of $\hat{\sigma}_t^2$, defined in equation [3], let e_{it} be employment in industry i at time t and let $e_t \equiv \sum_{i=1}^{I} e_{it}$ be the total level of employment in the economy at time t. The change in the number of people employed in industry i between periods t and $t-1$ is simply $e_{it} - e_{it-1}$. However, employment changes can occur for two reasons: economic growth and shifts in the underlying industrial composition of employment. For purposes of measuring structural change and relating structural change to the unemployment rate, adjustments in employment due to shifts in the employment distribution across industries alone are of interest. Thus, the expression $e_{it} - s_{it-1}e_t$ is simply the difference between employment in industry i at time t and the amount of employment in industry i that would have occurred at time t if the i^{th} industry had grown at the same rate as the aggregate economy, i.e. the employment share of industry i had remained unchanged. Obviously, if no change in employment share had occurred, then the expression $e_{it} - s_{it}e_t$ equals zero. Similarly, if $e_{it} - s_{it-1}e_t$ is positive (negative), then the i^{th} industry's employment share is rising (falling).

The change in employment attributable solely to changes in employment share and not economic growth can be rewritten in terms of growth rates as $e_{it-1}(g_{it} - g_t)$. Since the unemployment rate is assumed to respond to the magnitude and not the direction of employment changes, the total volume of employment flows attributable to shifts in the distribution of employment is simply calculated as $\sum_{i=1}^{I} e_{it-1} \mid g_{it} - g_t \mid$ which is proportional to $\sum_{i=1}^{I} s_{it-1} \mid g_{it} - g_t \mid$. Finally, by squaring the amount within the absolute value signs, the original expression for $\hat{\sigma}_t^2$ results. As discussed briefly in the text, by squaring $\mid g_{it} - g_t \mid$ those industries experiencing relatively large deviations of employment growth from the aggregate are given more weight in the calculation. Since structural shifts of large magnitudes are thought to have a disproportionately large impact upon the unemployment rate, such a weighting scheme is appropriate.

ployment rates. Simulations show that the maximum effect of an increase in the volume of interindustry employment changes is felt after a one-quarter lag, damping thereafter.

It should be noted that while the coefficient estimates on current and lagged values of $\hat{\sigma}^2$ are quite large in magnitude, the actual values of $\hat{\sigma}^2$ are relatively small, with an average value over the entire time period of $1.3x10^{-4}$. If, for example, a one standard deviation increase in $\hat{\sigma}^2$ occurred at time 0, the unemployment rate would rise by only 0.20 percent in the first quarter, 0.36 percent in the second quarter, and 0.16 percent after one year.

While the evidence reported in Table 1 suggests that the volume of interindustry movement of employees is positively related to the unemployment rate, the interpretation that the associated movements in the unemployment rate are due to structural change is not that easily justified. Thus, drawing inferences about structural unemployment or the natural rate of unemployment from the results found in Table 1 is inappropriate. The difficulty arises because of the simultaneous effect of cyclical and structural factors on employment flows. As illustrated in Figure 3, the ebb and flow of employment shares is dependent upon the stage of the business cycle. In durable manufacturing recessions are invariably associated with declining employment shares and therefore a greater amount of employment adjustment. The problem therefore is to develop a measure that distinguishes employment flows attributable only to structural factors from employment flows attributable to purely cyclical factors.

Structural change

There are a variety of ways to extract the purely cyclical effect on the distribution of employment across industries from the purely structural. These techniques all rely upon an assumption that cyclical changes in employment are temporary while structural changes are more or less permanent by definition.

In attempting to eliminate the effect of cyclical factors on the distribution of employment across industries, calculations can proceed along one of two lines. A measure of the variability of employment shares (or possibly employment growth) across industries can be calculated first and then decomposed into a permanent (structural) component and a temporary (cyclical) one. Alternatively, the employment share or level in each industry is decomposed into its permanent and cyclical elements and then, using only the permanent portion, a single measure of permanent change in employment distribution is devised. The first approach, while computationally easier, may obscure much of the underlying dynamics which by hypothesis are what give rise to structural unemployment. For this reason the second approach is preferred.[10]

As noted above, certain industries experience relatively smooth changes in employment shares over time while others experience much more volatile changes. While both of these types of changes can be permanent, intuition suggests that abrupt permanent changes in employment share add more to the volume of unemployment than do smoothly occurring changes. Thus, the permanent portion of changes in employment shares that is not explainable by past experience is the appropriate measure of structural change.

Calculating the difference between the actual employment share in industry i at time t and that which would be expected based upon past behavior is relatively straightforward. However, separating this measure into its permanent and temporary components is a more complicated endeavor. See Box, *Measuring structural change.*

Assuming that deviations of employment shares from trend in industry i at time t can be accurately decomposed into permanent changes (Δ_{it}^P) and temporary changes (Δ_{it}^T), then the measure of permanent structural change for the aggregate economy at time t (Δ_{it}^P) is simply defined as:

$$\Delta_t^P \equiv \left[\sum_{i=1}^{I} (\Delta_{it}^P)^2 \right]^{1/2} . \qquad [4]$$

Similarly, the measure of temporary change in employment shares (Δ_{it}^T), is defined as:

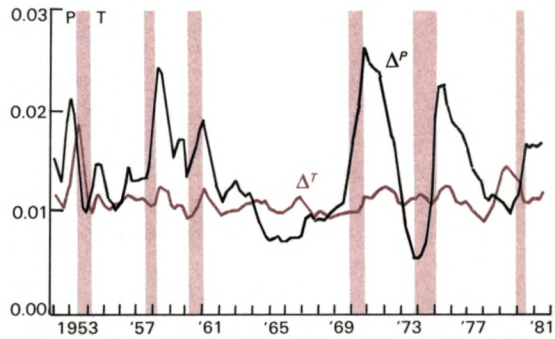
$$\Delta_t^T \equiv \left[\sum_{i=1}^{I} (\Delta_{it}^T)^2 \right]^{1/2} . \qquad [5]$$

Because the expression in parentheses is squared, effectively those industries experiencing relatively large permanent changes in employment shares are weighted more heavily in the calculation.

The behavior of Δ^P and Δ^T from the first quarter of 1952 through the third quarter of 1981 is examined in Figure 5.[11] As can be seen, permanent changes in the distribution of employment across industries correspond closely to business cycles, exhibiting quite noticeable peaks in 1958, 1961, 1970, and 1975, and possibly in 1980. In contrast, temporary changes in the employment distribution do not appear to be significantly correlated with the business cycle.

A comparison of the measurement of employment adjustments, $\hat{\sigma}^2$, with the constructed measure of permanent structural change, Δ^P, yields some interesting insight. The crude measure of employment adjustment records its largest value in 1975, leading to the premature conclusion that structural change was most

Figure 5
Permanent and temporary changes in the distribution of employment across industries



Measuring structural change

Let $\underline{s}_t$ be the $Ix1$ vector of employment shares at time t. Thus $\underline{s}_t'$ is simply defined as $(s_{1t}, s_{2t}, \ldots, s_{It})$ for $t = 0, \ldots, T$ where $'$ indicates the transpose and s_{it} is the employment share of industry i at time t. The vector of employment shares is assumed to be related to its past and future values. Specifically, assume that

$$\underline{s}_t = (1 - a_t)\sum_{j=1}^{J} \beta_j \underline{s}_{t-j} \qquad [i]$$

$$+ a_t \sum_{j=1}^{J} \beta_j \underline{s}_{t+j} + \varepsilon_t$$

where a_t is some time varying parameter, the β_j's are geometrically declining weights, $\sum_{j=1}^{J}\beta_j = 1$ and ε_t is an additive independent and identically distributed random error term. Thus, the current vector of employment shares is assumed to be a two-sided moving average of its past and future values. Subtracting $\sum_{j=1}^{J} \beta_j \underline{s}_{t-j}$ from both sides of equation [i], the following results:

$$\underline{s}_t - \sum_{j=1}^{J} \beta_j \underline{s}_{t-j} = \qquad [ii]$$

$$a_t[\sum_{j=1}^{J} \beta_j \underline{s}_{t+j} - \sum_{j=1}^{J} \beta_j \underline{s}_{t-j}] + \varepsilon_t$$

The left hand side of equation [ii] can be interpreted as the deviation in current employment shares from its expected value based upon past experience. This deviation is seen to be the sum of two components: a temporary component, ε_t, and a permanent component,

$$a_t[\sum_{j=1}^{J} \beta_j \underline{s}_{t+j} - \sum_{j=1}^{J} \beta_j \underline{s}_{t-j}].$$

Equation [ii] can be estimated by ordinary least squares assuming a fixed J and specific values for the β_j's. The permanent component for the i_{th} industry is simply defined as:

$$\Delta_{it}^{P} \equiv \qquad [iii]$$

$$\hat{a}_t[\sum_{j=1}^{J} \beta_j s_{it+j} - \sum_{j=1}^{J} \beta_j s_{it-j}]$$

where $\hat{}$ indicates the estimated value of the parameter, while the temporary component is calculated as the regression residual:

$$\Delta_{it}^{T} \equiv s_{it} - \sum_{j=1}^{J} \beta_j s_{it-j} \qquad [iv]$$

$$- \hat{\alpha}_t[\sum_{j=1}^{J} \beta_j s_{it-j} - \sum_{j=1}^{J} \beta_j s_{it-j}].$$

pronounced at that time. The more refined measure of permanent structural change, on the other hand, clearly indicates that structural change was far less important a factor in the 1975 recession than it was in the 1970 recession. Interestingly enough, even the recession that occurred in 1958 appears to have been associated with a more pronounced permanent change in the structure of employment than was the 1975 recession.

Structural change and the unemployment rate

The calculation of permanent and transitory changes in the distribution of employment across industries is a refinement of the measure of interindustry employment flows $\hat{\sigma}_t^2$ employed previously. It is constructed so as to give meaning to the concept of structural change. If structural change is rapid and accompanied by large employment shifts, then

unemployment is thought to be the by-product as workers struggle to adapt to the changing situation.

Analysis of the relation between the computed permanent and transitory variation of the employment distribution and the unemployment rate may proceed along lines similar to that presented in Table 1. However, it is implicitly assumed there that once demographic changes have been controlled for, all other unemployment results from cyclical, structural, or frictional factors where frictional unemployment is assumed to be some constant amount. In essence, this assumption denies the existence of other factors, particularly institutional arrangements, that have an effect upon the unemployment rate.

Changing institutional conditions are not cyclical by nature. Nor should they be thought of as contributing to structural unemployment because structural unemployment as defined here is the result of the changing relative demand for different types of labor. These changing institutional characteristics are most properly associated with frictional unemployment. As discussed elsewhere, frictional unemployment arises due to the functioning of a dynamic labor market where workers are continuously making decisions as to the proper allocation of their labor. These decisions are based upon the parameters of the underlying institutional framework. Thus, when this framework changes, it will also have an effect upon the decisions of the workers to seek work or quit work, and therefore it will have an effect upon the frictional rate of unemployment.

Much research has been devoted to analyzing the effect of unemployment insurance on job search. Critics argue that the existence of such unemployment insurance schemes lowers the costs of job search and therefore encourages unemployed workers to remain unemployed for a longer duration than they would have in the absence of such benefits. Thus, more lenient benefits tend to increase the unemployment rate. While this may in fact occur initially, it is also quite possible that by encouraging people to search longer for employment, better job matches between employees and employers will result, thereby having a negative long-run effect on the unemployment rate.

The regression models presented in Table 2 analyze the effect of permanent and transitory changes in the distribution of employment on the age-weighted unemployment rate. As presented previously, other explanatory variables include deviations in real Gross National Product from trend and unanticipated money growth. In light of the preceding comments on institutional arrangements, an additional variable is included (SI) which is social insurance expenditures as a percentage of Gross National Product.[12] This variable is assumed to proxy for the costs associated with unemployment.

Table 2 presents ordinary least square estimates from regressions on the civilian age-weighted unemployment rate over the period from 1954 through the third quarter of 1981. Parameter estimates and their associated standard errors in parentheses are reported along with some descriptive statistics. As in the regressions reported in Table 1, the models of Table 2 include two lagged dependent variables. Therefore, the OLS estimates are asymptotically equivalent to maximum likelihood estimates only if the errors are not heteroskedastic. The adjusted Box-Pierce statistic (Q) is reported testing for autocorrelation of the estimated residuals for a lag length of six quarters. Judging from the small magnitude of this statistic, the residuals appear to be "white noise".

The results indicate that structural change adversely affects the unemployment rate while transitory changes in the distribution of employment across industries have no discernible effect. As in Table 1, the inclusion of lagged dependent variables in the regression model complicates the interpretation of the coefficients. This occurs because current structural change not only affects the current unemployment rate but also influences the future time path of the unemployment rate directly through a one-quarter lag and indirectly through the two lagged dependent variables.

Figure 6 reports the results of a simulation based upon the parameter estimates found in column (1) of Table 2. The effect of a one standard deviation temporary increase in Δ^P at time 1 on the time path of the unemployment rate is analyzed. By temporary, it is meant that the disturbance occurs at time 1 after which Δ^P returns to its previous level. As seen in the graph, although current structural change adversely affects the unemployment rate both currently and into the future, the effects damp quite quickly. A one standard deviation rise in

Table 2
Structural change and the unemployment rate

	(1)	(2)
GNP_t	−0.009 (0.003)	−0.009 (0.003)
GNP_{t-1}	−0.008 (0.003)	−0.008 (0.003)
GNP_{t-2}	−0.002 (0.003)	−0.002 (0.003)
M_t	−7.740 (3.330)	−7.413 (3.444)
M_{t-1}	3.083 (3.492)	3.293 (3.564)
M_{t-2}	−0.563 (3.780)	−0.358 (3.848)
Δ_t^P	94.448 (14.734)	96.450 (16.439)
Δ_{t-1}^P	−86.213 (14.683)	−88.514 (16.545)
Δ_t^T	—	0.537 (35.092)
Δ_{t-1}^T	—	9.103 (36.516)
SI_t	3.332 (1.038)	3.158 (1.114)
UR_{t-1}	1.185 (0.078)	1.177 (0.082)
UR_{t-2}	−0.247 (0.078)	−0.239 (0.081)
C	0.018 (0.101)	−0.072 (0.224)
R^2	0.978	0.978
Q	3.30	3.49

Δ^P at time 1 causes the unemployment rate to rise by approximately one half of a percentage point that quarter. The following quarter when Δ^P returns to its previous level, the unemployment rate is still larger than it would have been by approximately one tenth of a percentage point. Within four quarters of the structural change the effect on the unemployment rate is small, being only one hundredth of a percentage point and continuing to decline thereafter. Thus, the long-term effects, i.e. greater than one year, of structural change on the unemployment rate are negligible.

The evidence provided in Table 2 and Figure 6 suggests that the unemployment rate adjusts quite rapidly to changes in the underlying structure of employment. This is surprising because it is widely held that structural change is responsible for creating a large pool of chronically unemployed workers. However, the numbers indicate that most of the effect occurs within two quarters of the disturbance and long-term effects are minimal. This evidence is at least partially corroborated by statistics on the distribution of unemployment by duration.

Table 3 reports for the period 1960 to 1985 the percentage of unemployed workers in a given year who have been unemployed for various specified lengths of time. As can be seen, the vast majority of the unemployed become reemployed (or perhaps leave the labor force) within six months of losing or leaving a job. Even in the worst year from unemployment duration standards, less than a quarter of the unemployed were unemployed for longer than twenty-six weeks. In fact, much of the change in the distribution of unemployment by duration that has occurred over this time appears to be related to cyclical factors associated with a general weakness in the labor market.

Thus, the perception that structural change leads to a more or less permanent pool of chronically unemployed workers is not entirely justified. However, this evidence should not be taken as confirmation that structural factors have an impact of only limited duration on the overall performance of the labor market. It may well be the case that structural change results in an increased frequency of unemployment rather than an increased duration so that

Figure 6
Effect of a one standard deviation increase in structural change on the unemployment rate

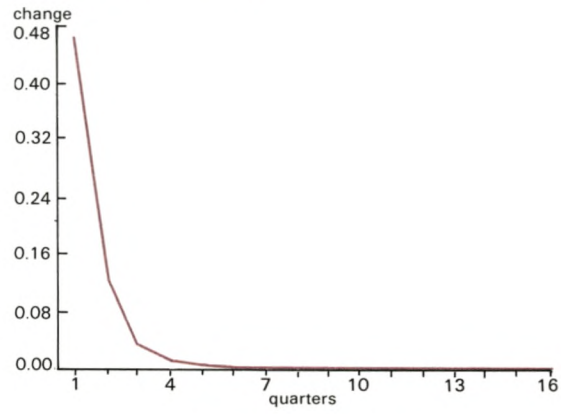


Table 3
Distribution of unemployed by duration of unemployment, 1960-1985

Year	Less than 5 weeks	5-14 weeks	15-26 weeks	27 weeks and over
1960	45	31	13	12
1961	38	29	15	17
1962	43	29	14	15
1963	43	30	13	14
1964	45	30	13	13
1965	48	29	12	10
1966	55	27	10	8
1967	55	30	9	6
1968	57	29	9	6
1969	58	29	9	5
1970	52	32	10	6
1971	45	32	13	10
1972	46	30	12	12
1973	51	30	11	8
1974	51	31	11	7
1975	37	31	16	15
1976	38	30	14	18
1977	42	30	13	15
1978	46	31	12	10
1979	48	32	12	9
1980	43	32	14	11
1981	42	31	14	14
1982	36	31	16	17
1983	33	27	15	24
1984	39	29	13	19
1985	42	30	12	15

SOURCE: *Economic Report of the President, February 1986, Table B-33.*

a worker who has been displaced by structural events may become unemployed more often in the future than those workers who have not been so affected.[13]

It also appears from Table 3 that social insurance expenditures are significantly positively associated with the unemployment rate. Thus, the evidence supports the hypothesis that increases in the amount and availability of social insurance that tend to reduce the opportunity cost of unemployment cause an increase in the unemployment rate.

Measuring the natural rate of unemployment

If the natural rate of unemployment is, as stated earlier, the sum of frictional and structural unemployment, it is now relatively straightforward to calculate the natural rate from the regression results presented previously. The natural rate is simply calculated as the rate of unemployment that would result if all cyclical variables, namely GNP and M, were set identically equal to zero over the entire time period. To implement these computations, it is necessary to specify initial values for the natural rate. However, the effect of these initial values on the calculations decreases rapidly. As a result, within two years the natural rate is virtually independent of the assumed initial values.

Figure 7 presents the actual age-weighted unemployment rate and the estimate of the natural rate of unemployment based upon the parameter estimates found in column (1) of Table 2. Initial values of the natural rate were taken to be equal to the actual values of the unemployment rate for the first and second quarters of 1954. The figure shows the estimates over the period from 1958 through the third quarter of 1981 so as to minimize the influence of this assumption about initial values on the natural rate.

As seen from the graph, the natural rate of unemployment has at times been below the actual unemployment rate and at other times has been above it. Until late 1966 the natural rate was consistently below the actual by as much as two percentage points. From late 1966 through 1973 the reverse occurred although the natural rate never exceeded the actual by more than one percentage point. The rise in the natural rate over this time is due predominantly to the relatively large amount of structural change that occurred and to a lesser extent the increase in social insurance expenditures as a percentage of GNP. From 1974 through 1977 the actual rate again exceeded the natural rate while for the brief period from 1978 to 1981 the opposite was true.

Not only has the relation between the actual and natural rates of unemployment changed over time, but the estimate of the natural rate has varied widely from a high of 7.01 percent in the third quarter of 1981 to a low of 3.48 percent in the first quarter of 1966. This variability of the natural rate makes appropriate policy-making difficult.

As suggested in the introduction, the difference between the natural rate of unemployment and the actual rate of unemployment is directly related to movements in the inflation rate. If the natural rate exceeds the actual rate, then labor market conditions are tight

Figure 7
The natural and fixed-weight unemployment rates

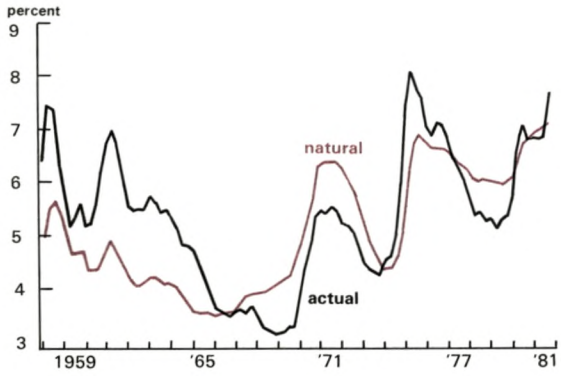
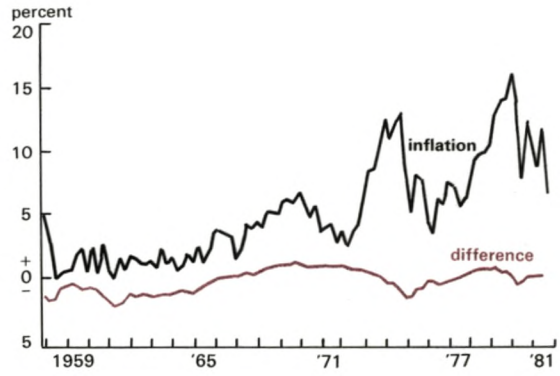


Figure 8
Inflation and the natural rate of employment



and inflation occurs. Conversely, if the actual rate exceeds the natural rate, then labor market conditions are slack and lower inflation or even possibly deflation results. Thus, the inflation rate should be positively correlated with the calculated difference. This indeed seems to be the case. The estimated correlation coefficient between the inflation rate and the difference between the natural and actual rates of unemployment is computed to be 0.46, indicating that the two do vary directly. In addition, there is no apparent linear relation between the inflation rate and the actual unemployment rate as the calculated correlation coefficient is a mere -0.01. Although these calculations are somewhat crude, they indicate that inflation does not depend upon the actual level of unemployment but rather the actual rate relative to the natural rate.

Figure 8 displays both the difference between the natural and actual rates and the annual inflation rate based upon quarterly data. The inflation rate from 1958 through 1966 fluctuates around two percent per year with no noticeable upward trend. During this time the actual unemployment rate was above the natural unemployment rate, implying that labor market conditions were somewhat slack. From 1967 to 1973 labor market conditions appear to be tighter as the natural rate rose above the actual. Inflation appears to be trending upwards during the same time period. Finally, the two drops in the difference between the natural and actual rates of unemployment occurring in 1975 and again in 1980 appear to coincide with rapid declines in the inflation rate.

While the two series are clearly positively related, a great deal of the variation in the inflation rate is unexplainable by changes in this measure of labor market tightness. If the estimates of the natural rate of unemployment are indeed correct, then a more adequate understanding of inflation requires incorporating other elements of the economy, such as monetary policy, into the analysis.

Conclusions

The historically high unemployment rates of recent decades are attributable in large part to a combination of two factors: rapid and pronounced structural change and low aggregate demand. Although demographic changes in the composition of the labor force have tended to adversely affect the unemployment rate, the actual impact has been quite modest.

The unemployment of the 1970s is attributable in large part to shifts in the distribution of employment across industries brought on by some sort of structural change. Unfortunately, the measure of structural change developed can be computed only with a four-year lag, thereby making policy decisions based upon such dated calculations inadvisable. Nevertheless, the need for policymakers to have some knowledge of the current magnitude of structural change is quite real.

The evidence on interindustry employment flows suggests that structural change has

not been as large a determinant of unemployment in the 1980s as it was in the 1970s. Thus, the double-digit unemployment of recent years is more closely associated with cyclical rather than structural or frictional factors.

Extrapolation of data used in the computation of Figure 7 suggests that the current natural rate of unemployment is approximately 6 percent. Given the actual unemployment rate of 7.07 for the first quarter of 1986, it appears that policymakers need not be unduly concerned with inflation at this time.

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[1] The discussion here is based to a large extent on Ronald G. Ehrenberg's and Robert S. Smith's book entitled *Modern Labor Economics: Theory and Public Policy*, 2nd edition, published by Scott, Foresman and Company, 1985.

[2] Real wages may not readily respond to decreases in aggregate demand because of long-term labor contracts which specify nominal wages, minimum wage legislation, and risk aversion on the part of workers who prefer fixed real wages and more variable employment.

[3] The unemployment rates have been constructed as in equation [1] so as to guarantee that the sum of the γ_{it}'s equals one.

[4] The age categories investigated were 16-to-19-year-olds, 20-to-24-year-olds, and those 25-years-of-age or older.

[5] Other traditional industries include construction, mining, transportation and public utilities. Service-related industries refer to wholesale and retail trades, finance, insurance, and real estate.

[6] This phenomenon was originally documented by Wesley C. Mitchell in *Business Cycles and Their Causes*, (Berkeley, CA: University of California Press, 1941).

[7] The industry categories examined include government, construction, mining, durable manufacturing, nondurable manufacturing, transportation and public utilities, services, wholesale trades, retail trades, and finance, insurance, and real estate.

[8] The dependent variable in the analysis is the fixed-weight unemployment rate adjusting for the effects of the changing age composition of the labor force. Similar calculations were also performed on the unadjusted unemployment rate but provide little additional insight.

[9] In the absence of serially correlated errors, ordinary least squares is equivalent to maximum likelihood estimation for large sample sizes. The adjusted Box-Pierce statistic (Q) is reported testing for serial correlation of the residuals through a lag length of six quarters. In all three regressions the hypothesis that the estimated residual is not serially correlated can be accepted at the five percent significance level.

[10] The measurement of permanent change in the distribution of employment across industries discussed below is found in George R. Neumann and Robert H. Topel, "Employment Risk, Sectoral Shifts, and the Geographical Distribution of Unemployment," forthcoming *Quarterly Journal of Economics*.

[11] Calculations are based upon the same ten industries as those used in computing $\hat{\sigma}^2$. The measures have been compiled assuming $J = 16$, creating a four-year lag in the estimate. As a result, values of Δ^P and Δ^T can be estimated only through the third quarter of 1981. The β_j's are assumed to be geometrically declining weights that sum to unity over 16 quarters. Therefore, $\beta_j = Cq^j$ where $C = (1 - q)/[q(1 - q^{17})]$. The results reported here are based upon the assumption that $q = 0.9$. However, in practice the actual weighting scheme used makes little difference in the final results. [See box for a discussion of the estimation.]

[12] Social insurance expenditures is available annually from the Social Security Administration's *Social Security Bulletin: Annual Statistical Supplement*. Quarterly data were calculated by linear interpolation.

[13] Some limited evidence to this effect is found in Robert E. Hall's article, "Why Is the Unemployment Rate So High at Full Employment?" in *Brookings Papers on Economic Activity*, vol. 3: 1970, pp. 369-396.

Bibliography

Barro, Robert J., "Unanticipated Money, Output, and the Price Level in the United States," *Journal of Political Economy*, August 1978, 86(4), pp. 549-80.

Hall, Robert R., "Why Is The Unemployment Rate So High at Full Employment?," *Brookings Papers on Economic Activity*, 1970(3), pp. 369-410.

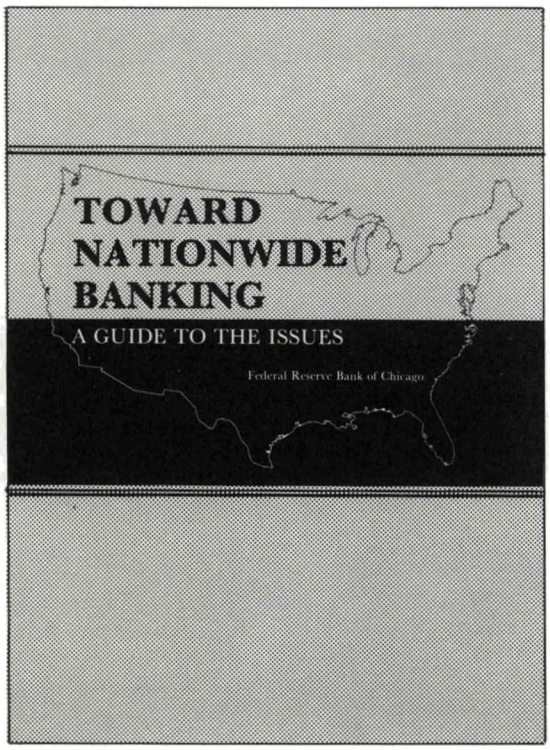
Lilien, David. "Sectoral Shifts and Sectoral Unemployment," *Journal of Political Economy*, August 1982, 90(4), pp. 777-93.

Mitchell, Wesley C., *Business Cycles and Their Causes*, (Berkeley, CA: University of California Press, 1941).

Neumann, George R. and Robert H. Topel, "Employment Risk, Sectoral Shifts, and the Geographical Distribution of Unemployment," forthcoming *Quarterly Journal of Economics*.

NOW AVAILABLE **Toward Nationwide Banking**

One of the major issues facing the financial industry today is that of interstate banking. *Toward Nationwide Banking,* recently published by the Research Department of the Federal Reserve Bank of Chicago, examines this timely topic from a variety of perspectives.



- Is there a need for interstate banking?
- What is the driving force behind interstate banking?
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- How will banking law liberalization affect local market structure?
- Where have nonbanks chosen to locate and why have they selected these locations?
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- How will the new interstate banking laws affect the viability and independence of small banks?

The research contained in *Toward Nationwide Banking* should be of valuable assistance to bankers, legislators, academics, and consumers who are concerned about this emerging development. *Toward Nationwide Banking* is available from the Federal Reserve Bank of Chicago, P.O. Box 834, Chicago, IL 60690 at $10 a copy. Make checks payable to Federal Reserve Bank of Chicago.

Annual conference assesses banking risk

Richard D. Simmons

Banking risks—and how to deal with them—were major topics at the Federal Reserve Bank of Chicago's 22nd annual Conference on Bank Structure and Competition held in Chicago on May 14-16, 1986. Since last year's conference, the financial industry has been rocked by several major events. Privately insured thrifts in Maryland and Ohio were temporarily closed; a record number of agricultural banks failed; and the Supreme Court issued decisions upholding nonbank banks and regional interstate banking compacts. In addition, 31 states have now passed interstate legislation, and many large nonbank holding companies compete with banks.

Given these events, this year's conference addressed risk-related issues in the context of a deregulated environment. Some 375 bankers, regulators, and academicians had an opportunity to hear many different perspectives on risk in the banking system. Among the speakers were William M. Isaac, former Chairman of the FDIC, Walter B. Wriston, former Chairman of Citicorp, and George J. Vojta, Executive Vice President at Bankers Trust Company.

Risk in historical perspective

George G. Kaufman, professor of economics and finance at Loyola University of Chicago, stated that between 1875 and 1919, before either the FDIC or the Fed existed, relatively few bank failures occurred, due to high capitalization and significant market discipline. In addition, illiquid banks were closed immediately, which halted depositor losses. If a closed bank was still solvent, it reopened soon afterwards.

Kaufman continued that many depositors now rely on federal deposit insurance rather than bank capital for the safe return of their funds. Accordingly, capital and loan loss reserves have decreased, and the risk of insolvency has increased. Further, regulators are often lenient regarding loss recognition and slow to close insolvent institutions. In this environment, insolvent institutions with nothing to lose have a strong incentive to take imprudent risks in an attempt to regain solvency. Moreover, due to the discount window, illiquidity does not necessarily limit losses or force immediate closures. Therefore, while insolvent institutions are left open, costs to taxpayers will increase as loan losses escalate.

Kaufman drew the following conclusions from this analysis. First, to minimize economic costs, regulators must close a financial institution promptly when the market value of the institution's net worth reaches zero. However, large institutions should be sold instead of liquidated. Second, financial institutions should be required to rebuild capital and loan loss reserves quickly, in preparation for any future losses. On this basis, Kaufman disagreed with the capital forbearance program for agricultural banks. Third, since only the deposit insurance agencies have a monetary incentive to minimize the costs of failures, authority to declare financial institutions legally insolvent should be transferred from the chartering agencies to the FDIC or FSLIC. Finally, the FDIC/FSLIC should insist on higher capital ratios, just as depositors did before deposit insurance existed.

Risk from a banker's viewpoint

George J. Vojta, executive vice president at Bankers Trust Company provided a second perspective on risk in the banking system. Vojta described several problems in today's banking system. First, banks are too insulated from market discipline. Currently, nearly 8,000 banks are not audited, too little disclosure exists, and bank examinations are too confidential. Second, uniform capital ratios and insurance premiums contribute to poor risk pricing and encourage excessive risk taking. Third, unnecessary legal and regulatory barriers preclude banks from diversifying their product lines and hinder banks' competitive abilities. These problems increase failures, weaken the banking system, and threaten the system's long term viability.

Richard D. Simmons is an associate economist at the Federal Reserve Bank of Chicago.

To solve these problems, Vojta argued for stronger examinations, increased disclosure, risk-based insurance premiums, and risk-based capital ratios. He also stressed that barriers to product diversification must be removed and that commercial banks must be allowed to satisfy the equity underwriting needs of their best clients.

Far from seeing a conflict between competition and safety, Vojta agreed with Kaufman that fostering competition and market discipline would provide the best path to a stronger banking system. Though some banks would fail, most would adjust successfully, resulting in a stronger global financial system.

Banking risk and the investor

Providing yet another perspective, Harry V. Keefe, Jr., Chairman and CEO of Keefe, Bruyette & Woods, Inc., an investment banking firm specializing in bank securities, said the problems are with individual banks, not with the banking system. Although the media have dramatized the 120 bank failures that occurred this year, Keefe stressed that this number is minuscule given that 14,400 banks exist in the country.

However, Keefe emphasized his belief that banks' capital ratios are too low. Many banks have lower price-to-earnings ratios than industrial companies with comparable earnings and growth because the market perceives these banks as undercapitalized. Keefe asserted that, by issuing additional equity capital, these banks could increase their stock prices and decrease their funding costs.

In addition, Keefe agreed that more disclosure and market discipline are needed. However, he disagreed with the FDIC's attempt to promote market discipline by requiring banks to maintain a capital-to-assets ratio of nine percent, of which up to three percent could be subordinated debt, because community banks would have to pay overly large premiums on subordinated debt due to the small size of their issues. He also stated that commercial banks should not be allowed to underwrite equity securities because it is inappropriate for commercial banks to own stock in their clients.

A regulatory perspective

The first luncheon featured guest speaker William M. Isaac, President of the Secura Group and former Chairman of the FDIC. A strong proponent of competition, Mr. Isaac emphasized that many of the problems in banking result from competitive inequities. He recommended reducing these inequities by equalizing capital requirements for banks and S&Ls, by including foreign deposits in the calculation of FDIC deposit insurance premiums, by developing a procedure to ensure that large and small bank failures will be handled similarly, and by allowing commercial banks to engage in insurance, real estate, and underwriting activities. In addition, he argued that risk-related insurance premiums, a stronger bank examination force, and increased disclosure would help bring about much needed market discipline.

Elaborating on the market discipline topic, Isaac stated that FDIC insurance could provide less than 100 percent coverage in order to promote discipline through uninsured depositors. However, he stated that the FDIC's capital proposal is a better approach. This capital proposal would gradually increase capital requirements from six to nine percent of total assets, and subordinated debt could be used to satisfy up to one third of the nine percent requirement. This debt should increase discipline by forcing each bank to pay a rate based on the market's perception of that bank's risk.

Contrary to Keefe's view, Isaac stated that banks under $100 million would not be significantly burdened by the increased capital requirement because their primary capital-to-total assets ratios currently average 9.1 percent and deficiencies at banks with lower ratios are small. Further, Isaac asserted that these small banks could place subordinated debt at reasonable costs through correspondent banks, insurance companies, and pension funds. Instead, the heaviest burden of this capital proposal would be on thrifts and large banks. According to Isaac, the proposal would equalize capital requirements for large and small banks, reduce the failure rate, and minimize FDIC losses.

A banker's perspective: Nonbanks vs. banks

The second luncheon featured guest speaker Walter B. Wriston, retired Chairman and CEO of Citicorp. Like previous speakers, Wriston emphasized the need to remove restrictions on banks so that banks could compete in the market on an equitable basis.

Throughout his talk, Wriston emphasized that banks are losing an increasingly large share of the market to large nonbank competitors such as GMAC, GE, Ford, Chrysler, American Express, and Sears. In the meantime, bankers and regulators quibble about how many yards from the head office a branch may be located. According to Wriston, if this mentality of looking at the trees instead of the forest continues, trivial issues such as allowable distance to a branch will be irrelevant because banks will have been supplanted by large nonbank competitors.

Wriston acknowledged that some banks will fail when a recession occurs. However, he argued that the purpose of bank regulation is to ensure a sound banking system, not to keep poorly managed banks afloat. Regulators must not try to restrict banks to "safe" activities in an attempt to limit failures. Banks must be at liberty to offer new products and to expand geographically.

Wriston continued that these pro-competitive actions will not cause another depression because the Fed will not allow the money supply to decrease sharply; the discount window provides emergency liquidity to banks; and the FDIC guarantees deposits. Moreover, allowing banks more flexibility to compete will strengthen the banking system. Accordingly, Wriston argued that regulatory restrictions must be removed so that banks can survive among and freely compete with other financial organizations.

Encouragement of market discipline

In addition to being a common thread for the preceding speakers, market discipline was the topic for many of the research papers presented. Robert B. Avery and Terrence M. Belton of the Federal Reserve Board and Michael A. Goldberg of the Federal National Mortgage Association found that the interest rate spread between the subordinated debt of large U.S. bank holding companies and of comparable Treasury securities was not significantly related to bank size, capitalization, earnings, liquidity, or loan quality. These findings argue that subordinated creditors have not imposed market discipline on banks.

Looking at depositors instead of creditors, Herbert Baer and Elijah Brewer, economists at the Federal Reserve Bank of Chicago, presented evidence that uninsured depositors require higher risk premiums on certificates of deposit when a bank's market value of equity-to-total assets ratio is low or when the variance of returns on a bank's stock is high. These results, presented elsewhere in this issue of *Economic Perspectives*, indicate that uninsured depositors have been exercising market discipline and that more disclosure would increase this discipline. Risk premiums on CDs were also found to be much greater than the differences in assessments proposed by the FDIC for risk-based deposit insurance. In addition, any proposals to extend insurance to these uninsured depositors would increase bank risk taking and reduce existing market discipline.

John M. Harris, Jr. of Clemson University, James R. Scott of the University of Arkansas, and Joseph F. Sinkey, Jr. of the University of Georgia analyzed market discipline from a different perspective. They argued that the bailout of Continental Illinois Corporation discouraged market discipline and caused a cumulative excess return of forty percent to stockholders of the nation's largest banks, because the market perceived that regulators would not let these large banks fail.

Off balance sheet activities

Another risk-related topic receiving much attention at the conference was bank off balance sheet activities. These activities include standby and commercial letters of credit, financial futures, interest rate swaps, and loan commitments. Because these activities have grown rapidly in recent years, with potentially adverse effects on bank safety, regulators are considering including them in an adjusted capital ratio.

Lawrence M. Benveniste and Allen N. Berger of the Federal Reserve Board argued that standby letters of credit and other off balance sheet items improve the social allocation

of investment funds because investors can make direct loans to a bank's customers by renting the bank's credit information on those customers. Elijah Brewer, Gary D. Koppenhaver, and Donald H. Wilson of the Federal Reserve Bank of Chicago argued that off balance sheet guarantees are priced by the market, and only the strongest and most creditworthy banks can effectively offer these guarantees. Finally, Marcelle V. Arak, Laurie S. Goodman, and Arthur Rones of Citicorp Investment Bank presented an approach for establishing credit lines for off balance sheet items. They considered both default and interest-rate risks in developing their approach.

Although the measurement and management of risks in banking were the dominant topics of this year's conference, some sessions were devoted to other issues of importance to financial institutions and markets. Among these were alternative banking strategies, market value accounting, interstate mergers and acquisitions, the use of economic models in banking, and the impacts of deregulation on banking performance.

Conference consensus

A surprising consensus seemed to emerge at the conference that banks are not special, that no bank should be considered too large to fail, that more disclosure is needed, that banking is in most respects like any other industry, and that more deregulation is needed. In such an environment, banks could freely compete with other financial service providers; well managed banks would thrive; poorly managed banks would fail; and a stronger and healthier banking system would result.

However, it is clear that regulators do believe banks are special. Regulators subsidize banks by providing federal deposit insurance and discount window access at below-market rates. Further, regulators are proposing tighter capital adequacy guidelines to decrease the number of failures and increase the safety and soundness of the banking system. Regulators also continue to judge banks' financial conditions and require improvements in various areas, again in the name of safety and soundness.

These conflicting views raise two unresolved questions: First, what advantages and disadvantages do banks have which make them special in comparison to other financial organizations? And second, how far should deregulation go in removing these differences to level the playing field between banks and other financial service providers?

Uninsured deposits as a source of market discipline: Some new evidence

Herbert Baer and Elijah Brewer

Money center banks typically place a heavy reliance on purchased funds, not explicitly insured by the FDIC. Suppliers of these funds will withdraw them from a bank if they believe that losses are imminent. Since the creation of the FDIC such deposit runs have been rare. But in the 1980s Continental Illinois National Bank experienced two deposit runs. The first occurred after the failure of Penn Square National Bank in July 1982 and the subsequent discovery that Continental had purchased more than a billion dollars of Penn Square energy loans. The second run occurred in spring 1984 and eventually forced the FDIC to guarantee all of Continental's creditors.

The experience with Continental has led many regulators to question the wisdom of a heavy bank reliance on purchased funds in general and uninsured deposits in particular. Others have argued that uninsured deposits are a source of market discipline, which means that when they are an important funding source, banks are likely to take less risk. This article examines the proposition that CD markets charge riskier banks higher rates. It begins by discussing recent trends in reliance on uninsured deposits, then summarizes previous evidence on their risk sensitivity, and ends by presenting the results of some of our own recently completed research.

Previous studies found little evidence that the market charges riskier banks more for deposits outside crisis situations. However, many of these studies employed inappropriate measures of bank risk. When we employ bank risk measures derived from stock price data, we find, among other things, that even when banks are solvent, the deposit market does charge riskier banks more for funds. The new evidence summarized here suggests that proposals to restrict bank reliance on uninsured, purchased deposits are not costless. While such proposals might reduce the likelihood of bank runs, they would at the same time reduce banks' incentives to control risk.

Trends in reliance on purchased funds

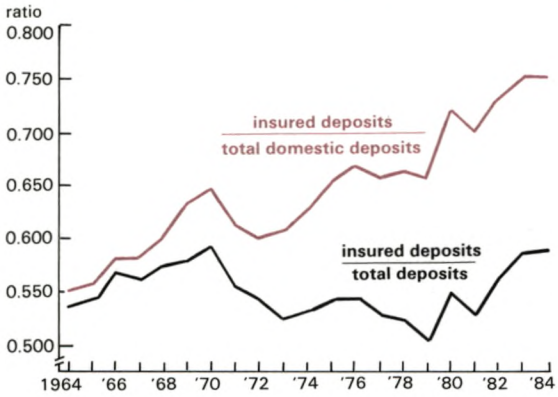
Purchased funds are generally defined as all uninsured liabilities with maturities of one year or less. Uninsured deposits make up the bulk of most banks' purchased funds. These deposits have come to make up a decreasing portion of deposits at domestic branches of U.S. banks (see Figure 1). However, from the point of view of bank safety and soundness, a more relevant figure is the ratio of uninsured deposits to total deposits, foreign and domestic. As Figure 1 illustrates, uninsured deposits' share of total deposits fell from 1964 to 1970, rose from 1970 to 1979 and fell again from 1979 to 1984. By 1984, uninsured deposits had returned to their 1970 share levels.

The data presented in Table 1 suggest that the recent decline in the relative importance of uninsured deposits is a result of two factors. First, there was a modest drop in reliance on uninsured deposits by banks in the largest size class. Second, and more importantly, the share of total deposits held by the largest banks fell from 31 percent in 1974 to 26 percent in 1984. These movements in the importance of uninsured deposits seem to have more to do with the elimination of Regulation Q than with any profound change in deposit insurance or bank supervision.

While there have been no long-term trends in the overall importance of uninsured deposits, Figure 1 shows that U.S. banks have experienced a steady shift from domestic uninsured deposits to foreign uninsured deposits. Unlike domestic uninsured deposits, foreign uninsured deposits are subject neither to reserve requirements nor to deposit insurance premiums. This suggests that the shift in uninsured deposits from domestic to foreign branches represents in part an attempt to avoid the re-

Herbert Baer is a senior economist and Elijah Brewer an economist at the Federal Reserve Bank of Chicago. The authors thank George Kaufman, Gary Koppenhaver, C. F. Lee, and Steven Strongin for useful comments.

Figure 1
Insured deposit share of total deposits



serve requirement tax as well as deposit insurance assessments.

There have also been clear trends within particular size classes. Table 1 shows how reliance on uninsured deposits has varied between 1974 and 1984 for banks in four size classes (as of 1984). As one would generally expect, banks in the largest size class placed significantly greater reliance on uninsured deposits than did banks in other size classes. Outside the largest size class, bank reliance on uninsured deposits has steadily increased. This increase has been greatest for banks in the smallest size class where the share of uninsured deposits increased by roughly 67 percent between 1974 and 1984.

The implications of these changes in the composition of total deposits for bank risk are complex. The recent decline in uninsured deposits relative to insured deposits has reduced bank vulnerability to funding risk. However, to the extent that market discipline exists, a decline in bank reliance on uninsured deposits also weakens market discipline.

Market discipline and purchased funds

In the aftermath of the Continental crisis, the importance of market discipline has been subject to sometimes heated debate. On the one hand it has been argued that, because the funds are not explicitly insured, purchasers of large CDs will demand higher rates from banks that are taking more risks. The risk-return trade-off set by the market will create incentives for bank managers to avoid unwarranted risk. On the other hand, de facto extension of deposit insurance to all depositors reduces the incentive of uninsured depositors to accurately evaluate bank risk. While the presence of uninsured depositors creates the potential for greater market discipline, particularly for money center and regional banks, realizing this potential depends on how these depositors permit analysis of available data to affect their decisions. This, in turn, depends on the capacity and willingness of these depositors to evaluate publicly available information on individual bank performance.

Do CD markets evaluate bank risk?

Since the Franklin National Bank failed in 1974, the FDIC has conducted various surveys of large depositors to determine how they evaluate their banking relationship, their sensitivity to their uninsured deposit status, and their reaction to adverse publicity (Eisenbeis and Gilbert, 1985). The results of these surveys suggest that if market discipline exists, it arises primarily from the actions of large institutional investors dealing with a few large banks. Past studies of the links between bank risks and rates

Table 1
Trends in reliance on uninsured deposits by size class of bank
(total deposits of size class as percent of total banking system deposits in parentheses)

	< 0.1 billion		0.1 billion to 1 billion		1 billion to 10 billion		>10 billion	
1974	7.9%	(16.0)	13.4%	(24.1)	21.7%	(27.6)	61.9%	(32.1)
1979	9.4%	(17.2)	14.9%	(24.1)	25.1%	(27.3)	63.3%	(31.2)
1984	13.2%	(18.6)	19.9%	(24.9)	33.3%	(30.3)	61.0%	(25.9)

on CDs suggest that the resulting market discipline is weak or nonexistent. There is some evidence that CD markets respond to crises after the fact, but little evidence that CD markets distinguish among banks on the basis of information regarding the relative soundness of banks.

Developments in the large CD market in the aftermath of the Franklin National Bank (1974) and Penn Square (1982) failures shed some light on the market's efficiency in responding to greater perceived banking risks. Evidence collected by Gary Gilbert (1983) subsequent to the Franklin failure indicated market "tiering," suggesting that size served as a proxy for lower risk. This tiering could be interpreted as evidence of the market's inability to isolate individual banking risks on the basis of differing performance characteristics. After Franklin National, tiering became somewhat more selective and the basis point spread between banks widened. Gilbert found that CD purchasers required a return from a regional bank that was 25 basis points higher than the return required from a large money center institution. This was double the normal spread prior to that period. It is not clear whether the tiering was a rational response to a situation in which regulators pursued a "too big to fail" policy, or simply reflected poor use of available data.

In contrast to these earlier findings, a preliminary FDIC analysis subsequent to the 1982 Penn Square failure did not reveal a short-term or a long-term effect on the general market for large bank CDs, or any tiering by size. However, for several months after Penn Square, the CD market penalized the Continental Illinois National Bank, which was linked most closely with Penn Square (Gilbert, 1983). A more recent study by Robert Cramer and Robert Rogowski (1985) indicates that Penn Square's failure did have an effect on the market for CDs. They found that CD risk premiums rose approximately 63 basis points after the announcement of problems at Penn Square and Continental.

There are several statistical studies of the factors influencing bank CD rates. A 1974 study by Dwight Crane of the largest 30 banks revealed a high inverse relationship between CD rates and bank size. The study found no consistent relationship between CD rates and measures of financial condition, such as the return on equity or assets, or capital ratios among banks of comparable size. Crane did find, however, an apparent relationship between the profitability of a bank in a given quarter and its CD rate. It is uncertain whether lower profitability induced higher CD rates or vice versa. A 1979 study by Chayim Herzig-Marx and Anne Weaver found that risk premiums decreased with increases in total assets and decreases in bank liquidity. A recent study by Robert Cramer and Robert Rogowski (1985) failed to find any relationship between their measure of bank-specific default risk and CD risk premium.

In a recent article, Michael Goldberg and Peter Lloyd-Davies (1985) perform a time-series analysis in which dealer quotes on large CD rates and other variables are aggregated across the ten prime, top-tier banks included on the Federal Reserve System's so-called "No-name" list. Goldberg and Lloyd-Davies find that the risk premiums the financial markets assign to large bank CDs increase as the amount of risky assets increases relative to bank capital.

If these studies are to be taken at face value then we would be forced to conclude that there is only a tenuous link between bank risk and CD rates. There are two plausible explanations for such a conclusion. First, holders of uninsured CDs may believe that regulators will probably protect them from losses, either by disposing of the failed banks through purchase and assumption transactions or by funding deposit runs through the discount window. Second, regulators may do a fairly good job of detecting and closing troubled institutions before uninsured depositors have suffered serious losses.

Acceptance of either of these conclusions may not be warranted. Because these studies were conducted without much attention to possible sources of CD risk, there is no assurance that risk was properly measured. To properly measure risk, we must understand the exact nature of the risks borne by holders of uninsured CDs.

Sources of CD market risk

Bank debt, including uninsured deposits, can be viewed as an option contract (Merton, 1974). As long as the book value of the bank remains above a critical point, the bank is

considered solvent and shareholders maintain control of the firm. However, when the book value of the firm falls below that point, the creditors' option to acquire the bank's assets is exercised by having regulators close the bank. The bank's debtors receive the value of the underlying assets. The value of the debt contract increases and the interest rate demanded decreases when the market value of the firm's assets increases, because any such increase increases the cushion available to absorb future losses. The greater the cushion, the smaller the chance that depositors will suffer a loss.

The value of the debt contract also increases when the standard deviation of returns on the bank's assets declines. A decrease in the standard deviation of the return on assets means that there is less chance that the value of the bank's assets will fall below the level needed to fully pay back all depositors.

The impact of a change in book value is unclear. If book value is perfectly correlated with market value, then changes in book value would have no effect on debt values that was not already captured by changes in market value. However, book value may diverge from market value for long periods of time. This makes it legally possible for a bank to continue operating after the economic value of its assets is less than the present value of its liabilities. This can create incentives for the managers of the firm to take more risk, leading to a further decline in debt values. On the other hand such a policy lowers the probability that the bank will be closed in the near future. Whether higher book values result in higher or lower CD rates depends on whether the prospect of rising losses in the bank portfolio is offset by the reduced probability of default before the CD matures.

Risk premiums and the probability of runs can both be reduced if the regulator closes the bank as soon as its expected market value hits zero. But even if the regulator tries to use market value closure rules, the values of many assets are difficult to monitor. More accurate estimates of assets values require a greater expenditure of resources. Thus CD holders will charge a risk premium to cover both the cost of monitoring asset values and the possibility that their assessments will be incorrect. Balance sheet data may be useful in estimating this type of risk. In particular, publicly traded securities are easily valued using market data, while loans, for which secondary markets are often thin or nonexistent, are not. As a consequence, risk premiums will be lower, the lower a bank's holdings of loans.

The maturity of the CD will also affect the risk premium demanded by depositors. How the risk premium changes with maturity depends on whether the bank is economically solvent—whether the market value of its assets exceeds that of its liabilities. If the bank is economically solvent and its deposits all mature on the same date, then the risk premium will decline with maturity. If the bank is economically insolvent and all deposits mature on the same date, then the risk premium will initially increase as the maturity of deposits increases (Merton, 1974). This suggests that for solvent institutions, average CD rates should decline as average maturity increases.

Two other factors may play an important role in determining CD risk premiums. There is a strong belief that the larger the bank, the more likely that any problems will be resolved in a way that does not penalize CD holders. This belief was given greater support in 1984 Congressional testimony by former Comptroller Todd Conover who stated that the nation's 12 largest bank holding companies were too important to be permitted to fail. Second, banks in unit banking states may have less funding flexibility due to their limited access to retail deposits. This lack of flexibility may also lead to an increase in the risks borne by the uninsured depositors.

Summarizing the preceding discussion, we would expect that the average rate on uninsured CDs would increase with increases in the riskless rate, the standard deviation of asset returns, and the size of the loan portfolio. Other things held equal, banks in unit banking states should pay more for uninsured CDs than banks in states which permit branching. On the other hand, increases in total assets and the ratio of market value of equity to total assets should cause rates on uninsured CDs to decline. The effect of changes in the average maturity of a bank's CDs or in the ratio of book value to assets cannot be predicted ex ante.

Data and estimation

We chose to test the preceding propositions by identifying those factors which affect the average rate paid on uninsured CDs. This

variable was estimated by dividing total interest paid on large domestic CDs over a quarter by the average value of large domestic CDs during the quarter. The average value of CDs was calculated by averaging weekly data. This measure of CD rates is less than perfect. In particular, it fails to account for differences in maturity. Nevertheless it does reflect the average cost of uninsured deposits and should adjust to changes in bank risk, albeit with a lag.

Because our measure of CD rate is an average across a number of maturities and origination dates, it was necessary to control for differences in CD rates which have nothing to do with differences in bank risk. We attempted to address this problem by developing a riskless rate which controls for the maturity date and age of each bank's portfolio.

At least one other macroeconomic factor is likely to affect the level of CD rates. Many researchers have found that the rate on a security is influenced by its supply relative to the supply of government securities (Cramer and Rogowski, 1985, for instance). An increase in the relative supply of CDs should cause their rate to rise relative to Treasury securities.

Table 2
Lead banks included in the study

Holding company name	1979 uninsured deposits as percentage of total deposits	1979 total assets *(billions of dollars)*
American Fletcher Corporation, Indianapolis	26	$2.620
American Security Corporation, Washington, D.C.	55	2.303
Bank of New York Company, New York	46	8.989
Bankers' Trust New York Corporation, New York	60	29.647
CBT Corporation, Hartford	19	2.592
Central National Chicago Corporation, Chicago	43	.669
Chase Manhattan Corporation, New York	65	64.129
Chemical New York Corporation, New York	58	38.777
Connecticut National Bank Corporation, Bridgeport	12	.753
Continental Illinois Corporation, Chicago	73	34.294
Crocker National Corporation, San Francisco	39	16.087
Fidelcor Inc., Philadelphia	30	2.728
First and Merchants, Richmond	19	2.235
First Chicago Corporation, Chicago	75	28.984
First Empire State, Buffalo	18	1.697
First Pennsylvania Corp. Philadelphia	60	8.406
Girard Company, Philadelphia	37	4.305
Harris Bankcorp, Chicago	53	7.104
Hartford National Corp, Hartford	22	2.555
Indiana National Corp., Indianapolis	14	2.080
Lincoln First Banks, Rochester	12	3.122
Manufacturers Hanover Corporation, New York	58	45.019
Marine Midlands, Buffalo	50	15.690
Maryland National Corporation, Baltimore	27	3.580
Mellon National Corporation, Pittsburgh	54	13.291
J.P. Morgan and Company, New York	67	42.435
Northern Trust, Chicago	49	5.326
Pittsburgh National Corporation, Pittsburgh	38	5.310
Provident National Corporation, Philadelphia	36	2.361
Riggs National Bank, Washington D.C.	33	2.686
Security Pacific Corporation, Los Angeles	41	23.537
State Street Boston Corporation, Boston	33	2.220
U.S. Bancorp., Portland	18	4.147
U.S. Trust Company, New York	42	1.976
Union Commerce, Cleveland	48	1.173
Union Planters Corporation, Georgia	08	1.127
Union Trust Bancorp., Baltimore	10	1.144
United Virginia Bancshares, Richmond	11	3.052
Virginia National Bancshares, Norfolk	14	2.470
Wells Fargo and Company, San Francisco	39	19.342

Data on daily stock prices and returns were obtained from Chase Econometrics and the Center for Research in Security Prices (CRSP) data base. Thirty-seven bank holding companies were included in the study. Each holding company had an identifiable lead bank and in every case the lead bank accounted for at least 80 percent of total holding company assets. On average the lead bank accounted for 94 percent of holding company assets. Table 2 shows total assets and reliance on uninsured deposits for each lead bank as of December 1979. Balance sheet data and interest paid on large domestic CDs were obtained from the *Quarterly Reports of Income and Condition*. Total holding company assets and shares outstanding were obtained from Moody's. Average holdings of uninsured CDs were calculated using the Federal Reserve Board's Weekly Reporting Bank series.

The market value of each bank's asset portfolio and the variance in returns on that portfolio were proxied by the market value of equity and the standard deviation of the return on equity. For each month, estimates of the standard deviation of returns on a bank's stock were made using daily data. These monthly estimates were then averaged together to generate quarterly estimates of bank stock price volatility.

Twelve quarters of data beginning in the fourth quarter of 1979 and ending in the third

Table 3
Determinants of average CD rates 1979:IV to 1982:III
(t values in parentheses)

	Expected impact on CD rates	Ordinary least squares		Fuller-Battese	
		(1)	(2)	(1′)	(2′)
maturity weighted T-bill rate	+	.8538** (16.28)	.7721** (13.68)	.3728** (4.46)	.3154** (3.67)
relative supply of CDs	+		.6051** (2.95)		1.3739** (2.69)
average maturity of CDs	?	.00005 (1.44)	.00004 (1.12)	−.00006† (1.94)	−.00006† (1.88)
log (book value / assets)	?	.0065 (1.70)	.0313†† (4.28)	.0044 (.66)	.0068 (.71)
log (market value / assets)	−	−.0011 (.50)	−.0047* (1.90)	−.0086** (3.26)	.0089** (3.25)
standard deviation of daily stock returns	+	.1657 (1.97)	.1751* (2.14)	.1267* (2.31)	.1252* (2.29)
log (total assets)	−		.0108 (1.78)		−.0016 (1.22)
log (total assets) x branching dummy[1]	+		.0005** (3.73)		.0005 (1.16)
log (loans)	+		−.0064 (1.22)		.0023 (.38)
intercept		.0290 (2.40)	−.0150	.0615* (2.84)	−.0304 (.70)
degree of freedom		438	434	438	433
R^2		.3879	.4391		

[1] The branching dummy equals 1 in unit banking states and zero otherwise.
*Significant at the 5% level, one tailed test.
**Significant at the 1% level, one tailed test.
†Significant at the 5% level, two tailed test.
††Significant at the 1% level, two tailed test.

quarter of 1982 were pooled, yielding 444 observations. Using this pooled data, the equations were estimated using both ordinary least squares regression and the Fuller-Battese technique for estimating regression coefficients when dealing with cross-section time series data.

Results

The results of this exercise are shown in Table 3. Each variable's expected impact on CD rates is shown in the first column. A regression coefficient of .0001 indicates that a one unit increase in the variable causes the average rate paid on uninsured CDs to rise by one basis point. Changes in the maturity-weighted Treasury bill rate explain 37 percent of the variation in CD rates using ordinary least squares. Including all other risk measures raises the proportion explained by another 5 percent. The first set of equations, (1) and (1′), includes the weighted T-Bill rate, the relative supply of CDs, the average maturity of the bank's CDs, the book-to-asset ratio, the market-to-asset ratio, and the standard deviation of stock price returns. Using ordinary least squares, both the market-to-asset ratio and the standard deviation of returns have the hypothesized sign. However, only the standard deviation of returns is significantly different from zero. Equation (1′) presents alternative estimates of equation (1) using an estimation technique designed for cross-section time series data. In this regression, the market-to-asset ratio and the standard deviation of stock returns both have the expected sign and are statistically significant.

Equations (2) and (2′) present coefficient estimates of taking other possible factors into account. In both equations the market-to-asset ratio and the standard deviation of stock returns have the expected sign and are statistically significant. The effect of changes in the relative supply of bank CDs is as expected and is significant; however, in equation (2) neither total assets or total loans have the expected effect. In equation (2′) total assets and total loans have the expected sign but are not significantly different from zero. The branching variable has the expected sign in both cases but is only significantly different from zero in equation (2).

These results suggest that CD holders are sensitive to differences in bank risk. They demand higher rates when a bank's market-to-asset ratio is low or when the volatility of bank stock returns is high. The next question is whether or not the implied differences in CD rates are large. To answer this question we need to know what changes in variables are plausible. One way this can be established is by looking at the impact of a one-standard-deviation change in a variable. There is a 68 percent chance a variable will be within one standard deviation of its mean. Table 4 shows how a one-standard-deviation change in the market-to-asset ratio and the standard deviation of bank stock returns translate into changes in CD rates. Based on the results of equation (2), a one-standard-deviation increase in the market-to-asset variable causes CD rates to fall by 17 basis points. A one-standard-deviation increase in the standard deviation of stock returns causes CD rates to rise by 16 basis points. Equation (2′) yields even stronger results in these cases.

This sensitivity of CD rates to change in these risk variables suggests that the FDIC's recent proposal for risk-related insurance premiums ranging from 1 to 8 basis points is significantly less sensitive to risk than are the money markets. It also suggests that a strengthening of implicit guarantees for uninsured deposits could eliminate an important source of market discipline.

There is, however, one potential problem with the preceding results. Many researchers have found a negative relationship between bank size and CD rates. Our regression results do not indicate such a relationship.

Nonetheless, our results are consistent with the earlier findings. While equations (2) and (2′) fail to display a significant negative relationship between asset size and CD rates, the market-to-asset ratio and total assets are positively correlated. This suggests that large banks will be observed paying lower interest rates because they have a higher market-to-asset ratio.

Postscript

About the same time we completed our work, we obtained another newly completed study whose conclusions support our own (Gerald Hanweck and Timothy Hannon,

Equations (1) and (1′)

$$\text{CD rate} = a_1 + b_1 * \text{maturity weighted T-bill rate} + c_1 * \text{relative supply of CDs} + d_1 * \text{average maturity of CDs} + e_1 * \log\left(\frac{\text{book value of capital}}{\text{total assets}}\right) + f_1 * \log\left(\frac{\text{market value of capital}}{\text{total assets}}\right) + g_1 * \text{standard deviation of stock returns} + \text{error}$$

Equation (1) assumes that any errors are independently distributed. Equation (1′) assumes that there are three components to the error term: a bank-specific component, a time-specific component, and an observation-specific component.

Equations (2) and (2′)

$$\text{CD rate} = a_2 + b_2 * \text{maturity weighted T-bill rate} + c_2 * \text{relative supply of CDs} + d_2 * \text{average maturity of CDs} + e_2 * \log\left(\frac{\text{book value of capital}}{\text{total assets}}\right) + f_2 * \log\left(\frac{\text{market value capital}}{\text{total assets}}\right) + g_2 * \text{standard deviation of stock returns} + h_2 * \log(\text{total assets}) + i_2 * \log(\text{total assets}) \times \text{branching dummy} + j_2 * \log(\text{loans}) + \text{error}$$

Equation (2) assumes that any errors are independently distributed. Equation (2′) assumes that there are three components to the error term: a bank-specific component, a time-specific component, and an observation-specific component.

1985). This study, which employed survey data on large CD rates for each of five different maturities, found that the CD risk premiums increase with both the ratio of risky assets to capital and uncertainty regarding bank returns on assets. These effects, in turn, tend to be more important in the case of the longer CD maturities, where insolvency risk is presumably more of an issue. As with our study, the implication is that the market for large CDs helps to discipline bank risk-taking. The study also suggests that bank CD rates are strongly affected by accounting-based measures of bank risk-taking. This latter point is in contrast to the findings of previous research regarding the effects of accounting-based measures of risk.

Summary and policy recommendations

The Continental experience indicates that uninsured depositors will run when they perceive that losses are possible. Many observers view these runs as potentially dangerous. However the same factor that generates runs would also be expected to generate market incentives for banks to take less risk. While earlier work using accounting measures of risk suggests little market discipline, our research suggests that holders of uninsured CDs set risk premiums as if they are at least partially at risk. This leads to the imposition of market discipline, in a nondisruptive fashion, on large institutions that are most dependent on the money market for funding.

Policies that cause banks to reduce reliance on purchased funds by increasing their reliance on insured deposits will reduce the likelihood of runs. However, our results suggest that an important source of discipline will be lost. This loss will certainly create further incentives for banks to take risks and would reduce funding flexibility. Purchased funding became popular precisely because it provides flexibility.

However, our findings are not yet complete enough to pass judgment on supervisory policies designed to link capital requirements to dependence on purchased funds. It is not enough to show that the purchased funds market provides market discipline. We also need to evaluate the cost and likelihood of runs on banks which rely on purchased funds. In particular, we need to show that the costs of bank runs are or can be made small (George Kaufman, 1985).

While we cannot presently recommend acceptance or rejection of proposals to limit reliance on purchased funds, our findings do suggest several actions that would improve market discipline. Our results suggest that CD

Table 4
The impact of bank characteristics on the average cost of uninsured CDs

	Sample average	Sample standard deviation	Change in CD rate due to a one standard deviation increase in variable based on (2)	based on (2′)
Standard deviation of daily stock returns	.0168	.009	16 basis points	11 basis points
$\log\left(\frac{\text{market value}}{\text{assets}}\right)$	−3.53	.367	17 basis points	32 basis points

markets are trying to evaluate risk. Proposals that improve the quality of information will improve the quality of the market discipline.

First, shortcomings of the marketplace in restraining bank risk-taking could be corrected to some degree by broadening disclosure. In particular, the disclosure of bank examination data could help bank-funding markets to identify an institution's weakness while remedial action is still possible. The impact of such disclosure on stock price and deposit flows may not be as disruptive as some expect. The recently required bank disclosure of past-due and other nonperforming loans should greatly help the market assess bank risk-taking.

Second, as demonstrated by the Continental experience, it is important to accurately value and close troubled banks of all sizes. Better monitoring of asset values by regulators would reduce the likelihood of runs.

Third, our results point out the need for risk-based premiums. If our results are correct, the FDIC is dramatically underpricing many of its deposit insurance policies. If the FDIC were to adopt the CD market's attitudes towards risk, then market discipline and the FDIC's revenues would both be increased.

References

Crane, Dwight. "A Study of Interest Rate Spreads in the 1974 CD Market," *Journal of Bank Research*, vol. 7 (Autumn 1976), pp. 213-224.

Cramer, Robert H. and Robert J. Rogowski. "Risk Premia on Negotiable Certificates of Deposit and the Continental Illinois Bank Crisis," paper presented to the Financial Management Association, October, 1985.

Eisenbeis, Robert A. and Gary Gilbert. "Market Discipline and the Prevention of Bank Problems and Failures," *Issues in Bank Regulation*, vol. 8 (Winter 1985), pp. 16-23.

Goldberg, Michael A. and Peter R. Lloyd-Davies. "Standby Letters of Credit: Are Banks Overextending Themselves?" *Journal of Bank Research*, vol. 16 (Spring 1985) 29-39.

Hanweck, Gerald and Timothy Hannan. "Bank Insolvency Risk and the Market for Large Certificates of Deposits," Board of Governors of the Federal Reserve System, mimeo 1985.

Herzig-Marx, Chayim and Anne S. Weaver. "Bank Soundness and the Market for Large Negotiable Certificates of Deposit," Federal Reserve Bank of Chicago *Research Paper* 79-1.

Kaufman, George G. "Implications of Large Bank Problems and Insolvencies for the Banking Industry and Economic Policy," *Issues in Bank Regulation*, vol. 8 (Winter 1985), pp. 16-23.

Merton, Robert. "On the Pricing of Corporate Debt: The Risk Structure of Interest Rates," *Journal of Finance*, vol. 29 (May 1974), pp. 449-470.

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