An Index of Leading Indicators for the Philadelphia Region

by Anthony M. Rufolo*

Updates to the regional index described in this article will be issued provisionally in a monthly press release.

As the economy continues its apparently inevitable ups and downs, countless people peer into crystal balls, record sunspots, or use more mundane methods to forecast its performance over the coming months or years. Many important individual, business, and government decisions hinge on expectations about future economic conditions.

Nevertheless, forecasting remains an inexact science; some would call it an art. Thus the wise forecaster seldom restricts himself to one forecasting tool. Whether the primary input is an elaborate statistical model of the economy or simply a hunch based on the weather, it is likely to be supplemented by many other pieces of information. Among the more common of these other pieces are the so-called leading indicators—sets of data that give signals about what the economy is likely to do in the months ahead.

The use of leading indicators is well established in forecasts of national economic activity, but it has barely been developed at the regional level. In 1978, on an experimental basis, the Federal Reserve Bank of Philadelphia constructed a regional index of leading indicators using data from 1960 forward. This index promises to be a useful forecasting tool.

WHAT ARE LEADING INDICATORS?

Hundreds of statistics about the economy are churned out every month. Each gives some information about where the economy stands, where it's been, or where it's going. In a complex economy like ours, however, none of these statistics alone is a reliable indicator of overall economic health. Even

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so frequently cited an indicator as Gross National Product, for example, doesn't tell the whole story: if GNP is growing rapidly but unemployment remains high, the economy is doing well in one way but poorly in another. Many pieces of information go into making a sound judgment about how well the economy is doing as a whole.

Why an Indicator Leads. Many economic statistics, though certainly not all, can be assigned to one or another of three distinct groups depending on the timing of their movements relative to changes in the national economy.[1] Some tend to turn upward in advance of the national economy and typically turn downward before the national economy begins to weaken. These are known as leading indicators, and they signal the advent of recessions and recoveries several months in advance. Others perform pretty much in step with the economy as a whole and so are known as coincident indicators. Finally, those whose turning points trail behind the national business cycle are known as lagging indicators.[2]

Of the three groups of indicators, the leaders seem to receive the most attention because they are likely to foreshadow changes in the economy. Housing construction, which is a leading indicator, illustrates this relation. A decline in housing construction usually is associated with overall weakness in the economy at a later date. This association may occur because consumers usually find it relatively easy to cut back on purchases of durable goods such as housing when they anticipate reductions in their income. Another possibility is that the reduced homebuying leads to reduced activity in other parts of the economy and may actually be a cause of a net economic slowdown. Because purchasers of new houses have to buy furniture and appliances, hire moving companies, and so on, a decline in housing construction usually signals a future decline in demand for those other goods and services. In addition, when fewer houses are being built, construction workers find themselves with less money to spend and uncertain future prospects, so they tend to cut back on their purchases. Finally, suppliers of construction materials find demand for their products falling off and may reduce their production. Since the housing sector is so large, these effects may have a significant impact. Thus whether it's a symptom or a cause, a change in planned housing construction can give a clue to future changes in economic activity; and similar clues can be found in a number of other indicators.

How Indicators Are Measured. The raw data on indicators can be converted to index numbers for ease of comparison with earlier data and with other statistical series. These index numbers present the current value of an indicator as a percentage of the value for that indicator in some year chosen as a base. U.S. employment, for example, grew from 81.7 million in 1972 to 90.5 million in 1977—a 10.8 percent increase. Thus, using 1972 as a base year, the employment index for the U.S. was 110.8 in 1977.

Many economic indicators show fairly drastic random movement from month to month. Some of this random movement can be eliminated by using a composite index. And the national index of leading indicators is just such a composite index—a weighted average of twelve different leading indicators (see THE NATIONAL INDEX). The result is an index derived from leading series which represent different economic processes and one which has a track record for turning

[1] The pioneering work in business cycle indicators was done by Wesley Clair Mitchell and Arthur F. Burns at the National Bureau of Economic Research. The interested reader is referred to Geoffrey H. Moore, ed. *Business Cycle Indicators, Volume 1: Contributions to the Analysis of Current Business Conditions* (Princeton: Princeton University Press, 1961).

[2] Monthly updates to the national indicators are provided by the U.S. Department of Commerce, Bureau of Economic Analysis, in *Business Conditions Digest*.

THE NATIONAL INDEX OF LEADING INDICATORS

The twelve series used in the national index of leading indicators are:

- Average workweek for manufacturing production workers
- Layoff rate for manufacturing workers
- New orders for consumer goods and materials
- Vendor performance
- Net business formation
- Contracts and orders for plant and equipment
- New building permits for private housing
- Change in inventories
- Change in sensitive prices
- Stock prices
- Change in total liquid assets
- Money supply (M1)

These and other cyclical indicators are published monthly by the U.S. Department of Commerce in *Business Conditions Digest*.

before the economy does.

Why Have a Regional Indicator? Events of the last ten years in the Philadelphia region have led to a particularly strong interest in forecasting economic activity here.[3] The hard times that have hit this region since the relatively prosperous 1960s have generated an atmosphere of increased uncertainty. There have been employment losses, fiscal problems, and Federal policies with inadvertently negative effects. The resultant pessimism probably has been excessive, but it's there, and it translates into cautious business decisions. Hence the increased demand for forecasts of the region's economic outlook. Leading indicators are not designed to provide forecasts of the level of economic activity, but they can be helpful in calling the turning points in the regional business cycle (see LEADING INDICATORS DIFFER FROM ECONOMETRIC MODELS, overleaf).

The timing of changes in the Philadelphia regional economy has run roughly parallel to national business cycles. This parallelism derives in part from the broad diversity of the region's economic base, which mirrors that of the country at large. But it can be traced in part also to the region's relatively heavy concentration of durable goods industries, which are the most cyclically sensitive industries.

Over time, however, the region has lost some of its durable goods manufacturing, and this loss may reduce its sensitivity to cyclical swings. Also, the region has been growing at a slower trend rate than the rest of the country, so a national slowdown might register as a recession here. Thus, although the region has followed national business cycles in the past, it may not continue to do so in the future. Indeed, a RAND corporation study of business cycles in various regions of the country found that past performance relative to the national business cycle was not a good predictor of a region's performance

[3]The region is usually defined as the Philadelphia SMSA which consists of eight counties—Bucks, Chester, Delaware, Montgomery, and Philadelphia in Pennsylvania and Burlington, Camden, and Gloucester in New Jersey.

in any given business cycle.[4] Information about the national cycle still is very useful to those who are forecasting the region's turning points, but the region's slower growth trend and shifting employment base may make this relation less stable than it has been in the past. If so, it will be more important than ever to have local measures of cyclical behavior.

A PHILADELPHIA REGIONAL INDEX

The data available at the regional level are nowhere near as plentiful as the national data. Samples are smaller, and statistical series are neither as refined nor as numerous. So the Bank has chosen to use only four indicators for the regional index rather than twelve as in the national index. Further, in lieu of making a judgment call about what constitutes the business cycle, as is done at the national level, the region's employment index was chosen to define the regional cycle, so that, for example, a cyclical employment peak would be called the region's business cycle peak and an employment trough would be called the business cycle trough. The employment index is a good indicator of economic activity in the region and corresponds to an index which is classified as coincident at the national level.

The four series used to construct the regional index are monthly retail sales in the region in constant dollars, residential construction permits, average weekly earnings in manufacturing in constant dollars, and the national money supply (M1) in constant dollars. Each series has been converted from raw data into an index (see Appendix). The index of leading indicators is an average of these four indices.

It is desirable for leading indicators used in an index to represent various economic factors. The mix of variables selected for the regional index appears to meet that criterion, although the variety is far from ideal. In addition, each indicator should be a good leading indicator by itself. Of the four series, both the money supply and residential construction permits are classified as leaders for peaks and troughs at the national level, and monthly retail sales is classified as a leader at upturns while being listed as unclassified for downturns. Average weekly earnings is not

[4]George Vernez *et al.*, *Regional Cycles and Employment Effects of Public Works Investments*, The Rand Corporation, R-2052-EDA, January 1977

LEADING INDICATORS DIFFER FROM ECONOMETRIC MODELS

Most economic forecasts draw at least some of their information from econometric models. These models are composed of equations which try to capture the major effects that changes in some economic variables have on other variables. By linking these equations together, modelers can trace out the likely effects of current economic activity and policy actions on future economic activity. Thus the models can generate expected values for employment, Gross National Product, and so on.

Leading indicators, however, do not attempt to trace through the causal relations of economic variables as models do. Rather they rely on correlations between the indicator and economic activity in the timing of turning points. For this reason, leading indicators do not provide information about the magnitude of economic changes, only the turning points. Thus models and indices tend to complement one another.

classified at the national level; but a related measure—average weekly hours—is classified as a leader.

Residential construction permits was chosen for the regional index because investment in durable goods such as housing usually is a reliable leading indicator, because such investment is sensitive to people's confidence in the future, and because it influences the demand for materials and labor services which are purchased to produce housing.

Monthly retail sales in constant dollars is a measure both of consumer confidence and of the future production which will be needed to replace items being sold. Retail sales provides a partial proxy for consumer sentiment because consumers are less likely to spend heavily if they face uncertain income prospects. It also provides some information about the amount of income in the region.

Average weekly earnings in constant dollars represents demand for labor as well as adjustment in the workweek. At the national level, average weekly *hours* is used as a leading indicator. The rationale for using hours is that employers may increase hours in the early part of an upturn and decrease them in the early part of a downturn because doing so is relatively easy and because they are not yet certain whether they should commit themselves to changes in the size of their labor force. The earnings figure reflects number of hours worked as well as amount of wages paid and, hence, the tightness of the labor market. It was chosen over average weekly hours because hours did not appear to vary much in the region and did not give clear cyclical signals, whereas the signals given by changes in earnings were fairly clear.

National money supply defined as M1 (currency in the hands of the public plus demand deposits) is a measure of purchasing power in the economy overall. Relatively large amounts of purchasing power usually are expected to lead to a relatively large volume of purchases and, therefore, an active economy. High prices, however, cut the purchasing power of a given stock of money, so the money supply is adjusted for inflation. The deflated money supply is used in the national index of leading indicators.[5]

The national money supply was selected for the Philadelphia regional index for two reasons. First, since money can flow easily between regions, the national measure is likely to be a better measure of regional monetary conditions than the imperfect regional measures currently available. Second, the region's durable goods industries tend to sell in national markets, and these industries are the most sensitive to liquidity conditions. As a check, national M1 was compared with a number of proxies for regional monetary conditions and did at least slightly better than they as a leading indicator for the region.

Each series separately seems to be somewhat erratic. The amount of lead time is not uniform and a number of false signals appear. But aggregating all four series into a composite regional index yields a fairly well-behaved precursor of local business cycle trends.

PERFORMANCE OF THE INDEX

The current version of the index can be seen in the figure overleaf which compares the composite index to total regional employment as a measure of the regional business cycle.

The best way to interpret the index is simply to look at whether its change from month to month is positive or negative. A positive change indicates that the regional economy is likely to grow, and a negative

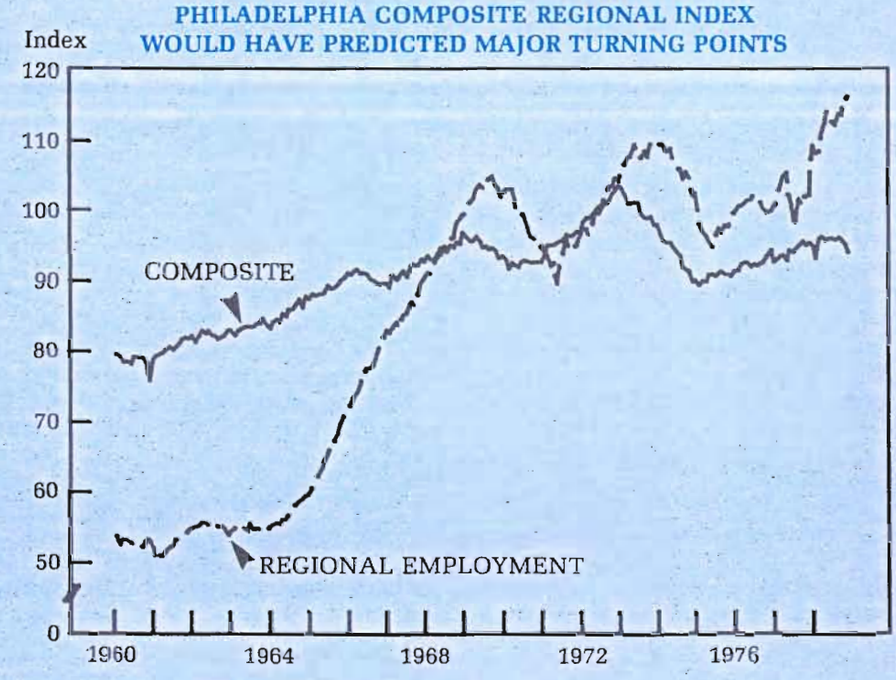
[5]It's possible that M2—M1 plus bank time and savings deposits—will be a better measure of purchasing power in the future, but that depends on public response to recent changes in the law which allow banks to transfer funds from savings to checking accounts.

one is a signal of a possible decline ahead. Any one month's change should not be regarded as very significant. The rule of thumb at the national level is that three consecutive months of change in the direction opposite that of the economy's current movement may augur the approach of a turning point, and a similar rule seems appropriate for the region.

Had the index been available over the years since 1960, it would have enabled forecasters to predict most of the regional economy's major turning points, including the peak in October 1969, the trough in June 1971, the peak in January 1974, and the trough in June 1975, with lead times of nine, fifteen, twelve, and four months respectively. In addition, the index would have continued signalling an upturn during the employment drops in the late part of 1976, after which employment did indeed turn up again. Thus despite an occasional lapse, such as the false signal for a recession in 1966 which never occurred, the regional index would have compiled an enviable record overall.

When the regional index is compared to the national index of leading indicators, the turning points coincide except for the second peak; the regional index turned down in January 1973, five months before the national index, which didn't peak until June 1973.

PHILADELPHIA COMPOSITE REGIONAL INDEX WOULD HAVE PREDICTED MAJOR TURNING POINTS



SOURCE: Data compiled and plotted by Federal Reserve Bank of Philadelphia.

This close coincidence is to be expected, since the regional turning points were very close to the national ones. The real test of the local indicators will come when there is a business cycle in which the region reacts differently from the nation.

Looking at the recent performance of the regional index, the numbers for 1978 show declines in January and February (probably caused by the weather), a large jump up for March, a peak in April, and small up and down movements from May to September. In October, however, the index began a three-month slide that normally would be interpreted as forecasting a recession. 'Normally' is the important word here, because the M1 figures may have been thrown off by regulatory changes and so may not be reliable. But even without the M1 figures, the composite index shows a small downward movement in November and a fairly large drop for December. On balance, while the index has to be interpreted with more than the usual caution, it does seem to be pointing to a downturn for the regional economy sometime later this year.

USES AND LIMITATIONS OF THE INDEX

An index of leading indicators has obvious uses for business planning. A businessman facing increased or decreased sales wants to know if a change in economic conditions is likely to last or is just a random fluctation. A temporary sales increase during a recession, for example, often can be met by reducing inventory or by putting current workers on overtime; but if the increased volume is expected to persist, it may be worthwhile to hire and train more workers. Or a downturn that is expected to persist may convince the businessman to forego a price hike. And businessmen aren't the only ones to worry about the future track of the economy. Local public-sector administrators, for example, also depend on economic projections for guidance in planning and budgeting.

The ability to forecast changes in the economy becomes even more valuable in times of uncertainty such as the present. In the past, the national index of leading indicators was a fairly reliable guide to the outlook for Philadelphia. But shifts in employment which may make the region less sensitive to national business cycles and a regional growth rate which continues to differ from that of the nation at large make further reliance on the national index somewhat chancy. Thus there seems to be a place for any tools that will make it easier to forecast regional ups and downs, and the Philadelphia Fed's new index of leading indicators is one such tool.

No matter how enticing a regional index of leading indicators may be, of course, it should be only one input into a forecast. The calculations used to construct it are too mechanical to be able to take account of all of the complex interrelations of economic forces. In addition, the Philadelphia index must still be considered experimental since it has not yet predicted a turning point outside its base period. But if its performance so far is a safe guide, this index should prove to be a useful supplement to the other information which is currently available for making regional forecasts.

For Appendix, see overleaf...

APPENDIX

CONSTRUCTION OF THE INDEX

In constructing the regional index, each series measured in dollar terms was deflated to 1972 dollars in order to eliminate the effects of inflation on the measurement, with all but the national money supply deflated by a regional measure—the regional consumer price index.[1] If this were not done, a series like retail sales might appear to be increasing when in fact fewer goods were being sold. Next, each series was seasonally adjusted to eliminate fluctuations which occur regularly each year.[2] If this were not done, large seasonal swings might cause the series to appear to be going in the direction opposite its actual trend. For example, Christmas sales may swell the retail sales figures even though the increase may be less than normally occurs. By adjusting for the normal bulge, we can see whether the increase is more or less than normal.

Once the data have been prepared, percentage changes for each series are computed from month to month. These changes are normalized so that each adjusted series averages a one-percent change each month over the base period (1960-77). This adjustment prevents a volatile series from dominating the composite index. The adjusted percentage changes for each series are averaged to get the percentage change for the composite index in a given month. An index is then created which has a percentage change for each month equal to this average percentage change and which has an average value of 100 for the year 1972.

Indices also have been prepared for each series separately, and it is possible to issue preliminary estimates for the composite index even if an update for one or more of the series is missing. Each series is a fairly good leading indicator by itself; and eliminating any one series from the composite index does not alter its performance very much.

THE INDIVIDUAL INDICES

The indices for each series alone are shown in Figures A1-A4. These indices do not represent the absolute changes in the given variable. Rather, they have been constructed so as to be readily aggregated into a composite index; and therefore they show only relative changes in the underlying variable. Changes in direction are the most important signals given by any of the indicators. The level of the indicator relative to its past values may also contain some information about the likely strength of the economy in the near future; but this is very qualitative information and great care should be used in making predictions based on it.

In the figures, each index is compared to the employment reference index to show how it does alone as a leading indicator. While each behaves fairly well, some of the individual indices give more false signals than the composite index.[3]

M1 leads at the two cyclical peaks and at the first trough. But it lags employment at the second trough and is still giving mixed signals even after employment has moved up significantly. M1 can be faulted also for strongly signalling an employment downturn in 1966 which never occurred. A final problem is that the M1 numbers will become hard to

[1] The regional index was constructed using the methodology of *Business Conditions Digest, Supplement: Handbook of Cyclical Indicators*, May 1977, U.S. Department of Commerce, pp. 73-76, with equal weight for each component series and no reverse trend adjustment. An excellent discussion of local indices and a description of a less complicated procedure to generate a very similar index can be found in "A Local Index of Leading Indicators: Construction, Uses, and Limitations" by Paul J. Kozlowski (The W.E. Upjohn Institute for Employment Research, October 1977).

[2] M1 is available in seasonally adjusted form. The other series were adjusted using the X-11 procedure.

[3] As more data become available, the individual indices may be trend adjusted so that their level can be interpreted more as a prediction of the future level of the employment index. But such an interpretation would be wrong given the methodology used to construct the current indices.

EACH LEADING INDICATOR DOES FAIRLY WELL ON ITS OWN WHEN MEASURED AGAINST THE EMPLOYMENT INDEX

FIGURE A1
MONEY

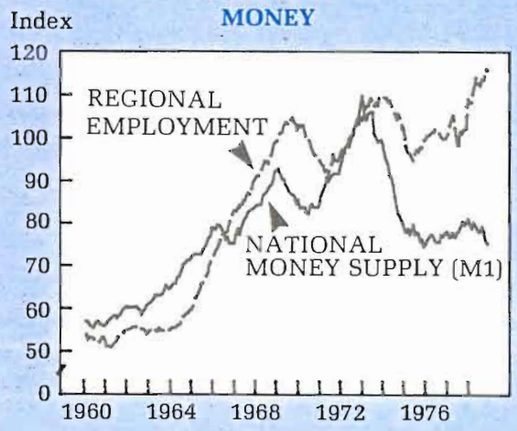


FIGURE A2
CONSTRUCTION

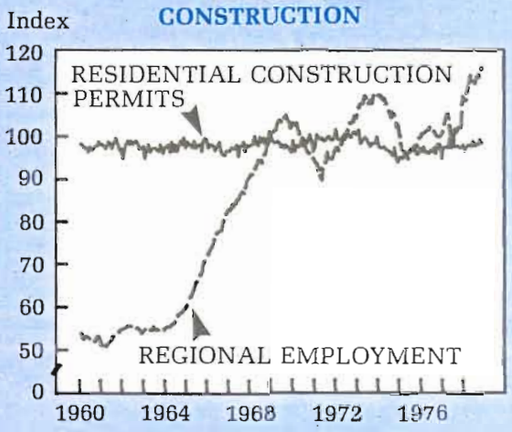


FIGURE A3
SALES

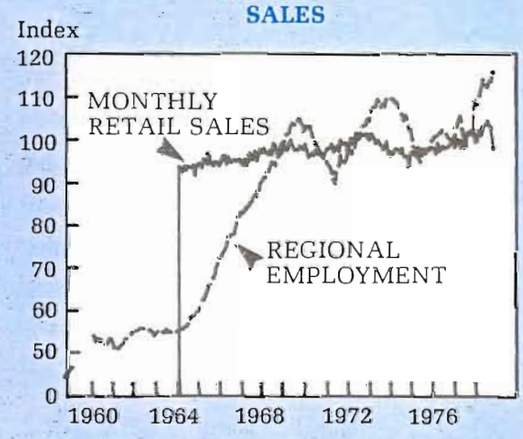
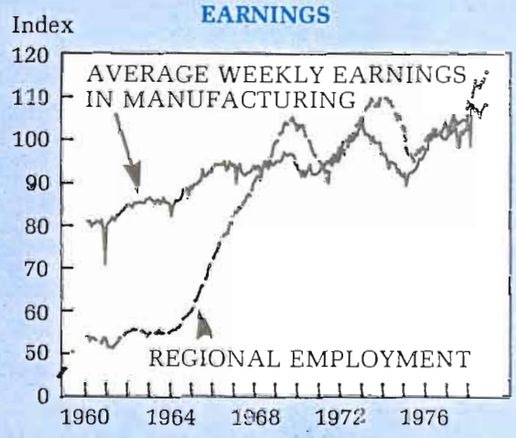


FIGURE A4
EARNINGS



SOURCE: Data compiled and plotted by Federal Reserve Bank of Philadelphia.

interpret for a while because of the changes in banking regulations which took effect on November 1, 1978.[4]

The index of *residential construction permits* shows surprisingly little nonseasonal variation over time. But it did give clear peaks and troughs with good leads for both of the business cycles. Unfortunately, it also signalled at least two additional downturns during the 1960s which never occurred.

The regional data for *monthly retail sales* starts in 1964, so it hasn't had as much opportunity to give false signals as the other series have. But it shows both of the business cycles and appears to have no false signals, although its lead time is not always as large as would be desireable.

The retail sales figures were collected by a new method starting in August 1977. The new method shows a generally higher level of sales than the old method, although there are no direct comparisons available at the local level. The index was created by assuming that the month-to-month percentage changes were correct as reported except for the July-August 1977 change which reflected the change in methodology. A consistent estimate is available for all of the Northeast states, and this percentage change was used to plug the gap in the index. Aside from the July-August change in 1977, this change in methodology should not affect the composite index.

The last series is *average weekly earnings*. It shows both of the business cycles, but it had a very slight lead for the first downturn. In addition, it shows at least two cycles in the 1960s that did not occur.

Overall, each series has some good leading indicator characteristics. But the composite index appears to be more reliable than the individual indicators.

OTHER COMBINATIONS FOR THE INDEX

Occasionally it may be necessary to calculate the composite index before data for all of the series are available. This will alter the confidence one can have in the number since it will then be subject to revision, but Figures A5-A8 show that eliminating any one series does not drastically alter the index. Each of these figures is generated by removing one of the series from the composite index. Only the index without M1 (Figure A5) differs noticeably from the four-component index. This index does not show much of a lead for the first downturn, but it also does not give any false signals.

[4]These changes, which allow banks to transfer funds from savings accounts to checking accounts to cover checks, probably will lead people to place more of their funds into savings accounts and less into checking accounts. Checking accounts are counted in M1, but savings accounts are not.

A COMPOSITE OF THREE LEADERS APPROACHES THE FOUR–LEADER PERFORMANCE

FIGURE A5
EARNINGS, SALES, CONSTRUCTION

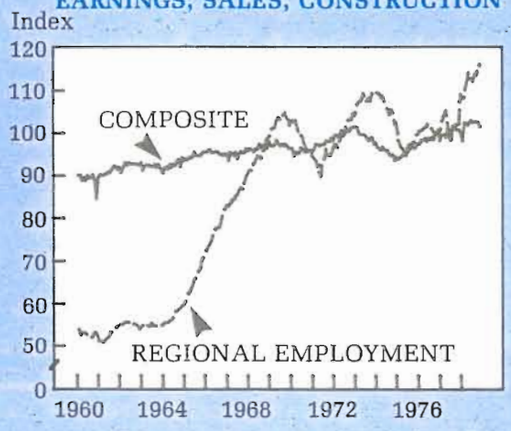


FIGURE A6
MONEY, CONSTRUCTION, EARNINGS

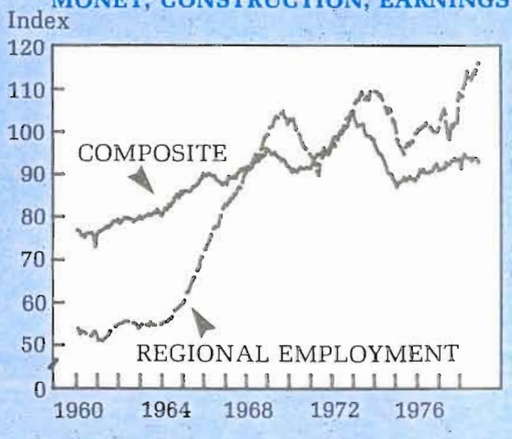


FIGURE A7
MONEY, SALES, CONSTRUCTION

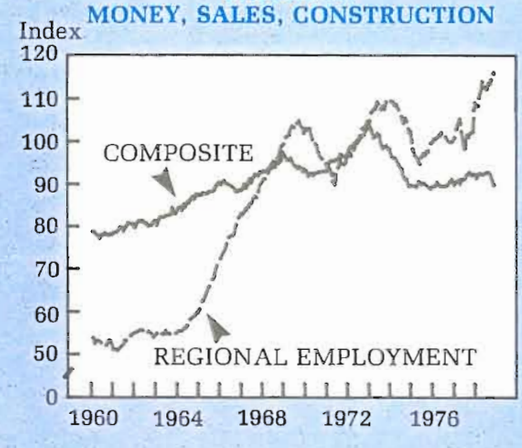
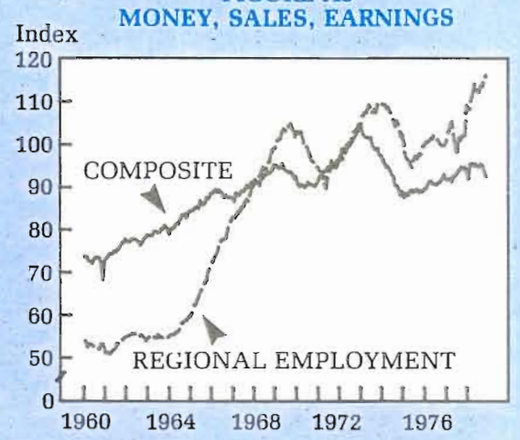


FIGURE A8
MONEY, SALES, EARNINGS



SOURCE: Data compiled and plotted by Federal Reserve Bank of Philadelphia.

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