THE KANSAS INDEX OF LEADING ECONOMIC INDICATORS

by

Mark Allen Willard

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Chapter One

Introduction

The agriculturally dependent states of the midwest are currently beginning to recover from economic problems in which they have been mired for at least the past six years. During this time, other regions of the country experienced recession, recovered from it, experienced prosperity, and in the case of the oil producing states, slipped into recession again. Our recent experience indicates clearly (if it had not been clear already) that our national economy is comprised of smaller regional economies, dependent upon one another but also, in many ways, unique from one another and in possession of needs that are not always mutually beneficial.

Over the years, considerable work has been done compiling and analyzing data related to the nation's economic activity by the National Bureau of Economic Research and the Commerce Department's Bureau of Economic Analysis. Among other things, some of this data has been used in efforts to predict the movement of the nation's business cycle. The construction of the U.S. Index of Leading Economic Indicators is one such effort.

Basically, the purpose of the index is to predict and observe peaks and troughs in the nation's business cycle. To the extent that the index is effective, policy makers and business people can benefit by moving to address whatever action of the business cycle the index predicts. In light of the fact that the economies of the different regions of this country do not always behave as one, an index designed

to predict a business cycle which is an aggregate of several regional business cycles may fail to address economic upturns and downturns in a particular region. Therefore,
it is beneficial to construct indexes similar to the Commerce Department's Composite Index of Economic Indicators that are intended to predict and observe regional business cycles. Several do exist. Indexes of leading economic indicators have been constructed for states such as Iowa, Missouri, and Texas using data from their respective states.

The purpose of this research is to construct an index of leading economic indicators specifically for the state of Kansas by following the Commerce Department's approach and utilizing state data. Ideally, this index will be more sensitive to changes in Kansas economic activity and more closely predict the business cycle of the state than the Commerce Department's national index does.

The Commerce Department Approach Briefly Summarized

The U.S. Index of Leading Economic Indicators begins with twelve monthly series of economic data that behave cyclically and tend to lead the business cycle in their behavior. These twelve series were selected over numerous others because of their superior performance in a number of statistical criteria and the strength of their theoretical justification as leading economic indicators. Weights are established for each of the twelve series based on the series' statistical characteristics. After each series has been weighted and adjusted for its variance, the monthly values of the twelve series are combined and

averaged to form the index.

The Kansas Index of Leading Economic Indicators is constructed following, as closely as possible, the approach used by the Commerce Department. Due to the relative unavailability of state data, the Kansas Index is comprised of only six economic series. These series are real wheat prices paid to Kansas farmers, real cattle prices paid to Kansas farmers, an average of stock prices for one hundred Kansas based and Kansas related firms, new housing units authorized for construction in Kansas, initial claims for unemployment insurance in Kansas, and real M2 money supply in the U.S. These series are assigned weights and combined into an index in a manner duplicating, to a large extent, the Commerce Department's approach.

Mitchell's Definition of Business Cycles

Since the purpose of an index of leading economic indicators is to predict movement in a business cycle, it is necessary to discuss what a business cycle is and why it occurs in a capitalistic economy. Wesley C. Mitchell devoted his life to the study of business cycles and their causes and provided this definition of business cycles:

> Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration business cycles

vary from more than one year to ten or twelve years; they are not divisible into shorter cycles of similar character with amplitudes approximating their own.[1]

Basically, the business cycle consists of four components: recovery and expansion, peak, recession, and trough. Business activity in a period of expansion increases for a time but eventually reaches the point where it rises no further. This point is referred to as the peak. After reaching the peak, business activity embarks on a period of decline referred to as a recession. The decline eventually ceases and business activity begins to pick up again. This bottom point is called the trough. As business picks up, the periods of recovery and expansion occur and the cycle repeats itself.

Mitchell's Explanation of Business Cycles

There have been several theories developed over the years that attempt to explain the phenomenon of the business cycle. The business cycle has been attributed to such things as sun spots, changes in agricultural yields, wars, underconsumption, and mistakes by businessmen. Probably the most accepted explanation of the business cycle and that on which the indicator approach is based was again developed by Wesley C. Mitchell in the early part of this century.

The following is a summary of Mitchell's ideas concerning the causes of business cycles and is basically paraphrased from a book on

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[1] Mitchell, Wesley C. and Arthur F. Burns, Measuring Business Cycles, Copyright 1946, National Bureau of Economic Research, New York, N.Y., page 3

business cycles written by Lloyd M. Valentine and Carl A. Dauten.[2]

During the trough period of a recession the general price level is low and static or falling, profit levels are low, there is excess production capacity in the economy, consumption is low as buyers are cautious, and credit is generally difficult to obtain. However, input prices are falling relative to output prices making it possible for some industries to increase profitability. Also, in time inventories become depleted and durable goods owned by consumers and producers wear out and require replacement. These factors along with potential external factors such as increased government spending or increased demand by foreigners for exported goods provide the impetus for economic recovery. The recovery generally begins in one or two sectors of the economy but, due to linkages between sectors, spreads to other sectors as well.

The recovery is fueled by increases in aggregate demand and income. The increase in demand for goods and services makes it possible for suppliers to raise prices, and hence, increase profitability as output prices rise faster than input prices. People begin to anticipate future price increases and hedge against them by increasing new orders for products. This further fuels business expansion. Realizing that businesses have become more profitable, creditors become more willing to supply funds for investment resulting in greater investment by businesses.

For a time input prices rise slowly relative to output prices due

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[2] See Valentine, Lloyd M., and Carl A. Dauten, Business Cycles and Forecasting, sixth edition, Copyright 1983, South-Western Publishing Company, Cincinnati, OH, pp.274-276

to the existence of excess capacity in the economy, fixed wage contracts, and other things. Eventually, all excess capacity is used up, wage contracts are renegotiated, and production costs begin to rise. These cost increases begin to catch up to some industries causing a decline in their profits. As industries become less profitable, creditors react by calling in debts which causes a decline in new investment.

The decline in profitability spreads from sector to sector due to the same linkages that caused the previous expansion. Eventually this effect causes a halt in business expansion, the business cycle peaks, and business activity begins to decline. As the recession proceeds prices begin to fall or become static, investment erodes, production levels fall, and workers are laid off. Now we are back where we started. Falling input prices, exhausted inventories, and the need to replace consumer and industrial durable goods set the stage for the next business recovery.

Organization of the Thesis

This thesis is organized in five chapters. Chapter one is an introduction to the thesis discussing the justification of the study and defining what a business cycle is. Chapter two is a literature review. It contains an account of the development of the index of leading economic indicators approach along with the primary aspects of the debate concerning this approach. Chapter three is a discussion of the method used in creating the Kansas Index of Leading Economic Indicators. First of all, the selection of the component series is

discussed. Secondly, the process used in weighting the individual component series of the index is described. Thirdly, the actual process used in constructing the index is described in detail. Chapter four begins with a description of the process used in dating the business cycle in Kansas. Secondly, this chapter is an account of the "track record" of the Kansas Index during the period of the study (ie. since 1970) and a comparison of its performance with six alternative formulations of the index. Chapter five contains suggestions for improvements on the Kansas Index and outlines possible avenues of future research that relate to this index.

This thesis also contains two appendixes. Appendix A is a detailed, mathematical account of the weighting process used in this thesis, carefully describing each mathematical step as it occurs. Appendix B discusses the formulation of the long run trend in real Kansas personal income and the long run trend in the unadjusted Kansas Index, which are used in the construction of the index in its final form, in mathematical detail. To conclude the thesis, all data used are reported in a series of tables and a number of relevant graphs are provided.

Chapter Two

A Brief History of the Development of the Index of Leading Economic Indicators Approach and the Ensuing Debate: A Literature Review

Criticism of the index approach is primarily of two forms. The first and initial form of criticism comes from those who feel that the index approach lacks theoretical justification and ignores the principles of economic theory. The second form of criticism, which is more commonly heard today, primarily concerns the ability of the index of leading economic indicators to accurately predict changes in business activity. This chapter begins by describing the historical development of the leading index approach. Next, criticisms of the index approach from a theoretical perspective are outlined along with replies from various authors. Finally, this chapter elaborates on the empirical criticisms of the index which suggest that the index does not do what it is intended to do.

Harvard ABC Curves

The first system that was similar to the index of economic indicators was developed around World War I and was known as the Harvard ABC curves. The A curve represented stock prices and was intended to measure investor speculation. The B curve measured the dollar volume of checks drawn on bank deposits and was intended to represent business activity. The C curve was the interest rate on short-term commercial loans and was supposed to measure the money

market.[3]

Those that developed the curves found that they moved in sequential order. The idea was that tight money led to a drop in business profitability, and hence, lower stock prices, which led in turn to lower business investment and a general recession. The recession led to an easier money policy which improved business profitability, increased stock prices, and caused an expansion in business activity. The developers of the ABC curves were greatly embarrassed when the system failed to predict the Great Depression. In an article discussing the Harvard ABC curves, Geoffrey Moore noted, however, that the fundamental relationships between the three variables are still valid today although the ABC curves are not comprehensive enough for modern business cycle forecasters.

Development of the Composite Index of Leading Economic Indicators

The severity of the Great Depression and the inability of forecasters to predict its occurrence and intensity led to the realization by the government that a comprehensive set of economic indicators was needed. Since the 1920's, the private organization "The National Bureau of Economic Research" (NBER) under the leadership of Wesley C. Mitchell and Arthur F. Burns had been compiling and analyzing large quantities of data pertaining to the American economy. In 1937 the Secretary of the Treasury commissioned Burns and Mitchell to construct a system of economic indicators that would signal to the

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[3] Moore, Geoffrey H., "The Analysis of Economic Indicators", Scientific American, Jan. 1975, page 17

government when the depression would be ending.

Burns and Mitchell compiled a list of economically significant series that had historically indicated changes in economic activity. From this list, indexes were compiled by combining information from those series that led the business cycle, those that behaved concurrently with the business cycle, and those that lagged behind the business cycle. These results were published in 1938, originating the concepts behind the Commerce Department's Composite Index of Economic Indicators.

Koopmans' Criticism

A comprehensive account of the research of Burns and Mitchell was published in 1946 by the NBER under the title Measuring Business Cycles. Its publication touched off a debate concerning this new approach to predicting economic events. Intended as a critical review of Burns and Mitchell's 1946 book, Tjalling C Koopmans published an article in 1947 that became the classic theoretical criticism of the index approach.[4] Koopmans presented three theoretically oriented arguments that were critical of Burns' and Mitchell's work. He first argued that the index approach failed to consider the theoretical preconceptions concerning the nature of business cycles. Koopmans scolded Burns and Mitchell for failing to utilize demand and supply equations or any other tools of the theoretical economist. According to Koopmans, the question of an individual series' economic relevance

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[4] See Koopmans, Tjalling C., "Measurement Without Theory", The Review of Economics and Statistics, Aug. 1947, pp.161-172

was not appropriately addressed:

> The choices (of series) may have been the best possible ones. But "good" choices mean relevant choices. What is relevant can only be determined with the help of some notions as to the generation of economic fluctuations, and as to their impact on society.[5]

Additionally, he argued that the attention of the researchers had shifted from the true underlying events that cause business cycles, such as wars and weather, to the combined effects of these causes.

His second argument was that without resort to economic theory, conclusions that are relevant in terms of policy advisement can not be drawn. The predictions resulting from the use of the index are of an unreliable nature because they fail to address the impact of the underlying structural equations concerning consumer tastes, levels of technology, and so forth.

Koopmans' third argument was that since Burns and Mitchell's data was gathered without the development of a fully theoretical hypothesis, much important information was deleted and that "better" data could have been obtained if a more theoretically rigorous approach had been used. He noted specifically that Burns and Mitchell failed to investigate the degree to which economic variables are random.

Vining's Reply to Koopmans

A reply to Koopmans was provided shortly thereafter by Rutledge

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[5] Koopmans, page 164

Vining.[6] His primary counterargument was that requiring economic research to conform to a narrow view of theoretical concepts was an unnecessarily harsh restriction. In presenting an argument that in this case no longer applies but at the time was important, he stated that rejecting an approach to economic inquiry out of hand before it is able to be fully developed and tested would stifle potentially useful research.

He admitted that a formal theoretical model based on individuals' tastes and motives would be desirable, but noted that no such model existed that could be used in a practical forecasting setting and until one was developed and empirically proven superior to Burns and Mitchell's method, research such as theirs should not be discouraged. Vining also pointed out that it could not be concluded that the index approach was ineffective for policy recommendation when it had not yet been fully developed.

In his book on macroeconomic policy and forecasting, Michael Evans devoted a few pages to discussing of the Koopmans-Vining debate. He concluded that Vining was right in that if it is believed that the purpose of the index approach is for prediction only, the primary consideration is that it is able to predict peaks and troughs in the business cycle. If it is better able to do this than some more theoretically supported method, for the purpose of prediction, it

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[6] See Vining, Rutledge,"Methodological Issues in Quantitative Economics", The Review of Economics and Statistics, May, 1949, pp.77-86

should be preferred.[7]

Burns, Mitchell, and those supporting their approach argued that their method was not as devoid of theory as their opponents claimed[8]. Those series that have been selected for use in the indexes are claimed to be related, in more that a statistical sense, either directly or indirectly to the business cycle. Stock prices, for example, are used as a leading economic indicator. Since the primary cause of a recession is believed to be a decline in business profitability, falling stock prices reflecting falling profitability can be considered a harbinger of recession.

Failure of Leading Indexes in Forecasting the Level of Economic Activity

Arguments concerning the empirical usefulness of indexes of economic indicators comprises the second area of criticism that the index approach has been subjected to. There is some confusion as to exactly what role the indexes are to play in economic forecasting. Studies have been done concerning the usefulness of indexes of economic

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[7] See Evans, Michael K., Macroeconomic Activity: Theory, Forecasting, and Control, Copyright 1969, Harper and Row, New York, NY, pp.449-450

[8] see Harris, Maury N. and Deborah Jamroz, "Evaluating the Leading Indicators", Federal Reserve Bank of New York Monthly Review, June, 1976, pp. 166-167
see also Zarnowitz, Victor and Charlotte Boschan, "Cyclical Indicators: An Evaluation and New Leading Indexes", Business Conditions Digest, May, 1975, U.S. Department of Commerce, p. vi
see also Burns and Mitchell 1946 pp. 17-19

indicators in forecasting business activity.[9]

Those studies all came to the conclusion that the indexes of economic indicators were much more effective at predicting and observing peaks and troughs in the business cycle than they were at forecasting the level of economic activity. Hymans pointed out that Burns and Mitchell intended for their indexes to be geared this way. If the position is held that the purpose of the indexes is solely to predict peaks and troughs in business cycles, then studies critical of the statistical fit between the indexes and the entire business cycle are arguing a moot point.

Weights Used in the Leading Index are Improper

Research along a similar avenue has inquired into the method that the Commerce Department uses in weighting its data. They propose that instead of using the current complex system for weighting, regression techniques should be used to determine the weights.[10] When Hymans did this he found that an index utilizing weights determined by regression provided a superior overall statistical fit to the business cycle than that of the Commerce Department's index. However, around peaks and

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[9] See Hymans, Saul H., "On the Use of Leading Indicators to Predict Cyclical Turning Points", Brookings Papers on Economic Activity Vol. 2, 1973, pp. 345-348
See also Stekler, H.O., and Martin Schepsman, "Forecasting With an Index of Leading Series", Journal of the American Statistical Association, June, 1973 pp.291-295
See also Harris and Jamroz p. 170

[10] see Hymans pp. 345-348
see also Maher, John E., "Forecasting Industrial Production", Journal of Political Economy, April, 1957, pp.158-165
see also Koch, Paul D., and Robert H Rasche, "An Examination of the Commerce Department Leading Indicator Approach", unpublished, pp.5-13

troughs the Commerce Department's index provided a better fit. Again, if prediction of peaks and troughs in business cycles is viewed as the role of an index of economic indicators, these studies support the current approach to weighting data.

Leading Index Provides Leads That are Too Short

The index on leading economic indicators has at times been accused of providing too short of a lead to be useful in light of the lag in reporting data. Tests on individual series have shown that some of the series used in the leading index provide no lead and in some cases actually lag behind business activity.[11] Although such information suggests a need to re-evaluate the economic impact of some series on the business cycle, it isn't of itself all that damaging to the usefulness of the index approach. Hymans observed and Koch and Rasche did not deny that the index as a whole did successfully lead business activity although some leads were shown to be short.[12]

Tendency of the Leading Index Towards False Peaks

By far the largest amount of empirical criticism has been directed towards the tendency of the Commerce Department's index of leading economic indicators to predict peaks and troughs in the business cycle that never occur. This is a potentially devastating problem in that if a leading index does this often enough its reliability as a forecasting

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[11] see Hymans, pp. 343-345
see also Koch and Rasche, p. 4

[12] see Hymans, pp. 348-349
see also Koch and Rasche, p. 4

tool becomes highly questionable.

Several authors have observed the tendency of the leading index towards generating false peaks.[13] Both Hymans and Stekler claimed that the Commerce Department's leading index produced a fifty percent false peak rate. Harris and Jamroz observed seven false peaks between 1948 and 1975. On the surface this appears to be a severe problem, and maybe it is, but Harris and Jamroz mentioned several plausible explanations for the observance of false peaks.

Hymans was criticized by Harris and Jamroz and also by Julius Shiskin [14] for applying overly rigid rules for identifying peaks and troughs. Hymans determined a peak to have been predicted when the leading index declined two consecutive months after it had been increasing. Those that use the index usually require three or four months decline before they are willing to predict that a peak will occur. Harris and Jamroz also pointed out that it is worthwhile considering the magnitude of decline in the leading index and the action of the individual components before predicting a peak. If the index is declining slowly, the prediction of a peak may not be in order. Also, if a few series are declining sharply while others are still rising, but the index as a whole is falling, a true peak may be less likely to occur than if most or all of the component series are falling.

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[13] See Hymans, pp. 355-358
see also Stekler and Schepsman, p. 293
see also Harris and Jamroz, pp. 168-170

[14] see Shiskin, Julius, "Comments and Discussion", Brookings Papers on Economic Activity Vol. 2, 1973, pp.378-382
see also Harris and Jamroz, p. 168

The effect of government economic policy is also a possible cause of false peaks.[15] The idea here is that when a recession appears likely, the implementation of countercyclical fiscal and monetary policy by the government can eliminate or delay a recession predicted by the leading index. This scenario could in turn lead people to believe that the leading index exhibited a false peak.

Another response to the accusation of false peaks comes from those who think that the classical definition of a business cycle may be outdated. They claim that in addition to the classical recession where prices and output fall, modern economies (specifically those in Europe) more often experience recessions that are actually just slowdowns in growth.[16] These "growth cycles" occur at shorter intervals than do their classical business cycle counterparts. Mintz observed that no false peaks occurred when the index of leading economic indicators was applied to a growth cycle of the U.S. economy.

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[15] see Shiskin, Julius, "The 1961-69 Economic Expansion in the United States: The Statistical Record", Business Conditions Digest, Jan., 1970, pp.101-112

[16] see Mintz, Ilse, "Dating American Growth Cycles", The Business Cycle Today, Victor Zarnowitz ed., copyright 1972, National Bureau of Economic Research, Columbia University Press, New York, NY, pp.39-88

Chapter Three

Methodology

This chapter is made up of three main sections. The first section discusses the six components that comprise the Kansas Index of Leading Economic Indicators along with the rationale for the selection of each component. The second section is concerned with the process used to calculate the weight for each of the component series. Finally, the third section discusses the procedures used in actually compiling the index from the weighted data.

Six series were chosen to be components of the Kansas Index of Leading Economic Indicators. They include real wheat prices paid to Kansas farmers, real cattle prices paid to Kansas farmers, an index of stock prices of selected Kansas owned firms and firms with important operations in Kansas, housing units authorized for construction in Kansas, initial claims for unemployment insurance in Kansas, and the M2 measurement of the nation's real money supply.

Rationale for Commodity Prices

Commodity prices are not used by the Commerce Department in formulating the index of leading economic indicators for the United States. The primary reason I chose to include wheat and cattle prices in the Kansas index is that agriculture is a much stronger component of the Kansas economy than it is to the nation as a whole. To ignore the agricultural sector may hinder the ability of an index of economic indicators for Kansas to accurately predict recessions in the state. Wheat and cattle prices were chosen because wheat and cattle are the

two principal agricultural products produced in Kansas.

When the price of a commodity falls, farmers are to a large extent not initially able to react by reducing production. Planting decisions have already been made, new calves have already been born, cows are already pregnant, and so forth. In time farmers are able to react to falling prices by reducing production. A decrease in production reduces the demand for such things as agricultural chemicals, farm implements, and other agriculturally related goods and services. The reduction in the amount of beef being marketed causes meat packers to reduce production and lay off workers. Through intersectoral multipliers other sectors of the economy are also adversely affected and the economy as a whole may fall into recession. Obviously, these effects are more severe the more the region depends on agriculture. Since all these things take time to occur, in an agriculturally dependent state such as Kansas falling commodity prices can lead the state's economy into recession.

The size of the multiplier effect of the agricultural sector in Kansas has been most recently estimated by The 1985 Kansas Input-Output Model.[17] These multipliers are of two types. Output multipliers were constructed to estimate the number of dollars worth of additional output produced by the entire state economy as a result of a one dollar increase in output in a given sector. The output multiplier for the wheat sector was determined to be 2.69 and the output multiplier for the cattle sector was 2.87. Income multipliers were also constructed

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[17] Emerson, M. Jarvin, The 1985 Kansas Input-Output Model, Kansas State University, unpublished

in the study. Income multipliers measure the number of dollars of additional income to the entire state economy resulting from a one dollar increase in income in a given sector. The income multiplier for the wheat sector was 1.89 and the income multiplier for the cattle sector was 4.40. The size of these multipliers suggests that the farm sector possesses a significant multiplier effect on the economy as a whole in the state of Kansas.

As the wheat price component I used the average monthly price paid to Kansas farmers for their wheat as reported by **Kansas Agricultural Statistics**. These numbers were then deflated by the producer price index for finished goods. The values for this series as with those for all of the components used are reported at the end of this thesis in table 1.

The cattle price component was found in a similar manner. The series used was the average monthly price per hundred-weight paid to Kansas farmers for all beef cattle marketed. This series too is compiled by **Kansas Agricultural Statistics** and is deflated by the producer price index for finished goods.

Rationale for Stock Prices

An index of stock prices was a component of the original index of leading economic indicators developed by Mitchell and continues to be a component to this day. To a large extent, the value of a firm's stock represents the profitability and economic health of the firm. Therefore, when the price of a firm's stock begins to consistently fall it is probable that the profitability of the firm has declined. When

an index of many companies' stocks falls for a period of time, it is possible that a recession is looming on the horizon.

There is also a link between stock prices and consumer confidence. When the stock market begins to fall, consumers tend to lose confidence in the strength of the economy. This lack of confidence results in a decline in consumption in society. Falling consumer expenditures can be a major force in bringing about an actual recession. Empirically, it has been estimated that consumption expenditures decline three to seven percent as much as a given decline in stock prices.[18]

In a 1975 article, Geoffrey Moore discussed the record of stock prices as a leading economic indicator.[19] He noted that since 1873 eighteen of the twenty-three recessions have occurred following a fall in stock prices. Other authors also note the existence of a relationship between stock prices and the business cycle. In a recent article, Bryon Higgins, using rather strict guidelines, determined that stock prices led recessions forty-one percent of the time.[20] In a related article, Douglas K. Pearce concluded that while stock prices proved to be poor leading indicators in other developed countries, they

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[18] Higgins, Bryon, "Is a Recession Inevitable This Year?", Economic Review of the Federal Reserve Bank of Kansas City, January, 1988, p.11

[19] Moore, Geoffrey, "Security Markets and Business Cycles", Business Cycles, Inflation, and Forecasting, Copyright 1983, NBER, Ballinger Publishing Co., Cambridge, Mass., pp. 139-158. reprinted from Financial Analyst's Handbook I, Copyright 1975, Dow Jones, Homewood, Ill.

[20] Higgins, p.14

continue to be a useful leading indicator in the United States.[21]

The third component of the Kansas Index of Economic Indicators is an index of stock prices for Kansas owned and Kansas related companies. For a given month, this index is found by averaging the stock prices of companies listed for the last Monday of the month in "The Kansas 100", which is published every Monday in the "Business Monday" supplement to The Wichita Eagle-Beacon.

Unfortunately for my purposes, "The Kansas 100" has only been available since September of 1983. For the months prior to that I averaged the closing stock prices for the last Friday of the month for as many stocks listed in the September, 1983 "Kansas 100" as could be found going back to January of 1970.

Rationale for New Housing Units

Housing unit construction is an industry which is heavily dependent on credit. As an economic expansion nears its apex, profit levels in many industries are falling and lenders become more cautious in their willingness to extend credit. This reduction in the availability of credit, expressed through higher interest rates, has an especially strong, negative impact on new housing construction. Hence a drop in housing starts is usually observed prior to the onset of a recession. In a paper published by the National Bureau of Economic Research, Leo Grebler noted that housing starts are highly sensitive to mortgage rates and that housing starts lead the business cycle because industry

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[21] Pearce, Douglas K., "Stock Prices and the Economy", Economic Review of the Federal Reserve Bank of Kansas City, Nov., 1983, p.22

as a whole is less sensitive to interest rates and reacts more slowly to rising rates.[22]

Additionally, since investing in a new home is an expensive and long term proposition, the willingness of individuals to purchase new homes is strongly influenced by their expectations of the future state of the economy. As an economic expansion approaches its end, people begin to lose confidence in the future health of the economy. This loss of confidence can be transferred into a reduction in the willingness of individuals to purchase new homes.

The fourth component of the Kansas Index of Economic Indicators is the monthly number of new housing units authorized in Kansas. These numbers are published monthly by the Commerce Department in **Housing Units Authorized by Building Permits and Public Contracts.**

Rationale for Initial Claims

Unemployment claims has an inverse relationship with the business cycle, falling during expansions and rising during recessions. During an expansion, as profit levels in some industries (especially manufacturing industries) start to diminish, these industries begin to lay off workers. These laid off workers then file initial claims for unemployment insurance. Since declining profit levels is a cumulative process which builds up over time, we would expect to see unemployment claims rising in advance of a general recession. In a 1961 article, Geoffrey Moore demonstrated how the layoff rate, which is similar to

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[22] Grebler, Leo, "Housing Issues in Economic Stabilization Policy", Occasional Paper #72, copyright 1960, National Bureau of Economic Research

initial claims, continuously led total manufacturing employment, where total manufacturing employment is identified as a coincidental economic indicator. He specifically mentioned that the layoff rate provided a seven month lead over manufacturing employment in 1952.[23]

The fifth component of the Kansas Index of Leading Economic Indicators is the number of initial claims for unemployment insurance filed by Kansans in a given month. This data is collected and provided by the Kansas Department of Human Resources.

Rationale for M2

The final component of the Kansas index is the M2 measure of the nation's money supply. The lead that the money supply would maintain over the business cycle can best be illustrated by recalling that the nation's money supply is determined by two components that are multiplied together. One is the monetary base which is determined by the Fed. The other is the money multiplier which is partly determined by the Fed and partly determined by the banking public.

As an expansion nears its end, the reduced willingness of banks to lend money causes the money multiplier to decline. This causes downward pressure on the money supply and reduces it altogether if the Fed does not pump reserves into the economy. At this same time the economy is usually experiencing unwanted inflation. In order to reduce inflation the Fed will very likely slow the rate of increase in the monetary base. Hence it is probable that both components of the money

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[23] Moore, Geoffrey, "Business Cycles and Labor Markets", Business Cycle Indicators Vol. 1, copyright 1961, National Bureau of Economic Research, Princeton University Press, Princeton NJ., p.508

supply will slow down in advance of a recession.

The relationship between the money supply and the business cycle was documented by Milton Friedman. Friedman and Anna Jacobson Schwartz determined that changes in the growth of the money supply result in changes in personal income. Hence a slowdown in money growth will usually precede the onset of a recession.[24] When viewed strictly empirically, in the time period of this study, M2 exhibited an average lead at peaks of 12.33 months when compared to Kansas personal income.[25] This was the best performance of any of the six components.

M2 is compiled and released on a monthly basis by the Federal Reserve and can be found from a variety of sources. I use The Wall Street Journal as my source for M2 as it is very quick in reporting the figure each month. The monthly M2 figure is deflated by the consumer price index for all urban consumers for the relevant month to arrive at a real measure of the M2 money supply. The rationale for using M2 as opposed to M1, M3, L, or any other measure of the money supply in the Kansas index is simply that M2 is the measure of the money supply that the Commerce Department uses in the U.S. Index of Leading Economic Indicators.

Procedures Used to Assign Weights

In order to maximize the accuracy of the Kansas Index, I decided to weight each of the six component series based on the criteria and

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[24] Friedman, Milton and Anna Jacobson Schwartz, "Money and Business Cycles", Review of Economics and Statistics, Feb., 1963 p.53

[25] see appendix A

procedures used by the Commerce Department in formulating the U.S. Index.[26] There are six criteria used to weight the Kansas Index. These six criteria are Economic significance (how important and well understood a role does the series play in the business cycle), statistical adequacy (how well does the series measure the business cycle), timing (how consistently has the series led, coincided, or lagged at the peaks and troughs of the business cycle over time), conformity to business cycles (how accurately has movement in the series reflected the actual movement in the business cycle), smoothness (how quickly and easily can movement in the series that reflects movement in the business cycle be distinguished from other movement in the series), and currency (how quickly does current data in the series become available and how frequently is it reported). Naturally, the better a series meets a given criteria, the higher is the weight assigned.

The actual weights used for the Kansas Index are listed in table 2 at the end of this paper. An explanation of how these weights were established is provided in the following paragraphs. A complete explanation of the process is included in appendix A.

Economic Significance

The assigning of weight for economic significance is of an ordinal nature and is inherently subjective. Zarnowitz and Boschen noted that while this aspect of a series is quite important, a large amount of the preselection process that the Commerce Department goes through when

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[26] see Zarnowitz and Boschan, pp. vi-vii

choosing a series for the index concerns economic significance. Series that are judged to have little economic significance are eliminated from consideration before they can become part of the index.[27] Economic significance is given a weight of 0.167. Since I considered all of the six components chosen for the Kansas Index to be economically significant, each was assigned the full weight of 0.167.

Statistical Significance

Statistical adequacy is also assigned a weight of one sixth and is the summation of eight subcomponent scores. Fifteen percent of the weight is derived from the quality of the reporting system used. This concerns whether the data were obtained from a source set up directly for statistical purposes, as a byproduct of an administrative program, or indirectly from estimates derived from related variables. All of the components received the full weight for this factor except the stock price variable. Since the stock price index was compiled by me and was not initially reported for this purpose, it was awarded two thirds of the full weight.

Coverage of the process is assigned fifteen percent of the weight. This identifies whether the data in a series reflects full enumeration, a statistical sample, or some other kind of sample. The stock index, housing starts, and M2 represent statistical samples and were awarded two thirds of this weight. The other components were of full enumeration and received the full weight.

Ten percent of the weight is assigned to the coverage of the time

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[27] see Zarnowitz and Boschen, p. vi

period (whether the data represents a full month or quarter, one week out of the month, one day out of the month, etc.). Data covering an entire period are preferred to data from a representative day or week. The stock index and M2 did not represent data for an entire month and were only awarded one third of this weight.

The availability of estimates of sampling and reporting errors is given five percent of the weight. Such estimates for the components used in the Kansas Index either do not exist or are not easily obtained, so all of the component series received no weight for this factor. The frequency of revisions is assigned twenty percent of the weight. The more revisions the higher the score. All of the component series received the full weight for this factor except for the stock series. Since it is not readily subject to revision it was assigned no weight for this factor.

The length of the series is assigned fifteen percent of the weight. If the series goes back to 1948 or before it is granted the full fifteen percent. All component series were awarded full weight in this category except for initial claims. This series has only been available since 1960, so it was assigned one half of the weight in this category.

Finally, Zarnowitz and Boschen mentioned that other miscellaneous considerations are assigned eight percent of the weight.[28] Since I was unable to determine what these considerations were, all components received the full weight for this category.

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[28] see Zarnowitz and Boschen, p. vi

Timing

Timing at peaks and troughs is considered vitally important and is assigned the highest weight of 26.7 percent. There are two primary components of the timing weight. One is the statistical probability that the lead, coincidence, or lag displayed by a series at a given peak or trough in the business cycle is not attributable to chance. This probability is derived through the use of the binomial distribution and is assigned eighty percent of the timing score, forty percent for peaks and forty percent for troughs. In applying this procedure to the Kansas Index I assumed that the probability that the value of a series would rise, fall, or stay the same from month to month is one third for each case. The probability that the lead displayed in a series is attributable to chance is found by using a simplified binomial formula:

$$P = (0.33)^X$$

where P = the probability that the lead displayed by the series is attributable to chance

x = average lead displayed by series

Each series is assigned its weight based on the value of "P" relative to the smallest value of "P" among the six components. When relative scores for peaks and troughs are combined together, the stock average, new housing units, and initial claims end up being awarded the full weight of 0.214. Cattle prices received the lowest weight, displaying an average lead of -1.33 months at peaks and 2.5 months at troughs.

The remaining twenty percent of the timing weight is assigned to the standard deviation of the leads and lags of series about their

respective means. This is referred to as dispersion. Ten percent of the weight is assigned to dispersion around peaks and ten percent is assigned to dispersion around troughs. M2 received the highest score for dispersion with a standard deviation of leads at peaks of 4.190 and a standard deviation at troughs of 1.886. Initial claims received the lowest score in this category with a standard deviation at peaks of 5.249 and a standard deviation at troughs of 4.992.

Conformity to the Business Cycle

Conformity to the business cycle is awarded a weight of one sixth, which is the same as that for the first two criteria. There are two ways in which a series can conform to the business cycle. It can move cyclically, that is rise and fall as the business cycle rises and falls or it can do just the opposite and move countercyclically. The degree to which a series conforms is measured by comparing the number of business cycles that are matched by movements in the series to the total number of business cycles covered. The leading or lagging characteristic of the series is dealt with by shifting the series by its median lead or lag so that its peaks and troughs correspond to those of the business cycle. This component of conformity is referred to as probability and is awarded fifty percent of the conformity weight. Each component of the Kansas Index was awarded this weight based on the percentage of business cycles that were matched by the series since 1970. Five of the six components were awarded the full weight in this category. Cattle prices gave no signal at all that corresponds to the trough of the 1979-80 recession and therefore was

awarded only two-thirds of this weight.

There are two other factors which are included in the score for conformity. One measures the number of extra turns (false peaks) that a series exhibits. The extra turns factor is assigned thirty percent of the conformity weight. This weight was applied to the Kansas Index using the following formula:

weight = 1/(1+x) * 0.05

where x = the number of extra turns displayed by the series. M2 received the full weight in this category with no extra turns. Wheat prices with six extra turns was assigned the lowest weight in this category. The other component is a measure of the amplitude of cyclical fluctuations in a series. To find the amplitude the percentage change between peak and trough values of a series during a given period is computed. This percentage change is then divided by the length of the period. The amplitudes derived throughout the series are then averaged and this average is used to determine the weight. Amplitude is assigned a weight of twenty percent of the conformity score. This weight was applied to my index by dividing the amplitude computed for each series by the largest amplitude displayed by a component. The largest amplitude displayed by one of the six components was 4.635, which was the amplitude for new housing units authorized. Thus, this component received the full weight for amplitude. M2 received the lowest weight for amplitude with an amplitude of 0.295.

Smoothness

The degree of smoothness in a series is awarded a weight of 13.3 percent. This weight is applied on the basis of the relationship between the irregular and cyclical components of a series. A trend cycle is computed for the series. The irregular component of the series is found by dividing the trend cycle components by the seasonally adjusted components of the series. Next, percentage changes for both the trend cycle and the irregular components are derived and averaged. The average percentage change for the irregular component is then divided by the average percentage change for the trend cycle. The shortest time period where this ratio is less than one is then found. The length of this time period is called the months for cyclical dominance (MCD). The lower is the MCD, the smoother is the series. The MCD is used to assign a series its weight for smoothness. Each series' score for smoothness was determined by its MCD relative to the lowest MCD among the six component series. The formula used to determine the relative weight for smoothness for each series is as follows:

((7-MCD)/6)*0.113

The MCD for each component series in the Kansas Index was computed through the use of the X-11 seasonal adjustment program which is available on the mainframe computer at Kansas State University. M2, with an MCD of one, received the full weight for smoothness while new housing units authorized, with an MCD of six, received the lowest weight.

Currency

Finally, the currency of a series is assigned a weight of ten percent. This weight is assigned arbitrarily by the researcher based on how often the data are released (monthly is preferred to quarterly) and how promptly the data become available once the period has passed. Each of the component series in the Kansas Index were assigned this weight based on how soon after the end of the month the figure is released.

The stock index component, M2, initial claims, and new housing units all received the full weight for currency. Stock prices are available within minutes of the close of markets. The monthly figure for M2 is released on the first Friday after the tenth of the following month. Initial claims figures are available fifteen days after the end of the month. Data for new housing units authorized are released on the eighteenth working day of the month The cattle and wheat prices figures are available usually within a week after the end of the month. However, these are first half of the month estimates. Complete figures are not available until the following month. For this reason cattle and wheat prices were awarded one half of the currency weight.

The following table, table 3-1, is a summary table showing all of the weights awarded to each of the six component series in each individual category, subcategory, and the total weight.

Table 3-1 Summary of component Weights

Component	Wheat	Cattle	Stocks	Housing	Claims	M2
Economic Sig.	0.167	0.167	0.167	0.167	0.167	0.167
Stat Sig.	0.138	0.138	0.078	0.130	0.126	0.119
quality	0.025	0.025	0.017	0.025	0.025	0.025
coverage	0.025	0.025	0.017	0.017	0.025	0.017
time period	0.017	0.017	0.006	0.017	0.017	0.006
errors	0.000	0.000	0.000	0.000	0.000	0.000
revisions	0.033	0.033	0.000	0.033	0.033	0.033
length	0.025	0.025	0.025	0.025	0.013	0.025
others	0.013	0.013	0.013	0.013	0.013	0.013
Timing	0.230	0.131	0.247	0.245	0.243	0.257
chance	0.197	0.100	0.214	0.214	0.214	0.206
std dev	0.033	0.031	0.033	0.031	0.029	0.051
Conformity	0.110	0.079	0.107	0.127	0.111	0.136
probability	0.084	0.056	0.084	0.084	0.084	0.084
extra turns	0.007	0.010	0.008	0.010	0.008	0.050
amplitude	0.019	0.013	0.015	0.033	0.019	0.002
Smoothness	0.110	0.089	0.089	0.023	0.044	0.113
Currency	0.050	0.050	0.100	0.100	0.100	0.100
Total	0.805	0.654	0.778	0.792	0.791	0.912

Procedure for Compiling Index

Once the data for a given month is collected and the appropriate weights applied, the statistical procedures involved in transforming the raw data into an index of leading economic indicators can be undertaken. After monthly data for each of the component series are collected, cattle and wheat prices deflated by the producer price index, and M2 deflated by the consumer price index the numbers are fed into the University's mainframe computer so that each series can be seasonally adjusted. This is done through the use of the X-11 seasonal adjustment computer program. All of the series are seasonally adjusted with the exception of M2, which the X-11 program determined did not require seasonal adjustment.

Once the seasonally adjusted data are retrieved from the main-frame

computer, each series is converted to month-to-month percentage changes through the following formula[29]:

$$200(B-A)/(B+A)$$

where A = the value of a given data series in the first month
B = the value in the second month.

For each series, this is done for every month from January 1970 to the current month.

Some series used in the Kansas Index (such as housing starts and unemployment claims) are much more volatile than other series (such as M2). In order to prevent these more volatile series from dominating the monthly fluctuations of the index, the month to month percentage changes for each series are divided by the average of their absolute values.

Next, each series is multiplied by its selected weight. This, again, reflects the relative quality of each data series on a number of economic and statistical criteria. The month to month standardized, weighted percentage changes for the six component series are then averaged by dividing their sum for each respective month by six.

Although they are intended primarily to predict turning points in the business cycle, indexes of leading economic indicators are also used by individuals to predict month to month movement in the business cycle. To facilitate this, the long run trend of the reference series (ie. business cycle) is added to the standardized average changes

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[29] see "Composite Indexes of Leading, Coincident, and Lagging Indicators: A Brief Explanation of Their Construction", Handbook of Cyclical Indicators, a supplement to Business Conditions Digest, U.S. Department of Commerce, 1984, pp.65-69

computed in the previous step. The Commerce Department uses the long run trend of its Index of Coincidental Economic Indicators for this purpose. Since no one has yet developed such an index for Kansas, the long run trend in real Kansas personal income (personal income being the major component of an index of coincidental economic indicators) is used for the Kansas Index of Leading Economic Indicators.

The procedure used to derive this trend is as follows.[30] First the reference series is divided into a series of cycles measured by the series' peak dates. The monthly values between the first two peaks is referred to as the initial cycle. The average value of the reference series for the initial cycle is calculated. The average value of the reference series in the terminal (most current) cycle is also calculated. Then the percentage change between these two averages is computed. This percentage change is converted to a monthly rate using the following compound interest formula:

$$T=(((C_L/C_I)^{1/m})-1)100$$

where: T = series trend
C_L = average value in terminal cycle
C_I = average value in initial cycle
m = number of months from center of initial cycle to center of terminal cycle

Using this procedure, the long run trend in real Kansas personal income is currently 0.24.

The same procedure is followed to find the trend in the index of leading economic indicators before it is adjusted for its base year. This was computed to be 0.04. To set the trend in the index of leading

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[30] see appendix b for a complete explanation of the calculation of the long run trend in Kansas personal income.

economic indicators equal to the long run trend in real Kansas personal income, the difference between these two trends (ie 0.20) is added to the average of the standardized, weighted percentage changes of the six component series for each month.

Next the standardized, weighted average changes must be reconverted from percentage changes to standard numerical notation. This is done in the following way. January, 1970 is given an initial value of 100. The standardized averages changes are then converted using the following formula:

$$B=A(200+r)/(200-r)$$

Where:

A = the value of the index for the first month
B = the value of the index for the second month
r = the standardized average percentage change between months A and B

The previous procedure provides the "raw" index. In its final form, the index must be expressed in terms of a base year. This is done by dividing the value of the raw index for a given month by the average value of the raw index in the base year. This quotient is then multiplied by 100. The base year of the Kansas Index of Leading Economic Indicators is currently 1982.

Chapter Four

Historical Accuracy of the Kansas Index of Leading Economic Indicators and a Comparison of this Index With Alternative Forms of the Kansas Index of Leading Economic Indicators

This chapter addresses the performance of the Kansas Index of Leading Economic Indicators and is comprised of two sections. The first section discusses the success of the index in leading the business cycle in Kansas. The second section concerns the performance of the index when compared with alternative formulations of the index. These alternatives include cases where one or more of the six component series are eliminated from the index, as well as the case where no weights are applied to the component series.

Rationale for Use of Real Kansas Personal Income as a Proxy for the State's Business Cycle

The series that is used by the Commerce Department to represent the business cycle is the index of industrial production. Unfortunately, there is no such series specifically for the state of Kansas. Real (ie. adjusted for inflation) Kansas personal income was chosen as a substitute for industrial production as it is generally viewed as coincidental to the business cycle.

Daniel Creamer did a study through the National Bureau of Economic Research which was published in 1956 concerning how personal income and the various subcomponents of personal income behaved during the business cycle. He concluded that monthly personal income as a whole is coincidental to the business cycle at troughs and lags slightly (one

to four months) at peaks.[31] The results of this study plus the fact that the Commerce Department views personal income as a reliable coincidental indicator makes personal income an acceptable substitute for a Kansas index of industrial production.

The Performance of the Index in Leading the Business Cycle

Once the index is compiled the question of the accuracy of the index must be addressed. It is important to determine what kind of lead warning the index would have provided if it were available prior to earlier recessions. The number of false signals provided by the index is also important to know. Recessions and expansions were dated based on the peaks and troughs in Kansas Personal Income.

The process used to date recessions in Kansas is as follows. First the quarterly values of Kansas personal income were converted to monthly form through linear interpolation. These numbers are expressed in annualized form. Next, the monthly values of Kansas personal income were divided by the monthly values of the Consumer Price Index and multiplied by 100. This provided a monthly approximation of real Kansas personal income. These numbers were fed into the computer and through the X-11 program a trend cycle for real Kansas personal income was generated. This trend cycle was used to date recessions during the sample period.[32]

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[31] Creamer, Daniel, Personal Income During Business Cycles, copyright 1956, National Bureau of Economic Research, Princeton University Press, Princeton, NJ, page 17

[32] See table 3-3 for the actual monthly data for the trend cycle of Kansas personal income. Also see figure 7 for a graphical display of this trend cycle.

According to the trend cycle for real Kansas personal income, between 1970 and the present Kansas has experienced three recessions. The first recession began in December 1973 and lasted through February 1975. The second recession began in July 1979 and lasted through June 1980. The third recession followed closely behind the second, beginning in May 1981 and ending in April 1983. It is important to point out that the dating of recessions in Kansas that I used for this analysis is not exact since personal income only approximates the business cycle. This should be kept in mind when discussing the relative success or failure of the index in leading the business cycle.

The actual index provided leads two of the three recessions covered.[33] It predicted the onset of the 73-75 recession three months in advance. For some reason, it lagged two months behind the peak that signaled the 79-80 recession in Kansas. The index led the onset of the 81-83 recession by two months. The index led the trough of the 73-75 recession by two months. It led the trough of the 79-80 recession by two months and led the trough of the 81-83 recession by nineteen months.

The actual index registered one false peak, although this should be viewed as not being a large problem. During the months of January through March of 1973 the index declined. The index moved upward for five of the next six months, then began a downward slide that signaled the approach of the 1973-75 recession. Although the January through March declines in the index are officially considered to be a false

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[33] See table 4-1 for the monthly values of the index since January 1970 along with the standardized, weighted percentage changes of the six components. Also see figure 14 for a graphical depiction of the index.

signal, its proximity to the 73-75 recession suggests that it may indeed have been the true signal and the following few months of increase in the index merely an aberration.

Alternative forms of the Kansas Index of Leading Economic Indicators

The purpose of this next section is to compare the performance of the Kansas Index of Leading Economic Indicators with a number of alternative formulations of the index. These comparisons are of two types. One is a comparison of the index with indexes in which one or more of the six components is deleted. To an extent this can provide evidence concerning the usefulness of a given series in the index. The other type of comparison is a comparison of the index with an index which does not have weights. Such a comparison will help to determine the usefulness of weighting the component series.

Six alternative indexes were constructed. Five are concerned with the deletion of one or more of the original components. The sixth index is the index without weights. The first alternative index deletes cattle and wheat prices, the second index deletes the stock price component, the third index deletes new housing units, the fourth index deletes initial claims, and the fifth index deletes M2.[34]

There are three primary approaches to comparing the performance of the index against the alternative indexes. One approach is to compare the averages of the leads displayed by the indexes at peaks and troughs

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[34] see table 4-2 for the monthly values of the six alternative indexes. Also see figures 15 through 20 for a graphical depiction of each of these alternative indexes compared to the actual Kansas Index of Leading Economic Indicators.

of the three recessions experienced during the sample period. Secondly, it is of value to compare the standard deviation of these peaks to see which version of the index provides the most consistent leads. Thirdly, the number of false peaks displayed by the various versions of the index is a vitally important avenue of comparison. False peaks are defined in this thesis as three consecutive months of downturn in a leading index that do not signal an impending recession. Like the little boy who cried wolf, the warning of an approaching recession given by a leading index that is prone towards false peaks lacks credibility.

The following two tables (tables 4-1 and 4-2) show the performance of the various alternative indexes as they relate to these three criteria. The first table shows the leads displayed by the various indexes at peaks and troughs of the 1973-75, 1979-80, and 1981-83 recessions respectively. The second table shows average leads displayed at peaks and troughs, the standard deviation of these leads, and the number of false peaks registered by the alternative indexes:

Table 4-1 Business Cycle Leads Provided by Alternative Indexes

	Leads (months)					
Index	73-75 peak	73-75 trough	79-80 peak	79-80 trough	81-83 peak	81-83 trough
Actual	3	2	-2	2	2	19
Non Ag	-2	2	-2	2	2	19
No Stocks	-3	0	-2	2	1	19
No Hsng	3	0	*	*	6	14
No Claims	3	1	-2	2	7	19
No M2	3	-9	*	*	2	9
No Weights	3	1	-2	2	2	9

Table 4-2 Average Leads and Standard Deviation of Leads

Index	Ave lead at peaks (months)	std. dev at peaks	Ave lead at troughs	std. dev. at troughs	# of false peaks
Actual	1.00	2.16	7.67	8.01	1
Non Ag	-0.67	1.89	7.67	8.01	0
No Stocks	-1.33	1.70	7.00	8.52	0
No Hsng	4.50*	1.50*	3.00*	3.00*	0
No Claims	2.67	3.68	7.33	8.26	1
No M2	2.50*	0.50*	5.50*	3.50*	2
No Weights	1.00	2.16	4.00	3.56	1

* The index without M2 and the index without new housing units provided no peak or trough signal for the 1979-80 recession. These figures were derived on the basis of how this index performed during the two other recessions covered by the study.

When comparing the five alternative indexes that delete one or more of the component series with the actual index, the results seem somewhat mixed. Although the actual index failed to give the best performance in any of the three categories, it was never outperformed by any alternative index in all categories. Of the six alternative indexes, the index without initial claims performed the best. It provided the largest average leads at peaks and of all of the indexes, including the actual index.[35] As with the actual index, this index failed to lead the 79-80 recession, lagging behind by two months. It also provided a shorter average lead at troughs than the actual index. This index emitted one false signal. From January through March of 1973 this index declined, after which it increased for the next three months. This is the same false peak as the one exhibited by the actual

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[35] It should be pointed out that the higher average lead displayed by all of the indexes at troughs than at peaks is attributable to the very large lead all of the indexes provided prior to the trough of the 1981-83 recession. In general, indexes of leading economic indicators display longer leads at peaks than at troughs. It is generally the case here also except for this one exception.

index and can be explained by using the same argument.

The performance of the actual index compared with the index when cattle and wheat prices are excluded is of particular significance because these are the only two component series of the Kansas Index whose national versions are not used in the Commerce Department's Index of Leading Economic Indicators. When commodity prices were removed from the index, the performance of the index generally worsened. This index lagged behind both the 73-75 and 79-80 recessions by two months. The average lead displayed by this index was actually negative, showing a lag of 0.67 months. However, this index emitted no false signals over the sample period. This is probably due to this index's insensitivity to actual business cycle peaks, particularly the 73-75 recession.

When the stock average was excluded from the index, the performance of the index deteriorated. This index averaged a 1.33 month lag at peaks, lagging behind the recession of 1973-75 by three months and the 1979-80 recession by two months. Although it attained an average lead at troughs of seven months, this index displayed the highest standard deviation at troughs of any of the indexes. However, this index did not exhibit any false peaks.

The index in which new housing units authorized is excluded experienced a severe problem in its performance when it failed to signal the onset of the 79-80 recession. This short, but severe recession was skipped entirely as this index did not peak until six months prior to the onset of the 81-83 recession. Among those recessions that this index did signal, its average lead at peaks, 4.5

months, was the highest of any of the alternative indexes. This index also emitted no false signals over the study period.

The same problem that harmed the index without new housing units was experienced by the index when M2 was excluded. This index failed to signal the 79-80 recession, not peaking until March 1981, two months prior to the onset of the 81-83 recession. In addition to this problem, this version of the index emitted two false signals. The first false peak occurred when this index declined from November 1974 through January 1975. This was just prior to the trough of the 73-75 recession but occurred seven months after this index signaled the end of this recession. This downturn probably reflected the recession that was still underway at the time and should not be interpreted as an honest to goodness false peak. The second false peak, however, can only be interpreted as a genuine false signal. From September through November of 1983 this index declined. This occurred five months after the trough of the 81-83 recession and fourteen months after the trough of this recession was signaled by this index. It can safely be said that the index without M2 performed the poorest of any of the alternative indexes.

The most important comparison of the alternative indexes concerns the comparison between the actual index and the index in which no weights were applied. This can be considered a test of the usefulness of the elaborate weighting process used in this thesis. In comparing the two indexes, it appears that the weights do indeed improve the performance of the index. The two versions of the index provided identical leads at business cycle peaks but the index with weights

outperformed the index without weights at troughs. The index without weights only led the trough of the 73-75 recession by one month while the index with weights led by two months. This index led the trough of the 81-83 recession by nine months while the index with weights led by nineteen months. The two problems of the actual index were not solved when component weights were removed. As with the actual index, the index without weights lagged behind the onset of the 79-80 recession by two months. This index also exhibited the same false signal as that exhibited by the actual index. From January through March of 1973 this index declined, then rose five of the next six months before signaling the onset of the 73-75 recession. As with the weighted index, this was very likely the true signal of the approaching recession.

The relative performances of the other indexes also argues in favor of the effectiveness of applying weights. Of the indexes in which one or more of the component series are excluded, that index which excludes M2 performed the worst. M2 is the component in the Kansas Index that is awarded the highest weight, so it stands to reason that its exclusion would cause the most damage to the index. The index without initial claims performed the best of the six alternative indexes. Only cattle prices and the stock price average are weighted lower than initial claims. There seems to be a loose inverse correlation between a component's weight and the performance of the Kansas Index of Leading Economic Indicators when that component is excluded.

Chapter Five

Suggestions for Further Research

The Kansas Index of Leading Economic Indicators in its present form is comprised of six components while the U.S. index is comprised of twelve. It would improve the accuracy of the Kansas Index if additional useful component series were added. As well as providing additional information this would also make the index smoother, thus reducing the number of one and two month downturns that commonly occur in the index in its present form. Two series currently used in the U.S. leading index that may be available at the state level could prove useful additions to the index. One is average weekly hours of nonsupervisory workers in manufacturing. The other is a state index of net business formation.[36]

An additional avenue of further research is the construction of indexes of coincidental and lagging economic indicators for the state. A coincidental index would exhibit peaks and troughs that occur at the same time as those of the business cycle. A lagging index would exhibit peaks and troughs which follow behind those of the business cycle. These indexes are constructed using the same procedure as that for an index of leading economic indicators except series that behave coincidentally with the business cycle are used to construct a coincidental index and series that lag behind the business cycle are used to construct a lagging index. The three indexes are then combined

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[36] These two series of state data are used in the Missouri Index of Leading Economic Indicators which was developed by Richard McHugh at the University of Missouri-Columbia.

into a composite system. With such a system, a recession can first be predicted by the leading index, then observed by the coincidental index, and finally confirmed by the lagging index. This is the approach taken by the Commerce Department and it has a number of useful properties.

Finally, a Kansas index of coincidental economic indicators with real Kansas personal income as a component should prove to be a more accurate measure of the state's business cycle than using solely real Kansas personal income. A Kansas Index of Coincidental Economic Indicators could replace real Kansas personal income as a proxy for the state's business cycle and be used to date recessions and recoveries in Kansas in the future.

BIBLIOGRAPHY

"Composite Indexes of Leading, Coincident, and Lagging Indicators: A Brief Explanation of Their Construction", Handbook of Cyclical Indicators, U.S. Department of Commerce, 1984.

Creamer, Daniel, Personal Income During Business Cycles, copyright 1956, National Bureau of Economic Research, Princeton University Press, Princeton, NJ.

Emerson, M. Jarvin, The 1985 Kansas Input-Output Model, Kansas State University, unpublished.

Evans, Michael K., Macroeconomic Activity: Theory Forecasting, and Control, copyright 1969, Harper and Row, New York, NY.

Friedman, Milton and Anna Jacobson Schwartz, "Money and Business Cycles", Review of Economics and Statistics, Feb., 1963

Grebler, Leo, "Housing Issues in Economic Stabilization Policy", Occasional Paper #72, copyright 1960, National Bureau of Economic Research.

Harris, Maury N. and Debroah Jamroz, "Evaluating the Leading Indicators", Federal Reserve Bank of New York Monthly Review, June, 1976.

Higgins, Bryon, "Is a Recession Inevitable This Year?", Economic Review of the Federal Reserve Bank of Kansas City, Jan., 1988.

Hymans, Saul H., "On the Use of Leading Indicators to Predict Cyclical Turning Points", Brookings Papers on Economic Activity, vol. 2, 1973.

Koch, Paul D., and Robert H. Rasche, "An Examination of the Commerce Department Leading Indicator Approach", unpublished.

Koopmans, Tjalling C., "Measurement Without Theory", The Review of Economics and Statistics, Aug., 1947.

Maher, John E., "Forecasting Industrial Production", Journal of Political Economy, April, 1957.

Mintz, Ilse, "Dating American Growth Cycles", The Business Cycle Today, copyright 1972, National Bureau of Economic Research, Columbia University Press, New York, NY.

Mitchell, Wesley C. and Arthur F. Burns, Measuring Business Cycles, copyright 1946, National Bureau of Economic Research, New York, NY.

Moore, Geoffrey H., "The Analysis of Economic Indicators", Scientific American, Jan. 1975.

Moore, Geoffrey H., "Business Cycles and Labor Markets", Business Cycle Indicators, vol. 1, copyright 1961, National Bureau of Economic Research, Princeton University Press, Princeton, NJ.

Moore, Geoffrey H., "Security Markets and Business Cycles", Business Cycles, Inflation, and Forecasting, copyright 1983, National Bureau of Economic Research, Ballinger Publishing Company, Cambridge, Mass. Reprinted from Financial Analyst's Handbook I, copyright 1975, Dow Jones, Homewood Ill.

Pearce, Douglas K., "Stock Prices and the Economy", Economic Review of the Federal Reserve Bank of Kansas City, Nov., 1983.

Shiskin, Julius, "Comments and Discussion", Brookings Papers on Economic Activity, vol. 2, 1973.

Shiskin, Julius, "The 1961-69 Economic Expansion in the United States: The Statistical Record", Business Conditions Digest, Jan., 1970.

Stekler, H.O., and Martin Schepsman, "Forecasting With an Index of Leading Series", Journal of the American Statistical Association, June, 1973.

Valentine, Lloyd M., and Carl A. Dauten, Business Cycles and Forecasting, sixth edition, copyright 1983, South-Western Publishing Company, Cincinnati, OH.

Vining, Rutledge, "Methodological Issues in Quantitative Economics", The Review of Economics and Statistics, May, 1949.

Zarnowitz, Victor and Charlotte Boschan, "Cyclical Indicators: An Evaluation and New Leading Indexes", Business Conditions Digest, May, 1975.

Appendix A
A Complete Analysis of the Process of Assigning Weights[1]

ECONOMIC SIGNIFICANCE (weight = 0.167)

Based on the modeler's subjective determination of the economic significance of the correlation of a given series with the business cycle. All six components of the Kansas Index of Leading Economic Indicators were judged to be economically significant and were assigned the full weight in this category.

STATISTICAL SIGNIFICANCE (weight = 0.167) (seven subcomponents)

Quality of the Reporting Service

Receives a weight of 0.025. Reflects whether a given series was obtained from a source set up specifically for statistical purposes, as a byproduct of an administrative program, or indirectly from estimates derived from related sources. Five of the component series came from sources set up specifically for statistical purposes and were assigned the full weight of 0.025. Since the stock price average came from a source which was not designed to be used for statistical purposes, it was awarded two-thirds of this weight or 0.017.

Coverage of Process

Receives a weight of 0.025. Identifies whether the data in a given series reflects full enumeration, a statistical sample, or some other kind of sample. Wheat prices, cattle prices, and

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[1] Comparisons of the performance of a given series as it relates to the reference cycle under the criteria used for weighting was done through the use of trend cycles. Trend cycles were computed, through the X-11 seasonal adjustment program, for each of the component series and for real Kansas personal income. When appropriate, these trend cycles were compared to the trend in real Kansas personal income in order to assign weight under a specific category.

initial claims are fully enumerated and were assigned the entire weight. The stock price average, new housing units authorized, and M2 are statistical samples and were awarded two-thirds of the weight.

Coverage of Time Period

Receives a weight of 0.017. This factor considers whether the data in a given sample represents a full month, one week out of the month, or one day out of the month. Four of the six series represent data for the whole month and were awarded the full value of this weight. Data for the stock price average and M2 concern representative days out of the month, therefore, they were awarded one-third of this weight.

Availability of Estimates of Sampling Errors

Receives a weight of 0.008. A series receives the value of this weight if estimates of sampling and reporting errors for the series are available. No such estimates, to my knowledge, are available for any of the six components of the Kansas Index of Leading Economic Indicators. Therefore all six series received no weight for this factor.

Frequency of Revisions

Receives a weight of 0.033. This weight reflects whether or not a given series is subject to revision and how often such revisions are done. Five of the six series were subject to revision and were awarded the full value of the weight. The stock price average is not subject to revision and was awarded no weight in this category.

Length of The Series

Receives a weight of 0.025. If the series dates back to 1948 or before with no interruptions it is awarded the full value of this weight. Five of the six series meet this criteria and were awarded the full value of this weight. Initial claims for unemployment insurance has only been available since 1960 so it was assigned half of this weight.

Other Considerations

Receives a weight of 0.013. This weight is comprised of a number of miscellaneous considerations. I was unable to determine what these miscellaneous considerations were, so each series was assigned the full value for this weight.

Total weights for statistical significance are 0.138 for wheat prices, 0.138 for cattle prices, 0.078 for the stock average, 0.130 for new housing units, 0.126 for initial claims, and 0.119 for M2.

TIMING (weight = 0.267) (two subcomponents)

Probability that Lead is Attributable to Chance

Receives a weight of 0.2136. This factor is a measure of the probability that the lead displayed by a series is statistically attributable to chance. The lower is this probability the higher is the weight awarded under this category. For a given series, half of the weight is assigned to the probability at peaks and half is assigned to the probability at troughs. This probability is estimated through the binomial distribution whose general form is:

$$p(X) = \{n!/(x!(n-x)!)\}P^{x}(1-P)^{n-x}$$

where: p(X) = the probability of event X
n = number of trials
x = number of successes
P = probability of success on a given trial

In this case p(X) equals the probability of the average lead displayed by one of the six series at peaks/troughs in the business cycle is attributable to chance, n equals the average lead displayed by the series at peaks/troughs, x equals the average lead displayed by the series at peaks/troughs, and P equals the probability that the value of a series will decline, prior to peaks, or rise, prior to troughs, in a given month.

There are three things that a series can do from one month to the next. It can either increase, decrease, or stay the same. For the purpose of this study each of these potential events were assigned an equal probability of 0.33. Therefore P is assumed to equal 0.33. Since n equals x in this case, the formula for the binomial distribution can be simplified to the following:

$$p(X) = P^{x}$$

M2 led the 1973-74 recession by eleven months, led the 1979-80 recession by eighteen months, and led the 1981-83 recession by eight months. The average lead of M2 at peaks of the business cycle from 1970 to the present (ie. x) was 12.33 months. The probability that this average lead is attributable to chance (ie. p(X)) equals $(0.33)^{12.33}$ which equals 0.0000011, or virtually zero. The probability that this lead is not attributable to chance (ie. 1 - p(X)) equals 0.9999. M2 led the trough of the 1973-74 recession by one month, led the trough of the 1979-80 recession by one month,

and led the trough of the 1981-83 recession by five months. The average lead at business cycle troughs displayed by M2 was 2.33 months. Therefore p(X) equals $(0.33)^{2.33}$. 1 - p(X) = 0.9245.

Wheat prices lagged behind the 1973-74 recession by one month, lagged behind the 1979-80 recession by one month, and led the 1981-83 recession by seven months. The average lead at peaks was 1.67 months. Therefore p(X) = 0.1570 and 1 - p(X) = 0.8430. Wheat prices led the trough of the 1973-74 recession by six months, led the trough of the 1979-80 recession by one month, and led the trough of the 1981-83 recession by twenty months. At troughs the average lead was determined to equal nine months. Therefore p(X) = 0.0001 and 1 - p(X) = 0.9999.

Cattle prices led the 1973-74 recession by six months, led the 1979-80 recession by four months, and lagged behind the 1981-83 recession by fifteen months. The average lead at peaks was -1.33 months. p(X) = 1 and 1 - p(X) = 0. Cattle prices led the trough of the 1973-74 recession by zero months, skipped the trough of the 1979-80 recession, and led the trough of the 1981-83 recession by five months. The average lead at troughs was 2.5 months. p(X) = 0.0626 and 1 - p(X) = 0.9374.

The stock price average led the 1973-74 recession by three months, led the 1979-80 recession by thirteen months, and led the 1981-83 recession by six months. The average lead at peaks was 7.33 months. p(X) = 0.0003 and 1 - p(X) = 0.9997. The stock price average led the trough of the 1973-74 recession by five months, led the trough of the 1979-80 recession by eighteen months, and led the

trough of the 1981-83 recession by eleven months. The average lead at troughs equals 11.33 months. $p(X) = 0.00001$ and $1 - p(X) = 0.99999$.

New housing units authorized led the 1973-74 recession by four months, led the 1979-80 recession by fourteen months, and led the 1981-83 recession by six months. The average lead displayed at peaks equals eight months. $p(X) = 0.0002$ and $1 - p(X) = 0.9998$. This series led the trough of the 1973-74 recession by five months, led the trough of the 1979-80 recession by four months, and led the trough of the 1981-83 recession by eighteen months. The average lead displayed at troughs equals nine months. $p(X) = 0.00004$ $1 - p(X) = 0.9999$.

Initial claims for unemployment insurance led the 1973-74 recession by eleven months, led the 1979-80 recession by thirteen months, and led the 1981-83 recession by one months. The average lead at peaks equals 8.33 months. $p(X) = 0.0001$ and $1 - p(X) = 0.9999$. Initial claims led the trough of the 1973-74 recession by thirteen months, led the trough of the 1979-80 recession by one month, and led the trough of the 1981-83 recession by eight months. The average lead displayed at troughs equals 7.33 months. $p(X) = 0.0002$ and $1 - p(X) = 0.9997$.

To simplify the analysis, the probabilities that leads are not attributable to chance for the components are reproduced on the following chart:

component	1 - p(X) at peaks	1 - p(X) at troughs
wheat	0.8430	0.9999
cattle	0.0000	0.9374
stocks	0.9997	0.9999
housing	0.9998	0.9999
claims	0.9999	0.9997
M2	0.9999	0.9245

The weight for this factor was assigned to each component by multiplying the numbers above by the value of this weight (0.1068 for both peaks and troughs). Each component's total weight for this factor is the sum of its weight for peaks and its weight for troughs.

component	weight for peaks	weight for troughs	total weight
wheat	0.090	0.107	0.197
cattle	0.000	0.100	0.100
stocks	0.107	0.107	0.214
housing	0.107	0.107	0.214
claims	0.107	0.107	0.214
M2	0.107	0.099	0.206

Dispersion

Receives a weight of 0.053. This factor compares the standard deviation of the leads that each series possesses at peaks and troughs respectively. The smaller is the standard deviation, the more consistent is the lead provided by the series, and the higher is the score. Half of the weight is applied to dispersion at peaks and half is applied to dispersion at troughs. Dispersion of the component series at peaks and troughs is provided in the following table:

component	dispersion at peaks	dispersion at troughs
wheat	3.771	8.042
cattle	9.463	2.500
stocks	4.190	5.312
hsng	4.320	6.377
claims	5.249	4.922
M2	4.190	1.886

To compute the weights, the smallest dispersion of the six components is divided by the dispersion for a given component. This quotient is then multiplied by 0.0265, which is half of the value of the dispersion weight. This is done for both dispersion at peaks and dispersion at troughs. The two products are then added together to get the total weight for dispersion. Weights for dispersion appear in the following chart:

component	dispersion weight at peaks	dispersion weight at troughs	total weight
wheat	0.027	0.006	0.033
cattle	0.011	0.020	0.031
stocks	0.024	0.009	0.033
hsng	0.023	0.008	0.031
claims	0.019	0.010	0.029
M2	0.024	0.027	0.051

Total weights for timing are 0.230 for wheat prices, 0.131 for cattle prices, 0.247 for the stock average, 0.245 for new housing units, 0.243 for initial claims, and 0.257 for M2.

CONFORMITY (weight = 0.167) (three subcomponents)

probability

Receives a weight of 0.084. Probability measures the degree to which a series conforms to peaks and troughs in the business cycle. This is done by shifting the component series by its median lead so that it corresponds to the reference cycle. The trend cycle for each component series is compared in this manner to the

trend in Kansas personal income. For my purposes I considered a series to conform to the reference cycle if there occurred a peak and trough in its trend cycle in the vicinity of a peak and trough in the reference cycle. Only if a series skipped a recession altogether was it penalized.

Under these criteria, all series received the full weight for probability except for cattle prices. Since cattle prices skipped the trough in the 1979-80 recession it was only awarded two-thirds of the weight for probability.

Extra Turns

Receives a weight of 0.05. This factor accounts for the number of cyclical fluctuations displayed by a component series in addition to those corresponding to the business cycle. That is, the number of false peaks or false signals generated by the series. Obviously, a history of numerous false peaks in a series is an undesirable characteristic. The formula used to assign each series its relative score for this criteria is $1/(1+x)$, where x equals the number of extra turns generated by the trend cycle of a given component series since 1970. This quotient is then multiplied by the extra turns weight of 0.05 and their product becomes each component's weight for the extra turns factor.

The following table shows how each series' actual weight for this factor was assigned:

x

component	extra turns (x)	1/(1+x)	weight (x * 0.05)
wheat	6	0.1429	0.007
cattle	4	0.2000	0.010
stocks	5	0.1667	0.008
hsng	4	0.2000	0.010
claims	5	0.1667	0.008
M2	0	1.0000	0.050

amplitude

Receives a weight of 0.033. This factor accounts for the amplitude or severity of cycle fluctuations in a component series. Strong amplitude is a desirable characteristic in a series as it shows that the series is sensitive to the business cycle and can help magnify the cyclical movement of the index. To measure amplitude in a given series, the percentage change between peak and trough values of every cycle is calculated. Each percentage change is then divided by the peak to trough length of the cycle. These quotients are then averaged. After this is done for all of the component series, each series' average is divided by the largest average displayed by one of the component series. This quotient is then multiplied by the amplitude weight of 0.033 and becomes the amplitude weight for the series.

The actual derivation of amplitude for each of the component series is listed in the following tables:

series = wheat

cycle	% ch	length	% ch/lngth
1	21.15	7	3.079
2	35.59	16	3.854
3	14.04	16	6.211
4	98.99	9	1.392
5	16.30	25	1.548
6	13.39	12	0.984
7	16.22	11	1.475
8	11.32	13	0.871
9	50.67	28	1.810

ave = 2.608

series = cattle

cycle	% ch	length	%ch/lngth
1	5.617	7	0.802
2	127.285	21	6.061
3	13.952	12	1.163
4	57.128	29	1.970
5	2.227	5	0.445
6	11.932	8	1.492
7	10.581	11	0.962

ave = 1.842

series = stocks

cycle	% ch	length	% ch/lngth
1	6.595	7	0.942
2	17.240	9	1.916
3	38.447	13	2.957
4	9.917	13	0.760
5	15.554	7	2.222
6	4.686	6	0.781
7	44.385	19	2.336
8	63.353	14	4.525

ave = 2.055

series = housing

cycle	% ch	length	%ch/lngth
1	13.947	12	2.662
2	78.688	14	5.621
3	12.371	10	1.237
4	135.901	22	6.177
5	121.574	12	10.131
6	29.686	15	1.979

ave = 4.635

series = initial claims

cycle	% ch	length	% ch/lngth
1	9.829	6	1.638
2	69.668	24	2.903
3	7.425	6	1.238
4	27.000	11	2.455
5	38.939	23	1.693
6	62.775	12	5.231
7	82.625	22	3.756
8	47.137	20	2.357

ave = 2.659

series = M2

cycle	% ch	length	%ch/lngth
1	9.160	25	0.366
2	10.560	29	0.364
3	2.008	13	0.155

ave = 0.295

The largest average is that for new housing units which is equal to 4.635. Following the above procedure, the following weights were awarded for amplitude: wheat = 0.019, cattle = 0.013, stocks = 0.015, housing = 0.033, claims = 0.019, and M2 = 0.002.

Total weights under the conformity category are 0.110 for

wheat, 0.079 for cattle, 0.107 for stocks, 0.127 for housing, 0.111 for initial claims, and 0.136 for M2.

SMOOTHNESS (weight = 0.133)

This weight measures the degree of smoothness of a series. Smooth series are generally preferred to highly volatile series. This is done through the use of the X-11 seasonal adjustment program. X-11 computes trend cycles and irregular cycles for each of the component series. Month to month percentage changes are computed and averaged for each cycle. The average percentage change in the irregular cycle is then divided by the average percentage change in the trend cycle. The shortest time period where this ratio is less than one is found. This is called the months to cyclical dominance MCD. MCD is provided for each component series by the X-11 program. The formula $1 + MCD_a - MCD$, where MCD_a equals the largest MCD displayed by one of the component series, was used to assign each component's MCD a relative score. This score for each series is then divided by the highest score. This quotient is then multiplied by the smoothness weight of 0.133. This product represents each component's weight for smoothness.

The actual numbers used to generate each component's weight for smoothness and each component's weight for smoothness are listed in the following table:

component	(1) MCD	(2) $1 + MCD_a - MCD$	(3) (2)/largest (2)	weight (3) * 0.133
wheat	2	5	0.833	0.111
cattle	3	4	0.667	0.089
stocks	3	4	0.667	0.089
hsng	6	1	0.167	0.022
claims	5	2	0.333	0.044
M2	1	6	1.000	0.133

CURRENCY (weight = 0.100)

This factor considers how quickly monthly data for a series is released. An index of leading economic indicators is most useful if it can be released quickly after the end of the month. The release lag for the U.S. index as well as the Kansas index is one month. Stock prices are available immediately after the market closes at the end of the day. The stock listing that I use for the Kansas Index comes out on the last Monday of the month. Since it is so quick to be released, the stock price average received the full currency weight of 0.1. M2 for a given month is available on the Friday following the tenth of the next month. M2's early release also earned it the full weight of 0.1. The monthly value of initial claims is available fifteen days after the end of the months. For this early release date, initial claims too was awarded the full weight of 0.1. Data for new housing units authorized in Kansas is available on the eighteenth working day of the month following the end of the month. That usually places it at about the twenty-fifth of the month. Since it too is released relatively quickly, new housing units was also awarded the full weight for currency.

Wheat and cattle prices are available in the first week after

the end of the month. However, these figures are estimates taken at the fifteenth of the month. Complete monthly figures are not available until two months after the end of the month. Since this is the case, wheat and cattle prices were awarded weights for currency of 0.05, or half of the currency weight.

Appendix B
Process Used in Adjusting the Kansas Index of Leading Economic Indicators for the Long Run Trend in Real Kansas Personal Income

This appendix provides a detailed description of the process used in adjusting the Kansas Index of Leading Economic Indicators to the long run trend in real Kansas personal income. This is done to facilitate the use of the index for the purpose of forecasting the level of future economic activity.

The first step in deriving the long run trend in real Kansas personal income is to compute that series' trend cycle. This is done on the university's mainframe computer through the use of the Commerce Department's X-11 seasonal adjustment program. Monthly data for the trend cycle of real Kansas personal income is listed in table 3 following this appendix. The months between the first and second peaks displayed in the series is called the initial cycle. The first peak in this trend cycle occurred in December 1973, the second peak occurred in July 1979. The average value of this series during this initial cycle was $9216 million. The months encompassing the most current peak to peak cycle of the series is termed the terminal cycle. The first peak of the terminal cycle for the trend cycle of real Kansas personal income occurred in July 1979, the second peak of the terminal cycle occurred in May 1981. The average value of the trend cycle of real Kansas personal income for this terminal cycle was $10,102 million.

Next, the following compound interest formula is applied:

$$T = ((C_L/C_I)^{1/m} - 1) * 100$$

where:
T = long run trend in the series
C_L = average value of series in terminal cycle
C_I = average value of series in initial cycle
m = number of months from center of initial cycle to center of terminal cycle.

For Kansas personal income, C_L and C_I are \$10,102 million and \$9216 million as described above. The center of the initial cycle was September 1976 and the center of the terminal cycle was June 1980. The length of time between these two months (ie m) is 45 months. Applying these numbers to the above compound interest formula provides a long run trend in real Kansas personal income of 0.204.

The same approach is used to determine the long run trend in the "raw" Kansas Index of Leading Economic Indicators. "Raw" referring to the index before it is adjusted for a base year. The first peak of the raw index's initial cycle occurred in September of 1973. The second peak of the initial cycle occurred in June of 1979. The average value of the raw index during this initial cycle was 106.73. The first peak of the raw index's terminal cycle occurred in June 1979. The second peak occurred in October 1980. The average value of the raw index during the terminal cycle was 106.92. The center of the initial cycle of the raw index was July 1976 and the center of the raw index's terminal cycle was February 1980. Therefore "m" in this case equals 43 months. Plugging these numbers into the compound interest formula generates a long run trend for the raw Kansas Index of Leading Economic Indicators equal to 0.004.

To make the long run trend in the Kansas Index of Leading Economic

Indicators equal to the long run trend in real Kansas Personal Income the long run trend in the raw index is subtracted from the long run trend in real Kansas personal income. This difference, 0.20, is added to the average of the standardized, weighted percentage changes of components of the index for each month.

Table 3-2 Original, Non-Seasonally Adjusted Data

	wheat (real)	cattle (real)	Stock Ave.	New Hsng Units	Initial Claims	M2 base 67	KS PI monthly
1.70	1.12	24.43	31.03	2266	12784	521.89	7238.01
2.70	1.10	25.89	33.13	692	10815	516.59	7218.61
3.70	1.09	27.39	32.60	1124	7639	514.67	7198.25
4.70	1.11	26.45	28.82	1030	8694	513.02	7207.18
5.70	1.06	26.18	25.63	704	6417	513.40	7228.46
6.70	1.02	25.54	23.53	990	7793	513.50	7243.34
7.70	1.03	25.07	25.33	825	11162	514.48	7265.07
8.70	1.09	24.37	26.71	449	7322	518.48	7299.12
9.70	1.20	24.32	28.38	500	7869	521.19	7308.09
10.70	1.19	24.71	27.53	640	6751	522.95	7285.92
11.70	1.22	23.35	28.66	807	7553	525.23	7276.23
12.70	1.19	23.06	30.69	826	11224	527.46	7254.41
1.71	1.19	24.33	32.74	735	18860	532.05	7308.72
2.71	1.16	26.51	33.73	584	8419	538.11	7356.78
3.71	1.15	26.08	35.00	1627	10242	543.66	7392.32
4.71	1.16	25.93	36.20	1476	7743	550.08	7453.13
5.71	1.17	25.90	35.00	1711	5550	553.97	7501.10
6.71	1.22	25.17	33.41	984	7370	555.47	7542.39
7.71	1.12	24.59	31.98	1202	9277	559.44	7545.16
8.71	1.11	26.24	33.07	1062	6583	563.06	7547.91
9.71	1.10	25.83	32.70	928	5226	568.33	7563.01
10.71	1.13	26.46	31.46	789	5557	572.22	7616.29
11.71	1.13	27.23	30.41	1423	7295	576.59	7669.39
12.71	1.15	27.25	33.22	760	9491	578.96	7703.49
1.72	1.13	28.80	34.01	969	12447	584.25	7759.47
2.72	1.11	29.33	34.47	1010	8325	588.05	7783.79
3.72	1.12	28.45	34.30	2502	5969	593.39	7833.06
4.72	1.15	28.51	33.15	1558	4590	596.78	7935.37
5.72	1.14	28.68	33.47	1621	4721	598.56	8030.74
6.72	1.07	29.71	32.08	898	5137	602.16	8132.00
7.72	1.09	29.91	32.03	1073	9913	607.49	8162.82
8.72	1.30	29.02	33.09	1335	6204	614.00	8212.94
9.72	1.52	30.03	32.47	1328	3660	618.78	8243.26
10.72	1.60	30.25	32.45	1162	4396	623.62	8349.39
11.72	1.62	29.16	34.65	1174	5580	627.82	8461.52
12.72	1.98	30.76	33.78	840	7548	632.44	8566.38
1.73	1.96	32.21	32.18	406	9988	637.20	8583.92
2.73	1.47	34.75	30.67	1050	5872	635.93	8567.91
3.73	1.53	35.98	30.27	1119	5190	630.74	8532.36
4.73	1.63	34.41	28.88	1165	4668	630.15	8577.91
5.73	1.58	33.71	28.12	1623	4265	631.63	8629.40
6.73	1.75	33.46	27.69	1488	4307	632.40	8673.72
7.73	1.79	34.55	29.30	635	9868	633.91	8810.10
8.73	3.00	35.89	28.81	864	5199	624.43	8806.81
9.73	3.24	33.64	31.10	881	3867	623.32	8933.58
10.73	2.96	31.65	31.91	1329	5467	621.08	9026.11
11.73	2.95	30.17	27.48	1390	5610	621.00	9123.79
12.73	3.29	28.00	28.13	652	13455	621.66	9226.71

Table 3-2 continued

1.74	3.56	30.49	27.77	556	15193	619.61	9120.02
2.74	3.61	29.50	28.17	472	6825	615.05	8976.91
3.74	3.02	27.61	26.77	804	5317	612.51	8849.76
4.74	2.43	26.20	25.40	789	5762	610.98	8749.13
5.74	2.06	23.94	23.40	713	5469	605.84	8602.06
6.74	2.21	19.91	23.48	581	5003	602.31	8469.71
7.74	2.45	21.21	21.91	809	8504	600.20	8496.62
8.74	2.32	20.97	20.57	1470	5274	594.46	8477.65
9.74	2.36	18.18	18.49	479	4632	590.05	8464.73
10.74	2.68	16.80	21.95	750	6965	588.30	8477.56
11.74	2.59	15.71	21.54	478	8707	586.84	8490.17
12.74	2.54	15.45	21.49	509	19008	584.56	8513.51
1.75	2.27	14.38	23.70	314	18672	584.50	8473.20
2.75	2.17	14.42	24.46	482	13124	585.31	8411.79
3.75	1.94	14.26	25.35	797	11078	590.18	8377.69
4.75	1.91	16.27	26.82	1241	10400	593.57	8420.34
5.75	1.74	18.36	28.00	852	8101	599.12	8467.88
6.75	1.59	19.86	29.62	1237	9687	603.61	8483.19
7.75	1.93	17.80	28.09	1106	15514	604.56	8521.67
8.75	2.09	16.19	27.48	859	8498	607.92	8622.44
9.75	2.15	18.12	26.61	969	7998	610.27	8706.60
10.75	2.08	17.66	27.24	1117	8598	610.33	8699.68
11.75	1.85	17.90	26.41	957	7321	612.80	8692.83
12.75	1.78	19.03	26.05	1204	15585	615.21	8701.74
1.76	1.82	18.84	29.85	690	12246	620.28	8765.05
2.76	1.96	20.18	29.76	987	9424	627.05	8828.05
3.76	1.94	20.20	29.79	1749	9230	630.93	8890.75
4.76	1.85	21.57	29.16	1199	8873	635.14	8891.60
5.76	1.79	20.84	28.69	1497	7287	639.48	8876.67
6.76	1.82	19.98	30.90	1288	8691	638.62	8867.14
7.76	1.78	17.68	30.66	1381	15664	640.27	8863.63
8.76	1.55	18.61	30.39	1284	8359	645.03	8870.47
9.76	1.47	16.99	30.91	1410	7623	649.25	8882.39
10.76	1.32	17.65	30.32	1524	7961	655.40	8924.60
11.76	1.20	16.43	30.83	1309	9362	660.82	8976.79
12.76	1.20	16.68	32.83	1803	12246	667.58	9028.69
1.77	1.23	17.07	31.93	582	16176	671.48	9038.22
2.77	1.24	17.93	31.49	1145	9371	670.98	9006.78
3.77	1.16	18.23	31.03	2109	7690	673.01	9011.22
4.77	1.06	18.63	31.44	1587	7912	674.39	9007.05
5.77	0.93	18.65	30.45	1240	7035	676.47	9022.89
6.77	0.99	16.81	31.38	1328	8481	676.73	9028.60
7.77	1.00	18.12	30.56	1572	8359	679.74	9091.09
8.77	0.99	18.24	29.30	1426	7797	681.89	9158.03
9.77	1.03	17.97	28.98	1147	6406	684.62	9224.46
10.77	1.12	17.52	27.64	1560	6409	688.08	9370.37
11.77	1.19	17.86	28.77	1334	8086	689.27	9494.97
12.77	1.19	18.57	28.80	1223	10837	691.35	9628.69
1.78	1.18	19.64	30.41	607	15489	692.41	9555.20
2.78	1.20	21.57	26.54	782	10655	690.66	9477.53

Table 3-2 continued

3.78	1.22	22.53	27.65	1400	6805	689.41	9390.94
4.78	1.37	24.07	30.08	1543	5831	687.62	9461.44
5.78	1.28	25.63	30.72	1650	6124	685.93	9525.78
6.78	1.29	25.81	29.88	1514	7797	682.74	9579.11
7.78	1.28	25.68	29.58	1471	7603	682.21	9601.08
8.78	1.30	25.69	30.58	1243	10101	682.15	9637.34
9.78	1.32	27.21	28.98	1875	5485	683.59	9653.79
10.78	1.39	27.18	25.22	1082	6328	682.73	9769.21
11.78	1.39	26.47	25.42	1310	7942	682.67	9907.26
12.78	1.35	27.59	25.40	968	9342	684.52	10053.72
1.79	1.34	29.26	26.87	273	17364	681.53	10013.68
2.79	1.32	31.06	25.74	798	10152	676.92	9945.44
3.79	1.31	32.64	27.61	1299	7006	675.23	9897.66
4.79	1.32	32.91	27.76	1559	7573	673.95	9925.45
5.79	1.39	32.33	26.82	1797	6738	669.59	9943.33
6.79	1.60	29.42	28.31	1268	7904	668.65	9965.37
7.79	1.63	28.62	29.47	912	13747	667.20	9953.40
8.79	1.54	28.16	31.48	930	10979	664.77	9946.18
9.79	1.59	29.30	31.48	1164	5437	663.16	9934.65
10.79	1.59	26.95	28.87	1055	7728	659.76	9929.16
11.79	1.59	27.63	30.65	669	8956	654.99	9919.41
12.79	1.52	28.71	31.15	402	13381	651.37	9896.91
1.80	1.46	25.77	33.62	417	23691	646.31	9758.72
2.80	1.43	29.02	33.36	343	12507	643.19	9628.45
3.80	1.33	26.42	28.04	553	10081	636.57	9493.74
4.80	1.30	23.71	27.78	434	18879	627.67	9413.33
5.80	1.30	23.16	29.02	499	17346	625.52	9346.13
6.80	1.33	23.46	29.34	900	18788	626.90	9268.98
7.80	1.34	23.93	31.44	1534	15044	634.71	9375.57
8.80	1.38	24.03	35.58	876	16275	637.13	9428.76
9.80	1.43	23.63	33.24	2147	11117	636.91	9454.91
10.80	1.49	22.68	34.15	1895	11546	636.39	9491.93
11.80	1.50	21.53	38.58	837	9904	635.91	9524.59
12.80	1.43	21.76	36.89	549	15894	630.92	9560.37
1.81	1.42	21.73	34.55	570	16249	629.40	9666.92
2.81	1.38	21.84	33.46	661	13091	627.51	9749.49
3.81	1.32	20.56	34.19	1841	10464	629.69	9860.05
4.81	1.34	21.71	33.72	730	10404	633.40	9837.21
5.81	1.30	19.42	33.55	657	9703	630.63	9796.41
6.81	1.26	19.47	31.07	623	11122	628.68	9752.67
7.81	1.25	18.80	31.19	649	11457	625.95	9714.04
8.81	1.24	19.84	29.03	516	12549	626.98	9711.27
9.81	1.26	20.05	26.68	593	9942	624.63	9684.21
10.81	1.29	18.78	28.28	470	12082	628.37	9693.46
11.81	1.34	18.78	28.61	585	13184	632.63	9695.76
12.81	1.32	17.55	27.66	436	19333	636.87	9698.05
1.82	1.28	18.57	28.00	314	19078	641.49	9716.46
2.82	1.28	19.42	24.55	297	17075	640.65	9738.18
3.82	1.26	20.10	24.39	1058	17692	645.00	9801.13
4.82	1.26	20.00	25.47	604	19698	646.57	9854.97

Table 3-2 continued

5.82	1.25	20.73	24.46	752	18111	644.65	9853.13
6.82	1.14	19.85	24.25	692	20600	640.67	9827.60
7.82	1.10	19.04	23.10	1021	20190	641.48	9741.73
8.82	1.10	19.99	25.70	546	21290	646.38	9689.78
9.82	1.11	19.18	26.35	1211	17483	650.77	9641.32
10.82	1.08	19.08	29.46	1031	18518	654.10	9725.72
11.82	1.13	17.58	29.97	1077	19576	659.98	9853.09
12.82	1.16	18.22	30.16	506	24127	667.78	10004.79
1.83	1.16	18.91	31.60	526	26924	684.78	9887.87
2.83	1.19	20.47	32.68	558	20167	697.37	9791.50
3.83	1.21	21.02	33.79	1358	16835	702.62	9691.89
4.83	1.23	20.83	34.77	1539	17185	703.28	9711.68
5.83	1.16	20.03	35.66	1432	15357	704.98	9747.56
6.83	1.14	19.05	35.99	1257	14470	707.18	9802.75
7.83	1.08	17.78	34.12	1028	14113	708.45	9782.83
8.83	1.13	18.18	34.22	1166	17218	709.19	9769.56
9.83	1.15	17.13	28.52	1603	12007	709.81	9740.23
10.83	1.11	16.96	27.67	1037	12449	714.87	9872.33
11.83	1.11	16.63	27.96	1163	14527	717.95	10013.64
12.83	1.11	17.80	26.58	1047	20082	720.26	10157.83
1.84	1.10	18.18	27.18	770	20895	720.67	10170.71
2.84	1.07	20.10	23.92	961	11992	722.70	10193.41
3.84	1.09	21.03	22.85	1557	11531	724.83	10239.18
4.84	1.12	20.72	23.17	1375	12002	726.23	10156.41
5.84	1.11	19.42	21.58	1323	9775	728.61	10093.96
6.84	1.07	19.21	21.39	1527	9598	730.13	10028.64
7.84	1.05	20.20	21.13	1989	12381	730.67	10052.40
8.84	1.09	20.02	22.71	997	15020	732.20	10066.35
9.84	1.12	19.82	22.60	1398	8455	734.44	10073.77
10.84	1.10	19.36	22.73	960	14677	736.95	10171.48
11.84	1.09	19.69	22.40	1800	14176	744.78	10294.75
12.84	1.07	19.17	22.03	1445	17801	752.39	10411.41
1.85	1.07	20.68	24.32	565	25007	759.22	10430.77
2.85	1.05	20.71	25.04	447	14208	763.01	10427.01
3.85	1.07	19.90	24.85	1232	12630	762.05	10420.01
4.85	1.05	19.20	24.64	1150	10937	760.51	10424.35
5.85	0.97	19.01	25.30	1408	11704	763.15	10431.89
6.85	0.94	18.56	25.15	1311	11203	769.16	10445.86
7.85	0.91	17.93	25.71	1386	14994	773.30	10437.94
8.85	0.85	17.77	25.08	981	16266	777.62	10423.60
9.85	0.90	16.57	24.21	1067	10813	779.63	10399.69
10.85	0.91	18.06	24.03	2164	13970	780.00	10478.34
11.85	0.94	19.35	27.06	748	15237	781.20	10553.28
12.85	0.97	19.73	27.66	813	23829	783.90	10637.45
1.86	0.95	18.68	27.97	660	19950	784.01	10545.27
2.86	0.94	18.73	30.27	552	16473	788.52	10514.30
3.86	0.98	18.32	30.94	1340	14719	797.21	10502.45
4.86	0.99	19.05	31.74	1312	15721	806.61	10688.60
5.86	1.00	18.22	31.95	1733	14431	811.31	10818.88
6.86	0.73	17.06	31.41	1001	12349	813.54	10928.33

Table 3-2 continued

7.86	0.71	19.44	29.83	1582	18094	821.28	10911.48
8.86	0.72	19.31	30.46	1210	11818	827.27	10878.07
9.86	0.72	19.73	29.01	905	11708	828.68	10811.93
10.86	0.74	19.64	30.24	851	16775	835.31	10914.17
11.86	0.76	19.79	30.69	706	14342	839.00	11016.22
12.86	0.76	19.53	29.75	839	22788	846.03	11118.09
1.87	0.78	19.77	32.46	1170	24170	847.25	11020.41
2.87	0.79	20.52	33.87	673	13304	843.75	10946.77
3.87	0.81	20.91	33.67	917	13664	840.93	10867.22
4.87	0.80	21.74	31.88	1466	13700	840.36	10820.55
5.87	0.83	21.43	31.49	952	13932	838.62	10799.82
6.87	0.75	21.46	32.51	1096	11254	835.61	10766.54
7.87	0.72	21.15	32.53	958	12184	835.68	10745.70
8.87	0.73	20.97	34.39	770	9900	835.19	10687.38
9.87	0.77	21.33	33.73	1207	8928	834.67	10635.89
10.87	0.78	21.42	25.66	940	9854	838.20	10772.76
11.87	0.81	21.29	24.92	764	9839	836.35	10921.53
12.87	0.85	21.42	26.14	596	18578	836.29	11089.09
1.88	0.84	22.16	26.07	421	20109	842.64	
2.88	0.91	23.01	28.03	582	12455	846.96	
3.88	0.88	22.84	27.99	904	11211	848.84	
4.88	0.85	22.75	28.02	916	9332	852.44	

Table 3-3 Seasonally Adjusted Data

	wheat	cattle	stocks	housing	claims	M2 base 67
1.70	1.07	24.30	29.90	2889.63	6995.7	521.89
2.70	1.11	24.67	31.55	1007.59	9436.6	516.59
3.70	1.13	26.24	31.18	782.56	8511.1	514.67
4.70	1.15	26.07	27.96	802.50	10460.6	513.02
5.70	1.14	26.06	25.77	529.61	9478.2	513.40
6.70	1.13	25.61	24.33	1183.96	9704.9	513.50
7.70	1.12	25.16	26.48	780.11	8524.5	514.48
8.70	1.11	24.50	27.16	500.44	8558.8	518.48
9.70	1.13	24.67	28.64	567.60	12657.7	521.19
10.70	1.11	25.06	28.46	694.68	8941.0	522.95
11.70	1.14	24.39	29.98	714.67	8227.3	525.23
12.70	1.10	23.91	30.03	1056.88	8313.3	527.46
1.71	1.13	24.20	31.59	958.20	10225.0	532.05
2.71	1.17	25.32	32.16	853.03	7431.1	538.11
3.71	1.19	25.02	33.51	1156.37	11445.6	543.66
4.71	1.20	25.53	35.19	1158.19	9294.7	550.08
5.71	1.27	25.78	35.25	1287.07	8047.3	553.97
6.71	1.36	25.24	34.41	1160.46	9274.2	555.47
7.71	1.21	24.63	33.25	1125.56	7071.2	559.44
8.71	1.13	26.23	33.68	1167.62	7811.8	563.06
9.71	1.04	26.18	32.99	1056.52	8483.6	568.33
10.71	1.05	26.90	32.45	811.92	7329.8	572.22
11.71	1.06	28.48	31.69	1267.65	8028.6	576.59
12.71	1.06	28.22	32.64	965.52	6841.9	578.96
1.72	1.06	28.77	32.90	1344.74	6711.9	584.25
2.72	1.12	28.16	33.05	1480.81	7503.5	588.05
3.72	1.16	27.39	33.00	1843.03	6665.9	593.39
4.72	1.20	28.00	32.34	1225.89	5542.3	596.78
5.72	1.25	28.47	33.61	1225.67	6745.9	598.56
6.72	1.21	29.74	32.71	1013.97	6559.7	602.16
7.72	1.16	29.81	32.99	1009.54	7504.3	607.49
8.72	1.31	28.74	33.74	1433.25	7522.6	614.00
9.72	1.44	30.35	32.88	1493.05	5934.6	618.78
10.72	1.48	30.94	33.35	1124.13	5752.9	623.62
11.72	1.52	30.58	36.02	1061.18	6255.5	627.82
12.72	1.83	31.77	33.33	1052.12	5212.9	632.44
1.73	1.84	32.44	31.22	605.60	5431.8	637.20
2.73	1.47	33.69	29.55	1523.10	5410.5	635.93
3.73	1.58	34.87	29.29	854.10	5815.7	630.74
4.73	1.71	33.57	28.36	932.99	5650.1	630.15
5.73	1.74	33.28	28.23	1267.14	5985.2	631.63
6.73	1.98	33.30	27.83	1599.71	5553.9	632.40
7.73	1.88	34.23	29.84	592.57	7440.3	633.91
8.73	3.01	35.31	29.42	899.94	6433.4	624.43
9.73	3.07	33.99	31.65	962.61	6198.8	623.32
10.73	2.73	32.55	32.76	1211.05	7093.3	621.08
11.73	2.80	31.87	28.48	1317.23	6375.2	621.00
12.73	3.07	28.94	27.89	778.63	9013.5	621.66

Table 3-3 continued

1.74	3.35	31.04	27.00	918.53	8382.6	619.61
2.74	3.58	28.86	27.35	671.42	6429.8	615.05
3.74	3.10	26.82	26.10	632.47	5944.7	612.51
4.74	2.55	25.31	25.05	642.72	6914.7	610.98
5.74	2.29	23.39	23.46	580.17	7571.0	605.84
6.74	2.47	19.71	23.22	589.07	6372.4	602.31
7.74	2.52	20.91	22.01	747.91	6491.7	600.20
8.74	2.32	20.52	20.99	1511.04	6603.7	594.46
9.74	2.25	18.38	18.87	508.71	7175.6	590.05
10.74	2.49	17.41	22.56	653.91	8949.5	588.30
11.74	2.50	16.71	22.29	468.55	10027.0	586.84
12.74	2.41	16.02	21.42	579.92	12616.4	584.56
1.75	2.16	14.78	23.08	558.19	10453.5	584.50
2.75	2.14	14.20	23.88	678.23	12396.8	585.31
3.75	1.97	13.87	24.98	641.22	12522.4	590.18
4.75	2.00	15.55	26.51	1037.84	12364.7	593.57
5.75	1.92	17.71	28.08	736.39	10972.7	599.12
6.75	1.73	19.52	28.95	1204.70	11833.1	603.61
7.75	1.95	17.53	27.96	988.99	12346.6	604.56
8.75	2.09	15.88	27.88	874.08	10514.5	607.92
9.75	2.07	18.37	27.06	971.59	11959.6	610.27
10.75	1.95	18.35	28.19	966.02	11002.2	610.33
11.75	1.80	19.16	27.24	975.61	8384.2	612.80
12.75	1.72	19.83	26.13	1311.29	10641.7	615.21
1.76	1.76	19.49	29.08	1313.76	6878.4	620.28
2.76	1.92	19.91	29.36	1394.10	8787.1	627.05
3.76	1.96	19.59	29.64	1434.44	10531.6	630.93
4.76	1.91	20.43	28.79	1006.91	10443.6	635.14
5.76	1.95	19.85	28.74	1367.76	9752.6	639.48
6.76	1.93	19.61	30.05	1205.83	10052.7	638.62
7.76	1.78	17.47	30.36	1227.51	13256.5	640.27
8.76	1.55	18.39	30.46	1304.22	9855.9	645.03
9.76	1.43	17.22	31.21	1308.43	10911.9	649.25
10.76	1.25	18.43	31.64	1329.72	10225.8	655.40
11.76	1.17	17.58	31.77	1343.53	10704.4	660.82
12.76	1.18	17.46	33.04	1962.20	8869.6	667.58
1.77	1.21	17.69	30.89	1124.53	9064.9	671.48
2.77	1.21	17.63	31.35	1630.96	8569.4	670.98
3.77	1.17	17.64	31.20	1745.89	8866.7	673.01
4.77	1.08	17.54	31.04	1389.35	9241.6	674.39
5.77	1.00	17.64	30.59	1187.81	9131.2	676.47
6.77	1.02	16.53	30.72	1228.84	9288.3	676.73
7.77	1.00	18.03	30.28	1380.60	7564.2	679.74
8.77	1.00	18.22	28.83	1450.88	8587.7	681.89
9.77	1.01	18.17	29.02	940.42	8922.9	684.62
10.77	1.07	18.27	28.99	1369.61	8276.1	688.08
11.77	1.16	19.09	29.49	1375.50	9202.0	689.27
12.77	1.18	19.47	28.83	1391.13	8449.5	691.35
1.78	1.17	20.29	29.34	1180.60	8732.9	692.41
2.78	1.18	21.11	26.75	1126.51	9571.6	690.66

Table 3-3 continued

3.78	1.24	21.68	27.99	1169.57	7866.2	689.41
4.78	1.39	22.61	29.72	1405.92	6692.7	687.62
5.78	1.35	24.28	30.96	1636.73	7657.8	685.93
6.78	1.31	25.59	29.66	1393.22	8214.8	682.74
7.78	1.29	25.76	29.31	1279.05	7293.6	682.21
8.78	1.31	25.82	29.69	1268.72	10436.4	682.15
9.78	1.30	27.33	28.98	1407.86	7510.4	683.59
10.78	1.34	28.34	26.38	940.44	8149.9	682.73
11.78	1.34	28.10	25.80	1320.31	9140.7	682.67
12.78	1.34	28.97	25.24	1184.25	7703.9	684.52
1.79	1.33	30.06	25.79	519.01	9927.0	681.53
2.79	1.31	30.25	26.20	1202.73	9100.1	676.92
3.79	1.33	31.30	28.16	1078.89	8063.3	675.23
4.79	1.32	30.96	27.41	1509.17	8489.7	673.95
5.79	1.45	30.83	27.09	1808.98	8048.8	669.59
6.79	1.63	29.37	28.54	1176.94	8105.4	668.65
7.79	1.65	28.96	29.31	758.78	13898.3	667.20
8.79	1.56	28.32	30.35	972.76	10921.6	664.77
9.79	1.58	29.30	31.56	812.62	7375.9	663.16
10.79	1.54	27.99	29.94	911.78	9771.5	659.76
11.79	1.53	29.18	30.72	658.89	10335.3	654.99
12.79	1.50	30.17	30.81	542.39	11287.0	651.37
1.80	1.45	26.37	32.36	782.22	14014.3	646.31
2.80	1.43	28.20	34.19	545.48	11264.3	643.19
3.80	1.36	25.21	28.59	454.67	11438.5	636.57
4.80	1.29	22.35	27.42	422.72	20547.5	627.67
5.80	1.34	22.24	29.25	503.03	20153.3	625.52
6.80	1.36	23.53	29.76	836.64	19296.8	626.90
7.80	1.37	24.42	31.35	1233.72	15734.6	634.71
8.80	1.40	24.08	34.34	933.95	15781.6	637.13
9.80	1.42	23.59	33.76	1470.20	14832.9	636.91
10.80	1.45	23.54	35.16	1654.27	14261.7	636.39
11.80	1.44	22.63	38.29	814.03	11401.0	635.91
12.80	1.40	22.83	36.42	788.45	13195.7	630.92
1.81	1.41	22.21	33.15	1045.49	10032.4	629.40
2.81	1.38	21.14	34.34	1106.00	12153.8	627.51
3.81	1.34	19.56	34.87	1479.09	11623.4	629.69
4.81	1.32	20.47	33.21	722.99	10992.0	633.40
5.81	1.33	18.79	33.75	651.18	11116.4	630.63
6.81	1.29	19.58	31.55	578.10	11662.1	628.68
7.81	1.29	19.24	31.24	491.10	12227.3	625.95
8.81	1.26	19.81	28.08	573.51	12058.5	626.98
9.81	1.25	20.12	27.49	406.58	13068.0	624.63
10.81	1.27	19.44	28.89	426.03	14334.6	628.37
11.81	1.30	19.72	28.30	567.69	14832.0	632.63
12.81	1.30	18.38	27.39	645.37	15614.0	636.87
1.82	1.27	18.96	27.01	575.39	12297.1	641.49
2.82	1.27	18.70	25.04	519.32	16326.0	640.65
3.82	1.26	19.10	24.69	831.70	19357.7	645.00
4.82	1.23	18.88	25.05	583.86	20453.8	646.57

Table 3-3 continued

5.82	1.27	20.20	24.44	711.93	20849.0	644.65
6.82	1.17	19.96	24.45	633.86	22539.1	640.67
7.82	1.15	19.51	23.12	745.06	21665.9	641.48
8.82	1.13	19.93	25.07	609.98	20291.2	646.38
9.82	1.11	19.37	27.61	880.99	22843.8	650.77
10.82	1.07	19.74	30.13	991.28	21235.7	654.10
11.82	1.11	18.40	29.65	1060.64	21251.2	659.98
12.82	1.14	19.02	30.07	725.23	18750.9	667.78
1.83	1.15	19.24	30.56	957.99	17854.4	684.78
2.83	1.18	19.62	32.97	1029.07	19858.0	697.37
3.83	1.19	20.01	34.00	1054.54	18356.1	702.62
4.83	1.19	19.74	34.04	1445.04	17834.0	703.28
5.83	1.16	19.64	35.33	1251.27	17930.5	704.98
6.83	1.17	19.14	35.99	1141.52	16651.7	707.18
7.83	1.14	18.15	34.23	722.83	15025.8	708.45
8.83	1.17	18.18	33.64	1315.25	16422.6	709.19
9.83	1.16	17.39	30.13	1251.55	15780.3	709.81
10.83	1.12	17.48	28.42	1066.01	13698.6	714.87
11.83	1.10	17.32	27.84	1182.41	15296.5	717.95
12.83	1.09	18.50	26.86	1447.77	15142.5	720.26
1.84	1.08	18.41	26.47	1388.05	13953.4	720.67
2.84	1.05	19.22	23.72	1813.49	12047.3	722.70
3.84	1.05	20.11	22.64	1244.88	12673.8	724.83
4.84	1.07	19.74	22.65	1189.62	12606.6	726.23
5.84	1.10	19.15	21.26	1075.62	11524.8	728.61
6.84	1.10	19.29	21.21	1354.98	11687.7	730.13
7.84	1.11	20.56	21.21	1413.19	13033.1	730.67
8.84	1.14	20.15	22.43	1105.08	14316.9	732.20
9.84	1.14	20.15	24.04	1177.61	11210.7	734.44
10.84	1.12	19.88	23.67	1036.35	15800.8	736.95
11.84	1.08	20.38	22.47	1938.82	14664.8	744.78
12.84	1.05	19.78	22.48	1901.32	13007.3	752.39
1.85	1.05	20.84	23.70	990.13	16552.1	759.22
2.85	1.03	19.81	24.43	836.47	14661.8	763.01
3.85	1.02	19.17	24.33	1025.45	14039.0	762.05
4.85	1.00	18.37	24.01	943.17	11613.2	760.51
5.85	0.96	18.88	24.90	1099.94	13807.2	763.15
6.85	0.96	18.68	24.86	1138.20	14236.6	769.16
7.85	0.97	18.13	25.91	980.78	15600.6	773.30
8.85	0.89	17.98	24.77	1083.06	15591.6	777.62
9.85	0.92	16.81	25.78	941.15	14466.3	779.63
10.85	0.93	18.42	25.17	2390.17	14636.3	780.00
11.85	0.94	19.91	27.36	855.51	15772.8	781.20
12.85	0.96	20.26	28.50	1040.17	17091.7	783.90
1.86	0.93	18.77	27.34	1134.30	13108.7	784.01
2.86	0.92	17.96	29.14	1007.59	17251.5	788.52
3.86	0.93	17.78	29.95	1162.65	16495.4	797.21
4.86	0.94	18.31	30.94	1025.50	16895.8	806.61
5.86	0.98	18.20	31.44	1329.57	16912.7	811.31
6.86	0.75	17.19	31.03	848.49	16049.4	813.54

Table 3-3 continued

7.86	0.76	19.60	30.06	1144.06	18648.6	821.28
8.86	0.76	19.62	30.13	1318.11	11428.9	827.27
9.86	0.74	19.93	30.98	825.23	15765.6	828.68
10.86	0.76	19.92	31.89	950.90	17404.8	835.31
11.86	0.76	20.26	31.12	831.18	14858.1	839.00
12.86	0.75	20.01	30.73	1047.05	16201.1	846.03
1.87	0.76	19.73	32.26	2015.70	15273.0	847.25
2.87	0.77	19.79	32.50	1199.38	14129.6	843.75
3.87	0.76	20.47	32.49	793.19	15377.6	840.93
4.87	0.76	20.80	31.06	1137.79	14802.5	840.36
5.87	0.81	21.45	30.89	723.89	16113.1	838.62
6.87	0.77	21.61	31.98	935.41	14623.3	835.61
7.87	0.77	21.29	32.47	707.36	12317.8	835.68
8.87	0.78	21.37	34.30	842.95	9835.8	835.19
9.87	0.80	21.57	35.44	1112.09	12355.7	834.67
10.87	0.80	21.74	26.81	1000.96	10671.8	838.20
11.87	0.81	21.60	25.38	931.14	10760.7	836.35
12.87	0.83	21.92	27.30	764.37	12775.9	836.29
1.88	0.81	22.16	26.23	737.24	12692.2	842.64
2.88	0.88	22.35	26.75	953.78	12869.1	846.96
3.88	0.82	22.47	26.77	795.84	12384.1	848.84
4.88	0.80	22.13	27.18	701.52	10582.0	852.44

Table 3-4 Trend Cycles

	wheat trend	cattle trend	stocks trend	housing trend	claims trend	M2 trend	KSPI trend
1.70	1.09	24.98	29.91	938.35	8692.68	518.73	7231.21
2.70	1.11	25.31	29.27	877.81	8985.56	516.32	7228.55
3.70	1.13	25.57	28.54	827.74	9238.06	514.32	7228.94
4.70	1.14	25.74	27.80	775.72	9409.50	512.94	7231.54
5.70	1.14	25.76	27.13	731.53	9448.54	512.76	7239.73
6.70	1.13	25.60	26.76	695.48	9345.18	514.18	7258.66
7.70	1.12	25.31	26.79	670.32	9092.25	516.42	7282.92
8.70	1.12	24.96	27.25	665.80	8817.75	518.99	7298.97
9.70	1.12	24.67	27.95	683.66	8641.38	521.36	7300.74
10.70	1.12	24.48	28.75	723.67	8602.96	523.49	7290.86
11.70	1.12	24.39	29.59	785.65	8737.44	525.69	7280.69
12.70	1.12	24.43	30.51	862.79	8929.12	528.54	7284.98
1.71	1.13	24.60	31.57	939.89	9135.16	532.51	7314.06
2.71	1.16	24.83	32.65	1008.50	9263.21	537.54	7363.31
3.71	1.19	25.07	33.62	1063.69	9241.50	543.01	7417.05
4.71	1.23	25.28	34.30	1099.31	9054.48	548.23	7464.75
5.71	1.26	25.39	34.59	1118.51	8731.48	552.78	7500.84
6.71	1.25	25.47	34.47	1125.31	8389.23	556.78	7524.06
7.71	1.20	25.63	34.01	1127.15	8127.76	560.58	7542.58
8.71	1.13	25.99	33.41	1131.65	7935.42	564.62	7561.50
9.71	1.07	26.56	32.87	1141.25	7774.84	568.88	7584.14
10.71	1.04	27.21	32.55	1155.03	7656.19	572.87	7611.12
11.71	1.04	27.78	32.45	1175.93	7498.68	576.35	7642.31
12.71	1.06	28.11	32.49	1197.72	7289.16	579.72	7680.61
1.72	1.08	28.20	32.62	1224.89	7033.55	583.40	7728.34
2.72	1.12	28.19	32.77	1251.50	6770.32	587.42	7790.65
3.72	1.16	28.20	32.90	1275.11	6637.47	591.39	7869.34
4.72	1.20	28.31	32.97	1288.32	6648.01	595.06	7957.71
5.72	1.20	28.58	33.02	1290.27	6732.40	598.77	8045.12
6.72	1.21	28.97	33.07	1276.49	6833.98	603.15	8118.88
7.72	1.24	29.38	33.17	1248.70	6859.87	608.47	8175.94
8.72	1.31	29.75	33.31	1212.28	6765.32	614.18	8225.15
9.72	1.40	30.10	33.39	1170.14	6511.60	619.57	8277.18
10.72	1.48	30.53	33.28	1127.72	6144.44	624.34	8339.03
11.72	1.53	31.17	32.90	1088.79	5788.68	628.57	8408.82
12.72	1.54	31.95	32.22	1053.31	5560.85	631.86	8474.47
1.73	1.53	32.72	31.25	1022.24	5459.62	633.68	8524.57
2.73	1.54	33.29	30.19	998.70	5478.83	633.76	8557.48
3.73	1.57	33.65	29.26	982.51	5579.89	632.91	8582.40
4.73	1.66	33.87	28.64	977.87	5730.46	632.12	8615.82
5.73	1.81	34.00	28.48	985.10	5936.49	631.65	8667.63
6.73	2.04	34.07	28.69	997.76	6141.40	630.96	8737.76
7.73	2.29	34.07	29.08	1011.60	6300.25	629.40	8814.19
8.73	2.52	33.95	29.36	1017.86	6466.48	626.89	8890.00
9.73	2.67	33.67	29.42	1008.60	6659.74	624.42	8958.41
10.73	2.78	33.14	29.20	983.99	6840.74	622.77	9015.24
11.73	2.92	32.34	28.76	944.89	6946.54	621.76	9052.79

Table 3-4 continued

12.73	3.08	31.31	28.16	894.46	6997.24	620.41	9061.52
1.74	3.20	30.09	27.47	841.40	7008.03	618.30	9033.45
2.74	3.20	28.67	26.73	786.41	6977.63	615.45	8970.32
3.74	3.07	27.08	25.89	735.33	6883.76	612.13	8881.22
4.74	2.87	25.38	24.93	689.12	6748.47	608.87	8780.39
5.74	2.68	23.71	23.88	647.90	6612.29	605.80	8682.07
6.74	2.53	22.18	22.88	613.73	6523.65	602.53	8601.87
7.74	2.42	20.84	22.05	589.33	6666.20	598.96	8543.67
8.74	2.36	19.66	21.50	574.43	7098.20	595.41	8505.39
9.74	2.37	18.54	21.25	569.63	7834.20	592.06	8478.42
10.74	2.42	17.47	21.29	575.77	8841.60	588.98	8455.99
11.74	2.43	16.50	21.58	590.54	9986.20	586.37	8435.17
12.74	2.37	15.70	22.15	617.08	11009.10	584.64	8415.05
1.75	2.24	15.17	23.00	652.81	11704.70	584.18	8401.13
2.75	2.11	14.99	24.08	696.16	12075.40	585.57	8401.16
3.75	2.01	15.14	25.31	743.17	12157.70	588.82	8419.46
4.75	1.96	15.57	26.48	794.35	12067.30	593.12	8453.74
5.75	1.93	16.18	27.40	844.41	11964.90	597.60	8499.75
6.75	1.95	16.81	27.94	898.12	11834.30	601.87	8549.53
7.75	2.00	17.38	28.07	948.53	11640.60	605.57	8597.53
8.75	2.03	17.87	27.95	997.71	11363.30	608.45	8633.27
9.75	2.02	18.32	27.77	1046.11	11007.00	610.37	8652.68
10.75	1.94	18.73	27.75	1092.32	10535.70	611.64	8656.98
11.75	1.83	19.09	27.97	1135.96	10060.20	613.10	8661.01
12.75	1.78	19.42	28.33	1177.62	9718.60	615.78	8683.17
1.76	1.80	19.70	28.70	1212.52	9573.00	620.01	8733.44
2.76	1.87	19.91	28.97	1241.50	9613.00	625.11	8800.66
3.76	1.93	20.01	29.15	1263.42	9773.80	630.05	8865.48
4.76	1.97	19.94	29.28	1274.60	9989.50	634.00	8909.54
5.76	1.95	19.72	29.46	1282.66	10149.90	636.89	8928.59
6.76	1.88	19.38	29.72	1287.26	10294.40	639.36	8927.22
7.76	1.76	18.96	30.16	1297.30	10426.50	642.22	8917.75
8.76	1.59	18.52	30.70	1314.26	10476.40	645.83	8907.77
9.76	1.41	18.15	31.22	1338.25	10433.80	650.38	8902.76
10.76	1.27	17.89	31.60	1368.23	10252.40	655.68	8903.68
11.76	1.20	17.73	31.80	1398.87	9909.40	661.02	8912.97
12.76	1.19	17.65	31.81	1426.64	9500.70	665.55	8932.69
1.77	1.20	17.60	31.68	1441.19	9175.10	668.83	8961.74
2.77	1.19	17.56	31.47	1447.13	8985.50	670.99	8995.00
3.77	1.15	17.56	31.24	1441.23	8908.80	672.67	9023.75
4.77	1.09	17.59	30.98	1425.85	8919.10	674.49	9046.75
5.77	1.04	17.66	30.67	1405.44	8909.40	676.65	9068.36
6.77	1.00	17.74	30.31	1379.43	8848.70	678.87	9095.79
7.77	0.99	17.85	29.91	1351.62	8740.00	680.99	9136.33
8.77	1.00	18.01	29.51	1324.96	8636.90	683.12	9195.91
9.77	1.03	18.24	29.25	1302.85	8605.50	685.19	9268.33
10.77	1.08	18.56	29.09	1290.91	8693.60	687.13	9343.34
11.77	1.13	18.98	28.99	1287.82	8811.80	688.69	9405.37
12.77	1.16	19.51	28.94	1293.73	8824.60	689.74	9446.89

Table 3-4 continued

1.78	1.18	20.19	28.99	1303.72	8691.40	690.08	9465.87
2.78	1.20	21.03	29.10	1316.11	8430.80	689.84	9474.44
3.78	1.24	21.98	29.29	1325.58	8129.40	689.17	9490.91
4.78	1.28	22.98	29.57	1332.05	7841.60	688.10	9523.65
5.78	1.31	23.98	29.85	1333.36	7617.10	686.75	9568.30
6.78	1.32	24.95	29.94	1326.72	7540.30	685.41	9612.99
7.78	1.31	25.80	29.67	1314.10	7581.50	684.25	9646.14
8.78	1.31	26.55	29.02	1297.41	7731.40	683.36	9674.87
9.78	1.32	27.21	28.03	1281.43	7960.10	682.79	9708.52
10.78	1.33	27.85	27.02	1263.53	8218.80	682.45	9759.12
11.78	1.34	28.52	26.27	1250.51	8499.70	681.84	9820.48
12.78	1.33	29.25	25.91	1236.19	8742.40	680.64	9876.33
1.79	1.32	29.94	25.94	1225.34	8826.50	678.97	9914.20
2.79	1.33	30.48	26.29	1214.71	8704.40	676.99	9934.20
3.79	1.35	30.75	26.82	1199.48	8509.90	675.04	9948.20
4.79	1.40	30.71	27.41	1177.41	8411.70	673.54	9964.90
5.79	1.46	30.36	28.03	1137.88	8515.40	672.27	9983.70
6.79	1.51	29.83	28.69	1085.32	8802.10	670.73	10000.50
7.79	1.55	29.33	29.31	1016.06	9164.80	668.71	10004.90
8.79	1.57	28.95	29.91	936.09	9561.20	666.10	9994.30
9.79	1.57	28.67	30.47	845.58	9926.60	662.81	9968.20
10.79	1.55	28.43	30.88	754.69	10322.60	658.73	9925.40
11.79	1.53	28.08	31.05	670.28	10876.30	654.32	9865.00
12.79	1.49	27.56	31.01	604.16	11761.50	649.76	9787.30
1.80	1.45	26.84	30.76	567.96	13143.90	645.23	9697.20
2.80	1.42	26.05	30.33	565.22	14875.40	640.57	9600.90
3.80	1.38	25.31	29.89	596.11	16559.30	635.67	9507.00
4.80	1.36	24.72	29.66	655.78	17780.90	631.56	9431.20
5.80	1.35	24.33	29.84	737.38	18349.90	629.78	9389.90
6.80	1.36	24.10	30.53	833.27	18159.30	630.88	9389.50
7.80	1.38	23.96	31.67	933.04	17339.90	633.81	9421.20
8.80	1.40	23.83	32.99	1021.33	16108.90	636.64	9458.50
9.80	1.43	23.68	34.11	1091.50	14762.30	637.79	9484.80
10.80	1.44	23.41	34.88	1128.81	13616.00	636.63	9498.10
11.80	1.44	23.02	35.23	1131.69	12784.10	633.83	9516.60
12.80	1.42	22.52	35.20	1101.96	12193.00	630.54	9558.50
1.81	1.40	21.94	34.96	1042.58	11743.20	628.07	9628.90
2.81	1.37	21.32	34.64	961.12	11440.90	627.42	9712.10
3.81	1.35	20.68	34.25	867.90	11309.70	628.59	9780.40
4.81	1.33	20.13	33.65	774.85	11273.20	630.24	9813.50
5.81	1.31	19.75	32.80	690.67	11336.60	630.97	9814.10
6.81	1.30	19.58	31.74	620.62	11546.70	630.24	9794.90
7.81	1.28	19.57	30.59	566.95	11964.00	628.59	9774.90
8.81	1.27	19.62	29.55	531.80	12555.10	627.32	9756.80
9.81	1.27	19.62	28.78	513.24	13252.70	627.51	9737.60
10.81	1.27	19.54	28.21	510.75	13943.40	629.42	9710.70
11.81	1.28	19.34	27.71	521.30	14659.80	632.44	9680.40
12.81	1.29	19.09	27.17	541.49	15458.30	635.73	9664.70
1.82	1.28	18.92	26.51	567.23	16410.30	638.41	9678.70

Table 3-4 continued

2.82	1.27	18.88	25.79	595.60	17562.60	640.32	9723.00
3.82	1.25	19.01	25.08	626.15	18788.70	641.67	9783.30
4.82	1.23	19.23	24.58	654.56	19952.40	642.36	9833.50
5.82	1.21	19.47	24.40	683.67	20901.90	642.62	9851.20
6.82	1.18	19.66	24.55	710.97	21575.80	643.19	9835.20
7.82	1.15	19.74	25.07	740.50	21953.60	644.74	9803.30
8.82	1.13	19.70	25.88	773.05	21972.50	647.50	9778.80
9.82	1.11	19.56	26.87	812.48	21683.80	651.25	9774.70
10.82	1.11	19.41	28.02	856.34	21177.00	656.38	9792.90
11.82	1.12	19.31	29.20	904.81	20506.40	662.97	9817.50
12.82	1.13	19.32	30.35	954.11	19802.20	671.30	9824.10
1.83	1.15	19.44	31.49	1004.87	19190.30	680.63	9799.90
2.83	1.17	19.59	32.63	1051.13	18662.80	689.36	9755.40
3.83	1.18	19.70	33.75	1090.18	18214.10	696.28	9718.30
4.83	1.18	19.65	34.70	1123.20	17823.00	701.43	9715.60
5.83	1.17	19.41	35.17	1150.33	17342.20	705.21	9745.40
6.83	1.16	18.98	34.97	1176.37	16756.40	707.95	9790.40
7.83	1.16	18.45	34.06	1201.56	16177.50	710.10	9829.30
8.83	1.15	17.98	32.66	1225.96	15772.00	712.27	9858.40
9.83	1.14	17.67	31.03	1247.31	15494.30	714.59	9888.10
10.83	1.13	17.60	29.37	1265.17	15185.00	716.67	9928.20
11.83	1.11	17.78	27.85	1282.42	14804.10	718.15	9982.70
12.83	1.09	18.13	26.54	1298.16	14302.30	718.89	10043.90
1.84	1.07	18.53	25.36	1309.38	13663.40	719.34	10101.50
2.84	1.06	18.89	24.21	1316.40	12977.40	720.30	10140.10
3.84	1.06	19.17	23.11	1314.94	12422.70	722.25	10149.40
4.84	1.07	19.39	22.16	1307.75	12077.60	724.99	10133.90
5.84	1.09	19.57	21.61	1291.09	12031.50	727.86	10110.30
6.84	1.11	19.75	21.53	1268.66	12342.70	730.41	10097.90
7.84	1.12	19.94	21.77	1238.80	12824.50	732.47	10106.70
8.84	1.13	20.08	22.16	1202.40	13328.00	734.27	10134.90
9.84	1.13	20.16	22.56	1165.81	13795.60	736.69	10173.30
10.84	1.12	20.17	22.92	1130.20	14178.50	740.46	10213.60
11.84	1.09	20.10	23.20	1100.71	14400.30	745.61	10256.10
12.84	1.06	19.95	23.42	1073.51	14458.50	751.23	10302.30
1.85	1.05	19.77	23.64	1050.90	14395.30	756.05	10349.30
2.85	1.03	19.55	23.92	1032.01	14254.20	759.05	10388.60
3.85	1.01	19.28	24.26	1020.75	14123.00	760.58	10414.60
4.85	0.99	18.98	24.56	1015.07	14092.50	762.12	10428.60
5.85	0.97	18.69	24.75	1016.07	14206.30	764.92	10438.90
6.85	0.96	18.45	24.84	1018.94	14412.30	769.33	10453.50
7.85	0.95	18.29	24.98	1021.66	14728.50	774.33	10472.80
8.85	0.94	18.24	25.26	1027.16	15108.20	778.47	10492.00
9.85	0.94	18.28	25.68	1032.23	15448.20	780.95	10504.80
10.85	0.93	18.36	26.24	1041.28	15743.00	781.73	10507.70
11.85	0.94	18.43	26.92	1049.27	16012.20	781.57	10499.30
12.85	0.94	18.44	27.72	1059.97	16283.10	781.65	10488.50
1.86	0.93	18.34	28.58	1070.06	16501.40	783.71	10491.50
2.86	0.93	18.21	29.41	1077.24	16652.70	788.73	10528.10

Table 3-4 continued

3.86	0.91	18.14	30.07	1082.35	16721.20	795.94	10602.40
4.86	0.90	18.22	30.50	1079.30	16699.80	803.77	10702.00
5.86	0.87	18.45	30.70	1072.50	16690.20	810.97	10803.10
6.86	0.83	18.82	30.73	1056.06	16717.40	816.93	10879.80
7.86	0.80	19.24	30.65	1040.26	16750.50	822.13	10922.30
8.86	0.77	19.62	30.57	1022.70	16763.20	827.02	10938.60
9.86	0.76	19.87	30.66	1006.27	16686.80	831.74	10943.70
10.86	0.75	19.97	30.96	992.78	16452.90	836.21	10950.20
11.86	0.75	19.98	31.38	979.12	16059.60	840.14	10959.60
12.86	0.76	19.96	31.73	968.10	15617.00	842.92	10965.60
1.87	0.76	20.03	31.90	956.83	15298.70	843.79	10955.60
2.87	0.76	20.22	31.91	948.90	15171.90	842.95	10927.20
3.87	0.76	20.50	31.85	940.18	15095.10	841.36	10887.30
4.87	0.76	20.83	31.82	934.16	14970.70	839.76	10843.10
5.87	0.77	21.12	31.86	924.12	14630.90	838.56	10802.40
6.87	0.77	21.34	31.90	915.36	13945.80	837.55	10769.00
7.87	0.78	21.44	31.87	905.57	13038.10	836.61	10747.20
8.87	0.78	21.48	31.57	895.25	12132.90	835.97	10743.10
9.87	0.79	21.52	30.89	887.15	11512.70	835.79	10767.70
10.87	0.81	21.60	29.88	882.53	11364.40	836.03	10813.60
11.87	0.82	21.76	28.76	877.48	11614.50	836.90	10868.40
12.87	0.82	21.97	27.76	869.90	12027.00	838.96	10927.10
1.88	0.82	22.17	27.01	860.92	12405.80	841.95	
2.88	0.82	22.37	26.42	856.95	12729.50	845.36	
3.88	0.81	22.55	26.03	839.17	12945.00	848.93	

Table 4-3 Index With Standardized, Weighted Components

	wheat szd	cattle szd	stocks szd	housing szd	claims szd inv	M2 szd	Index base 82
1.70							71.03
2.70	0.82	0.28	1.11	-3.22	-1.89	-1.94	70.60
3.70	0.26	1.15	-0.25	-0.84	0.66	-0.71	70.78
4.70	0.39	-0.13	-2.25	0.08	-1.31	-0.61	70.47
5.70	-0.19	-0.01	-1.69	-1.37	0.63	0.14	70.32
6.70	-0.08	-0.33	-1.18	2.55	-0.15	0.04	70.56
7.70	-0.28	-0.33	1.74	-1.37	0.82	0.36	70.81
8.70	-0.22	-0.50	0.53	-1.46	-0.03	1.47	70.93
9.70	0.45	0.13	1.10	0.42	-2.46	0.99	71.15
10.70	-0.38	0.29	-0.13	0.67	2.19	0.64	71.68
11.70	0.55	-0.51	1.07	0.09	0.53	0.83	72.13
12.70	-0.77	-0.37	0.04	1.29	-0.07	0.80	72.39
1.71	0.51	0.22	1.05	-0.33	-1.31	1.65	72.75
2.71	0.85	0.84	0.37	-0.39	2.01	2.15	73.61
3.71	0.26	-0.22	0.85	1.01	-2.70	1.95	73.89
4.71	0.30	0.38	1.01	0.01	1.32	2.23	74.69
5.71	1.01	0.18	0.03	0.35	0.91	1.34	75.32
6.71	1.56	-0.40	-0.50	-0.35	-0.90	0.51	75.46
7.71	-2.54	-0.46	-0.71	-0.10	1.71	1.35	75.52
8.71	-1.43	1.18	0.27	0.12	-0.63	1.23	75.76
9.71	-1.66	-0.04	-0.43	-0.33	-0.52	1.77	75.76
10.71	0.22	0.51	-0.34	-0.87	0.93	1.30	76.13
11.71	0.13	1.06	-0.49	1.46	-0.58	1.44	76.67
12.71	0.07	-0.17	0.61	-0.90	1.01	0.78	77.01
1.72	-0.01	0.36	0.16	1.09	0.12	1.73	77.61
2.72	1.14	-0.40	0.10	0.32	-0.71	1.23	77.98
3.72	0.69	-0.52	-0.03	0.73	0.75	1.72	78.57
4.72	0.77	0.41	-0.42	-1.34	1.17	1.08	78.95
5.72	0.78	0.31	0.80	0.00	-1.25	0.56	79.27
6.72	-0.70	0.81	-0.56	-0.63	0.18	1.14	79.46
7.72	-0.81	0.05	0.17	-0.01	-0.85	1.67	79.65
8.72	2.51	-0.69	0.47	1.16	-0.02	2.03	80.53
9.72	1.90	1.02	-0.53	0.14	1.50	1.47	81.44
10.72	0.58	0.36	0.29	-0.94	0.20	1.48	81.87
11.72	0.61	-0.22	1.59	-0.19	-0.53	1.28	82.38
12.72	3.78	0.71	-1.60	-0.03	1.16	1.39	83.29
1.73	0.06	0.39	-1.36	-1.80	-0.26	1.42	83.25
2.73	-4.52	0.71	-1.13	2.87	0.02	-0.38	83.08
3.73	1.43	0.64	-0.18	-1.88	-0.46	-1.56	82.97
4.73	1.70	-0.71	-0.67	0.29	0.18	-0.18	83.22
5.73	0.36	-0.16	-0.10	1.01	-0.37	0.45	83.55
6.73	2.56	0.01	-0.30	0.77	0.48	0.23	84.24
7.73	-1.04	0.52	1.45	-3.06	-1.85	0.45	83.92
8.73	9.58	0.58	-0.30	1.37	0.92	-2.86	85.40
9.73	0.40	-0.71	1.51	0.22	0.24	-0.34	85.76
10.73	-2.40	-0.81	0.71	0.76	-0.86	-0.68	85.46
11.73	0.52	-0.39	-2.89	0.28	0.68	-0.02	85.37
12.73	1.89	-1.80	-0.43	-1.71	-2.18	0.20	84.97

Table 4-3 continued

1.74	1.78	1.31	-0.67	0.55	0.46	-0.63	85.54
2.74	1.40	-1.36	0.27	-1.04	1.68	-1.40	85.64
3.74	-3.01	-1.37	-0.97	-0.20	0.50	-0.79	84.99
4.74	-3.97	-1.08	-0.85	0.05	-0.96	-0.47	84.13
5.74	-2.25	-1.48	-1.35	-0.34	-0.58	-1.60	83.23
6.74	1.52	-3.19	-0.21	0.05	1.09	-1.11	83.14
7.74	0.45	1.11	-1.11	0.79	-0.12	-0.67	83.37
8.74	-1.72	-0.36	-0.98	2.25	-0.11	-1.83	83.16
9.74	-0.65	-2.05	-2.20	-3.31	-0.53	-1.42	81.93
10.74	2.12	-1.02	3.69	0.83	-1.40	-0.56	82.60
11.74	0.05	-0.76	-0.25	-1.10	-0.72	-0.47	82.31
12.74	-0.70	-0.79	-0.82	0.71	-1.45	-0.74	81.96
1.75	-2.26	-1.51	1.54	-0.13	1.19	-0.02	81.96
2.75	-0.26	-0.74	0.71	0.65	-1.08	0.26	82.06
3.75	-1.64	-0.43	0.93	-0.19	-0.06	1.58	82.25
4.75	0.27	2.13	1.23	1.58	0.08	1.09	83.29
5.75	-0.80	2.43	1.18	-1.13	0.76	1.77	84.05
6.75	-2.13	1.82	0.63	1.61	-0.48	1.42	84.62
7.75	2.47	-2.01	-0.72	-0.66	-0.27	0.30	84.66
8.75	1.41	-1.84	-0.06	-0.41	1.02	1.05	85.00
9.75	-0.22	2.71	-0.62	0.35	-0.82	0.73	85.47
10.75	-1.21	-0.01	0.84	-0.02	0.53	0.02	85.66
11.75	-1.69	0.80	-0.71	0.03	1.72	0.77	85.97
12.75	-0.90	0.65	-0.86	0.98	-1.51	0.75	86.01
1.76	0.51	-0.33	2.21	0.01	2.73	1.56	87.15
2.76	1.74	0.40	0.20	0.20	-1.55	2.06	87.77
3.76	0.46	-0.30	0.19	0.10	-1.15	1.17	88.01
4.76	-0.52	0.78	-0.60	-1.17	0.05	1.26	88.16
5.76	0.41	-0.54	-0.04	1.01	0.44	1.29	88.72
6.76	-0.28	-0.23	0.92	-0.42	-0.19	-0.25	88.83
7.76	-1.59	-2.15	0.22	0.06	-1.75	0.49	88.31
8.76	-2.87	0.96	0.07	0.20	1.87	1.41	88.73
9.76	-1.70	-1.23	0.50	0.01	-0.65	1.24	88.64
10.76	-2.72	1.27	0.28	0.05	0.41	1.79	88.98
11.76	-1.40	-0.88	0.08	0.03	-0.29	1.57	89.02
12.76	0.15	-0.14	0.81	1.25	1.19	1.94	89.98
1.77	0.59	0.25	-1.39	-1.81	-0.14	1.10	89.95
2.77	0.03	-0.06	0.31	1.23	0.36	-0.14	90.39
3.77	-0.74	0.01	-0.10	0.23	-0.22	0.57	90.53
4.77	-1.60	-0.10	-0.11	-0.76	-0.26	0.39	90.34
5.77	-1.76	0.11	-0.31	-0.52	0.08	0.59	90.25
6.77	0.55	-1.22	0.09	0.11	-0.11	0.07	90.35
7.77	-0.41	1.62	-0.30	0.39	1.30	0.84	91.06
8.77	-0.13	0.20	-1.01	0.17	-0.81	0.60	91.09
9.77	0.29	-0.05	0.14	-1.42	-0.24	0.76	91.19
10.77	1.24	0.10	-0.03	1.24	0.48	0.96	91.98
11.77	1.57	0.82	0.36	0.01	-0.67	0.33	92.54
12.77	0.34	0.37	-0.47	0.04	0.54	0.57	92.94
1.78	-0.08	0.77	0.37	-0.55	-0.21	0.29	93.22
2.78	0.17	0.74	-1.92	-0.16	-0.58	-0.48	93.06

Table 4-3 continued

3.78	0.93	0.50	0.94	0.13	1.24	-0.34	93.77
4.78	2.34	0.78	1.24	0.61	1.03	-0.49	94.83
5.78	-0.49	1.33	0.85	0.51	-0.86	-0.47	95.16
6.78	-0.59	0.98	-0.89	-0.54	-0.45	-0.88	94.97
7.78	-0.41	0.13	-0.25	-0.28	0.76	-0.15	95.13
8.78	0.38	0.04	0.27	-0.03	-2.25	-0.01	95.06
9.78	-0.17	1.06	-0.50	0.35	2.07	0.40	95.77
10.78	0.62	0.68	-1.94	-1.33	-0.52	-0.24	95.52
11.78	0.03	-0.16	-0.46	1.12	-0.73	-0.02	95.68
12.78	-0.14	0.57	-0.45	-0.36	1.08	0.51	96.06
1.79	-0.08	0.69	0.44	-2.60	-1.60	-0.83	95.62
2.79	-0.31	0.12	0.32	2.65	0.55	-1.29	96.14
3.79	0.35	0.63	1.50	-0.36	0.77	-0.48	96.72
4.79	-0.13	-0.20	-0.56	1.11	-0.33	-0.36	96.84
5.79	1.86	-0.08	-0.24	0.60	0.34	-1.23	97.23
6.79	2.39	-0.91	1.08	-1.41	-0.04	-0.27	97.56
7.79	0.33	-0.26	0.55	-1.44	-3.35	-0.41	97.02
8.79	-1.17	-0.42	0.72	0.82	1.53	-0.69	97.34
9.79	0.21	0.64	0.81	-0.60	2.46	-0.46	98.03
10.79	-0.52	-0.86	-1.08	0.38	-1.78	-0.98	97.44
11.79	-0.16	0.78	0.53	-1.07	-0.36	-1.38	97.37
12.79	-0.44	0.62	0.07	-0.65	-0.56	-1.05	97.23
1.80	-0.63	-2.51	1.01	1.21	-1.37	-1.48	96.82
2.80	-0.37	1.26	1.14	-1.19	1.38	-0.92	97.22
3.80	-1.03	-2.09	-3.69	-0.61	-0.10	-1.96	95.89
4.80	-0.96	-2.25	-0.86	-0.24	-3.62	-2.68	94.40
5.80	0.77	-0.09	1.34	0.58	0.12	-0.65	94.91
6.80	0.23	1.05	0.36	1.66	0.28	0.42	95.74
7.80	0.23	0.69	1.08	1.28	1.29	2.35	97.04
8.80	0.42	-0.26	1.88	-0.92	-0.02	0.72	97.53
9.80	0.29	-0.39	-0.35	1.49	0.39	-0.07	97.95
10.80	0.41	-0.04	0.84	0.39	0.25	-0.15	98.43
11.80	-0.12	-0.73	1.76	-2.27	1.42	-0.14	98.61
12.80	-0.57	0.16	-1.03	-0.11	-0.93	-1.50	98.15
1.81	0.11	-0.51	-1.95	0.93	1.73	-0.46	98.33
2.81	-0.52	-0.92	0.73	0.19	-1.22	-0.57	98.15
3.81	-0.57	-1.45	0.32	0.96	0.28	0.66	98.37
4.81	-0.24	0.85	-1.01	-2.29	0.36	1.12	98.37
5.81	0.08	-1.60	0.34	-0.35	-0.07	-0.83	98.17
6.81	-0.58	0.76	-1.39	-0.40	-0.30	-0.59	97.96
7.81	0.06	-0.32	-0.20	-0.54	-0.30	-0.83	97.80
8.81	-0.50	0.54	-2.21	0.52	0.09	0.31	97.79
9.81	-0.14	0.30	-0.44	-1.14	-0.51	-0.71	97.56
10.81	0.21	-0.64	1.03	0.16	-0.59	1.13	97.97
11.81	0.52	0.26	-0.43	0.95	-0.22	1.29	98.55
12.81	-0.05	-1.31	-0.68	0.43	-0.33	1.27	98.64
1.82	-0.45	0.58	-0.29	-0.38	1.51	1.37	99.22
2.82	0.05	-0.25	-1.56	-0.34	-1.79	-0.25	98.74
3.82	-0.19	0.39	-0.29	1.54	-1.08	1.29	99.21
4.82	-0.49	-0.21	0.30	-1.17	-0.35	0.46	99.17

Table 4-3 continued

5.82	0.57	1.25	-0.51	0.66	-0.12	-0.56	99.58
6.82	-1.63	-0.22	0.00	-0.39	-0.50	-1.18	99.13
7.82	-0.37	-0.43	-1.16	0.54	0.25	0.24	99.18
8.82	-0.41	0.40	1.67	-0.66	0.42	1.45	99.85
9.82	-0.27	-0.53	1.99	1.21	-0.75	1.29	100.54
10.82	-0.69	0.35	1.81	0.39	0.46	0.97	101.30
11.82	0.62	-1.32	-0.33	0.23	0.00	1.70	101.65
12.82	0.60	0.63	0.29	-1.25	0.79	2.23	102.41
1.83	0.13	0.21	0.34	0.92	0.31	4.78	103.77
2.83	0.55	0.37	1.57	0.24	-0.68	3.46	104.94
3.83	0.18	0.37	0.63	0.08	0.50	1.43	105.71
4.83	-0.01	-0.25	0.03	1.04	0.18	0.18	106.13
5.83	-0.48	-0.10	0.77	-0.48	-0.03	0.46	106.36
6.83	0.15	-0.49	0.39	-0.31	0.47	0.59	106.72
7.83	-0.53	-0.99	-1.04	-1.50	0.65	0.34	106.39
8.83	0.46	0.03	-0.36	1.94	-0.56	0.20	106.91
9.83	-0.08	-0.83	-2.28	-0.17	0.25	0.17	106.60
10.83	-0.81	0.10	-1.21	-0.53	0.90	1.35	106.77
11.83	-0.34	-0.17	-0.42	0.35	-0.70	0.82	106.90
12.83	-0.11	1.23	-0.75	0.67	0.06	0.61	107.43
1.84	-0.16	-0.10	-0.30	-0.14	0.52	0.11	107.63
2.84	-0.57	0.81	-2.27	0.89	0.93	0.53	107.90
3.84	-0.05	0.85	-0.96	-1.24	-0.32	0.56	107.91
4.84	0.38	-0.35	0.01	-0.15	0.03	0.37	108.18
5.84	0.57	-0.57	-1.31	-0.34	0.57	0.62	108.31
6.84	-0.08	0.14	-0.05	0.77	-0.09	0.40	108.72
7.84	0.32	1.20	0.00	0.14	-0.69	0.14	109.14
8.84	0.40	-0.38	1.15	-0.82	-0.60	0.40	109.39
9.84	0.10	0.00	1.43	0.21	1.55	0.58	110.32
10.84	-0.44	-0.26	-0.32	-0.43	-2.16	0.65	110.00
11.84	-0.61	0.46	-1.08	2.02	0.47	2.01	110.82
12.84	-0.62	-0.55	0.02	-0.07	0.76	1.93	111.31
1.85	-0.05	0.97	1.09	-2.10	-1.53	1.72	111.56
2.85	-0.39	-0.94	0.63	-0.56	0.77	0.95	111.86
3.85	-0.23	-0.61	-0.08	0.68	0.28	-0.24	112.05
4.85	-0.43	-0.80	-0.28	-0.28	1.20	-0.38	112.09
5.85	-0.91	0.51	0.76	0.51	-1.10	0.66	112.40
6.85	0.17	-0.19	-0.03	0.11	-0.19	1.49	112.88
7.85	0.15	-0.56	0.85	-0.50	-0.58	1.02	113.17
8.85	-1.68	-0.16	-0.93	0.33	0.00	1.06	113.14
9.85	0.69	-1.26	0.82	-0.47	0.48	0.49	113.51
10.85	0.09	1.71	-0.50	2.90	-0.07	0.09	114.54
11.85	0.23	1.45	1.73	-3.15	-0.48	0.29	114.78
12.85	0.39	0.32	0.84	0.65	-0.51	0.66	115.46
1.86	-0.59	-1.42	-0.85	0.29	1.68	0.03	115.53
2.86	-0.23	-0.83	1.31	-0.39	-1.74	1.09	115.61
3.86	0.15	-0.19	0.57	0.48	0.28	2.08	116.49
4.86	0.28	0.55	0.67	-0.42	-0.15	2.23	117.34
5.86	0.90	-0.12	0.33	0.86	-0.01	1.10	118.18
6.86	-5.55	-1.06	-0.27	-1.47	0.33	0.52	116.94

Table 4-3 continued

7.86	0.29	2.45	-0.66	0.99	-0.95	1.80	117.95
8.86	0.12	0.01	0.05	0.47	3.05	1.38	119.19
9.86	-0.52	0.30	0.57	-1.53	-2.03	0.32	118.86
10.86	0.35	-0.01	0.59	0.47	-0.63	1.51	119.55
11.86	0.03	0.32	-0.50	-0.45	1.00	0.84	120.04
12.86	-0.26	-0.23	-0.26	0.77	-0.55	1.59	120.49
1.87	0.23	-0.27	1.00	2.11	0.37	0.27	121.48
2.87	0.36	0.06	0.15	-1.69	0.49	-0.79	121.44
3.87	-0.25	0.63	-0.01	-1.36	-0.54	-0.64	121.24
4.87	-0.12	0.30	-0.93	1.19	0.24	-0.13	121.60
5.87	1.46	0.58	-0.11	-1.48	-0.54	-0.39	121.74
6.87	-1.09	0.14	0.72	0.85	0.62	-0.68	122.10
7.87	-0.03	-0.28	0.31	-0.93	1.09	0.02	122.38
8.87	0.24	0.07	1.13	0.58	1.42	-0.11	123.31
9.87	0.55	0.17	0.68	0.92	-1.44	-0.12	123.72
10.87	-0.01	0.15	-5.73	-0.35	0.93	0.80	123.09
11.87	0.25	-0.12	-1.13	-0.24	-0.05	-0.42	122.99
12.87	0.61	0.27	1.51	-0.66	-1.09	-0.01	123.37
1.88	-0.35	0.20	-0.83	-0.12	0.04	1.44	123.69
2.88	1.46	0.16	0.41	0.85	-0.09	0.97	124.72
3.88	-1.46	0.10	0.02	-0.60	0.24	0.42	124.70
4.88	-0.51	-0.28	0.32	-0.42	1.00	0.80	125.14

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Table 4-4 Comparative Indexes

	Index base 82	Index nonag	Index no stocks	Index no hsng	Index no claims	Index no M2	Index no weight
1.70	71.03	69.10	70.05	69.87	69.53	76.48	71.18
2.70	70.60	68.22	69.36	69.79	69.26	76.19	70.65
3.70	70.78	68.16	69.57	70.08	69.35	76.49	70.88
4.70	70.47	67.60	69.49	69.68	69.14	76.15	70.46
5.70	70.32	67.35	69.52	69.66	68.85	75.90	70.23
6.70	70.56	67.70	69.94	69.56	69.12	76.18	70.48
7.70	70.81	68.10	69.97	70.02	69.28	76.42	70.75
8.70	70.93	68.32	70.01	70.34	69.39	76.32	70.82
9.70	71.15	68.47	70.09	70.51	69.96	76.42	71.04
10.70	71.68	69.19	70.71	71.02	70.25	76.97	71.67
11.70	72.13	69.76	71.06	71.52	70.68	77.40	72.17
12.70	72.39	70.26	71.33	71.61	70.96	77.57	72.43
1.71	72.75	70.59	71.58	72.06	71.55	77.75	72.82
2.71	73.61	71.47	72.51	73.10	72.24	78.48	73.85
3.71	73.89	71.81	72.70	73.27	72.94	78.51	74.13
4.71	74.69	72.78	73.46	74.19	73.67	79.14	75.07
5.71	75.32	73.41	74.17	74.86	74.25	79.70	75.80
6.71	75.46	73.33	74.38	75.05	74.52	79.76	75.92
7.71	75.52	73.89	74.53	75.10	74.30	79.59	75.91
8.71	75.76	74.22	74.75	75.34	74.65	79.67	76.20
9.71	75.76	74.46	74.78	75.36	74.70	79.35	76.12
10.71	76.13	74.80	75.24	75.91	74.97	79.58	76.54
11.71	76.67	75.29	75.92	76.30	75.67	80.00	77.19
12.71	77.01	75.73	76.20	76.81	75.88	80.26	77.55
1.72	77.61	76.47	76.85	77.32	76.54	80.70	78.25
2.72	77.98	76.80	77.25	77.69	77.06	80.93	78.64
3.72	78.57	77.57	77.93	78.25	77.61	81.35	79.29
4.72	78.95	77.82	78.41	78.88	77.85	81.61	79.72
5.72	79.27	78.00	78.64	79.23	78.39	81.88	80.08
6.72	79.46	78.18	78.92	79.53	78.55	81.90	80.29
7.72	79.65	78.53	79.08	79.73	78.88	81.83	80.45
8.72	80.53	79.40	80.04	80.58	79.91	82.55	81.47
9.72	81.44	80.08	81.17	81.61	80.71	83.39	82.58
10.72	81.87	80.44	81.61	82.25	81.16	83.64	83.07
11.72	82.38	81.04	81.93	82.87	81.82	84.02	83.64
12.72	83.29	81.39	83.25	83.94	82.69	84.86	84.75
1.73	83.25	81.15	83.39	84.15	82.64	84.53	84.63
2.73	83.08	81.59	83.34	83.43	82.40	84.36	84.41
3.73	82.97	80.92	83.20	83.58	82.31	84.45	84.28
4.73	83.22	81.01	83.58	83.80	82.55	84.75	84.53
5.73	83.55	81.38	83.96	84.00	82.97	85.05	84.89
6.73	84.24	81.78	84.82	84.67	83.69	85.82	85.73
7.73	83.92	81.33	84.15	84.76	83.57	85.31	85.28
8.73	85.40	81.32	85.95	86.28	85.15	87.59	87.20
9.73	85.76	81.81	86.09	86.65	85.51	88.05	87.59
10.73	85.46	81.96	85.57	86.12	85.27	87.77	87.16
11.73	85.37	81.73	85.93	85.93	85.01	87.63	86.98
12.73	84.97	81.05	85.48	85.70	84.86	87.07	86.34

Table 4-4 continued

1.74	85.54	81.16	86.25	86.26	85.43	87.84	87.08
2.74	85.64	81.22	86.30	86.54	85.24	88.18	87.15
3.74	84.99	81.08	85.63	85.74	84.34	87.47	86.24
4.74	84.13	80.79	84.71	84.66	83.44	86.46	85.07
5.74	83.23	80.18	83.82	83.61	82.44	85.60	83.88
6.74	83.14	80.30	83.71	83.45	82.12	85.65	83.62
7.74	83.37	80.24	84.15	83.57	82.38	86.01	83.93
8.74	83.16	80.27	84.02	82.90	82.11	86.03	83.64
9.74	81.93	78.94	82.86	81.94	80.71	84.71	82.00
10.74	82.60	79.61	83.02	82.57	81.69	85.60	82.77
11.74	82.31	79.26	82.69	82.38	81.44	85.29	82.35
12.74	81.96	78.96	82.36	81.80	81.22	84.94	81.85
1.75	81.96	79.63	82.08	81.79	81.00	84.91	81.76
2.75	82.06	79.90	82.05	81.77	81.26	84.96	81.81
3.75	82.25	80.51	82.09	82.00	81.47	84.89	81.96
4.75	83.29	81.48	83.10	82.95	82.66	85.96	83.29
5.75	84.05	82.17	83.78	84.01	83.40	86.56	84.25
6.75	84.62	82.99	84.32	84.39	84.13	86.98	84.97
7.75	84.66	82.88	84.46	84.52	84.19	86.95	84.89
8.75	85.00	83.38	84.84	84.96	84.39	87.14	85.17
9.75	85.47	83.47	85.48	85.43	85.06	87.56	85.81
10.75	85.66	83.93	85.53	85.63	85.16	87.76	86.01
11.75	85.97	84.48	85.98	85.96	85.20	87.97	86.37
12.75	86.01	84.51	86.15	85.81	85.47	87.85	86.39
1.76	87.15	86.07	87.10	87.14	86.33	88.94	87.74
2.76	87.77	86.44	87.77	87.81	87.30	89.29	88.44
3.76	88.01	86.68	87.99	88.05	87.76	89.35	88.67
4.76	88.16	86.75	88.24	88.40	87.89	89.27	88.81
5.76	88.72	87.52	88.88	88.86	88.44	89.67	89.42
6.76	88.83	87.70	88.82	89.03	88.58	89.82	89.51
7.76	88.31	87.66	88.12	88.36	88.23	89.06	88.71
8.76	88.73	88.62	88.57	88.79	88.36	89.28	89.21
9.76	88.64	89.05	88.34	88.64	88.33	88.92	88.97
10.76	88.98	89.79	88.66	89.00	88.63	88.97	89.36
11.76	89.02	90.29	88.66	89.02	88.70	88.71	89.31
12.76	89.98	91.65	89.62	89.90	89.59	89.47	90.42
1.77	89.95	91.32	89.80	90.16	89.54	89.20	90.31
2.77	90.39	91.90	90.24	90.43	89.97	89.71	90.82
3.77	90.53	92.20	90.39	90.52	90.14	89.75	90.94
4.77	90.34	92.21	90.15	90.40	89.93	89.42	90.65
5.77	90.25	92.36	90.06	90.34	89.77	89.17	90.48
6.77	90.35	92.58	90.13	90.41	89.88	89.24	90.51
7.77	91.06	93.29	90.99	91.15	90.44	89.89	91.40
8.77	91.09	93.23	91.18	91.12	90.59	89.78	91.38
9.77	91.19	93.24	91.24	91.47	90.72	89.73	91.44
10.77	91.98	94.04	92.16	92.16	91.54	90.46	92.37
11.77	92.54	94.24	92.72	92.79	92.30	91.02	93.05
12.77	92.94	94.59	93.26	93.22	92.64	91.35	93.51
1.78	93.22	94.75	93.48	93.62	92.97	91.59	93.84
2.78	93.06	94.20	93.61	93.43	92.86	91.45	93.63

Table 4-4 continued

3.78	93.77	94.85	94.26	94.23	93.44	92.32	94.52
4.78	94.83	95.61	95.26	95.34	94.47	93.62	95.85
5.78	95.16	95.81	95.46	95.60	94.99	94.06	96.29
6.78	94.97	95.34	95.36	95.45	94.81	93.97	96.07
7.78	95.13	95.55	95.56	95.65	94.82	94.15	96.23
8.78	95.06	95.26	95.40	95.54	95.13	94.04	96.10
9.78	95.77	96.01	96.30	96.28	95.54	94.76	96.98
10.78	95.52	95.23	96.34	96.20	95.31	94.47	96.65
11.78	95.68	95.40	96.58	96.14	95.60	94.63	96.79
12.78	96.06	95.78	97.10	96.64	95.82	94.95	97.25
1.79	95.62	94.88	96.43	96.56	95.55	94.54	96.68
2.79	96.14	95.60	96.96	96.64	96.03	95.37	97.33
3.79	96.72	96.13	97.33	97.37	96.54	96.11	98.06
4.79	96.84	96.29	97.55	97.26	96.70	96.28	98.16
5.79	97.23	96.36	98.03	97.58	97.07	96.95	98.64
6.79	97.56	96.40	98.18	98.22	97.44	97.36	98.98
7.79	97.02	95.47	97.37	97.80	97.40	96.75	98.22
8.79	97.34	96.23	97.58	97.98	97.45	97.23	98.58
9.79	98.03	96.96	98.22	98.90	97.76	98.11	99.46
10.79	97.44	96.32	97.68	98.07	97.36	97.55	98.64
11.79	97.37	95.96	97.45	98.15	97.30	97.69	98.57
12.79	97.23	95.63	97.24	98.08	97.21	97.70	98.41
1.80	96.82	95.67	96.51	97.30	96.94	97.45	97.76
2.80	97.22	95.96	96.73	97.99	97.12	98.08	98.30
3.80	95.89	94.64	95.81	96.45	95.50	96.81	96.52
4.80	94.40	93.09	94.15	94.66	94.36	95.48	94.55
5.80	94.91	93.60	94.47	95.14	94.92	96.19	95.17
6.80	95.74	94.42	95.35	95.77	95.82	97.07	96.19
7.80	97.04	96.04	96.67	97.05	97.10	98.16	97.77
8.80	97.53	96.63	96.85	97.78	97.65	98.57	98.31
9.80	97.95	97.18	97.38	97.96	98.04	99.06	98.78
10.80	98.43	97.70	97.74	98.41	98.52	99.62	99.33
11.80	98.61	98.08	97.58	99.04	98.42	99.83	99.49
12.80	98.15	97.41	97.20	98.47	98.02	99.54	98.90
1.81	98.33	97.67	97.75	98.46	97.85	99.80	99.06
2.81	98.15	97.65	97.35	98.16	97.83	99.66	98.76
3.81	98.37	98.39	97.52	98.21	98.01	99.76	98.91
4.81	98.37	98.14	97.67	98.62	97.90	99.50	98.87
5.81	98.17	98.11	97.33	98.40	97.63	99.38	98.51
6.81	97.96	97.65	97.31	98.18	97.40	99.19	98.24
7.81	97.80	97.39	97.12	98.07	97.23	99.13	98.00
8.81	97.79	97.27	97.51	97.92	97.17	99.02	97.95
9.81	97.56	96.78	97.27	97.82	96.95	98.84	97.64
10.81	97.97	97.40	97.52	98.24	97.51	99.07	98.04
11.81	98.55	97.98	98.26	98.72	98.21	99.48	98.70
12.81	98.64	98.35	98.46	98.70	98.34	99.30	98.67
1.82	99.22	99.09	99.18	99.43	98.70	99.69	99.34
2.82	98.74	98.31	98.86	98.88	98.43	99.11	98.67
3.82	99.21	98.87	99.45	99.10	99.17	99.38	99.20
4.82	99.17	98.88	99.30	99.24	99.15	99.20	99.07

Table 4-4 continued

5.82	99.58	98.95	99.86	99.56	99.63	99.77	99.61
6.82	99.13	98.64	99.28	99.06	99.15	99.43	99.02
7.82	99.18	98.80	99.52	98.97	99.12	99.39	99.00
8.82	99.85	99.71	99.96	99.87	99.80	99.87	99.78
9.82	100.54	100.85	100.35	100.42	100.74	100.40	100.54
10.82	101.30	101.98	100.85	101.21	101.52	101.08	101.44
11.82	101.65	102.59	101.30	101.54	101.91	101.12	101.72
12.82	102.41	103.32	102.11	102.68	102.62	101.53	102.60
1.83	103.77	105.19	103.63	104.08	104.15	102.12	104.13
2.83	104.94	106.62	104.65	105.39	105.65	102.75	105.47
3.83	105.71	107.54	105.40	106.26	106.44	103.32	106.37
4.83	106.13	108.14	105.85	106.50	106.86	103.73	106.83
5.83	106.36	108.55	105.93	106.84	107.11	103.87	107.06
6.83	106.72	109.08	106.23	107.30	107.40	104.13	107.41
7.83	106.39	108.87	106.02	107.18	106.82	103.63	106.88
8.83	106.91	109.42	106.67	107.34	107.52	104.15	107.47
9.83	106.60	109.09	106.74	106.96	107.05	103.71	106.98
10.83	106.77	109.45	107.17	107.25	107.03	103.60	107.12
11.83	106.90	109.67	107.37	107.29	107.29	103.54	107.19
12.83	107.43	110.06	108.12	107.73	107.86	103.98	107.84
1.84	107.63	110.33	108.39	107.96	107.95	104.15	108.03
2.84	107.90	110.57	109.17	108.05	108.03	104.31	108.34
3.84	107.91	110.25	109.34	108.28	108.07	104.16	108.31
4.84	108.18	110.55	109.62	108.60	108.34	104.35	108.57
5.84	108.31	110.64	110.03	108.79	108.33	104.33	108.63
6.84	108.72	111.15	110.50	109.07	108.80	104.69	109.09
7.84	109.14	111.26	110.96	109.50	109.41	105.10	109.61
8.84	109.39	111.52	110.97	109.94	109.80	105.26	109.84
9.84	110.32	112.80	111.73	110.97	110.53	106.17	110.95
10.84	110.00	112.39	111.37	110.63	110.58	105.62	110.45
11.84	110.82	113.58	112.57	111.13	111.42	106.10	111.40
12.84	111.31	114.57	113.12	111.69	111.81	106.21	111.88
1.85	111.56	114.56	113.13	112.41	112.39	106.08	112.13
2.85	111.86	115.30	113.31	112.86	112.55	106.19	112.38
3.85	112.05	115.71	113.51	112.89	112.66	106.41	112.54
4.85	112.09	116.02	113.58	112.96	112.40	106.50	112.51
5.85	112.40	116.50	113.73	113.17	112.97	106.66	112.84
6.85	112.88	117.13	114.28	113.67	113.55	106.84	113.33
7.85	113.17	117.60	114.40	114.10	113.99	106.92	113.59
8.85	113.14	117.97	114.52	113.94	113.91	106.61	113.45
9.85	113.51	118.60	114.74	114.45	114.20	106.88	113.78
10.85	114.54	119.56	116.06	114.98	115.41	107.99	115.11
11.85	114.78	119.32	115.90	115.95	115.77	108.15	115.42
12.85	115.46	120.05	116.49	116.58	116.67	108.74	116.22
1.86	115.53	120.63	116.72	116.54	116.31	108.76	116.17
2.86	115.61	120.95	116.46	116.69	116.76	108.57	116.13
3.86	116.49	122.23	117.35	117.60	117.72	109.07	117.12
4.86	117.34	123.19	118.17	118.68	118.74	109.49	118.09
5.86	118.18	124.15	119.06	119.45	119.71	110.14	119.05
6.86	116.94	124.12	117.58	118.25	118.09	108.61	117.37

Table 4-4 continued

7.86	117.95	124.74	118.90	119.19	119.48	109.29	118.65
8.86	119.19	126.54	120.35	120.53	120.21	110.32	120.12
9.86	118.86	125.96	119.76	120.45	120.25	109.84	119.64
10.86	119.55	126.83	120.41	121.13	121.19	110.23	120.41
11.86	120.04	127.36	121.07	121.78	121.49	110.54	120.95
12.86	120.49	128.11	121.63	122.10	122.13	110.64	121.40
1.87	121.48	129.58	122.54	122.74	123.20	111.63	122.58
2.87	121.44	129.25	122.40	123.05	122.97	111.72	122.48
3.87	121.24	128.68	122.12	123.10	122.82	111.60	122.23
4.87	121.60	129.06	122.73	123.19	123.14	111.97	122.63
5.87	121.74	128.51	122.88	123.68	123.40	112.17	122.79
6.87	122.10	129.25	123.08	123.86	123.63	112.68	123.22
7.87	122.38	129.67	123.30	124.38	123.65	112.94	123.50
8.87	123.31	130.91	124.09	125.32	124.38	113.95	124.63
9.87	123.72	131.19	124.36	125.53	125.18	114.38	125.09
10.87	123.09	130.03	124.99	124.81	124.14	113.47	124.21
11.87	122.99	129.69	125.10	124.69	123.98	113.40	124.01
12.87	123.37	129.86	125.13	125.27	124.66	113.77	124.44
1.88	123.69	130.30	125.68	125.64	124.99	113.76	124.69
2.88	124.72	131.26	126.78	126.63	126.21	114.63	125.96
3.88	124.70	131.55	126.71	126.71	126.08	114.47	125.87
4.88	125.14	132.37	127.11	127.30	126.31	114.72	126.32

Fig. 3–1 Kansas Wheat Prices

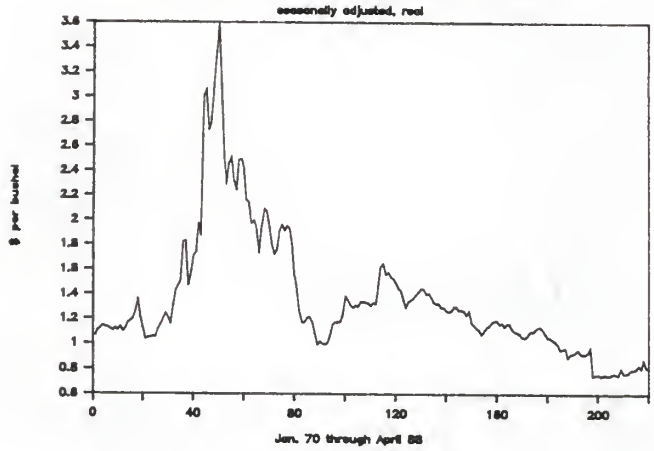


Fig. 3–2 Kansas Cattle Prices

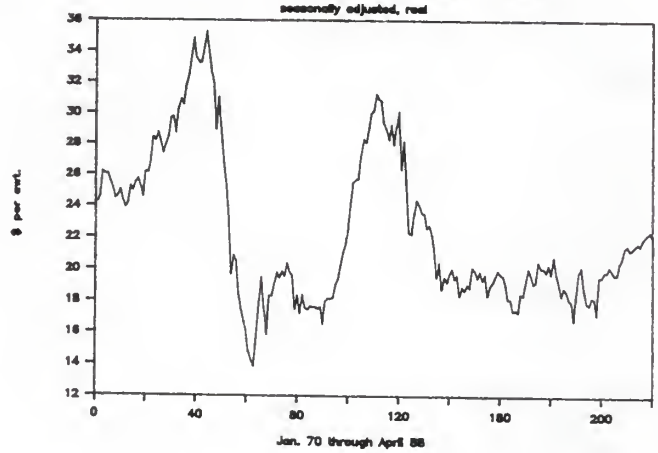


Fig. 3–3 Kansas Stock Price Average

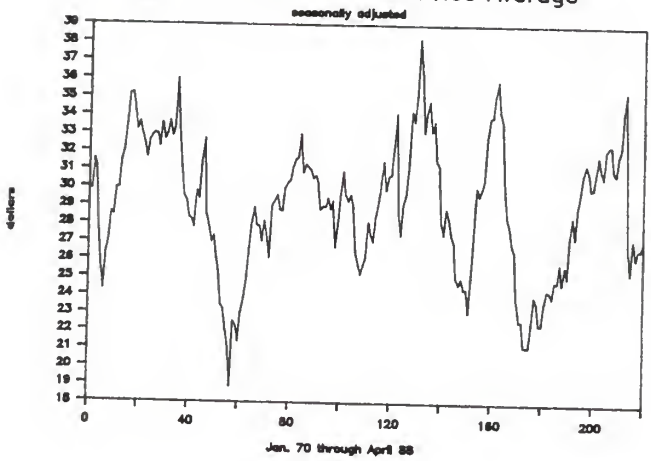


Fig. 3–4 Kansas New Housing Units

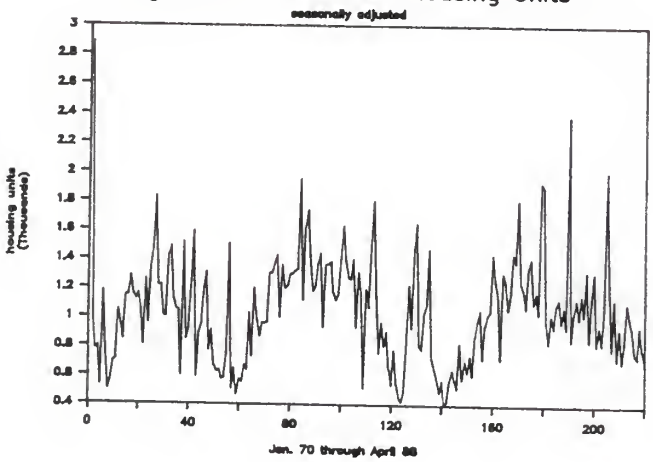


Fig. 3–5 Kansas Initial Claims

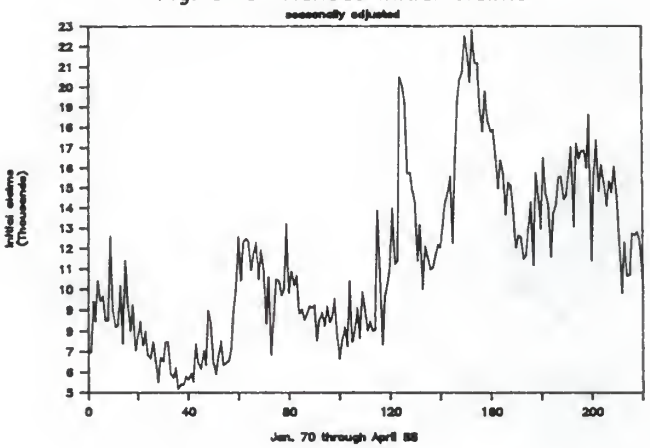


Fig. 3–6 M2 Money Supply

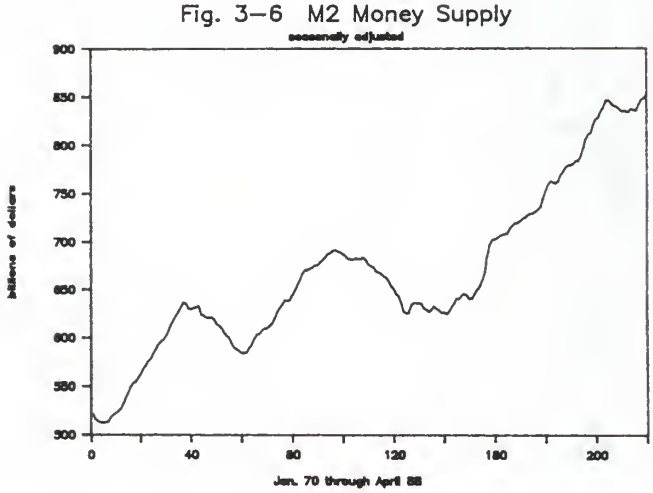


Fig. 3–7 Real Kansas Wheat Prices

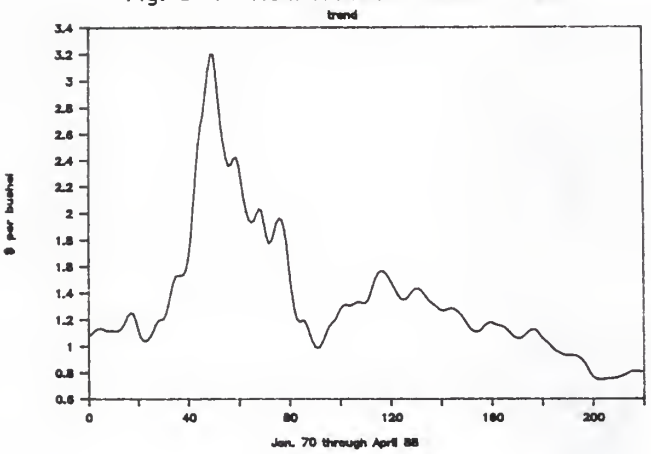


Fig. 3–8 Real Kansas Cattle Prices

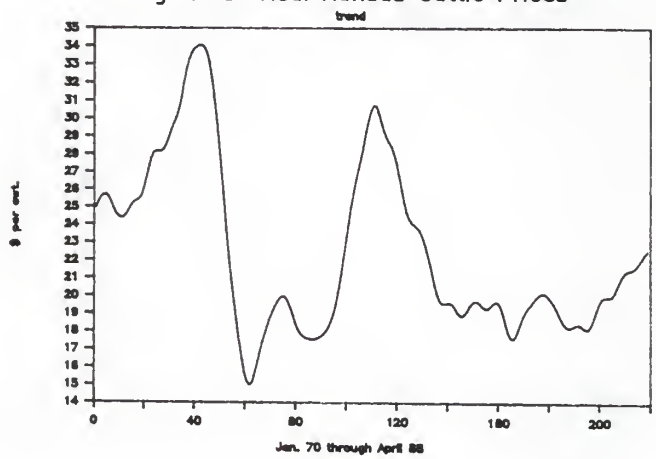


Fig. 3–9 Kansas Stock Average

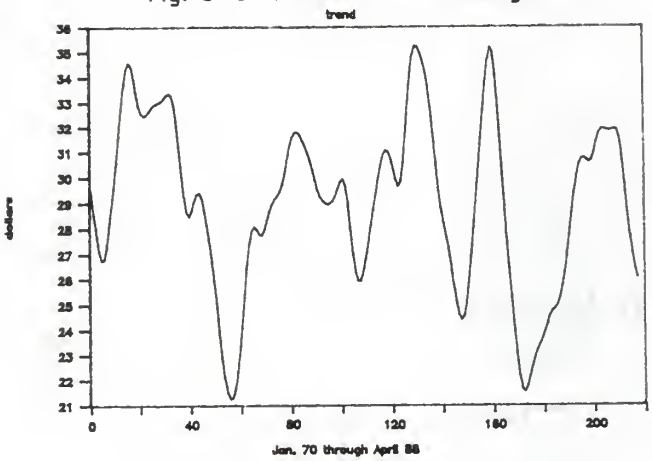


Fig. 3–10 Kansas New Housing Units

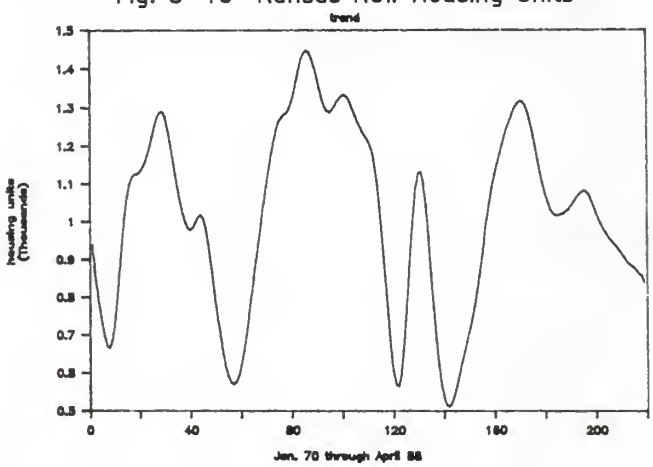


Fig. 3–11 Kansas Initial Claims

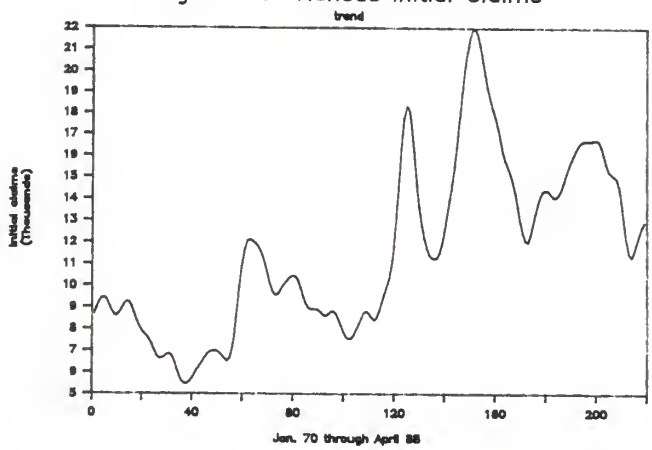


Fig. 3–12 Real M2 Money Supply

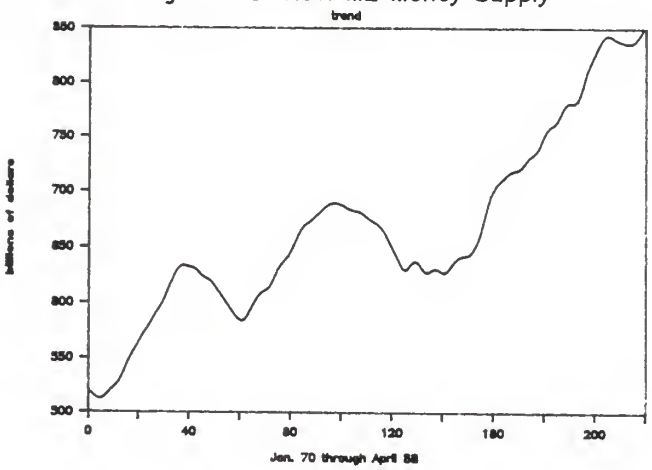


Fig. 3—13 Kansas Index of Leading

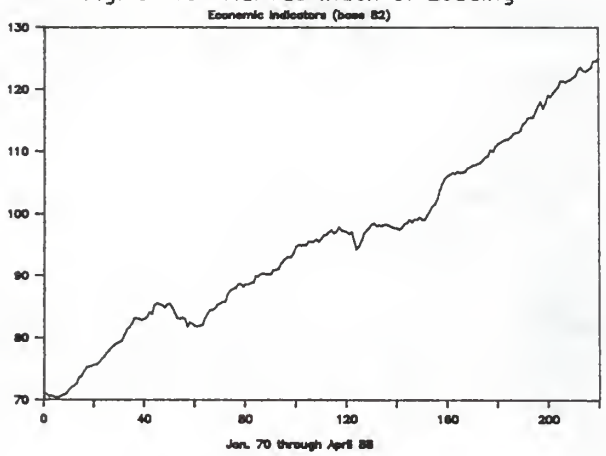


Fig. 4—1 Real Kansas Personal Income

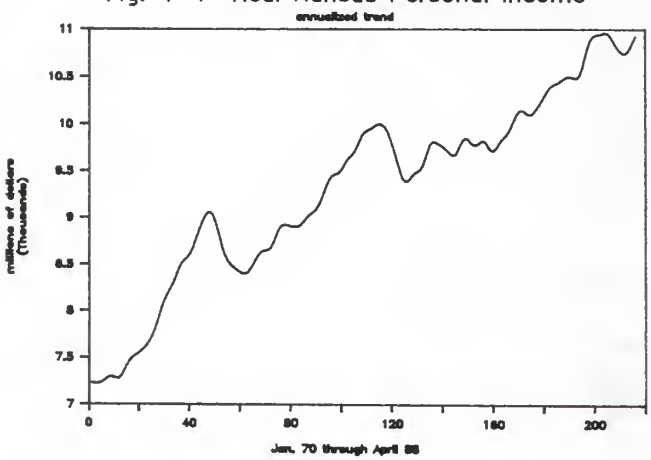


Fig. 4–2 Kansas Leading Index

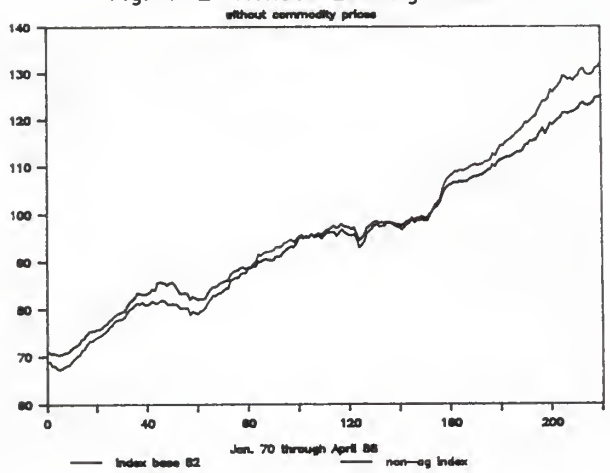


Fig. 4–3 Kansas Leading Index

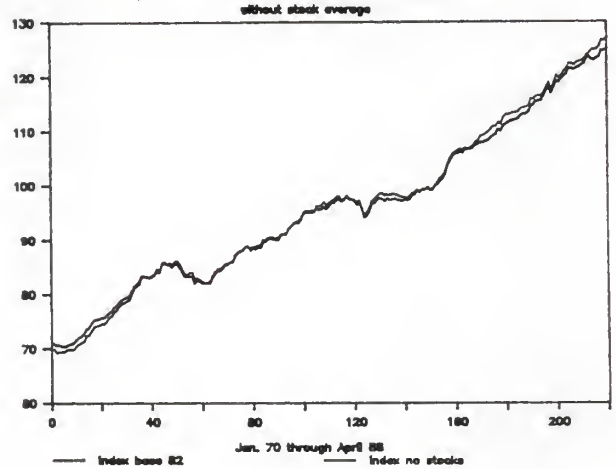


Fig. 4–4 Kansas Leading Index

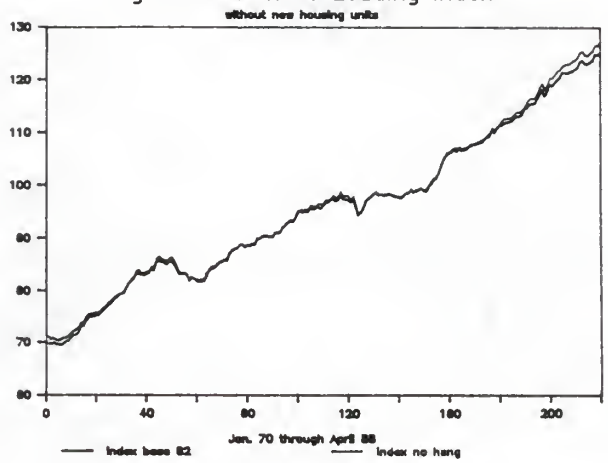


Fig. 4–5 Kansas Leading Index

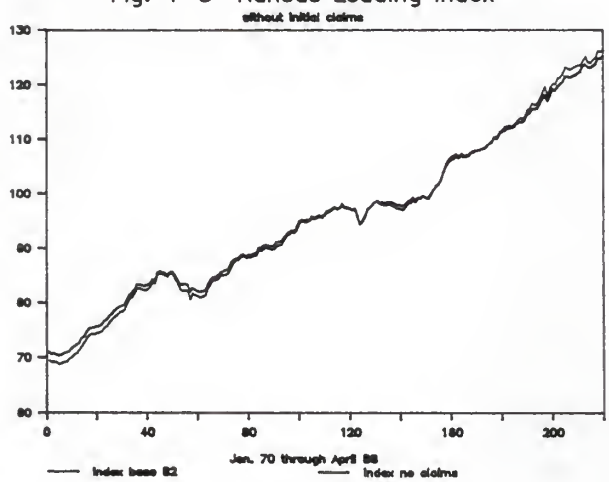


Fig. 4—6 Kansas Leading Index

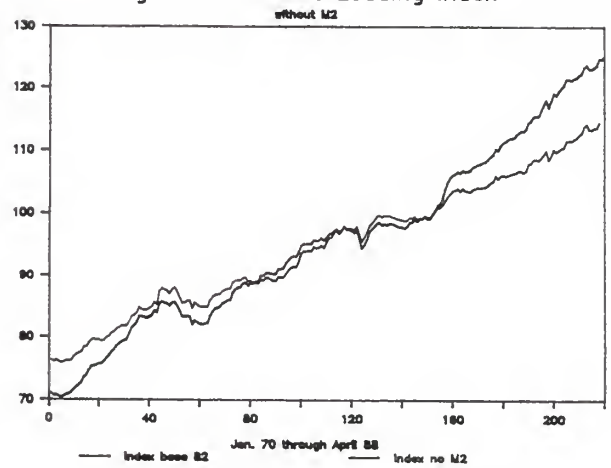
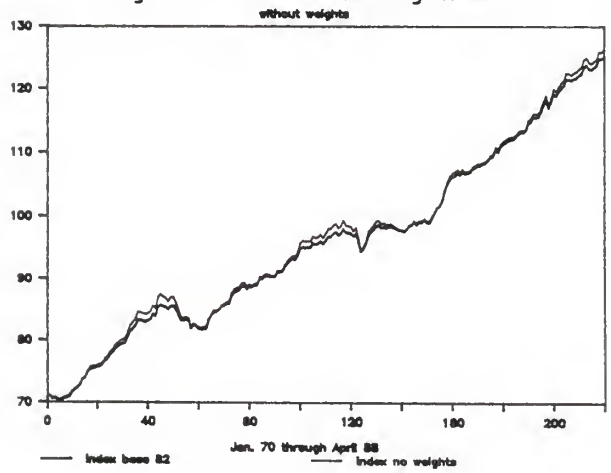


Fig. 4—7 Kansas Leading Index



THE KANSAS INDEX OF LEADING ECONOMIC INDICATORS

by

Mark Allen Willard

B.A., University of Northern Iowa, 1985

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF ARTS

Department of Economics

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1988

Abstract

The purpose of this thesis is to construct an index of leading economic indicators for the state of Kansas. This index is constructed, for the most part, following the approach used by the U.S. Department of Commerce to construct the U.S. Index of Leading Economic Indicators.

Six series were chosen as components for the Kansas Index of Leading Economic Indicators. The first two series are Wheat Prices paid to Kansas farmers and the price paid to Kansas farmers for cattle. In order to be expressed in real terms, these two series are deflated by the U.S producer price index for finished goods. The third series is a monthly stock price average of approximately 100 Kansas based and Kansas related firms. The fourth series is the number of new housing units authorized for construction in Kansas per month. The fifth series is monthly initial claims for unemployment insurance filed by Kansans. Finally, the sixth component of the index is the M2 measure of the U.S. money supply. This series is deflated by the consumer price index for all urban consumers so that it can be expressed in real terms.

Historical monthly data for each of these series was collected back to January of 1970. Each series is then assigned a weight based on numerous, complicated economic and statistical criteria. Those series which best contribute to the early prediction of business cycle peaks and troughs are assigned the highest weights.

Once the component series are weighted, the index can be constructed. First each component series is adjusted for its variance so that the more volatile series do not dominate. Then these

standardized, weighted series are combined and averaged on a monthly basis to form an index. The index becomes the Kansas Index of Leading Economic Indicators after it is adjusted for its base year, 1982.

Real personal income in Kansas was chosen as a proxy for the Kansas business cycle. Comparing the index to real Kansas personal income showed that the index led the business cycle proxy at peaks by an average of one month. At business cycle troughs, the average lead provided by the index was 7.67 months.

The index was compared to several alternative leading indexes. Most of these alternatives deleted one or more of the component series. The final alternative index included all six components, but assigned each component an equal weight. It was found that the original index generally outperformed the alternatives and was never entirely outperformed by any of the alternative indexes.

The thesis concludes with suggestions concerning two avenues of potential future research on this topic. First, it is suggested that additional potential component series be considered for inclusion in the index. Secondly, it is suggested that a Kansas Composite Index of Economic Indicators be developed, combining the existing leading index with an index of coincidental economic indicators and an index of lagging economic indicators.