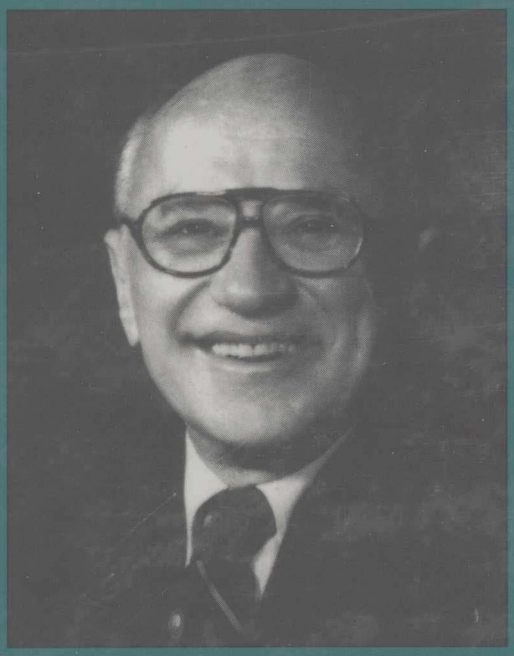

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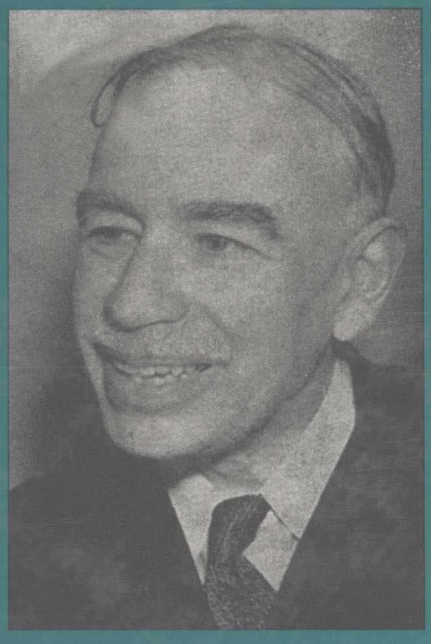

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The Lorenz Curve—
Youth in the Workforce

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CONTENTS—VOLUME TWO

INTERNATIONAL ENCYCLOPEDIA OF ECONOMICS

THE LORENZ CURVE

Type of economics: Growth and development
Fields of study: Economic growth, development, and planning; statistical data and analysis

A Lorenz curve shows how much of society's resources are available to persons at different points in the income distribution, ranked from poorest to richest. It graphically illustrates the nature of income inequality in a society.

Principal terms

COEFFICIENT OF VARIATION: the ratio of the variance of the income distribution to the mean of the income distribution

GINI COEFFICIENT: a number between 0 and 1 that measures the distance of the Lorenz curve from a diagonal line, where 0 indicates complete income equality and 1 indicates that one person has all the income for the group

IN-KIND TRANSFERS: goods or services that are received from the government

INCOME DISTRIBUTION: for a group of persons or families, describes what percentage of total income is owned by each subgroup, where subgroups are ranked by amount of income

MONEY INCOME: a person's or family's money from all sources, including wages, profits, interest, and transfers; may be before or after taxes

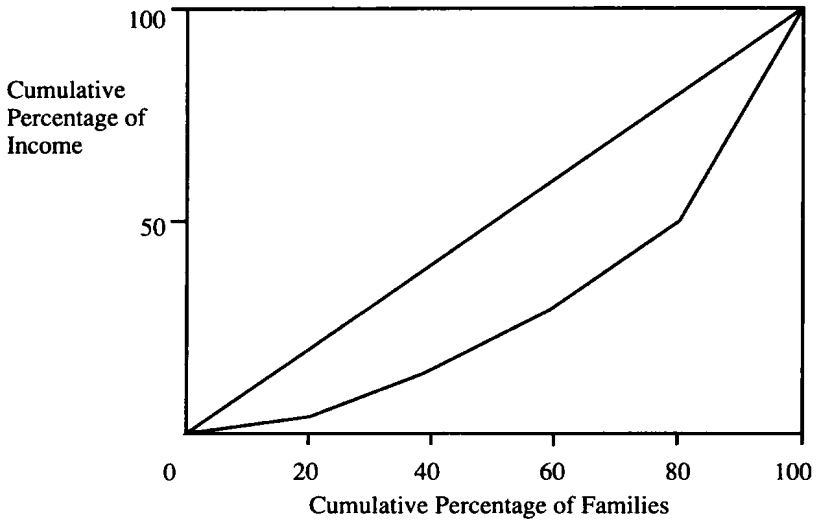
TRANSFER INCOME: money that is received from the government, generally by poor or retired persons

Overview

The Lorenz curve shows how much of total income (or wealth) is accounted for by given proportions of a country's families (or individuals). It is a convenient, graphical way to illustrate the degree of income dispersion, or inequality, in a society.

To construct a typical Lorenz curve, families are first ranked by the percentage of the total national income that each family possesses. Data that are arranged by income quintile are often used. For example, the poorest fifth of families may own 5 percent of the total national income; the next poorest fifth, 10 percent; the middle fifth, 15 percent; the next fifth, 20 percent, and the richest fifth, the remaining 50 percent. Therefore, the poorest 20 percent of the population has 5 percent of the total income, the poorest 40 percent of the population has 15 percent of the total income, the poorest 60 percent has 30 percent of the total income, and the poorest 80 percent has 50 percent of total income. These cumulative percentages are plotted in increasing order of wealthiness on a graph on which the percentage of families is shown on the horizontal axis and the percentage of total national income is shown on the vertical axis. These points are connected with a continuous line (see figure 1). This line is a Lorenz curve. The curve starts at zero (zero percent of the population has zero percent of the total income) and ends at 100 for both axes (100 percent of the population has 100 percent of the total income).

Figure 1. The Lorenz Curve



If the Lorenz curve were a straight line, it would mean that every family has exactly the same income. The farther that the curve bends away from the diagonal that connects 0 and 100 percent, the more unequal is the income distribution. The most unequal income distribution for a society would be one in which one person has all the resources and everyone else has nothing. In this case, the Lorenz curve would be a right angle.

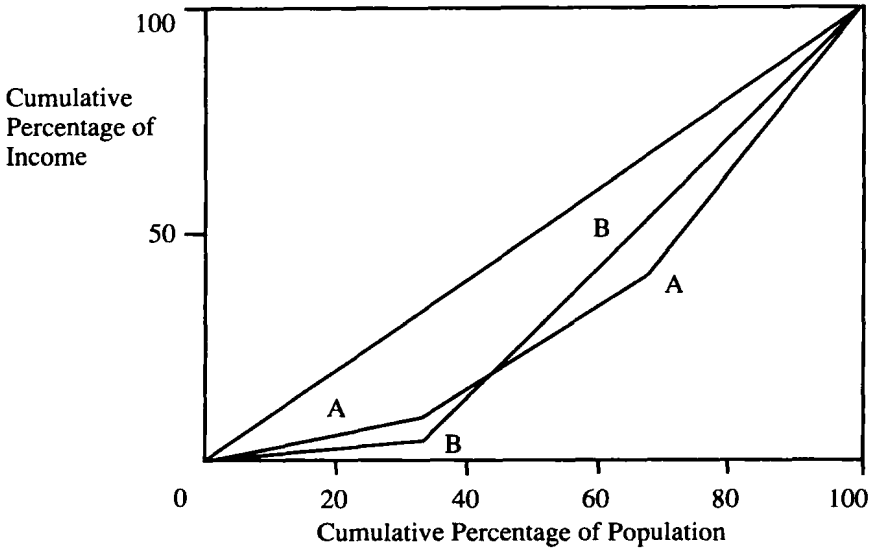
By construction, the Lorenz curve does not present information on the total number of persons or the total amount of income or wealth in a society; that is, it is unit-free. The advantage in being unit-free is that the Lorenz curve allows for comparisons across two groups with different numbers of people and different total incomes. Multiple Lorenz curves can be plotted on the same diagram in order to compare two or more income distributions. If one Lorenz curve lies everywhere below another one, then the first curve is said to represent a greater degree of income dispersion than the second, or a greater degree of inequality. If two Lorenz curves cross, however, then it is impossible to state which curve represents a greater degree of inequality.

For example, compare country A (see figure 2), in which the poorest third of the population owns 10 percent of the wealth and the richest third owns 60 percent of the wealth, to country B, in which the poorest third owns 5 percent of the wealth and the richest third owns 50 percent. In country A, the poorest third commands a larger share of the total income than in country B, but the poorest two-thirds of the population commands a smaller share of the total income in country A than in country B. The Lorenz curve for country A will be above the Lorenz curve for country B until the middle of the diagram, where the curves will cross.

The Gini coefficient is a widely used measure of inequality which is derived directly from the Lorenz curve. It is defined as the ratio of the area bounded that is by the Lorenz curve and the diagonal of the graph, divided by the area of the triangle that is formed by the diagonal and two sides of the graph. This number will vary between 0 and 1, with 1 indicating complete inequality, namely a right-angle Lorenz curve; and 0 indicating complete equality, with the Lorenz curve overlaying the diagonal. Therefore, a country with a Gini coefficient of 0.4 would be considered to have a more equal income distribution than a country with a Gini coefficient of 0.6. While the Lorenz curves of two countries may cross, the use of the Gini coefficient may lead the user to assert that one country has a more equal income distribution than the other. For this reason, the Gini coefficient is considered to give a less accurate portrayal of income dispersion than is gained from actually graphing the Lorenz curve. All other numerical measures of income inequality, such as the coefficient of variation, are considered to be inferior to the Lorenz curve for the same reason.

Data are commonly available for use in constructing Lorenz curves for different countries.

Figure 2. The Lorenz Curve of Countries A and B



Most developed countries conduct income surveys at least once a decade. In the United States, survey data is collected annually by the Bureau of the Census for a random sample of households, who are asked to estimate their current annual level of income (including transfer payments). This data can then be used to estimate the overall income distribution by quintiles (or by an even finer degree of accuracy such as deciles). Additionally, historical data on income distributions are available on many countries for various points in time.

Applications

The Lorenz curve is used by economists to illustrate the distribution of either income or wealth in a country, although it is a more general analytical tool. Three primary uses for this curve are to compare income distributions for one country at different points in time, to compare before- and after-tax and transfer income distributions for one country at one point in time, and to compare income distributions across countries at the same point in time.

An example of the first use is a comparison of income distribution data for Great Britain from four points in time: 1688, 1801, 1867, and 1979. In plotting Lorenz curves for each year on the same diagram, the Lorenz curves for 1688, 1801, and 1867 each cross the others. The Lorenz curves for 1688 and 1801 almost exactly overlie each other, leading to the observation that the British income distribution changed very little over the eighteenth century. Yet, all three of these curves lie below the Lorenz curve for 1979. Therefore, one can conclude that there has been a clear reduction in British income inequality since 1867.

Turning to the United States, there appears to be a similar long-term trend of decreasing inequality. For example, if Lorenz curves are constructed from data for 1929, 1964, and 1971, the 1971 curve lies everywhere above the 1964 curve, which in turn lies completely above the curve for 1929. Thus, one can again make the statement that there has been a clear reduction in income inequality over this time period.

Turning to more recent data, there has been much debate among policy analysts as to whether President Ronald Reagan's policies in the 1980's made the U.S. income distribution more or less equal. Using data on the distribution of money income among families and comparing 1980 to 1987, the lowest fifth of families owned 5.1 percent of the aggregate money income in 1980 but only 4.6 percent in 1987. In fact, looking at the income distribution by quintile, only the richest fifth of families received an increased share of income by 1987, increased from 41.6 percent in 1980 to 43.7 percent by 1987. Because the four lowest quintiles of families all saw reduced shares of the national income, a comparison of the Lorenz curves for these two years shows unambiguously that U.S. income inequality increased over this period; that is, the curves do not cross.

Another way to address the question of how income inequality has changed as the result of government policies is to compare the income distribution before taxes and transfers to the income distribution that results after transfers and taxes have been added and subtracted. In order to account completely for governmental influences on society's resource distribution, in-kind transfers such as food stamps and housing subsidies need to be valued at their monetary equivalents. In the United States in the 1980's adjustments for taxes alone caused almost no change in the distribution of income. Therefore, the tax system taken as a whole (incorporating all federal, state, and local taxes) is neither progressive (decreasing inequality) nor regressive (increasing inequality). The addition of transfers to after-tax income has a major redistributive impact, however, so that the Lorenz curve after taxes and transfers have been accounted for lies everywhere above the Lorenz curve for unadjusted income.

It is also instructive to construct Lorenz curves for different countries in order to compare income dispersion across national boundaries. In this case, the problem of intersecting Lorenz curves is often encountered. For example, in comparing Great Britain, West Germany, and the United States using data from the mid-1970's, the Lorenz curve for Great Britain lay everywhere above the curve for the United States, showing a more equal distribution for Great Britain. Yet, the Lorenz curves for Great Britain and West Germany intersected: The lowest 20 percent of the population had a greater share of national income in Great Britain than in West Germany, but above that point the income distribution became more unequal in Great Britain. Therefore, it cannot be said unambiguously that West Germany had greater or lesser income inequality than Great Britain.

While the Lorenz curve is usually used to describe the distribution of income or wealth for a group of individuals or families, this method also

can be used to illustrate inequality in the distribution of other personal or family attributes. For example, Lorenz curves can illustrate the distribution for a society of height, weight, or intelligence quotient (IQ) scores. In fact, if Lorenz curves for height, IQ, and income distributions for a country are all plotted on the same graph, measured IQ scores are more dispersed than height and income is in turn more dispersed than IQ.

Context

A fundamental area of interest for economists and public policymakers alike is the topic of income distribution. As such, there exists a need for statistical measures of income distribution. These measures can be used to assess the effects of redistributional policies, as well as to look at trends in inequality and cross-country comparisons.

The Lorenz curve was proposed by statistician M. O. Lorenz in 1905 as a method of measuring the concentration of wealth. Since then, it has been used widely by economists who are interested in graphically illustrating the distribution of either income or wealth. The relationship of the Lorenz curve to various numerical measures of income distribution has been developed subsequently, notably by economist Corrado Gini (1884-1965) in 1912, who proposed the Gini coefficient as a measure of the Lorenz curve's distance from the diagonal, which represents the condition of complete equality.

While a single number would be preferable for ease in describing and comparing income distributions across groups, countries, and time spans, however, the information that is presented in a Lorenz curve cannot be summarized accurately by a single number. The use of the Gini coefficient or the coefficient of variation to compare distributions leads to a false sense of precision. The inability to say definitively whether one country has a more or less equal income distribution is encapsulated by the condition in which two Lorenz curves cross at any point along their lengths. Empirically, curve-crossing is the rule rather than the exception. For example, economist A. B. Atkinson, in creating pairwise comparisons of Lorenz curves for twelve countries (seven economically advanced, five developing), found that the curves do not intersect in only sixteen out of the sixty-six cases.

This dilemma of being unable to rank countries or time periods by degree of inequality arises throughout welfare economics and relates to the fundamental problem in economics of being unable to make interpersonal utility comparisons. For example, is a society in which the poorest third of the population owns 10 percent of the wealth and the richest third owns 60 percent of the wealth more or less equal than a society in which the poorest third owns 5 percent of the wealth and the richest third 50 percent? The Lorenz curves for these two societies will cross for the middle third of the population, and no relative inequality ranking can be made without making an additional judgment as to what constitutes equality. Additionally, it cannot be said which society is "better" without making a value judgment as to which type of society is preferable and what degree of inequality is preferred. It must be determined whether a society is willing to alleviate the condition of the very poor through the use of antipoverty programs, even if this relief comes at the expense (through increased taxation, for example) of the middle rather than the upper class. The comparison of Lorenz curves will, in general, allow for the creation of only a partial ordering, rather than a complete ordering, of societies by degree of inequality.

Bibliography

Atkinson, A. B. *The Economics of Inequality.* 2d ed. Oxford: Clarendon Press, and New York: Oxford University Press, 1983. Designed to be used as a textbook for the advanced undergraduate and is an excellent survey of the topic. Covers the measurement of inequality using various indexes, as well as the Lorenz curve, and compares the outcomes from the various measures.

———. *Social Justice and Public Policy.* Cambridge, Mass.: MIT Press, and Brighton: Wheatsheaf Books, 1983. This collection of essays includes Atkinson's classic article "On the Measurement of Inequality" (1970), along with an extended bibliography for 1970-1982, which includes a section on the Lorenz curve. Suitable for advanced undergraduates.

———, ed. *Wealth, Income, and Inequality.* 2d ed. London and New York: Oxford University Press, 1980. This reader contains the classic articles in the area of economics of inequality. A section on the distribution of income contains several clear examples of Lorenz curves for Great Britain, The Netherlands, and West Germany, demonstrating curve comparisons across countries and time. Suitable for advanced undergraduates.

Cowell, F. A. *Measuring Inequality.* 2d ed. New York: Prentice Hall, and London: Harvester Wheatsheaf, 1995. This monograph compares various methods of charting inequality and computing inequality measures. Too technical for the casual reader, but useful for practitioners who may need to calculate inequality measures.

Lorenz, M. O. "Methods of Measuring the Concentration of Wealth." *Publications of the American Statistical Association* 9 (June, 1905): 209-219. This article first defined the Lorenz curve and is useful in showing the inferior methods of illustrating wealth distribution which preceded it. Suitable for the general reader.

Osberg, Lars. *Economic Inequality in the United States.* Armonk, N.Y.: M. E. Sharpe, 1984. This 305-page book contains a useful discussion of the Lorenz curve and a comparison of various inequality measures. The book is nontechnical and is written to appeal to the general reader.

Slottje, Daniel J. *The Structure of Earnings and the Measurement of Income Inequality in the U.S.* New York: Elsevier, 1989. This technical monograph contains a full mathematical treatment of the Lorenz curve for those who are curious to see a formal statement of its properties. Also contains a comprehensive comparison of various measures of inequality using U.S. data from 1976 to 1985. Suitable for advanced undergraduates.

Taubman, Paul. *Income Distribution and Redistribution.* Reading, Mass.: Addison-Wesley, 1978. A good, short (110-page) introduction to the topic of income inequality with useful illustrations of Lorenz curves. For beginning undergraduates.

Williamson, Jeffrey, G., and Peter H. Lindert. *American Inequality: A Macroeconomic History.* New York: Academic Press, 1980. This 362-page book utilizes Gini coefficients rather than Lorenz curves but has extensive sources and references to historical data on American wealth and income distribution since colonial times, which would allow one to construct Lorenz curves. For advanced undergraduates.

Joyce P. Jacobsen

Cross-References

Distribution Theories; Income Inequality; Pareto Economics; Poverty; Redistribution of Wealth; Welfare Economics.

MACROECONOMIC MODELS

Type of economics: Monetary and fiscal theory
Fields of study: Fiscal theory and public finance; monetary theory

Macroeconomic models are simplified descriptions of the relationship between some collection of macroeconomic variables. They are used by government officials, including the U.S. Congress and president, as well as private financial institutions and large businesses, to chart the likely course of the aggregate economy.

Principal terms

CLASSICAL MODEL: a macroeconomic model that assumes that the economy will always attain full employment at the current level of production

GROSS NATIONAL PRODUCT (GNP): the value of all goods and services that are produced in the economy in one year

INFLATION RATE: the rate at which the general price level is increasing over time

KEYNESIAN MODEL: a macroeconomic model that asserts that involuntary unemployment may exist and that the government has a role to play in alleviating economic problems

MACROECONOMIC VARIABLE: an economic quantity that measures some aspect of the behavior of the economy as a whole, such as the overall unemployment rate, the level of inflation, or the level of production for the entire economy

MONETARISM: a theory that states that erratic growth in the money supply is the major reason for economic instability

UNEMPLOYMENT RATE: the percentage of people who are actively looking for a job but cannot find one

Overview

An economic model is a simplified description of some aspect of the economy or of economic relationships. When economists speak of a macroeconomic model, they are referring to a model that characterizes the relationship among a set of macroeconomic quantities which involve the economy as a whole. These quantities might include, in particular, the unemployment rate, the rate of inflation, the size of the gross national product (GNP), the trade balance, or the money supply. In general, a macroeconomic model would describe the behavior of the overall unemployment rate for an entire country, not the unemployment rate in a specific sector of the economy.

A model could take the form of a verbal description, a graph, or a set of mathematical equations. An example of a macroeconomic model which is usually presented as a graph is the IS-LM model, which is the basic model taught in most intermediate macroeconomics courses. The model explains the relationship between government policy, private economic decision making, interest rates, and output. A macroeconomic model which takes the form of a set of mathematical equations to which statistical techniques have been applied is called an econometric model. An example of an econometric model is the Klein-Goldberger model of the economy.

Macroeconomic models are formulated in order to answer certain questions about the overall state of the economy. Probably the most important quantities in which we are interested are the unemployment rate, the inflation rate, and the level of the GNP because the values of these macroeconomic variables have a direct bearing on the well-being of the citizens who work in the economy. Other macroeconomic variables directly affect the levels of unemployment, inflation, and output, and thus are of direct interest also. These variables include the money supply, interest rates, the levels of government spending and taxation, and stock prices. Examples of questions that are critical to the people who use macroeconomic models include: What will the rate of unemployment be next year? How fast is inflation rising? and How can the level of government spending be adjusted to ensure a reasonable growth rate in the GNP and in standards of living?

Because of the complex nature of modern economies, macroeconomic models are, by necessity, simplifications of reality. Macroeconomic models range from very simple descriptions of the relationship between two or three quantities such as the money supply, the inflation rate, and the unemployment rate, to vast models which include characterizations of the relationships among several hundred quantities. Even in these large models, however, it is not possible for economists to take into account every connection between the quantities in the model. The belief is that the neglected relationships are unimportant when trying to an-

swer the questions for which the model was invented.

The earliest macroeconomic model was the classical model, widely used by economists until the Great Depression. The hallmark of the classical model was its assumption that prices and wages adjusted very quickly in response to changes in the demands for products. For example, if there was a decline in the demand for steel products, one would expect steel manufacturers to lower their production of that commodity. In turn, fewer steel workers would be needed, wages in the steel industry would fall, and steel workers who were not content with lower wages would seek jobs elsewhere. Wages would adjust so that workers would transfer into other industries in which wages were higher. In the classical model, this wage adjustment took place very quickly so that unemployment was minimal. The only unemployment that existed would be the transitional unemployment of workers seeking new jobs in other fields. In this kind of economy, there is no role for government policy in trying to decrease unemployment. Unemployment is short term and self-correcting.

The behavior of the world economy during the Great Depression led John Maynard Keynes (1883-1946) to question the validity of this model. At the peak of the Great Depression of the 1930's, one-quarter of the U.S. work force could not find jobs. Economists of the classical mold believed that each of these workers would be able to find a job if only he or she would accept a wage cut. Keynes pointed out that this was simply not true; jobs were not available at *any* wage. What has come to be known as the Keynesian model had at its core the idea that involuntary unemployment could exist.

A central feature of the Keynesian macroeconomic model is that the government should play an active role in alleviating the effects of unemployment. Keynes advised President Franklin D. Roosevelt to implement massive spending programs in order to employ workers directly. The spending programs had two effects on the employment rate. First, some workers would receive jobs and income directly from the government. As these workers spent their newly earned income on goods and services, other people would be able to regain employment by producing these goods and services, the secondary effect of government spending. It was thought that a dollar's worth of government spending would multiply through the economy several times, generating many dollars worth of income to many different individuals.

Although the Keynesian model explains periods of high unemployment very well, it is not as successful during periods of high inflation, such as the late 1960's and 1970's. Monetarism, an alternative to the Keynesian model, was developed as a theory by Milton Friedman during the 1960's. He argued that rising prices occurred because of increases in the money supply, that rising prices would decrease the GNP in the long run, and that the only path to a stable economy with low unemployment, low inflation, and moderate growth rates in output was strict control over the money supply.

The new classical model also emerged during the 1970's and is associated with the economists Thomas Sargent and Robert Lucas, among others. Many of the features of this model are classical in nature. The model emphasizes that the economy will operate at full employment if left to its own devices and that prices will adjust very quickly to changes in the demand or supply of goods. One of the implications of this model is that there is little role for either monetary policy (changing the money supply) or fiscal policy (changing tax rates or the level of government expenditures) in stabilizing the economy. The economy, if not interfered with, will operate at its optimum level.

Applications

Macroeconomic models are in use at all levels of government and in the private sector. Two very important government bodies which use macroeconomic models are the Congressional Budget Office (CBO) and the Office of Management and Budget (OMB). Each has the task of forecasting the future path of the economy and of rates of unemployment, income levels, and inflation rates. Both the level of tax revenues collected by the government and the level of governmental expenditures depend on these quantities. As unemployment rises, spending on unemployment compensation and various welfare programs rises and tax collections decrease. Because a federal budget deficit is defined as the excess of expenditures over tax revenues, a large expected increase in the unemployment rate means that the budget deficit will increase. It became especially important to have accurate forecasts of these quantities during the 1980's, as Congress and the president attempted to balance the federal budget, which was in a serious deficit. The accuracy of the forecasts depended, in turn, on the