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Abstract

This report is an empirical inquiry into how poverty is changed by the macroeconomy. The analysis suggests low real wage rates and not the unemployment rate are the most important determinant of poverty in the long run. Changes in output and unemployment primarily affect cyclical or shortrun poverty. The empirical results weaken the belief that output growth acting alone will significantly and permanently reduce poverty in the United States. Instead, the results suggest combining economic growth strategies with targeted interventions that may lie outside the traditional sphere of monetary and fiscal policy.

Keywords: Poverty, unemployment, wages, economic growth.

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Summary

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We explore how changes in important macroeconomic variables have affected the rate of poverty in the United States over the last 30 years. Popular notions often cast the poor as a persistent underclass, where people remain poor from year to year. Evidence suggests that poverty is a more dynamic condition. In addition, focusing on the change in the aggregate poverty rate through time and over the business cycle disguises different experiences among demographic subgroups. The poor are not a homogeneous population. Poverty rates differ significantly by race, sex, and household head. In general, the relative disparities among demographic subgroups have persisted.

We separate the long-term effects of the macroeconomy from cyclical effects, thereby illuminating how rapidly economic growth and reduced unemployment can be expected to decrease the proportion of people living in poverty. Differentiating between cyclical and secular effects is important because they imply different policy responses to poverty. Policies fostering recovery from economic downturns are different from policies promoting economic growth through increases in net investment, labor force expansion, or productivity growth associated with changing technology. The longrun empirical approach is of interest because it tells something about how economies and poverty change over time, in particular over the last three decades.

Macroeconomic growth has been less successful in reducing poverty since the mid-1970's. Although many reasons for the divergence between the historical poverty rate and economic growth have been advanced, only a few are compelling. The leading candidates include: (1) changing institutional wage-setting mechanisms with the decline of labor unions; (2) a changing labor cohort; (3) globalization of production and markets; (4) shifting relative expenditures for goods and services; (5) technological change associated with the digital revolution; and (6) increased earnings instability. The literature suggests no single cause large enough to account for the divergence between economic growth and poverty, but labor-market changes fostered by technological change, economic restructuring, and shifts in relative wages are the most important.

For the working poor, low wage rates, not low numbers of work hours, appeared to be a major factor in the incidence of poverty among households headed by either men or women. Significant evidence points to changing technology as a key to explaining the stagnation of wages, particularly for low-skilled workers. If competitive pressures in the labor market ensure that the wage distribution reflects the skill distribution, a decline in job opportunities for low-skill workers will lower their wages.

Estimating the relationship between important macroeconomic variables and the poverty rate presents a difficult methodological problem. Disquieting research published in the 1970's called into question the use of classical linear regression techniques for analyzing macroeconomic time-series data. These studies claimed that most macro time series were not stationary, rather than stationary around a deterministic trend. Nonstationarity could lead to serious problems when interpreting traditional statistics like R^2, the Durbin-Watson statistic, and the t statistic, and running regressions with nonstationary data produced spurious results. We address the problem of nonstationarity by applying a cointegration model developed by Johansen. In stark contrast to differencing, cointegration analysis mitigates estimation errors by avoiding standard distributions and instead applies corrected or alternative distributions. The essence of cointegration is that the cointegrated variables share a common trend that is removed when producing the cointegrating regression residuals. Because of the common trend, there may be strong multicollinearity, tempting a researcher to drop a variable.

The Johansen method views all the variables as potentially endogenous, with each expressed as a linear function of lagged values of it and all other variables. This set of equations is expressed mathematically in the form of a single-vector autoregression. The

Johansen approach has several advantages over other approaches. First, it avoids the problem of normalization that plagues other estimators. The second advantage relates to the first. Johansen guards against inconsistent estimation of the cointegrating relationship by incorporating knowledge that there may be more than one cointegrating vector. In addition, the maximum likelihood estimation of the shortrun dynamics increases the efficiency of the estimation, and a systems approach allows parameter estimates in any given equation to incorporate information from other equations.

Changes in the market for labor are central for understanding changes in poverty. Changes in the real wage rate—and not hours worked as reflected in the change in output—are the most important determinant of long-term changes in poverty. This conclusion is supported by our estimate of the equilibrium relationship between poverty, unemployment, wages, and money stocks. This finding is consistent with previous research conducted in the early 1990's.

Unemployment is estimated to have a strong positive cyclical effect on the poverty rate, suggesting joblessness is responsible for pushing many household incomes below the poverty level. This finding is robust across empirical approaches and the period of study. Our results modify this story. Although decreasing unemployment certainly reduces poverty, increasing output and the hours worked by those already employed is likely to be the most efficacious way to reduce poverty in the short term. This result contrasts sharply with the long-term equilibrium results that emphasize the role of the real wage rate as the most effective mechanism for decreasing poverty.

Understanding the effects on important subgroups requires that the analysis be disaggregated. The poverty rates of some groups are more sensitive to output growth; other groups are less affected. Changes in the poverty rates for whites, including white female-headed households, are more volatile than for black households. The most difficult poverty rates to explain are associated with white female-headed households. We attribute this difficulty to the large off-trend gains made generally by white women during the last two decades.

Changes in output are the most important shortrun determinant of changes in the poverty rate for each demographic subgroup. The size of the effect, however, depends on the household considered. Longrun economic effects on poverty for most households are dominated by the wage rate. Changes in the level of the wage rate have the most significant longrun effect on decreasing poverty for white households, less so for black households. Increases in the money stock (nominal output) decrease poverty, and increases in the unemployment rate increase poverty in the long run for all population subgroups.

Our assessment of economic effects provides empirical evidence about the likely efficacy of alternative longrun and shortrun strategies to reduce poverty. Evidence drawn from our study supports a mix of cyclical and longrun approaches for alleviating poverty with a realization that the effectiveness of any approach depends importantly on the dynamics of the macreconomic-poverty relationship and the population subgroup considered. Our empirical results weaken the belief that output growth alone will significantly and permanently reduce poverty in the United States. Instead, the results suggest complementing growth strategies with targeted interventions. Although considerable antipoverty rhetoric has emphasized work, a key to permanently reducing poverty is to improve the returns to labor. While the economy has generated many jobs, wages and benefits are often insufficient to lift a family out of poverty. Improvements in education and job training are likely to be important means for improving wages for the poor.

Poverty, Policy, and the Macroeconomy

Michael LeBlanc

The fault, dear Brutus, is not in our stars, but in ourselves.
—William Shakespeare, *Julius Caesar*

Introduction

Economic growth has long been viewed as one of the most effective ways to reduce poverty. Over the last 20 to 30 years, critics have questioned the continued efficacy of growth for improving the incomes of the poor. Since the mid-1960's, when the outline and economic rationale for the War on Poverty were developed, considerable attention has focused on alternative approaches for alleviating poverty. The antipoverty program of the 1960's was built on targeted measures like increased education, improved public and individual health, vocational training, and community development initiatives, to improve the earning capacities of individuals and communities.

Pitting economic growth as a remedy for poverty against antipoverty and income transfer programs pits diffuse policy intervention based on broad fiscal and monetary measures against targeted interventions. If changes in the macroeconomy can be shown to significantly affect poverty, then a case for substantial programs of a selective character is weakened. In this case, greater consideration should be given to the role that economic growth can play in eliminating poverty. Rather than viewing economic growth as a complement to more targeted approaches, critics have argued reliance on growth with trickle-down serves as an excuse for doing nothing.

This report is an empirical inquiry into how poverty is changed by the macroeconomy. We explore how changes in important macroeconomic variables have affected the rate of poverty in the United States over the last 30 years. We seek to untangle the secular long-term effects of these variables from cyclical effects, thereby illuminating how rapidly economic growth and reduced unemployment can be expected to reduce the proportion of people living in poverty. Differentiating between cyclical and secular effects is important because they imply different policy responses to poverty. Policies fostering recovery from economic downturns are different from policies promoting economic growth through increases in net investment, labor force expansion, or productivity growth associated with changing technology. The longrun empirical approach is of interest because it tells something about how economies and poverty change over time, in particular over the last three decades.

The focus of this inquiry is to assess how change in the economy affects the proportion of people living in poverty. Perhaps as important, however, is our assessment of how the economy affects poverty for important demographic groups. Changes in relative business profitability and returns to low- and high-skilled labor affect changes in output, factor returns, and the flow of resources across industries. These kinds of system-wide changes are likely to affect whites, blacks, men, and women differently depending on whether they are employed, where they are employed, and their relative wages. Significant differences among groups strengthen arguments for special programs aimed at disadvantaged groups, and weaken arguments for the role of overall economic growth in eliminating poverty.

Beginning in the 1980's, a number of studies examined the relationship between U.S. macroeconomic performance and the poverty rate. Our analysis builds on this empirical literature. We develop an explanation of the relationship between the macroeconomy and poverty, highlighting the importance of the labor market, and quantify this explanation with a statistical approach that allows us to distinguish the effect of short-term, cyclical phenomena from long-term relationships on the poverty rate. Our results suggest the level of real wages is the prime determinant of poverty in the long run. Policy interventions that target output growth and unemployment are likely to be the most effective shortrun avenues for addressing poverty. In addition, we document different effects of macroeconomic variables on population groups.

Defining and Measuring Poverty

Constructing a poverty measure implies a value judgment about social welfare. The value judgment says it is not just the total welfare of all people in society that is important, but also the well-being of our least well-off people. Because poverty is measured for some purpose, the selection of a poverty measure is a function of the rationale for measurement. Official measures typically determine poverty status by considering a person's command over goods and services, not patterns of behavior, beliefs, or general levels of satisfaction or happiness.

At the most fundamental level, a person's position in society can be judged from two perspectives: actual achievement and the capability to achieve (Sen, 1992). Achievement is what we accomplish; capability means the opportunity to accomplish or achieve goals we value. The two need not be congruent. A problem underlying the measurement of poverty naturally arises between the concepts of the capability to act versus the measurement of well-being. That is, whether a person's position in society should be judged positively in terms of achievement, or negatively, in terms of the shortfall of what could have been achieved. The answer to this question contrasts a person's control over resources, usually in the form of income, with actual consumption of goods and services. In a practical sense, it is ultimately a judgment about our ability to adequately represent well-being with a measure of income.

Money income, the basis of most poverty indicators, is an incomplete measure of a family's potential ability to fulfill basic needs. It often omits many goods and services such as housework and child care provided for within the household rather than purchased. Money income also fails to capture the "time poor." In addition, it neglects any in-kind benefits, the benefits families receive from the government in the form of goods or services rather than cash. The largest of these programs are food stamps, Medicare, Medicaid, various housing subsidy programs, and aid to education.

Variations in converting income into consumption can arise from simple physical differences. A poor person's food security, for example, depends not only on income to buy food, but also on a person's metabolic rate, gender, pregnancy status, access to stores, transportation availability, local environment, and health. Of two persons with identical incomes and resources, one may be food secure and the other not. The persistence of food insecurity in wealthy societies cannot be fully understood if attention is confined only to income. Food insecurity in the United States is associated with many factors of which low income is only one, albeit an important one. The social environment, the provision of medical care, the pattern of family life, and various other factors affect food insecurity. A purely income-based analysis of poverty only partially explains food insecurity.

In 1968, the Federal Government adopted as its operational definition of poverty a set of annual dollar needs developed by the Social Security Administration, under the direction of Mollie Orshansky.[1] The Federal Government uses the official poverty measure to publish statistics on income and to set eligibility standards for public programs.[2] The official definition compares a family's cash income with an estimate of its needs. At the heart of the original definition of poverty was a set of minimally adequate food budgets for families of various sizes and types designed by the Department of Agriculture. It was determined from the Department of Agriculture's 1955 Household Food Consumption Survey that families of three or more persons spent approximately one-third of their after-tax money income on food. Poverty thresholds for families of three or more persons were set at three times the cost of the "economy food plan." Since 1969, annual adjustments in the thresholds were based on changes in the Consumer Price Index (CPI) rather than on changes in the cost of foods in the economy food plan. In 1999, the poverty threshold for a family of four with two children under 18 was $16,895 per year.

Although critics argue about the absolute accuracy of the official poverty measure, most agree the measure provides a useful indicator of change in economic status. During the rapid growth of the postwar era, poverty fell dramatically as the United States enjoyed a long

[1]Critics argue the official standard of poverty was adopted haphazardly rather than through a systematic consideration of alternative methods and measures. For critiques of the official poverty measure, see Ruggles (1990) and Citro and Michael (1995).

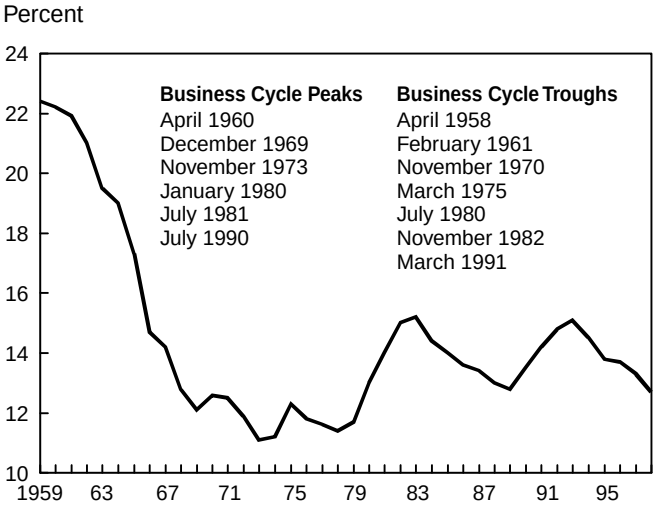
[2]Large proportions of those who spend time in poverty are not poor on the basis of their annual incomes and are consequently not identified as poor by official statistics. Because only one or two months of low income are typically needed to qualify for benefits, the population eligible for public assistance, the Food Stamp Program for example, may be much larger than would be estimated using annual income data alone.

period of uninterrupted growth. From 1959-1973 poverty declined from over 22 percent to 11 percent (fig. 1). So precipitous was the decline in poverty, that it gave rise to hopes of eliminating poverty. As incomes grew rapidly, many poor and near-poor families were lifted from poverty into the middle-class. Indeed, the entire income distribution had shifted upward.

The U.S. poverty rate increased after 1973 and then fluctuated around a narrow range. Only in 1978, as the economy neared its business-cycle peak, and the poverty rate declined to 11.4 percent, has the poverty rate approached its measured low of 11.1 percent. The poverty rate increased from 11.4 to 15 percent from 1979 to 1982, and declined only 2.2 percentage points during the 7-year recovery in the 1980's and increased again to 15 percent in 1993.

Part of the explanation for the increase in poverty is doubtless the poorer performance of the economy over part of this period. The growth of per capita real gross domestic product (GDP) slowed. The trend growth of productivity has been about 2 percentage points lower since 1973 (0.8 percent per year) than in the previous quarter-century (2.9 percent per year) (Tobin, 1994).

Figure 1
Poverty rate, 1959-98



Source: March Current Population Survey.

Not only was the growth of potential output at full employment weaker, but potential output was less frequently and fully realized. Cyclical recessions were more severe after 1973, and the unemployment rate averaged 2.2 points higher.

Poverty Dynamics

Popular notions often cast the poor as a persistent underclass, where the poor remain poor from year to year. Evidence suggests poverty is a more dynamic condition. Studies in the 1970's and 1980's by Morgan (1974) and Levy (1987) found significant numbers of people leave and enter the poverty population each year. Nearly a quarter of the U.S. population experienced at least occasional periods of poverty between 1969 and 1978. The number with persistently low resources was much lower than a quarter, however. Levy estimated the probability of remaining poor for a cohort of persons who were poor in 1967 and concluded that fewer than half could be considered permanently poor.

Two other studies of the persistently poor conducted in the 1980's suggested about 40 percent of the poor will remain poor for some years to come. A study by Duncan (1984) estimated 5-6 million people, representing 2.2 to 2.6 percent of the total U.S. population and 20-25 percent of the annual poverty population had been poor for 8 years or more. Bane and Ellwood (1986) estimate 51.5 percent of the nonelderly poverty population are in the midst of a spell of poverty lasting more than 9 years. Individuals with persistently low incomes are not predominantly an underclass of young adults living in large urban areas. Rather, the persistently poor are disproportionately black, elderly, and those living in rural areas and in the South. The persistently poor are more sharply defined by these demographic characteristics than those found to be poor in a given year.

More recent data on the duration of poverty indicates about 40 million people were poor in an average month in 1993 and 1994 (Naifeh, 1998). However, about 53 million people, or 22 percent of the U.S. population, were poor 2 months or more in 1994. A noticeable proportion of the population was poor on a chronic basis: 5 percent, or 12 million people, were poor all 24 months. Half of all poverty spells lasted 4.9 months or longer. In addition, children and the elderly were less likely to exit poverty than were nonelderly adults.

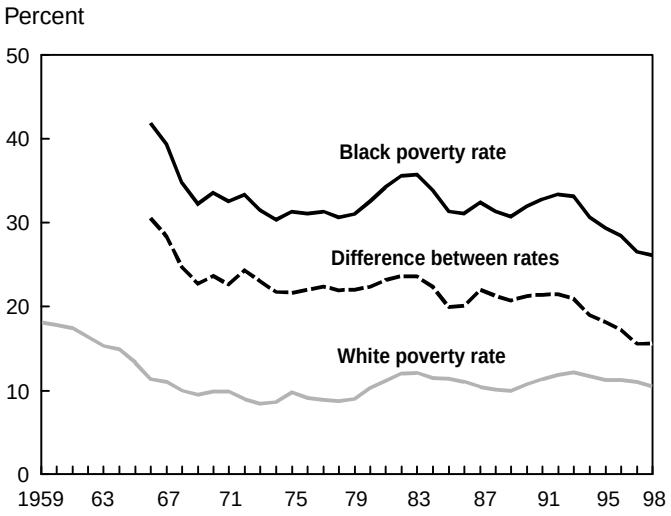
Differences Among Groups

The poor are not a homogeneous population. Focusing on the change in the aggregate poverty rate through time and over the business cycle disguises different experiences among demographic groups. Poverty rates differ significantly by race, sex, and household head. In general, the relative disparities among demographic groups have persisted over the last 30 years. The only exception is that the poverty rate for children now exceeds the poverty rate for the elderly.

Over the last two decades, the elderly have experienced rising incomes and declining poverty. There continues to be a dramatic difference in poverty rates for black and white population groups, although the difference has declined modestly (fig. 2). From 1966 through 1998, the average poverty rate for blacks was about 2.5 times greater than the white poverty rate. In the mid-1960's, the black rate was nearly 4 times the white poverty rate. The black poverty rate has oscillated since the 1970's, but can be characterized by an overall stability and, more recently, by modest declines. The difference between the black and white poverty rates has decreased as white rates increased and black poverty rates have fallen about 27 percent since 1965.

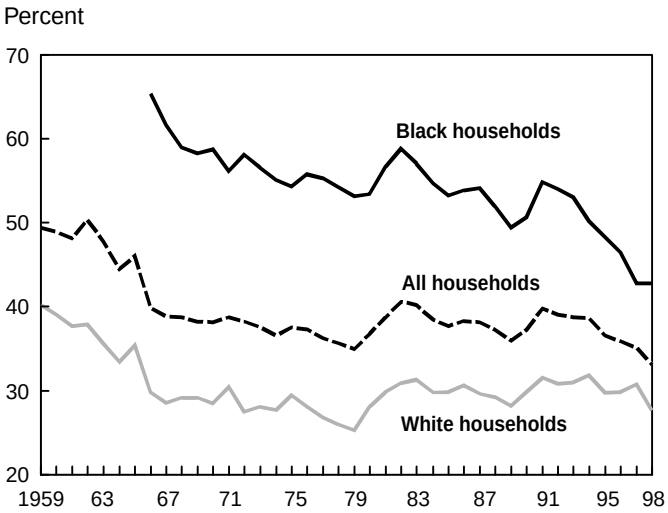
Women's increased earnings have caused the poverty rate for households headed by women to decrease (fig. 3). Although still high (33-39 percent) during the 1990's, the average poverty rate for this group dropped from 49 percent in 1959. Nevertheless, poverty rates for female-headed households continue to be perilously high. Over 1959-98, the poverty rate for female-headed households averaged nearly 39 percent. Like the difference between poverty rates for blacks and whites, generally there are significant racial differences for female-headed households. Black households have experienced gains, but poverty rates for black female-headed households still approach 43 percent. White female-headed household poverty rates are around 28 percent.

Figure 2
Poverty status by race, 1959-98



Source: U.S. Department of Commerce, Census Bureau.

Figure 3
Poverty status of female-headed households by race, 1959-98



Source: U.S. Department of Commerce, Census Bureau.

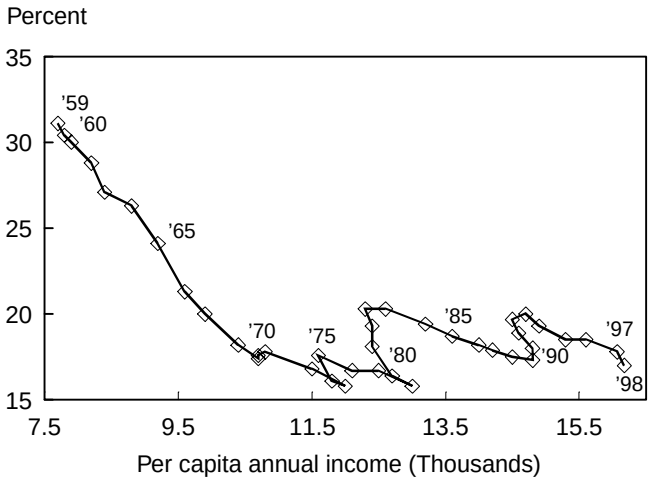
Macroeconomic Growth and Poverty

Economic growth was a powerful engine for reducing poverty during the 1940's and 1950's. An important element of overall economic growth during the post-war era was the shift of labor from subsistence agriculture and other labor-intensive work into jobs of higher value added in urban industry. Denison (1979) credits such shifts with 19 percent of the growth in net national product per person employed in 1941-48 and 14 percent in 1948-54. This growth was especially important for reducing poverty among migrants, both blacks and whites, as labor moved from the South to the industrial Midwest.

Macroeconomic performance has been less successful in reducing poverty since the mid-1970's, apparently because of poorer aggregate economic performance and a changing distribution of the gains from growth. Figure 4 plots the percent of the population with incomes less than 125 percent of the official poverty rate against real personal income per capita for 1959-98. Extending the measure of poverty to include people at or below 125 percent of the official poverty threshold captures a larger number of the working poor, low-income people whose poverty status is more sensitive to changes in the macroeconomy. The plot shows a strong downward relationship between income and poverty through 1973. Episodic setbacks to poverty relative to macroeconomic performance occur in 1974 and more severely in the early 1980's. Backward shifts in the relationship between poverty and income are associated with decreases in per capita income and increases in the poverty rate. Only since 1994 has the relationship between poverty and income resembled that of previous years. Weaker macroeconomic performance and breaks in the growth of per capita income have clearly moderated any decreases in the poverty rate since the mid-1970's.

From 1959 until the late 1970's, fluctuation in the poverty rate paralleled changes in the performance of the macroeconomy. Business cycle upswings significantly reduced poverty while business cycle troughs increased poverty. Since the late 1970's, the relationship between economic performance and poverty is less clear. From 1959 to 1989, per capita growth averaged a fairly constant 2.7 percent. From 1959 to 1969 the poverty rate declined dramatically but only modestly during the 1980's. One major difference in the

Figure 4
Relationship between poverty and income, 1959-98



two periods was that from 1959-69 the growth in real GDP per employee was 2.1 percent, while it was only 1.1 percent from 1983 to 1989 (Blank and Card, 1993). If the historical relationship between economic expansion and poverty prevailed during this period, then the prolonged expansion observed from 1983 to 1989 would have reduced poverty to about 9.3 percent, the lowest in U.S. history. By 1989, however, the measured poverty rate was 12.8 percent, higher than in 1979.

Although earlier work by Gallaway (1967) and Aaron (1967) existed, it was not until the 1980's that a large number of economists turned their attention to the relationship between the macroeconomy and poverty.[3] This larger body of work, consisting of notable contributions from Blank and Blinder (1986), Cutler and Katz (1991), Blank (1993), Blank and Card (1993), Tobin (1994), and Powers (1995), quantifies the relationship between the poverty rate and the macroeconomy, particularly the relationship among poverty, unemployment, and inflation.

These studies, relying on stylized-reduced-form models, provide statistical estimates of the relationship between poverty and important macroeconomic variables. A typical approach hypothesizes the poverty rate

[3]Gallaway provided empirical evidence of a strong relationship between growth and poverty reduction and promoted general economic growth as an alternative to the Johnson-Kennedy antipoverty program. Aaron rebutted Gallaway's recommendations by arguing Gallaway's results were not robust to how his data were aggregated and how his statistical model was specified.

is determined by unemployment, inflation, wages, the relative poverty level or density of the income distribution, and a measure of government transfers. Inflation and unemployment are treated as if they have no influence on one another or are not partly determined by some common factor. The studies provide a heuristic statistical estimate of the relationship between poverty and specific macroeconomic variables.

Unemployment is consistently estimated to have a strong positive effect on the poverty rate, suggesting joblessness is responsible for pushing many households' incomes below the poverty level. The unemployment rate has been shown to be an important determinant of poverty, even though most unemployed are not poor and most poor are not unemployed. This finding is robust across empirical approaches and the period of study. The estimated effect of inflation on poverty is unclear. Estimated results are sensitive to how inflation is modeled. In some studies, inflation has a modest positive effect on the poverty rate (Blank, 1993; Powers, 1995), and in others it is associated with poverty-rate declines (Cutler and Katz, 1991). The literature, in general, finds inflation has a relatively minor effect on the incidence of poverty and on the well-being of poor and near-poor households.

A Changing Relationship Between Poverty and the Economy

The same body of work provides empirical support for a changing relationship between poverty and the macroeconomy during the last 30 years. Empirically speaking, this change or deterioration in the relationship between the poverty rate and economic performance has been identified as a growing prediction error in models explaining the poverty rate (Cutler and Katz, 1991; Blank, 1993; Tobin, 1994; Powers, 1995). These studies conclude that observed poverty rates are significantly higher than those that would have been predicted using only the macroeconomic variables in their models. Blank's study suggesting a change in the historical relationship between poverty and macroeconomic activity is illustrative. Building on her earlier study with Blinder, she explains the poverty rate with macroeconomic variables and a set of dummy variables. Blank estimates models for 1959-83 and 1959-89 and compares the coefficients and out-of-sample forecasts for the alternative models. When Blank combines the observed differences between parameter estimates for the alternative models and the poor forecast performance for the model estimated for 1959-83, she provides support for the belief in a structural break in the expected effect of macroeconomic performance on the poverty rate after 1983.

Although many reasons for the divergence between the historical poverty rate and economic growth have been advanced, only three or four are compelling. And unlike the structural break hypothesized in nearly all existing empirical studies, the most plausible explanations characterize the changing relationship between poverty and growth as a slower cumulative change occurring over one or possibly two decades, not in a discontinuous radical shift taking 2-3 years. The leading explanations for the increasing divergence between economic growth and poverty reduction are changing institutional wage-setting mechanisms with the decline of labor unions, a changing labor cohort, globalization of production and markets, shifting relative expenditures for goods and services, technological change associated with the digital revolution, and increased earnings instability.[4] The literature suggests no single cause is large enough to account for the divergence between economic growth and poverty, but labor market changes fostered by technological change and economic restructuring and shifts in relative wages are the most important.

The first empirical evidence of a changing relationship between economic growth and poverty appeared during the 1980's. Increases in labor use (number of hours worked), not productivity growth associated with increased real wages, drove GDP growth in the 1980's. Moreover, wage inequality increased during the 1980's. Although average incomes increased, the increases were largely among incomes of the nonpoor (Blank and Card, 1993). Evidence suggests younger workers earned less than older workers and returns to education increased, leaving less educated poor people less able to reap the benefits of economic expansion (Cutler and Katz, 1991).

During 1983-89, the economy grew around 4 percent per year, yet poverty fell modestly. Real wages declined for workers in the poorest 10 percent of the population (families below the poverty line). Over the expansion, a 1-percent increase in aggregate economic activity was associated with a 0.3-percent decline in weekly wages (Blank, 1993). Wage and career opportunities for many less skilled workers had deteriorated over the previous 15 years, which had resulted in increased earnings inequality. Earnings inequality has taken the form of polarization and the apparent hollowing out of the income distribution, with a decline in the middle of the distribution and increases in the upper and lower tails. The observed increase in earnings inequality has been driven by increased wage variation rather than changing hours of work. Polarization, combined with stagnant growth in average earnings, has increased the proportions of male workers with earnings below $20,000 and over $40,000 per year.

[4]Weisskopf, Bowles, and Gordon (1983) offer a different perspective. Their work highlights the importance of structural changes caused by crisis. Crisis occurs when the social structure of the economy changes. The post-war social structure was based on four key components each undergoing crisis since the mid-1960's: collective bargaining, government responsibility for the macroeconomy, anticommunist foreign policy, and control of domestic and international monetary systems.

Having earned income is the best way for one to climb out or stay out of poverty. Regardless of the theory applied, labor earnings is the product of two components: the hourly wage rate and the total number of hours worked. In the early 1980's, real hourly and weekly earnings declined from their peak in 1973, and the growth of worker productivity slowed. Moreover, earnings fell behind productivity. However, the share of labor in business value added stayed fairly constant (Cutler and Katz, 1991). Compensation, including fringe benefits, increased roughly in step with productivity: this is the labor cost that matters to firms. The rise in the wages of unskilled and less educated workers relative to skilled and better educated workers, a stylized fact of past business cycle recoveries, did not take place in the 1980's.

Research conducted during the early 1990's suggested that low wages, not less work, were responsible for lower earnings. For the working poor, low numbers of work hours appeared not to be a major factor in the incidence of poverty. Instead, evidence suggested that, based on the characteristics of the heads of poor households, the expected average wage rates were low (Levy and Murnane, 1992). Low as these expected wage rates were, the actual wages were lower still. More recent estimates suggest that a quarter of the earnings inequality among male workers between 1973 and 1991 could be attributed to differences in hours worked. These findings suggest that unequal distribution of work in the past tended to equalize earnings, whereas, today it magnifies income disparities.

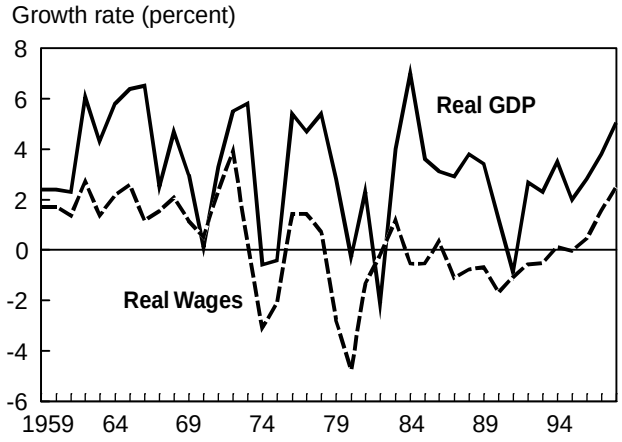
Part of the explanation for low wages relates to changes in the supply of labor witnessed over the last two or three decades. The labor force increased by 1.7 percent in the 1960's, 2.6 percent in the 1970's, and 1.6 percent in the 1980's. Changes in the supply of labor include both changes in the size and composition of the workforce. The most significant change has been the entry of an unprecedented number of baby-boomers into the labor force starting in the late 1960's and continuing through the late 1970's. In addition, there has been a historically unequaled rise in paid employment among women and, recently, large changes in the flow and composition of immigrant workers. The annual rate of immigration nearly doubled in recent decades. Recent immigrants have fewer skills and less education than did past immigrants who were from Europe or well-educated groups from less developed countries.

The large increase in effective labor supply, particularly among less skilled workers, put downward pressure on real wages. Even with unemployment rates of 4-5 percent, wage growth has been modest. During the last two decades, declining wages offset an increase in job opportunities. The growth of hourly real wages for production workers has lagged below the growth in real GDP for many years (fig. 5). The greatest divergence occurred in 1974-80 and 1983-88 when the growth in real wages was negative. Led by a strong economic recovery beginning in 1992, the rate of growth in real wages has improved, although it still remains below the growth in GDP.

Significant evidence points to changing technology as a key to explaining the stagnation of wages, particularly for low-skilled workers. The implications of this technological transformation can be readily explained using a traditional neoclassical model of the labor market. If competitive pressures in the labor market ensure the wage distribution reflects the skill distribution, a decline in job opportunities for low-skill workers will lower their wages, assuming supply does not decline. There are simply too many low-skill workers. Projections by the U.S. Bureau of Labor Statistics show the fastest growing occupations within most industries are those requiring high levels of education and skills.

Several studies indicate recent technological change has favored the more skilled over the less skilled (Welch, 1970; Davis and Haltiwanger, 1991; Katz and

Figure 5
Comparing gross domestic product and wage growth



Source: U.S. Department of Commerce, Bureau of Economic Analysis
U.S. Department of Commerce, Bureau of Census.

Murphy, 1992; Sachs and Shatz, 1994). Increased technological change linked with greater spending on research and development has been associated with increasing pay differentials between less educated and highly educated workers (Bartel and Lichtenberg, 1987). More recent studies indicate workers who use computers in the execution of their job received higher wages than those who do not (Krueger, 1993). These studies suggest the shift in demand away from unskilled and toward skilled labor in U.S. manufacturing is explained by the adoption of labor-saving technological change and a reallocation of production away from industries with a high labor production component (Berman, Bound, and Griliches, 1994).

Cross-sectional results reported by Doms, Dunne, and Troske (1997) show manufacturing plants that use many new technologies, programmable controllers, computer-automated design, and numerically controlled machines employ more educated workers, employ relatively more managers, professionals, and precision-craft workers, and pay higher wages. Their longitudinal analysis, which stands in modest opposition to the findings reported by Berman, Bound, and Griliches, shows little correlation between skills upgrading and the adoption of new technologies. They suggest that plants that adopt new factory automation technologies have more skilled workforces both before and after the new technologies are adopted.

The simple labor-market model notwithstanding, the transition to more advanced technologies caused by the discipline of the market need not reflect a clear, continuous path of adjustment. Instead, some firms may adopt alternative production strategies to forestall capital investment in an unfamiliar technology. In the presence of increasing competition, employers have reduced unit labor costs and increased flexibility in production with a variety of management strategies that do not require large financial outlays by following the low road (lower wages, little training, and fewer permanent employees). Lower wages, outsourcing production, reduced employee training, fewer permanent workers, relocation of operations to low-wage sites, and other employer policies aimed at reducing labor costs all had substantial effects on relative wage trends in the 1980's. This intermediate position between old and new technology suggests aggregate labor markets should not be viewed as seamlessly equilibrating wage and skill levels.

Estimating Key Relationships

For many years, macroeconomists analyzed time-series data using classical linear regression techniques. They tended to worry about questions of simultaneity and autocorrelation, but paid scant attention to specifying the dynamic structure of relationships. Implicit in their assumptions was that the data being analyzed were stationary, nicely behaved, or at least stationary around a deterministic trend. Disquieting research published in the 1970's called into question such methodologies. The first set of research provided evidence that forecasts made by structural macroeconomic models were inferior to forecasts made by simpler time-series models. More important for this study, a second set of research indicated that most macroeconomic data were not well behaved. Studies appeared claiming that most macro time series were not stationary, rather than stationary around a deterministic trend.[5] Nonstationarity could lead to serious problems when interpreting traditional statistics such as R^2, Durbin-Watson statistic, and the *t* statistic. Running regressions with nonstationary data produced spurious results.[6]

A restrictive but serviceable definition of stationarity requires that a stochastic process has a constant mean and variance and the covariance between any two values of the process depends only on the distance between the two points, not on time itself. Essentially, a stationarity assumption is equivalent to saying the stochastic generating process is itself time invariant, so that neither the form nor the parameter values on the process change through time. Any shocks to the system are temporary, and the series is expected to return to its mean value.

Nonstationary series that become stationary when differenced *n* times, are called integrated of order *n*. For a set of series to be cointegrated, each member of the set must be integrated of the same order, *n*; thus, the term cointegration. A set of series, all integrated of order *n*, are cointegrated if and only if some linear combination of the series is integrated of order less than order *n*. Such a linear combination is called a cointegrating relationship. Cointegration is a probabilistic concept. The difference or distance between two cointegrated random variables may be stationary, that is, fixed, despite the nonstationarity of the two variables. If the terms are not stationary, the two variables are likely to drift farther apart over time.[7] By definition, a stationary series is integrated of order zero.

A nonstationary variable tends to wander aimlessly. But some pairs of nonstationary variables can be expected to wander in a way that they do not drift too far apart because of the equilibrium forces that keep them together.[8] Nonstationary variables pose two threats to conventional regression analysis. The first threat to modeling arises with unrelated nonstationary variables that are random walks (this period's value is equal to last period's plus a random error).[9] Random walk processes are important. Many macroeconomic data are nonstationary because they are generated by a random walk process (Nelson and Plosser, 1982). Regressing two unrelated random walks against one another results in regression coefficients that are small in relation to their standard errors much less often than predicted using stationary regressors. Consequently, the use of standard distributions when the variables are unrelated and nonstationary will lead to too frequent rejections of the null hypothesis that there is no relationship between the two random variables.

The second threat arises with truly related nonstationary variables that are integrated of order one and the relationship is cointegrated. If a regression model is specified in terms of changes in the variables only, one misses the error-correction mechanism that connects cointegrated variables. Regressions involving the changes of cointegrated variables should also include the lagged levels of those variables, but with the constraints of the cointegrating relationship imposed (Engle and Granger, 1987). If one omits the cointegrating relationship, the regression in first differences is mis-specified.

[5]Nelson and Plosser (1982) discovered many macroeconomic time series have stochastic trends. By the mid-1980's, economists began employing statistical approaches to isolate independent trend and cyclical components in output. Watson (1986) modeled growth as a random walk with drift and the independent cyclical component as a second-order autoregression.

[6]These were not new problems. Yule identified the problem of spurious regressions associated with trending time series as early as 1926.

[7]In general, cointegration does not require the difference between the variables to be stationary. Two variables are cointegrated if there exists any linear combination of the variables that is stationary.

[8]This equilibrium or error-correction property is illustrated effectively and cleverly in Michael Murray's (1994) article, "A Drunk and Her Dog: An Illustration of Cointegration and Error Correction."

[9]Random walks have become prominent in the macroeconomics literature since the development of rational expectations.

For some time, spurious regressions associating nonstationary variables were avoided by conducting regressions on changes in the variables (Box and Jenkins, 1970; Granger and Newbold, 1974). Granger and Newbold pursued the problem of spurious regressions further leading to the development of the concept of cointegration (loosely speaking, lack of cointegration means spurious regression).[10] In stark contrast to differencing, cointegration analysis avoids errors by avoiding standard distributions and instead applies corrected or alternative distributions. The essence of cointegration is that the cointegrated variables share a common trend that is removed when producing the cointegrating regression residuals. Because of the common trend, there may be strong multicollinearity, tempting a researcher to drop a variable.

The estimation of a cointegrating relationship stands in opposition to purging the non-stationarity from the stochastic process by differencing and estimating with differenced variables. Differencing causes the loss of valuable information concerning the longrun equilibrium properties of the data. Sims (1980) and others argued that economic theory tells us too little about the dynamics of economic relationships to impose many useful restrictions on dynamic equations. Arguably, however, economic theory does tell us more about the longrun equilibrium relationships that hold among economic variables and hence may tell us quite a bit about what we should find in cointegrating relationships.

A stylized explanation of a procedure for estimating a cointegrated system has four steps:

1. Use a unit root test for stationarity and to determine the order of integration.
2. Run the cointegrating regression suggested by theory.
3. Apply an appropriate unit root test to the residuals to test for cointegration.
4. If cointegration exists, use lagged residuals from the cointegrating regression as an error-correction term in an error-correction model (ECM) with first differences.

A number of alternative approaches are available to test stationarity. The subject represents a virtual industry of arguments and counterarguments. Some of the more prominent approaches have been proposed by Dickey and Fuller (1979, 1981), Said and Dickey (1985), Phillips (1987), and Phillips and Perron (1988). The seminal work by Dickey and Fuller (1979, 1981) was criticized by Phillips and Perron as being insufficiently robust to consider time series with a structural break.[11] The vast majority of unit root tests have nonstationarity (a unit root in the time series) as the null hypothesis. Because the traditional classical testing methodology accepts the null unless there is strong evidence against it, these tests usually conclude that a series is nonstationary.[12]

Most tests for cointegration take the form of a unit root test applied to the residuals resulting from estimating the cointegrating (longrun) relation. The most appropriate methodology for estimating a cointegration model is not obvious, but there appears to be some consensus that the longrun cointegrating relationship is best estimated as a byproduct of a full error-correction formulation. The methods of Johansen (1988) and Stock and Watson (1988) can be used in this context, with the Johansen approach emerging as the method of choice. Some research, for example, suggests using the Johansen maximum likelihood procedure whenever more than two variables appear in a cointegrating relationship (Gonzalo, 1994).

The Johansen method views all variables as potentially endogenous, with each expressed as a linear function of lagged values of it and all other variables. The set of equations is expressed mathematically in the form of a single vector autoregression. Manipulation of this vector equation produces a vector error equation in which differenced vector terms are explained as lagged-differenced vector terms plus a lagged-levels term that represents the error-correction phenomenon. It turns out that the number of cointegrating vectors is equal to the rank of the coefficients associated with the levels variables in the error correction model matrix. The first step of the Johansen method consists of a test for the rank of this matrix. Following this, parameters of the system are estimated simultaneously, using maximum likelihood.

[10]Early concepts of multicollinearity can be viewed as presaging the modern concept of cointegration.

[11]Maddala and Kim (1998) provide a comprehensive review of unit root or stationarity testing.

[12]It is often difficult to reject the null hypothesis of a unit root because most tests have low power.

The Johansen approach has several advantages over other approaches. First, It avoids the problem of normalization that plagues other estimators. The second advantage relates to the first. Johansen guards against inconsistent estimation of the cointegrating relationship by incorporating knowledge that there may be more than one cointegrating vector. In addition, the maximum likelihood estimation of the shortrun dynamics increases the efficiency of the estimation, and a systems approach allows parameter estimates in any given equation to incorporate information from other equations. Finally, the Johansen method allows testing of restrictions on the cointegrating vector.

The major limitations of the Johansen method include sensitivity to assumptions regarding the underlying error distribution, a tendency to find spurious cointegration, and high variance and high probability of producing outliers. The Johansen procedure assumes that the errors are independent normal. When the errors are not, it has been found that the procedure has a distorted probability of rejecting the null hypothesis of no cointegration even when no cointegrating relations exist (Huang and Yang, 1996). In addition, there are size distortions in the tests for the second and subsequent cointegrating vectors when the ratio of data points to the number of parameters is small (Toda, 1994; Ho and Sorensen, 1996). Finally, parameter interpretation is often complicated. Because linear combinations of cointegrating vectors are themselves cointegrated, the Johansen procedure identifies the cointegration space, and not the cointegrating vectors.

Empirical Model

We distinguish between shortrun and longrun effects by adopting a model specification that explicitly allows for dynamics. There is little doubt that, when they exist, equilibrium relations can only be viewed in a long-term context because the speed of adjustment must be slow due to costly information-gathering and other transaction costs. Therefore, we assume a less restrictive hypothesis than annual equilibrium. We consider a model formulation that assumes a tendency in the specified relations to react to deviations. The cointegrating model we report here is estimated with four endogenous variables (the poverty rate, unemployment rate, wage rate, and the money stock) that highlight the importance of the relationship between poverty and the labor market. Output is assumed exogenous, and a linear trend drift term is included in the variables but excluded from the cointegration space.[13]

The logic of using unemployment, wages, and changes in the money supply, a proxy for inflationary expectations, to explain the poverty rate is straightforward if we consider how changes in macroeconomic variables are transmitted into poverty rates. As real wages rise throughout the economy, more workers might be able to earn sufficient income to escape poverty. Nearly all poor families rely on wages for most of their earned income. The unemployment rate is a general indicator of the health of the economy and an indicator of the possibilities of work. The business cycle is not neutral in spreading the burden of unemployment. Low-income wage earners bear a disproportionate share of unemployment in economic downturns, and given the importance of wages to the poor, business downturns are particularly devastating. The inflation rate is important for understanding the poverty rate because the poor often depend on unindexed income through government transfers, historically AFDC and general assistance programs, or the minimum wage.

Our analysis uses annual data for the period 1961-98. The base variables, their definitions, and sources are provided in table 1. The wage rate and output are estimated in real terms. All data are transformed using natural logarithms. In this analysis, stationarity and the order of integration were examined using Augmented Dickey-Fuller and the Phillips and Perron tests. In all series, the hypothesis of a unit root cannot be rejected. In addition, application of the Schwarz criterion and examination of autocorrelation and partial autocorrelation functions suggest that all variables in the analysis are reasonably represented by an AR(1) process and the order of integration is one.

The general root analytical construct is as a four-dimensional-vector autoregessive model with Gaussian errors. The basic model can be recast in an error-correction form:

$$\Delta z_t = \Gamma_1 \Delta z_{t-1} + \ldots + \Gamma_{k-1} \Delta z_{t-k+1} + \Pi z_{t-1} + \mu + \theta y_{t-1} \varepsilon_t$$
$$t = 1, \cdots, T \qquad (1)$$

[13]The assumption of exogeneity reduces the number of estimated parameters and improves the economic and statistical properties of the model. One explanation for the improved statistical properties of the model is the large number of interventions (changes in fiscal and monetary policy) throughout the period that have likely affected output and distorted the longrun relationship between output and the other variables in the model.

Table 1–Data definitions

Variable	Definition	Source
Poverty rate	Percent persons below the official poverty level. Not defined for people in military barracks, institutional quarters, or for unrelated individuals under age 15.	U.S. Department of Commerce, Bureau of Census
Wage rate	Average hourly earnings for production and non-supervisory workers	U.S. Department of Labor, Bureau of Labor Statistics
Unemployment rate	Civilian labor force, 16 years and older	U.S. Department of Labor, Bureau of Labor Statistics
Consumer Price Index	All urban consumers, all items, 1984=1	U.S. Department of Labor, Bureau of Labor Statistics
Money stock	M2 (Billion dollars)	Federal Reserve Board
Output	Gross National Product (billion dollars)	U.S. Department of Commerce, Bureau of Economic Analysis

where z_t is a 4 x 1 vector of stochastic variables, poverty rate, unemployment rate, wage rate, output, and the money stock, μ is a linear trend, y_t is the change in output, and $\varepsilon_1, \ldots, \varepsilon_t$ are normally, identically, and independently distributed $(0, \Sigma)$.

A characteristic feature of the error-correction formulation is that both differences and levels are included in the same model. This allows us to investigate both shortrun (cyclical) and longrun (equilibrium) effects in the data. The interpretation of the coefficients in terms of dynamic effects, however, is difficult. This is true in particular for the constant term, μ. Our model allows for linear trends in the data, but it is assumed that there are no trends in the cointegrating relations. The cointegrating relations have a zero intercept.[14] Formal testing and examination of the correlogram of residuals for each endogenous variable indicate that residuals are normally distributed and unencumbered by serial correlation.

The hypothesis of cointegration is formulated as hypothesis test of the rank of the Π-matrix:

$$H(r): \quad \Pi = \alpha\beta' \qquad (2)$$

where α and β are $4 \times r$ matrices of full rank. It is the Π matrix that conveys information about the longrun relationship between the variables contained in z. There are three possibilities: (1) if Π is of full rank, then z_t is stationary in levels and a vector-autoregressive model in levels is appropriate; (2) if Π has zero rank, then it contains no longrun information and the appropriate model is a traditional vector autoregressive model in differences; and (3) if the rank of Π is a positive number less than r, then the error-correction model described by equation 1 is appropriate. The hypothesis H(r) implies that the stochastic process Δz_t is stationary, z_t is nonstationary, but $\beta' z_t$ is stationary (Johansen, 1991).

The tests to determine the rank of Π, or the number of cointegrating vectors denoted by r, require the ordered eigenvalues, $\lambda_1^* > \ldots > \lambda_p^*$ from the characteristic equation,

$$\left| \lambda S_{kk} - S_{k0} S_{00}^{-1} S_{0k} \right| = 0, \qquad (3)$$

where $S_{ij} = T^{-1} \sum R_{it} R'_{jt}$ for i,j = 0,k and T is the sample size. The OLS residuals R_{0t} and R_{kt} are obtained by regressing Δz_t and z_{t-k} on $\Delta z_{t-1}, \ldots, \Delta z_{t-k+1}$ and an intercept.

The likelihood ratio test for the reduced rank hypothesis is:

$$-2 \ln Q\left(H_1(r) \middle| H_1(p)\right) = \left| S_{00} \right| \sum \ln(1 - \lambda_i^*), \qquad (4)$$

which is called the Trace statistic. An alternative test statistic called the λ_{max} (Maximum Eigenvalue) statistic is based on the comparison $H_1(r)$ given $H_1(r+1)$:

$$-2 \ln Q\left(H_1(r) \middle| H_1(r+1)\right) = T - \ln(1 - \lambda_{r+1}). \qquad (5)$$

The null hypothesis of the likelihood ratio test is that $\lambda_{r+1} = \lambda_{r+2} = \ldots = \lambda_p = 0$, which means the system has p - r unit roots. To determine the cointegration rank, one uses a sequence of hypotheses starting with the hypothesis of p unit roots. If this hypothesis is rejected, it implies that λ_1 is greater than zero and one continues to test the hypothesis $\lambda_2 = \lambda_3 = \ldots = \lambda_p = 0$. Rejection of this hypothesis implies λ_2 is greater than zero and so forth. When the hypothesis is accepted, one has the number of unit roots and thereby the number of cointegration vectors. A full discussion of the two test statistics is given in Johansen and Juselius (1990), and the mathematical derivation of the asymptotic distributions is given in Johansen (1988).

The maximum likelihood tests developed by Johansen (1991, 1992) and Johansen and Juselius (1990, 1992) can distinguish more than one cointegrating relation and can be applied in a multivariate setting. The final determination of the number of cointegration vectors is based on results of these formal tests, the interpretability of the estimated coefficients, and graphical comparison of the residuals associated with the cointegrating vectors and the residuals associated with the cointegrating vectors corrected for shortrun dynamics.[15] Our modeling system is estimated to have one cointegrat-

[14] An alternative model allowing for linear trends in variables and the cointegration space was also estimated. Neither the maximum eigenvalue, trace test, or parameter values indicated a significant difference from the more parsimonious model.

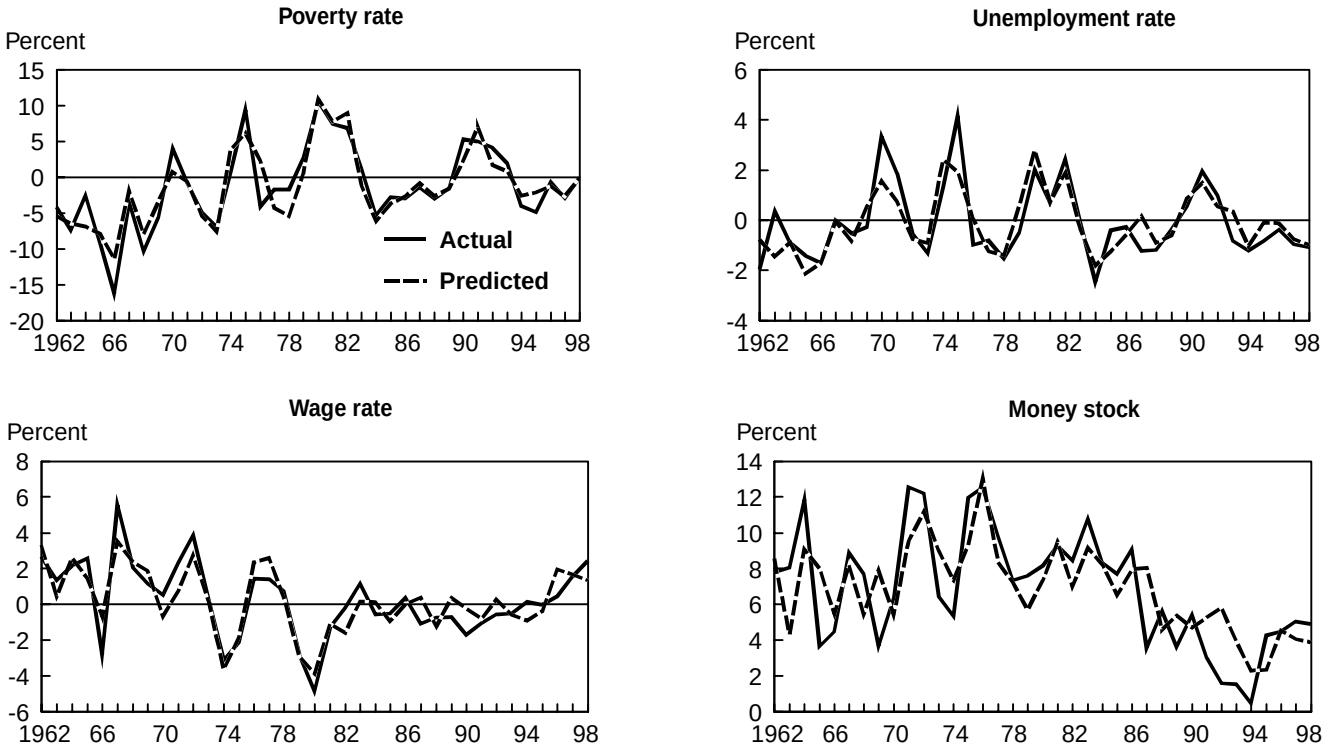
[15] The graphs of the cointegrating relations corrected for shortrun dynamics look more satisfactory than the graphs of actual deviations. This illustrates the tendency of the model to move toward an equilibrium state and supports the existence of a cointegrating relationship. Equilibrium need never be attained because of frequent and often large shocks pushing it away from the equilibrium path.

Table 2—Cointegration test statistics*

Eigenvalues	H_0: r	p-r	Test statistic		Critical values (95%)	
			Maximum eigenvalue	Trace	Maximum eigenvalue	Trace
0.6294	0	4	36.73	60.24	27.07	47.21
0.3662	1	3	16.87	23.51	20.97	29.68
0.1626	2	2	6.56	6.64	14.07	15.41
0.0021	3	1	.08	.08	3.76	3.76

*Critical values for the maximum eigenvalue and trace tests are from Osterwald-Lenum (1992).

Figure 6
Actual and predicted changes, 1962-98

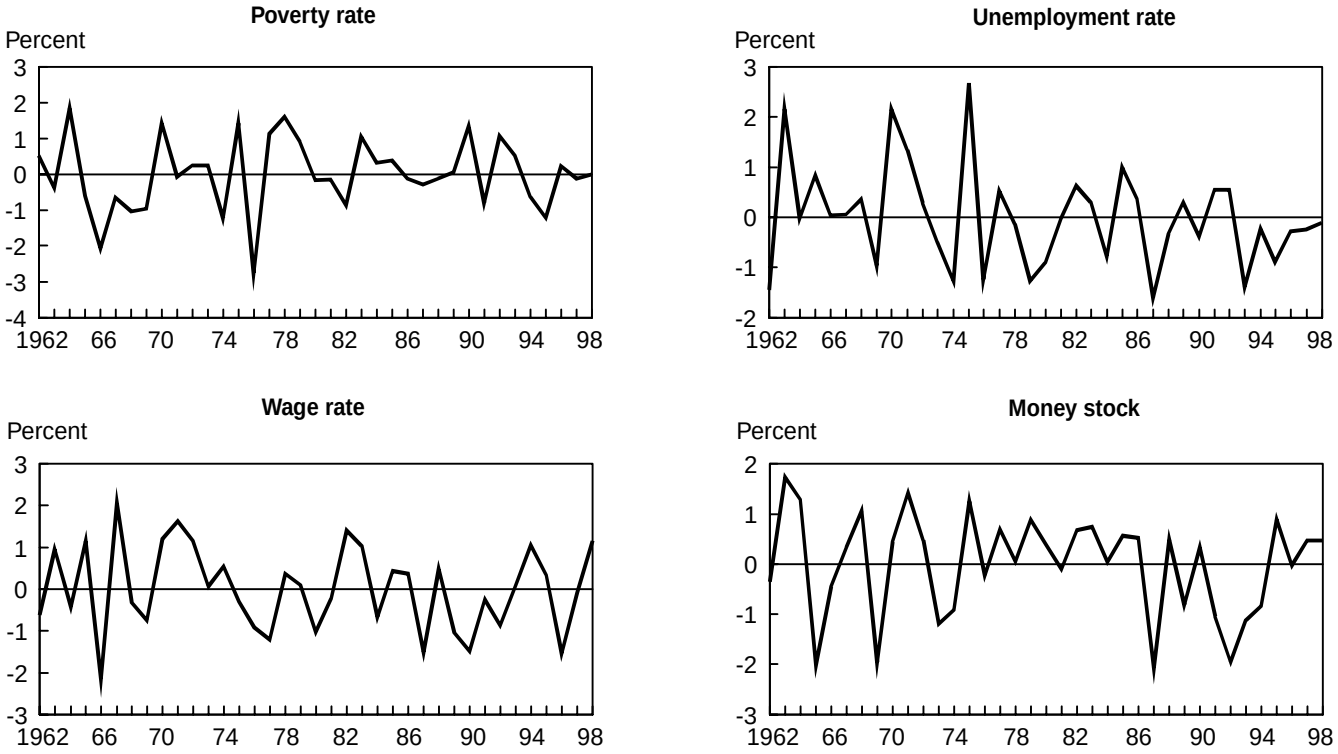


ing vector. Maximum eigenvalue and trace statistics are provided in table 2.[16]

The estimated modeling system parallels the observed values of the endogenous variables, changes in the logarithm of the poverty rate, unemployment rate, wage rate, and money stock (fig. 6). Associated standardized residuals for each endogenous variable are provided in figure 7. The pseudo R^2 for each endogenous variable is 0.82 (poverty), 0.67 (unemployment), 0.77 (wage), and 0.55 (money). The largest prediction errors for the poverty rate and unemployment rate occur during the economic instability of the 1970's. The largest errors for the money stock and wage rate predictions occur during the 1990's. The residuals show no strong trends or patterns in the predictive errors although residuals for the change in the money stock show a tendency for overprediction (underprediction of the decrease) during the 1990's.

[16]Because the nonstationary variables in our analysis are integrated of the same order and there exists a unique cointegrating vector, the OLS estimators of the cointegrating vector are consistent and highly efficient.

Figure 7
Standardized residuals, 1962-98



Output growth has the largest cyclical effect on poverty (table 3).[17] A 1-percent increase in real gross domestic product decreases the poverty rate by 1.4 percent. Although no other variable approaches the potent effect of output on the poverty rate in the short term, changes in unemployment and the wage rate should not be ignored. A 1-percent increase in the wage rate decreases the poverty rate by 0.7 percent. A 1-percent increase in the unemployment rate, unaccounted for by changes in the growth of the economy, increases the poverty rate by .06 percent. Increases in the real money stock, acting as a proxy for inflationary expectations, increase the poverty rate. With all other variables constant, poverty in one year fosters poverty the next.

One should be mindful that the expected effect of a change in a macroeconomic variable on the poverty rate depends on the elasticity of the response and the size of the change in the variable. In general, changes in annual real wages are small (1.6 percent) and changes in the unemployment rate are large (12 percent). The mean annual change for the poverty rate is 4.7 percent, the money stock is 6.8 percent, and output (GDP) is 3.4 percent.

Output growth also has a powerful cyclical effect on reducing unemployment. Increases in the lagged poverty rate are associated with decreases in the current unemployment rate, perhaps presaging improvement in labor market conditions. Increases in the wage rate and money stock decrease unemployment, although the effects are small and statistically insignificant. Poverty decreases wages. Output and the money stock have positive cyclical effects on the wage rate, 0.319 and 0.275 percent. That is, inflationary expectations and economic growth put upward pressure on wage rates. The lagged unemployment rate is also associated with increases in wage rates though at levels far less than the money stock and economic growth.

The linear drift term, μ, measures the effect of time on changes in the poverty rate, unemployment rate, wage rate, and money stock (table 3). The effect of the linear drift term is to decrease the poverty rate by nearly 0.3

[17]Although the individual parameter estimates are difficult to interpret because of the autoregressive representation of the model, the estimated coefficients provide insights into the overall performance of the model.

Table 3–Estimated cyclical (shortrun) effects*

Variable	Δpov_{t-1}	Δu_{t-1}	Δw_{t-1}	Δm_{t-1}	Δy_{t-1}	μ
Δpov_t	0.140	0.063	-0.743	0.260	-1.419	-0.275
	(1.28)	(1.56)	(-2.69)	(1.50)	(-7.35)	(-0.60)
Δu_t	-0.728	0.529	-0.041	-0.085	-4.767	1.243
	(-1.84)	(3.65)	(-0.04)	(-0.14)	(-6.83)	(0.76)
Δw_t	-0.145	0.032	0.210	0.319	0.275	-1.257
	(-3.17)	(1.93)	(1.81)	(4.39)	(3.41)	(-6.83)
Δm_t	-0.280	0.133	- 0.612	0.447	0.056	0.582
	(-2.77)	(3.58)	(-2.39)	(2.79)	(0.31)	(1.39)

* Asymptotic t-statistics in parentheses. Estimated values based on one cointegrating vector. Variable definitions: Δpov_t is the change in the logarithm of the poverty rate in period t, Δu_t is the change in the unemployment rate, Δw_t is the change in the real wage rate, Δm_t is the change in the money stock, Δy_t is the change in real GDP, and μ is the linear drift term.

percent per year, decrease expectations of rising prices (0.582 percent per year), increase the unemployment rate by about 1 percent, and decrease the hourly wage rate by 1 percent per year. The asymptotic t-statistics suggest support is warranted for the results associated with the wage rate, but less so for the effects on the money stock, poverty, and unemployment.

The estimated cointegrating vector describes a long-run equilibrium among our endogenous variables. These variables are linked in a long-term relationship irrespective of short-term interventions or shocks. Because the estimated cointegrating vector is common to each of the endogenous variables, it can be viewed as a constraint on the shortrun movement of variables. If the cointegrating vector is normalized on poverty, it can be recast as:

$$pov = + 0.147u - 3.329w - 0.091m \qquad (6)$$

where pov is the poverty rate, u is the unemployment rate, w is the real wage rate, and m is the money stock. All the variables are levels rather than changes and are transformed using natural logarithms. The estimated equilibrium relationship provides a plausible longrun relationship between the poverty rate and the macroeconomic labor market. The longrun relationship suggests the poverty rate is increased by the level of the unemployment rate and decreased by higher wages and money stocks. The longrun poverty relationship is dominated by changes in the wage rate. The estimated relationship represented by equation 6 suggests a 1-percent increase in the real wage rate is associated with a decrease in the poverty rate of about 3 percent. The money stock also has an important long-term relationship with poverty. A 1-percent increase in the level of the money stock is associated with a decrease in the poverty rate of 0.1 percent.

Output is treated as exogenous and excluded from the longrun relationship. In models with endogenous output, relationships among variables were characterized by illogical and insignificant parameter values in both the short run and long run. These problems were likely caused by the high correlation between the money stock and output when measured in levels. The contemporaneous correlation between these two variables is 98 percent over the sample. In the more parsimonious model, which excludes output from the cointegrating vector, we interpret the money stock as a measure of the size of the economy or nominal output, which is negatively related to poverty.

Disaggregating Poverty

If the effect of the macroeconomy on the poverty of different demographic groups is heterogeneous, then understanding requires that the analysis be disaggregated. The poverty rates of some groups may be highly sensitive to economic growth; other groups may be barely affected.[18] In this case, aggregate statistics provide weakened evidence for or against the backwash thesis—the thesis that poverty will not largely disappear with growth.

Sufficient data exist to decompose our more aggregate analysis by estimating poverty rate/macroeconomic relationships for four categories of the poor: white, black, female head white, and female head black. As in the aggregate model, the number of cointegrating vectors is determined through formal testing, the interpretability of the estimated coefficients, and graphical comparison of the residuals associated with the cointegrating vectors and the residuals associated with the cointegrating vectors corrected for shortrun dynamics. Statistical and graphical information for each indicated the presence of a single cointegrating vector. Statistics for the trace and maximum eigenvalue tests are provided in table 4.

Observed and predicted changes in poverty rates for black, white, white female-headed, and black female-headed population groups are provided in figure 8.[19] Prediction errors associated with the white female-headed households can be attributed to the generally large off-trend gains made by white women during the last two decades. The predictions for each of the poverty rates display more noticeable errors for 1992-98. The errors are underpredictions. That is, each of the models predicted a smaller change in the poverty rate than was observed. Overall, however, the residuals show no apparent trends or pattern in their predictive errors through time.

Model results across all households indicate that changes in output have the most significant (statistically and economically) cyclical effect on changes in the poverty rate (table 5).

Table 4–Cointegration test statistics for population groups*

	Test statistics			
	H_0:2		H_0:3	
Population group	Maximum eigenvalue	Trace	Maximum eigenvalue	Trace
Critical value (95%)	**27.07**	**47.21**	**20.97**	**29.68**
White	32.01	53.88	17.13	21.87
Black	35.48	62.44	15.03	26.96
Female head white	31.79	56.02	18.78	24.24
Female head black	34.66	62.06	14.30	27.39

*Critical values for the maximum eigenvalue and trace tests are from Osterwald-Lenum (1992).

The size of the cyclical effect depends on the level of aggregation and the household considered. Output effects are greatest for poor white and least for poor in families headed by black females. When output increases by 1 percent, overall white poverty declines by 1.6 percent, and black female-headed households by 0.6 percent. Increases in the unemployment rate uniformly increase the change in poverty rate, but the effect appears important only for the poor in households headed by white females.

Changes in the wage rate are important for poor whites and blacks. Estimates for whites and blacks are similar and suggest a nearly one-for-one negative relationship between changes in the wage rate and poverty. However, results suggest economic policies aimed at alleviating poverty through changes in the wage rate will have differential impacts on poor female-headed households compared with other poor households. Wage-oriented policies will have a more significant effect on the poor in households headed by black females and a small effect, if any, on poor households headed by white females. The poor in households headed by white females are strongly affected by the linear drift term. The linear drift term is small and statistically insignificant for all other population groups but suggests time-related improvements in poverty for the poor in households headed by white females and increases in poverty for the poor in households headed by black females. Shortrun changes in lagged poverty consistently increase current changes in the poverty rate for all groups except poor households headed by white females. This result reinforces the idea that changing social or demographic conditions for this

[18]In 1998 68 percent of poor households were white (white not Hispanic 46 percent, white Hispanic 22 percent), 26 percent were black, and 6 percent were other. Across all racial and ethnic groups, female-headed households contrasted starkly with married-couple households. Families with a female head, no husband present, had the highest poverty rate (30 percent) and comprised the majority of poor families (53 percent).

[19]Predictions are made for each endogenous variable. Only the results for the poverty rate are reported here.

Figure 8

Predicted change in poverty rates for demographic subgroups

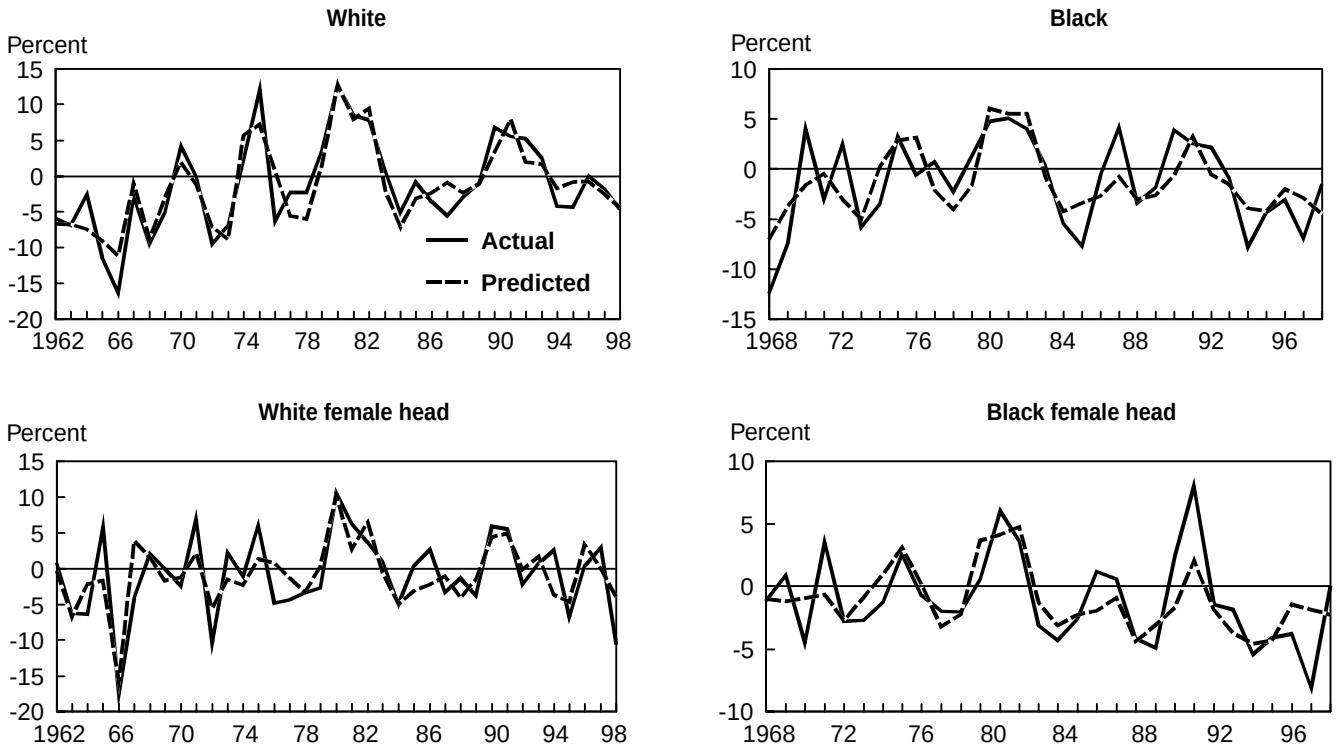


Table 5—Estimated cyclical (shortrun) effects on the change in the poverty rate by population groups[1]

	Δpov_{t-1}	Δu_{t-1}	Δw_{t-1}	Δm_{t-1}	Δy_{t-1}	μ
All[2]	0.140	0.063	-0.743	0.260	-1.419	-0.275
	(1.28)	(1.56)	(-2.69)	(1.50)	(-7.35)	(-0.60)
White	0.115	0.051	-0.836	0.098	-1.603	-0.050
	(0.93)	(1.05)	(-2.54)	(0.44)	(-6.79)	(-0.09)
Black	0.135	0.048	-0.727	0.430	-0.842	-0.205
	(0.75)	(0.87)	(-1.88)	(1.85)	(-2.96)	(-0.77)
Female head white	-0.301	0.157	0.161	0.699	-1.325	-0.641
	(-2.31)	(3.22)	(0.40)	(2.89)	(-4.55)	(-3.23)
Female head black	0.166	0.014	-0.523	0.606	-0.615	0.191
	(0.95)	(0.32)	(-1.76)	(3.65)	(-2.77)	(1.67)

[1]Asymptotic t-statistics in parentheses. Estimated values based on one cointegrating vector. Variable definitions: Δpov_t is the change in the poverty rate in period t, Δu_t is the change in the unemployment rate, Δw_t is the change in the real wage rate, Δm_t is the change in the money stock, Δy_t is the change in real GDP,and μ is the linear drift term.

[2]Parameter estimates for the group "All" are taken from table 3 and are included to facilitate comparisons.

cohort may play a relatively larger role in the determination of poverty than for the other cohorts. Inflation is positive for all groups but most important for the poor in households headed by females.

A single cointegrating vector is present for each population group. The equilibrium relationship for these households is rewritten to highlight the relationship between the poverty rate and the other economic variables. If the cointegrating vector is normalized on poverty, it can be recast as:

$$
\begin{aligned}
povw &= +0.105u - 3.824w - 0.050m \qquad (7)\\
povb &= +0.144u - 2.823w - 0.218m\\
povfhw &= +0.025u - 2.025w - 0.013m\\
povfhb &= +0.098u - 1.688w - 0.199m
\end{aligned}
$$

where povw is the poverty rate for poor white, povb is the poverty rate for poor black, povfhw is the poverty rate for poor households headed by white females, povfhb is the poverty rate for poor households headed by black females, u is the unemployment rate, w is the real wage rate, and m is the real money stock. A fixed longrun relationship is estimated to exist where the poverty rate is increased by unemployment and decreased by growing wages and the money stock. Wage and unemployment effects are greatest for the aggregate categories of black and white and lower for the poor in female-headed households. Money stock effects are greatest for the black poor, irrespective of household head.

The Nature of Our Findings

Our inquiry assesses how change in the economy affects the proportion of people living in poverty, as well as how the economy affects poverty for different races and households. Our assessment of economic effects provides empirical evidence about the likely efficacy of alternative longrun and shortrun strategies to reduce poverty.

Evidence drawn from our study supports a mix of cyclical and longrun approaches to alleviate poverty. An effective approach depends importantly on the dynamics of the macroeconomic-poverty relationship and the population considered. Our empirical results weaken the belief that output growth acting alone will significantly and permanently reduce poverty in the United States. Instead, the results suggest complementing growth strategies with targeted interventions that may lie outside the traditional sphere of monetary and fiscal policy. Targeted wage or education policies, for example, may be more efficacious for reducing poverty for households headed by black females than undifferentiated growth.

Our focus on the macroeconomy and poverty abstracts from countless issues and complications. Poverty, a complex phenomenon, has an etiology that crosses disciplinary boundaries. A complete explanation of why individuals are poor requires integrating many disciplines and competing theories. Theories and models explaining poverty have included cultural determinism, population and demographic explanations, Marxian dialectics, and neoclassical economic growth. An understanding of population and family demographics, for example, requires theories of marriage, divorce, and fertility. A complete inquiry into poverty would also include an understanding of society's judgments of basic needs and how they change over time. And because nearly all income for a poor family is wage income, we also need to know how labor markets function and how individuals respond to market incentives and income transfers.

Our empirical analysis rests on the official definition of poverty. We use this definition because it is widely available, well documented, copiously studied, and used to set eligibility standards for public programs. A different definition of poverty would likely lead to a different estimated relationship between poverty and economic growth and change our results and perhaps our policy guidance.

The official poverty definition abstracts from any distribution of poverty. An alternative measure based on the additional income needed to bring all poor to the level of the poverty line, for example, would likely magnify the importance of the relationship between poverty and the economy. Other views of poverty are likely to suggest still different relationships between the poor and the macroeconomy. Increasingly, objections are raised about using income as the basis for measuring poverty. Income is not an accurate measure of the extent of poverty because the level of income does not accurately represent inequality of opportunity. Quality of life depends not only on income, but also on the variety of physical and social characteristics that affect lives.

Variations in physical and social characteristics largely neglected by economics, affect how income is converted into consumption. Money income, therefore, is an incomplete measure of a family's potential to satisfy basic needs. It often omits many goods and services such as housework and child care provided within a household, rather than purchased. A definition of poverty that relies on the capability to convert income into utility suggests a weaker link with the economy because additional emphasis is placed on issues that may not be macroeconomic at their foundation. They include concerns about disabilities, discrimination, demographics, and even the community.

Changes in the market for labor is central for understanding changes in poverty. Changes in the real wage rate—and not hours worked as reflected in the change in output—are the most important determinant of long-term changes in poverty. This conclusion is supported by our estimate of the equilibrium relationship among poverty, unemployment, wages, and money stocks. This finding is consistent with previous research conducted in the early 1990's suggesting that low wages, not less work, was responsible for lower earnings. For the working poor, low numbers of work hours appeared not to be a major factor in the incidence of poverty among households headed by either men or women.

A bifurcated labor market and labor force has had significant effects on the poor. The shift in demand away from unskilled and toward skilled labor in U.S. manu-

facturing is explained by the adoption of labor-saving technological change and a reallocation of production away from industries with production based on unskilled labor. Over the last two to three decades, industrial restructuring, technological change, and shifting relative expenditures for services have reinforced the effects of the entry into the workforce of a well-educated labor cohort. The less skilled and more poorly paid workers have suffered as the relative demand for highly skilled labor has increased, and workers, in general, have seen their relative compensation affected by profits and wages in other countries. A large increase in effective labor supply, among less-skilled workers, has put downward pressure on real wages and declining real wages have offset an increase in job opportunities.

Unemployment is consistently estimated to have a strong positive cyclical effect on the poverty rate, suggesting that joblessness is responsible for pushing many household incomes below the poverty level. This finding is robust across empirical approaches and the period of study. Our results modify this story. Although decreasing unemployment certainly reduces poverty, increasing output and the hours worked by those already employed is likely to be the most efficacious way to reduce poverty in the short term. This result contrasts sharply with the long-term equilibrium results that emphasize the role of the real wage rate as the most effective mechanism for decreasing poverty.

The literature consistently finds inflation has a relatively minor effect on the incidence of poverty and on the well-being of poor and near-poor households. The estimated effect of inflation on poverty is sensitive to how it is modeled. In some studies, inflation has a modest positive effect on the poverty rate, and in others it is associated with poverty-rate declines. In this analysis, increases in the real money stock, acting as a proxy for inflationary expectations, decrease the poverty rate.

The poor are not homogeneous. Poverty rates differ significantly by race, sex, and household head. Focusing on the change in the aggregate poverty rate through time and over the business cycle disguises different experiences among demographic groups. To understand the effects on important demographic groups requires that the analysis be disaggregated. The poverty rates of some groups are more sensitive to output growth; other groups are less affected. The existence of significant differences between groups strengthens arguments for antipoverty programs of a selective character, and weakens the argument for relying solely on economic growth to reduce or eliminate poverty. Changes in the poverty rates for white households, including households headed by females, are more volatile than changes in the poverty rate for black households. The most difficult poverty rates to explain are associated with white female-headed households. We attribute this difficulty to the large off-trend gains made generally by white women during the last two decades. The predictions for each of our population cohorts display noticeable errors for 1992-94, suggesting a temporary breakdown in historical relationships.

Changes in output are the most important shortrun determinant of changes in the poverty rate for each demographic group. The size of the effect, however, depends on the household considered. Longrun economic effects on poverty for most households are also dominated by the wage rate. Changes in the level of the wage rate have the most significant longrun effect on decreasing poverty for white households, less so for black households. Increases in the money stock (nominal output) decrease poverty, and increases in the unemployment rate increase poverty in the long run for all demographic groups.

The most direct policy intervention to reduce poverty is to redistribute income by government fiat. Recent welfare legislation, however, suggests a greater reliance on individual and family responsibility and less on the government. This legislation has raised fundamental questions about the proper role of government. Attempts to rewrite the social contract call for increased reliance on the private sector to provide, through investment and growth, the basic goods and services needed by all consumers, particularly poor ones. Reformers envision replacing the welfare state, or at least modifying it, with institutions that place greater emphasis on individual rewards and consumption consistent with contributions to society's economic output.

Although considerable antipoverty rhetoric has emphasized work, a key to permanently reducing poverty is to improve the returns to labor. While the economy has generated many jobs, wages and benefits are often insufficient to lift a family out of poverty. Improvements in education and job training are likely to be

important venues for improving wages for the poor, but an effective strategy must be more comprehensive than simply increasing spending on school infrastructure or decreasing student-teacher ratios. The connections between education and the economy are complex and interdependent. The economy affects the attractiveness of education by creating incentives for the poor to continue schooling. In addition, family structure and stress on and access to learning resources and experiences have important implications for educational success. Policy cannot, therefore, focus solely on educational institutions to increase the quality of and returns to workers. Attention and financial resources must focus on the lives of children in and out of school if we are to improve the knowledge, abilities, and attitudes of our future workforce and foster market-driven reductions in poverty.

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