EXTERNAL APPENDICES TO CHAPTER 4

Appendix X-4.1: INCOME DISTRIBUTION REGRESSION

This appendix is jointly written with my Swarthmore College colleague Phillip Jefferson and appears in a somewhat different version in Jefferson and Pryor (2001). Before carrying out the statistical exercise, several pressing methodological issues need to be addressed.

A. Definition of Income

It is customary to analyze income distribution problems either in terms of some overall measure of income inequality or in terms of the shares of total income received by different groups. The first approach often does not distinguish between different income behavior at the two extremes of the income distribution. It also does not allow the impact of causal factors influencing only one tail of the income distribution to be clearly isolated. The second approach raises problems concerning the very poor and the very rich. More specifically, considerable underground economy income is not included in the measurement of income for either and, as a share of reported income, this is particularly important for the very poor who, ostensibly, do not have employment. Among the top income receivers, one important source of income is also excluded, namely capital gains (both realized and unrealized). Our approach avoids most of these problems.

We have chosen to focus on family money income before taxes (income and property) because this series is available for the longest period (the sources are discussed in Section H of this appendix). This definition of income omits capital gains, non-monetary income (such as imputed rents of owner-occupied housing or non-monetary fringe benefits such as health insurance), and the impact of taxes. Studies using shorter time series have employed a broader definition of income and, in addition, have focused on adjusted

income per person, where each person in a family is considered to have an income equal to the total family income divided by the adjusted number of people in the family. While these latter measures of income provide a better picture of welfare, the time-series patterns of these various measures of income inequality are basically the same as our series.

We focus attention on incomes at the 10^{th} and 95^{th} percentiles of the income distribution, rather than following the usual practice of using average incomes of those from the zero to the 10^{th} percentile or from the 95^{th} to the 100^{th} percentile. This is to minimize the problems noted above arising from omission of particular sources of income of families at these extremes of the income distribution. To standardize our data for comparison between years, we calculate the ratio of family income at these various percentiles to the median income. In a fuller exposition of this model (Jefferson and Pryor, 2001), we also test our propositions using the data from the 20^{th} and 80^{th} income percentiles.

B. Specification Issues

In the specification of the determinants of income inequality, many economists assume that all causal factors operate within a relatively short time period. For instance, Bishop, Formby, and Sakano (1994) analyze income shares only in terms of contemporaneous variables and note (footnote 9) that none of their results hold if lags are introduced, which we find worrisome. Their approach contrasts with that of Blank and Blinder (1986), who analyze the distribution of income in a given period in terms of various determinants and an equilibrium income distribution which takes some time to achieve. Assuming a simple geometric distributed lag, their final specification is: $Y_t = a + bY_{t-1} + cX_t + e_t$, where Y is the income share measure, X is a vector of determinants, and e is a random variable. Our initial approach (Table X-4.1) starts out with a similar specification.

We also assume that different causal forces influence relative income levels at the low and high end of the income distribution. For instance, the percentage of single parent families should have little influence on the relative income level of those in the 95th percentile. We also try to select variables that are linked with the relative income level by some discernible mechanism.[1]

To explain relative income levels of those in the 10th percentile of the income distribution, we have selected four variables: the lagged value of the relative income level; the percentage of one-parent families; governmental (federal, state, and local) monetary welfare expenditures as a percentage of aggregate wages and salaries; and the weakness of the labor market as measured by the percentage of prime age men (those between 25 and 50) who are jobless. This latter series is more appropriate than a standard measure of unemployment because it includes discouraged workers and others without employment, who are not counted among the unemployed under the government's current methodology. This joblessness rate fluctuates much less than the unemployment rate and seems to reflect more accurately the long-term trend in labor market conditions.

To explain relative income levels in the 95th percentile, the choice of variables is not so easy, except, of course, for the lagged value of the dependent variable. A promising causal variable is the share of women working. Men are likely to marry women with roughly their same level of education. Highly

[1] In contrast, some studies of income inequality include variables both for unemployment and inflation. Although the linkage between labor market weakness and relative money income in the lowest part of the income distribution is clear, its linkage with the top part is not. Furthermore, once labor market variables are included in the regressions, the theoretical linkage between inflation and income inequality is not apparent. Certainly annual price increases and the higher interest rates accompanying them should have little impact on the money income of the poor; for the rich, their interest income may be higher, but this is a very minor part of their total income. For these reasons we have not included an inflation variable.

educated women, in turn, earn more than those with less education. Since employment rates of less educated prime age women did not change greatly between 1964 and 1994, while such employment rates among women with more education increased (Pryor and Schaffer, 2000, p. 8), family incomes of highly-educated (and well-paid) men should rise faster than family incomes of less-educated (and less well-paid) men. This conjecture receives empirical support from the detailed analyses of Current Population Survey data by Burtless (1998) and Karoly and Burtless (1995).[2]

To test the rich-at-the-expense-of-the-poor hypothesis offered by many Marxists and populists, we also include the relative income level of those in the 95th percentiles to help explain relative income of those in the 10th percentiles. The reverse procedure is used to help explain relative income of those in the 95th and 80th percentiles.

C. Initial Results

The variations over time of the income shares at the opposite ends of the income distribution are quite different. Between 1947 and 1997, the income at the 10th percentile varied only between 25.9 and 33.5 percent of the median income; with a coefficient of variation of 6.5 percent. In contrast, at the 95th percentile, the variation was between 231.5 and 309.5 percent of the median income with a coefficient of variation of 8.6 percent.

The most appropriate first step for exploring the relationship between relative incomes at the two

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[2] It might be argued that we should include some indicator of the share of property income or the profit rate, since these are related to the income of the rich, but not the poor. Such variables, however, raise a serious simultaneity problem in the model for the income of the rich (discussed in Jefferson and Pryor (2001). Moreover, experiments with this variable at a very early stage of the research showed that it added very little explanatory power to the regressions reported in Table X-4.1. and, as a result, it was dropped from further consideration.

Table X-4.1: Two-Stage Least Squares Regressions Explaining Relative Income Levels, 1948 - 1997
Contemporaneous values of independent variables (except lagged dependent variable)

Dependent variables:	Relative income level at 10th percentile		Relative income level at 95th percentile
Regressors:			
Constant	+0.493*	Constant	+1.995*
	(0.100)		(0.585)
Dependent variable lagged one year	+0.148	Dependent variable lagged one	+0.506*
	(0.162)	year	(0.111)
Year (1947 = 1)	+0.0026*	Year (1947 = 1)	+0.0101*
	(0.0005)		(0.0049)
Relative income at 95th percentile	-0.082*	Relative income at 10th	-2.349*
	(0.025)	percentile	(0.705)
Prime age male joblessness rate	-0.088	Share of women in labor	-0.675
	(0.094)	force (>19)	(1.078)
Ratio of governmental money transfers to total compensation of employees	+0.689*		
	(0.237)		
Percentage of female headed families	-0.901*		
	(0.300)		
Adjusted-R^2	0.8657		0.9585
Durban-Watson	1.746		2.051

Notes: Standard errors in parentheses. An asterisk designates statistical significance at the 5 percent level; a double asterisk, at the 10 percent level. Sources of data are presented in Section H of this appendix. For results of similar regressions for the 20th and 80th income percentiles, see Jefferson and Pryor (2001).

extremes of the income distribution is to estimate a simultaneous equation system, where the dependent variables of the two equations are the relative income ratios at the 10th and 95th percentile. Table X-4.1 presents the results of such a calculation, using two-stage, least-squares approach, which can be quickly summarized. In both regressions, the sign of the variable reflecting the relative income level at the opposite end of the income distribution is negative and statistically significant. In short, the relative (to the median) income levels of the rich and poor move in opposite directions. For the 20th and 80th percentiles (Jefferson and Pryor, 2001), the same inverse relationships between relative incomes are found, but the coefficient for the 80th percentile income ratio as an explanation of the relative income at the 20th percentile is not quite statistically significant.

On a descriptive level, therefore, the populist and Marxist political rhetoric about the rich getting richer at the expense of the poor appears correct. These calculations using contemporaneous variables do not indicate, however, whether the relation is causal or spurious, or whether both relative income variables are influenced by some other unspecified variables. It is necessary, therefore, to examine this problem in greater depth.

D. Testing for Spurious Correlation

It is possible that the relative income levels of the rich and poor are inversely correlated because both wander away from a determinate trend in the opposite direction. In order to explore this possibility, we start by examining a key stochastic property of the individual data series, namely, whether they have unit roots. Table X-4.2 shows the results of tests of the null hypothesis of the existence of a unit root in all

Table X-4.2: Augmented Dickey-Fuller (ADF) Tests

	No trend		Trend	
Relative income level at the 10th percentile	-1.603	(2)	-1.673	(2)
Prime-age male joblessness rate	-1.787	(0)	-2.267	(0)
Ratio of governmental money transfers to total compensation of employees	-0.843	(2)	-2.875	(1)
Percentage of female headed families	-0.200	(3)	-2.251	(3)
Relative income level at the 95th percentile	+0.182	(0)	-2.082	(3)
Share of women in the labor force (only those 20 and over taken into account)	-1.692	(1)	-0.275	(1)

Note: The numbers in parentheses are the optimal lag lengths: k - max = 4. The 5 and 10 percent critical values are: -2.914 and -2.598 (no trend) and -3.501 and -3.179 (trend). Sources of data are cited in Section H of this appendix. For results with data from the 20th and 80th percentiles, see Jefferson and Pryor (2001).

of the variables over the full sample, using an augmented Dickey-Fuller (ADF) test.[3]

At conventional significance levels, we fail to reject the hypothesis that all of the variables have unit roots. This means that the inverse correlations between the relative incomes at the 10th and 95th percentiles shown in Table X-4.1 may be spurious (Granger and Newbold (1974)) and that further examination of the data is in order. Although the individual variables are not stationary, it is possible that some linear combinations of the variables are stationary, that is, that they are cointegrated. In such a case, the inverse relation between the relative income levels of the rich and poor would not be spurious.

E. Testing for Cointegration

In Table X-4.3, we test whether linear combinations of the variables are stationary, using Stock and Watson's (1993) dynamic estimator for the cointegrating vector (DOLS). This technique corrects for simultaneity bias in small samples by including leads and lags of the differences of the right-hand-side variables in the cointegrating regression. Also, DOLS is asymptotically equivalent to Johansen's (1991) full information maximum likelihood procedure.

The statistics of the augmented Dickey-Fuller test indicate the presence of a cointegrating relationship for each of the relative income level measures. For relative income in the 10th percentile, the null hypothesis of no cointegration is rejected at the 5 percent level. For relative income in the 95th percentile, the null hypothesis of no cointegration is rejected at the 10 percent level. An interpretation of the cointegrating vector is that it represents the long-run equilibrium relationship among the variables. It is

[3] Blough (1992) and Cochrane (1991) discuss some of the limitations of unit root tests. MacKinnon's (1991) Table 1 is used to generate the critical values for all of the unit root tests reported. The indicated lag lengths resulted from the use of the selection procedure suggested by Campbell and Perron (1991).

Table X-4.3: DOLS Cointegrating Vectors and Tests for Cointegration

Dependent variables	Relative income level at 10th percentile		Relative income level at 95th percentile
Regressors:			
Constant	+0.6123*	Constant	+4.3371*
	(0.0457)		(0.6476)
Year (1947 = 1)	+0.0043*	Year (1947 =1)	+0.0279*
	(0.0005)		(0.0091)
Relative income at 95th percentile	-0.0983*	Relative income level at	-4.0006*
	(0.0267)	10th percentile	(0.6241)
Prime age male joblessness rate	-0.0867	Share of women in labor	-3.3043
	(0.1445)	force (>19)	(2.1966)
Percentage of female headed families	-1.5829*		
	(0.3725)		
Ratio of governmental money transfers to	+1.0285*		
total compensation of employees	(0.3382)		
DOLS Lags	+2 to -2		+2 to -2
ADF test	-6.0461* (3)		-5.2563** (0)

Note: Standard errors in parentheses for the point estimates. DOLS Lags is the leads and lags of the first differences of the right-hand-side variables used in the estimation of the cointegrating vector. For the ADF test, the numbers in parentheses are the optimal lag lengths: k-max = 4. The 5 and 10 percent critical values for the ADF tests are -5.4914 and -5.1010. * and ** denote statistical significance at the 5% and 10% levels, respectively. Sources of data are cited in Section H of this appendix. For results with data from the 20th and 80th percentiles, see Jefferson and Pryor (2001).

worth noting that when the 20th and 80th percentiles are used instead of the 10th and 95th, such cointegration is not found. This result suggests that the causal variables which influence the distribution extremes are not completely applicable for percentiles that are closer to the median in the income distribution. The chief significance of the results presented in Table X-4.3 can be simply stated: In the last half of the 20th century, the inverse relationship between *levels* of the relative income at the extremes of the income distribution does not appear spurious. Something of importance is happening to the relative income ratios of rich and poor, making them move in opposite directions.

F. Exploration of Changes in Relative Income Ratios

It is also worthwhile to look at the causal factors underlying *changes* in these relative income ratios. Of course, it might not be expected for an equilibrium in relative income levels to be attained year by year, but, to the extent it does not, relative income may partially adjust in order to close the gap from equilibrium. This consideration suggests the following error correction specification:

$$(1)\quad \Delta X_t = \alpha_0 + \alpha_1 \Delta X_{t-1} + \alpha_2 \Delta Z_{t-1} + \beta_1 L_{t-1} + \varepsilon_t ,$$

where X = the relative income variable to be explained
Z = a vector of explanatory variables
L = error term from the corresponding equation in Table X-4.3 (called "equilibrium error" in Table X-4.4)
ε = error term for this equation.

In equation (1) the change in relative income responds to lagged changes in its determinants as well as deviations from the long-run equilibrium. The estimated value of the error correction coefficient, β_1, should be negative as the system at time period t moves to close the gap between the actual value of relative income at time period t - 1 and its long-term equilibrium value.

Table X-4.4 reports the results of estimating equation (1) for the relative income ratios at the

Table X-4.4: Error Correction Model for Changes in Relative Income Levels, 1948 - 1997

Dependent variables:	Relative income level at 10th percentile		Relative income level at 95th percentile
Regressors			
Constant	+0.0004	Constant	+0.0031
	(0.0014)		(0.0142)
Dependent variable	+0.2300	Dependent variable	+0.0281
	(0.1570)		(0.1439)
Relative income at 95th percentile	+0.0387	Relative income level at	-1.9028*
	(0.0220)	10th percentile	(0.8600)
Equilibrium error, 10th percentile	-1.3653*	Equilibrium error, 95th	-0.8060*
	(0.4024)	percentile	(0.1973)
Prime age male joblessness rate	-0.2683*	Share of women in labor	+2.9373
	(0.1212)	force (>19)	(3.1652)
Ratio of governmental money transfers to	+0.5175		
total compensation of employees	(0.3558)		
Percentage of female headed families	-0.5780		
	(0.4611)		
Adjusted-R^2	0.2263		0.3517
Durban-Watson test	2.375		1.9853

Notes: All of the regressors are lagged one period and all variables, except the equilibrium error term, are in first differences. A more exact description of the equations is presented in the text. Because we use first differences, one observation had to be dropped; four observations were also dropped due to the DOLS leads and lags in the first stage equation. An asterisk designates statistical significance at the 5% level. Standard errors in parentheses. Sources of data are cited in Section H in this appendix. For results using data from the 20th and 80th percentiles, see Jefferson and Pryor (2001).

extremes of the income distribution. The results suggest that relative incomes at the tail of the income distribution respond to deviations from long-run equilibrium level in the expected manner. For example, if relative income for the 95th percentile was above its equilibrium level by one percentage oint in the previous year, then it is expected to fall by 0.81 percentage points in the current year, everything else held constant.[4] Similar results occur when the model is calculated using relative income levels at the 20th and 80th percentiles.

If we look at annual changes in the relative incomes of rich and poor, rather than their relative annual levels, the results in Panel A in Table X-4.4 yield an asymmetry: At the upper tail of the income distribution, the expected tradeoff appears between the incomes of the rich and the poor, that is, the annual changes in the relative income of the poor predict annual changes in the opposite direction in the relative income of the rich. At the lower tail of the income distribution, however, this finding does not receive empirical support. Nevertheless, it is important to note that the inverse relation between the *levels* of relative income at the extremes of the income distribution can be obtained if the inverse relationship of *changes* in these relative incomes shown in Table X-4.4 is statistically significant for only the wealthy, but not the poor.

G. Conclusions and Suggestions for Further Research

1. General Remarks

Neoclassical economists can point out that even if the relative incomes of the rich and poor diverge,

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[4] For relative income in the 10th percentile, the 95 percent confidence interval for the error correction coefficient is (-2.154, -0.577). Thus, we cannot reject the hypothesis that if relative income for the 10th percentile was above its equilibrium level by one percentage point in the previous year, it can be expected (other things held equal) to fall by one percentage point or less in the current year.

it does not negate their argument that policy analysis should be concerned with absolute, not relative, income. Moreover, although an inverse relation of relative incomes at the two extremes of the income distribution may exist, it is irrelevant for questions of equity, which only concern income in an absolute sense.

This raises a much larger issue: What is the impact of income inequality on other variables of economic, political, or social concern? For instance, for a number of reasons that have received attention in the literature, a widening gap in relative income can lead to lower economic growth, a relationship discussed below in External Appendix X-4.3. Income inequalities may raise social tensions and lead to socially wasteful expenses for police and other types of guard labor (Bowles, Gordon, and Weisskoff, 1990, p. 194) or to the conditions fostering hate groups (Jefferson and Pryor, 1999).

These broad and crucially important issues lie outside the scope of this technical appendix, which has focused on the technical issue of whether the inverse relationship between relative incomes of the rich and poor are causally related.

2. The Underlying Mechanism: A Puzzle

At this point one conclusion can be immediately drawn: The descriptive inverse relation between relative income levels of the rich and the poor does not appear to be spurious. This forces our attention on the mechanisms underlying the results in Table X-4.4, and in this regard an interesting and peculiar asymmetry is revealed.

At the upper tail of the income distribution, a dynamic tradeoff appears between the incomes of the rich and the poor. Changes in the relative income of the poor forecast changes in the relative income of the rich in the opposite direction. But this inverse relation is not evident at the lower tail of the income

distribution.

We know of no economic theory that explains such an asymmetry. It is certainly not a feature of the traditional class-struggle approach. In this regard it should also be noted that many of those at the 10th percentile are not working in the capitalist sector, so that their only impact on workers in this sector is to serve as a downward force on their wages. The Marxist/populist approach, which is primarily descriptive, suffers from the additional difficulty that it does not take into account income mobility of individual families.[5]

The asymmetry might be statistical and due to our omission of some variable which explains part of the movement of relative incomes in the 10th percentile, and which is positively related to relative income at the 95th percentile. But we know of no such factor. Other explanations can be offered, but they are also not convincing.[6] In brief, although the inverse relation between high and low incomes is not spurious, the underlying economic mechanism remains a puzzle.

H. Data Sources for Tables in Appendix 4.2

Data on family incomes at the 20th, 50th ,80th, and 95th percentiles, and data on the number of female headed families come the Census Bureau website: http://www.census.gov/hhes/income/histinc. For family income at the 10th percentile, we use data from various issues of the Current Population Reports,

[5] Various empirical studies, such as Gottschalk and Danziger (1998), show a year-to-year movement of many families from one income quintile to another.

[6] A microeconomic analogy might be suggested. Changes in relative income at the 95th percentile parallel a situation where, if wages change and the company maintains the same price, changes in high incomes (managerial bonuses and profits) and low incomes (wages) move in opposite directions. If high incomes are, in addition, influenced by shocks - for instance, a change in price or in labor productivity - while low incomes are not, then low incomes may not be inversely related to high incomes. In brief, high-income receivers absorb the major price and productivity shocks of the system, so that the income of the poor is not greatly affected. Results from some preliminary tests of this approach did not seem promising and this avenue of research was abandoned.

series P-60, that give the percentage of families with incomes below certain levels, and, by assuming a log normal distribution of income, interpolated these series to obtain family income at the 10th percentile.

Data on joblessness among prime-age (25 through 50) men for 1964 through 1994 come from Current Population Survey, as calculated for each year in Pryor and Schaffer (2000, Chapter 1). This series is highly correlated to a series of employed men divided by total population of men from 20 through 64, minus an estimate of male students, male members of the armed forces, and adult male prisoners (to derive the non-institutionalized population). The latter series was used to extrapolate from 1964 back to 1947 and from 1995 to 1998.

Data on government money transfers and total compensation of employees come from U.S. Department of Commerce, Bureau of Economic Analysis (1998), Tables 1.14, 3.15 and 3.16, supplemented by data from Survey of Current Business, August 1998. The transfers include those for welfare and social services, disability, and unemployment on both the federal, state, and local levels.

Data on the share of women over 19 years as a share of the total labor force over 19 years come from various editions of Council of Economic Advisors (annual).

Appendix X-4.2: INCOME SHARES

The statistics from the National Income and Product Accounts allow an easy calculation of shares of income from various sources. I separate proprietor income (both farm and non-farm, such as the income of those owning their own stores) from other sources, because these contain an inextricable mix of labor and property income. I also distinguish the more traditional types of property income (interest and rents) from other kinds (primarily withheld corporate profits and dividends). The data are shown in Table X-4.5;

Table X-4.5: Shares of Different Types of Income in the National Income

	1950s	1960s	1970s	1980s	1990s
Wage income	67.1%	69.2%	72.7%	72.6%	71.9%
Proprietor income	14.1	11.1	9.4	7.7	8.5
(Subtotal)	81.1	80.3	82.1	80.3	80.4
Rental and interest income	6.0	6.6	7.2	10.7	9.0
Other property income	12.9	13.1	10.7	9.0	10.6
(Subtotal)	18.9	19.7	17.9	19.7	19.6
Total	100.0	100.0	100.0	100.0	100.0

Note: All data come from Table 1.14 in the official national income and product accounts found at the Department of Commerce, Bureau of Economic Analysis website: www.bea.gov/. Totals may not add up because of rounding.

the data for the 1950s are not quite comparable with those for other decades.

Appendix X-4.3: INCOME INEQUALITY AND ECONOMIC GROWTH

Several theoretical arguments link greater income inequality to faster economic growth. For instance, saving and investment should be greater if income differences are greater, since the affluent save a greater share of their income than the poor. Moreover, inequality provides a greater incentive for entrepreneurial activity if those making good money can keep a larger share of what they earn. In the same vein, some (e.g., Siebert, 1999) argue that nations that do more to redistribute income and level inequalities also suffer from greater disincentives for work along many dimensions. Moreover, in the absence of a developed credit market, income inequality can also lead to investment in large projects, since it may not be necessary to involve very many investors to get such a project off the ground. Finally, income redistribution raises taxes and lowers the after-tax profits, thereby discouraging new investment.

But other arguments point to a negative relation between income inequality and growth.[7] Greater income inequality leads to less political stability, and a number of studies (reviewed by Bénabou (1996)) show that such political difficulties discourage investment and growth. Such political instabilities also discourage traditional economic activities in favor of the searching for profits through the political process (rent seeking). Wide income differentials reduce borrowing opportunities by making it difficult for those with low incomes to invest either in their education or in physical capital, since they find it more difficult to obtain credit. Inequality also reduces the number of investment opportunities that are exploited, since investment

[7] For this discussion I draw upon much more extensive analyses by Furman and Stiglitz (1999) and Aghion et al. (1999). Certain evidence presented by Forbes (2000) is also relevant.

is confined only to a restricted group of people who may not know of all the possibilities for profitable investment, particularly small scale projects.

Greater income inequality can also lead to a larger group of people voting for highly progressive taxes and income redistribution, which might discourage investment and reduce growth. On the other hand, high concentrations of income and wealth make it easier for the wealthy to control legislatures through campaign donations and other "gifts," which might encourage new investment.

To put it mildly, the theoretical arguments on the relation between income inequality and economic growth are mixed. The empirical evidence is seemingly less ambiguous, at least from cross-country investigations of simple relationships between growth and inequality variables. Nevertheless, such studies also raise some serious problems of interpretation.

In a review of 23 different studies, Bénabou (1996) finds that most show a positive relation either between growth and income equality or growth and governmental policies to redistribute income. Nevertheless, the evidence is fragile, and robust conclusions cannot be drawn.[8] Furthermore, problems arise in most of the statistical investigations of this relationship, because they do not take into account the multiplicity of causal factors that influence both inequality and growth or the fact that growth and inequality may also mutually influence on each other. Two methods have been developed for circumventing these

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[8] For instance, Robert Barro (1999) finds a positive relationship between income inequality and both saving and economic growth, at least for countries with a per capita income of more than $2000. By way of contrast, Furman and Stiglitz (1999) find no relationship at all. In yet another study Banerjee and Duflo (2000) use a single-equation model to show that the relationship between growth and inequality is shaped like an inverted U, such that changes in inequality in any direction are associated with lower growth in the next period, but that in countries where inequality is not high to start with, there seems to be a negative relation between growth rates and inequality (lagged one period).

problems.

The first is to estimate statistical models that explicitly take into account the various causal relations underlying both income inequality and economic growth. In a pioneering essay, Lundberg and Squire (1999) calculate several simultaneous equation models and show that certain governmental policy variables act in opposite directions on growth and inequality, thereby forcing policy makers to make tradeoffs between the two goals. Finding that particular events, such as a downturn in the terms-of-trade, have little effect on growth but a highly negative impact on low-income groups within the economy, they also emphasize that policies can be set in place which improve income distribution without hurting growth. Thus, policy variables play an important role in determining an economy's performance with regard to both growth and inequality. Moreover, because of the simultaneous determination of both variables by other factors, no simple relation between growth and income equality can be specified. Empirical results like these suggest that changes in income inequality in the coming decades in the U.S. depend in large measure on political will.

The second method is to look at changes in growth (or other economic variables) between two periods of time when inequality could not have greatly changed. These include the studies by Dani Rodrik (1998) and by Andrew Berg and Jeffrey Sachs (1998) that are discussed in the text.

In recent years some economists have also investigated relationships between economic inequality and other indicators of macroeconomic performance. Some have looked at the relationships between economic growth and unemployment;[9] others have investigated the link between economic growth and

[9] For instance, Furman and Stiglitz (1999) argue not only that unemployment leads to greater income inequality but that the income inequality can also lead to greater unemployment. They posit a two-

volatility.[10] Up to now, however, the evidence to support most of these theories is not very convincing.

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sector economy. In the first sector, training costs are high and/or the output of workers is expensive to monitor. Firms pay higher-than-market-wages (so-called "efficiency wages") to give their employees an incentive to remain with the company and to work intensively (to minimize the risk of losing their employment if the occasional inspections reveal their low productivity). In the second sector, firms do not have high training costs and/or are more easily able to monitor the output of individual workers. In this situation employers simply pay market wages. If technological change leads to greater complexity of production and it becomes increasingly expensive to train workers and/or more difficult to monitor their output, the gap between efficiency wages and competitive wages will widen. This will, in turn, provide an incentive for workers in the second sector to quit their jobs to obtain the time to search for work in the first sector, so that frictional unemployment rises. While theoretically intriguing, the restrictive assumptions of this model lead me to doubt its empirical relevance.

[10] For instance, Aghion et al. (1999) review favorably the theoretical and empirical evidence suggesting that greater income inequality can lead to macroeconomic instabilities, which, in turn, discourage investment (and growth). Nevertheless, others, such as Breen and Garcia-Peñalosa (1999), present evidence from a worldwide sample that the causation runs the other way, namely, that greater volatility causes greater income inequality. Looking at just the OECD nations and calculating an ordinary least squares regression, I could find no significant relation between inequality and GDP volatility in either direction.

For these calculations I used my own estimates for economic volatility (the coefficient of determination of a growth regression) and income as well as those of Breen and Garcia-Peñalosa. Furthermore, I calculated both simple regressions and regressions holding constant a number of relevant factors such as per capita GDP, the trade/GDP ratio, and the ratio of government expenditures to the GDP.

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