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Repairing the Safety Net: Is the EITC the Right Patch?

Abstract: Using data from the Michigan Panel Study of Income Dynamics, I assess the impact of the Earned Income Tax Credit on income risk. The EITC offers help only to working people, and therefore fails to insure against unemployment. Traditional means-tested programs may provide more income security for the same investment. The paper finds that both program types do provide significant income security, but that the EITC's effects are weaker. The difference is not statistically significant, however. The paper also provides evidence that the security effects of redistribution programs can generate wide political support. Security benefits for medium and high wage individuals may be large enough to offset the burden of taxation. Thus, redistribution programs like the EITC may increase the well-being of everyone, not just the needy.

I. Security and the Safety Net

When the welfare state relieves one family of its poverty, it relieves another of its fear of poverty. In providing direct cash assistance to the poor, progressive policies enhance the economic security of everyone else. While most research focuses on the direct anti-poverty aspects of social spending, the economic security aspects also deserve attention (Lampman, 1984; Haveman, 1988). They directly benefit middle class voters, which helps explain why these voters accept the tax burdens that redistribution imposes. Income support for the poor is the voter's premium on her poverty insurance policy.

Does the Earned Income Tax Credit, or EITC, fit into the social insurance paradigm? While traditional safety net programs have become increasingly unpopular, the EITC has been the fastest-growing element of the US welfare state. Yet most explanations for its popularity do not rest on a social insurance foundation. Rather, the EITC seems to be popular because it helps the working poor without greatly reducing their work incentives (Munnell, 1994). The EITC may also have become popular because it is an easy way to spread the burden of deficit reduction more fairly. In any case, the pure economic security function does not seem to have played a prominent role.

This paper investigates these issues empirically. Does the EITC provide significant income insurance to medium and high wage individuals? Does it produce more or less income security than traditional means-tested transfer programs, like Aid to Families with Dependent Children (AFDC) and Food Stamps? Does the security it provides explain the EITC's recent political support?

Using longitudinal data from the Michigan Panel Study of Income Dynamics (PSID), I analyze the income security effects of expanding the EITC. This requires three steps.

First, I simulate the mean and variance of future income before and after the 1990 and 1993 Omnibus Budget Reconciliation Acts (OBRA90 and OBRA93), which greatly expanded the EITC. Second, I calculate the welfare cost of risk under both regimes. If this has fallen, the EITC has produced an increase in well-being that should be counted as a benefit in a social cost-benefit analysis. Third, I compare this benefit to the benefits of expanding means-tested transfers.

In brief, the results suggest that the EITC does provide significant income security benefits to medium and high wage individuals. Under reasonable assumptions about risk aversion, these benefits can exceed the tax burdens required to bring them about. Nevertheless, for a fixed level of funding, the EITC provides less income security than traditional means-tested transfers. Three cautions regarding these results are in order. First, the differences between the two program types are not statistically significant. Second, the effects depend heavily on the assumptions behind the research, especially the level of risk aversion. Third, the results do not take into account the efficiency costs of redistribution, which may amount to five percent or more of GNP (Lampman, 1984). Nevertheless, the findings are robust enough to allow a general conclusion: the study of security effects can contribute much to our understanding of the social impact and political feasibility of redistribution policies.

The remainder of the paper is organized as follows. Section I defines income risk and surveys past policy-oriented work on the topic. Section II describes the EITC and explains why it may not reduce income risk. Section III describes a method of measuring income risk. Section IV discusses the data and the simulations of policy changes. Section V presents results, while Section VI summarizes the paper's main conclusions.

I. Income Risk: A Definition and Survey

Income risk is defined as the variance of an uncertain future income around its mean (Atkinson and Stiglitz, 1970). The *risk premium*, defined in Section III below, measures in money terms the welfare cost of income risk. When an individual dislikes risk (or is *risk averse*), a rise in the variance of income causes an increase in the risk premium, and the amount of that increase should be counted as a social cost in a benefit-cost analysis. Thus, a social policy can raise welfare in two ways, directly by transferring money to the person in question, and indirectly by decreasing that person's income risk. Because most social policies make direct transfers to only a small fraction of the population, fewer people feel the direct effect of the policy than the indirect effect. The broad distribution of security benefits may explain much of the political support for social programs (Haveman, 1988; Lampman, 1984).

Research in economic theory characterizes formally the impact of social policies on income risk. Varian (1980) and Moffitt and Rothschild (1987) show that any progressive tax-transfer policy will reduce income risk. Betson and van der Gaag (1985) demonstrate this effect for the AFDC program. Risk falls for two reasons. First, transfers lessen the probability of extreme poverty, and second, taxes lessen the probability of extreme wealth. These effects narrow the range of possible future incomes at both ends, and this reduces the variance of income.

A few studies analyze income risk in an empirical context. Haveman and Wolfe (1985) and Bird (1993) provide explicit measures of income risk and the effect of policies on it. In Jenkins and Millar (1989), Feldstein (1973) and Gramlich and Wolkoff (1979), income risk plays an important role as a motivator of individual actions and as part of the overall assessment of policies.[1] Together, these papers constitute a surprisingly small literature, given the political importance of the topic. Unfortunately, income security does not lend itself to empirical study. It does not appear in household balance sheets or social science data, and is difficult to measure.

II. The Earned Income Tax Credit

The Earned Income Tax Credit (EITC) may or may not reduce income risk. It entered the tax code in 1975, providing a small, refundable credit specifically to those who both worked in the past year and had children. Its designers sought to relieve low-wage workers of some of their tax burdens, especially the Social Security payroll tax (Munnell, 1994; Committee on Ways and Means, 1993). The credit depends on earnings and initially rises as earnings rise, to a maximum credit amount. At a higher earnings level, the credit gradually declines to zero. Figure 1 illustrates the effect of the EITC on a standard labor-earnings budget diagram. At labor hours up to L1, the credit increases in size, effectively raising the wage rate. Between L1 and L2, the credit is constant and acts as a lump-sum grant. Between L2 and L3, the credit declines, and so acts as a wage tax. The credit can only be received by individuals with earnings, and is received at different phase-in and phase-out rates depending on the number of children. Until recently the credit was only available to workers with children; beginning in 1994, a small EITC is available for those with no children.[2] The EITC has faced some difficult compliance problems and, although it provides a wage subsidy over some range of earnings, it is believed to reduce work effort

(Scholz, 1994; General Accounting Office, 1993; Hoffman and Seidman, 1990; Campbell and Peirce, 1980).[3]

Unlike other social policy programs, the EITC is part of the federal tax system. This means that the progressiveness of tax changes can be increased by increasing the EITC. In recent years, the pressure of federal deficits has repeatedly pushed political actors into unpopular income tax increases, under political conditions which required that the burden of new taxation be spread progressively across the income distribution. The EITC has been a potent weapon in achieving this progressivity, and in the two recent rounds of deficit-reduction, OBRA90 and OBRA93, the EITC emerged a big winner. EITC expenditures were $1.5 billion in 1985 and $6 billion in 1990. OBRA 1990, however, made the EITC a $16 billion program, and OBRA 1993 will make it a $20 billion program (Committee on Ways and Means, 1993; Congressional Quarterly, 1993).

Despite its popularity, the design of the program reveals some weaknesses from a social insurance standpoint. The EITC provides income support for low-wage workers and can be thought of as insurance for all workers against future low-wage employment. While this type of insurance is not trivial, it leaves many risks uncovered, especially the risk of unemployment or complete detachment from the labor force. Those who are not working, including those in the very worst-off segment of society, receive no benefits from the EITC. By contrast, means-tested transfers provide benefits to virtually anyone with low income, especially the very worst off. Nevertheless, traditional transfer programs have become less popular in recent years. The EITC may not provide the best antidote to welfare cutbacks, however, since it focuses on low-wage workers rather than the poorest of the poor.

III. Measuring the Risk Premium and Income Insurance Benefits

To investigate this question empirically, the paper evaluates the EITC's impact on the variance of future income. Through the risk premium, variance effects translate into effects on well-being. This section defines the risk premium and describes in three parts how it can be analyzed in a policy context. Part A presents methods for estimating the mean and variance of income. Part B describes the welfare costs of income variance. Part C shows how policies affect these costs. These subsections are only overviews of the methods; the appendix provides greater detail.

A. Measuring the variance of income. The paper uses longitudinal data to estimate a model of income determination. The model distinguishes between permanent and transitory shocks to income, an approach common in the literature on the economics of savings. Estimating the model employs multiple regression techniques that proceed through the following five steps. The first step measures permanent income via a fixed-effects income regression. In practice, this comes close to measuring it as the longitudinal average of observed income.[4] The second takes the difference between permanent and observed income and defines it as the transitory shock. The third step defines the permanent shock as the average change in permanent income from year to year in the panel. With observations on permanent income and the two shocks, the model then estimates the variance of the shocks as a function of individual characteristics. The fifth and final step imputes three things to each individual: 1) permanent income, 2) permanent shock variance, and 3) transitory shock variance. Then, from the standpoint of year t, the individual faces an *expected future income* equal to next year's permanent income, and a *variance of future income* equal to the sum of the transitory and the permanent shock variance.

Though it would be unorthodox in the context of current research in the economics of savings, a much simpler method would measure expected income as the longitudinal average income, and income variance as the average squared deviation of observed income from expected income. In its intuition, such a procedure would differ little from the one adopted here.

B. The welfare consequences of income variance. The economic notion of risk aversion holds that most people are happier having the expected value of a gamble, with no income variance, than having the gamble and the income variance associated with it. Figure 2 illustrates how one can monetize the utility costs of income variance. The agent faces a gamble in which, on average, she expects to receive income $M. Her expected utility from the situation, E(U(Y)), is less than the utility she would obtain if she had the amount $M for certain. The fact that U(M) exceeds E(U(Y)) defines the agent as *risk averse*: she would rather have the average outcome as a sure thing than the gamble. The distance between U(M) and E(U(Y)) expresses the utility cost of the income variance that is present in the gamble, but not in the sure thing.

We can monetize the utility loss by comparing the certain money equivalents of the two utility levels. For U(M), this amounts to M itself, because the amount of certain income necessary to achieve the utility provided by M is simply M. For E(U(Y)), the associated certain income must be read off the utility function. In the diagram, the amount $C is the *certainty equivalent income* for the gamble that provides expected utility E(U(Y)). The certainty equivalent can be thought of as the level of real income, because it provides in money terms the amount of utility the agent actually receives when facing this gamble. The difference between M and C is called the *risk premium*, and can be interpreted as the amount of money the agent could pay and still be indifferent between having the gamble and not having it.

Certainty equivalents and risk premiums depend on the shape of the utility function. Savings researchers typically use the Constant Relative Risk Aversion (CRRA) function, which specifies that the fear of risk remains constant relative to income. This implies that aversion to an absolute amount of risk declines as income rises. Thus, agents have a constant willingness to wager 2 percent of their income, but they are more willing to wager $1,000 when they are rich. The CRRA form further implies that the risk cost of an uncertain 10 percent loss exceeds that of an uncertain 10 percent gain.

In the CRRA form, a single parameter γ determines the level of the agent's risk aversion. Higher values of γ imply higher aversion to risk, and estimates of γ range between 1.5 and 5.0 (Friend and Blume, 1975; Hall and Mishkin, 1982; Carroll, 1992; Bird, 1993). I take $\gamma = 1.5$ as the base case, so as to avoid artificially overstating the social benefits of reducing risk. To assess their sensitivity to this assumption, however, the results also include some calculations using $\gamma = 4.0$.[5]

C. Policy effects. Let $R_0 = M_0 - C_0$ be the risk premium associated with the status quo, and let $R_1 = M_1 - C_1$ be the risk premium associated with a policy change. The change in total well-being is given by the change in certainty equivalents:

$$C_1 - C_0 = (M_1 - M_0) - (R_1 - R_0) \tag{1}$$

Thus, the policy's effects decompose into a change in expected income and a change in the cost of risk. The income model allows these quantities to be estimated individually for every respondent in a sample. Thus, one can examine whether the per capita risk cost fell among the college-educated or rose among single-parent families. Further, one can aggregate from per-capita effects to social benefits and costs. At the level of all society, a redistribution program will produce a net aggregate change in expected income of $0. If it also reduces income variance, there will be a net aggregate decline in risk costs. The decline in risk costs enters the accounting as a social benefit, against which any efficiency costs of the transfer must be weighed. The paper does not estimate efficiency costs, but they should be borne in mind when interpreting the results.

IV. Data and Policy Simulations

1. Data. The database for the study is the Michigan Panel Study of Income Dynamics, waves 1981-1988, covering calendar years 1980-1987. Major reforms of the tax code occurred in 1981 and 1986, though the economy probably did not perceive the effects of the second and more extensive reform until 1988. Some changes to the transfer system also occurred in 1981. Otherwise, stability marks the tax-transfer system throughout the panel years. The panel consists of 2,849 men and women between the ages of 20 and 65, all of whom are either heads of household or spouses, who responded in each year of the panel. In the late 1980s, the population of individuals meeting this criteria in the United States numbered about 100 million (US Bureau of the Census, 1992).

The income variables in the PSID include labor and non-labor income of the individual and his or her spouse, federal income taxes (imputed by the PSID staff), AFDC, Food Stamps, other welfare, the EITC and a number of other income categories. I also construct a FICA tax variable based on reported earnings and the FICA tax code. The wages of both hourly and salaried employees are measured as annual labor income divided by annual hours worked. For those individuals with zero labor income, a Heckman selection-corrected wage regression imputes the most probable market wage. All dollar figures have been converted to 1991 values.

Rather than model the impact on income of the tax code and each transfer program, I approximate the tax-transfer system as a simple negative income tax. The tax-transfer system is too complex to be modeled explicitly in empirical work, and many researchers adopt simplifications similar to this one (for a recent example, see Fullerton and Rogers, 1993).

The tax-transfer system takes the form $T = G - tY$, where T is the net transfer from government, Y is household income, t is the tax rate, and G is a lump-sum transfer. A regression of T on Y yields an estimate of G as the constant and t as the first coefficient. I perform these regressions before and after each simulation to emulate the impact of policy changes on the tax-transfer system. I also allow some variation in the parameters by running separate regressions for married and unmarried individuals, and for individuals with and without children.

2. Income definition. Usually, risk enters an economic model as an exogenous shock from the external environment. To be consistent with this approach, income risk has to be defined with respect to an income that is exogenous. The income one observes directly in the data is exogenous only in the short term, because in the long term one can change characteristics, such as education and family structure, that determine that income. Thus, the dilemma is whether to analyze an observable budget constraint that is exogenous only in the short run, or to estimate an unobservable lifetime budget constraint that is exogenous from the standpoint of the entire life cycle. The long-term approach is necessary for some purposes, such as an examination of the effect of Social Security on post-retirement income risk. For this study, however, the short-term focus is adequate. The EITC is meant to be a short-term supplement to the income of lower and lower-middle class workers, who receive most of their income from earnings. With this focus, a number of otherwise complicating factors can be considered exogenous: wage rates, nonlabor income and tax and transfer parameters.

Income is defined as follows. The PSID sample contains individuals that are either single persons, heads of households, or their spouses. Let the income in any two-person household be split evenly.[6] The budget constraint for one person is:

$$\frac{(1-t)(k + wL + svH) + G}{1+s} = c \tag{2}$$

where t is the income tax rate, k is capital income, w is the head's wage rate, L is the head's labor supply, v is the spouse's wage rate, H is the spouse labor supply, G is a lump-sum government transfer, c is consumption, and s is a dummy variable equaling 1 if the individual has a spouse, 0 otherwise. Everything in the budget constraint is exogenous except c, L and H. Let labor be denominated in hours per year, and let the maximum work hours per year be 4000. Let l and h be head's and spouse's hours of leisure time per year, with l=4000-L and h=4000-H. Rearranging equation (2) yields

$$\frac{(1-t)(k + 4000(w+sv)) + G}{1+s} = c + \frac{(1-t)(wl + svh)}{1+s} \qquad (3)$$

The LHS of (3) is exogenous and will function as the basic measure of income in the paper.[7] When this income has variance, its certainty equivalent gives the overall level of well-being.

3. Policy simulations. Policies are simulated by changing the amounts of transfers that eligible sample families receive. A proportional tax surcharge, large enough to pay for the simulated increase in spending, is then added to the federal tax payments of all individuals. Then, new post-policy tax-transfer parameters are estimated, which change income as defined in (3). The tax surcharge guarantees that increases in expected income for some individuals will be perfectly offset by decreases for others. The only aggregate welfare effects will come from changes in risk premiums.

Two specific policy changes are simulated. First, the effect of recent OBRA bills on the EITC is emulated by replacing the pre-OBRA EITC in the data with a simulated EITC grant based on the parameters of OBRA93. Applied to the PSID respondents, this simulation increases annual EITC expenditures to more than $24 billion, a $4 billion overestimate relative to current projections of about $20 billion (Congressional Quarterly, 1993).[8] The tax surcharge necessary to keep the simulation deficit neutral is 2.3 percent.

The second policy simulation devotes these funds to traditional welfare instead of the EITC. This is accomplished by eliminating the simulated EITC expenditures in the data and using the resulting $24 billion to increase welfare grants. This sum is large relative to the welfare expenditures reported in the PSID, so that each recipient enjoys an increase of 114 percent in his or her grant amount. This change is also made deficit-neutral by application of the 2.3 percent surcharge to tax payments.[9]

V. The Income Security Impact of the EITC and Means-Tested Transfers

Applying these methods, I obtain under each policy regime four quantities for each individual: expected income E(Y), the standard deviation of income S(Y), the risk premium R, and the certainty equivalent C. Fifty-three of the 2,849 households had negative estimates of income variance and are dropped, leaving 2,796 observations.

Table 1 gives average per capita values for society as a whole and for individuals at various wage levels, under the assumption of low risk aversion ($\gamma = 1.5$).[10] The figures under 'Status Quo' refer to the pre-simulation incomes observed in the PSID. The average per capita risk premium in the sample is \$1,911, derived from a standard deviation of \$10,505 around average expected income of \$40,512. The corresponding certainty equivalent is \$38,601. Thus, the true welfare level of a typical individual is (38,601/40,512) = 95.3 percent of the expected income level. The welfare cost of risk amounts to about 5 percent of observed income.

The value of \$1,911 is the average of all the status quo risk premiums in the sample and can be thought of as an estimate of the population risk premium. As an estimate of that object, however, it is very inaccurate, with a standard error of \$1,165 (not shown). Virtually all of the risk premium estimates presented in the paper have similarly high standard errors. As a result, in no case will the differences in average risk premiums be statistically significant across groups or policy regimes. They may be substantively significant, of course, and this will be the focus of the discussion. Still, one should not consider these results conclusive in any sense.

Considering now the distribution of effects by wage, Table 1 shows that the economy distributes risk almost equally in the population. The risk premium makes up 4.0 percent of income for the lowest-wage individuals and rises continuously to 5.6 percent among the highest-wage individuals.[11] Nevertheless, the risk premium never grows so large with the wage that the corresponding certainty equivalent falls. Rather, per capita well-being rises with the wage, from a certainty equivalent of $26,233 among the lowest-wage individuals, to $67,968 among the highest-wage individuals.

The post-policy outcomes exhibit the same patterns, with means, variances, risk premiums and certainty equivalents all rising with the wage. Three features of the simulations merit attention. First, by design, expected income does not change for society as a whole, remaining at $40,512 per capita. Second, both policy changes impose a loss of expected income on high-wage individuals, and a gain in expected income among low-wage individuals. Third, at all wage levels save the highest, the status quo risk premium exceeds the EITC risk premium, which exceeds the means-tested transfer risk premium.

Table 2 repeats Table 1 but with a higher assumed level of risk aversion ($\gamma = 4.0$). The change affects only the risk premiums and the certainty equivalents. The status quo risk premium increases dramatically, from $1,911 to $4,983, more than 2.5 times as large. Differences throughout the table have the same relative magnitude, and results reported in the appendix suggest that the risk aversion parameter systematically has such a proportional effect. In raising the parameter by 260 percent, from 1.5 to 4.0, we raise all the risk costs by about 260 percent. Thus, the pattern of results remains the same as in Table 1, though at higher levels.

Table 3 returns to the lower risk aversion assumption and shows per capita effects by family structure. Individuals without children experience significantly higher income variance, with correspondingly higher absolute risk costs. In relative terms, risk premiums constitute about 5 percent of income for all family types. Like the wage distribution, the family type distribution demonstrates that the highest absolute risks are borne by those with the most well-being at stake. For example, married couples with no children face two events that have a negative impact on monetary well-being: divorce and childbirth. Combined, these events would send the married/childless individual from the richest category to the poorest, lone parenthood. Having more to lose, these individuals face higher risks. Contrast this with the perspective of a single parent, to whom no further income-reducing family events can happen, unless an income-improving event like marriage happens first. Having less to lose, single parents face lower risks.

The post-policy sections of Table 3 demonstrate again that the redistribution of income lowers risk costs for all groups, and that the EITC has a relatively weaker security effect. Table 4, which presents outcomes by educational attainment, disability and race, also produces these results. The under-educated, the disabled, and the nonwhite, all groups with lower expected incomes, systematically face lower standard deviations and risk costs. In relative terms, those with no high school degree have risk costs of about 4.3 percent of expected income, while those with college degrees have risks costs of about 4.9 percent of expected income. Similarly, the risks of nonwhites amount to 4.1 percent of income, those of whites, 4.8 percent.

Regardless of how one defines groups in society, two conclusions emerge from tables 1-4. First, low income is associated with low income variance and low risk costs, so that the relative cost of income risk is about the same in every social group. If anything, the more disadvantaged groups bear slightly lower relative risks. Second, redistribution programs reduce per capita income risk in virtually every group.

Table 5 provides more focus on policy effects. Its columns show the policy-induced per capita changes in expected income (the 'expected cash transfer'), the risk premium (the 'change in security'), and the certainty equivalent (the 'change in well-being'). Line 1 of the table shows that the average person enjoys a net transfer of $0 under both policies (since in the aggregate all transfers cancel). The EITC creates $24 in per capita security benefits, while means-tested transfers create $30 in per capita security benefits.

The remainder of Table 5 shows welfare effects by wage and family type. The EITC transfers $149 in expected income per capita to the lowest wage individuals, but taxes the highest wage individuals $186 per capita.[12] Means-tested transfers are more progressive: persons at the low end of the wage distribution receive $242 per capita, while those with wages between $15 and $30 pay significantly more than they did under the EITC. In return for their tax payments, however, the medium and upper-wage individuals receive positive security benefits under both policies. Security benefits reach a maximum under the means-tested transfer expansion of $40 per capita for wages between $15 and $20. Security benefits are negative only for the highest-wage individuals. With the exception of these individuals, security benefits under the means-tested transfer policy always exceed those under the EITC.

Similar patterns obtain for family structure, shown at the bottom of Table 5. Both the

EITC and means-tested programs transfer significant amounts of expected income to single parents. Means-tested programs are slightly more progressive, offering $648 per capita to this most-disadvantaged group, compared to the $423 given by the EITC. Both programs, however, provide an increase in income security to all family types. Single persons with and without children would certainly prefer means-tested transfers to the EITC, because they offer both greater security and higher well-being overall. Low-wage employment risk, against which the EITC provides its best protection, may not be an important risk in the lives of single persons. These figures, at least, suggest that it is not as important as the risks of family break-up and unemployment, which are insured by means-tested transfers but not the EITC. The fact that married persons receive the same security benefits from both programs suggests only that the respective risks that these programs insure are about equally important. The forces underlying these patterns certainly deserve greater scrutiny in future research.

Table 6 offers similar figures broken down by education, disability and race. In overview, it again appears that all groups enjoy some security benefit from both programs, though the security benefits of means-tested transfers exceed those of the EITC. Also consistent with the previous table, the EITC systematically transfers less expected income to disadvantaged groups. For example, those with no high school degree enjoy an increase of $141 per capita in expected income under the expansion of means-tested programs, but only $92 under the expansion of the EITC. The disabled receive transfers of $54 under means-tested programs, but less than half that under the EITC.

Together, Tables 5 and 6 suggest several conclusions. First, the EITC expansion is less progressive than the means-tested transfer expansion. Second, the EITC offers lower security benefits. Third, both programs spread income security benefits widely in the population.

Tables 7 and 8 take up the political implications of these patterns. Table 7 shows aggregate welfare effects of both policy changes. These effects assume low risk aversion, with $\gamma = 1.5$. They are aggregated over the total population and also over the population of three groups: 1) Subsistence wage earners, with wages below \$5 per hour, 2) Low wage earners, with wages between \$5 and \$10 per hour, and 3) medium to high wage earners, with wages above \$10 per hour. Respectively, these groups constitute 12, 32, and 56 percent of the total population being studied.

Overall, the EITC creates \$2.468 billion in aggregate social benefits, while means-tested transfers create \$3.055 billion in aggregate social benefits. Thus, expanding the EITC rather than means-tested transfers gives up about \$600 million in potential social benefits every year. The EITC's social benefits come to about 10 percent of the total investment of \$24 billion, compared to 13 percent for means-tested transfers. Thus, efficiency costs must not exceed 10-13 percent if these programs are to pass a benefit-cost test.

Table 7 shows that the EITC creates its security benefits by transferring \$3.9 billion from medium and high wage individuals to low and subsistence wage individuals. In return for their contribution, the upper wage earners enjoy \$1.5 billion in security benefits, equal to about 1/3 of their tax burden. The means-tested transfer expansion exhibits a similar pattern, with \$5.6 billion in transfers from rich to poor and near-poor, in return for larger security benefits. The greater progressivity of means-tested transfers can be seen in the fact that subsistence wage earners receive most of the expected cash transfer. By contrast, the EITC gives slightly less direct transfer assistance to subsistence workers. This pattern is consistent with the EITC's goal of helping lower-wage workers, the just-poor, and the near-poor, rather than those at the very bottom of the social scale.

Table 8 repeats the analysis with risk aversion at $\gamma = 4.0$, a higher level, but one that nevertheless falls well within the range of existing estimates. With higher risk aversion, risk costs and security benefits grow, so that the social benefits of the programs become \$6.934 billion and \$8.504, respectively. These benefits constitute 29 and 35 percent of the investment of \$24 billion, respectively. The social loss from expanding the EITC instead of means-tested transfers becomes \$1.5 billion annually.

The change in risk aversion does not affect expected cash transfers, which leaves upper wage individuals with the same tax burden as in the previous table. Now, however, they balance that burden against a larger security benefit. Under the EITC, the security benefit is \$4.4 billion and more than offsets the tax burden. The net gain for upper wage individuals is \$520 million. Low wage and subsistence wage individuals, of course, continue to enjoy substantial direct and indirect benefits. Thus, the EITC raises well-being for everyone in society.

The means-tested transfer expansion does not perform as well, as upper wage earners still experience a small net decline in well-being of \$133 million. Nevertheless, the higher security benefits here almost eliminate the burden of the taxation that creates them.

VI. Conclusions

Three general conclusions emerge from the results.

First, though the EITC's effects are slightly weaker, both policies provide substantial amounts of income security to a large number of individuals. They should be considered part of the social insurance system, because they do, in fact, provide social insurance. Further, both programs provide social benefits that may be large enough to outweigh their efficiency costs. Depending on risk aversion and program type, redistribution generates marginal security benefits between 10 and 35 percent of the amount transferred. Estimates of the marginal efficiency cost of redistribution typically exceed the lower return but not always the higher one (for example, see Ballard, 1988). A sufficiently risk averse society could find redistribution welfare-enhancing, despite its deadweight costs.

Secondly, deadweight costs aside, redistribution programs face a dilemma in that progressivity simultaneously increases both upper-income tax burdens and upper-income security benefits. The political viability of a program depends on its ability to target security benefits on those bearing the tax burdens. The EITC appears better able to provide the right mix of burdens and benefits. How? The EITC recognizes that upper wage individuals probably face a higher risk of falling into the low wage category than the subsistence wage category. It offers relatively more of its total cash transfers to low wage individuals, and relatively less to subsistence wage individuals. Thus, in targeting assistance on the low wage group rather than the subsistence group, the EITC offers relatively more security against the specific risks of upper wage individuals. This raises the security benefits of that group while reducing the progressivity of the program, and hence its tax burden. By providing upper wage groups with a better targeted income insurance at less cost, the EITC lessens the net burdens it imposes, and comes closer than means-tested transfers to creating net gains. In this, it may have discovered the political bedrock that has long eluded traditional welfare programs.

Finally, the accuracy of the results leaves much to be desired. All the findings are heavily sensitive to risk aversion assumptions. They also depend on the many methodological assumptions described in the appendix. Further, because they are difficult to estimate, the risk premiums and security benefits bear large standard errors, and none of the program and group-level differences highlighted above pass standard statistical significance tests. This means that we cannot rule out the possibility that the differences are zero. It also means that we cannot rule out the possibility that they are twice as large. As a result, the patterns outlined here are only tentative and may not withstand further scrutiny. Still, their substantive significance suggests that they merit further investigation.

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Appendix

This appendix describes the methods for estimating four separate aspects of future income, in four steps. In order, estimates are described for a) the expectation of future income, b) the variance of future income, c) the risk premium, and d) the change in the risk premium caused by a policy change. The discussion assumes a panel of N individuals covering T years. Income is denoted 'Y,' and the log of income is denoted 'y.'

a. Expected future income

According to the permanent-transitory model for income (Carroll, 1992; Hall and Mishkin, 1982), agent i's log income in period t+1 is decomposed as follows:

$$y_{it+1} = p_{it+1} + \varepsilon_{it+1} \quad \textbf{(A1)}$$

where p_{it+1} is permanent income and ε_{it+1} is the transitory error term. ε has mean zero and variance $\sigma^2_{i\varepsilon}$. The *expectation of future income* is therefore p_{it+1}. We can estimate p_{it+1} using a fixed-effects human capital model. Let $E(\varepsilon|X) = 0$, for some individual characteristics X, and let the expectation of future income be a linear function of X:

$$E(y_{it+1}|X_{it}) = \alpha_i + \beta X_{it} \quad \textbf{(A2)}$$

with coefficients β and individual effect α_i. The parameters α_i and β can be estimated in three steps. First, using pooled data from all T years of the panel, the first difference of income is regressed on the first difference of X, to obtain estimates of β. Then, a value of α is produced for each individual in each panel year:

$$\hat{\alpha}_{it} = y_{it+1} - \hat{\beta} X_{it} \quad \textbf{(A3)}$$

The individual effect α_i is the average of individual i's T-1 estimates of $\hat{\alpha}_{it}$. Finally, expected income is:

$$\hat{p}_{it+1} = \hat{\alpha}_i + \hat{\beta} X_{it} \quad \textbf{(A4)}$$

b. Variance of income

Following the permanent-transitory income model, permanent income evolves through time as follows:

$$p_{it+1} = d_{it} + p_{it} + \nu_{it+1} \quad \textbf{(A5)}$$

where d_{it} is the growth rate of income and υ_{it+1} is the permanent error term. Because the growth rate and current permanent income p_{it} are known at the beginning of period t, they have zero variance. The variance of future income is thus:

$$Var(y_{it+1}) = Var(d_{it} + p_{it} + \nu_{it+1}) + Var(\varepsilon_{it+1}) = \sigma^2_{i\nu} + \sigma^2_{i\varepsilon} \quad \textbf{(A6)}$$

where $\sigma^2_{i\upsilon} = Var(\upsilon_{it+1})$. $E(\upsilon) = E(\varepsilon,\upsilon) = 0$. The two variance parameters can be estimated separately.

First, note from (5) that the variance of the permanent shock equals the variance of the first difference of permanent income minus the growth rate:

$$\sigma^2_{iv} = Var(p_{it+1} - p_{it} - d_{it}) \tag{A7}$$

To find an individual-specific estimate of the permanent variance, I apply a version of weighted least squares estimation to the first difference of permanent income. Let the growth rate be a function of individual characteristics Z_{it}. Then, from (5):

$$p_{it+1} - p_{it} = \phi Z_{it} + \nu_{it+1} \tag{A8}$$

Under the assumption that $E(\upsilon | Z) = 0$, a regression of differenced permanent income on Z yields estimates of ϕ and, more importantly, residuals that are empirical realizations of υ. The expected value of the squared residuals equals the variance of υ. That variance, in turn, can be assumed to be a linear function of the characteristics Z (as in weighted least squares). Then the variance can be estimated by first regressing the squared residuals on Z and then taking fitted values. That is the approach adopted here. *Permanent income variance* is the fitted value of a regression of the squared residuals from (8) on Z, using a pooled sample of N individuals in T years. Because these fitted values will vary across time as well as individuals, I will take the average of the T variance estimates for one individual as that individual's final permanent income variance estimate.

The transitory income variance is estimated in the same way. The difference between ordinary income and permanent income in (1) offers empirical realizations of ε. In the pooled individual-year sample, these are squared and regressed on Z. *Transitory income variance* is the fitted value of the regression of squared differences in (1) on Z. Because these differ across time, the average of T fitted values is one individual's transitory variance estimate.

The two variance estimates are then added to create an estimate of the variance of future income.

c. The Risk Premium

At this point the expectation and variance of the log of future income are known; denote these m and s^2, respectively. Assuming log income is normally distributed, one can derive f(Y), the distribution of income in levels (see below). Let the expectation of Y under f(Y) be μ and let the variance be σ^2. Expected utility is the following integral over f(Y):

$$W(f(Y)) = \int U(Y) f(Y) dY \tag{A9}$$

where U(Y) is the utility function $U(Y)=(1/1-\gamma)Y^{1-\gamma}$. The parameter γ sets the degree of aversion to risk. The money-valued welfare level granted by W(f(Y)) is given by the *certainty equivalent* of f(Y), denoted C:

$$W(f(Y)) = U(C) \tag{A10}$$

If income is certain, equation (9) implies W(f(Y)) = U(Y), and equation (10) implies C=Y. If income is uncertain, then welfare is lower than expected income, because there is unpleasant income risk. The *risk premium*, denoted R, is the solution to this equation:

$$W(f(Y)) = U(\mu - R) \tag{A11}$$

and C = μ-R. Welfare is decomposed into expected income and the risk premium. The risk premium can therefore be thought of as the welfare cost of risk: if income were certain at μ, then the welfare level would also be μ. But because income is not certain, the welfare level is C, which is less than μ by the amount R. The risk premium is the amount of money the individual could surrender and be just indifferent between the uncertain income f(Y) and a certain income at μ.

The risk premium can be calculated by inverting (11):

$$R = \mu - \left((1-\gamma) W(f(Y)) \right)^{\frac{1}{1-\gamma}} \tag{A12}$$

The difficulty remains of calculating expected income, μ, and expected utility, W(f(Y)), from the lognormal expectation and variance. That is, even though the distribution of log income is known to be normal with a given mean and variance, there is no closed-form solution to (9) as a function of μ and σ^2. Instead (9) must be integrated numerically with a change of variables from logs into levels.

This begins with sequence of incomes in levels, Y_1, Y_2, ... , Y_Q that should cover the entire range of income that has positive probability. For example, in this paper the grid begins at \$0 and proceeds to \$200,000 in 100 steps of \$2,000 each. Let dY be the distance between two incomes in the income levels sequence. The probability of Y_q is approximately

$$p_q \approx \frac{1}{Y_q} (s\sqrt{2\pi})^{-1} \exp\left(-\frac{1}{2}\left(\frac{Y_q - m}{s}\right)^2 \right) dY \tag{A13}$$

and expected utility is approximately

$$W(f(Y)) \approx \sum_{q=1}^{Q} U(Y_q) p_q \tag{A14}$$

Further, the expected income in levels is approximately

$$\mu \approx \sum_{q=1}^{Q} Y_q p_q \tag{A15}$$

These approximations can be used in (12) to calculate the risk premium.

d. Insurance benefits

A policy can have two welfare effects: it can change expected income, and it can change the risk premium. Evaluations of social programs tend to focus on expected income rather than the variance of income. This paper focuses on the variance.

The impact of a policy on income variance is best observed through the risk premium, because this is denominated in money terms and can be compared to other benefits and costs of the policy. Let μ_{i0} and μ_{i1} be individual i's expected income before and after the policy. The pre- and post-policy risk premiums are R_{i0} and R_{i1}. Suppose the policy reduces risk for everyone, with $R_{i0} > R_{i1}$, all i. The *insurance benefit* of the policy for individual i is R_{i0}-R_{i1}. The aggregate insurance benefit is $\Sigma_i(R_{i0}-R_{i1})$. The aggregate affect of the policy on welfare is $\Sigma_i(C_{i1}-C_{i0}) = \Sigma_i(\mu_{i1}-\mu_{i0}) - \Sigma_i(R_{i1}-R_{i0})$, and if the policy is simply an income transfer, individual changes in μ will cancel out in the aggregate, leaving the insurance benefit as the only aggregate welfare effect. The policy simulations I will examine have this property.

e. Technical discussion of results from the PSID. Some observations have an estimated income variance less than zero. Dropping these observations, however, causes the sample average of pre- and post-policy expected incomes to differ, even though in principle they should not; the policies are supposed to be deficit-neutral. The difference is slight, amounting to 3/5 of a percentage point. To restore equality of the sample averages, I increase every expected income and certainty equivalent in the post-policy data by 3/5 of a percentage point.

Tables A.1 through A.4 present a selection of the regression output from the estimation process for pre-OBRA income. Most noteworthy is the poor fit of the fixed-effects regression in Table A.1, which ensures that, for the most part, permanent income is determined by the average of seven estimates of the fixed effect α. Thus, permanent income comes close to being a simple seven-year average of income.

Table A.5 shows the sensitivity of some of the basic outcomes to variations in methods. Line 1 repeats results for base case parameters. These figures reflect a risk-aversion coefficient of $\gamma=1.5$, no measurement error in income, and an income grid for numerical integration ranging from \$0 to \$200,000 in intervals of \$2,000. The table's columns report four measures under the status quo and the two policy simulations. They are: 1) expected income, 2) standard deviation of income, 3) risk premium of income, and 4) certainty equivalent income.

Lines 2 and 3 show that raising the risk aversion parameter to 2.0 or 4.0 significantly affects the risk premium and the insurance benefit. The relationships are roughly linear: doubling risk aversion from 2.0 to 4.0, for example, doubles the per capita risk premium from \$2,600 to \$5,100. The importance of risk aversion here is what motivates the attention paid in the text to variations in the risk aversion parameter.

A second area of concern is the possibility of measurement error, which adds spurious variance to observed income. A study of measurement error in the PSID (Duncan and Hill,

1985) suggests that labor hours and earnings were reported with reasonable accuracy but that a measure of wages generated by dividing earnings by hours was highly inaccurate. About two-thirds of the cross-sectional variance in this wage measure could be assigned to variance in measurement error. Because the income concept used here depends on such a wage measure, the amount of transitory uncertainty in the income processes is probably overstated. To adjust for this possibility I reduce each individual's transitory income variance by two-thirds. Line 3 shows how the risk figures react. Not surprisingly, they fall dramatically. Again, there is a roughly linear relationship: reducing transitory variance by two-thirds reduces the risk premium from about $1,900 to about $650.

The third area of sensitivity involves the grid used to calculate the numerical integral in equation (14). Increasing the density of the grid by using $1,000 and $500 intervals seems to have little effect (lines 5 and 6); raising the upper bound to include more of the upper tail regions of super-rich individuals' pdfs (line 7) generates a modest increase in risk premiums. This suggests that excluding the very rich from the data can have an effect on the average and aggregate risk figures. Even so, the effect is not strong.

The figures in Table A.5. can be used to calculate the rate of return on the social policy investment of $24 billion, as is done in the text. These supplementary calculations show that the rate of return is highest under the case of $\gamma = 4.0$, at 40 percent. The rate of return is lowest under the case adjusting for measurement error, at 5 percent. Thus, the social benefits and costs of redistribution programs are sensitive to methodological assumptions. The conclusions of the paper should be treated with corresponding caution.

Though risk premiums respond to a number of factors, in the text I examine sensitivity only with respect to the risk aversion coefficient. This keeps the exposition relatively clear.

Endnotes

1. The literature on income risk should be distinguished from two close relations. The first is the literature on income variability, which examines the changes in income from period to period (Burkhauser and Duncan, 1989; Burkhauser et al., 1991). The changes may or may not be unexpected, however, so properly speaking these papers are not about risk. The second is the literature on vulnerability and at-risk populations (Palmer, Smeeding and Torrey, 1988), which have more to do with poverty than income risk.

2. OBRA 1993 stipulates the following EITC parameters for 1996 and later. There is a credit of 34 percent of the first $6,170 of earnings for families with one child, and 40 percent of the first $8,425 for families with two or more children. The credits are phased out beginning at $11,000 of earnings, with full phase-out at $23,760 for one-child families and $27,000 for two-child families. Childless workers younger than 65 can receive a credit of 7.65 percent on earnings up to $4000, which is then phased out by $9,000.

Under 1985 law, the last year before the TRA 86 expansion, the credit, offered only to families with children, was 11 percent of earnings up to $5,000. At earnings between $5,000 and $6,500 the credit remained at $550; thereafter it was phased out at a rate of 12.22 percent. Full phase-out occurred at $11,000.

Relative to the 1985 law, OBRA 1993 has more than tripled the credit rate, more than doubled the maximum income for eligibility, and extended the credit to childless workers.

3. Its efficiency costs are not well understood, however, and involve difficult simulation issues. As a result, I will consider not efficiency costs in this paper. The presence of these costs should be borne in mind when interpreting the aggregate welfare effects presented below.

4. In the fixed-effects regressions, the individual-specific intercept is estimated as the longitudinal average of $y-x\hat{\beta}$. Because the explanatory power of the independent variables happens to be small, the permanent income consists largely of the intercept, which in turn consists largely of the panel average of y.

5. The appendix carries out sensitivity tests on a number of other assumptions as well.

6. There are two other assumptions about other family members. First, children are 'consumption items,' in that the income parents must devote to their children adds as much to their own happiness as if they had consumed it themselves. Thus children need not be considered part of the family for purposes of well-being. Second, other adults besides husband and wife are assumed to generate sufficient income to support themselves, and thus are also not considered part of the family for purposes of well-being. Both of these assumptions are necessitated by the data set, the Michigan Panel Study of Income Dynamics, whose structure allows individual-level samples only of husbands, wives and single persons.

7. If the consumption-leisure utility function is Cobb-Douglas, one can derive an indirect utility function defined over this definition of Y, that has the CRRA form assumed above.

8. It should be noted that social policy expenditures in the PSID do not always aggregate accurately. EITC expenditures reported in the PSID match the actual figures extremely well: in 1985, actual expenditures were $1.645 billion, while PSID expenditures were $1.564 billion. By contrast, welfare expenditures reported in this PSID sample match actual figures abysmally: in 1985, actual national expenditures on AFDC, SSI, General Assistance and Food Stamps were $44.562 billion, while the analogous PSID welfare measure aggregates to only $14.853 billion (US Bureau of the Census, 1989). The disparity could have several sources, the most important of which is sample selection: this PSID sample contains only husbands and wives between ages 20 and 64. Many cash benefits go to the elderly. Still, the difference is too large and one must assume there is substantial under-reporting of welfare benefits in the PSID. There is no reason to expect that this will affect the results, however, since we will not be comparing current levels of welfare spending to current levels of EITC spending; rather, the comparison is between adding $24 billion to EITC *or* welfare, on top of current levels.

9. Eligibility is assumed unchanged, so the simulation only increases the grant size of currently eligible families. Changes in eligibility are difficult to model because of possible changes in take-up rates, and because of variations in eligibility rules across states.

10. This is the 1985 wage of the respondent. Respondents who were not working were assigned a wage from a selection-corrected wage regression.

11. This may seem counter-intuitive, but the logic of the outcome emerges when one remembers that these are measures of future risks, not past events. Those with low wages have already experienced misfortune, true, but this does not mean that they face the highest likelihood misfortune in the future. On the contrary, they probably have less to lose. In this and other work (Bird, 1993), the data show repeatedly that individuals with low current incomes face low variance in future income. In absolute and relative terms, the poor bear risk costs equal to or lower than the average.

12. For reference, the group "w > $30" contains 4 percent of the sample with 113 observations. It is the smallest wage category. None of the other wage groups contains more than 17 percent of the sample.

Table 1. Per Capita Effects of Policy Changes on Expected Income, Standard Deviation of Income, the Risk Premium, and the Certainty Equivalent, by Wage
Risk Aversion = 1.5
All figures in 1991 dollars

	Status Quo				EITC Expansion				Means-Tested Transfer Expansion			
	E(Y)	S(Y)	R	C	E(Y)	S(Y)	R	C	E(Y)	S(Y)	R	C
All Wages	40,512	10,505	1,911	38,601	40,512	10,356	1,887	38,625	40,512	10,337	1,881	38,631
$w \leq 5$	27,314	6,426	1,081	26,233	27,463	6,344	1,063	26,402	27,556	6,351	1,062	26,495
$5 < w \leq 7.5$	29,175	6,937	1,190	27,984	29,267	6,834	1,168	28,101	29,300	6,822	1,162	28,139
$7.5 < w \leq 10$	35,011	8,685	1,543	33,468	35,051	8,553	1,516	33,537	35,056	8,533	1,509	33,548
$10 < w \leq 12.5$	39,156	9,947	1,796	37,360	39,148	9,800	1,769	37,381	39,127	9,774	1,761	37,367
$12.5 < w \leq 15$	42,445	10,868	1,983	40,462	42,406	10,712	1,954	40,455	42,368	10,684	1,946	40,423
$15 < w \leq 20$	47,215	12,466	2,321	44,894	47,140	12,283	2,290	44,854	47,096	12,252	2,281	44,818
$20 < w \leq 30$	56,445	15,733	3,015	53,430	56,304	15,517	2,987	53,321	56,279	15,496	2,982	53,300
$30 < w$	71,984	21,623	4,016	67,968	71,798	21,407	4,022	67,780	71,810	21,408	4,027	67,787

Source: Michigan Panel Study of Income Dynamics, 1980-1987. N = 2,796. The number of cases in the smallest cell is 113.

Uses base-case parameters. w is the individual's wage in 1985. E(Y) is expected income, S(Y) is the standard deviation of income, R is the risk premium, and C is the certainty equivalent of income (equal to E(Y) - R). Income is family income per major adult (just the individual if single, individual and spouse if married).

Table 2. Per Capita Effects of Policy Changes on Expected Income, Standard Deviation of Income, the Risk Premium, and the Certainty Equivalent, by Wage
Risk Aversion = 4.0
All figures in 1991 dollars

	Status Quo				EITC Expansion				Means-Tested Transfer Expansion			
	E(Y)	S(Y)	R	C	E(Y)	S(Y)	R	C	E(Y)	S(Y)	R	C
All Wages	40,512	10,505	4,983	35,529	40,512	10,356	4,914	35,596	40,512	10,337	4,898	35,612
w ≤ 5	27,314	6,426	2,822	24,492	27,463	6,344	2,776	24,687	27,556	6,351	2,773	24,783
5 < w ≤ 7.5	29,175	6,937	3,071	26,103	29,267	6,834	3,015	26,252	29,300	6,822	3,002	26,298
7.5 < w ≤ 10	35,011	8,685	3,976	31,036	35,051	8,553	3,907	31,144	35,056	8,533	3,890	31,166
10 < w ≤ 12.5	39,156	9,947	4,641	34,515	39,148	9,800	4,570	34,578	39,127	9,774	4,550	34,577
12.5 < w ≤ 15	42,445	10,868	5,103	37,342	42,406	10,712	5,030	37,376	42,368	10,684	5,010	37,358
15 < w ≤ 20	47,215	12,466	5,989	41,225	47,140	12,283	5,906	41,235	47,096	12,252	5,882	41,214
20 < w ≤ 30	56,445	15,733	7,879	48,566	56,304	15,517	7,790	48,514	56,279	15,496	7,773	48,506
30 < w	71,984	21,623	11,289	60,695	71,798	21,407	11,225	60,572	71,810	21,408	11,227	60,583

Source: Michigan Panel Study of Income Dynamics, 1980-1987. N = 2,796. The number of cases in the smallest cell is 113.

Uses base-case parameters. w is the individual's wage in 1985. E(Y) is expected income, S(Y) is the standard deviation of income, R is the risk premium, and C is the certainty equivalent of income (equal to E(Y) - R). Income is family income per major adult (just the individual if single, individual and spouse if married).

Table 3. Per Capita Effects of Policy Changes on Expected Income, Standard Deviation of Income, the Risk Premium, and the Certainty Equivalent, by Family Type
Risk Aversion = 1.5
All figures in 1991 dollars

	Status Quo				EITC Expansion				Means-Tested Transfer Expansion			
	E(Y)	S(Y)	R	C	E(Y)	S(Y)	R	C	E(Y)	S(Y)	R	C
All Families	40,512	10,505	1,911	38,601	40,512	10,356	1,887	38,625	40,512	10,337	1,881	38,631
Single No Children	39,491	11,107	2,155	37,336	39,471	10,953	2,130	37,341	39,457	10,851	2,098	37,359
Married No Children	45,398	11,916	2,146	43,253	45,358	11,794	2,138	43,220	45,362	11,795	2,138	43,224
Single Children	31,664	8,136	1,489	30,175	32,087	8,082	1,471	30,616	32,312	8,040	1,449	30,863
Married Children	39,129	9,812	1,757	37,371	39,101	9,636	1,722	37,380	39,072	9,634	1,722	37,350

Source: Michigan Panel Study of Income Dynamics, 1980-1987. N = 2,796. The number of cases in the smallest cell is 189.

Uses base-case parameters. Refers to family status in 1985. E(Y) is expected income, S(Y) is the standard deviation of income, R is the risk premium, and C is the certainty equivalent of income (equal to E(Y) - R). Income is family income per major adult (just the individual if single, individual and spouse if married).

Table 4. Per Capita Effects of Policy Changes on Expected Income, Standard Deviation of Income, the Risk Premium, and the Certainty Equivalent, by Education, Disability and Race
Risk Aversion = 1.5
All figures in 1991 dollars

	Status Quo				EITC Expansion				Means-Tested Transfer Expansion			
	E(Y)	S(Y)	R	C	E(Y)	S(Y)	R	C	E(Y)	S(Y)	R	C
All Persons	40,512	10,505	1,911	38,601	40,512	10,356	1,887	38,625	40,512	10,337	1,881	38,631
No high school	31,211	7,616	1,341	29,871	31,303	7,524	1,323	29,871	31,352	7,516	1,318	30,034
High school, no college degree	39,425	10,213	1,867	37,558	39,429	10,060	1,838	37,591	39,420	10,036	1,831	37,589
College degree	51,043	13,659	2,501	48,541	50,954	13,475	2,480	48,474	50,937	13,462	2,477	48,460
Not Disabled	40,755	10,549	1,913	38,842	40,751	10,398	1,888	38,863	40,748	10,380	1,882	38,865
Disabled	38,581	10,154	1,901	36,680	38,607	10,021	1,876	36,731	38,635	9,998	1,867	36,768
Nonwhite	31,691	7,544	1,297	30,394	31,838	7,445	1,275	30,563	31,941	7,412	1,261	30,680
White	41,405	10,804	1,973	39,431	41,390	10,651	1,948	39,442	41,380	10,634	1,943	39,436

Source: Michigan Panel Study of Income Dynamics, 1980-1987. N = 2,796. The number of cases in the smallest cell is 257.

Uses base-case parameters. Refers to education, disability and race in 1985. E(Y) is expected income, S(Y) is the standard deviation of income, R is the risk premium, and C is the certainty equivalent of income (equal to E(Y) - R). Income is family income per major adult (just the individual if single, individual and spouse if married).

Table 5. Per Capita Cash Transfers and Economic Security Effects
by Wage and Family Type
Risk Aversion = 1.5
All figures in 1991 dollars

	EITC Expansion			Means-Tested Transfer Expansion		
	Expected Cash Transfers	Change in Economic Security	Change in Well-being	Expected Cash Transfers	Change in Economic Security	Change in Well-Being
Full population	0	24	24	0	30	30
w ≤ 5	149	18	167	242	19	261
5 < w ≤ 7.5	92	22	114	125	28	153
7.5 < w ≤ 10	40	27	67	45	34	79
10 < w ≤ 12.5	-8	27	19	-29	35	-6
12.5 < w ≤ 15	-39	29	-10	-77	37	-40
15 < w ≤ 20	-75	31	-44	-119	40	-79
20 < w ≤ 30	-141	28	-113	-166	33	133
30 < w	-186	-6	-192	-174	-11	-185
Single No Children	-20	25	5	-34	57	23
Married No Children	-40	8	-32	-36	8	-28
Single Children	423	18	441	648	40	688
Married Children	-28	35	7	-57	35	-22

Source: Michigan Panel Study of Income Dynamics, 1980-1987. N = 2,796. The number of cases in the smallest cell is 113.

Uses base-case parameters. Refers to wage and family status in 1985. Expected Cash Transfer is the difference in E(Y) between the Status Quo and a policy expansion. The Change in Economic Security is the difference in R, the Change in Well-Being is the difference in C. See Table 1 for definitions.

Table 6. Per Capita Cash Transfers and Economic Security Effects
by Education, Disability and Race
Risk Aversion = 1.5
All figures in 1991 dollars

	EITC Expansion			Means-Tested Transfer Expansion		
	Expected Cash Transfers	Change in Economic Security	Change in Well-being	Expected Cash Transfers	Change in Economic Security	Change in Well-Being
Full population	0	24	24	0	30	30
No high school	92	18	110	141	23	164
High school, no college degree	4	29	33	-5	36	31
College degree	-89	21	-68	-106	24	82
Not Disabled	-4	25	21	-7	31	24
Disabled	26	25	51	54	34	88
Nonwhite	147	22	169	250	36	286
White	-15	25	10	-25	30	5

Source: Michigan Panel Study of Income Dynamics, 1980-1987. N = 2,796. The number of cases in the smallest cell is 257.

Uses base-case parameters. Refers to education, disability and race in 1985. Expected Cash Transfer is the difference in E(Y) between the Status Quo and a policy expansion. The Change in Economic Security is the difference in R, the Change in Well-Being is the difference in C. See Table 1 for definitions.

Table 7. Aggregate Effects of EITC and Means-Tested Transfer Expansion, by Wage
Risk Aversion = 1.5
All money figures in 1991 $billions

	% of Pop.	Expansion of the EITC: Expected Cash Transfer	Expansion of the EITC: Change in Security	Expansion of the EITC: Change in Well-Being	Expansion of Means-Tested Transfers: Expected Cash Transfer	Expansion of Means-Tested Transfers: Change in Security	Expansion of Means-Tested Transfers: Change in Well-Being
Total Population	100.0	0	2.468	2.468	0	3.055	3.055
Subsistence Wage Earners (below $5.00)	12.2	1.818	0.220	2.038	2.952	0.232	3.184
Low Wage Earners (Between $5.00 and $10.00)	31.7	2.040	0.782	2.822	2.613	0.989	3.602
Medium and High Wage Earners (Above $10.00)	56.1	-3.858	1.466	-2.392	-5.565	1.834	-3.731

Source: Michigan Panel Study of Income Dynamics, 1980-1987. N = 2,796. The number of cases in the smallest cell is 342.

Uses base-case parameters. w is wage in 1985. Aggregated assuming a total population of 100 million individuals. Expected Cash Transfer is the difference in E(Y) between the Status Quo and a policy expansion. The Change in Security is the difference in R, the Change in Well-Being is the difference in C. See Table 1 for definitions.

Table 8. Aggregate Effects of EITC and Means-Tested Transfer Expansion, by Wage
Risk Aversion = 4.0
All money figures in 1991 $billions

	% of Pop.	Expansion of the EITC: Expected Cash Transfer	Change in Security	Change in Well-Being	Expansion of Means-Tested Transfers: Expected Cash Transfer	Change in Security	Change in Well-Being
Total Population	100.0	0	6.934	6.934	0	8.504	8.504
Subsistence Wage Earners (below $5.00)	12.2	1.818	0.563	2.381	2.952	0.599	3.551
Low Wage Earners (Between $5.00 and $10.00)	31.7	2.040	1.993	4.033	2.613	2.473	5.086
Medium and High Wage Earners (Above $10.00)	56.1	-3.858	4.378	0.520	-5.565	5.432	-0.133

Source: Michigan Panel Study of Income Dynamics, 1980-1987. N = 2,796. The number of cases in the smallest cell is 342.

Uses base-case parameters. w is wage in 1985. Aggregated assuming a total population of 100 million individuals. Expected Cash Transfer is the difference in E(Y) between the Status Quo and a policy expansion. The Change in Security is the difference in R, the Change in Well-Being is the difference in C. See Table 1 for definitions.

Table A.1. Fixed-effects estimation
Regression of first difference of log income on first difference of characteristics

Dependent variable is the first difference of log income	Mean	Coefficient	Standard Error
Dummy=1 if spouse present, first difference	1.805e-3	-22.706e-3	12.025e-3
Number of children, first difference	-23.918e-3	-1.866e-3	6.096e-3
Dummy=1 if head has high school degree, first difference	-5.817e-3	-9.750e-3	27.133e-3
Dummy=1 if head has college degree, first difference	4.413e-3	-86.645e-3	*43.068e-3
Dummy=1 if head is disabled, first difference	11.082e-3	-2.817e-3	9.092e-3
Constant	--	1.237e-3	2.710e-3

N=19,943. The data consist of pooled observations of first differences from seven waves, each containing 2,849 respondents. Coefficients with standard errors marked (*) are statistically significant at the five percent level, two-tailed test. $R^2 = 0.0005$. Mean of the dependent variable is 0.884e-3.

Table A.2. Regression of differenced permanent income on household characteristics

Dependent variable is the first difference of log permanent income	Mean	Coefficient	Standard Error
Observed household income	42,511	9.58e-10	1.56e-9
Dummy=1 if spouse present	0.78	2.52e-3	1.11e-4
Number of kids	1.10	-8.05e-4	4.18e-5
Age of head	38.98	-2.02e-4	3.47e-5
Age squared	1628.53	1.43e-6	4.32e-7
Dummy=1 if head is female	0.54	1.49e-4	8.58e-5
Dummy=1 if head is nonwhite	0.09	5.25e-4	1.52e-4
Dummy=1 if head has high school degree	0.60	-5.03e-4	1.16e-4
Dummy=1 if head has college degree	0.22	-8.10e-4	1.45e-4
Dummy=1 if head is disabled	0.11	-1.42e-3	1.38e-4
Constant	--	5.00e-3	6.57e-4

N=19,943. The data consist of pooled observations of first differences from seven waves, each containing 2,849 respondents. All coefficients are statistically significant at the five percent level, two-tailed test, except female head. $R^2 = 0.0510$.

The mean of the dependent variable is 4.69e-5.

Source: Michigan Panel Study of Income Dynamics, 1980-1987.

Table A.3. Regression of squared permanent shock residuals on household characteristics

Dependent variable is the square of regression residuals from Table A.1.	Mean	Coefficient	Standard Error
Observed household income	42,511	6.92e-11	6.09e-11
Dummy=1 if spouse present	0.78	-1.89e-5	*4.31e-6
Number of kids	1.10	-1.90e-6	1.63e-6
Age of head	38.98	4.97e-7	1.35e-6
Age squared	1628.53	-1.85e-8	1.69e-8
Dummy=1 if head is female	0.54	-4.14e-6	3.35e-6
Dummy=1 if head is nonwhite	0.09	-1.29e-5	*5.91e-6
Dummy=1 if head has high school degree	0.60	-4.21e-7	4.54e-6
Dummy=1 if head has college degree	0.22	-1.84e-5	*5.63e-6
Dummy=1 if head is disabled	0.11	2.22e-6	5.37e-6
Constant	--	6.75e-5	*2.56e-5

N=19,943. Coefficients whose standard errors are marked with (*) are statistically significant at the five percent level, two-tailed test. $R^2 = 0.0042$.

The mean of the dependent variable is 3.54e-5.

Source: Michigan Panel Study of Income Dynamics, 1980-1987.

Table A.4. Regression of squared deviations of observed income from permanent income on household characteristics

Dependent variable is the squared deviation of permanent income from observed income.	Mean	Coefficient	Standard Error
Observed household income	42,511	1.10e-6	*4.23e-8
Dummy=1 if spouse present	0.78	-10.835e-3	*2.990e-3
Number of kids	1.10	-4.330e-3	*1.132e-3
Age of head	38.98	-1.469e-3	0.920e-3
Age squared	1628.53	5.51e-6	11.30e-6
Dummy=1 if head is female	0.54	0.774e-3	2.325e-3
Dummy=1 if head is nonwhite	0.09	-4.054e-3	4.108e-3
Dummy=1 if head has high school degree	0.60	-5.915e-3	3.148e-3
Dummy=1 if head has college degree	0.22	-16.372e-3	*3.892e-3
Dummy=1 if head is disabled	0.11	11.480e-3	*3.645e-3
Constant	-	84.868e-3	*17.724e-3

N=22,792. Coefficients whose standard errors are marked with (*) are statistically significant at the five percent level, two-tailed test. $R^2 = 0.0321$.

The mean of the dependent variable is 63.274e-3.

Source: Michigan Panel Study of Income Dynamics, 1980-1987.

Table A.5. Per Capita Sensitivity Tests
All figures in 1991 dollars

	Status Quo				EITC Expansion				Means-Tested Transfer Expansion			
	E(Y)	S(Y)	R	C	E(Y)	S(Y)	R	C	E(Y)	S(Y)	R	C
Base Case	40,512	10,505	1,911	38,601	40,512	10,356	1,887	38,625	40,512	10,337	1,881	38,631
Risk Aversion: 2.0	40,821	10,639	2,566	38,254	40,821	10,489	2,534	38,287	40,821	10,469	2,526	38,294
Risk Aversion: 4,0	40,512	10,505	4,983	35,529	40,512	10,356	4,914	35,596	40,512	10,337	4,898	35,612
Transitory Variance Reduced by 2/3	40,417	6,070	675	39,742	40,417	5,986	666	39,751	40,417	5,975	664	39,753
Increased Grid Density	40,512	10,505	1,912	38,600	40,512	10,356	1,888	38,625	40,512	10,338	1,882	38,631
Extreme Grid Density	40,512	10,505	1,913	38,599	40,512	10,356	1,888	38,625	40,512	10,334	1,882	38,631
Upper Bound: $400,000	41,998	11,189	2,124	39,874	41,998	11,032	2,097	39,901	41,998	11,010	2,090	39,909

Source: Michigan Panel Study of Income Dynamics, 1980-1987. N: 2,796 rows 1, 3, 5, 6; 2,810 row 2; 2,824 row 4; 2,843 row 7.

E(Y) is expected income, S(Y) is the standard deviation of income, R is the risk premium, and C is the certainty equivalent of income (equal to E(Y) - R). Income is family income per major adult (just the individual if single, individual and spouse if married). Increase grid density uses widths of $1,000 between points. Extreme grid density uses widths of $500.

Fig. 1 EITC Budget Line

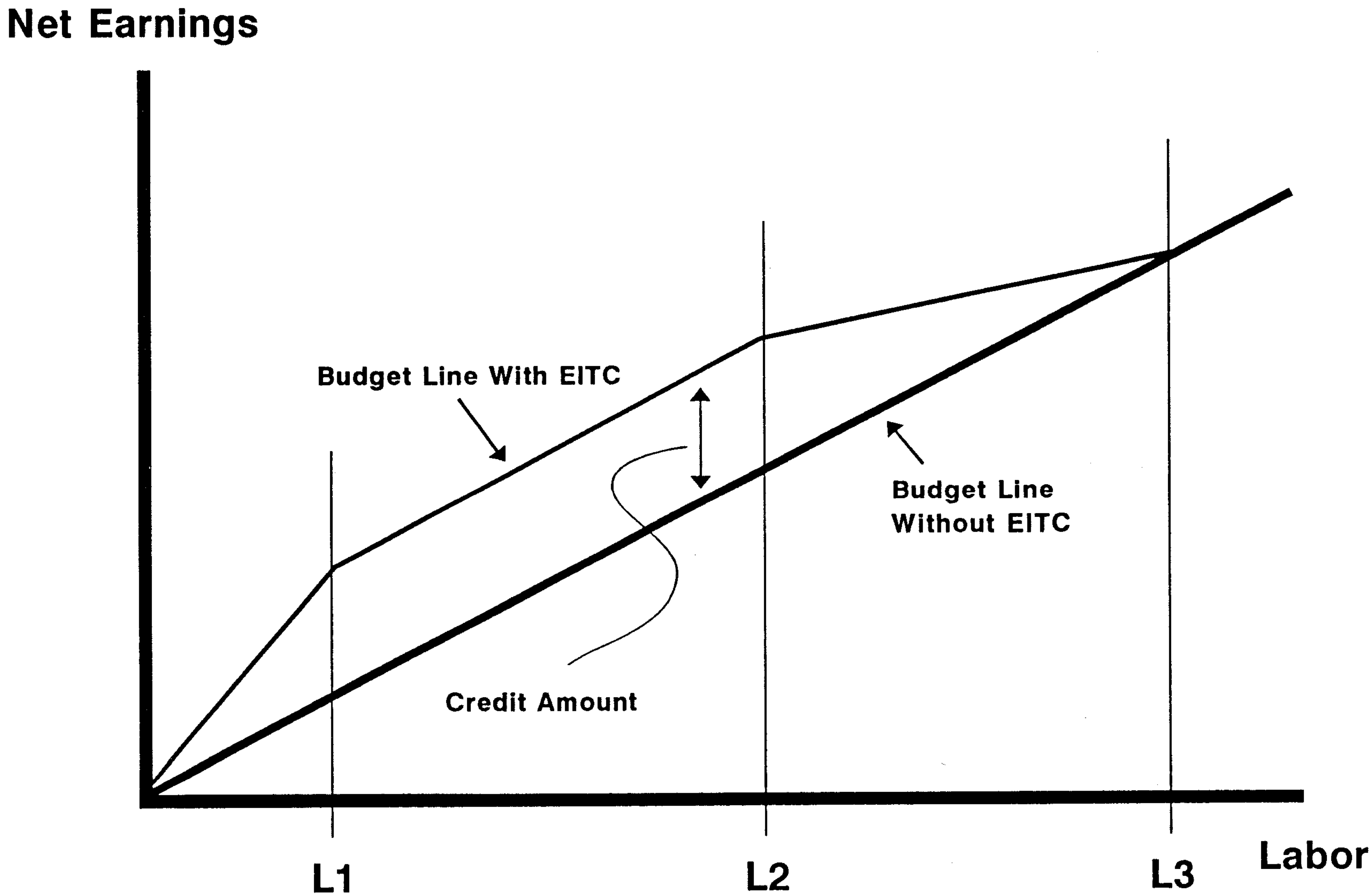

Fig. 2 Illustration of the Risk Premium