The Earned Income Tax Credit: Insurance Without Disincentives?*

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Abstract

The Earned Income Tax Credit (EITC) is now the single most important public insurance program in place in the US. It provides wage-subsidies to households that are sharply dependent on their demographic status, especially the number of children present in the household. In addition to productivity risk, it is the case that early in life, neither future marital status, nor the number of dependents, is known with certainty. Therefore, an important dimension of the EITC to act as insurance against such risk. However, given the fundamental nature of EITC as a public insurance scheme, there are potential effects on incentives. We ask the following questions. Who benefits from the EITC, and to what extent are beneficiaries recipients of pure transfers relative to pure insurance? What the temporal distribution of benefits? Lastly, how distortionary is the EITC likely to be? Our study, to our knowledge, is the first to measure the implications of the EITC in a setting capable of accommodating the essential features governing its impact. Preliminary results suggest that the EITC provides substantial insurance to young US households, and does not significantly alter, and hence does significantly distort, labor-leisure choices.

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*All errors are are own.

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1 Introduction

The Earned Income Tax Credit (EITC) has become the U.S. federal government's largest cash-assistance program for low-income families, making it the centerpiece of anti-poverty programs in the U.S. According to Eissa and Hoynes (2009), approximately $43 billion was allocated to 22 million families in the U.S. in 2007 through the federal EITC, more than *twice* as much as the $16.5 billion spent on traditional welfare program in the same year.

As a result, approximately 15 percent of households nationwide now qualify for the EITC (Hoffman and Seidman, 2003). The EITC is designed to encourage work: the tax credit increases with earnings for low levels of household income. However, the credit is phased out, until eventually a household is disqualified for it. The credit also targets families with children, and increases in generosity with the number of children in the household.[1] For example, households with two or more children (in tax year 2008) earning $15,000 could qualify for up to $4,824 in federal earned income credits. However, a childless single filer can receive at most $438 from the EITC.Families earning less than $41,646 in 2008 could qualify for the EITC. Moreover, the average amount of the credit among recipients reached 25% of annual income for families with 2 or more children. Thus, for low-income households who qualify for the EITC, the EITC is a negative tax and constitutes a significant portion of their after-tax wage income.

The EITC is a wage-*insurance* scheme: it works by supplementing earned income for low-wage, low-income workers. It is intended to help households deal with adverse shocks to wages while preserving their incentives to work. Because the EITC compresses the variability in effective (after tax and transfer) wages faced by workers, and because its generosity depends in part on *individual*-level outcomes for productivity, it provides insurance against both idiosyncratic and aggregate risk. Morever, given that idiosyncratic risks are far larger than aggregate risks (see e.g. Heathcote et al, 2009)), and because the reason for low income is immaterial for receipt of EITC transfers, the program is likely to have quantitatively important insurance benefits on many US households, especially those with low skills.

Given the fundamental nature of EITC as a public insurance scheme, there are, as usual, effects on incentives. In the case of EITC, the tension between insurance and incentives is that society wants to deliver social insurance to those with low market wages, or to those with shocks to their earnings potential, but to avoid "abuse" of these transfer schemes, it must impose limits on eligibility. The first objective requires transfers to those doing badly, but the second necessitates having a "phase-out" range for eligibility. The phase out however means that the marginal reward to work may fall. In fact, in the US, the central source of high marginal tax rates arises from the loss of eligibility for transfers, rather than having anything to do with the explicit income tax code (see e.g. Hotz

[1] For an in-depth description of the EITC, we refer the reader to Hotz and Scholz (2003) or Athreya, Reilly and Simpson (2009).

and Scholz (2001)). Ironically, then, the effort to *preserve* incentives for some through limits on eligibility for EITC, creates clear disincentives for others.

Our study, to our knowledge, is the first to measure the implications of the EITC in a setting capable of accommodating the essential features governing its impact. These are (i) a well-defined dynamic setting in which productivity varies with both age, and with uninsurable shocks (ii) liquidity constraints, and (iii) demographic risk. Each of these features is essential for understanding EITC. First, the EITC is aimed at buffering the wages of those whose labor earnings fall below a threshold. The life-cycle profile of earnings in turn makes this assistance temporary for most household. Second, the EITC helps mitigate the effect of borrowing constraints, which have been estimated by many (see, e.g. Jappelli (1989)) to long have be pervasive among young, low-skilled households. In particular, because the EITC works by buffering wages, it will reduce the demand for borrowing by households by flattening the life-cycle profile of productivity, and compressing its variability. presence of liquidity constraints is important. Third, the structure of EITC differentiates substantially between households by their demographics, especially in terms of whether are one or two earners, and how many dependent children are present. Early in life, neither future marital status, nor the number of dependents, is known with certainty. Therefore, an important dimension of the EITC to act as insurance against such risk, particularly the state in which one experiences marital separation while parenting dependent children.

An important innovation of our paper is to utilize a key insight from recent work on labor supply under uninsurable risk, especially that of Floden and Linde (2001), and Pijoan-Mas (2006). These papers strongly suggest that the labor supply for the target population of the EITC will be relatively low. The fundamental insight of these papers is that underlying elasticities of labor supply may well be far higher than the *equilibrium* responses of hours to after-tax wages. These models, intuitively speaking, capture the natural idea that the poor may simply "have to work", especially if they are close to a borrowing constraint. For the analysis of a program explicitly aimed at buttressing the wages of those with low productivity, it is clear that the economic environment may itself provide a substantial countervailing force to any disincentives created by the high marginal tax rates created by the EITC phase out.

The preceding work therefore suggests that the incentive effects of the EITC, which is primarily aimed at young, low-wealth, and low-wage households, will be substantially lower than what has been measured thus far. All existing studies of EITC ignore uninsurable risk and borrowing constraints. Moreover, the insurance provision of the EITC will depend critically on allowing for uninsurable risk, and the presence of such insurance will, as a result, will actually allow households to better align their labor effort and productivity, while the subsidy to wages while unproductive will lead to higher labor effort on average, ceteris paribus. The net effect of EITC on labor supply will therefore depend in the relative strengths of these forces, something that we are able to address.

Our central finding is that ****

Figure 1: EITC Structure, Tax Year 2008

Note: Single filers are depicted by solid lines, whereas married filers are depicted by dashed lines.

2 Details of the EITC and Marginal Income Tax Rates

The EITC is structured in three phases: in the phase-in period, the credit increases with earnings; in the plateau period, the credit reaches a maximum and levels off; and in the phase-out period, the credit falls as the claimant's earnings rise. In Figure 1, we plot the amount of federal EITC that single and married households receive across various income levels. As you can see, the EITC significantly varies with children: the federal credit can represent up to 34 and 40% of income for filers with one and two or more children, respectively. Notice that the slope of the EITC function is steeper in the phase-in range than in the phase-out range. That is, an additional dollar of earned income rewards households in the phase-in region more by giving them a credit, which can range from $0.07 (for childless singles) to $0.40 (for married couples with two children). In the phase-out range, an additional dollar of income results in a reduction in the credit, from $0.07 (for childless singles) to $0.21 for married couples with two children). In addition, the range of eligible income for the EITC is much larger as the number of dependant children rises and for married couples. Also notice that the range of eligible income is much larger in the phase-out range compared to the phase-in range.

As a result of the EITC, marginal income tax rates are negative for low income households. Using data from TAXSIM version 9.0 from the NBER, we calculate the marginal income tax rates for single and married households with 0 and 2 children (i.e., dependents exemptions) for tax year 2008. In Figures 2 and 3, we plot the marginal tax rates across various income levels for single and married filing status earning up to $100,000. As you can see, for low levels of income, the marginal tax rate is -40% for both single and married filers with 2 children, which represents the phase-in rate for the EITC. As incomes approach $13,000, the marginal tax rate is 0%. For households with income above $13,000, the marginal tax rate becomes positive and jumps to 21% (for married households with 2 kids and incomes between approximately $19,000 and $25,000); this represents the EITC phase-out rate as documented above. That is, at the margin, these households are losing 21% of their income for any additional income they earn in this range. For married households with 2 kids and incomes between approximately $25,000 and $40,000, the marginal income tax rate increases to 31%, which represents the EITC phase-out rate plus the lowest income tax bracket of 10%. For married households wiht 2 kids earning $42,000, they face the phase-out rate and the next highest tax bracket of 15%, making their marginal tax rate 36%. For households above $42,000, they no

longer qualify for the EITC; hence, they face a 15% marginal tax rate. As household income approaches $90,000, the marginal tax rate increases to 25% for married filers.

For households with no children, the story is very different. They qualify for much less EITC, and hence their marginal tax rates are lower (in absolute value), up to approximately $42,000 (where the EITC is phased out). Since the EITC targets is more generous for households with children, they face higher marginal tax rates in the income ranges where they qualify for the EITC. For household income beyond $42,000, the marginal tax rates of childless households are higher than for households with children (independent of marital status) until approximately $64,000 of household income, where margainl tax are approximately the same for households with and without children.

The U.S. income tax system yields the highest marginal tax rates for low-income households (Ellwood and Liebman, 2001), and this is due to a system of means-tested credits, income-support programs and the progressive income tax schedule (Romich, 2006). That is, the source of the high marginal tax rates is because of the loss of eligibility for means-tested programs. Figure 2 also shows that single taxpayers with two children experience similar jumps in the marginal income tax rates, but for lower levels of income than married households. Thus, low-income single parents that receive the EITC face the largest marginal income tax rates in the U.S.

3 Related Work on the Labor Market Effects of the EITC

As a wage subsidy, the EITC has the potential to affect both the decision to work and the number of hours worked. In a static labor-leisure model, the EITC increases the marginal value of working (i.e., the after-tax wage rate) which influences labor market participation (i.e., the extensive margin). Thus, in theory, the EITC will increase labor market participation due to the substitution of work for leisure. However, the effects of the EITC on hours worked (i.e., the intensive margin) are theoretically ambiguous.[2]

In the phase-in range of the EITC, since the marginal income tax rate is negative, a negative income effect and a positive substitution effect are both at play, making the effects on hours worked ambiguous. Households in the plateau region of the EITC receive the same amount of credit if they earn more income, and hence a pure income effect occurs in which higher income reduces the incentive to work. In the phase-out range, a negative substitution effect influences workers to substitute leisure for hours worked. In addition, a negative income effect may reduce hours worked even more. Since a majority of EITC recipients fall in the flat or phase-out region, it is likely that the overall effects of the EITC on hours worked are negative (Hotz and Scholz, 2003). For

[2] For a more detailed analysis of the static labor-leisure model with the EITC, see Eissa and Hoynes (2005), and Athreya et al. (2009).

those with income just beyond the phase-out region, they may be influenced to reduce their labor hours to get back into the range of EITC eligibility.

There is a large empirical literature that examines the effects of the EITC on labor supply. Much of the evidence indicates that the EITC does in fact increase labor force participation, and especially for single mothers (Meyer, 2001). In fact, the EITC has led to a dramatic increase in employment rates for single mothers during the 1980s and 1990s (Eissa and Leibman, 1996; Meyer, 2001; Grogger, 2004). However, the effects of the EITC on hours worked are less clear in the data, with most studies not finding a significant change in hours worked due to the EITC. Still, there is some evidence that single mothers may work more in response to the EITC since they are likely to be in the phase-in region where marginal income tax rates are negative (Eissa and Liebman, 1996). Married women, however, who typically fall in the phase-out range, may work fewer hours as a result of the EITC rates (Ellwood, 2000; Eissa and Hoynes, 2004). Recall that households in the phase-out region experience some of the highest marginal income tax rates in the U.S. If these households are very close to a large jump in the marginal tax rate, their labor supply decision may be significantly distorted. Recall that the jump in tax rates are caused by the phasing-out of tax credits and other income-support programs, thus, it is inevitable that these households will eventually be hit by high marginal rates. However, the extent to which this affects aggregate labor supply depends critically on the mass of households near these jumps.

4 Model

The economy consists of a continuum of households, each of whom works for J periods, and then retire. Each period, a new cohort of agents arrives to replace the one that exits.

4.1 Preferences

Households value consumption and leisure. Their preferences are represented by a standard time-separable CRRA utility function over a composite good consumed in each period. During working life, this composite good is defined by a Cobb-Douglas aggregator of consumption and lesiure. During retirement, households no longer have work opportunities, and therefore choose only consumption. Given our target population of the "working young", we do not gain substantially by explicitly modeling the consumption-savings problem in retirement.We therefore directly specify a "retirement felicity function", ϕ, that is defined on *wealth* x_R taken into retirement. All households have a common discount factor β and discount exponentially.

The general problem for the household is to choose consumption $\{c_j\}_{j=1}^J$, leisure $\{l_j\}_{j=1}^J$, and retirement wealth x_R, to maximize lifetime utility. As will be detailed further below, households size is subject to risk. As a result, household-level expenditures on consumption at any age j will translate into effective

consumption per adult equivalent according to the age-specific equivalence scale ES_j. Let $\Pi(\Psi_0)$ denote the space of all feasible combinations $(\{c_j\}, x_R)$, given initial state Ψ_0. The household optimization problem is then:

$$\sup_{(\{c_j,l_j\},x_R)\in\Pi(\Psi_0)} E_0 \sum_{j=1}^{J} \beta^j \frac{\left(\frac{c_j}{ES_j}^{\theta} l_j^{1-\theta}\right)^{1-\alpha}}{1-\alpha} + \phi(x_R) \tag{1}$$

Retirement felicity as a function of retirement wealth takes the same form as preferences over the composite good in working life:

$$\phi(x_R) = \frac{x_R^{1-\alpha}}{1-\alpha} \tag{2}$$

4.2 Endowments

Households receive endowments in the form of wages, and must choose labor supply. Given their labor earnings, households then face a tax or credit. All agents enter life with zero wealth.

4.2.1 Wages

Households face stochastic productivity shocks to their wages. I closely follow the literature (e.g. Hubbard et al. (1995), Storesletten et al. (2004), Huggett and Ventura (2000)), and disaggregate log wages into three components: an age-specific mean of log wages μ_j, persistent shocks, z_j, and transitory shocks, u_j. Log wages therefore evolves as:

$$\ln w_j = \mu_j + z_j + u_j \tag{3}$$

where

$$z_j = \gamma z_{j-1} + \eta_j,\ \gamma \leq 1,\ j \geq 2 \tag{4}$$

$$u_j \sim i.i.d\ N(0,\sigma_u^2),\ \eta_j \sim i.i.d.\ N(0,\sigma_\eta^2),\ u_j, \eta_j \text{ independent} \tag{5}$$

To reflect heterogeneity prior to any direct exposure to labor market risk, households draw their first realization of the persistent shock from a distribution with a different variance than at all other ages. That is,

$$z_0 = 0, \text{ and } \eta_1 \sim N(0,\sigma_{\eta_1}^2) \tag{6}$$

In subsequent periods, the log of household (non-asset) wages is determined as the sum of the unconditional mean of log wages μ_j, the persistent shock $\ln \eta_j$ and the transitory shock, $\ln u_j$.

4.2.2 Demographic Risk

In adddition to wage risk, households face the risk that their family composition may change. In particular, we model all households as representing single agents for the first τ_y periods of life. In between age τ_y and $\tau_y + 1$, households receive a "demographic shock" that determines their marital status, $S \in \{0, 1\}$ for single and married, respectively, and how many children $N_{c,j} \in \{0, 1, 2+\}$ they will have at any age j. This shock is denoted ξ, and has components which are jointly distributed according to $f(S, N_{c,j})$. If a household is endowed with children, the latter will live with the parent(s) until they become independent adults, at age τ_A. Once marital status is determined, it will not change again. The presence of marital status and number of children enter the household's problem through the equivalence scale, $ES_j = \chi(S, N_{c,j})$, and will evolve determinstically with age.

4.2.3 Retirement Income

In the last period of working life J, households evaluate retirement savings according to the function $\phi(x_R)$, and save accordingly. Households aged $J + 1$ are guaranteed to have a minimal standard of living given by the threshold $\underline{\tau}^R$. The representation of social insurance policy after working life is aimed at capturing the sum of welfare programs and the sum of social security and medicare. Transfers during retirement are therefore *not* means-tested, and are given instead by a single lump-sum transfer $x_{\underline{\tau}}$ to all retiring households. We follow Huggett (1996) and Gourinchas and Parker (2002). A household's wealth level at retirement is then the sum of the household personal savings x_{J+1} and the baseline retirement benefit $x_{\underline{\tau}^R}$

$$x_R = x_{J+1} + x_{\underline{\tau}^R} \tag{7}$$

The amount $x_{\underline{\tau}^R}$ is the wealth level that, when annuitized at the discount rate R^f, and adjusted for the probability of survival for k periods, π_k, yields a flow of income each period equal to the societal minimum retirement consumption floor $\underline{\tau}^R$. That is, minimal retirement wealth $x_{\underline{\tau}}$ solves:

$$\sum_{k=1}^{K} \frac{\pi_k \underline{\tau}^R}{(R^f)^k} = x_{\underline{\tau}^R} \tag{8}$$

4.2.4 Taxation

The central focus of this paper is on the role of wage-insurance in altering allocations and welfare. Agents face a tax/transfer function $\tau(y_j)$ on all earned income (i.e. labor earnings) y_j. In addition to being positive for a wide range of earned income, the function $\tau(y_j)$ can take on negative values as well, which are to be interpreted as transfers or credits. Therefore, given wages w_j and labor supply $(1 - l_j)$, a household's labor earnings are given by: $y_j \equiv w_j(1 - l_j)$. Net of taxes, or *credit*, the household's labor income is then: $y_j(1 - \tau(y_j))$.

4.3 Technology and Market Arrangement

Households have access to a credit market which allows them to issue risk-free debt, and also have access to a risk-free savings instrument. A household of age-j choose savings, or a level of one-period risk-free debt, denoted x_{j+1}, to smooth consumption in the face of uncertainty. A value for $x_{j+1} > 0$ is interpreted as savings, which earns the return $R^f > 0$.[3] To remain close to the literatures on life-cycle consumption (e.g. Low (2006), Attanasio et al (2008)), we assume a small open-economy setting whereby R^f is exogenous.[4] If $x_{j+1} < 0$, households have borrowed in the current period. When borrowing, the interest rate is denoted by $R^l = R^f + \psi$, were ψ denotes transaction costs arising from resources used in intermediation. In what follows we denote the interest rate by R, with the understanding that it represents the values R^l and R^f as needed.

4.4 Recursive Formulation

The household's problem is recursive in a state vector that is defined as follows. During working life, a household's feasible set for consumption and savings is determined by its age j, beginning-of-period net worth x_j, current-period realization of the persistent shock z_j, and current-period realization of transitory income u_j.

4.4.1 Value Functions

Beginning with a newly entering adult, for periods 1,2,...τ_y, its value function is:

$$W^Y(j, x_j, z_j, u_j) = \sup_{x_{j+1}} \left\{ \frac{\left(\frac{c_j}{ES_j}^{\theta} l_j^{1-\theta}\right)^{1-\alpha}}{1-\alpha} + \beta E_{z_{j+1}|z_j} W^Y(j+1, x_{j+1}, z_{j+1}, u_{j+1}) \right\} \tag{9}$$

Subject to

$$c_j + \frac{x_{j+1}}{R} \leq w_j(1-l_j)\tau(y_j) + x_j \tag{10}$$

[3] Since shocks are realized once-per-period, the restriction to one-period debt is natural in any setting in which lenders cannot commit themselves against renegotiating the terms of debt in the future. In most credit-card arrangements, for example, the right to reprice at will is made explicit. However, it is important to note that longer-term debt may allow households more flexibility in borrowing. Moreover, to the extent the default premia make unsecured borrowing expensive, households may ultimately "overuse" collateralized debt (e.g. home equity) as an alternative method to smooth consumption. Both points suggest that multi-period debt should be allowed for and studied in future work.

[4] Examples include Livshits et al. (2007), Carroll and Samwick (1997), and Hubbard et al. (1995). This abstraction is also reasonable in the present context, as the measure of households most responsive to the policy experiments conducted here hold very low net worth in the aggregate.

where the function $R(j, x_{j+1}, z_j)$ specifies the interest rate associated with the level of savings or borrowing, x_{j+1}, chosen by the household with current age j, and current realization of the persistent shock z_j.

Since period τ_y is the final period prior to realizing demographic status, expected household continuation utility $V(\cdot)$ is given by the value of entering the next period as a function of realied marital and child status. Therefore, we have:

$$W(\tau_y, x_j, y_j, u_j) = \sup_{x_{j+1}} \left\{ \frac{\left(\frac{c_j}{ES_j}^{\theta} l_j^{1-\theta}\right)^{1-\alpha}}{1-\alpha} + \beta E_{\xi, z_{j+1}|z_j} V(S, N_{c,\tau_y+1}, j+1, x_{j+1}, z_{j+1}, u_{j+1}) \right\} \tag{11}$$

Subject to

$$c_j + \frac{x_{j+1}}{R} \leq w_j(1-l_j)\tau(y_j) + x_j \tag{12}$$

$$N_c = 0$$

Once demographics have been assigned, optimal decisions for the remainder of working life will satisfy:

$$V(S, N_{cj}, j+1, x_{j+1}, z_{j+1}, u_{j+1}) = \sup_{x_{j+1}} \left\{ \frac{\left(\frac{c_j}{ES_j}^{\theta} l_j^{1-\theta}\right)^{1-\alpha}}{1-\alpha} + \beta E_{\xi, z_{j+1}|z_j} V(S, N_{cj+1}, j+1, x_{j+1}, z_{j+1}, u_{j+1}) \right\} \tag{13}$$

Subject to

$$c_j + \frac{x_{j+1}}{R} \leq w_j(1-l_j)\tau(y_j) + x_j \tag{14}$$

And since households do not have children before age τ_y, and because these children leave the household after τ_A periods, we have that:

$$\begin{gathered} N_{c,j} = 0 \text{ for } j \leq \tau_y \\ N_{c,j} = N_{c,\tau_y} \text{ for } j = \tau_y + 1, \tau_y + 2, ..., \tau_y + \tau_A \\ N_{c,j} = 0 \text{ for } j \geq \tau_y + \tau_A + 1 \end{gathered}$$

In the final period of working life, period J, households make decisions taking as given the retirement felicity function as the continuation value. This gives:

$$W(\tau_y + \tau_A, x_j, y_j, u_j) = \sup_{x_{j+1}} \left\{ \frac{\left(\frac{c_j}{ES_j}^{\theta} l_j^{1-\theta}\right)^{1-\alpha}}{1-\alpha} + \beta) \right\} + \beta\phi(x_R) \tag{15}$$

Subject to

$$c_j + \frac{x_R}{R} \leq w_j(1 - l_j)\tau(y_j) + x_j \tag{16}$$

5 Equilibrium

A stationary recursive partial competitive equilibrium (RCE) of our model is defined as follows. Let $\Omega \equiv S \times N_c \times J \times x \times z \times u$ denote the state space, and let ω denote the borel σ-algebra on Ω. Given the interest rate function R, and tax function $\tau(\cdot)$, a RCE is a collection of :

1. $\omega-$measurable value functions $W^Y(\cdot)$, $W(\cdot)$, and $V(\cdot)$
2. $\omega-$measurable decision rules for assets and labor supplies $g(\cdot)$ and $h(\cdot)$ such that $x_{j+1} = g(S, N_c, j, x_j, z_j, u_j)$ and $l_j = h(S, N_c, j, x_j, z_j, u_j)$
3. A transition function $P(b, B)$ giving the conditional probability that a household currently in state b will be in a subset $B \in \omega$ next period.
4. A measure, $\mu^* : \omega \to \Re$, of households over subsets of the state space.

such that:

1. The value functions satisfy the recursions (9), (11), (13)and (15) subject to the relevant budget constraints.
2. The decision rules $g(\cdot)$ and $h(\cdot)$ attain the supremum of the RHS of the relevant value functions for all values of the current state.
3. The measure $\mu^* : \omega \to \Re$, is stationary. That is, μ^* satisfies $\mu^*(b) = \int P(b, B)d\mu^*$.

6 Parameterization

6.1 Marginal Tax Rates

Based on Figures 2 and 3, the marginal income tax rate schedule is discontinuous, in that it exhibits several jumps in tax rates at various levels of income. However, researchers may require a continuous function that closely approximates the actual marginal income tax schedule in the U.S. We think the general shape of the marginal income tax schedule mimics the logistic function. That is, marginal tax rates are an increasing function of income, and then converge to fixed rate. We use the following specification for the marginal tax function:

$$tax = \frac{t}{1 + g\exp(f(a - income))} - z$$

where *tax* is the marginal tax rate, *income* is the level of household income, and t, g, f, a and z are parameters of the logistic function. The parameters are set according to: XXX.

This parameterization delivers a functional form that is closest to the marginal income tax schedule for married couples with two children, as plotted in Figure X (the solid line). The marginal tax rate is negative for low levels of income (below $17,000), is an increasing function of income, and then converges to a rate of 28% for relatively high levels of income (above $27,000). Certainly, our estimated logistic function misses the drop in marginal tax rates for households with income around $40,000. This is exactly the point in which the EITC disappears and the standard U.S. tax schedule is applied. Thus, any model that uses this functional form will not appropriately capture the decisions at the margin for these households. However, the logistic function for marginal tax rates delivers an average tax function that is continuous and mimics the shape in the data (source). We integrate our marginal tax rate function to get an average tax rate function, and plot both functions in Figure 6 using the parameterization above. Based on this specification, average tax rates are negative for households earning less than $29,000, which is due to the EITC (and other tax credits for low-income households). Average tax rates rise in income, and eventually become positive at income levels of $29,000 and higher. Above this threshold, average tax rates continue to increase in income, but at a decreasing rate.

6.2 Wages

Wages paramteres are set as follows. We set $\gamma = 0.99$, $\sigma_u^2 = 0.063$, $\sigma_{\eta_1}^2 = 0.22$, $\sigma_\eta^2 = 0.0275$. These values allow the model to match three important targets. First, the variances of the transitory shock and initial persistent shock allow the model to match the variance of log income among the youngest working-age households in the data. Second, the near-unit root in the persistent shock of $\gamma = 0.99$ generates the essentially linear life-cycle growth of cross-sectional variance in log income documented in Storesletten et al. (2004). Third, the variance of the persistent shock beyond the youngest age captures the total increase in cross-sectional (log) income variance over the life-cycle, from approximately 0.28 among 21-year-olds, to approximately 0.90 among new retirees. To parameterize the profile of the mean of log endowments over the life cycle, I use the data on median earnings from Census (2000) on US males. Since endowments are log normal, the mean of log endowments equals the logarithm of median endowments. Therefore, I take logs of the preceding estimates of median earnings, and generate a profile $\{\mu_j\}_{j=1}^J$.[5] When solving the household's problem numerically, I use a 256 point discretization for the income process, and employ

[5] The resulting profile is very similar to the profile of mean efficiency units estimated by Hansen (1993). A third process is that of Huggett and Ventura (2000). The latter process is steeper at both ends of the life cycle, as it is adjusted for labor force participation (treated as an exogenous process). The results are robust to the all three choices of the age-profile for the mean of log income, and are available upon request.

the approximation of Tauchen (1986) to represent the stochastic components of the income process. To obtain decision rules and value functions, I use standard discrete-state space dynamic programming.[6]

The fact that the income process generates an increasing cross-sectional variance with age is crucial. It is this prominent feature of the data that will make precise the role played by credit markets in moderating the effects of income risk over the life-cycle. I discipline the model by targeting the distribution of US net worth, which I measure using the Survey of Consumer Finances (2001). I employ a smoothed version of a variety of percentiles, by age, of this distribution, which generates paths similar to those of Kennickel (2002).

The final objects for parameterization are the means-tested transfer function and retirement benefit. With respect to preferences for retirement wealth, I set $\alpha = \mu = 2$. Turning first to the means-tested transfer function, $\tau(j, x_j, y_j)$, the interpretation is that households are eligible for a transfer, subject to the sum of the current income and wealth falling below a threshold $\underline{\tau}$, deemed necessary by society. I denote the transfer under current US policy as τ^{US}, and set $\tau^{US} \cong$\$7,600. The dollar value of this income floor is less than the inflation-adjusted value of Hubbard et al. (1995) of approximately $\$10,800$ in constant 1991 dollars per household annually, but allows the benchmark model to much better capture the observed asset accumulation of households in the lower percentiles of the wealth distribution.[7]

To be completed

7 Results

To be completed.

7.1 Steady States

To be completed.

7.2 How Much Does the EITC Matter?

To be completed.

[6] All code is available from the Author on request.

[7] The probabilistic receipt of some classes of transfers (especially housing assistance) is part of what is being captured in this reduction. Notably, Hubbard et al. (1995) assign households the expected value of the transfer. However, this will overestimate the floor, as the value of the expectation will be strictly greater than the value of the lottery to the household. Lastly, the \$10,800 is arrived at by adjusting for inflation the \$7000 income floor of Hubbard et al. (1995), which was measured in 1984 dollars, using the CPI "All Items" index. Moreover, as the referee has noted, less-than-100% utilization may also arise from various transactions costs, lowering the value of the transfer.

7.2.1 The Transition

To be completed.

8 Concluding Remarks

To be completed.

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Figure 2: Marginal Tax Rates, Two Kids

Figure 3: Marginal Tax Rates, No Kids