Welfare Reform and the Labor Market

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Abstract

This paper reviews the basic theoretical models that are appropriate for analyzing different types of welfare reforms, and the related empirical literature. We first present the canonical labor supply model of a classical welfare program, and then extend this basic framework to include in-kind transfers, incomplete take-up, human capital, preference persistence, and borrowing and saving. The empirical literature on these models is presented. The negative income tax, earnings subsidies, US welfare reforms with features that differ from those in other countries, and child care reforms are then surveyed both in terms of the theoretical model and the empirical literature surrounding each.

I. Introduction

The relationship between welfare programs and the labor market is one of the oldest topics of interest in modern labor economics. Also termed means-tested transfer programs because they condition eligibility on current income and, possibly, assets, welfare programs potentially have effects on labor supply and work effort, the outcome which has been studied the most. This literature began in the 1960s and early 1970s, when the static model of labor supply was applied to the work incentives of a negative income tax (NIT). Since that time, the static model has been extended in many directions, to dynamic models in general and to models of life cycle labor supply, human capital, marriage and child bearing, migration, and other outcomes in particular.

It is an international literature which has been closely tied to policy developments and to proposed welfare reforms in different countries. Even the initial research interest in an NIT was motivated by proposals by policy-makers for that particular reform which suggested that reductions in the implicit marginal tax rate on earnings in a welfare program could increase labor supply. Since that time, many countries have enacted significant changes in their programs, introduced new types of programs, and have proposed others which have attracted research attention even if not enacted. Across the countries, these new reforms include programs which subsidize earnings or wage rates for low-income workers, provide in-kind benefits (food, housing, or medical care), subsidize child care, impose job training or work requirements, and impose time limits. Very commonly, an economics literature develops in the years after a major reform in a country is enacted or proposed, developing new models appropriate to the policy in question and analyzing its effects, often in new ways.

The close relationship between policy developments and labor market effects is well illustrated by the history of earnings subsidies, traditional welfare programs, and child care subsidies in the U.S. and the U.K. In the U.S., attempts were made in the 1960s to provide work incentives in its main welfare program which set off the modern labor economics literature on the labor supply effects of those

reforms. But opposition to the NIT led to the very different earnings subsidy, the 1975 Earned Income Tax Credit (EITC), which provided much stronger earnings incentives but less support for nonworkers. Expanded in later years, the EITC has been studied in economic research and has been shown to increase the labor force participation of single mothers. Further concerns with disincentives of traditional welfare programs led to reductions in benefits for nonworkers in 1996, but coupled with expansions in subsidies for child care expenses while working and further increases in the EITC, creating what is known in the U.S. as the "work-based safety net". That combination of reforms has also been heavily studied and, as we report below, has resulted in further increases in employment and hours although not always increases in family income.

In the UK, the situation has been different because benefits for nonworkers are much higher than those in the US and there has been no movement to reduce them, so most reforms have been to provide more work incentives in the presence of such high base benefits. From the Family Income Supplement in 1971 to the Family Credit in 1988 to the Working Families Tax Credit in 1999 to the Working Tax Credit in 2003 to the Universal Credit in 2013, work incentives have been reformed repeatedly, usually in a positive direction. Different from the U.S., some of these programs have had minimum hours requirements (which have also changed over time) which effectively create an earnings subsidy not dissimilar to the EITC (because tax rates can be negative over a range). Much research in the UK has shown work-increasing effects of many of the reforms. But some of these reforms, most prominently the most recent Universal Credit, have attempted to simplify tax rates more than reducing them overall, with the result that work incentives have gone up for some families and down for others. Many of these reforms have also changed the relationship between child tax credits and welfare payments, and expenditures for child care subsidies have also risen over time.

This paper provides a review of the models appropriate to an analysis of these and other types of reforms and provides a relatively brief summary of the empirical literature on each reform type.

Because the amount of work done over the past 50 years is vast, we mostly concentrate on recent developments in the literature, although we provide select citations to the older literature as well.[1] For space reasons, we also do not spend a great deal of time discussing econometric methods per se, although we will refer to them in our review of past studies and what types of estimation methods have been used.

The next section of the paper outlines the types of welfare reforms we will cover and their policy history in different countries. Following that, we have a section on "basic" labor supply models in the presence of welfare programs and the empirical evidence surrounding them, then we have a section on the models and empirical evidence on four different types of reforms--reductions in marginal tax rates as in an NIT, earnings subsidies, US-style reforms, and child care reforms.

II. Outline of Types of Welfare Reforms To Be Covered

A welfare program, by definition, offers some kind of benefit or service to individuals or families with income and, possibly, assets below some cutoff values. By definition, then, the benefit or service must be eliminated at a high enough level of income or assets. We present the basic static model of the labor supply effects of a standard welfare program in the first section below and we show how it can be extended to include the analysis of in-kind transfers and of incomplete takeup by eligibles, as well as extensions to dynamic models of the effect of welfare programs in models of life cycle labor supply, human capital and preference persistence.

The first type of reform we discuss is a change in the financial incentives in a standard welfare program. The rate of elimination of benefits as income rises, usually termed the tax rate, or benefit-reduction rate, varies widely across programs. Many welfare programs in industrialized countries offer

[1] We restrict ourselves to citing only to papers that have been published or which we know to be accepted and forthcoming.

the largest benefit to those with the lowest incomes and then phase out the benefit at a fairly high rate. The main U.S. cash program for single mothers had a 100 percent tax rate for most of its history and many other OECD countries have programs with tax rates exceeding 60 or 70 percent in their social assistance systems.[2] Friedman (1962) was the first economist to publicly criticize high tax rates in welfare programs for their potential work disincentives, and advocated a reduction of the tax rate to increase work incentives. Because Friedman proposed that it be operated through the U.S. tax system, the program was dubbed the Negative Income Tax (NIT), which has come to be associated with the general idea of simply reducing the tax rate on benefits in a welfare program.

The second type of reform we will cover is that of earnings subsidies. Earnings subsidies are a rather different type of welfare program that have become popular in several countries in recent decades. The Earned Income Tax Credit (EITC) in the U.S. is one example, as are several programs in the UK which have evolved in form over the years but which all gave a substantial benefit bonus if the recipient worked at least some minimum hours per week (those programs have now been replaced). Several other countries have earnings tax credits in their tax code. While the exact form of the subsidy differs across countries and programs, a common structure is a simple one in which the individual or family receives a cash benefit from the government which is positively related to the level of earnings. The subsidy rate in this case, which is effectively a negative tax rate, determines the increase in the benefit per dollar of additional earnings. Because it is a welfare program, eventually the benefit has to be phased out and, in that range, the effect of the rate of phaseout is similar to that of a tax rate in a more conventional welfare program. There are variations in the structure across countries but, whatever its exact form, its work disincentives are quite different from those of more conventional welfare programs.

[2] http://www.oecd.org/els/benefits-and-wages-statistics.htm

The third type of reform we discuss are more heavily associated with particular reforms in the U.S. The most prominent examples are reforms which impose restrictions on the recipient individual or family in the form of work requirements or time limits. In their strictest form, a recipient is required to work a minimum number of hours in order to receive any benefit at all.[3] A time limit rule allows the recipient to receive benefits for only a maximum period of time, such as 5 years in the well known Temporary Assistance for Needy Families (TANF) program in the U.S. While work requirements have been implemented in mild forms in the UK, Canada, and some other countries, they have been adopted in their strictest form in the U.S. Time limited welfare has also been implemented in the most extensive way in the U.S.

The final type of reform we cover are those which create or change subsidies for child care costs. While child care subsidies are, formally, in-kind programs like those previously discussed, they have a more direct relationship to work because they are most often offered only to low income individuals who wish to use the child care while working rather than while at home or in some other activity. Many countries offer subsidized child care to low income families (Canada, UK, US, and other countries) and have implemented reforms in recent years.

We should note that there are many important transfer programs we do not have the space to cover. Social insurance programs such as Unemployment Insurance, Disability Insurance, and retirement benefits have important labor market effects, as do means-tested programs for the disabled. Child support programs are another important set of government policies with labor market implications in many countries. Government health insurance programs, while touched upon briefly in our review, have special features which make their labor market implications rather different than those of most of the reforms we review.

[3] A milder form of requirement is a job training or job search requirement, rather than a requirement for an actual job. We do not cover these requirements because they are an extension of the strict work requirement (although they may have effects on human capital, which strict work requirements are usually assumed not to have).

III. Basic Theoretical Framework

III.A. Basic Models and Extensions

Classic Static Labor Supply Model. The utility function is $U(H, Y; \theta)$ where H is hours of work, Y is take-home income (equivalent to consumption in the static model), θ is a vector of preference parameters varying in the population, and with U assumed to satisfy the usual concavity conditions and with leisure (the time residual from H) assumed to be a normal good. The budget constraint is

$$Y = WH + N + B \tag{1}$$

where W is the hourly wage rate, N is private nonlabor income, and B is the welfare benefit.[4] Assuming the benefit formula is $B = Max\{0, G - \tau WH - rN\}$, where G is the guaranteed benefit for those with no income and where τ and r are the tax rates on earned and nonlabor income, respectively, the budget constraint can be rewritten as

$$Y = W(1-\tau)H + [N(1-r) + G] \qquad \text{if} \quad H \leq \frac{G - rN}{W\tau} \tag{2}$$

$$Y = WH + N \qquad \text{if} \quad H > \frac{G - rN}{W\tau} \tag{3}$$

Let $H(\widetilde{W}, \widetilde{N}; \theta)$ be the labor supply function denoting optimal H for an individual with preferences θ who faces a linear budget constraint with net wage equal to $\widetilde{W}$ and nonlabor income equal to $\widetilde{N}$. Then optimal labor supply if $B > 0$ can be written as $H[W(1-\tau), N(1-r) + G; \theta]$ and as $H[W, N; \theta]$ if $B = 0$. The individual will choose the one which yields maximum utility, which is most easily represented by use of the indirect utility function giving the maximum utility obtainable for an individual facing a linear budget constraint with net wage $\widetilde{W}$ and nonlabor income $\widetilde{N}$, denoted as $V(\widetilde{W}, \widetilde{N}; \theta)$. Letting P denote a welfare participation indicator variable equal to 1 if the individual maximizes utility

[4] For notational convenience, we suppress preference and wage shocks in the static model. Otherwise, the optimal decision can be expressed as a function of preference parameters and realizations of shocks. See the dynamic model for more details.

on welfare and equal to 0 if she maximizes utility off welfare, the final labor supply function can be succinctly written as

$$H = H[W(1 - \tau P), N + P(G - rN); \theta] \quad (4)$$

$$P = 1[P^* \geq 0] \quad (5)$$

$$P^* = V[W(1 - \tau), N(1 - r) + G; \theta] - V[W, N; \theta] \quad (6)$$

where 1[·] is the indicator function. It can be easily shown that the introduction of a welfare program will either leave H unchanged (if she does not go onto the welfare program) or reduce H (if she does go onto welfare) since, in the latter case, both substitution and income effects operate in a negative direction. Estimation of the model, given data on the budget constraint variables, yields estimates of the parameters of θ.[5]

It can be shown formally with equation (6) but is intuitive that an increase in W will lower the probability of being on welfare. Equation (6) can likewise be used to define a reservation wage W^* as the value of W that makes that equation equal to 0. Wages above that value result in non-participation in welfare and wages below it result in participation.

Three variations should be mentioned. First, the corner solution of $H = 0$ is ignored in this model. Allowing it requires the addition of utility at the corner, $U(0, N + P(G - rN); \theta)$, where $P = 1$ if $N < G/r$. The individual chooses $H = 0$ if this utility is greater than both values of V in their feasible ranges. Second, empirical work on labor supply has also often modelled labor supply choice from among a discrete set of hours values H_j, j=1,…,J, which has computational advantages when the budget constraint is more complex than in this simple model. A typical case is J=3 with the three hours choices of nonwork, part-time work, and full-time work. In this case, the indirect utility function is not needed and the individual is just assumed to choose the maximal $U(H_j, Y_j; \theta)$, where Y_j is the value of Y at $H =$

[5] The vector θ typically is also made a function of exogenous observables. A term for measurement or optimization error is also usually tacked on to the end of the H equation.

H_j.[6] Third, many labor supply models assume the existence of fixed costs of work, which implies that individuals will not work at low values of H and which typically fits the data better since such low values are rarely observed. Since those costs are usually not measured in the available data, they must be treated as an unknown parameter (or distribution) to be estimated. A term $\gamma 1[H > 0]$ is usually introduced, either in the utility function or the budget constraint, with the parameter γ to be estimated simultaneously with the other parameters of the model.

Non-participation of eligibles. In most means-tested transfer programs, a fraction of those individuals who appear to be eligible for the program are not participating and receiving benefits. While it could be that eligibility rules are complex and a researcher's calculation of who is eligible could have error, most non-participation rates are too large for that to be plausible (e.g., up to 40 percent for the main U.S. food subsidy program). Three possible reasons which have been put forth for low takeup of eligibles are (1) social stigma from being a welfare recipient, (2) lack of information on eligibility, and (3) costs of participation, including time and money costs as well as utility costs ("hassle"). Whatever the reason, their existence poses problems for model estimation. If non-participants are simply assigned the non-welfare budget constraint and participants are assigned the welfare budget constraint, parameter estimates will be biased and inconsistent if participation is endogenous (i.e., correlated with work preferences). If non-participation is ignored and all eligible individuals are assigned the welfare budget constraint, then there is a danger of misspecification because some sample individuals (i.e., nonparticipants) do not, in fact, face that constraint.

An alternative is to model non-participation directly. While some of the possible reasons for non-participation should go into the budget constraint (time and money costs, for example), others should go into the utility function (stigma, hassle). The literature has, by and large, followed the latter interpretation, hoping that the factors in the former category can also be picked up by a fixed cost of

[6] Blundell and MaCurdy (1999, Section 6.7).

participation in the utility function, e.g., $U(H, Y; \theta) - \psi P$, where ψ represents the fixed cost (which can vary across the population and possibly be correlated with θ). This specification can rationalize the data because it implies that some individuals who are eligible for a positive benefit will not participate because the gains in U from decreased H and increased C are smaller than ψ. The labor supply function in this case consists of (4) to (6) above but with (6) replaced by:

$$P^* = V[W(1-\tau), N(1-r) + G; \theta] - V[W, N; \theta] - \psi \quad (7)$$

There are no particularly interesting new theoretical results from this model for the effects of welfare programs on labor supply. The existence of non-participating eligibles only means that the aggregate labor supply reduction will be smaller than it would be if the takeup rate were 100 percent.

In-Kind Transfers. Most countries have some means-tested transfer programs that provide free or subsidized quantities of specific goods like housing, food, or medical care. These programs can have different effects on labor supply than cash transfers, with the key issue being whether leisure and the subsidized good are substitutes or complements. This can be easily illustrated by imagining a program which simply reduces the price of a particular good by a straightforward price subsidy. If the utility function is $U(L, C, X)$, where L is leisure (the time residual from *H*), X is the quantity of the subsidized good and C is other consumption, and if the market price of *X* is *q* and the subsidy rate is *s*, then the Marshallian demand function for *L* is

$$L = f[W, q(1-s), WT + N] \quad (8)$$

The effect of the price subsidy on L is $\frac{\partial f}{\partial s} = -qf_2$ where f_2 is the second partial of f. The term $f_2 > 0$ if L and X are gross substitutes and $f_2 < 0$ if they are gross complements. Hence an increase in s can decrease L and hence increase H in the former case.

While this example provides a certain level of intuition, the model does not capture the income conditioning of the subsidy, nor does it represent the form of most in-kind transfer programs, which offer the individual a fixed quantity of the good. In some programs, it is possible for the individual to

top the quantity up and consume be more than the fixed quantity, while in other programs that is not possible and the individual simply has to accept the fixed quantity or not ("take it or leave it"). If the fixed quantity of the subsidized good is $\bar{X}$, and the government makes the recipient pay $\tau(WH + N)$ for it, then the individual maximizes $U(L, C, \bar{X})$ w.r.t. *L* and *C* subject to $C = (WH + N)(1 - \tau)$ and the MRS between *L* and *C* at the optimum is

$$\frac{U_L}{U_C}|_{X=\bar{X}} = W(1 - \tau). \quad (9)$$

While this familiar MRS may seem to imply that the subsidy to leisure will unambiguously increase *L* and decrease *H*, that is not the case if the individual would prefer to consume less *X* than $\bar{X}$. In that case, the individual is constrained and *L* is pushed upward by the increase in *X* if they are complements and pushed down by the increase in *X* if they are substitutes, similar to the case described earlier.[7]

Figure 1 illustrates the possible choices between *X* and *C*, holding *L* fixed for the moment at its initial value. The budget constraint AA'B'B holds before the program is offered, while the constraint CDE holds for a program allowing top-up while the single point D holds for a program in which top-up is not possible. When top-up is allowed, unconstrained individuals such as person 1 will increase consumption of both goods while constrained individuals such 2 or 3 will accept the program but consume more *X* than they would for an equivalent cash transfer (budget constraint shown by the constraint E'DE) because they are constrained (indifference curves are not drawn for simplicity). When top-up is not allowed, there may also be individuals such as 1' who reduce their consumption of *X* to accept the program offer at D. For either program, there will be individuals who do not accept the program at all,

[7] As stated, this result only applies if the individual is constrained. If instead the program allows the individual to top-up the program by purchasing additional *X* and hence would consume more than $\bar{X}$ in the presence of the subsidy, the consumer is unconstrained and the subsidy is inframarginal and equivalent to a cash transfer (Murray (1980), Leonesio (1988), Gahvari (1994), Currie and Gahvari (2008)). If there is a black market and the individual can sell the good on the market, that would move it closer to a cash program.

either because they wish to consume too low a value of *X* or, in the case of a take-it-or-leave-it program, do not wish to reduce their *X* by the amount required for participation.[8]

Dynamic Models.[9] We first consider dynamic models which include human capital and preference persistence. We include both in the same model because they have some similar implications for welfare programs and labor supply. We allow uncertainty in preferences and wage rates. A basic starting point is an illustrative model in which the individuals' instantaneous utility function can be written as $U(H_t, Y_t, P_t; \theta, \psi, H_{t-1}, P_{t-1}, \epsilon_{\theta t}, \epsilon_{\psi t})$, where H_{t-1} and P_{t-1} represent the individual's decisions the previous period, θ and ψ are the time-invariant components of her leisure and welfare preference parameters, respectively, as defined in equation (7), and $\epsilon_{\theta t}$ and $\epsilon_{\psi t}$ are the time-varying components of her preferences arising from shocks to her leisure and welfare preferences, respectively. The lagged values of labor supply and participation represent preference persistence. Let the wage function be $w_t = g(K_t, \epsilon_{wt})$, where K_t is her human capital stock and ϵ_{wt} is her wage shock. Assume that the human capital stock evolves according to the learning-by-doing process $K_t = f(K_{t-1}, H_{t-1})$, which is net of any depreciation and where $\frac{\partial f}{\partial K_{t-1}} > 0, \frac{\partial f}{\partial H_{t-1}} > 0$. Denote the discount factor by β and assume there is no borrowing or saving, so that the static budget constraint above holds. Assume as well that all three shocks are serially independent.[10] The individual's intertemporal optimization problem can be written in a recursive form as follows:

$$V_t\left(H_{t-1}, P_{t-1}, K_{t-1}; \theta, \psi, \epsilon_{\theta t}, \epsilon_{\psi t}, \epsilon_{wt}\right) \equiv$$

[8] The diagram shows the possible changes in *X* and *C* holding *L* fixed. As described in the previous paragraph, *L* may rise or fall, shifting the budget constraint outward or inward. In addition, because *L* is now being subsidized, further substitutions between *C* and *L*, and between *X* and *L*, may take place.

[9] For discussions of dynamic models of labor supply with welfare programs, see Killingsworth (1983) and Blundell and MaCurdy (1999).

[10] Otherwise, E_tV_{t+1} will also depend on the realization of the period-t shocks. When shocks are serially independent, then individuals who experience a negative wage shock may know, in expectation, that their wage will return to being higher tomorrow and hence may expect to be on welfare for only a short period. Negative autocorrelation of shocks exacerbates it and positive autocorrelation of shocks ameliorates it, which are capable of generating frequent entries and exits of welfare and long periods of welfare with declining wages, respectively.

$$\max_{H_t, Y_t, P_t} [U(H_t, Y_t, P_t; \theta, \psi, H_{t-1}, P_{t-1}, \epsilon_{\theta t}, \epsilon_{\psi t}) + \beta E_t V_{t+1}(H_t, P_t, K_t; \theta, \psi)] \quad (10)$$

where the expectation is taken over the distribution of the three shocks at time t+1. The value function $V_t(.)$ depends on time-invariant preference parameters θ and ψ as well as six state variables, three of which have already been determined in period t-1 $(H_{t-1}, P_{t-1}, K_{t-1})$ and the rest are shocks unknown prior to period t $(\epsilon_{\theta t}, \epsilon_{\psi t}, \epsilon_{wt})$. In this model, the individual's labor supply decision will affect her utility next period directly via lagged *H* and also indirectly via *K*, which changes her wage next period. Her welfare participation decision will only affect her utility next period via lagged *P*.

A common example for preference persistence is that current labor supply reduces the disutility of labor supply next period, i.e., $\frac{\partial^2 U_{t+1}}{\partial H_{t+1} \partial H_t} > 0$. This can reflect habit formation or large initial utility costs of engaging in an activity. In such a case the individual's labor supply will exhibit persistence over time and she will respond only gradually to policy changes. The same case can be demonstrated for preference persistence in welfare participation.

The welfare participation and labor supply effects in the dynamic case are different than in the static case. Preference persistence implies larger utility gains from going onto welfare and reducing labor supply than in the static model, because the gain in leisure from doing so will increase the utility value of future leisure and hence being on welfare. Human capital effects, on the other hand, will reduce the utility value of going onto welfare and reducing labor supply because future wages are now reduced and the budget set contracts, reducing future utility. But those who do go onto welfare and reduce labor supply will have lower future wages and hence lower labor supply and higher welfare participation rates than would occur in the static model. The presence of uncertainty in future wages adds an additional insurance element that would not be present in a static model which will work toward increasing the value of the welfare program. Preference persistence and human capital

dynamics can be distinguished because the latter works through the wage rate and the former does not.[11]

A number of additional general issues should be mentioned. First, in a general human capital model, working may not represent human capital investment per se and may even crowd out such activities. This has implications for the long-term effects of welfare programs (e.g., Heckman, Lochner and Cossa, 2003). For example, suppose education (or training) and employment are both in the choice set and human capital can only improve via the former activity. In this case, introducing a welfare program creates an incentive to reduce human capital investment, but whether that translates to a further reduction in *H* (than in the static model) depends on the substitutability between education and labor supply. Second, the model so far assumes that individuals receive a wage offer each period; employment is determined exclusively by choice. The model can be modified to incorporate "frictions" in which the individual may receive no offers. Human capital may increase the probability of receiving a job offer, in addition to increasing the wage level. Finally, the opportunity cost of leisure consists of not only forgone wage (or the discounted marginal value of financial wealth, if saving is allowed) but also human capital accumulation. When the latter component is substantial, the labor supply decision will be dominated by the incentive to build human capital rather than financial incentives.

Other extensions. In most means-tested transfer programs, the benefit amount increases with the number of dependent children. Some programs are only available to unmarried individuals. These features will generate indirect effects on labor supply if individuals respond by having more children or reducing marriage. Having additional children will typically reduce labor supply, but the effect of reduced marriage is less clear. For example, individuals may increase *H* due to the loss of their spouse's income; they may reduce *H* if they need to stay home and take care of their children (e.g., child care is

[11] Wages are unobserved for nonworkers, so selection effects will change over time and the greater percent of nonworkers may cause the conditional wage mean to rise. Grogger (2009) illustrates this effect.

no longer affordable). If individuals are heterogeneous, the compositional effect may create an econometric issue; the labor supply effect may be biased when the researcher only focuses on a particular demographic group (e.g., single mothers) for analysis.

Another extension allows borrowing and saving and allows welfare programs to impose an assets test. For illustration purposes, ignore preference persistence and human capital, and suppose the individual makes consumption and leisure (the time residual from *H*) decisions each period given the asset level *A*, with the resulting intertemporal value function:

$$V_t\left(A_t;\theta,\psi,\epsilon_{\theta t},\epsilon_{\psi t},\epsilon_{wt}\right) \equiv Max_{C_t,L_t,P_t}[U\left(C_t,L_t,P_t;\theta,\psi,\epsilon_{\theta t},\epsilon_{\psi t}\right)+\beta E_t V_{t+1}(A_{t+1};\theta,\psi)] \quad (11)$$

The intertemporal budget constraint is $A_{t+1} = RA_t + w_t H_t + B_t - C_t$ where R is the gross interest rate. The asset test becomes a salient constraint, forthe benefit formula is $B_t = \max\{G - \tau w_t H_t - r[(R-1)A_t + N_t], 0\}$ if $A_t < \bar{A}$, and the individual is ineligible for welfare if the asset level exceeds $\bar{A}$. Without the welfare program, the first order conditions are $U_C(C_t, L_t) = \beta E_t(\lambda_{t+1})$ and $U_L(C_t, L_t) \geq \beta E_t(\lambda_{t+1}) w_t$ where $\lambda_{t+1} \equiv \frac{\partial V_{t+1}}{\partial A_{t+1}}$ denotes the marginal value of wealth in period t+1. The envelope theorem yields the Euler equation $\lambda_t = \beta R E_t(\lambda_{t+1})$. When the welfare program is present, there is another set of first order conditions, $U_C(C_t, L_t) = \beta E_t(\lambda'_{t+1})$ and $U_L(C_t, L_t) \geq \beta E_t(\lambda'_{t+1}) w_t(1-\tau)$, that characterizes the solution along the welfare segment of the budget constraint. The global solution is obtained by comparing the solution from each segment.[12] The usual implication of this model remains similar to that of the static model: the individual works less (and is more likely to go on welfare) when the wage is low and works more when the wage is high. The welfare program generates a substitution effect and a wealth effect (which reduces λ) which tend to reduce *H.* However, it is theoretically ambiguous as to whether introducing a welfare program will reduce *H* beyond what is implied by the static model because the magnitude depends on the degree of nonseparability between *C* and *L.* The

[12] Not discussed is the corner solution of no savings, which is empirically relevant as a significant group in the US population have virtually no wealth. See Hubbard et al. (1995) for details.

asset test may further reduce *H*, although individuals may respond by simply increasing *C* to remain asset-eligible. When earnings are exogenous, *C* would increase and *A* would decrease (e.g., Hubbard et al. (1995) and Ziliak (2016)). Finally, when the model contains a precautionary saving motive, the welfare program reduces the need to self-insure by building a buffer stock and this may again reduce *H*.

III.B. Empirical Literature

We review the empirical literature on the effect of a welfare program—relative to no program—on labor supply using models described in the previous section.

General Models. The development of models for the effect of welfare programs began in the late 1960s and early 1970s with the static labor supply model and was well worked out by the 1980s. Killingsworth (1983) provides a comprehensive overview of the early literature, both of the models used, econometric issues, and empirical results. His review showed that literature had produced a wide range of income and substitution elasticities, which together imply labor supply reductions from a standard welfare program. In later reviews, Danziger et al. (1981) and Moffitt (1992) tried to narrow the range of estimates, concluding that the hours reductions from the then-existing U.S. program, Aid to Families with Dependent Children (AFDC) were in the range of 1 to 10 hours per week. A later review article by Blundell and MaCurdy (1999) also outlined the basic static labor supply model with welfare programs, with an extended discussion of econometric issues as well as reviewing in detail the specifications and results of each of the major papers in the empirical literature, most of which were published subsequent to the prior reviews.[13]

All the reviews showed a significant range of elasticities from the nonexperimental literature. Possibly more reliable evidence comes from the U.S. NIT experiments of the 1960s and 1970s, reviewed

[13] We have not had the space to cover family labor supply models of welfare programs. Hoynes (1996) developed a model of husband and wife choice of discrete hours points and how they responded to a welfare program in the U.S. called the AFDC-UP program which offered benefits to two-parent families.

by Killingsworth (1983) and Moffitt and Kehrer (1981) and well summarized by Burtless (1987). Burtless summarized the overall effects of an NIT relative to no program at all and found that married men reduced their hours by about 7 percent and that married women and single mothers had hours reductions of about 17 percent. Burtless also showed that these reductions were actually quite large relative to the benefits provided, even for men, and that the earnings "leakage" from the program was non-trivial—for example, a $1 increase in the benefit led to as high as a $.80 reduction in earnings, thereby raising income only by $.20.

From a modeling standpoint, a breakthrough by Burtless and Hausman (1978) solved the econometric problem posed by the existence of the two-segment budget constraint created by the basic welfare program (a segment below the eligibility point for those on welfare and a segment above the eligibility point for those off) and the non-convexity of the constraint. The authors show that the choice of hours along each segment is made jointly with the choice of which segment to locate on and that the two choices have to be estimated simultaneously. They assume a particular functional form for the indirect utility function and model the choice of segment as described in our model section above, and specify a particular stochastic structure with both preference heterogeneity and optimization errors. Estimating their model with maximum likelihood on data on single mothers from one of the U.S. NIT experiments, they found a range of disincentive effects that depended on wage rates and parameters of the welfare program. While the subsequent literature has used different specifications for the utility function, different sources of preference heterogeneity, often discreteness of the *H* distribution, and different parametric assumptions on unobservables, the basic Burtless-Hausman model underlies all structural models of the effect of simple welfare programs on labor supply.[14]

[14] There have been relatively few papers using the basic static model of labor supply in recent years, with most papers addressing more innovative models or features. See Bargain et al. (2014) for an exception.

Non-Participation. Moffitt (1983) estimated a formal structural model with non-participation, assuming that it was generated by stigma, although his estimates presumably picked up the influence of all factors (money and time costs, hassle costs, etc.).[15] He assumed that there might be "variable" stigma as well as "flat" stigma, where the former increases with the level of benefits received while the latter is of the fixed type discussed above. He assumed a utility function with preference heterogeneity, allowed optimization errors, and estimated the joint choice of segment, hours of work, and participation with maximum likelihood assuming joint normality for the errors. His estimates showed that there was strong selection bias in who participated and who did not, and that participation was positively affected by the potential benefit as well as by observable socioeconomic characteristics.

Many structural papers in the subsequent literature have taken non-participation into account. Hoynes (1996) adopted a specification similar to that of Moffitt (1983) but with only flat stigma, equivalent to fixed costs, which is the approach most often taken. Miller and Sanders (1997), in a dynamic discrete choice model discussed further below, also allowed nonparticipation of eligibles and argued that it could partly be the result of human capital effects, as eligible participants may choose to work to increase human capital and be off welfare later.[16] Keane and Moffitt (1998) extended the approach to multiple program participation with a static model, allowing individuals to participate in combinations of programs, each of which had its own fixed cost. The choice of the combination in which to participate is a function not only of the utility gain but also of the combination of fixed costs. The estimates showed strong evidence of participation costs and that individuals often do not locate on the boundary of their budget sets. Swann (2005) allowed stigma in a dynamic discrete choice model and

[15] Moffitt assumed that stigma was internal to the individual and not generated by how many other people are on welfare. A different assumption is that stigma is a function of how many other people are on welfare (Besley and Coate, 1992; Lindbeck et al., 1999; Nechyba, 1999). Currie (2006) has an in-depth investigation of the reasons for non-takeup of welfare programs.

[16] However, it is unclear why an eligible could not accept the welfare benefit and maintain the same level of labor supply after doing so.

Keane and Wolpin (2010), whose model is discussed further below, also allowed welfare participation to be in the utility function with a negative sign, therefore allowing nonparticipation of eligibles. Chan (2013) allows welfare participation to affect utility and to interact with the disutility of employment.[17]

In-Kind Transfers. Estimation of a structural model of in-kind transfers requires the modeling of consumption of the good being subsidized, and lack of data sets with sufficient consumption together with labor supply data has limited research. Structural models of this kind have therefore not been estimated. Keane and Moffitt (1998) took an approximate approach to the problem by putting a parameter to be estimated in front of the subsidy amount of the in-kind good in the budget constraint, allowing its effect to differ from that of cash. Their estimates showed that the coefficients on several in-kind transfers were far below one, implying a much smaller disincentive effect on labor supply than for cash benefits.

Although there have been few structural models incorporating in-kind transfers, there is a large reduced form literature estimating the overall effects of various in-kind transfers in the U.S. Surveys of the results of studies of the U.S. Food Stamp program (Currie, 2003; Hoynes and Schanzenbach, 2016) show, with some exceptions, very small if any work disincentives of that program (e.g., Fraker and Moffitt 1988, Hagstrom 1996). An exception is Hoynes and Schanzenbach (2012), who found that the rollout of Food Stamps in the 1970s had modest negative effects on the work effort of single mothers. A smaller literature on the work disincentives of the U.S. Medicaid program (see Gruber, 2003; Buchmueller et al., 2016) has also shown very small if any work disincentives, although some recent work has generated larger effects (see the Buchmueller review). There have been a handful of studies of the effects of U.S. housing programs on labor supply, with one study using quasi-randomization from

[17] In the 2000s, the U.S. government allowed many states to reduce participation costs directly in its Food Stamp program. Hoynes and Schanzenbach (2016) have a brief review of the reforms; there is a separate literature showing that they increased takeup in the program. The effects on labor supply are theoretically ambiguous.

waiting lists showing non-trivial work disincentives of the program (Jacob and Ludwig, 2012; see Collinson et al. (2016) for a review of other studies).

Dynamic Models. Dynamic structural models that incorporate welfare programs were first developed in the 1990s. Traditionally, estimating these models was computationally cumbersome because of the large state space involved in the dynamic programming problem; different states had different welfare benefit levels, and the welfare rule parameters evolved over time. Miller and Sanders (1997) estimated a discrete choice dynamic programming model of female employment and welfare participation decisions, featuring welfare stigma, habit formation (via duration dependence) and human capital accumulation but without borrowing or saving. They did not discuss the implications of the estimates for work disincentives of welfare but reported that habit persistence in welfare overwhelms human capital considerations in the sense that lagged work levels do not much affect future work once intertemporal dependence of welfare participation is accounted for. Extending this framework, Swann (2005) incorporated marriage decisions and richer dynamics, took into account the evolution of state-year welfare benefit rules, again did not allow saving or borrowing, and estimated the choice model jointly with the wage equation by maximum likelihood. He did not simulate the effect on labor supply of welfare versus no welfare, but only simulated effects of U.S. welfare reforms, which we will report in Section VI. Fang and Silverman (2009) estimated a hyperbolic discounting model of labor supply and welfare participation for single mothers. Individuals' time preference exhibited present bias creating a misalignment between short-run and long-run goals, which led to problems of commitment and self-control. The authors found evidence for time-inconsistency but also found ambiguous effects of that inconsistency on labor supply. Keane and Wolpin (2010) estimated a dynamic structural model of labor supply, welfare participation, education, marriage and fertility decisions for women.[18] Their model

[18] Keane and Wolpin (2002, 2007) reported labor supply effects of welfare from models consistent with forward-looking behavior.

incorporated various dynamics such as preference persistence, work experience accumulation, years of completed schooling, family size, job offer arrivals, and match-specific offers in the marriage market but assumed no saving or borrowing. Individuals started making decisions as early as age 14, with the choice set depending on the stage of the life cycle. While they only reported the behavioral responses of individuals with the lowest initial human capital endowment, who constituted about 25% of the sample, they found that reducing/eliminating welfare benefits and imposing time limits had large labor supply effects. Ferrall (2012) and Chan (2013, 2017) estimated their dynamic structural models incorporating welfare programs as well as features that were important to specific policy reforms or experiments. They did not study the effects of eliminating welfare but simulated the effects of reforms (see Sections V and VI). Blundell, Costas Dias, Meghir and Shaw (2016)) estimate a dynamic structural model of education, labor supply, and consumption for women. In their life-cycle model, individuals first choose their level of education and, upon completion of education, make choices in each year subject to exogeneous stochastic evolution of marriage and fertility. Their model incorporates both human capital and borrowing and saving.[19] In addition, their budget set captures the complexity of the UK transfer system. Their estimates show that human capital and asset accumulation are important. The authors do not simulate the effects of welfare versus no welfare, but only effects of tax-transfer reforms, which we report in Section V.

IV. Classical Reform: The Negative Income Tax

IV.A. Models

This section takes the basic models of welfare and labor supply exposited in Section III.A and presents their implications for perhaps the oldest welfare reform proposed by economists: a reduction

[19] Imai and Keane (2004), who study both dynamics among men, consider neither transfer programs nor the extensive margin of labor supply but they fully estimate the utility function. The authors incorporate the extensive margin but the risk aversion coefficient is calibrated.

in the tax rate, τ. This is the reform that most economists think of when they think of a negative income tax. Its attraction lies in increasing the reward to working more by reducing the rate at which benefits fall as earnings increase.

The basic models in III.A, however, do not imply that H will necessarily rise with a reduction in τ. The static model illustrates the issues most transparently. Consider the labor supply function in equations (4)-(6) and consider the effect on labor supply of a discrete reduction in the tax rate from τ to τ':

$$H(\tau') - H(\tau) = A + B \tag{12}$$

$$A = H[W(1-\tau' P(\tau')), N + P(\tau')(G - rN); \theta] - H[W\big(1-\tau P(\tau')\big), N + P(\tau')(G - rN); \theta] \tag{13}$$

$$B = H\big[W\big(1-\tau P(\tau')\big), N + P(\tau')(G - rN); \theta\big] - H[W\big(1-\tau P(\tau)\big), N + P(\tau)(G - rN); \theta] \tag{14}$$

where $H(\tau)$ and $P(\tau)$ denote their values for any given τ. Expression A gives the change in H arising the increase in the net wage, measured over those on welfare after the tax rate reduction. Assuming that the substitution effects of an increase in the wage dominate its income effects, A will be positive. Expression B gives the change in H that results from a possible change in welfare participation. As can be seen from equation (14), only two cases can arise: (1) there is no change in *P*, implying *B*=0, and (2) *P* changes from 0 to 1 (because the reduction in the net wage if on welfare makes it more attractive), which unambiguously reduces H and hence B<0. If there are any individuals in the latter category, the net effect of the reduction in τ is ambiguous in sign.[20] Note that due to entry (component B), the effect of an NIT on H cannot be ascertained merely from knowledge of the substitution and income elasticities of labor supply.

[20] While a change in G is not ordinarily considered a "reform," we note in passing that the comparative statics of an increase in its levels has, contrary to a reduction in t, an unambiguously negative effect on H since the corresponding components A and B are both negative.

The ambiguity is illustrated in the familiar Figure 2, where line ACDE is the no-program budget constraint, ABCDE is the budget constraint with the initial welfare program, and ABDE is the constraint after the reduction in τ (the vertical distance between *A* and *B* equals *G*). The reduction in the tax rate causes increases in hours worked for persons 1 and 2 but reductions for persons 3 and 4.

No ambiguity arises if the probability of working any hours is considered. In the model with corner solutions outlined in Section III.A, utility at $H = 0$, $U(0, N(1-r) + G; \theta)$ (assuming $N < G/r$) is unchanged by the reduction in τ. Since utility over some ranges of $H > 0$ are increased, the only direction H can change is in a positive direction.

These effects of a reduction in τ take a different form, but with the same ambiguity of effects, for programs which restrict eligibility to those with private income below some upper limit, independent of the normal benefit formula. With a modified benefit formula $B = Max\{0, 1[WH + N < E](G - \tau WH - rN)\}$, where E is the upper limit on eligibility, a "notch" is created at $H = (E - N)/W$ at which point the tax rate on an extra dollar of earnings exceeds 100 percent because all benefits are lost.[21] A reform which smooths out the notch by simply eliminating the upper income limit results in a reduction in τ at the notch point but increases τ for a range of H above it, inducing some reductions in H of the same type discussed above for the more typical welfare program.[22]

As discussed in Section III.A, both preference persistence and (learning by doing) human capital accumulation considerations magnify the labor supply disincentives of a welfare program (relative to no welfare program) compared to the static model. A reduction in τ does not change this result in the sense that, at the new lower level of τ, all individuals on welfare still will have lower levels of labor supply than they would have off welfare and the magnitudes of those differences are greater in the dynamic models

[21] The U.S. has several programs of this type with $\tau = 0$, the most well-known being the Medicaid program (Buchmueller et al., 2016).

[22] The same ambiguity arises if the notch is removed by eliminating the income eligibility rule but also increasing t over all ranges of t in an attempt, say, to hold expenditures constant.

than in the static model. But it is also true that the incentives to increase *H* for those at lower levels and the incentives to decrease *H* for those at higher levels are greater in the dynamic models than in the static models as well because of the future wage implications of increasing or decreasing *H* in the dynamic models. Thus the positive and negative effects are both magnified, with the net effect remaining ambiguous in sign.

IV.B. Empirical Literature

We consider in this section studies in the literature which have focused on the effects of a reduction in the tax rate in a welfare program, or at least have presented estimates of those effects even if the focus of the study was elsewhere. The original empirical work attempting to estimate the effects of an NIT were those in Cain and Watts (1973) but were merely attempts to estimate wage and income elasticities of labor supply which are, for reasons clear from the last section, inadequate by themselves to predict the effects of a reduction in a welfare program tax rate. The first direct evidence stemmed from the NIT experiments in the U.S. in the late 1960s and 1970s, which were referred to in Section III.B for what they revealed about the effect of welfare programs on labor supply relative to nothing. But they estimated the effects of changes in τ as well, mostly in reduced form regressions of labor supply on the values of G and τ randomly assigned to different groups of experimentals (controls were assigned 0 values for the two parameters). The interpretation of the coefficient on τ is as the net effect of the effects on H going in different directions as described in the last section. Many of the OLS coefficients on τ were statistically insignificant, implying that the positive and negative effects cancelled out (or that all elasticities were zero!). But looking at raw means across individuals who had been assigned different τ but the same G showed that reductions in τ increased labor supply for some groups and decreased it for others, which could simply be a result of a different fraction of the group's families

at lower and higher levels of income. Burtless (1987, Table 4) argued that the evidence showed, in fact, lower levels of H in plans with lower levels of τ.

The first structural model applied to the NIT experiments by Burtless and Hausman (1978), also referenced above, also found very modest changes in H in response to reductions in τ simulated from their estimated model, with essentially no change at all for individuals at low wages or high levels of G, but small increases for individuals with high wages and low G. However, the experiment they examined only varied τ in a narrow range, from .40 to .60. A later structural study by Moffitt (1983), using instead data from the AFDC program in the U.S., showed that a reduction in τ of 10 percentage points increased H by only a third of an hour. Keane and Moffitt (1998), in the multiple program participation study referred to earlier, simulated a much larger reduction in τ but found an increase in H of only one-fifth of an hour. Hoynes (1996) simulated a large reduction in the implicit tax rate of the AFDC-UP program, which targeted two-parent households, and found a very small reduction of *H* among husbands but virtually no effect among wives. Moffitt (1992, 2003a) examined the robustness of these results by simulating the effect on labor supply of plans with different levels of G and τ, using a U.S. nationally representative database and drawing a range of elasticities from the experimental and nonexperimental literature, and also found a very weak response of average labor supply to reductions in τ (but with effects varying by the size of the elasticities). Nevertheless, these basic results all point to net changes in labor supply from a reduction in τ that are modest at best if not in the opposite direction intended.

Much of the literature over the last decade or so has not had a focus on the labor supply effects of reductions in τ but rather on other issues (possibly excepting some U.S. reforms discussed in Section VI). An exception is Swann (2005), who simulated the effects of a reduction in τ in a dynamic discrete choice model and found its effects on labor supply to be very small.

V. Earnings Subsidies

V.A. Models.

Many earnings subsidies consist of a "phase-in" region where the individual receives a subsidy $S = sWH$ for earnings (WH) up to a threshold level C_1, a "ceiling" region where the subsidy remains fixed at $S = sC_1$ for earnings between C_1 and C_2, and a "phase-out" region where the subsidy is $S = \max\{sC_1 - r(WH - C_2), 0\}$ for earnings beyond the threshold level C_2. The net wage is therefore W(1+s) for earnings under C_1, *W* for earnings between C_1 and C_2, and W(1-r) for earnings higher than C_2 (up to the point where the subsidy reduces to zero). Two features set an earnings subsidy apart from a welfare program. First, individuals receive no benefit when they do not work. Second, the benefit amount is an increasing function of earnings at the lower range, whereas in a welfare program, the benefit amount always falls when earnings increase. For the same reason as an NIT, an earnings subsidy unambiguously increases the probability of working any hours but the overall effect on *H* is ambiguous (Figure 3). The increase in *H* occurs in the phase-in region where the net wage is higher than the gross wage. In the ceiling region there is only a negative income effect and, in the phase-out region, the income and substitution effects have the same direction and cause a reduction in *H*.

Some earnings subsidies have a minimum work hour requirement, so S=0 if $H < \bar{H}$. Upon satisfying the requirement, the subsidy is fixed for earnings below a threshold level, then falls as earnings rise beyond the threshold. In some cases, there is no ceiling region and earnings are immediately phased out. A simple version of the formulas in the UK program and in Canada's welfare reform experiment is $S = r(C - \max\{WH, D\})$ where C is the "income standard", r is the taper/withdrawal rate, and D is an earnings threshold . Given that $H \geq \bar{H}$, the subsidy is fixed at $\bar{S} = r(C - D)$ for earnings up to threshold D, it is $S = \bar{S} - r(WH - D)$ for earnings between D and C, and $S = 0$ when earnings reach C. Although this type of program has no phase-in region (the subsidy increases abruptly at $H = \bar{H}$), it also increases the probability of working any hours and reduces *H* in the ceiling and phase-out regions.

Unlike the welfare program, imposing a work requirement in the form of a minimum hours requirement to an earnings subsidy does not always increase labor supply (Figure 4). This is because the work requirement removes the phase-in region, which causes some individuals to quit working or reduce *H* even if it causes others to increase their *H* up to $\overline{H}$.

Another feature is that the work requirement may reduce the incentive to build human capital. This is because the requirement makes the subsidy rate a decreasing function of the wage rate. As an illustration, consider an individual with a "low" wage rate *W* where $W\overline{H} \ll D$. When the individual works $\overline{H}$, she receives a subsidy $\bar{S}$ so the subsidy rate is $\frac{\bar{S}}{W\overline{H}}$. Clearly, the subsidy rate reduces as *W* increases. By contrast, in the absence of the work requirement she would lie in the phase-in region where the subsidy rate remain fixed as W increases.

V.B. Empirical Literature

The U.S. Earned Income Tax Credit (EITC) began in 1975 as a small earnings subsidy program for families with dependent children. It underwent major expansions in the tax reform acts of 1986, 1990 and 1993, with the 1993-96 expansion being most notable.[23] There is a large literature on the EITC, mostly reduced form in nature but with a few structural models. We refer readers to Hotz and Scholz (2003) and Nichols and Rothstein (2016) for detailed reviews. We will note only a few of the studies.

Eissa and Liebman (1996) examine the effect of the 1986 increase with a difference-in-difference (DD) strategy comparing single women with children to those without, since the latter were not affected by the reform. They find an increase in labor force participation rates of 2.8 percentage points (ppt) but no change in hours worked conditional on working. But more work has been done on the larger 1993-96 expansions. Meyer and Rosenbaum (2001) estimate a quasi-structural labor supply model by

[23] For a minimum-wage single parent, the 93-96 expansion increased her net wage by 8 to 20 percent depending on the number of children and work hours.

exploiting the nonlinear budget sets created by EITC and other programs, including single mothers with and without children. In their preferred specification, they find that the expansion increased single mothers' employment rates by 2 to 3 ppt. Estimates with single mothers only produce a smaller policy effect of about 1.2 ppt. Using a sample of single mothers and exploiting time- and family-size-variations in the generosity of EITC benefits, Grogger (2003) finds that the EITC increased single mothers' employment by 4.7 ppt between 1993 and 1999. Using a similar approach but with a richer specification, Fang and Keane (2004) find that the EITC increased single mothers' employment rate by 0.7 ppt in 1997, which widened to 3.6 ppt in 2002.

Eissa and Hoynes (2004) examine married couples with children. Their preferred specification exploits the nonlinear budget sets created by the EITC, as in Meyer and Rosenbaum, but the sample includes married mothers only. They find that the 1993-96 EITC expansion reduced married mothers' employment by 0.6 ppt.[24] In a DD model similar to Eissa and Liebman (1996), using married women without children as the control group, they find that the estimate is roughly 4 times as large. They find very small effects among married fathers.

Keane and Wolpin (2010), whose dynamic structural model was described in III.B, use their model to simulate the life-cycle effects of the EITC system as of 2004. They find that it increases the short-run employment among women who have the lowest skill endowments and are most susceptible to poverty by about 1 ppt but reduces their long-run employment by about 4 ppt.[25]

Chan (2013) uses a dynamic structural model of labor supply, welfare participation and food stamp participation to estimate EITC's effects on single mothers along both the extensive and intensive margins. When implementing an EITC program as of 1999, while holding everything else as in 1992, he finds that the employment rate increases by 0.6 ppt initially due to preference persistence and a low

[24] The full effect of the 1984-96 expansions was 1.1 ppt.
[25] They explain this from the perspective of increased fertility (the EITC increases fertility which reduces labor supply).

probability of non-workers finding a job. In year 5 the effect widens to 2.4 ppt but the average work hour among workers increases by merely 0.7% relative to no reform.[26] He also simulates an earnings subsidy with an hour requirement, and finds that its labor supply effect is smaller than that of an EITC with similar expenditure.

More recent advances have been made regarding the EITC's effect along the intensive margin.[27] Consistent with a small intensive margin, Saez (2010) finds limited evidence of bunching around the kink points of the EITC schedule, except for the self-employed. In a field experiment, Chetty and Saez (2013) find that increased knowledge of the EITC rules had a small impact on EITC payment. Chetty, Friedman and Saez (2013) exploit geographical variations in the knowledge of EITC rules and find a larger intensive margin compared to the previous two studies. They also find that the earnings elasticity is larger in the phase-in region than the phase-out region.

The UK introduced an earnings subsidy program in 1971 for families with dependent children, with a minimum work hour requirement (24+ hours/week) and phasing-out of benefits as income increased.[28] There were several subsequent changes, most notably changes in the hour requirement in 1992 and 1995, and the replacement of the program by Working Families' Tax Credit (WFTC) in late 1999. The WFTC increased the benefit, reduced the phase-out rate from 70% to 55%, and provided more credit for families that used child care. In 2003, the WFTC was replaced by two programs which, amongst other changes, further reduced the phase-out rate and extended entitlement to families without children. Unlike the US, the WFTC reform was accompanied by an increase of Income Support

[26] Based on the modelling assumption that part-time work is 20 hours/week and full-time work is 40 hours/week. When simulating a wage increase, his model yields an intensive margin that is roughly half of the extensive margin. This comparison can be misleading, however, due to similar reasons to those described in Section IV. More generally, he finds that individuals tend to work whenever an opportunity is available because there is a strong incentive to maintain human capital (hard to find a job once nonemployed).

[27] These studies focus on earnings, not labor supply, responses so the elasticities are not directly comparable with those reported in earlier studies.

[28] Labor supply effects of earnings subsidies have also received attention in other European countries although they have not been as extensively studied as in the UK. See for instance Bargain and Orsini (2006), Stancanelli (2008) and Haan and Prowse (2010) for examples of different approaches on the topic.

(IS) benefits, a cash welfare program for nonworking families and those working below the minimum hours. This dampened the net financial incentive to work (Brewer, 2001; Blundell and Hoynes, 2004).[29] The official take-up rates in IS and WFTC are about 90% and 70%, respectively (Brewer, Duncan, Shephard and Suarez, 2006).

Several studies have used static structural models to estimate or simulate the effects of UK in-work benefit reforms. Bingley and Walker (1997) estimate a structural model of labor supply and in-work benefit participation for single mothers and find that a 25-percent increase in the maximum in-work benefit will increase employment by 2.5 ppt. Using separate samples for single mothers and married couples with children, Blundell, Duncan, McCrae and Meghir (2000) estimate a structural labor supply model with a nonlinear budget set and simulate the WFTC reform. They find that it increases single mothers' employment by 2.2 ppt, reduces married mothers' (with employed partners) employment by 0.6 ppt, and increases married fathers' employment by 0.1 ppt. Brewer, Duncan, Shephard and Suarez (2006) extend their work by incorporating in-work benefit participation decisions and using pre- and post-reform data. They find that for single mothers, the participation cost ("stigma") of the in-work benefit program fell after the WFTC reform, which magnified WFTC's effect. They also find that other post-reform tax/transfer changes (including the IS expansion) partially offset WFTC's effect.

Francesconi and van der Klaauw (2007) and Gregg, Harkness and Smith (2009) use a differences-in-differences (DD) strategy by comparing single women with and without children and find that the combined policy changes (including the WFTC reform) during 1999-02 increased single mothers' employment by 5 ppt. Using a similar approach, Francesconi, Rainer and van der Klaauw (2009) find an insignificant employment effect among married mothers with a working partner and a positive effect among those with a non-working partner. Focusing on a shorter (15-month) time window during 1999-

[29] In addition, unlike EITC, the FC/WFTC benefit is counted toward income in the calculation of benefits from other programs such as Housing Benefit.

00, Leigh (2007) finds that the 1999 reform alone increased parents' employment by 1 ppt relative to non-parents. Using a DD strategy on a sample of workers who are single mothers or single women without children, Blundell, Brewer and Francesconi (2008) find that the 1992 and 1995 reforms have no significant impact on the weekly hours of work among workers, while 1999-02 reform has a large positive effect.

Blundell, Costas Dias, Meghir and Shaw (2016), whose dynamic structural model was described in III.B, simulate the effect of a revenue-neutral reform that includes the WFTC as of 2002 and a 0.9-ppt increase of the Income Tax basic rate. They find that the reform increases single mothers' employment by between 8.5 ppt (university) and 20.4 ppt (secondary); among married mothers, employment falls by between 1.0 ppt (university) and 6.6 ppt (secondary). There are no long-term effects on employment and wage rates once the children become adults. These result from a complex combination of different mechanisms throughout the life cycle. For example, many single mothers remain so for a limited period and many become married eventually. WFTC induce single mothers to work more, but mainly part-time hours that avoids depreciation but does not build experience. After they become married, WFTC induces them to work less, which reduces experience and results in no net effect on wages when their children become adults.

Shephard (2017) estimates an equilibrium job search model with wage posting in part-time and full-time jobs. In his model, individuals receive job offers (and accept or decline them) when employed and unemployed, and firms set the wage rate and recruiting intensity (which affects job offer arrival) to maximize their profits. In a simulation of the tax and benefit system (including WFTC) as of 2002 with his estimated model from pre-reform data, he finds that the general equilibrium effects on labor supply are modest.

In the early 1990s Canada implemented the "Self-Sufficiency Project" (SSP), a welfare reform experiment offering an experimental group of welfare recipients a generous subsidy for working more

than 30 hours/week, compared to a control group of welfare recipients facing a 100% tax rate. The experiment had an unusual dynamic feature because the experimentals had to first quit welfare within 12 months after random assignment to be offered the subsidy at all. Upon quitting welfare, the experimentals were offered the work subsidy for the next 36 months. This created a difficult selection problem because welfare exit was no doubt endogenous. Card and Hyslop (2005) and Ferrall (2012) analyzed the experiment, the first estimating reduced form models of welfare participation and employment and the second estimating a structural dynamic model of welfare participation, labor supply and job search. Although neither study reported the subsidy's effect on labor supply, Ferrall's model estimates revealed evidence of myopia and labor market barriers, which partly explained why two-thirds of the experimentals did not quit welfare within the specified period to become eligible for the subsidy.

VI. US Welfare Reforms

The U.S. enacted several reforms of its welfare system in the 1990s and 2000s which differed in kind and/or magnitude from prior reforms and from those in other countries. These include major reforms in the 1990s introducing time limits, work requirements, and lower tax rates on benefits in its AFDC-TANF program. Each of these reforms, possibly excepting the last, requires new or modified models from the ones we have considered.

VI.A. Models

A1. Time Limits

In a typical welfare time limit, an individual loses eligibility for welfare when her cumulative periods of welfare participation since the time limit was introduced, S_t, reaches the specified limit $\bar{S}$. Its

effects can be analyzed in a dynamic model of labor supply and welfare participation.[30] Consider a dynamic labor supply model simpler than that in Section III.A, without welfare participation preference parameters and without preference persistence or human capital, but still without borrowing or saving. Suppose a time limit is introduced in period 1 (S_1=0) and let $\bar{S} < T$, where T is the length of the time horizon. The decision problem in period t is

$$V_t(S_t; \theta, \epsilon_{\theta t}, \epsilon_{wt}) \equiv \max_{H_t, Y_t}[U(H_t, Y_t; \theta, \epsilon_{\theta t}) + \beta E_t V_{t+1}(S_{t+1}; \theta)] \quad (15)$$

where θ is a time-invariant preference parameter, $\epsilon_{\theta t}$ is a preference shock, ϵ_{wt} is a wage shock, the expectation is taken over the distribution of the two shocks, and where H_t and $Y_t$are as defined in III.A. The time limit introduces a new state variable S, which evolves according to $S_{t+1} = S_t + P_t$, where P_t is again a welfare participation indicator. Thus the intertemporal tradeoff is that the individual loses one period of stock of welfare eligibility when she participates in welfare now. The utility function does not depend on S when $S < \bar{S}$. When $S = \bar{S}$, the individual becomes ineligible for welfare and the utility falls indirectly through the budget constraint.

For a myopic individual ($\beta = 0$), the time limit has no effect when $S < \bar{S}$ and it increases labor supply when $S = \bar{S}$ (a "mechanical" effect). For a forward-looking individual ($\beta > 0$), she may change her decision pre-emptively (a "behavioral" effect), which allows her to "smooth out" the reduction in welfare generosity due to the time limit. Let $\bar{V}[.]$ be the indirect utility function conditional on welfare participation status as defined in the static model of III.A. Denote the wage by $\widetilde{W}_t$, which reflects the wage shock in t. The individual chooses $P_t = 1$ when

$$\bar{V}\left[\widetilde{W}_t(1-\tau), N(1-r) + G; \theta, \epsilon_{\theta t}\right] - \bar{V}\left[\widetilde{W}_t, N; \theta, \epsilon_{\theta t}\right]$$
$$-\beta[E_t V_{t+1}(S_t; \theta) - E_t V_{t+1}(S_t + 1; \theta)] \geq 0 \quad (16)$$

[30] Grogger and Michalopoulos (1999) were the first to write down a dynamic theoretical model to demonstrate the result given in this section.

The last term inside the brackets is positive and reflects the option value of refraining from participating in welfare now and "banking" the stock of benefits for which the individual is eligible. As a consequence, because the term in brackets enters with a negative sign, the individual is less likely to choose P_t=1 than in the static model. This is akin to an increase in the fixed cost of welfare participation (see Section III.A), which results in non-participation of eligibles and an indirect increase in labor supply.[31] The magnitude of this "banking" effect depends on the anticipated levels and distributions of future wages, for lower values of future wages and/or a greater probability of a low wage in the future will increase the option value of saving a period of welfare eligibility for later and not using it today.[32]

A2. Work Requirements

In its strictest form, a work requirement simply makes benefit receipt conditional on working some minimum numbers of hours. In the static labor supply model, the utility function is the same as in III.A but the budget constraint is:

$$Y = WH + N \qquad \text{if } H < H_{min} \tag{17}$$

$$Y = W(1-\tau)H + [N(1-r) + G] \qquad \text{if } H_{min} < H < \frac{G-rN}{W\tau} \tag{18}$$

$$Y = WH + N \qquad \text{if } \frac{G-rN}{W\tau} < H \tag{19}$$

Participation in welfare now occurs if the maximum utility obtainable along the segment implied by the second line of the budget constraint exceeds maximum utility elsewhere.[33] Compared to the situation without work requirements, only those individuals whose utility-maximizing$H$ was below H_{min} are affected. Some of those will choose to increase H up to H_{min} exactly, while others will simply go off

[31] Note that this result remains qualitatively similar in a model without uncertainty. Suppose the individual knows the wage in every period, and the number of periods that she participates in welfare in the absence of a time limit exceeds $\bar{S}$. Then, in the presence of the time limit, she participates in welfare in the $\bar{S}$ periods that have the lowest wage. This implies that she quits welfare in some periods, which increases labor supply.

[32] This could also be formulated in terms of the reservation wage for welfare participation, which was defined in III.A, by showing that, under time limits, the welfare participation reservation wage increases (Grogger and Michalopoulos, 1999). Also, we have not illustrated the point with preference shocks, which are in the model, but an analogous set of results follow for them.

[33] If the benefit is zero at H_{min}, the individual cannot be on welfare and hence $P = 0$.

welfare and locate on the nonwelfare constraint (Figure 5). In either case, H will rise (or possibly remain at zero) and utility will fall.

In actual practice, work rules in U.S. welfare reform are much more complicated than this simple model (Ziliak, 2016). Work requirements are typically not imposed on all participants but only on those who are presumed to be able to work; those presumed not able to work are exempted from the requirement. Ability to work is often proxied by health and disability, or by the presence of young children (the latter is not really "ability" per se). Using observed variables which are only a partial proxy for true ability to work means that Type I and Type II errors will be made (some individuals who can work will not be required to and some who "cannot" work will be required to).[34] Violations of a work requirement usually are initially met with sanctions (i.e., benefit reductions) rather than expulsion from welfare, although most often continued violation will result in such expulsion. Most states allow individuals to reenter the welfare system at some later date. There are also work requirement "time limits" that are separate from overall limits, which give the individual some period of time (e.g., two years) after first entering welfare before the requirement must be met, although other states are "Work First" states which require work immediately. Other states initially require a period of job search rather than actual work, although requiring work after some period of time. Some states require applicants to register with the local Unemployment Insurance office and begin job search before benefit application can proceed. There has been little attempt to model these complexities in the literature.[35]

A3. Reductions in Tax Rates

At the same time states were required to impose time limits and work requirements, they were given the option to set the tax rate (i.e., percent earnings disregards) at their preferred level. Prior to the

[34] There is a separate literature which considers work requirements and other requirements as a screening device working to ensure that only the most needy individuals apply. See Moffitt (2002, pp.2412-13; 2003b, pp.130-131) for short reviews.

[35] See Pavoni and Violante (2007) and Pavoni et al. (2016) for models of optimal sequences and combinations of monitored and unmonitored job search, workfare, and permanent assistance with no requirements.

reform, states were required to allow a deduction of $90 per month and were required to have a 67 percent tax rate for any earnings above the deduction for 3 months, followed by a 100 percent tax rate. After the reform, many states reduced the tax rates and extended them beyond 3 months. Section IV above reviewed the models and empirical evidence for such reductions in τ, so we have covered that topic already (although there probably are interactions between such reductions and time limits and work requirements). We will review the evidence on tax rate reductions that occurred specifically as part of this U.S. reform below. But many states also increased the $90 deduction to higher amounts. An increase in a deduction has the effects shown in Figure 6, illustrating that there should be both positive and negative labor supply effects of such a change, and therefore also with a net effect ambiguous in sign.

VI.B. Empirical Literature

B1. Time Limits

The most well-known form of time limit is the TANF federal limit, which restricted female-headed families to a maximum of 5 years of federally funded cash benefits. Prior to TANF, benefits were an entitlement for low-income female-headed families with children under 18 years of age. Overall, the literature finds that time limits reduced welfare use and increased labor supply by a smaller degree. The literature's development is complicated by two issues: (1) Unlike most other policies, time limits generate an inherently dynamic effect; in particular, whether individuals respond pre-emptively has important behavioral, policy and estimation implications. (2) There is mixed success in disentangling the effects of welfare reform components using policy variations across state and time, and in separating the effects of time limits from the many other components of the same reform (e.g., Figlio and Ziliak (1999), Moffitt (1999), Ziliak et al. (2000), Blank (2001), Ziliak (2016)).

Building on reduced-form implications from the model in VI.A, Grogger and Michalopoulos (2003) show that the incentive to conserve welfare benefits for future use depends negatively on the age of the youngest child (A) and they use it to estimate the effect of a time limit in a welfare reform experiment. Their empirical specification is adapted by subsequent reduced form studies that examine time limits at a national scale (e.g., Grogger (2003, 2004), Fang and Keane (2004), Mazzolari (2007)). Mazzolari (2007) also incorporates proxies for S; she finds limited pre-emptive response along S, and the mechanical effect plays a large role in reducing welfare use. In a competing-risk hazard model estimated from administrative data in South Carolina, which implemented a stringent time limit, Ribar, Edelhoch and Liu (2008) find substantial pre-emptive response via S as well as direct evidence of mechanical effects. Chan (2018) shows that some existing reduced-form evidence likely understates the effect of time limits due to an implicit modelling assumption. He also compares the pre-emptive responses along S and A and finds that the former channel is important. All of the above studies estimate the welfare use effects of time limits and only a handful estimate labor supply effects. Grogger (2003) finds that time limits increased employment by an average of 0.9 ppt between 1993 and 1999. In Fang and Keane (2004), the effect is between 0.3 and 1.1 ppt from 1997 to 2003.

There have been three estimated structural models of time limits. Swann (2005) and Keane and Wolpin (2010) estimate structural dynamic models on the pre-1996 AFDC program and use their estimated models to simulate what the effect of time limits would be, while Chan (2013) is the first to estimate a dynamic structural model on the post-reform data themselves.[36] Swann (2005) forecasts that a 5-year time limit would increase the employment rate of all women by about 2.3 ppt.[37] Chan (2013)

[36] He incorporates differences in the time horizon as well as variations in the implementation dates, lengths and types of time limits across states.

[37] Keane and Wolpin (2010) also forecast that a time limit increases employment for those with the highest propensities to be on welfare, by different degrees by race. But they find that the effects differ by age, with only small effects on employment at young ages but larger effects at higher ages because women usually hit the time limit and go off welfare altogether.

finds that a 5-year time limit increases employment among single mothers by 2.2 ppt by the end of year 5, just prior to anyone reaching the limit, and it increases the average weekly work hour among workers from 32.4 to 32.8 (+1.1%).

B2. Work Requirements

There have been few structural models of work requirements estimated in the literature, possibly because of the complexity of the content and implementation of work requirements mentioned above. Instead, the empirical work has mostly estimated reduced form models which typically use cross-state variation in some aspect of work requirements that differed across states or else use evidence from experiments that tested different types of work requirements that usually did not exactly replicate those implemented by states after the reform. Blank (2002) and Grogger and Karoly (2005) review evidence from welfare reform experiments that involve mandatory work-related requirements or services. The experimental evidence overwhelmingly shows positive effects on employment, although the magnitude of the effect varies with the type of mandatory work required (e.g., simple job search, some of kind of human capital training, or a combination of both).[38] . Fang and Keane (2004) characterize the various types of work requirements for different states (including exemptions) in a detailed reduced-form specification. They find that these policies as a whole increased the work participation of single mothers by 0.8 to 1.8 ppts between 1997 and 2003. Using information from Grogger and Karoly (2005) who classify states into three levels of sanction severity for noncompliance of work requirements, Chan (2013) allows sanctions to reduce the welfare benefit among nonworkers in the budget constraint (except among those who are exempt due to having a young child). He finds that an

[38] However, Blank and Grogger-Karoly also show that benefit reductions, including exits from welfare, reduced income by either the same amount or more than earnings increased. Consequently, family income generally fell after the implementation of these work requirement programs. See also Greenberg (2009) for more detail on this issue. These average effects presumably reflect a combination of income gains and losses, as shown in Figure 2(c). Other evidence consistent with the existence of both income losers as well as income gainers from work requirements has shown a growth after these reforms in the number of so-called "disconnected" families who have neither cash welfare benefits nor earnings (Ziliak, 2016, p.367).

intermediate/severe sanction policy is roughly equivalent to a one-third reduction in the benefit among non-workers, and it increases employment by 1.9 ppt in year 5 following implementation. As in Fang and Keane, he finds that many individuals simply quit welfare. Similarly, the limited evidence on work requirement time limits suggests that they tend to move nonworking welfare recipients off welfare (Swann (2005), Keane and Wolpin (2010)).[39] In a related reform on Food Stamps, Ribar, Edelhoch and Liu (2010) use time and county-by-county variability in the applicability of work requirement time limits to able-bodied adult-only households in South Carolina to find that these rules reduced Food Stamp participation by about 10%. The rules led to some program exits into employment but many other exits into non-employment.

Fang and Silverman (2009) examine whether work requirements (and time limits) can alleviate individuals' work commitment problem. Present-biased individuals may be "trapped" in a status of suboptimal employment as they systematically underestimate the future value of human capital accumulation. They find that these policies are generally ineffective as a commitment device. Chan (2017) estimates a dynamic structural model with heterogeneous discount and present-bias factors, which are identified via a welfare reform experiment with a time limit. He finds that some sanctions are effective in that they magnify the labor supply response due to commitment-related incentives. He also finds that such incentives are larger among the most present-biased individuals, who also tend to prefer a sanction policy over no sanctions.

B3. Tax Rate Reductions

[39] See Ziliak (2016) for an additional review of this literature.

Major reductions in welfare tax rates were part of the same reforms of the US AFDC program that enacted time limits and work requirements.[40] Structural models estimated from pre-reform data have examined this issue one way or another, typically finding small effects of reductions in τ on average labor supply (e.g., Keane and Moffitt (1998), Swann (2005), as noted in Section IV.B). Also, very few studies have attempted to use cross-state variation to identify the effects of reductions in τ separate from the effects of time limits, work requirements, and other reform features, again primarily because of the difficulty in separating their effects. One exception is Chan (2013), who finds a small effect of the reductions in τ (as well as increases in the deduction) on average labor supply.

Most of the literature on the effects of reductions in τ on labor supply in 1990s-style reforms comes instead from experimental evidence. Unfortunately, one problem with these studies is that most of the experiments tested combinations of tax rate reductions with other reforms (time limits, work requirements) and hence inferences about the effects of tax rate reductions per se are problematic. But a more basic problem with most of the experiments is that they randomized tax rates (and other reform features) on a sample of current welfare recipients, which means that they could not estimate the effects of the reform on entry into welfare. Yet the simple model in IV.A makes clear that the total effect on labor supply will depend on entry. Indeed, that model implies that tax-rate reductions will only have positive effects on labor supply of those initially on welfare, and the negative effects arising from entry will be missed altogether. In fact, most of the experimental evidence shows increases in average labor supply and earnings from tax-rate reductions, probably for this reason.[41]

[40] This and other reforms in this period also increased the income eligibility in the Medicaid program, moving the "notch" upward (see IV.A). As noted previously, this has ambiguous effects on labor supply. See Buchmueller et al. (2016) for a survey of empirical results.

[41] Grogger and Karoly (2005, Figure 6.1) find that virtually all experiments showed positive effects on employment from increasing financial work incentives, although sometimes combined with work requirements. However, reductions in τ should always increase employment; it is their effects on hours of work and earnings that are ambiguous in sign.

Bitler, Gelbach and Hoynes (2006), unlike virtually all of the rest of the literature, attempt to estimate the distribution of labor supply effects of welfare reform and to identify both the positive and negative effects of a reduction in τ. Using earnings data from a welfare reform experiment in Connecticut that tested the effect of a zero-percent tax rate combined with a maximum income limit (creating a notch in the budget constraint), they show that the average effect masks heterogeneous responses that are consistent with the simple labor supply theory. While the experiment also tested time limits, work requirements, sanctions, and other policies, the authors argue that the effects of those components did not affect their results.[42] In a follow-up paper, Kline and Tartari (2016) use revealed preference to estimate the effects of the experiment on earnings and welfare participation, assuming that the time limit has no effect. They find that at least 20% of control group women whose earnings are above the notch will reduce their earnings below the notch (but remain working) and receive welfare under the experiment. While more individuals work in the treatment group, they find that it is more difficult to disentangle the response into specific channels.

VII. Child Care Reforms

VII.A. Models

Child care subsidies from governments take a variety of forms—free center-based care, subsidized center-based care, subsidized care for multiple types of child care arrangements and modes, lump sum cash payments, and so on. Often aimed at the low income population (but not always; they are sometimes universal), they also sometimes come with minimum hours restrictions, earnings requirements, and other rules. Nevertheless, modelling their effects on labor supply can be most easily illustrated by assuming that they take the form of a simple open-ended subsidy of *s* per hour of paid

[42] As noted above, experiments on recipients necessarily miss entry effects and hence it is likely that there were more negative effects than were captured by the data. The authors note this drawback but also note that they could capture reentry and exit effects.

child care given to a parent who works.[43] Assuming that paid care is required for all workers, such a subsidy simply raises the net wage (compared to no subsidy) from *W* to *W+s*, which has the same effect on labor supply as any increase in the wage rate (Heckman (1974)).[44]

Almost all of the models of child care do not adopt the simple consumption-leisure model of child care, with the only effect of subsidization to affect the net wage. Instead, the models introduce child quality into the parental utility function, usually as $U(L, Q, C)$ where *L* is leisure hours, *Q* is child quality (assume one child), and *C* is consumption. A child quality production function is specified, most often as $Q = Q(M, F, C)$ where *M* is the parent's hours spent in child care and *F* is hours spent in paid child care with an associated market price per hour.[45] Using the household production framework of Becker (1965), it can be shown that *M* and *F* are optimally allocated so that the ratio of their factor prices (wage and paid care price, respectively) equals the ratio of their marginal products in child quality production. A child care subsidy shifts this optimal allocation by increasing *F* and reducing *M*, which in turn increases *H*. Therefore, the subsidy's effect on labor supply remains qualitatively similar to that in the simple consumption-leisure model, although the underlying mechanism is different.

The literature has also long noted that the subsidy's effect on *Q* is ambiguous because it depends on the shape of *Q*(.), or the "relative quality" of *M* and *F*. Some empirical work has shown, in fact, negative effects of the use of formal child care on child outcomes, presumably because the child care is low in quality. This has led to debates in the U.S. of whether the government should only subsidize high-quality care, even if that were to have a smaller positive effect on employment. The simple models like

[43] Paid care which is provided unrelated to employment or hours simply can be viewed in terms of income effects which shift the budget constraint outward but also has a substitution effect that induces people to use paid care rather than unpaid care. Blau (2003) presents several simple static labor supply models with different types of child care subsidies.

[44] If a parent was already incurring costs c per hour, then the net wage rises from W-c to W-c+s.

[45] Some papers add 'free' relative care to the production function.

the one above used in the literature are not well-suited to addressing this issue because the choice of different child care arrangements with different qualities and different prices is not modelled.

The static model also cannot capture many important dynamics which are no doubt important to the parental decision to work and use paid care or to stay home and use parental care. For example, parents may feel that their own time has a higher marginal product relative to paid care when the child is young than when the child is older, which will generate age-dependent patterns of labor supply and child care use. Human capital considerations may play a role if the foregone future earnings from devoting home time differs by age of the child. Child care subsidy programs could therefore have different effects at different child and parental ages.

VII.B. Empirical Literature

There is a large literature on the labor supply effects of child care in the U.S. which uses the market child care price as a variable in an empirically-estimated labor supply equation rather than any direct measurement of government subsidy.[46] This literature usually uses the child production function model described above but only estimates reduced form regressions of labor supply on wages and child care prices, interpreting the coefficients as an amalgam of preference and production function parameters (and not attempting estimation of the child production function). The child care price is often predicted from a first-stage regression using a variety of instruments, sometimes geographic and sometimes indicators of child care quality in an area. To the extent that government child care programs can be modelled as a simple reduction in the market price of average quality care, these estimates can be used to estimate the impacts of government care.

[46] We limit our scope to narrowly defined definitions of child care subsidies. Some related programs, such as Head Start, are means-tested but they place the key emphasis on child development. The evidence on labor supply effects of Head Start remain mixed (Griffen and Todd, 2017). For a general review of programs related to early childhood education and their effects on child outcomes, see for instance Elango, Garcia, Heckman and Hojman (2016).

Blau (2003) reviewed the early literature, finding that a higher child care price reduces labor supply among both single and married mothers. While the elasticities range widely across studies, those that adopt a multinomial specification (combinations of labor supply and paid care) tend to have a smaller elasticity (-0.07 to -0.34). Several structural or quasi-structural studies have used their estimated models to simulate reforms on the non-refundable Child and Dependent Care Tax Credit (CDCTC), which covers up to 30% of child care expenditure for low-income families. While Michalopoulos, Robins and Garfinkel (1992) and Ribar (1995) find very small labor supply effects (but larger effects on paid care use), a larger labor supply effect is found in Averett, Peters and Waldman (1997), who treat paid care utilization as exogenous.

There have been more U.S. studies of female labor supply in response to child care price since these early studies. In a study which focuses more on the effect of child care on child outcomes than on labor supply, Bernal (2008) estimates a dynamic discrete choice structural model of employment and child care usage jointly with a child cognitive ability production function. Her data did not have information on child care price, so she estimated it from the utility cost of using child care. Overall, she finds that a 35% child care subsidy (implemented as a reduction of child care price) increases the employment rate of married mothers by about 1 ppt.

There have also been a number of studies which instead use some kind of child care reform to estimate employment effects although, again, in most cases not modeling the quality of the child care directly or modeling the price-quality choice tradeoff and its effects on labor supply. Blau (2003) and Blau and Tekin (2007) review a few evaluations of local-area reforms in the 1980s and early 1990s, either from direct comparisons of recipients to a comparison group, from an experiment, or from using variation in reform offerings to instrument a child-care receipt variable in an employment equation. Most of these studies found increases in employment from the reforms.

A major reform in the U.S. in 1996 increased total child care subsidies to states, consolidated four programs into the Child Care and Development Fund (CCDF), allowed states great flexibility in designing eligibility and subsidy levels, and formed eligibility rules that required parents to only be employed (or engaged in work-related activities) and not to have to be recipients of cash welfare (TANF). Studies of this reform include Fang and Keane (2004), who note that states shifted funds into child care from other grants to maintain overall spending out of their own funds at a required minimum level. The authors used the resulting cross-state variation in state CCDF expenditure per single mother as a measure of the availability and generosity of child care subsidies (as well as some age differentiation in eligibility). In a reduced form regression of employment on this CCDF variable and a variety of other state policy variables and individual demographics and their interactions, the authors find that the CCDF increased the employment of single mothers by 0.1 to 1.3 ppt between 1997 and 2002. Blau and Tekin (2007) and Tekin (2007) use a post-reform cross-sectional survey to estimate the effect of cross-state variation in child care prices to estimate effects of the reform on labor supply. Blau and Tekin find that the reform increased employment by 13 ppt while Tekin finds that the subsidy has a only a small employment effect, although he also simulates a more lenient eligibility limit and finds that it increases full-time work by a larger degree (in absolute and relative terms) than part-time work.[47] Griffen (forthcoming) uses post-reform data to estimate a dynamic structural model of maternal labor supply and child care usage with built-in features of child quality production, price-quality relationship of child care, and the income-conditioning of child care subsidies. He finds that the subsidy program increases maternal employment by 6.38 ppt but has virtually no impact on cognitive skills, which is partly driven by shifts in child care quality choices.

[47] Bernal and Keane (2010, 2011) use the same data set used by Bernal (2008) but use the child-care reform variables used in Fang and Keane (2004) to estimate the effect of child-care reform on child test scores with reduced-form equations derived from a structural discrete choice dynamic model. However, they do not examine labor supply per se.

There is a significant literature on the effect of child care subsidies on labor supply in other countries. Child care subsidies in Europe are quite different than those in the U.S., often provided through supply-side subsidies to child care providers. Direct subsidies are often on top of subsidized private or public care. Child care subsidies in other countries also typically place less emphasis on promoting employment and more on promoting child development (some subsidies are not linked to employment at all, which is likely to reduce any positive impact on employment).[48]

Blau and Tekin (2007) reviewed some early European studies from the 1990s and early 2000s which generally show positive effects of child care programs on labor supply. But the empirical evidence remains mixed. Baker, Gruber and Milligan (2008) and Lefebvre and Merrigan (2008) studied a reform that reduced the price of subsidized child care to CAD$5 per day in Québec using a DD strategy, finding that it increased the employment rate of mothers with young children by 7 ppt. Lundin, Mork and Ockert (2008) studied a reform that placed a cap on childcare prices in Sweden using a DD strategy and find that the effect is close to zero. Havnes and Mogstad (2011) studied the expansion of subsidized child care in Norway in the 1970s using a DD strategy and they find that it has a very small labor supply effect. Bauernschuster and Schlotter (2015) studied a reform that removed child care rations in Germany and find that it increases the employment of mothers with young children by 6 ppt.[49] Bettendorf et al. (2015) studied the effects of an expansion of the generosity of child care subsidies in the Netherlands using a DD strategy and find only modest impacts on maternal employment.

[48] There are exceptions such as Australia, where some subsidies require work and others do not. The labor supply effects of that system were analyzed in Doiron and Kalb (2005), Apps, Kabatek, Rees and van Soest (2016) and Gong and Breunig (2017).

[49] See Geyer, Haan and Wrohlich (2015), who use German data, for child care policy simulations from a structural labor supply model that incorporates child care costs. See also Del Boca and Vuri (2007) for evidence on rationing in Italy.

Nollenberger and Rodriguex-Planas (2015) studied a reform that expanded subsidized child care in Spain and find a large effect in some specifications.[50]

Some child care reforms tend to discourage employment. In the late 1990s Norway implemented a reform which provided cash benefits to parents with children aged 1-3 who did not use formal child care. Parents could substitute cash benefits for formal care, which was heavily subsidized. Benefit receipt did not involve employment restrictions, and its amount (per child) was similar to the state subsidy in formal care. Schøne (2004) and Drange and Rege (2013) use a DD approach by comparing mothers of age-5 children and age-2 children and find that the reform reduced maternal employment by 2 to 3 ppt and full-time work by 4 to 5 ppt. Similar effects are found in Kornstad and Thoresen (2007) who simulate the reform using a static discrete choice model of labor supply child care estimated from pre-reform data. Chan and Liu (forthcoming) estimate a dynamic structural model of labor supply, child care use and fertility, and use it to examine the reform's life-cycle effects (not just mothers with young children) and effects on the long-run cognitive outcomes of children. Their model incorporates the variations in reform exposure across women and child cohorts. They find that the effects differ substantially by the stage of the life cycle and are partly driven by increased fertility.[51] If the program is introduced when a low-education woman is aged 19, then it will reduce her employment by 1.9 and 2.4 ppt in the 6th and 12th year, respectively, due to a decrease in full-time work and a small increase in part-time work.

[50] We should note that Blundell et al. (2016) incorporated policy changes in the amount of childcare cost tax credits given in the UK welfare system when estimating their structural model. However, they did not simulate the effects of those changes in credits independent of other policy changes that occurred at the same time.
[51] They find that formal care use among mothers with young children reduced considerably, but formal care use among all women reduced slightly partly because more women became mothers.

VIII. Summary and Future Research

This brief review of the models and empirical literature on welfare reform and the labor market reveals an area of research that is both old and voluminous yet still producing new and interesting research. The development of dynamic models which incorporate life cycle and human capital effects, models to capture the effects of U.S. reforms like time limits, and models to capture the wide variety of earnings subsidies are among the most recent contributions. Empirically, there has been a large volume of new research on earnings subsidies, U.S. reforms, and child care reforms.

For future research, we can confidently predict that research in this area will continue to follow the lead of policy developments in the various countries where welfare reform has been occurring. In most countries, welfare programs are periodically reformed and changed in response to shifting social and political preferences as to the purpose and goals of those programs, whom they are intended to serve, and what their incentive effects should be. Earnings subsidies, U.S.-style welfare reforms, and child care subsidies are continuing to be modified. This by itself should provide a continued source of fresh inspiration for research and evaluation.

But in addition to future research as programs continue to be modified, there are many areas we have reviewed where more modelling and empirical work are needed. Speaking generally, there has been far too little work on the dynamic aspects of labor supply choices in the presence of different kinds of programs (traditional welfare versus earnings subsidies, for example) where human capital, family structure, migration, occupational choice, and other important life cycle decisions are important. Relatedly, while the insurance motive for transfer programs has been examined on and off in the literature, dynamic models with uncertainty are needed to fully understand those insurance effects and how they relate to labor market issues. While not exactly the same as insurance in steady state periods, the role of programs in providing a type of insurance during downturns, while often discussed informally, has rarely been modeled, even though it has strong implications for macroeconomic models

as well as microeconomic ones. Finally, in a more methodological vein, more structural models are needed in almost every area of research we have covered. A healthy mix of reduced form and structural estimation would be optimal in this field, with both contributing in complementary ways, but only models with at least some structure are capable of delivering the kinds of counterfactual analyses that are needed to predict the effects of reforms the government is considering but which have not been tried. These, and no doubt many other topics we have not mentioned, furnish a rich menu of research questions that will move the field forward in the future.

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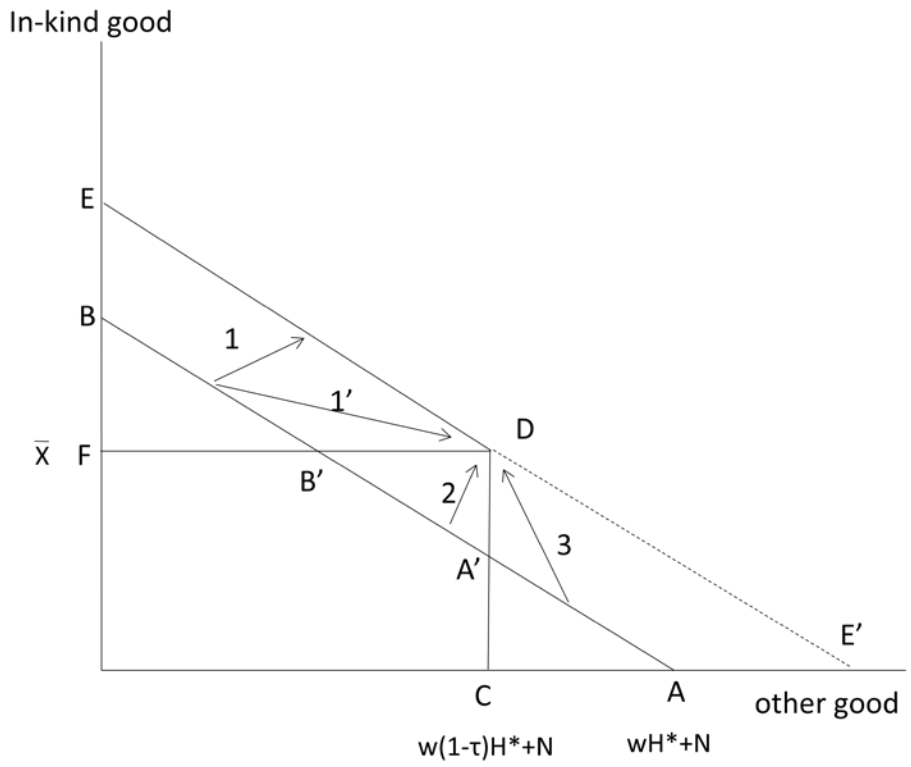

Figure 1: Effects of an In-Kind Program on the Consumption Bundle, Holding Labor Supply Fixed.

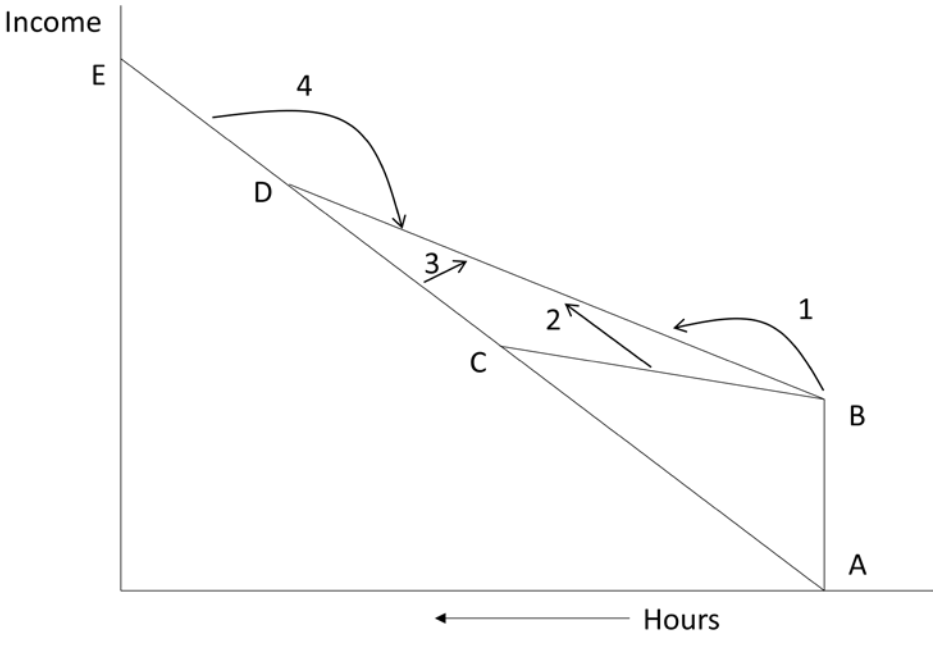

Figure 2: Effects of a Negative Income Tax Reform.

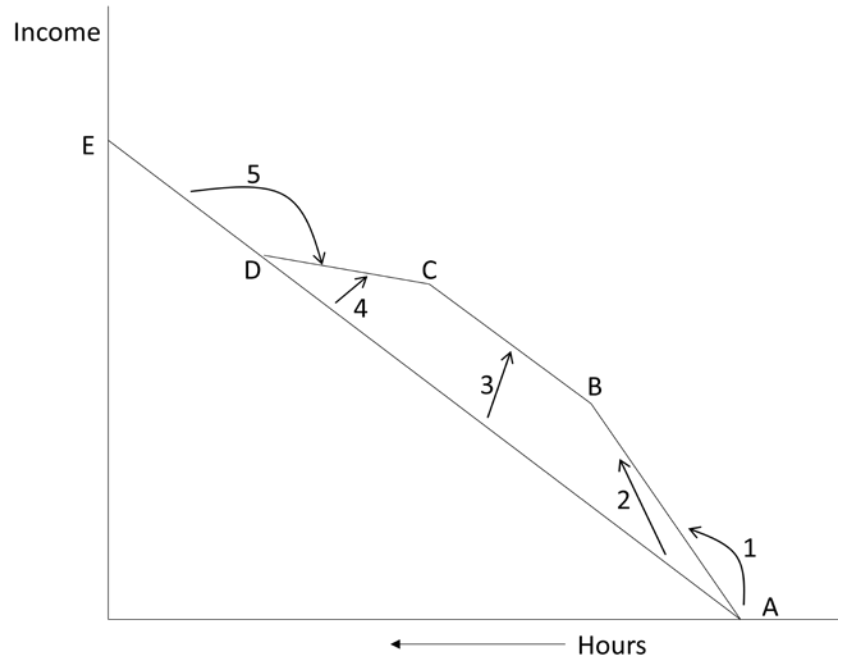

Figure 3: Effects of an Earned Income Tax Credit.

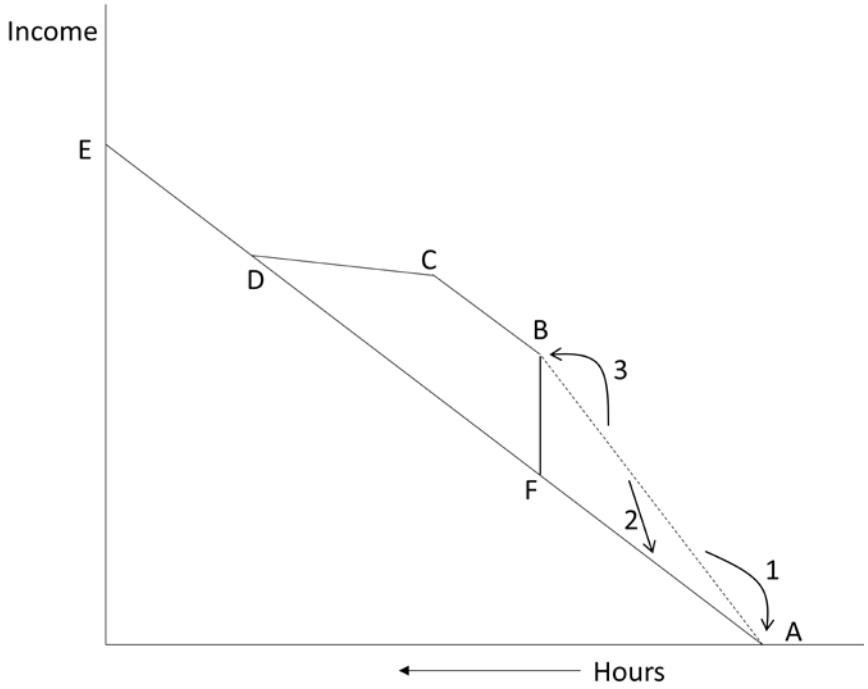

Figure 4: Effects of Imposing a Work Requirement on an Earnings Subsidy.

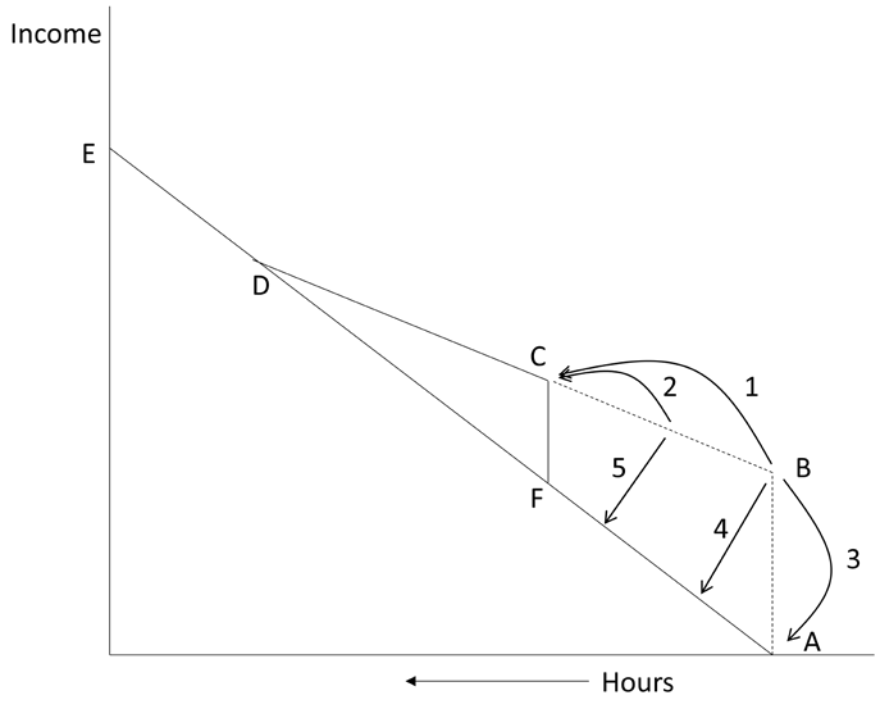

Figure 5: Effects of Imposing a Work Requirement on a Welfare Program.

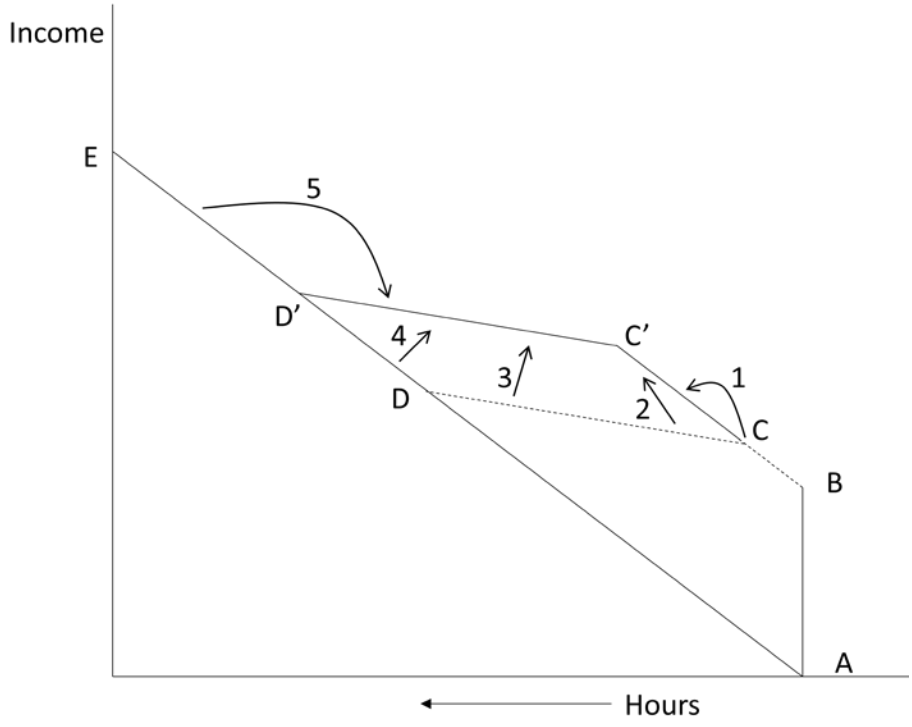

Figure 6: Effects of Increasing the Deduction of a Welfare Program.