Women on Welfare: A Macroeconomic Analysis

Jeremy Greenwood; Nezih Guner; John A. Knowles

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By Jeremy Greenwood, Nezih Guner, and John A. Knowles*

Look at the dramatic change in family structure that has occurred recently, illustrated in Figure 1. In the United States, 23 percent of children lived with an unwed mother in 1998, compared with only 8 percent in 1960.[1] Of this 15-percentage-point increase, about 6 percentage points are due to a rise in the rate of divorce; the remaining 9 percentage points arise from an increase in out-of-wedlock births. Why care about this change in the structure of families? The lot of children living with a single mother is bleak. About 70 percent of those children in a family with a never-married mother were living near or below the poverty level in 1995. The corresponding figure for children being raised by a divorced mother was 45 percent.

Associated with the increase in number of single mothers has been a rise in the percentage of the population on welfare. In 1960 only 1.7 percent of the population was on AFDC (Aid to Families with Dependent Children), while in 1995 about 5.2 percent were. Most mothers who received AFDC were single; 71 percent were in 1993. Also, AFDC mothers tended to have more children (2.6 on average vs. 2.1 for the population as a whole in 1993). It is interesting to note that there is evidence suggesting that more entrances into and exits out of welfare are connected with a shift in family structure rather than with a change in employment status. For instance, of the first-time entrances into welfare during 1983–1991 about 21 percent were associated with an out-of-wedlock birth, 23 percent were connected with a divorce or separation and 21 percent were linked with a reduction in the mother's work hours. Last, real AFDC benefits rose by about 70 percent between 1945 and 1977. They were about 25-percent higher in 1995 than in 1945. Could this have contributed to the rise in single motherhood?

The task here is to outline a general-equilibrium model in which, at any point in time, some individuals will marry, others will divorce, and yet others will choose to have out-of-wedlock births. While the model is still prototypical in nature, it will be shown how such a framework can be used to address public-policy questions, in particular, the impact of welfare on family structure and the well-being of the economy.

I. The Model

1. *Environment.*—The world is populated by overlapping generations made up of children and adults, half of which are males.[2] A person lives for four periods, two as a child and two as an adult. Each adult female is indexed by a productivity level, x, where $x \in X = \{x_1, x_2, \ldots, x_{15}\}$. Likewise, a male is indexed by his productivity $z \in Z = \{z_1, z_2, \ldots, z_{15}\}$. An agent's productivity level determines how much he or she can earn in a period. The type distributions for young and old adult females who are single are denoted by $\Phi_1(x)$ and $\Phi_2(x)$, while the corresponding distributions for males are represented by $\Omega_1(z)$ and $\Omega_2(z)$.

At the beginning of each period, each single agent draws a potential mate from a marriage market. Associated with each draw is a match quality variable $\gamma \in \{0, 2.5\}$ that is drawn in line with the distribution $\Pr[\gamma = 0] = \Pr[\gamma = 2.5] = 0.5$. Hence, some matches between a male and a female are good, while others are bad. At the time of meeting, each party knows his or her mate's type, x or z, and the quality of the match, γ. When old they also know the number of kids, k, the woman already has. If the

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[1] The statistics quoted here have been collected from the publications of various U.S. government agencies: U.S. Bureau of the Census, U.S. Department of Health and Human Services, U.S. House of Representatives, and the U.S. Social Security Administration.

[2] No work is done in isolation. A discussion of some of the model's ancestors is contained in Jeremy Greenwood et al. (1999), which also provides details of the model.
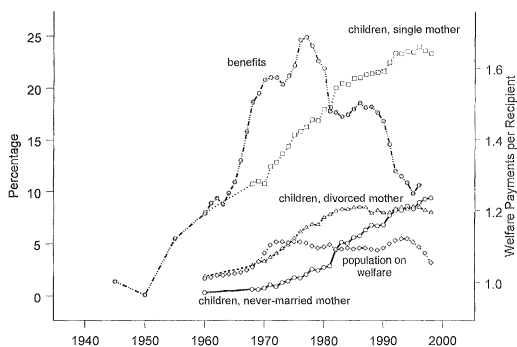
FIGURE 1. FAMILY STRUCTURE (LEFT-HAND AXIS GIVES PERCENTAGES) AND WELFARE BENEFITS (RIGHT-HAND AXIS)

couple decides to marry, then the quality of the match next period γ' evolves according to $\Pr[\gamma' = 0 | \gamma = 0] = \Pr[\gamma' = 2.5 | \gamma = 2.5] = 0.5$. Similarly, at the beginning of a period, each married agent decides whether to remain married or get divorced. In the first period of their adult lives, young married couples and single females must decide how many children, $k \in \{1, 2, 3, 4, 5\}$, to have. Children always live with their mothers. Young and old agents also choose the quality of their children, which is determined by investments of time (t) and money (d).

2. *Tastes.*—The momentary utility function for a female adult is

$$F(c, e, k, 1 - \ell - t) \equiv \frac{c^{0.5}}{0.5} + \left(\frac{k^{0.325}}{0.325} \right)$$
$$\times \left(\frac{e^{0.21}}{0.21} \right) + 3.0 \, \frac{(1 - \ell - t - 0.05k)^{0.35}}{0.35}.$$

The female realizes utility from household consumption (c) and the quantity (k) and the quality (e) of her children. She spends ℓ units of time working in the market, t units on nurture, and $0.05k$ units of time on childcare. The momentary utility function for a male depends upon his marital status. A married male's momentary utility function reads

$$M(c, e, k, 1 - n) \equiv \frac{c^{0.5}}{0.5} + \left(\frac{k^{0.325}}{0.325} \right)$$
$$\times \left(\frac{e^{0.35}}{0.35} \right) + 3.0 \, \frac{(1 - n - 0.0325k)^{0.35}}{0.35}$$

where n is the amount of time he spends at work. Males spend no time on nurture. A single male (either never-married or divorced) does not realize any utility from children. Thus, the middle term is dropped.

3. *Welfare, $w(k)$.*—A single female is eligible to collect welfare. If a single woman does not work, she receives a lump-sum payment $w(k) = \omega = 1.0$, which is about 10 percent of average income in the model. These benefits are taxed at a 50-percent rate for every dollar the woman earns from market work. Welfare benefits are financed by levying lump-sum taxes, τ, on married couples, single males, and those single females who do not collect benefits.

4. *Income.*—A married couple's labor income is $x\ell + zn$; after taxes they earn $x\ell + zn - \tau$. Likewise, a single mother on welfare receives $w(k) + (1 - 0.5)x\ell$.

5. *Investment in Quality, e.*—Child quality is given by

$$(1) \qquad e = \left(\frac{t}{k^{0.4}} \right)^{0.5} \left(\frac{d}{k^{0.5}} \right)^{1 - 0.5}$$

where d is the total amount of goods invested in k children and t is the mother's time. When a young girl grows up, she draws a productivity level, x, from a (discretized) lognormal distribution with mean

$$(2) \qquad \ln[15.5(e_{-2} + e_{-1})^{0.5}]$$

and standard deviation 0.40. Here, e_{-1} and e_{-2} denote an agent's human capital investment during the first and second periods of childhood, respectively. A young male also draws his productivity level, z, from a lognormal distribution with a standard deviation of 0.40. The mean is again specified by (2) but with the constant 4.17

added to the term inside the brackets. When old, a female's productivity will move to x', which is lognormally distributed with mean $2.20[1.0 - 0.70] + 0.70 \ln x$ and standard deviation 0.57. A male's productivity evolves to $z' \sim \ln \mathcal{N}(2.58[1.0 - 0.70] + 0.70 \ln z, 0.57)$.

6. *Consumption, c.*—There are economies of scale in household consumption. Per capita consumption in the household is given by $c = (a + 0.4k)^{-0.5}(y - d) - \gamma$, where a is the number of adults in the household and y is after-tax income. The goods spent nurturing children, d, come out of income. Consumption is linear in match quality, γ. Therefore, for a married couple, per capita consumption is given by $c = (2 + 0.4k)^{-0.5}[x\ell + zn - \tau - d] - \gamma$, while for a single female receiving welfare it would read $c = (1 + 0.4k)^{-0.5}[w(k) + (1 - 0.5) x\ell - d]$.

7. *Marriage and Divorce.*—Imagine that a young female of type x meets a young male of type z in the marriage market and that their match is quality γ. Will they marry or not? Marriage requires mutual consent, so each party must prefer married life to single life. Suppose that the expected lifetime utility of single life for the female is $G_1(x)$ while the expected lifetime utility from marriage is $W_1(x, z, \gamma)$. She will desire to marry if $W_1(x, z, \gamma) \geq G_1(x)$, and to remain single otherwise. Her mate is also comparing the expected lifetime utility from marriage, $H_1(x, z, \gamma)$, with the expected lifetime utility from bachelorhood, $B_1(z)$. Thus, for a marriage to occur it must happen that both $W_1(x, z, \gamma) \geq G_1(x)$ and $H_1(x, z, \gamma) \geq B_1(z)$.

The decision for old agents is analogous. For example, suppose that the young couple above decided to get married and have k children. Next period let his type evolve to z', hers to x', and match quality transit to γ'. The female will divorce her spouse if her happiness from single life, $G_2(x', k)$, exceeds the utility she will realize from remaining married, $W_2(x', z', \gamma', k)$. A divorce will transpire if either $W_2(x', z', \gamma', k) < G_2(x', k)$ or $H_2(x', z', \gamma', k) < B_2(z', k)$.

8. *Young Women on Welfare.*—It is now easy to see that the expected lifetime utility for a young single woman on welfare will be given by

$$(3) \quad G_1(x) = \max_{c,e,d,\ell,t,k} \{F(c, e, k, 1 - \ell - t)$$

$$+ \beta E[W_2(x', z', \gamma', k)$$

$$\times I_2(x', z', \gamma', k)$$

$$+ G_2(x', k)$$

$$\times [1 - I_2(x', z', \gamma', k)]]\}$$

subject to $c = [1 + 0.4k]^{-0.5} \max\{w(k) + (1 - 0.5) x\ell - d, x\ell - d - \tau\}$ and (1). Here $I_2(x', z', \gamma', k) = 1$ if $W_2(x', z', \gamma', k) \geq G_2(x', k)$ and $H_2(x', z', \gamma', k) \geq B_2(z')$; it is zero otherwise. This takes into account that any future marriage must be mutually agreeable.

9. *Nash Bargaining.*—The Nash bargaining solution is imposed on decisions within a marriage.[3] For example, the decision problem facing a young married couple indexed by (x, z, γ) is

$$(4) \quad \max_{c,e,k,\ell,t,n} \{F(c, e, k, 1 - \ell - t)$$

$$+ \beta E[W_2(x', z', \gamma', k)I_2(x', z', \gamma', k)$$

$$+ G_2(x', k)[1 - I_2(x', z', \gamma', k)]]$$

$$- G_1(x)\} \times \{M(c, e, k, 1 - n)$$

$$+ \beta E[H_2(x', z', \gamma', k)$$

$$\times I_2(x', z', \gamma', k) + B_2(z', k)$$

$$\times [1 - I_2(x', z', \gamma', k)]] - B_1(z)\}$$

subject to $c = [2 + 0.4k]^{-0.5}[x\ell + zn - \tau - d] - \gamma$ and (1). The maximized value of the first term in braces gives $W_1(x, z, \gamma)$, while the second term yields $H_1(x, z, \gamma)$. In the above problem $G_1(x)$ and $B_1(z)$ represent the female's and male's threat points, or the expected discounted utilities that would result from single life.

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[3] For a discussion about Nash bargaining applied to household decision-making, see Marjorie B. McElroy (1997).

10. *Equilibrium.*—In order to compute a young single female's decision problem one needs to know the availability of males in the future. That is, problem (3) depends on $\Omega_2(z)$ through the expectations operator. The availability of males in the future, however, depends upon the marriage decisions that young agents make today. This depends on the solution to problems such as (3) and (4). Hence, computing the model's equilibrium involves solving a fixed-point problem.

II. The Benchmark Steady State

1. *Marriage, Divorce, and Out-of-Wedlock Births.*—The steady state for the above model displays several interesting features. At any point in time 85 percent of the adult populace is married. Fifteen percent of young women are unmarried, while roughly 9 percent of old women divorce, and 5 percent never marry. Eighty-four percent of young single women are on welfare, and young welfare mothers have an average of 3.9 children, as opposed to 1.8 for married mothers. The overall annual rate of growth for the population is 0.13 percent.

2. *Welfare Dependence.*—In the U.S. data, a girl who grew up with a mother on welfare has about a 58-percent chance of living on welfare when she grows up. This compares with 27 percent for a girl who grew up in a family that never received welfare. Now turn to the model. A welfare mother's income is much less than that earned by a married couple. On average her income is only 7.5 percent of that enjoyed by a married couple. Not surprisingly, the level of human-capital investment in a child by a welfare mother is considerably smaller than for a married couple, about 75 percent less. This occurs because a welfare mother has both less income and more children to spread her time and money over. This leads to welfare dependence across generations. Since a welfare mother invests relatively little in her daughter, when the latter grows up she is less likely to marry than a girl from a two-parent home and therefore more likely to live on welfare.

The situation is illustrated in Figure 2, which is a graph of data generated by the model. The downward-sloping curve plots the relationship between parental investment in a daughter, or
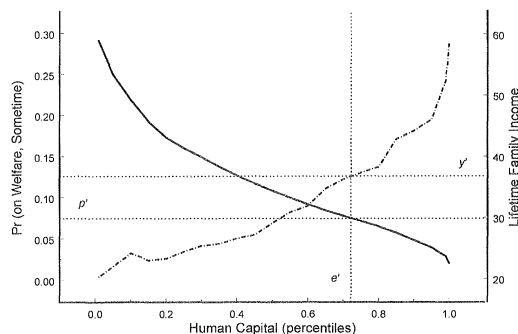

FIGURE 2. MODEL: WELFARE DEPENDENCY AND FAMILY INCOME

Notes: The downward-sloping curve plots the relationship between parental investment in a daughter and the probability that she will receive welfare sometime in her life (left-hand axis). The upward-sloping curve shows how parental investment in a daughter depends positively on the family's lifetime income (right-hand axis).

$e_{-1} + e_{-2}$, and the probability that she will receive welfare sometime in her life. The upward-sloping curve shows how parental investment in a daughter depends positively on the family's lifetime income (the relationship is inverted on the diagram). Thus, a family with lifetime income y' invests e' in a daughter, who has the probability p' of receiving welfare sometime. The probability of receiving welfare sometime decreases with lifetime family income. The pattern of welfare dependence that emerges is portrayed in Table 1. A girl who grows up with a mother who never received welfare ($\sim w \rightarrow \sim w$) has only a 12-percent chance of living on welfare herself. Contrast this with the girl who lived in a family that was always on welfare ($w \rightarrow w$). The odds of her receiving welfare are 38 percent.

III. Welfare Experiments

1. *The No-Welfare World.*—The artificial economy without welfare looks quite different from one with welfare. First, the fraction of the population that is married rises from 0.85 to 0.93. This occurs for two reasons. First, the value of single life falls for a female. Second, two-parent families invest more in their children than do single mothers. As fewer children are raised in single-parent homes, the quality of children, and hence the quality of the mating

TABLE 1—MODEL: WELFARE DEPENDENCE

Childhood history	Adult history			
	$\sim w \to$ $\sim w$	$\sim w \to$ w	$w \to$ $\sim w$	$w \to$ w
$\sim w \to \sim w$	0.88	0.03	0.04	0.05
$\sim w \to w$	0.79	0.06	0.05	0.10
$w \to \sim w$	0.77	0.07	0.06	0.10
$w \to w$	0.62	0.14	0.07	0.18

Note: The table reports probabilities of transitions between childhood and adult welfare states: w = welfare; $\sim w$ = no welfare.

FIGURE 3. TRANSITIONAL DYNAMICS

Notes: "Comp. Var." = compensating variation; "Cum. Dist." = cumulative distribution.

pool, begins to rise. Since married couples have fewer children on average, the population's annualized growth rate drops to -1.5 percent. Last, the average level of income rises by 24 percent.

The effects of eliminating welfare take time to occur. Figure 3 plots the model's transitional dynamics (a period is 10 years). In the short run, women have lower average expected utility. In the initial generation, young women are willing to give up 2.5 percent of their consumption (the compensating variation) in order to return to the old welfare system (see Fig. 3C). It takes about 70 years before they are better off, on average. The fourth panel plots the evolution of the utility distribution for females. While on average women are better off in the new steady state, a significant number (about 25 percent) are worse off (the unproductive, unmarried). There is short-run pain in the sense that the benchmark economy's utility distribution stochastically dominates the one that occurs after ten years; that is, there are more young women at low expected utility levels after 10 years than in the benchmark economy. Last, the number of low-type women declines slowly (Fig. 3B), because investment in children gradually edges up.

2. *A Work-Requirement World.*—Right or wrong, there is a widespread feeling that welfare promotes indolence. In the model, part of the lure of welfare is the extra leisure that a woman can enjoy. About 69 percent of a welfare mother's time is leisure, compared with 39 percent for a single mother not on welfare. To combat the image of the slothful welfare mother, imagine that the government requires each recipient to spend about 5 percent of her
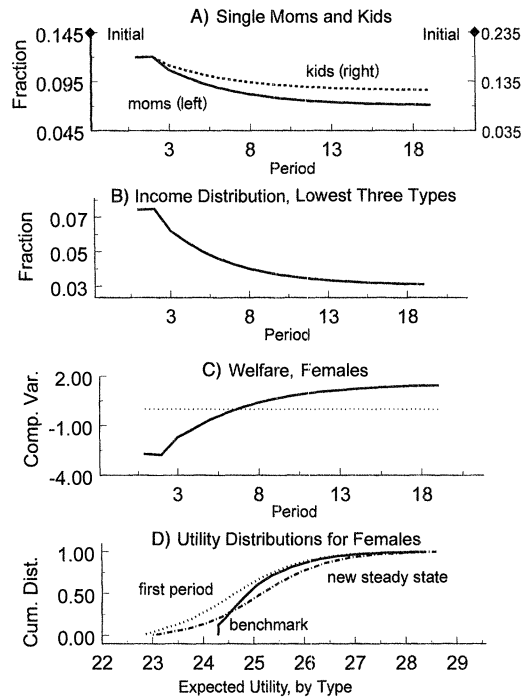
time in some kind of work (assumed for convenience to be unproductive). The work requirement has two effects. First, it may induce some women to prefer married to single life. Second, it may persuade some single women that working is better than welfare. In the new steady state the proportion of the population that is married rises from 0.85 to 0.87. The fraction of single women on welfare drops from 0.84 to 0.75. Recall that welfare mothers invest the least in a child. Hence, the quality of the mating pool rises as the number of women on welfare falls. This works to promote marriage in the long run. Since welfare mothers have the most children, the growth rate for population drops by 0.41 percentage points. Average income rises by 6 percent.

3. *A Per-Child Payment World.*—The purpose of welfare is to ease the plight of children living in single-parent families. Given this, it may seem logical to make welfare payments a

function of the number of dependent children in the household. To this end, let $w(k) = 0.25\omega k$. With this specification, a mother with four children receives the same welfare payment as in the benchmark economy. The policy has two effects. First, a young welfare mother would like to have more children, five as compared with four in the benchmark economy. Second, it raises the value of single life, compared with married life. These two effects operate to increase the fraction of children who are living with a welfare mother from 0.21 to 0.31. Since single mothers invest the least in their children, this lowers the long-run quality of the mating pool. The result is that the fraction of population that is married falls by 6 percentage points. The annual population growth rate jumps up to 1.9 percent. Average income drops by 18 percent.

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